Scientific Program

Congress of Neurological Surgeons Annual Meeting

50th Anniversary Celebration

September 23-28, 2000

Henry B. Gonzalez Convention Center
San Antonio, Texas

Mission Statement

The Congress of Neurological Surgeons exists for the purpose of promoting the public welfare through the advancement of neurosurgery, by a commitment to excellence in education and by dedication to research and scientific knowledge. The Congress of Neurological Surgeons maintains the vitality of our learned profession through the altruistic volunteer efforts of our members and the development of leadership in service to the public, to our colleagues in other disciplines, and to the special needs of our fellow neurosurgeons throughout the world and at every stage of their professional lives.

Founding Members

F. S. Barringer
Leon M. Becker
Carrol M. Brown
Bland W. Cannon
Richard L. DeSaussure
John W. Devanney
Franklin Ernest, III
Edward M. Gates
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Thomas M. Marshall
F.A. Palazzo
Frederick C. Rehfeldt
Elmer C. Schultz
H.J. Svien
Donald B. Sweeney
A. Roy Tyrer
Edgar N. Weaver

History of the Congress of Neurological Surgeons

The founding meeting of the Congress of Neurological Surgeons was held by 22 men in St. Louis, Missouri, on May 11, 1951. The first annual meeting of the Congress was held in November 1951, in Memphis, Tennessee. Total membership at that meeting was 121. Currently our membership has grown to over 4,500 neurosurgeons worldwide.

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CONGRESS OF NEUROLOGICAL SURGEONS
1951
ERUDITIO SOCIETAS OBSERVANTIA

Dedicated to Neurosurgical Excellence

The Congress of Neurological Surgeons is pleased to announce its latest Member Services Benefit at our 2000 Annual Meeting and 50th Anniversary Celebration! CNS is proud to offer its members a new affinity program provided in cooperation with **MBNA**, the world's largest independent credit card issuer.

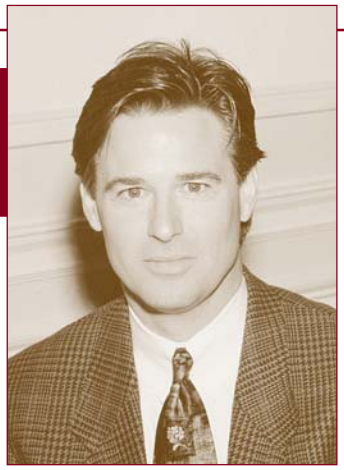
Visit the CNS Member Services Center, Booth 456, in Hall C of the Henry B. Gonzalez Convention Center to learn all there is to know about this new value packed Member Services Benefit.

The Congress of Neurological Surgeons gratefully acknowledges MBNA for its grant in sponsorship of our Special Guest, Fran Tarkenton.

MBNA AMERICA®

CNS President

Daniel L. Barrow



Daniel Louis Barrow was raised in west central Illinois, the first of four children of Dr. and Mrs. Warren C. Barrow. During high school, Dan was active in varsity sports, including football, golf and track. He was named an Illinois State Scholar and appeared in *Who's Who in High School Dramatics.* Dan graduated magna cum laude from Westminster College in 1976 and began his medical education at Southern Illinois University School of Medicine in the summer of 1976. He received his M.D. degree from Southern Illinois University in 1979 and moved to Atlanta, Georgia to obtain his postgraduate training in neurosurgery at Emory University School of Medicine.

Dr. Barrow completed his general surgery internship and neurosurgical residency at Emory University affiliated hospitals and obtained his neurology training at Massachusetts General Hospital. Upon completing his neurosurgical residency, Dr. Barrow did a fellowship in cerebrovascular surgery at the Mayo Clinic in Rochester, Minnesota. He returned to Emory University in 1985 as an Assistant Professor in the Department of Neurosurgery. In 1990, Dr. Barrow was promoted to Associate Professor, and in 1991 was named Vice-Chairman of the Department of Neurosurgery at Emory University School of Medicine. In 1995, Dr. Barrow was named MBNA/Bowman Professor and Chairman of the Department of Neurosurgery. In 1998, he was appointed to the Board of Directors of the Emory Clinic, Inc.

Dr. Barrow has authored over 200 scientific articles and chapters in medical textbooks. He has authored or edited twelve monographs, including a major textbook of neurosurgery, *The Practice of Neurosurgery*. He has been a visiting professor at major universities throughout the United States, Europe and Asia. His research interests have focused on cerebrovascular disease and stroke. During his career in medicine he has won many awards, including induction into the honorary medical society, Alpha Omega Alpha. He has been named in *Who's Who in America* and has been chosen by his peers to appear in the publication, *The Best Doctors in America*. In 1997, Dr. Barrow received the Distinguished Alumnus Award from Southern Illinois University School of Medicine, one of only four recipients of this prestigious honor. In 1998, he received the Alumni Achievement Award from Westminster College.

Dr. Barrow has been active in organized neurosurgery, holding a variety of leadership and editorial positions. He has been on the Executive Committee of the CNS since 1989 and served as Scientific Program Chairman (1991), Annual Meeting Chairman (1992), Secretary (1992-1995), and President (1999-2000). He was President of the Georgia Neurosurgical Society and is a member of the AANS/CNS Washington Committee (1997-present). Dr. Barrow has been on the Editorial Boards of *Clinical Neurosurgery* (1988-1992), *Neurosurgery* (1993-present), *Neurosurgical Consultations* (1989-1995), *Neurologia Medico-Chirurgica* (1996-present), co-edited *Contemporary Neurosurgery* (1985-1995), edited *Perspectives in Neurological Surgery* (1989-1992) and chaired the AANS Publications Committee.

Dr. Barrow is an avid outdoorsman who enjoys hunting, fishing and other outdoor sporting activities. He is married to Mollie Winston Barrow, a practicing oral and maxillofacial surgeon. They live in Atlanta with their three children, Emily (12), Jack (10) and Tom (8).

2000 Honored Guest

Edward R. Laws, Jr., MD

Join Edward R. Laws, Jr., MD, our Honored Guest, as he presents, "Indications for Glioma Surgery: Is Radical Resection Necessary or Desirable?", "Doctors in Opera", "Background and Skills for a Neurosurgeon in 2010" and "Pituitary Tumor Surgery: Long-Term Surgical Outcomes and Expections".

Edward R. Laws was born in New York City on April 29, 1938, the son of a physician and a teacher/editor. He was educated in the New York City public school system, attending the Bronx High School of Science. He received his Bachelor's degree from Princeton University with honors in Economics and Sociology in the Special Program in American Civilization. At Princeton he was awarded a Woodrow Wilson Scholarship and combined interests in sociology and religion in writing his senior thesis.

He attended the Johns Hopkins University School of Medicine in Baltimore, Maryland. During a summer research position at the end of his first year, he became associated with Dr. A. Earl Walker and the Department of Neurosurgery at Hopkins. Tom Langfitt was the Chief Resident at that time, and the Department was an exciting environment. He began his research work on the metabolism and cytochemistry of brain tumors at that time working with Drs. George Udvarhelyi and John O'Connor and continued these research efforts throughout his medical school career. At Hopkins, he was a National Foundation Health Scholar and a Johns Hopkins Fund Scholar and he also was awarded the Henry Strong Dennison Fellowship in Research. He stayed on at Johns Hopkins for an internship in surgery under Dr. Alfred Blalock, and then spent two years in the U.S. Public Health Service working at the Communicable Disease Center in Atlanta, Georgia, doing research focused on pesticide toxicology.

Dr. Laws returned to Johns Hopkins in 1966 to resume his training in Neurosurgery under Dr. Walker, and completed his residency in 1971. He was then asked to join the faculty at Johns Hopkins with a primary appointment in Pediatric Neurosurgery and the rank of Assistant Professor.

Dr. Colin MacCarty at the Mayo Clinic was a close friend both of Dr. Walker and Dr. Frank Otenasek, another one of the faculty members at Johns Hopkins. He invited Dr. Laws to consider moving to the Mayo Clinic in Rochester, Minnesota, which he did in September 1972. At Mayo, he spent 15 highly productive years developing major interests and experience in pituitary surgery and epilepsy surgery, along with a continuing laboratory interest in the metabolism and pathophysiology of primary brain tumors. With Colin MacCarty and Ross Miller as mentors and Thor Sundt as friend and colleague, this experience was extraordinarily valuable. The wealth of clinical and research material at the Mayo Clinic made it possible to develop significant expertise in a relatively short period of time and to publish the results of these endeavors.

Dr. Laws' career with the Congress of Neurological Surgeons began with an appointment to the Executive Committee in 1973 and he rapidly became Secretary of the Congress of Neurological Surgeons and served under David Kelly and Albert Rhoton during their respective presidencies. This experience began a long career of service to national neurosurgical organizations.

In 1987, Dr. Laws was appointed Editor of ***Neurosurgery***, succeeding Robert Wilkins and Clark Watts. His wife, Margaret Anderson Laws, became the Managing Editor and for five years they had an extraordinary experience in the editing and the developing of ***Neurosurgery*** as a first rate international medical journal.

Later in 1987, Dr. Laws was offered the Chair of the Department of Neurosurgery at the George Washington University Medical Center in Washington, D.C., succeeding Dr. Hugo Rizzoli. The next five years were spent in Washington where the environment and the opportunities were somewhat different from those in Rochester, Minnesota.

In 1992, the opportunity arose for Dr. Laws to focus his work on pituitary tumors by joining what is certainly the most outstanding pituitary/endocrine group in the country, if not the world, at the University of Virginia. A coordinated Neuroendocrine Center was rapidly developed. Dr. John A. Jane, Sr., has made it possible for this work to continue to develop, and in addition to dealing with pituitary lesions, Dr. Laws also has current responsibility for epilepsy surgery, movement disorder surgery, peripheral nerve surgery and a variety of other types of brain tumors. During his surgical career he has operated upon more than 5,000 brain tumors, of which some 3,400 have been pituitary lesions. He has thoroughly enjoyed his collaborative work with endocrinologists, neuroradiologists, otorhinolaryngologists, neuro-ophthalmologists and others. He currently is the W. Gayle Crutchfield Professor of Neurosurgery and Professor of Medicine at the University of Virginia in Charlottesville.

Dr. Laws has served as President of the Congress of Neurological Surgeons, President of the American Association of Neurological Surgeons, Editor of ***Neurosurgery***, Chairman of the Board of Trustees of the Foundation for International Education in Surgery, Secretary and First Vice President of the World Federation of Neurosurgical Societies, Director of the American Board of Neurological Surgery and President of the Pituitary Society. He has been the author of eight books and more than 400 scientific papers and book chapters.

Currently, he is a member of the Executive Committee of the Board of Regents of the American College of Surgeons, where he represents neurosurgery on the Board of Regents, and he is Vice Chair of the Residency Review Committee for Neurosurgery. He remains actively involved in brain tumor and neuroendocrine research.

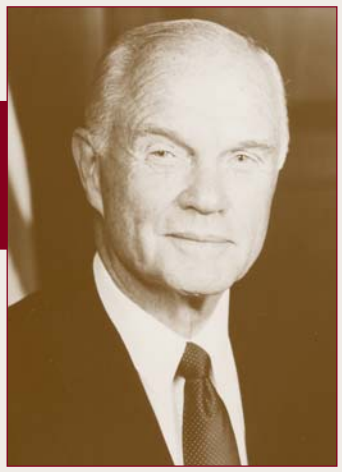
Dr. Laws and his wife Margaret (Peggy) continue to work together in many areas, including editing and publishing. They have four daughters and three grandchildren.

Past Honored Guests

Herbert Olivecrona 1952
Sir Geoffrey Jefferson 1953
Kenneth G. McKenzie 1954
Carl W. Rand 1955
Wilder G. Penfield 1956
Francis Grant 1957
A. Earl Walker 1958
William J. German 1959
Paul C. Bucy 1960
Eduard A.V. Busch 1961
Bronson S. Ray 1962
James L. Poppen 1963
Edgar A. Kahn 1964
James C. White 1965
Hugo Krayenbuhl 1966
W. James Gardner 1967
Norman M. Dott 1968
Wallace B. Hamby 1969
Barnes Woodhall 1970
Elisha S. Gurdjian 1971
Francis Murphey 1972
Henry G. Schwartz 1973
Guy L. Odom 1974
William H. Sweet 1975
Lyle A. French 1976
Richard C. Schneider 1977
Charles G. Drake 1978
Frank H. Mayfield 1979
Eben Alexander, Jr. 1980
J. Garber Galbraith 1981
Keiji Sano 1982
C. Miller Fisher 1983
Hugo V. Rizzoli 1984
Walter E. Dandy 1984
Sidney Goldring 1985
M. Gazi Yasargil 1986
Thomas W. Langfitt 1987
Lindsay Symon 1988
Thoralf M. Sundt, Jr. 1989
Charles B. Wilson 1990
Bennett M. Stein 1991
Robert G. Ojemann 1992
Albert L. Rhoton, Jr. 1993
Robert F. Spetzler 1994
John A. Jane 1995
Peter J. Jannetta 1996
Nicholas T. Zervas 1997
John M. Tew, Jr. 1998
Duke S. Samson 1999

1st Annual Walter Dandy Orator

Senator John Glenn



Tuesday, September 26 – 11:00 am

In 1998, as John Glenn and his crew ascended into the Earth's orbit among the full throttle of rockets and glowing engines, NASA proclaimed, "Lift-off of Discovery with a crew of six astronaut heroes and one American legend." John Glenn: American legend, Astronaut, United States Senator, distinguished Marine, Businessman, Husband, Father. A sterling American hero.

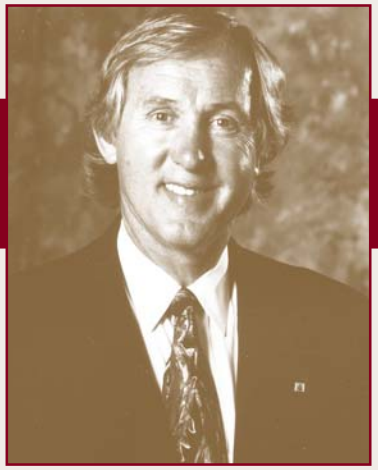
In 1962, John Glenn climbed into NASA's tiny Mercury capsule, was launched into the still mysterious and consuming darkness of space, and circumnavigated the Earth three times. It was an epic journey: systems malfunctioned and he had to manually pilot his space capsule at 17,500 miles per hour as he rocked wildly and watched fiery bits of his capsule fly past him into space. Retrospectively, we can see that defining moment marked a drastic shift in the power-play of the Cold War and brought relief and hope to anxious Americans. John Glenn had renewed our national spirit.

President Kennedy would not allow NASA to send John Glenn back into space, deeming him too valuable of a national hero. Mr. Glenn then left NASA and entered the private sector as an international executive in the cola industry, where he found his attention to detail and gutsy instincts served him well.

Mr. Glenn, however, was feeling pulled back into the direct service of his country, and where he had previously represented his country in space, he then represented his country on the floor of the United States Senate with his election in 1974. For twenty-four years, Mr. Glenn served as a Democratic Senator from his home state of Ohio, focusing on issues such as arms control, nuclear proliferation, government efficiency, and campaign finance reform.

But John Glenn yearned to soar in space again. On October 29, 1998, John Glenn returned to space with a crew of astronauts who were not yet born when he made his first ascent into space. After training diligently and easily passing the battery of physical tests before flight, Mr. Glenn, at 77 years old, became the oldest man to ever fly in space, and while there conducted medical tests to study the effects of zero-gravity on the aging body.

Currently, Mr. Glenn is establishing the John Glenn Institute for Public Service and Public Policy at Ohio State University. He is also at work on a book about his remarkable life and journey through the Canyon of Heroes.



Fran Tarkenton

Monday, September 25 – 10:25 am

"What Losing Taught Me About Winning"

Fran Tarkenton: Classically American; uniquely successful. Throughout his diverse career, he has blended his drive for competition with his widely recognized leadership skills and ability to swiftly respond to changing environments. The result has been the creation of highly charged and powerful organizations that can anticipate and adapt to fluid and sometimes volatile circumstances. He not only understands — he has managed change in the 1990s.

Fran's wide-ranging skills span not only from business, but also to his legendary sports career. He was inducted into the National Football League and Collegiate Football Halls of Fame. He quarterbacked the Minnesota Vikings to the 1973, 1974 and 1976 Super Bowls and was an All-American athlete at the University of Georgia.

Unlike other former athletes or celebrities who become involved in business as merely spokespersons, Fran is a hard-driving entrepreneur who has conceived, launched, and sold twelve different businesses, ranging from $1 million to $142 million in annual revenues. He currently owns GoSmallBiz.com, a 24 hour a day, 7 days a week total business resource center. He has served on the Board of Directors of Sterling Software, the 10th largest software company in the world, Pre-Paid Legal Services and was a founding Board member of Coca-Cola Enterprises. He now serves on the boards of Blimpie International and Quality Click.com. In addition, he advises and counsels businesses about new opportunities in fast changing environments, as well as how to identify and tap into new and innovative channels of distribution. And who should know more about succeeding in a competitive arena than one of the NFL's all time great competitors whose leadership skills have been tested time and time again?

Fran likes to speak about the quickly changing environment in which we live and help us better understand what that change means to our organization, and how one must take the disappointment of failure and make it an engine to drive greater success. As Fran explains it, "Organizations must examine and energize their models and practices almost daily just to keep pace with today's global economy. To excel, they must explode complacent leadership styles and literally reinvent their organizations, systems, and processes."

Fran brings to the speaker's platform a life of tremendous experiences in competitive situations, his unique viewpoints on what American organizations and businesses must do to remain competitive in a global marketplace, his real-world experiences and examples in the new age of information, and his always engaging and entertaining speaking style make him a compelling and illuminating consultant and speaker.

Michael J. Fox

Wednesday, September 27 – 11:25 am

Michael J. Fox returned to series television in 1996 with ABC's *Spin City*, portraying Michael Flaherty, New York's deputy mayor. He won critical praise, garnering three Golden Globe Awards, three Emmy Nominations, a GQ Man-of-the-Year Award (in the TV comedy category), a People's Choice Award, and two SAG Awards. During his time on the show, shot entirely in New York City, Michael did everything from galloping bareback through Central Park, to jumping into the Hudson River. Fox also served as one of the series' executive producers.

Born Michael Andrew Fox to parents William and Phyllis in Edmonton, Alberta, Fox adopted the "J" as an homage to legendary character actor Michael J. Pollard. Fox, an "army brat," moved several times during his childhood, along with his parents, brother, and three sisters. The Foxes finally planted roots in Burnaby, B.C. (a suburb of Vancouver), when William retired from the Canadian Armed Forces in 1971.

Like most Canadian kids, Michael loved hockey, and dreamed of an NHL career, though he never realistically expected it. In his teens, Michael's interests expanded. He began experimenting with creative writing, art, and played guitar in a succession of rock-and-roll garage bands, before ultimately realizing his affinity for acting.

He debuted as a professional actor at 15, co-starring in the CBC sitcom, *Leo and Me*, with future Tony Award-winner Brent Carver. For the next three years, Michael juggled local theater and TV work, and landed a few roles in American TV movies shooting north-of-the-border.

At 18, Michael ventured to Los Angeles. He struggled through a series of bit parts and CBS' short-lived (yet critically-acclaimed) Alex Haley/Norman Lear series *Palmerstown USA*, before winning the role of lovable conservative Alex P. Keaton in NBC's enormously popular *Family Ties* (1982-89). During Michael's seven years on *Ties*, he earned three Emmy Awards and a Golden Globe, making him one of America's most prominent young performers.

Michael's other forays into television included a variety of roles and duties. In 1994, he starred in Woody Allen's *Don't Drink the Water* on ABC. He directed Teri Garr and Bruno Kirby in an episode of cable's *Tales From the Crypt*, and later directed an installment of the critically acclaimed *Brooklyn Bridge*.

During all of this, Fox also became an international film star, appearing in over a dozen features showcasing his keen ability to shift between comedy and drama. These include the *Back to the Future* trilogy, *The Hard Way*, *Doc Hollywood*, *The Secret of My Success*, *Bright Lights, Big City*, *Light of Day*, *Teen Wolf*, *Casualties of War*, *Life With Mikey*, *For Love or Money*, *The American President*, *Greedy*, *The Frighteners*, and *Mars Attacks!*

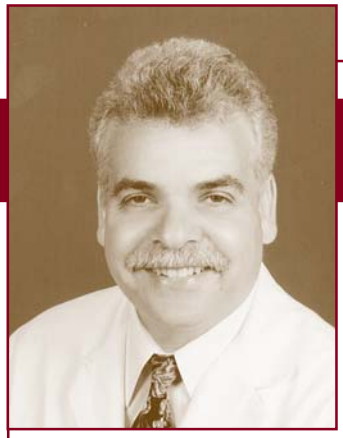
Fox married *Ties* co-star, actress Tracy Pollan, in 1988. Together, they have three children. Inspired to find projects that his kids would enjoy, Fox lent his voice to a variety of hit children's films in the 1990s. He began as Chance the dog in Disney's *Homeward Bound* movies. In December 1999, he provided the voice of Stuart Little for the Sony feature of the same name, and in summer, 2001, Fox will be featured as the lead in *Atlantis The Lost Empire*, his first animated Walt Disney feature.

Though he would not share the news with the public for another seven years, Michael J. Fox was diagnosed with young-onset Parkinson's disease in 1991. Upon disclosing his condition in 1998, he committed himself to the campaign for increased Parkinson's research.

Michael announced his retirement from *Spin City* in January, 2000, effective upon the completion of his fourth season and 100th episode. Expressing pride in the show, its talented cast, writers, and creative team, he explained that new priorities made this the right time to step away from the demands of a weekly series.

Though he maintains a strong commitment to his acting career and running Lottery Hill Entertainment, Fox has shifted a good deal of his focus and energies toward the Michael J. Fox Foundation for Parkinson's Research. He hopes the foundation will increase awareness, provide a voice for PD advocacy, and raise much-needed research funding.

Fox whole-heartedly believes that if there is a concentrated effort from the Parkinson's community, our elected representatives in Washington, and (most importantly) the general public, researchers can pinpoint Parkinson's cause and cure by 2010.

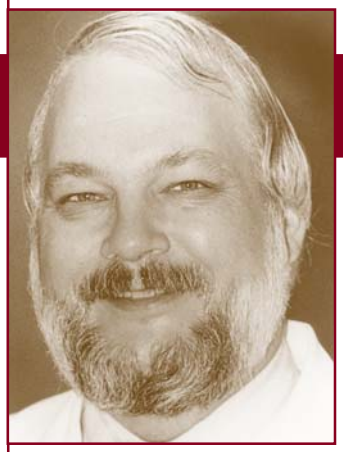


Paul Sanberg, DSc

Tuesday, September 26 – 7:30 am
"Neurosurgery for the 21st Century: What Does Neurobiology Justify?"

Dr. Paul R. Sanberg is Professor and Research Director in the Department of Neurosurgery, and Director of the Neuroscience Program and of the Center for Aging and Brain Repair at the University of South Florida College of Medicine. Dr. Sanberg did his undergraduate degree at York University in Toronto, Ontario. He subsequently received a M.Sc. in Neurological Sciences from the University of British Columbia, before earning his Ph.D. at the Australian National University in Canberra, for which he won the Sir J. C. Crawford medal for most outstanding Australian thesis. This was followed by a post-doctoral fellowship in neuroscience at the Johns Hopkins University School of Medicine. Dr. Sanberg became a full professor at the age of 32 and has held academic positions at the Ohio University, the University of Cincinnati, and Brown University prior to his current position. In 1998 he earned a D.Sc. from the Australian National University for his research in neuroscience. His industry experience has included being Scientific Director for CytoTherapeutics, Inc. (Providence, Rhode Island) and he is currently on the Board of Directors for Layton BioScience, Inc. (Atherton, California). Both companies are involved in cell therapy for neurodegenerative disorders. Dr. Sanberg is Editor-in-Chief of *Cell Transplantation*, Executive Director of the American Society for Neural Transplantation and Repair, and past president of the Cell Transplant Society, and others. He is the author of more than 300 scientific articles and has published ten books, including *Cell Transplantation for Huntington's Disease* (Landes Publishers, 1994), and *Central Nervous System Diseases: Innovative Animal Models from Lab to Clinic* (Humana Press, 2000), and is an inventor with about twenty U.S. patents. His early work was pioneering in understanding a role for excitotoxicity in neurological disorders. He has also made important contributions in developing animal models for neurodegenerative diseases, and performing novel therapeutic-oriented preclinical studies which have provided the basis for ongoing clinical trials in Huntington's, Parkinson's and stroke disorders. His work on brain nicotinic receptors has led to a number of drug trials involving novel nicotinic agents in some neuro-psychiatric disorders, for which he received the Ove Ferno Prize from the CINP/Pharmacia-Upjohn in 1996. His latest research involves the use of human neural stem cells to repair CNS disorders.

Outside of academics, Dr. Sanberg lives with his daughter, Nikki, and a Piper Aztec in an airplane flying community north of Tampa, where he is a multi-engine flight instructor.

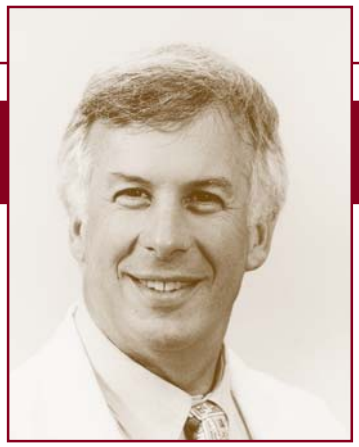


Roy A. E. Bakay, MD

Wednesday, September 27 – 11:00 am
Special Lecture: ***"Research, Funding and Clinical Trials: Translating New Therapies to Patients"***

Dr. Roy Bakay serves as Professor of Neurological Surgery at Emory University, and as Vice-Chairman of the Department of Neurological Surgery. Dr. Bakay received his medical degree from Northwestern University in Chicago and completed residency training at the University of Washington. He served as a fellow at the National Institutes of Health between 1981-82. Dr. Bakay has served as a member of the Advisory Panel for the Office of Technology of the United States Congress, and as an advisor to the Epilepsy Foundation of America. He served as president of the American Society for Stereotactic and Functional Neurosurgery (1991-93), and is the current president of the American Society for Neurotransplantation and Repair.

Amongst his numerous clinical and research interests, Dr. Bakay has been a leader in neurotransplantation studies for Parkinson's disease. In addition, his work in stereotactic lesioning and deep brain stimulation has set benchmarks for the rigid evaluation of patients. He has worked with colleagues in bioengineering to develop methods of translating thought into action for patients with locked-in syndromes. Dr. Bakay's work has been supported by an array of granting agencies. His ability to bring ideas to the operating room defines translational neurosurgery. He will discuss the interplay between basic and clinical neuroscience, the realities of funding and regulatory agencies, and the issues pertinent to the developing of new neurosurgical techniques.



James N. Weinstein, DO, MS

Wednesday, September 27 – 7:45 am

"Determining Outcomes in Spinal Surgery: Orthopedic Initiatives"

Much of Dr. Weinstein's time in the next five years will be devoted to being the principal investigator of a $14 million multicenter randomized trial of operative and non-operative treatments for three diagnoses for low back pain. The project was funded by the National Institute of Arthritis & Musculoskeletal & Skin Diseases of the National Institutes of Health, with contributions from the NIH Office of Research on Women's Health and the National Institute for Occupational Safety & Health of the Centers for Disease Control and Prevention.

The randomized trial is the result of tremendous effort on the part of many people, but also comes partly as a result of Dr. Weinstein's international reputation as an outstanding researcher and clinician. He completed his residency in Orthopedics at the Rush-Presbyterian-St. Luke's Medical Center in Chicago in 1983. He became director of the Surgical Outcomes Assessment Program in the Center for the Evaluative Clinical Sciences at Dartmouth College in 1996, having moved from an Endowed Professorship in the Department of Orthopaedics at The University of Iowa. Also, he directed the Spine Diagnostic and Treatment Center at Iowa from 1987-96, and was co-director of the Office of Outcomes for University of Iowa Hospitals and Clinics.

At Dartmouth-Hitchcock Medical Center, he directs the new multidisciplinary Spine Center and the Shared Decision Making Center. He is currently working with Dr. Jack Wennberg at the Center for the Evaluative Clinical Sciences at Dartmouth Medical School on a national atlas for orthopaedic surgery. He collaborates with the Foundation for Informed Medical Decision Making to provide content for the production of videotapes designed to help patients make better decisions for themselves regarding their treatment options. He's well known for his expertise in low back pain and for advocating conservative, non-invasive approaches to its treatment.

Dr. Weinstein is the Editor-in-Chief of *Spine,* the official journal of 10 national and international societies of spinal study. *Spine* is a subspeciality journal with an unusually high Scientific Citation impact factor and one of the highest readerships in the nation.

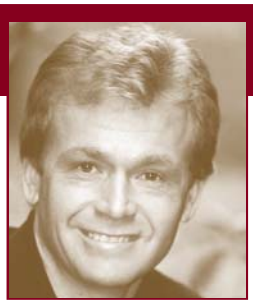
His own research and publications, arising out of an early interest in determining the validity and reliability of the medical diagnostic tests and procedures used in treating spinal disease and injury, have won numerous awards, including being honored as one of the best orthopedists in America by his peers. His latest listing in "Best Doctors in America" was in 1998. In 1997, he was a co-author on the paper "Lumbar Radiculopathy: An Animal Model with Relevance to Clinical Practice" which won the Kappa Delta Award, the most prestigious award given for orthopaedic research.

He is much in demand as a lecturer and visiting professor, having been asked to speak to academic and professional organizations throughout the United States as well as in Korea, Japan, Belgium, Italy, Czechoslovakia and Sweden. He recently spent three weeks in Adelaide, Australia, as Nimmo Visiting Professor. His expertise and the quality of his research in each area have made him a valuable member of numerous organizations and committees, such as the AAOS Council on Research and Scientific Affairs and the Committee on Guidelines to Low Back Pain of the Department of Health and Human Services Agency for Health Care Policy and Research.

Dr. Weinstein plans to continue his work for numerous national and international organizations and maintain his clinical expertise in the diagnosis and treatment of spine cancers. He works closely with Dr. Joyce DeLeo in Anesthesiology at DHMC on studies regarding the mechanisms of pain. He will combine his expertise in outcomes assessment with that of the CECS in informed decision making to steer surgical residents toward new and valuable areas of research (e.g., new paradigms for doctor/patient relationships) as well as methodologies for improving patient care and satisfaction. Of note, Dr. Weinstein regards his most prized asset and accomplishment to be his family.

CNS Cushing Clinical Fellowship
Robert J. Spinner

Robert J. Spinner completed neurosurgical residency at the Mayo Clinic, and previously completed training in orthopedic surgery. He has received training at the Massachusetts Institute of Technology, Oxford University, Duke University and the Mayo Clinic. Dr. Spinner plans to study peripheral nerve surgery at Johns Hopkins University and will visit the Seddon Teaching Center in London, England to study peripheral nerve function.



CNS Dandy Clinical Fellowship
Gavin W. Britz

Gavin W. Britz obtained his undergraduate training in South Africa at the University of Witwatersrand and in 1991 began his internship in general surgery at Johns Hopkins Hospital in Baltimore. He joined the University of Washington in Seattle and entered the neurological surgery residency program under Dr. H.R. Winn. His research interest centers around the epidemiology of vascular and neoplastic disease and he has pursued an MPH degree during his training. He will work in minimally invasive neurosurgery with Dr. Axel Perneczky in Mainz, Germany. He is hoping to apply this experience in minimally invasive neurosurgery to practice in the fields of neurovascular and skull base surgery.

CNS DePuy AcroMed Clinical Fellowship in Spinal Neurosurgery
William Mitchell

William Mitchell received his neurosurgical training at Thomas Jefferson University. He completed medical school at the University of Southern California School of Medicine. Dr. Mitchell will study with Dr. Edward Benzel at the Cleveland Clinic in the field of biomechanics. In addition, his clinical focus in spine surgery will include an introduction to endoscopy and image-guidance, as well as scoliosis surgery.

CNS Charles Plante Public Policy Fellowship
Alan M. Scarrow

Alan M. Scarrow completed his medical school training at Case Western Reserve University. He also received his degree in law at the same institution. He is currently completing neurosurgical residency at the University of Pittsburgh. Recently, Dr. Scarrow has been involved in the Council of State Neurosurgical Societies. He will work in a legislative office in Washington during this fellowship experience. His fellowship plans include conducting an analysis of the pros and cons of unionization for neurosurgeons, creating a standardized credentialing system for expert witness testimony, and a study of coverage and reimbursement issues that face neurosurgery.

CNS Wilder Penfield Clinical Investigation Fellowship
Abhaya V. Kulkarni

Abhaya V. Kulkarni is completing neurosurgical residency at the University of Toronto. Dr. Kulkarni is the recipient of the CNS Resident Award presented at this meeting. He will study outcomes research as applied to clinical neurosurgery at the University of Toronto and McMaster University. He will work within a structured PhD program in clinical epidemiology. His specific goals include the development of a health status outcomes measure scale for pediatric hydrocephalus.

CNS Fellows

CNS Sean Mullan Neuroendovascular Surgery Fellowship
Alan Boulos

Alan Boulos received his medical and neurosurgical training at Albany Medical Center in New York. He received the 1999 Resident Research Award at Albany Medical College and the 1994 Charles Eckert Award for achievement in surgery. His fellowship is sponsored by Drs. L. N. Hopkins and L. Guterman at Millard Filmore Hospital in Buffalo, New York.

CNS/Elekta Lars Leksell International Fellowship
Tulio P. Murillo

Tulio P. Murillo completed his medical training in neurosurgery at the Hospital Escuela in Tegucigalpa, Honduras. This fellowship will be under the supervision of Dr. Roberto Heros at the University of Miami. He hopes to develop skills in microneurosurgery, stereotactic surgery and gamma knife radiosurgery as well as neuroendoscopy.

CNS Kenichiro Sugita International Fellowship
Vladimir Katuch

Vladimir Katuch received his neurosurgery training in Kosice in the Slovak Republic. His fellowship will be conducted under the supervision of Dr. Christopher Loftus at the University of Oklahoma. Dr. Katuch will study carotid endarterectomy and vascular neurosurgery.

CNS George Ablin International Fellowship
Ketan Desai

Ketan Desai received his neurosurgical training at the K.E.M. Hospital at Bombay University. He previously completed a Master of Science degree in general surgery, as well as completing his medical school training at Gujarat University, Ahmedabad. Dr. Desai will study with Dr. David Kline at the Louisiana State Medical Center in the field of peripheral nerve surgery, where he will gain experience to help treat patients in his home country of India.

Extreme Neurosurgery: Operating in Hostile Environments

Monday, September 25, 2000
12:30 pm - 2:00 pm, Room 214A

Speakers: Ismail H. Aydin
Armando Basso
Robert J. Dempsey
Howard L. Finney

Ismail H. Aydin

Ismail H. Aydin is Professor and Chairman of the Department of Neurosurgery at the Ataturk University Medical School in Turkey. He and his team were among the first neurosurgical respondents to the tragic earthquake which recently caused death and destruction in that country. Dr. Aydin will describe how members of the neurosurgical community responded to this natural disaster.

Armando Basso

Armando Basso is Professor and Chairman of the Department of Neurosurgery at the University of Buenos Aires in Argentina. Dr. Basso has extensive knowledge of international neurosurgery, as he is past President of the World Federation of Neurosurgical Societies. Dr. Basso will describe the role of organized neurosurgery in the third world.

Robert J. Dempsey

Robert J. Dempsey is Professor and Chairman of Neurosurgery at the University of Wisconsin-Madison. Throughout his professional life, he has been involved in bringing neurosurgical care to underdeveloped countries in Latin America. Dr. Dempsey will describe his neurosurgical experiences in Guatemala and Ecuador.

Howard L. Finney

Howard L. Finney practices neurosurgery in Great Falls, Montana. For many years, he has been the link between Honduran and North American neurosurgery. Dr. Finney will describe the state of neurosurgery in Honduras and cooperative projects that are currently underway.

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325 Paramount Drive
Raynham, MA 02767
(508) 828-3253

Designs for Visions, Inc. 552
760 Koehler Avenue
RonKonKoma, NY 11779
(800) 345-4009

Diversified Diagnostic Products 427
11603 Windfern
Houston, TX 77064
(281) 955-5323

Doctors' Ideal Supply Co., Ltd. 363
462 Kamikomachi
Omiya, Saitama
Japan
81486584300

DunnAmics, Inc. 299
3502 Fairview Way
West Linn, OR 97068
(503) 699-8824

Dupaco 301
2620 Temple Hts. Drive
Oceanside, CA 92056
(760) 758-4550

Eastern Medical Publishers 798
3600 Commerce Drive
Baltimore, MD 21227
(410) 536-9300

EBI 793-795
100 Interpace Parkway
Parsippany, NJ 07054
(800) 526-2579

Elekta 168
3155 Northwoods Parkway
Norcross, GA 30071
(770) 300-9725

Ellman International 603
1135 Railroad Avenue
Hewlett, NY 11557
(516) 569-1482

Encore Medical Corp. 398-399
9800 Metric Blvd.
Austin, TX 78758
(512) 834-6225

Technical Exhibitors

Booth #

Endius, Inc. 295-297
23 West Bacon Street
Plainville, MA 02762
(508) 643-0983

Endure Medical, Inc. 285-287
1490 Ventura Drive
Cumming, GA 30040
(770) 888-3755

Ethicon, Inc. 758b
Route 22 West
Somerville, NJ 08876
(908) 218-2517

Fehling Surgical Instruments, Inc. 360-362
509 Broadstone Lane
Acworth, GA 30101
(770) 794-0111

FHC, Inc. (Frederick Haer & Co.) 192
9 Main Street
Bowdoinham, ME 04008
(207) 666-8190

Flowtronics, Inc. 328
10250 N. 19th Avenue, Suite B
Phoenix, AZ 85021-1945
(602) 997-1364

GE OEC Medical Systems 750-752-754
384 Wright Brothers Drive
Salt Lake City, UT 84116
(435) 644-3169

GenSci OrthoBiologics, Inc. 161
2 Goodyear
Irvine, CA 92618
(949) 595-8710

Gliatech, Inc. 526
23420 Commerce Park Road
Cleveland, OH 44122
(888) 454-2832

Haemacure Corporation 851
2 North Tamiami Trail, Suite 80
Sarasota, FL 34236
(941) 364-3700

Harcourt Health Sciences 698
625 Walnut Street/300 East
Philadelphia, PA 19106
(215) 238-8404

Hitachi Medical Systems America, Inc. 582-681
1959 Summit Commerce Park
Twinsburg, OH 44087
(330) 425-1313

Image-Guided Neurologics, Inc. 380-382
2290 W. Eau Gallie Blvd, Suite 210
Melbourne, FL 32935
(321) 757-8990

Integra NeuroSciences 824
105 Morgan Lane
Plainsboro, NJ 08536
(609) 275-0500

Booth #

Integrated Surgical Systems 302-401
1850 Research Park Drive
Davis, CA 95616
(530) 792-2600

Interpore Cross International 482-581
181 Technology Drive
Irvine, CA 92618
(949) 453-3200

Jerome Medical 162-164
305 Harper Drive
Moorestown, NJ 08057
(856) 234-8600

Journal of Neurosurgery 596-597-699
1224 West Main Street, Suite 450
Charlottesville, VA 22903
(804) 924-2204

JVC HDTV 121
2246 Camino Ramon
San Ramon, CA 94583
(925) 355-0750

Karl Storz Endoscopy-America, Inc. 158-160
600 Corporate Pointe
Culver City, CA 90230
(310) 338-8100

Keeler Instruments, Inc. 789
456 Parkway
Broomall, PA 19008
(610) 353-4350

Kilgore International, Inc. 461
36 W. Pearl Street
Coldwater, MI 49036
(517) 279-9000

Kinamed, Inc. 457
2192-C Anchor Court
Newbury Park, CA 91320
(805) 499-5999

Kirwan Surgical Products, Inc. 651-653
180 Enterprise Drive
Marshfield, MA 02050
(781) 834-9500

KLS-Martin, LP 393-395
P.O. Box 50249
Jacksonville, FL 32250
(904) 641-7746

Komet Medical 229
One Brasseler Blvd.
Savannah, GA 31419
(800) 535-6638

Kyphon 601
1350 Bordeaux Drive
Sunnyvale, CA 94089
(408) 548-6526

Lake Cumberland Regional Hospital 694
305 Langdon Street
Somerset, KY 42503
(606) 678-3295

Technical Exhibitors

Booth #

Leica Microsystems, Inc. 816
110 Commerce Drive
Allendale, NJ 07401
(800) 526-0355

Life Instrument Corp. 352
14 Wood Road
Braintree, MA 02184
(781) 849-0109

LifeNet 138
5809 Ward Court
Virginia Beach, VA 23455
(800) 847-7831

Linvatec/Hall Surgical 716-718-720
11311 Concept Blvd.
Largo, FL 33773
(727) 399-5349

Lippincott Williams & Wilkins 498-499
530 Walnut Street
Philadelphia, PA 19106
(215) 521-8300

Lone Star Medical Products, Inc. 791
8733 Knight Road
Houston, TX 77054
(713) 796-0505

Luxtec Corporation 141
326 Clark Street
Worcester, MA 01606
(508) 856-9454

Market Access Partners 265
25107 Genesee Trail Road #300
Golden, CO 80401
(303) 526-1900

Market Research Institute 157
5920 Longbow Drive
Boulder, CO 80301
(303) 530-6345

Marshfield Clinic 403
1000 North Oak Avenue
Marshfield, WI 54449
(800) 782-8581

MD Productivity 607
12710 Research Blvd., Suite 205
Austin, TX 78759
(512) 336-2833

Medem, Inc. 193
333 Bush Street, 24th Floor
San Francisco, CA 94104
(630) 260-9984

MedSpecialists 592
211 5th Street NE
Charlottesville, VA 22902
(804) 817-4510

Medtronic Midas Rex 433C
4620 North Beach Street
Ft. Worth, TX 76137
(817) 788-6400

Booth #

Medtronic Neurological 433D
800 53rd Avenue NE
Minneapolis, MN 55421
(763) 514-5000

Medtronic PS Medical 433E
125 Cremona Drive
Goleta, CA 93117
(805) 968-1546

Medtronic Sofamor Danek 433A-433B
1800 Pyramid Place
Memphis, TN 38132
(901) 396-3133

Microline, Inc. 692
800 Cummings Center, #157X
Beverly, MA 01915
(978) 922-9810

Mizuho America, Inc. 116
123 Brimbal Avenue
Beverly, MA 01915
(800) 699-2547

Moller Microsurgical Div. Of Haag-Streit 368
5500 Courseview Drive
Mason, OH 45040
(800) 440-9105

MTF 481-483
125 May Street, Suite 300
Edison, NJ 08837
(732) 661-0202

National Biological Labs 122
140-C Tewning Road
Williamsburg, VA 23188
(757) 565-0200

Neurosurgery 456
1975 Zonal Avenue, KAM 415
Los Angeles, CA 90033
(313) 442-3001

NMT Neurosciences 316
3450 Corporate Way
Duluth, GA 30096
(678) 282-0542

NS Recruitment, Inc. 485
P.O. Box 36096
Louisville, KY 40233-6096
(888) 673-6096

Ochsner Clinic 487
1514 Jefferson Highway
New Orleans, LA 70121
(800) 488-2240

Odin Medical Technologies, Inc. 658
29 Crafts Street, Suite 420
Newton, MA 02458
(617) 527-1785

Olympus America, Inc. 586
Two Corporate Center Drive
Melville, NY 11747
(631) 844-5435

Technical Exhibitors

Booth #

OMI Surgical Products 608
4900 Charlemar Drive
Cincinnati, OH 45227
(513) 561-2241

Omni Medical Designs, Inc. 688
12296 Hubbard Drive
Livonia, MI 48150
(734) 513-7450

Omni-Tract Surgical 364
1100 New Brighton Blvd.
Minneapolis, MN 55413-1660
(800) 367-8657

ORATEC Interventions, Inc. 682-781
3700 Haven Court
Menlo Park, CA 94025
(888) 996-1996

Ortho Development Corp. 244
12 Ichigayadaimachi
Shinjuku-ku
Tokyo 162-0066
Japan
81333416901

Orthofix, Inc. 139
10115 Kincey Avenue, Suite 250
Huntersville, NC 28078
(704) 948-2618

Orthologic 286-288
1275 W. Washington
Tempe, AZ 85281
(602) 286-5272

Orthopedic Systems, Inc. (OSI) 817-819-821
30031 Ahern Avenue
Hayward, CA 94587
(800) 777-4674

Orthovita, Inc. 797
45 Great Valley Pkwy
Malvern, PA 19355
(610) 407-5223

OsteoMed Corp. 225
3750 Realty Road
Addison, TX 75001
(972) 241-3401

Osteotech, Inc. 549-551
51 James Way
Eatontown, NJ 07724
(732)-544-6211

Parallax Medical, Inc. 891
2160 NE 44th Court
Lighthouse Point, FL 33064
(954) 784-7727

Paraspinal Diagnostic Corporation 199
1275 Kinnear Road
Columbus, OH 43212
(614) 675-3740

Booth #

Philips Medical Systems, N.A. 123
710 Bridgeport Avenue
Shelton, CT 06484
(203) 926-7584

Phoenix Biomedical Corp. 232
2495 Gen. Armistead Avenue
Norristown, PA 19403
(610) 539-9300

PMT Corporation 238
1500 Park Road
Chanhassen, MN 55317
(952) 470-0866

Prescott's Inc. 908
P.O. Box 609
Colorado Springs, CO 80132
(719) 481-3353

Pro Med Instruments GmbH 609
Basler-Landstr 52A
Freiburg79111
Germany
761441545

Proxima Therapeutics, Inc. 386-388
1111 Alderman Drive, Suite 280
Alpharetta, GA 30005-4143
(770) 753-4848

Radionics, a Div. of Tyco Healthcare Group 416
22 Terry Avenue
Burlington, MA 01303
(781) 272-1233

Realtime Visualization-Mitsubishi 263
300 Baker Street, Suite 301
Concord, MA 01742
(408) 774-3092

Regeneration Technologies, Inc. 143
Two Innovation Drive
Alachua, FL 32615
(904) 418-8888

Sacred Heart Health Systems 889
5151 North 9th Avenue
Pensacola, FL 32504
(850) 505-4195

Scanlan International, Inc. 324-326
One Scanlan Plaza
St. Paul, MN 55107
(651) 298-0997

Schering Oncology/Biotech 132
2000 Galloping Hill Road
Kenilworth, NJ 07033
(908) 298-4000

Signus Medical, LLC 227
7140 Derby Drive
Chanhassen, MN 55317
(952) 975-0461

Technical Exhibitors

Booth #

Straumann USA 853
1601 Trapelo Road
Waltham, MA 02451
(781) 890-0001

Stryker Instruments 670A
4100 E. Milham Avenue
Kalamazoo, MI 49001
(800) 253-3210

Stryker Leibinger 670B
4280 Commercial Avenue, Suite A
Portage, MI 49002
(616) 323-7700

Stryker Spine 670C
2 Pearl Court
Allendale, NJ 07401
(201) 760-8059

Sulzer Spine-Tech 616
7375 Bush Lake Road
Minneapolis, MN 55439
(612) 832-5600

Surgical Acuity, Inc. 553
5225-3 Verona Road
Madison, WI 53711
(608) 227-1143

Surgical Dynamics 216
150 Glover Avenue
Norwalk, CT 06856
(203) 845-8594

Surgical Enterprise Corporation 842
360 Industrial Road, Unit H
San Carlos, CA 94070
(847) 689-5044

Surgical Laser Technologies 605
147 Keystone Drive
Montgomeryville, PA 18936
(215) 619-3212

Surgical Navigation Network 600
6509 Airport Road
Mississauga, ON L4V 1S7
Canada
(905) 672-2100

SurgiTel/General Scientific 259
77 Enterprise Drive
Ann Arbor, MI 48103
(734) 996-9200

Synergetics, Inc. 548-550
88 Hubble Drive
St. Charles, MO 63304-8694
(636) 939-5100

Synthes 810
1690 Russell Road
Paoli, PA 19301
(610) 647-9700

Booth #

T. Koros Surgical Instruments 448-450
610 Flinn Avenue
Moorpark, CA 93021
(805) 529-0825

TDC/The Doctor's Company 195
185 Greenwood Road
Napa, CA 94558-0900
(800) 421-2368

Thieme Medical Publishers 887-888
333 Seventh Avenue
New York, NY 10001
(212) 760-0888

Think First 404-501
c/o CNS, 475 S. Frontage Rd.
Burr Ridge, IL 60521

Thompson Surgical Instruments 529
10170 E. Cherry Bend Road
Traverse City, MI 49684
(800) 227-7543

Visualization Technology, Inc. 492
200 Research Drive
Wilmington, MA 01887
(978) 933-1103

W. Lorenz Surgical 652
1520 Tradeport Dr.
Jacksonville, FL 32218
(904) 741-4400

W.L. Gore & Associates, Inc. 186-188
3250 W. Kiltie Lane
Flagstaff, AZ 86001
(520) 779-2771

Welch Allyn, Inc. 696
4341 State Street Road
Skaneateles Falls, NY 13153
(315) 685-4100

Z-KAT 100-201-203
2903 Simms Street
Hollywood, FL 33020
(954) 927-2044

Zeppelin Instruments GmbH 261
Gistlstrasse 99
Pullach D-82049
Germany
49897936880

Product/Service Guide

ALLOGRAFTS/HUMAN TISSUE
Cortek, Inc.
GenSci OrthoBiologics, Inc.
Kinamed, Inc.
LifeNet
MTF
Osteotech, Inc.
Regeneration Technologies, Inc.
Sulzer Spine-Tech

ANATOMICAL CHARTS/MODELS
Kilgore International, Inc.
National Biological Labs
Synthes

ANEURYSM CLIPS AND ACCESSORIES
Aesculap
Doctors' Ideal Supply Co., Ltd.
Mizuho America, Inc.
Surgical Enterprise Corporation
Synergetics, Inc.
Zeppelin Instruments GmbH

ASPIRATORS
Integra NeuroSciences
Synergetics, Inc.

BONE GROWTH STIMULATORS
Biolectron, Inc.
EBI
GenSci OrthoBiologics, Inc.
Orthofix, Inc.
Orthologic
Regeneration Technologies, Inc.
Sulzer Spine-Tech

BONE SUBSTITUTE
Bio Medical Enterprises, Inc.
Blackstone Medical
GenSci OrthoBiologics, Inc.
Interpore Cross International
Orthovita, Inc.
Stryker Leibinger
Synthes
W. Lorenz Surgical

CERVICAL COLLARS
Jerome Medical

COMPUTER HARDWARE
BrainLAB
Compass International Drive
Realtime Visualization-Mitsubishi

COMPUTER SOFTWARE FOR OFFICE MANAGEMENT
AllMeds.com
Alpha Omega Engineering
MD Productivity
MedSpecialists

COMPUTER SOFTWARE FOR SURGICAL APPLICATIONS
BrainLAB
Compass International Drive
Elekta
FHC, Inc. (Frederick Haer & Co.)
Integrated Surgical Systems
MedSpecialists
Surgical Navigation Network
Z-KAT

CONTINUING MEDICAL EDUCATION COURSES
Medtronic Midas Rex
Spine Universe

CRANIOTOMES, DRILLS & ACCESSORIES
Acra-Cut Inc.
Anspach Companies
Codman/Johnson & Johnson
Kirwan Surgical Products, Inc.
Komet Medical
Linvatec/Hall Surgical
Medtronic Midas Rex
OsteoMed Corp.
Stryker Instruments
Surgical Enterprise Corporation
Zeppelin Instruments GmbH

CSF DRAINAGE DEVICES
Acra-Cut Inc.
Cook Incorporated
Integra NeuroSciences
Medtronic PS Medical
Phoenix Biomedical Corp.
Synergetics, Inc.

CT/MRI MAGNETIC SOURCE IMAGING
4-D Neuroimaging
Diversified Diagnostic Products
Odin Medical Technologies, Inc.
Realtime Visualization-Mitsubishi

DIAGNOSTIC IMAGING
Aloka
B-K Medical Systems, Inc.
Cytometrics, Inc.
Diversified Diagnostic Products
GE OEC Medical Systems
Paraspinal Diagnostic Corporation
Realtime Visualization-Mitsubishi

Product/Service Guide

DURA SUBSTITUTE
Bio-Vascular, Inc.
Integra NeuroSciences

ENDOSCOPES, NEUROLOGICAL
Aesculap
Cook Incorporated
Endius, Inc.
Karl Storz Endoscopy-America, Inc.
Luxtec Corporation
Medtronic PS Medical
Synergetics, Inc.
T. Koros Surgical Instruments
Zeppelin Instruments GmbH

ENDOVASCULAR DEVICES
Boston Scientific/Target
Cook Incorporated

FIBRIN SEALANTS
Haemacure Corporation

FLUOROSCOPES
GE OEC Medical Systems

FUNCTIONAL STEREOTACTIC SURGERY
Alpha Omega Engineering
Axon Instruments, Inc.
BrainLAB
Compass International Drive
Elekta
Medtronic Neurological
Z-KAT

HALO SYSTEMS/SPINAL ORTHOSIS/ SPINAL SUPPORT SYS.
Aspen Medical Products
Bremer Group Co.(The)
Cortek, Inc.
DePuy AcroMed, a Johnson & Johnson Co.
Dupaco
Jerome Medical
Orthopedic Systems, Inc. (OSI)
PMT Corporation
Sulzer Spine-Tech

HEADLIGHTS, SURGICAL
Cogent Light Technologies
Keeler Instruments, Inc.
Luxtec Corporation
OsteoMed Corp.
SurgiTel/General Scientific
W. Lorenz Surgical
Welch Allyn, Inc.

HEMOSTATS
Davol Inc.
Ethicon, Inc.
Fehling Surgical Instruments, Inc.

IMAGE-GUIDED NAVIGATION SYSTEMS
Aesculap
Alpha Omega Engineering
BrainLAB
Carl Zeiss, Inc.
CBYON, Inc.
Compass International Drive
DePuy AcroMed, a Johnson & Johnson Co.
Image-Guided Neurologics, Inc.
Integrated Surgical Systems
Linvatec/Hall Surgical
Odin Medical Technologies, Inc.
OMI Surgical Products
Stryker Leibinger
Surgical Navigation Network
Visualization Technology, Inc.
Z-KAT

IMAGING AGENTS
Diversified Diagnostic Products

INSURANCE
TDC/The Doctor's Company

LASERS
Surgical Laser Technologies

MEDICAL DEVICES
4-D Neuroimaging
Accuray Incorporated
Advanced Spine, Inc.
Alphatec Manufacturing, Inc.
ArthroCare NeuroSpine
Axon Instruments, Inc.
Blackstone Medical
Boston Scientific/Target
CBYON, Inc.
Cook Incorporated
DePuy AcroMed, a Johnson & Johnson Co.
Diversified Diagnostic Products
Dupaco
EBI
Encore Medical Corp.
Endius, Inc.
FHC, Inc. (Frederick Haer & Co.)
Flowtronics, Inc.
Gliatech, Inc.
Image-Guided Neurologics, Inc.
Integrated Surgical Systems
Kyphon
Linvatec/Hall Surgical

Product/Service Guide

MEDICAL DEVICES *(continued)*
- Luxtec Corporation
- Medtronic Neurological
- Medtronic PS Medical
- Omni-Tract Surgical
- ORATEC Interventions, Inc.
- Orthofix, Inc.
- Osteotech, Inc.
- Parallax Medical, Inc.
- Paraspinal Diagnostic Corporation
- PMT Corporation
- Proxima Therapeutics, Inc.
- Scanlan International, Inc.
- Signus Medical, LLC
- SIMAL S.A.
- Sulzer Spine-Tech
- Surgical Laser Technologies
- T. Koros Surgical Instruments
- Visualization Technology, Inc.
- W.L. Gore & Associates, Inc.
- Z-KAT

MICROSCOPE SYSTEMS
- Carl Zeiss, Inc.
- Cytometrics, Inc.
- Endure Medical, Inc.
- Leica Microsystems, Inc.
- Moller Microsurgical Div. Of Haag-Streit
- Prescott's Inc.

MICROSURGICAL INSTRUMENTATION
- Aesculap
- Alpha Omega Engineering
- BOSS Instruments, Ltd.
- Cytometrics, Inc.
- Doctors' Ideal Supply Co., Ltd.
- Endius, Inc.
- Fehling Surgical Instruments, Inc.
- FHC, Inc. (Frederick Haer & Co.)
- Keeler Instruments, Inc.
- Kirwan Surgical Products, Inc.
- KLS-Martin, LP
- Mizuho America, Inc.
- OMI Surgical Products
- PMT Corporation
- Scanlan International, Inc.
- Stryker Instruments
- Synergetics, Inc.
- W. Lorenz Surgical
- Zeppelin Instruments GmbH

MONITORING SYSTEMS
- Codman/Johnson & Johnson
- FHC, Inc. (Frederick Haer & Co.)
- Flowtronics, Inc.
- Integra NeuroSciences

OPERATING TABLES & ACCESSORIES
- Cloward Instrument Corp.
- Life Instrument Corp.
- OMI Surgical Products
- Orthopedic Systems, Inc. (OSI)

PATIENT EDUCATION INFORMATION
- Kilgore International, Inc.
- MedSpecialists
- Spine Universe

PHARMACEUTICALS
- Aventis Pharmaceuticals
- Bayer Corporation, Pharmaceutical Div.

PRACTICE MANAGEMENT
- MedSpecialists
- Spine Universe

PUBLISHERS, SCIENTIFIC/JOURNALS
- Eastern Medical Publishers
- Harcourt Health Sciences
- Lippincott Williams & Wilkins
- *Neurosurgery*, official CNS Journal
- Thieme Medical Publishers

RECRUITERS
- Lake Cumberland Regional Hospital
- Marshfield Clinic
- Ochsner Clinic
- Sacred Heart Health Systems

REHABILITATION
- Bremer Group Co.(The)
- EBI
- Orthologic
- Paraspinal Diagnostic Corporation

RESEARCH, MEDICAL MARKETING
- Doctors' Ideal Supply Co., Ltd.
- Market Access Partners
- Stryker Leibinger

RIGID FIXATION/PLATING SYSTEMS
- Acra-Cut Inc.
- Advanced Spine, Inc.
- Aesculap
- Codman/Johnson & Johnson
- DePuy AcroMed, a Johnson & Johnson Co.
- Interpore Cross International
- Kinamed, Inc.
- KLS-Martin, LP
- OMI Surgical Products
- OsteoMed Corp.
- Osteotech, Inc.
- Spinal Concepts
- Straumann USA
- Stryker Spine
- Sulzer Spine-Tech
- W. Lorenz Surgical

Product/Service Guide

SHUNTS & VALVES
Codman/Johnson & Johnson
Integra NeuroSciences
Medtronic PS Medical
Phoenix Biomedical Corp.

SPINAL CORD STIMULATION SYSTEMS
Medtronic Neurological

SPINAL FIXATION INSTRUMENTATION
Kinamed, Inc.

STEREOTACTIC RADIOSURGERY SYSTEMS
Accuray Incorporated
Alpha Omega Engineering
BrainLAB
Elekta
Integrated Surgical Systems

STERILIZATION CONTAINERS
BOSS Instruments, Ltd.
Scanlan International, Inc.
Surgical Enterprise Corporation

SURGICAL INSTRUMENTS/SUPPLIES
Acra-Cut Inc.
Ad-Tech Medical Instrument Corp.
American Surgical/Sponges Div.
ArthroCare NeuroSpine
Axon Instruments, Inc.
Bio-Vascular, Inc.
Biolectron, Inc.
Biomec
Blackstone Medical
BOSS Instruments, Ltd.
Buxton BioMedical, Inc.
Cloward Instrument Corp.
Codman/Johnson & Johnson
Connell Neurosurgical
Cortek, Inc.
DePuy AcroMed, a Johnson & Johnson Co.
Doctors' Ideal Supply Co., Ltd.
DunnAmics, Inc.
Encore Medical Corp.
Endius, Inc.
Fehling Surgical Instruments, Inc.
Karl Storz Endoscopy-America, Inc.
Keeler Instruments, Inc.
Kirwan Surgical Products, Inc.
KLS-Martin, LP
Komet Medical
Leica Microsystems, Inc.
Life Instrument Corp.
Lone Star Medical Products, Inc.
OMI Surgical Products
Omni Medical Designs, Inc.
Omni-Tract Surgical
ORATEC Interventions, Inc.
Orthopedic Systems, Inc. (OSI)
OsteoMed Corp.
Osteotech, Inc.
Scanlan International, Inc.
Signus Medical, LLC
SIMAL S.A.
Stryker Spine
Surgical Enterprise Corporation
Surgical Laser Technologies
Synthes
T. Koros Surgical Instruments
Thompson Surgical Instruments
W. Lorenz Surgical
Zeppelin Instruments GmbH

SUTURES/SPONGES
American Surgical/Sponges Div.
Ethicon, Inc.

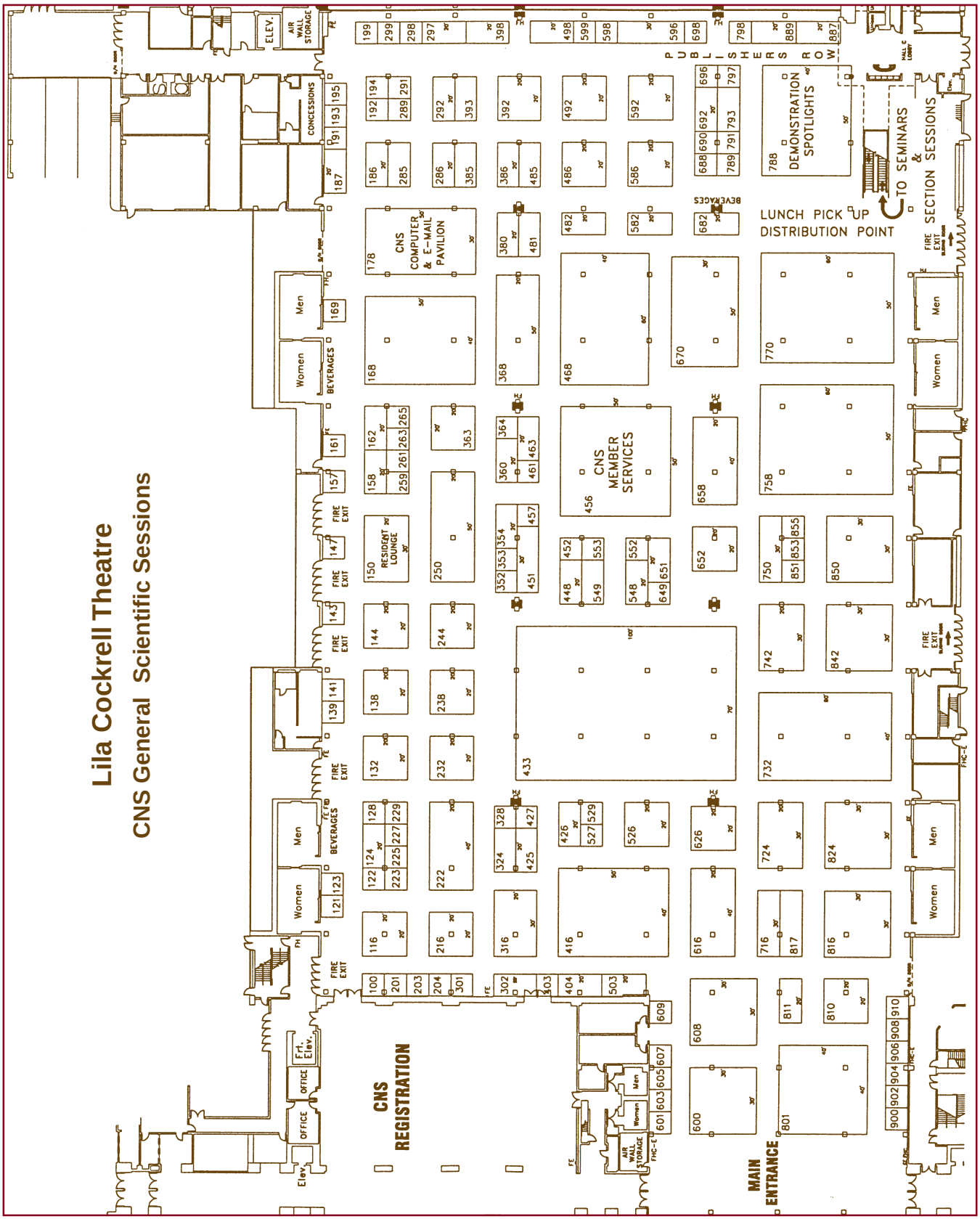
TELESCOPES, SURGICAL(LOUPES)
Carl Zeiss, Inc.
Designs for Visions, Inc.
Keeler Instruments, Inc.
Luxtec Corporation
Scanlan International, Inc.
Surgical Acuity, Inc.
SurgiTel/General Scientific

ULTRASOUND EQUIPMENT
Aloka
B-K Medical Systems, Inc.

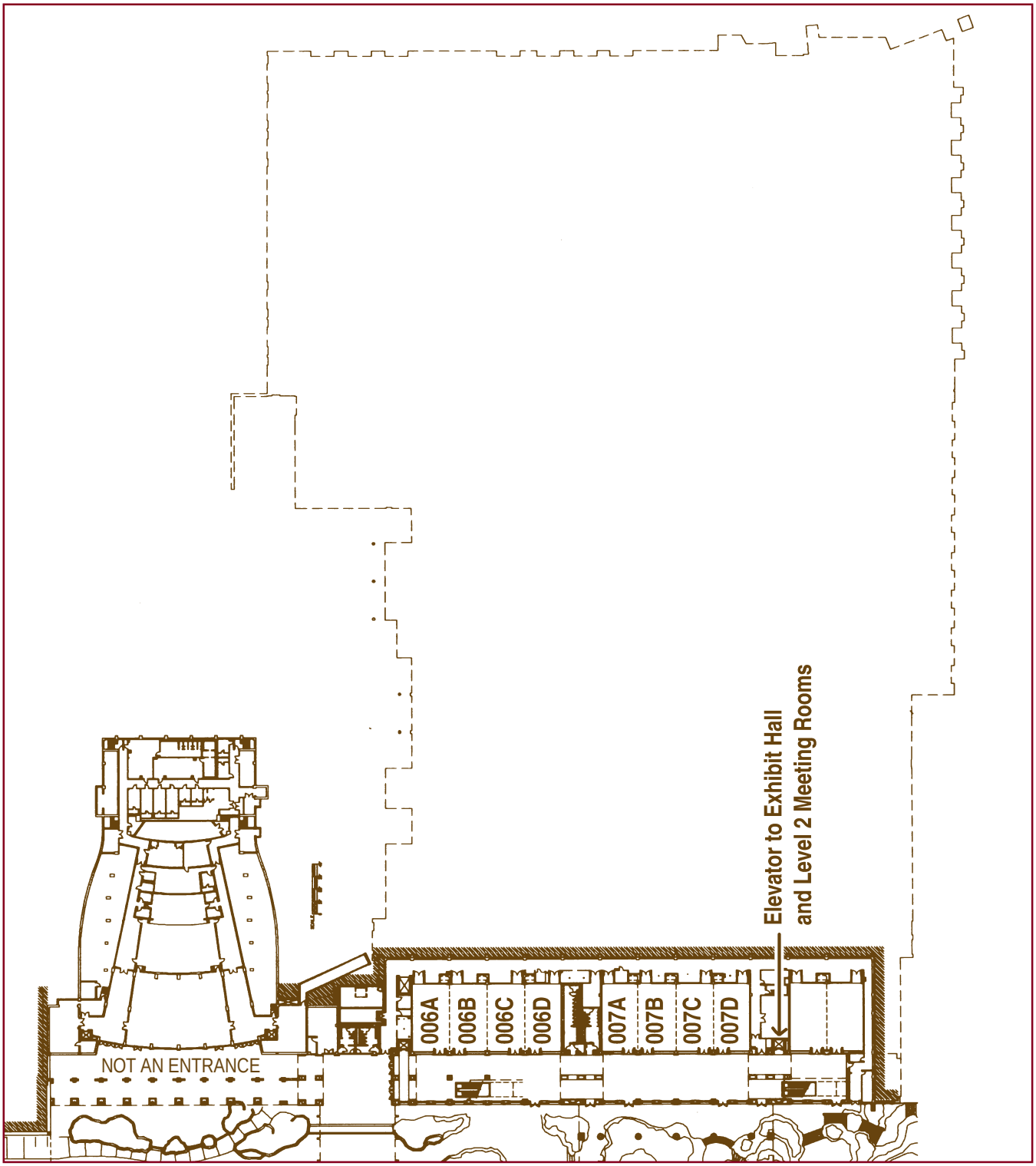
VIDEO EQUIPMENT
Carl Zeiss, Inc.
Cytometrics, Inc.
Endure Medical, Inc.
JVC HDTV
Karl Storz Endoscopy-America, Inc.
Prescott's Inc.

WEB PAGE DEVELOPERS
Medem, Inc.
Spine Universe

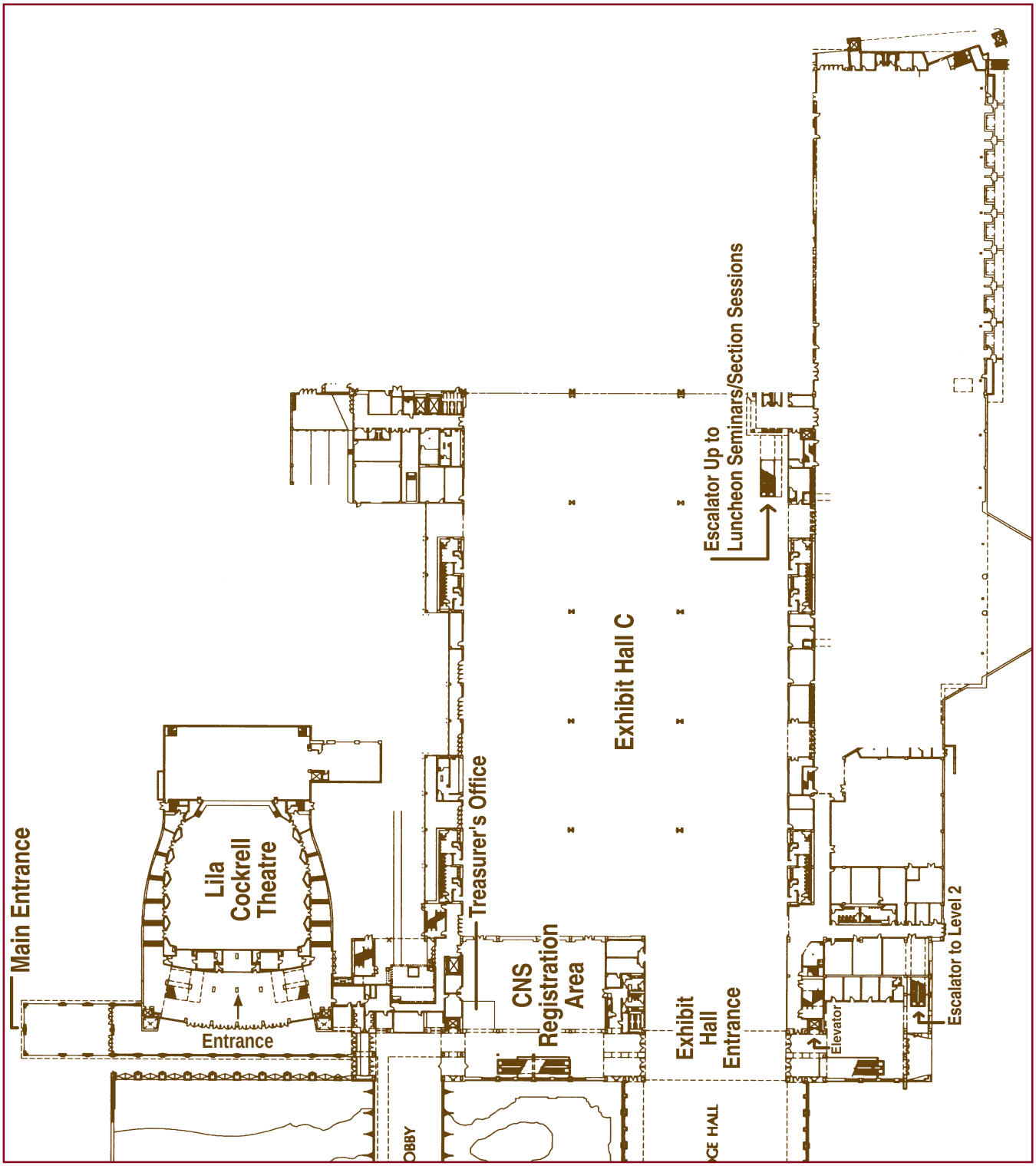
Henry B. Gonzalez Convention Center
EXHIBIT HALL C (Street Level)



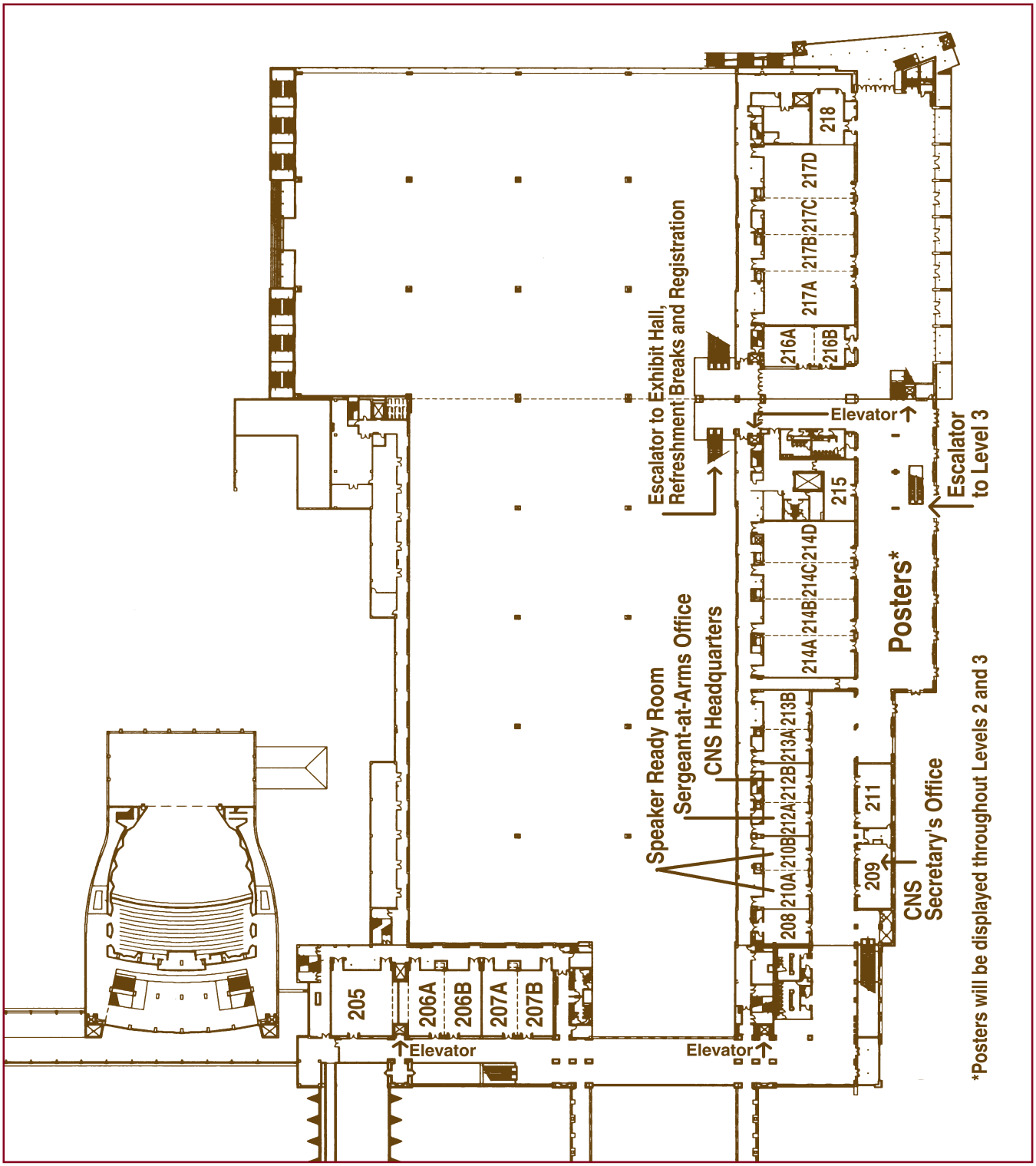
Henry B. Gonzalez Convention Center
RIVER LEVEL *(below street level)*



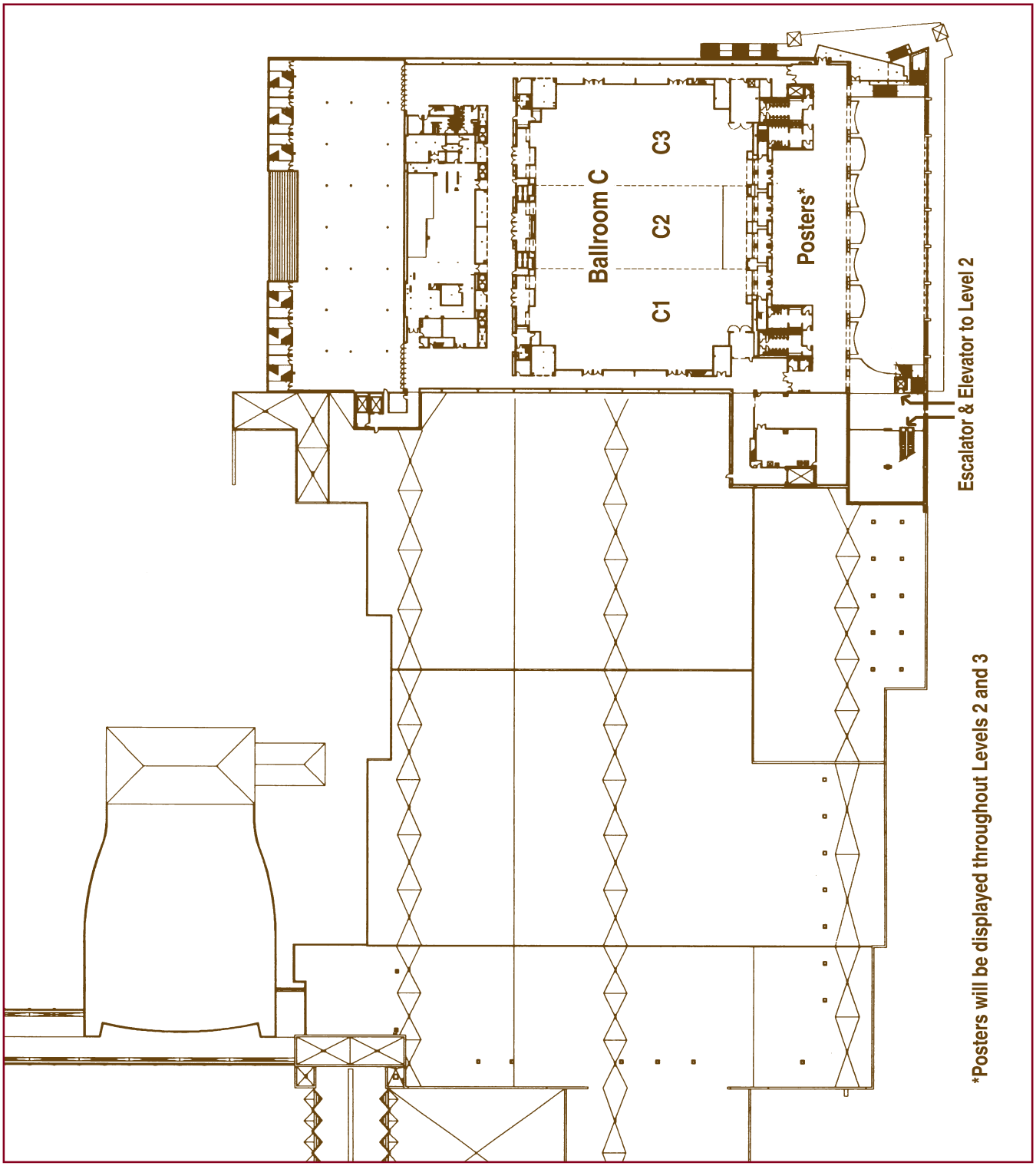
Henry B. Gonzalez Convention Center
STREET LEVEL



Henry B. Gonzalez Convention Center
CONCOURSE 2ND LEVEL



Henry B. Gonzalez Convention Center
3RD LEVEL



General Information

ADMISSION REQUIREMENTS

Admission to Scientific Sessions, Exhibits, and the Friends of the Congress Café is by badge only. Badges are distributed at the time of registration.

AUDIOTAPED SALES

Some sessions at the CNS Annual Meeting will be audio taped. Tapes will be available for purchase in the CNS Registration Area at the Henry B. Gonzalez Convention Center.

AUXILIARY TOURS, OPTIONAL EVENING EVENTS AND CNS SOCIAL PROGRAM

Auxiliary Tours are optional activities and programs available to registered spouses and guests only. Physicians and Allied Health Professionals may not register for these activities and programs. These activities and programs are selected to provide an opportunity to explore the more interesting attractions in the San Antonio area.

All tours will depart from the CNS headquarters hotel, the Marriott Rivercenter, unless otherwise noted.

All CNS Annual Meeting spouses and guests are invited to use the Friends of the Congress Café, including daily continental breakfasts from 7:30 am - 10:00 am. Please note that admittance to the Friends of the Congress Café is by Spouse/Guest or Nurse/Spouse badge only. The Friends of the Congress Café is located in Conference Room 17 of the Marriott Rivercenter Hotel and is open from 7:30 am - 5:00 pm Sunday through Wednesday and from 7:30 am - 11:00 am Thursday.

Optional Evening Events are available to all registered attendees and our exhibit partners. Complete details and fees for all planned Optional Activities can be found on page 56 of the Preliminary Program.

CNS Social Program is also open to all registered attendees and is included with each registration. This includes the Opening Reception on Sunday, September 24, (one complimentary ticket with each registration) and the Home on the Ranch Annual Reception and Dinner at Don Strange Ranch (ticket purchase required) on Wednesday, September 26. See page 57 of the Preliminary Program for more details.

Children over the age of 12 may register as a guest at the Guest Registration Fee. This will allow full participation in the Auxiliary Program activities. However, please note that children under 18 years of age are not allowed into the exhibit hall.

CHILDREN

Parents are asked to use their discretion in determining which tours are appropriate for young children. Some tours do have age restrictions. Please check the tour section of your Preliminary Program or Auxiliary Guide. Children under the age of 18 are not permitted in the exhibit hall. Child care will be provided at the CNS Child Care Activity Center in the Marriott Rivercenter Hotel. The Child Care Activity Center will allow spouses and members to leave their children with trained, professional caregivers in a safe, secure, educational environment while the parents participate in Annual Meeting activities.

CONTINUING MEDICAL ACCREDITATION

The Congress of Neurological Surgeons is accredited by the Accreditation Council for Continuing Medical Education to sponsor continuing medical education for physicians.

The CNS designates this continuing medical education activity for a maximum of 22.25 credit hours in category 1 credit towards the American Medical Association's Physician's Recognition Award. An additional 20.50 hours of credit may be earned by attending optional educational programs such as Practical Courses and Luncheon Seminars. Each physician should claim only those hours of credit that he/she actually spent in the educational activity.

Presenters of scientific posters can claim up to 10 category 2 credits for designing a poster and can also claim 1 category 2 credit for teaching.

Attendees can claim 1 category 2 credit for each hour spent viewing posters.

The same number of category 1 credits awarded will be applied toward the Continuing Education Award in Neurosurgery.

Certificates of attendance are mailed approximately six weeks after the meeting.

DEMONSTRATION SPOTLIGHT

Various exhibiting companies will provide in-depth discussion and hands-on demonstrations of their products or services each morning and afternoon of the show.

General Information

E-MAIL STATIONS

You will be able to check your e-mail messages from the E-mail Stations in the CNS Member Services Center in Exhibit Hall C. Please be sure to have your e-mail account username, password and the mail server name.

EXHIBITION

Over 600 exhibit booths will be located in Henry B. Gonzalez Convention Center, Hall C.

Hours are:
Monday, September 25 ..... 9:00 am – 4:30 pm
Tuesday, September 26 ..... 9:00 am – 4:30 pm
Wednesday, September 27 ..... 9:00 am – 4:00 pm

Admittance to Exhibit Hall C is by CNS name badge only. Please note that children under the age of 18 are not allowed in Exhibit Hall C.

HOTELS

SAN ANTIONIO MARRIOTT RIVERCENTER
101 Bowie Street
San Antonio, TX 78205
210/223-1000

HILTON PALACIO DEL RIO
200 South Alamo Street
San Antonio, TX 78205-3299
210/222-1400

HOMEWOOD SUITES RIVERWALK
432 W. Market
San Antonio, TX 78205-2920
210/222-1515

HYATT REGENCY SAN ANTONIO ON THE RIVERWALK
123 Losoya
San Antonio, TX 78205-2688
210/222-1234

LA MANSION DEL RIO HOTEL
112 College Street
San Antonio, TX 78205
210/518-1000

SAN ANTONIO MARRIOTT RIVERWALK
711 East Riverwalk
San Antonio, TX 78205
210/224-4555

MENGER HOTEL
204 Alamo Plaza
San Antonio, TX 78205
210/223-4361

WESTIN RIVERWALK
420 Market
San Antonio, TX 78205
210/224-6500

MEMBER SERVICES CENTER

Designed to increase the visibility of the CNS Secretary's Office, the CNS Membership Office, NEUROSURGERY: //ON CALL as well as the Resident's and Placement Offices, a CNS Member Services Center has been established in the Henry B. Gonzalez Convention Center. The CNS Member Services Center will be open Monday and Tuesday from 9:00 AM – 4:30 PM and Wednesday from 9:00 AM – 4:00 PM, and is located in Booth 456. Staff members will be available to answer any questions you may have regarding the CNS and its member services.

MESSAGE CENTER

The Message Center is located in the CNS Registration Area at the Henry B. Gonzalez Convention Center during registration hours.

PLACEMENT SERVICE

The Placement Committee's Office is located in the CNS Member Services Center located in the Exhibit Hall, Booth 456, of the Henry B. Gonzalez Convention Center Monday and Tuesday from 9:00 AM – 4:30 PM and Wednesday from 9:00 AM – 4:00 PM. A computerized service matching available jobs to applicants is open to all CNS members.

POSTERS

Scientific posters are on display throughout the Henry B. Gonzalez Convention Center Monday and Tuesday from 9:00 AM – 4:30 PM and Wednesday from 9:00 AM – 4:00 PM.

PRESS ROOM

The Press Room is located at the Henry B. Gonzalez Convention Center. It will be open from 9:00 am, Sunday, September 24 through 11:00 am, Thursday, September 28.

General Information

REGISTRATION INFORMATION

Registration Hours:

Saturday, September 23	7:00 am – 5:30 pm
Sunday, September 24	7:00 am – 5:30 pm
Monday, September 25	7:00 am – 5:30 pm
Tuesday, September 26	7:00 am – 5:30 pm
Wednesday, September 27	7:00 am – 5: 30 pm
Thursday, September 28	7:00 am – 11:00 am

RESIDENT DESK

Information about Resident membership and status in the CNS may be obtained from the CNS Member Services Center, located in Exhibit Hall Booth 456 of the Henry B. Gonzalez Convention Center.

SCIENTIFIC EVALUATION

The input of meeting attendees is very important for planning future programs. Evaluation forms are provided for all Scientific Sessions, Luncheon Seminars, and Practical Courses in the registration packets and throughout the Convention Center. Receptacles identified as "CNS Annual Meeting Evaluations" are conveniently placed in the Convention Center, Marriott Riverwalk and Marriott Rivercenter. Or you can return them to the Sergeant-at-Arms Committee members or to the Registration Area. In addition, an overall meeting evaluation form is included in each registration packet.

SHUTTLE SERVICES

Because of the convenient location of all participating hotels, limited shuttle service will be available. A shuttle schedule will be posted at these hotels and at the Convention Center. Shuttle hours are as follows: Saturday 6:30 am –5:30 pm

Sunday	6:30 am – 5:30 pm
Opening Reception at the Convention Center*	6:10 pm – 9:30 pm
Monday	6:45 am – 6:00 pm
Tuesday	6:45 am – 6:00 pm
Wednesday	6:45 am – 5:30 pm
Home on the Ranch Reception and Dinner**	6:15 pm – 11:00 pm
Thursday	6:45 am – 11:15 am

**The site of the Opening Reception is the Henry B. Gonzalez Convention Center. The daily, existing shuttle routes are also in operation for Sunday evening's Opening Reception.*

***The site of the Home on the Ranch Reception and Dinner is the Don Strange Ranch. Shuttles will depart from the headquarters hotel, the Marriott Rivercenter.*

SMOKING

Smoking will be prohibited in all meeting rooms and exhibit areas.

SPEAKER READY ROOM

The Speaker Ready Room will be available Saturday, September 23 through Wednesday, September 27, from 6:30 am - 6:00 pm and Thursday, September 28 from 6:30 am - 11:00 am at the Henry B. Gonzalez Convention Center in Room 210AB for speakers wishing to preview their audio visual materials.

TICKET SALES

Tickets for all evening events, courses, spouse programs, and tours are available for purchase in the Registration Area, located in the East Registration Area of the Henry B. Gonzalez Convention Center.

DISCLAIMER

The material presented at the 50th Annual Meeting has been made available by the Congress of Neurological Surgeons for educational purposes only. The material is not intended to represent the only, nor necessarily the best method or procedure appropriate for medical situations discussed, but rather is intended to present an approach, view, statement or opinion of the faculty, which may be helpful to others who face similar situations.

The Congress of Neurological Surgeons disclaims any and all liability for injury or damages resulting to any individual attending the Annual Meeting and for all claims which may arise out of the use of the techniques demonstrated therein by such individuals, whether these claims shall be asserted by physicians or any other person.

Calendar of Events

Thursday, September 21

Time	Event	Location
7:30 am - 5:00 pm	AANS Executive Committee	514 (MRC)
8:00 am - 6:00 pm	CSNS Office	Conference Room 19 (MRC)
8:00 am - 11:59 pm	CNS Headquarters' Office	212 B
5:30 pm - 9:00 pm	AANS Dinner Meeting	514 (MRC)

Friday, September 22

Time	Event	Location
8:00 am - 5:00 pm	AANS Executive Committee	Conference Suite 544 (MRC)
8:00 am - 6:00 pm	CSNS Office	Conference Room 19 (MRC)
8:00 am - 6:00 pm	CSNS Conference Room	Conference Room 10 (MRC)
8:00 am - 6:00 pm	CNS Headquarters' Office	212 B
8:30 am - 10:00 am	CSNS Communications & Education Committee	Conference Room 7 (MRC)
10:00 am - 12:00 pm	CSNS Officers & Quad Chairs Meeting	Conference Room 13 MRC)
11:00 am - 12:00 pm	CSNS Residents Information Conference	Conference Room 14 (MRC)
11:00 am - 12:00 pm	CSNS New Delegates, Alternate Delegates & Guests	Conference Room 9 (MRC)
12:00 pm - 1:30 pm	CSNS Neurotrauma Committee	Conference Room 5 (MRC)
12:00 pm - 1:30 pm	CSNS Reimbursement Committee	Conference Room 7 (MRC)
12:00 pm - 1:30 pm	CSNS Medical/Legal Committee	Conference Room 8 (MRC)
12:00 pm - 1:30 pm	CSNS Medical Practices Committee	Conference Room 12 (MRC)
12:00 pm - 1:30 pm	CSNS Workforce Committee	Conference Room 18 (MRC)
12:00 pm - 1:30 pm	CSNS Health Systems Committee	Conference Room 17 (MRC)
12:00 pm - 5:00 pm	THINK FIRST Office	Conference Room 6 (MRC)
1:45 pm - 5:00 pm	CSNS Plenary Session/Reference Hearings	Salons G/M (MRC)
5:00 pm - 5:30 pm	CSNS Networking Break	Salon G/M Foyer (MRC)
5:30 pm - 7:00 pm	CSNS SW Quadrant Meeting	Conference Room 9
5:30 pm - 7:00 pm	CSNS NW Quadrant Meeting	Conference Room 8
5:30 pm - 7:00 pm	CSNS SE Quadrant Meeting	Conference Room 5
5:30 pm - 7:00 pm	CSNS NE Quadrant Meeting	Conference Room 7
5:30 pm - 11:59 pm	CSNS Reference Committee Meeting	Conference Room 12
7:00 pm - 8:00 pm	CSNS Young Physicians Committee	Conference Room 17/18

Calendar of Events

Saturday, September 23

Time	Event	Location
8:00 am - 6:00 pm	CSNS Office	Conference Room 19 (MRC)
8:00 am - 6:00 pm	CSNS Conference Room	Conference Room 10 (MRC)
7:00 am - 8:00 am	CSNS SW Quadrant Caucus	Conference Room 9 (MRC0
7:00 am - 8:00 am	CSNS NW Quadrant Caucus	Conference Room 8 (MRC)
7:00 am - 8:00 am	CSNS NE Quadrant Caucus	Conference Room 7 (MRC)
7:00 am - 8:00 am	CSNS/AANS Caucus	Conference Room 16 (MRC)
7:00 am - 8:00 am	CSNS SE Quadrant Caucus	Conference Room 15 (MRC)
7:00 am - 8:00 am	CSNS/CNS Caucus	Conference Rooms 10 (MRC)
7:00 am - 8:30 am	THINK FIRST Marketing and Public Relations Committee Meeting	Conference Room 11(MRC)
7:00 am - 5:00 pm	THINK FIRST Office	Conference Room 6 (MRC)
7:00 am - 5:30 pm	CNS Registration Office	East Registration
7:00 am - 5:30 pm	CNS Registration	East Registration
7:00 am - 5:30 pm	CNS Treasurer's Office	East Registration
7:00 am - 5:30 pm	CNS Secretary's Office	209
7:00 am - 5:30 pm	CNS Audio VisualOffice	213 AB
7:00 am - 5:30 pm	CNS Headquarters' Office	212 B
7:00 am - 5:30 pm	CNS Sergeant-at-Arms Office	212 A
7:00 am - 5:30 pm	CNS Speaker Ready Room	210 AB
7:00 am - 5:30 pm	CNS Exhibitor Registration	East Registration
8:00 am - 12:00 pm	CSNS Plenary Session	Salons C/D (MRC)
8:00 am - 12:00 pm	PC05 - Spinal Biomechanics and Clinical Management Decision Making	206 B
8:00 am - 12:00 pm	PC06 - Trigeminal Neuralgia: Percutaneous	214 CD
8:00 am - 12:00 pm	PC07 - Image-Guided Cranial Surgical Navigation	007 ABC
8:00 am - 12:00 pm	PC08 - Posterior Circulation Aneurysms	Ballroom C3
8:00 am - 12:00 pm	PC09 - Lumbosacral Fusion: Cages, Dowels, and Pedicle Screws	207 AB
8:00 am - 12:00 pm	PC10 - Cervical Spine Stabilization	205
8:00 am - 12:00 pm	PC11 - CPT Coding, Medicare Documentation and Audits	215
8:00 am - 12:00 pm	PC12 - Computer Skills - Basic Database Design	211
8:00 am - 5:00 pm	PC01 - Microsurgical Anatomy	006 ABCD
8:00 am - 5:00 pm	PC02 - Treatment Of Carotid Disease: Evaluation, Medical- Endovascular- and Surgical Management Techniques	216 AB
8:00 am - 5:00 pm	PC03 - Anterior and Posterior Approaches and Stabilization Techniques for the Thoracolumbar Spine	Ballroom C2
8:00 am - 5:00 pm	PC04 - Transsphenodial Surgery	214 AB

Saturday, September 23

Time	Event	Location
9:30 am - 10:30 am	THINK FIRST Finance Committee Meeting	Conference Room 6
9:45 am - 10:00 am	CSNS Networking Break	Salon C/D Foyer (MRC)
11:30 am - 12:30 pm	THINK FIRST Resource Development Committee Meeting	Conference Room 11
12:00 pm - 2:30 pm	CSNS Luncheon	Salon I (MRC)
1:00 pm - 3:00 pm	AANS Spokespersons Network Media Training	Conference Room 3/4 (MRC)
1:00 pm - 5:00 pm	PC13 - Microsurgical Dissection Techniques	007 D
1:00 pm - 5:00 pm	PC14 - Image-Guided Spinal Navigation	007 ABC
1:00 pm - 5:00 pm	PC15 - Microvascular Decompression for Trigeminal Neuralgia and Other Cranial Nerve Syndromes	214 CD
1:00 pm - 5:00 pm	PC16 - Lumbosacral Fusion: Cages, Dowels, and Pedicle Screws	207 AB
1:00 pm - 5:00 pm	PC17 - Pediatric Traumatic CNS Injury and Critical Care	217 C
1:00 pm - 5:00 pm	PC18 - Internet and Office Applications	211
1:00 pm - 5:00 pm	PC19 - Movement Disorders: Pathophysiology, Diagnosis, Treatment	206 A
1:00 pm - 5:00 pm	PC20 - Anterior Circulation Aneurysms	217 AB
1:00 pm - 6:00 pm	AANS Education Committee	Conference Room 1 (MRC)
2:30 pm - 5:00 pm	AANS CNS Joint Officers' Meeting	Conference Room 17/18 (MRC)
2:30 pm - 4:00 pm	THINK FIRST Program Advisory Committee Meeting	Conference Room 11 (MRC)
4:00 pm - 5:30 pm	Section on PN and Spine Scientific Program Committee	Conference Room 8 (MRC)

Calendar of Events

Sunday, September 24

Time	Event	Location
12:00 am - 11:59 pm	CSNS Office	Conference Room 19 (MRC)
7:00 am - 9:00 am	Van Wagenen Trust Committee	Conference Room 9 (MRC)
7:00 am - 9:30 am	THINK FIRST Executive Committee Meeting	Conference Room 11 (MRC)
7:30 am - 10:00 am	CNS Friends of the Congress Café Breakfast	Conference Room 17 & 18 (MRC)
7:00 am - 12:00 pm	Pediatric Hypothermia Investigators Meeting	Conference Room 1 (MRC)
7:00 am - 5:00 pm	THINK FIRST Office	Conference Room 6 (MRC)
7:30 am - 5:00 pm	CNS Friends of the Congress Café	Conference Room 17/18 (MRC)
7:00 am - 5:30 pm	CNS Secretary's Office	209
7:00 am - 5:30 pm	CNS Exhibitor Registration	East Registration
7:00 am - 5:30 pm	CNS Registration	East Registration
7:00 am - 5:30 pm	CNS Sergeant-at-Arms Office	212 A
7:00 am - 5:30 pm	CNS Audio Visual Office	213 AB
7:00 am - 5:30 pm	CNS Headquarters' Office	212 B
7:00 am - 5:30 pm	CNS Speaker Ready Room	210 AB
7:00 am - 5:30 pm	CNS Treasurer's Office	East Registration
7:00 am - 5:30 pm	CNS Registration Office	East Registration
7:00 am - 5:30 pm	CNS MBE Business Office	2nd Floor
7:30 am - 9:30 am	PAC Board of Directors	Conference Room 2 (MRC)
8:00 am - 9:30 am	Drug and Device Subcommittee of the QAC	Conference Room 10 (MRC)
8:00 am - 12:00 pm	PC26 - Managing and Building a Neurosurgical Practice Using Marketing, Media and the Internet	215
8:00 am - 12:00 pm	PC27 - Nursing in Neurosurgery	007 D
8:00 am - 12:00 pm	PC28 - Functional Cerebral Mapping	207 AB
8:00 am - 12:00 pm	PC29 - Anterolateral Skull Base Approaches	006 ABCD
8:00 am - 12:00 pm	PC30 - Minimally Invasive Techniques for the Lumbar Spine	Ballroom C2
8:00 am - 12:00 pm	PC31 - Basic Computer Skills: Computers Made Easy	211
8:00 am - 12:00 pm	PC32 - Endovascular Techniques in Stroke	205
8:00 am - 12:00 pm	PC33 - Stereotactic Radiosurgery	Ballroom C3
8:00 am - 12:00 pm	PC34 - Critical Care for Neurotrauma	206 B
8:00 am - 5:00 pm	PC21 - Microvascular Reconstruction	University of Texas Health Science Center - 252A
8:00 am - 5:00 pm	PC22 - Temporal Bone - Acoustic Surgery	007 ABC
8:00 am - 5:00 pm	PC23 - Exposure and Surgery of the Peripheral Nerves	University of Texas Health Science Center 1.236S/1.284T
8:00 am - 5:00 pm	PC24 - Neuroaugmentation for Pain Control	217 AB
8:00 am - 5:00 pm	PC25 - Thoracoscopic Spinal Surgery	217 CD

Sunday, September 24

Time	Event	Location
9:00 am - 10:30 am	CSNS Officers/Quadrant Chairs & Committee Chairs Meeting	Conference Room 5 (MRC)
9:00 am - 12:00 pm	NREF Executive Committee	Conference Room 8 (MRC)
9:30 am - 11:00 am	AANS Joint Sponsorship Subcommittee	Conference Room 7 (MRC)
10:30 am - 12:30 pm	Joint Coding and Reimbursement Committee	Conference Room 10 (MRC)
12:00 pm - 1:30 pm	AANS Nominating Committee	Conference Room 13 (MRC)
12:00 pm - 2:00 pm	AANS Spokesperson Network Media Training	Conference Room 3/4 (MRC)
12:00 pm - 2:00 pm	AANS Professional Liability Task Force	Conference Room 7 (MRC)
12:00 pm - 3:30 pm	AANS Outcomes Committee	Conference Room 5 (MRC)
12:00 pm - 6:00 pm	CNS Mock Oral Board Exam	Salon D (MRC)
12:30 pm - 3:00 pm	CNS Publications Committee	Conference Room 2 (MRC)
1:00 pm - 3:00 pm	AANS Professional Conduct Meeting	Conference Room 10 (MRC)
1:00 pm - 5:00 pm	PC35 - Vertebroplasty	205
1:00 pm - 5:00 pm	PC36 - Spinal Deformity and Scoliosis in Adults: Surgical and Management Options	216 AB
1:00 pm - 5:00 pm	PC37 - Technological Advances: Programmable Devices in Practice	215
1:00 pm - 5:00 pm	PC38 - Intracranial Endoscopy	214 AB
1:00 pm - 5:00 pm	PC39 - Lateral Skull Base Approaches	006 ABCD
1:00 pm - 5:00 pm	PC40 - Digital Images and Presentations	211
1:00 pm - 5:00 pm	PC41 - Grants: Getting Started, Applications and Funding	007 D
1:00 pm - 5:00 pm	PC42 - Anterior Approaches to the Lumbar Spine	214 CD
1:00 pm - 5:00 pm	PC43 - Critical Care Acute Stroke/Neurovascular	206 A
1:00 pm - 5:00 pm	PC44 - Brain Mapping and Surgery of Epilepsy	207 AB
2:00 pm - 3:30 pm	AANS Internet Advisory Task Force	Conference Room 8 (MRC)
2:15 pm - 3:30 pm	AANS Meeting	Conference Room 16 (MRC)
2:30 pm - 5:00 pm	Journal of Neurosurgery Editorial Board Meeting	Conference Room 9 (MRC)
3:00 pm - 4:30 pm	CNS Education Committee	Conference Room 3 (MRC)
3:00 pm - 5:00 pm	AANS Meeting	Conference Room 9 (MRC)
3:00 pm - 6:00 pm	AANS Public Relations Committee	Conference Room 11 (MRC)
3:30 pm - 5:00 pm	AANS Committee for the Assessment of Quality	Conference Room 5 (MRC)
4:00 pm - 6:00 pm	American Brain Injury Consortium	Salon J (MRC)
4:00 pm - 6:00 pm	Federation of Latin American Neurological Societies	Conference Room 4 (MRC)
4:00 pm - 6:00 pm	CNS International Committee Meeting	Conference Room 10 (MRC)
5:00 pm - 6:00 pm	CNS Neurosurgery Open House	Salon I (MRC)
6:30 pm - 9:00 pm	Opening Reception	Ballroom C

Calendar of Events

Monday, September 25

Time	Event	Location
6:00 am - 7:00 am	AANS Focus Group	Conference Room 16 (MRC)
6:00 am - 7:15 am	Section on Tumors Executive Council Meeting	Conference Room 2 (MRC)
6:30 am - 7:45 am	Section on Cerebrovascular Surgery Executive Committee	Conference Room 3/4 (MRC)
7:30 am - 10:00 am	Friends of the Congress Café Breakfast	Conference Room 17/18 (MRC)
7:00 am - 5:00 pm	THINK FIRST Office	Conference Room 6 (MRC)
7:30 am - 5:00 pm	Friends of the Congress Café	Conference Room 17/18 (MRC)
7:00 am - 5:30 pm	CNS Registration Office	East Registration
7:00 am - 5:30 pm	CNS Sergeant-at-Arms Office	212 A
7:00 am - 5:30 pm	CNS Audio Visual Office	213 AB
7:00 am - 5:30 pm	CNS Treasurer's Office	East Registration
7:00 am - 5:30 pm	CNS MBE Business Office	2nd Floor
7:00 am - 5:30 pm	CNS Secretary's Office	209
7:00 am - 5:30 pm	CNS Exhibitor Registration	East Registration
7:00 am - 5:30 pm	CNS Headquarters' Office	212 B
7:00 am - 5:30 pm	CNS Speaker Ready Room	210 AB
7:00 am - 5:30 pm	CNS Registration	East Registration
7:30 am - 8:30 am	CNS Leadership Development Committee	Conference Room 1 (MRC)
7:30 am - 11:45 am	General Scientific Session I	Lila Cockrell Theatre
8:00 am - 6:00 pm	CSNS Office	Conference Room 19 (MRC)
9:00 am - 4:30 pm	Poster Viewing	2nd and 3rd Floors
9:00 am - 4:30 pm	Exhibits	Hall C
9:00 am - 4:30 pm	CNS Member Resources Center	Hall C, Booth 456
9:30 am - 1:00 pm	THINK FIRST Board of Directors Meeting	Conference Room 11 (MRC)
11:45 am - 12:30 pm	Visit Exhibits and Lunch Pick Up Distribution Point	Hall C, Booth 788
12:00 pm - 1:00 pm	THINK FIRST Board of Directors Lunch	Conference Room 11 (MRC)
12:00 pm - 1:45 pm	Neurosurgery://On-Call Editorial Board Meeting	Salon C (MRC)
12:00 pm - 1:45 pm	AANS Electronic CME Subcommittee	Conference Room 1 (MRC)
12:00 pm - 1:45 pm	AANS Bulletin Editorial Board Meeting	Conference Room 2 (MRC)
12:00 pm - 1:45 pm	Joint Section of Disorders of Spine & PN Executive Committee	Conference Rooms 3/4 (MRC)
12:30 pm - 2:00 pm	M01/M01R - International Luncheon and Program	214 A
12:30 pm - 2:00 pm	M02/M02R - Management of Craniovertebral Junction Abnormalities	214 C
12:30 pm - 2:00 pm	M03/M03R - Case Management: Cervical Spondylotic Myelopathy	214 D
12:30 pm - 2:00 pm	M04/M04R - Management of Thoracolumbar Fractures	006 A
12:30 pm - 2:00 pm	M05/M05R - Current Surgical Options for Lumbar Discectomy: Comparison of Results	Ballroom C1
12:30 pm - 2:00 pm	M06/M06R - Spinal Infections: Contemporary Diagnosis and Management	215
12:30 pm - 2:00 pm	M07/M07R - Case Management: Gliomas	217 A

Monday, September 25

Time	Event	Location
12:30 pm - 2:00 pm	M08/M08R - Brain Tumor Irradiation: Strategies and Controversies	208
12:30 pm - 2:00 pm	M09/M09R - Controversies in Pituitary Surgery	Ballroom C2
12:30 pm - 2:00 pm	M10/M10R - Surgical Approaches to the Anterior and Central Skull Base	207 B
12:30 pm - 2:00 pm	M11/M11R - Optimizing Outcomes in Acoustic Tumor Surgery: Practical and Technical Considerations	206 B
12:30 pm - 2:00 pm	M12/M12R - Anterior Circulation Aneurysms: Options and Approaches	205
12:30 pm - 2:00 pm	M13/M13R - Poor-Grade Aneurysm Patients: Surgical and ICU Management	206 A
12:30 pm - 2:00 pm	M14/M14R - Management of Cavernous and Paraclinoidal Vascular Lesions	214 B
12:30 pm - 2:00 pm	M15/M15R - Current and Emerging Technologies for Monitoring Head-Injured Patients	Ballroom C3
12:30 pm - 2:00 pm	M16/M16R - Craniosynostosis: Controversies in Treatment	207 A
12:30 pm - 2:00 pm	M17/M17R - Pediatric Spine Surgery	006 B
12:30 pm - 2:00 pm	M18/M18R - Surgical Management of Tremor: Role of Thalamotomy, Chronic Thalamic Stimulation, and Stereotactic Radiosurgical Thalamotomy	217 D
12:30 pm - 2:00 pm	M19/M19R - Current Management of Medically Refractory Spasticity: From Rhizotomy to Baclofen Pump	211
12:30 pm - 2:00 pm	M20/M20R - Neurosurgical Management of Athletic Injuries	006 D
12:30 pm - 2:00 pm	M21/M21R - Ablative Surgery for Intractable Pain: What Works and Why Are We Not Utilizing These Procedures More Often?	006 C
12:30 pm - 2:00 pm	M22/M22R - Surgical Management of Brachial Plexus Pathology	218
12:30 pm - 2:00 pm	M23/M23R - Spinal Cord Injury Management	217 B
12:30 pm - 2:00 pm	M24/M24R - Case Management: Unruptured Aneurysms	217 C
12:30 pm - 2:00 pm	M25/M25R - Publishing Scientific Articles in Neurosurgery	216 B
12:30 pm - 2:00 pm	M26/M26R - Neurotrauma Issues for the Neurosurgeon: Coverage, Procedures, and the Roles of Physician Extenders	216 A
2:00 pm - 5:00 pm	Special Course I	Lila Cockrell Theatre
2:00 pm - 5:30 pm	Section on Cerebrovascular Surgery I	Ballroom C1
2:00 pm - 5:30 pm	Section on Stereotactic and Functional Surgery I	Ballroom C3
2:00 pm - 5:30 pm	Section on Tumors I	Ballroom C2
2:00 pm - 5:30 pm	Section on Neurotrauma and Critical Care I	007 AB
2:00 pm - 5:30 pm	Council of State Neurosurgical Societies	007 CD
5:00 pm - 6:00 pm	CNS Neurosurgery Open House	Salon I (MRC)
5:00 pm - 6:00 pm	Illinois State Neurosurgeon Society Meeting	Conference Room 8 (MRC)
5:30 pm - 6:30 pm	ESIT Meeting (Endoscopic Shunt Insertion Trial)	Conference Room 2 (MRC)
5:30 pm - 7:00 pm	Princeton in Neurosurgery	Salon J (MRC)
6:00 pm - 7:30 pm	Score Project Meeting	Conference Suite 514 (MRC)
6:00 pm - 8:00 pm	AANS Young Neurosurgeons Meeting	Salon E (MRC)
6:00 pm - 9:30 pm	Section on Neurotrama and Critical Care Executive Committee	Conference Room 3/4 (MRC)
6:30 pm - 8:00 pm	Mayo Medical Alumni Association Reception	Salon D (MRC)

Calendar of Events

Tuesday, September 26

Time	Event	Location
8:00 am - 12:00 pm	CSNS Office	Conference Room 19 (MRC)
6:00 am - 8:00 am	Women in Neurological Surgery (WINS) Board Meeting	Conference Room 5 (MRC)
7:30 am - 10:00 am	Friends of the Congress Café Breakfast	Conference Room 17/18 (MRC)
7:00 am - 5:00 pm	THINK FIRST Office	Conference Room 6 (MRC)
7:30 am - 5:00 pm	Friends of the Congress Café	Conf. Room 17/18 (MRC)
7:00 am - 5:30 pm	CNS Registration	East Registration
7:00 am - 5:30 pm	CNS MBE Business Office	2nd Floor
7:00 am - 5:30 pm	CNS Secretary's Office	209
7:00 am - 5:30 pm	CNS Sergeant-at-Arms Office	212 A
7:00 am - 5:30 pm	CNS Headquarters' Office	212 B
7:00 am - 5:30 pm	CNS Treasurer's Office	East Registration
7:00 am - 5:30 pm	CNS Audio Visual Office	213 AB
7:00 am - 5:30 pm	CNS Speaker Ready Room	210 AB
7:00 am - 5:30 pm	CNS Exhibitor Registration	East Registration
7:00 am - 5:30 pm	CNS Registration Office	East Registration
7:30 am - 11:45 am	General Scientific Session II	Lila Cockrell Theatre
8:30 am - 4:30 pm	CNS Member Resource Center	Hall C, Booth 456
9:00 am - 4:30 pm	Poster Viewing	2nd & 3rd Floors
9:00 am - 4:30 pm	Exhibits	Hall C
11:45 am - 12:30 pm	Visit Exhibits & Lunch Pick Up Distribution Point	Hall C - Booth 788
12:00 pm - 1:30 pm	CNS EAC Meeting	Conference Room 9 (MRC)
12:00 pm - 1:45 pm	AANS EAC Meeting	Conference Room 2 (MRC)
12:00 pm - 1:45 pm	AANS Member Benefit Development Committee	Conference Room 3 (MRC)
12:00 pm - 1:45 pm	AANS Coordinating Committee for Continuing Education	Conference Room 4 (MRC)
12:00 pm - 1:45 pm	AANS Publications Committee Meeting	Conference Room 5 (MRC)
12:00 pm - 2:00 pm	Section on Pediatric Neurosurgery Executive Committee	Conference Room 1 (MRC)
12:30 pm - 2:00 pm	PAC Luncheon	Salon E
12:00 pm - 2:00 pm	T27/T27R - Resident's and Honored Guest Luncheon	205
12:30 pm - 2:00 pm	T28/T28R - Intracerebral Hematoma: Treatment Options and Controversies	206 A
12:30 pm - 2:00 pm	T29/T29R - Management of Lesions at the Cervicothoracic Junction	208
12:30 pm - 2:00 pm	T30/T30R - Case Management: Lumbar Spondylolysis/ Spondylolisthesis	Ballroom C1
12:30 pm - 2:00 pm	T31/T31R - Sympathetic vs. Neuropathic Pain: Differences in Pathophysiology and Treatment	206 B
12:30 pm - 2:00 pm	T32/T32R - Biology of Bone Fusion and Techniques of Bone Grafting	Ballroom C3

Tuesday, September 26

Time	Event	Location
12:30 pm - 2:00 pm	T33/T33R - Outcomes Assessment for Spinal Surgery	217 A
12:30 pm - 2:00 pm	T34/T34R - Novel Therapies for Malignant Gliomas	Ballroom C2
12:30 pm - 2:00 pm	T35/T35R - Case Management: Intracranial Meningiomas	211
12:30 pm - 2:00 pm	T36/T36R - Technical Issues and Complication Avoidance in Pituitary Surgery	215
12:30 pm - 2:00 pm	T37/T37R - Third Ventricular Tumors: Open, Stereotactic, and Endoscopic Approaches	207 A
12:30 pm - 2:00 pm	T38/T38R - Complication Avoidance and Management in Cranial Base Surgery	216 A
12:30 pm - 2:00 pm	T39/T39R - Cerebral Aneurysm Surgery: Complication Avoidance and Mangement	207 B
12:30 pm - 2:00 pm	T40/T40R - Multimodality Management of AVMs	214 B
12:30 pm - 2:00 pm	T41/T41R - Vascular Augmentation Techniques for Cerebral Ischemia	216 B
12:30 pm - 2:00 pm	T42/T42R - Case Management: Carotid Disease	214 C
12:30 pm - 2:00 pm	T43/T43R - Contemporary Management of Head Injury	217 B
12:30 pm - 2:00 pm	T44/T44R - Management of Posterior Fossa and Brain Stem Tumors in Children	006 A
12:30 pm - 2:00 pm	T45/T45R - Chiari Malformation and Syringomyelia: Controversies in Mangement	214 A
12:30 pm - 2:00 pm	T46/T46R - Managing Complex Myelomeningoceles	006 B
12:30 pm - 2:00 pm	T47/T47R - Functional Brain Mapping Techniques	006 C
12:30 pm - 2:00 pm	T48/T48R - Intracranial Navigation Systems: What is Nice and What is Necessary	214 D
12:30 pm - 2:00 pm	T49/T49R - Pediatric Epilepsy Surgery	217 D
12:30 pm - 2:00 pm	T50/T50R - Current Clinical Applications of Spinal Cord Stimulation	218
12:30 pm - 2:00 pm	T51/T51R - Peripheral Nerve Surgery: Clinical and Electrical Diagnosis, Surgical Exposure, and Results	006 D
12:30 pm - 2:00 pm	T52/T52R - Diagnosis and Management of Child Abuse	217 C
2:00 pm - 5:15 pm	Special Course II	Lila Cockrell Theatre
2:00 pm - 5:30 pm	Section on Disorders of the Spine and Peripheral Nerves I	Ballroom C1
2:00 pm - 5:30 pm	Section on Tumors II	Ballroom C2
2:00 pm - 5:30 pm	Section on Stereotactic and Functional Surgery II	Ballroom C3
2:00 pm - 5:30 pm	Section on Pediatrics I	007 AB
2:00 pm - 5:30 pm	Section on Pain I	007 CD
5:00 pm - 6:00 pm	CNS Neurosurgery Open House	Salon I (MRC)
5:00 pm - 6:00 pm	2001 CNS Annual Meeting Committee	Conference Room 3 (MRC)
5:30 pm - 6:30 pm	CNS Annual Business Meeting	206 A
6:00 pm - 7:00 pm	Reception for Prospective Joint Section on Tumors Members	Salon D (MRC)
6:00 pm - 8:00 pm	Women in Neurological Surgery Meeting (WINS)	Salon J (MRC)
6:30 pm - 8:00 pm	Brigham & Women's Hospital & Children's Hospital Alumni Reception	Conference Room 5 (MRC)
7:00 pm - 9:00 pm	Oregon Reception	Salon K (MRC)

Calendar of Events

Wednesday, September 27

Time	Event	Location
7:30 am - 10:00 am	Friends of the Congress Café Breakfast	Conference Room 17/18 (MRC)
7:30 am - 5:00 pm	Friends of the Congress Café	Conference Room 17/18 (MRC)
7:00 am - 5:30 pm	CNS Headquarters' Office	212 B
7:00 am - 5:30 pm	CNS Speaker Ready Room	210 AB
7:00 am - 5:30 pm	CNS Audio Visual Office	213 AB
7:00 am - 5:30 pm	CNS Registration	East Registration
7:00 am - 5:30 pm	CNS Registration Office	East Registration
7:00 am - 5:30 pm	CNS Treasurer's Office	East Registration
7:00 am - 5:30 pm	CNS Sergeant-at-Arms Office	212 A
7:00 am - 5:30 pm	CNS MBE Business Office	2nd Floor
7:00 am - 5:30 pm	CNS Secretary's Office	209
7:00 am - 5:30 pm	Exhibitor Registration	East Registration
7:30 am - 11:45 am	General Scientific Session III	Lila Cockrell Theatre
8:00 am - 5:00 pm	2001 CNS Scientific Program Committee Meeting	Conference Room 3 /4 (MRC)
9:00 am - 4:00 pm	Exhibits	Hall C
9:00 am - 4:00 pm	Poster Viewing	2nd & 3rd Floors
9:00 am - 4:00 pm	CNS Member Resources Center	Hall C, Booth 456
11:45 am - 12:30 pm	Visit Exhibits & Lunch Pick Up Distribution Point	Hall C, Booth 788
12:30 pm - 2:00 pm	W53/W53R - Current Management of Odontoid Fractures	Ballroom C1
12:30 pm - 2:00 pm	W54/W54R - Single-Level Cervical Disk Disease: Optimal Surgical Management	214 A
12:30 pm - 2:00 pm	W55/W55R - Vertebroplasty: Indications and Techniques	214 B
12:30 pm - 2:00 pm	W56/W56R - Career Options and Tracks in Neurosurgery	217 D
12:30 pm - 2:00 pm	W57/W57R - Multidisciplinary Management of Failed Back Surgery Syndrome	Ballroom C2
12:30 pm - 2:00 pm	W58/W58R - Management Strategies for Spinal Neoplasms	217 B
12:30 pm - 2:00 pm	W59/W59R - Intraoperative Spinal Navigation: Current Technology and Practical Applications	206 A
12:30 pm - 2:00 pm	W60/W60R - Case Management: Brain Metastases	207 A
12:30 pm - 2:00 pm	W61/W61R - Treatment of Craniopharyngiomas	211
12:30 pm - 2:00 pm	W62/W62R - Pineal Region Tumors	207 B
12:30 pm - 2:00 pm	W63/W63R - Management of Skull Base Meningiomas	217 A
12:30 pm - 2:00 pm	W64/W64R - Coding for the Spine: Case Examples	217 C
12:30 pm - 2:00 pm	W65/W65R - Treatment Strategies for Spinal Cord Tumors	206 B
12:30 pm - 2:00 pm	W66/W66R - Neuroanatomy Topics for Cranial Base Surgery	Ballroom C3
12:30 pm - 2:00 pm	W67/W67R - Posterior Circulation Aneurysms	007 A

Wednesday, September 27

Time	Event	Location
12:30 pm - 2:00 pm	W68/W68R - Instability of the Subaxial Cervical Spine: Current Concepts in Management	007 B
12:30 pm - 2:00 pm	W69/W69R - Management of Penetrating CNS Injuries	006 C
12:30 pm - 2:00 pm	W70/W70R - Management of Acute Cerebral Ischemia	006 D
12:30 pm - 2:00 pm	W71/W71R - Pediatric Head Injury	006 A
12:30 pm - 2:00 pm	W72/W72R - Managing Shunt Complications	006 B
12:30 pm - 2:00 pm	W73/W73R - Moya Moya Syndrome in Adult and Pediatric Patients	208
12:30 pm - 2:00 pm	W74/W74R - Video Case Management: Advanced Parkinson's Disease and Dystonia	205
12:30 pm - 2:00 pm	W75/W75R - Indications for Epilepsy Surgery: Who Should Get Surgery, Which Operation and When?	214 C
12:30 pm - 2:00 pm	W76/W76R - Trigeminal Neuralgia: Treatment Options	214 D
12:30 pm - 2:00 pm	W77/W77R - Medicolegal Issues in Neurosurgery	215
2:00 pm - 5:00 pm	Special Course III	Lila Cockrell Theatre
2:00 pm - 5:30 pm	Section on Disorders of the Spine and Peripheral Nerves II	Ballroom C1
2:00 pm - 5:30 pm	Section on Cerebrovascular Surgery II	Ballroom C2
2:00 pm - 5:30 pm	Section on Neurotrauma and Critical Care II / General Neurosurgery	Ballroom C3
2:00 pm - 5:30 pm	Section on Pediatrics II/General Interest	007 C
2:00 pm - 5:30 pm	Section on Pain II/General Neurosurgery	007 D
5:30 pm - 6:30 pm	CNS International Reception	Salon I (MRC)
7:00 pm - 10:00 pm	Home on the Ranch Reception & Texas BBQ!	Don Strange Ranch

Calendar of Events

Thursday, September 28

Time	Event	Location
7:30 am - 10:00 am	Friends of the Congress Café Breakfast	Conf. Room 17/18 (MRC)
7:30 am - 11:00 am	Friends of the Congress Café	Conf. Room 17/18 (MRC)
7:00 am - 12:00 pm	CNS Registration Office	East Registration
7:00 am - 12:00 pm	CNS Secretary's Office	209
7:00 am - 12:00 pm	CNS Speaker Ready Room	210 AB
7:00 am - 12:00 pm	CNS Headquarters' Office	212 B
7:00 am - 12:00 pm	CNS Sergeant-at-Arms Office	212 A
7:00 am - 12:00 pm	CNS Registration	East Registration
7:00 am - 12:00 pm	CNS Treasurer's Office	East Registration
7:00 am - 12:00 pm	CNS Audio Visual Office	213 AB
7:30 am - 11:15 am	General Scientific Session IV	Lila Cockrell Theatre

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Shigeru Miyachi
John J. Moossy
Jacques J. Morcos
John L. Moriarity
Thomas M. Moriarty
Akio Morita
Richard J. Moulton
Karin M. Muraszko
Antonio Mussi
Cheryl A. Muszynski
Ali Nader-Sepahi
Hiroshi Nakagawa
Norio Nakajima
Anil Nanda
Tung T. Nguyen
Ajay Niranjan
Russell P. Nockels
Thorkild V. Nooregard
Michael Nosko
G. Robert Nugent
Eric S. Nussbaum
Michael J. O'Connor
Seong Oh
Andre Olivier
Thomas C. Origitano
Richard K. Osenbach
Nelson M. Oyesiku
Sylvain Palmer
Dachling Pang
Stephen M. Papadopoulos
Andrew Parent
John Park
Jongsoo Park
Jung Y. Park
Michael David Partington
Nikunj K. Patel
Sunil J. Patel
Ravish V. Patwardhan
Troy Payner
Noel I. Perin
Richard G. Perrin
Nicolas Phan
Joseph M. Piepmeier
Webster H. Pilcher
Ian F. Pollack
Bruce E. Pollock
A. John Popp
Marc Proctor
Mark R. Proctor
Gregory J. Pryzbylski
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Michael J. Rauzzino
Gary L. Rea
Keith M. Rich
Charles J. Riedel
Andrew J. Ringer
Jon H. Robertson
Jack Rock
Gerard S. Rodziewicz
Mark L. Rosenblum
Robert H. Rosenwasser
Richard A. Roski
James T. Rutka
Michael Salcman
Duke S. Samson
Abhay Sanan
Hirotoshi Sano
Rick Sasso
Raymond Sawaya
Paul D. Sawin
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Christopher I. Shaffrey
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Yuichiro Tanaka
Nitin Tandon
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Jeffrey E. Thomas
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Alan R. Turtz
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Disclosure Information

The following speakers and paper presenters/authors did not return the requested Disclosure Form.

Bret Abshire
Oscar Benavente
Barry L. Birch
David Bissonette
Gregory Brandenberg
Gavin Britz
Mark H. Camel
Michael J. Caron
Jens Chapman
W. Bruce Cherny
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Kerry R. Crone
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William D. Tobler
Gerald Tuite
Craig A. Van Der Veer
David G. Walker
Marion Walker
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Reinhard Wurm

Saturday-At-A-Glance

8:00 am - 5:00 pm All Day Practical Courses (PC01-PC04)
8:00 am - 12 noon Morning Practical Courses (PC05-PC12)
1:00 pm - 5:00 pm Afternoon Practical Courses (PC13-PC20)

All courses will be held at the Henry B. Gonzalez Convention Center, except PC21 and PC 23 which will be held at the University of Texas on Sunday. Please see course information for further details. Tickets are required and may be purchased in the CNS Registration Area.

8:00 am - 5:00 pm All Day Practical Courses (PC01-PC04)

PC01 Microsurgical Anatomy

Room 006ABCD

Course Director: Albert L. Rhoton, Jr.
Faculty: Antonio Mussi, Takuya Inoue, Ryusui Tanaka, Qing Liang Liu, Toshio Matsushima, Evandro de Oliveira, Hung Tzu Wen, Helder Tedeschi, Ronald Smith

Learning Objective: The clinic will provide hands-on experience with exposing the lateral, third and fourth ventricles, the cavernous sinus, basal cisterns, and the cranial nerves in the middle and posterior cranial fossae. The operative approaches will be done under the operating microscope. Lectures will focus on the microsurgical anatomy of each of these areas. After this course participants will be able to expose the third ventricle and basal cisterns through the choroidal fissure, complete an intra- and extradural approach to the cavernous sinus and petrous apex and expose the nerves in the cerebellopontine angle and internal acoustic meatus.

PC02 Treatment Of Carotid Disease: Evaluation, Medical- Endovascular- and Surgical Management Techniques

Room 216AB

Course Directors: Joshua B. Bederson, B. Gregory Thompson
Faculty: M. Christopher Wallace, Robert J. Dempsey, J. Max Findlay, Robert E. Harbaugh, Wesley A. King, Christopher M. Loftus, Oscar Benavente, B. Gregory Thompson, Jr., Robert H. Rosenwasser

Learning Objective: Participants will experience didactic lectures and small interactive group sessions on clinical indications, non-invasive assessment, and clinical management scenarios as well as surgical and endovascular video workshops. Additionally, participants will choose one of two alternative practical sessions: 1) cadaveric specimens for endarterectomy surgical technique OR 2) a focused endovascular management session. Participants will be able to discuss the clinical presentation of patients with carotid stenosis and the indications and methods for investigation. Participants will be able to demonstrate non-invasive Doppler imaging of the extracranial and intracranial circulation. Participants will be able to review the current indications for surgical, endovascular and medical therapy for symptomatic and asymptomatic carotid disease. Depending on the specific practical path the individual chooses, participants will be able to perform a carotid endarterectomy, anastomotic repair, and patch graft on a fresh cadaveric specimen, and discuss the surgical procedure in detail or review the endovascular management of carotid disease in detail.

PC03 Anterior and Posterior Approaches and Stabilization Techniques for the Thoracolumbar Spine

Ballroom C2

Course Directors: David W. Cahill, Brian G. Cuddy
Faculty: Christopher I. Shaffrey, Stephen L. Ondra, Robert F. Heary, Eric J. Woodard, Patrick W. Hitchon, Daniel H. Kim, Ziya L. Gokaslan, Robert Ho, George Martin, Chris Kuntz, Bret Abshire, Paul C. McCormick, Paul Montaldano, Patrick Jacobs, Shahin Etebar

Learning Objective: This course is designated to provide hands-on experience and instruction with exposure, decompression and reconstruction of the thoracolumbar spine from the cervicothoracic junction to the sacrum using cadaveric dissection. Didactic lectures will cover both anatomic exposure techniques and graft/instrumentation and reconstruction techniques. After the course, participants will be able to describe anterior, lateral, and posterolateral approaches and to utilize anterior, lateral, and posterior instrumentation systems.

PC04 Transsphenoidal Surgery

Room 214AB

Course Director: Warren R. Selman
Faculty: William F. Chandler,William T. Couldwell, Craig T. Montgomery, Gerard S. Rodziewicz, Gail L. Rosseau

Learning Objective: This course will provide the participant with a knowledge of the principles of treatment of patients with sellar and parasellar lesions. The course will focus primarily on surgical therapy and will provide the anatomical foundation for performing the transsphenoidal approach. Additionally, participants will be exposed to endoscopic suprasellar approaches. The use of the operating microscope and the endoscope will be taught, and participants will learn the transsphenoidal operations through cadaveric dissection. After the course, participants will demonstrate improved skills in the assessment and treatment of patients with pituitary dysfunction. They will also have improved knowledge in the use of adjuvant therapy to surgery, including radiation and hormonal therapy.

Saturday, September 23

8:00 am - 12 noon Morning Practical Courses (PC05-PC12)

PC05 Spinal Biomechanics and Clinical Management Decision Making

Room 206B

Course Director: Edward C. Benzel
Faculty: Vincent C. Traynelis, Michael A. Morone, Eric J. Woodard, Nevan G. Baldwin

Learning Objective: This practical course is an in-depth, didactic session presenting the physical principles and biomechanical foundation of spine surgery and spine stabilization. The participants will be able to describe the biomechanical principles that form the basis of complex spinal surgery. The seminar will introduce participants to problem-based decision making strategies and apply these to hypothetical clinical situations.

PC06 Trigeminal Neuralgia: Percutaneous

Room 214CD

Course Directors: Jeffrey A. Brown, Harry R. van Loveren
Faculty: Samuel J. Hassenbusch, Jeffrey T. Keller, Bruce E. Pollock, Ernest Matthews, G. Robert Nugent, Walter C. Jean, Sebastian Froelich, Ali Nader-Sepahi, Khaled M. Abdel Aziz

Learning Objective: Participants will be exposed to current strategies for the treatment of trigeminal neuralgia including diagnosis, medical management, and patient selection for specific surgical procedures with emphasis on percutaneous rhizotomy and radiosurgery. Participants will acquire hands-on experience with percutaneous surgical procedures and will learn the specific applications of each for individual patient pathology. After this course, participants will be able to develop improved management skills for patients with trigeminal neuralgia refractory to medical management.

PC07 Image-Guided Cranial Surgical Navigation

Room 007ABC

Course Directors: Isabelle M. Germano, Kevin T. Foley
Faculty: Richard D. Bucholz, Haring Nauta, Robert J. Maciunas, Christopher R. Mascott, William D. Tobler, Ronald E. Warnick, Philip E. Stieg, David G. Walker, Michael Nosko

Learning Objective: This course will provide an opportunity for hands-on experience with state of the art neurocranial navigation systems. After this course, participants will be able to review concepts of registration and localization for cranial navigation and apply cranial navigation techniques to patients in their practice.

PC08 Posterior Circulation Aneurysms

Ballroom C3

Course Director: Thomas A. Kopitnik, Jr.
Faculty: Duke S. Samson, Jonathan White, Zeena Dorai, Debra Steele, Jacques J. Morcos, Arthur L. Day

Learning Objective: Following completion of this course, participants will be able to identify the indications and contraindications for surgery, via specific approaches, for posterior circulaton aneurysms; identify the vascular anatomy by preoperative imaging and intraoperative visualization; and identify and manage the common operative and postoperative complications associated with surgery in this region. This is a hands-on cadaver microdissection course with experts on intracranial aneurysms.

PC09 Lumbosacral Fusion: Cages, Dowels, and Pedicle Screws

Room 207AB

Course Directors: Regis W. Haid, Jr., Christopher I. Shaffrey
Faculty: Jens Chapman, Steven L. Ondra, Joseph T. Alexander, Robert F. Heary, Rick Sasso, Daniel K. Resnick, Marc E. Eichler, Barry D. Birch, Seth M. Zeidman, Charles Kuntz, IV, Michael J. Rauzzino, John J. Knightly, Nathan E. Simmons, Mark McLaughlin

Learning Objective: After this course, participants will be able to describe the indications, contraindications, uses and benefits of lumbar and lumbosacral fusion. A variety of techniques employing cages, ALIF, PLIF and pedicle screws will be discussed. Participants may have the option to learn techniques on sawbones models.

PC10 Cervical Spine Stabilization

Room 205

Course Directors: H. Louis Harkey, III, Christopher G. Paramore
Faculty: Allan D. Levi, Michael G. Fehlings, Joseph T. Alexander, R. John Hurlbert, Paul Marcotte, Timothy C. Ryken, Thomas T. Lee, J. Patrick Johnson, Brian G. Cuddy, Carl Lauryssen, Perry Ball, Seth M. Zeidman, Gerald Tuite, Juan Ronderos, Donald D. Dietze, Jr.

Learning Objective: The indications, techniques and complications of stabilization of the cervical spine including the craniovertebral junction will be reviewed using lectures, case presentation and hands-on application with anatomical models. Upon completion of this course, participants will be able to recognize the indications for cervical and craniovertebral junction fusion and instrumentation, and will also be able to describe the technical application of such.

PC11 CPT Coding, Medicare Documentation and Audits

Room 215

Course Directors: Gregory J. Pryzbylski, Richard A. Roski
Faculty: Kimberly Pollock, David Bissonette

Learning Objective: This course provides a concentrated summary of the principles and application of CPT coding in describing office, consultation, and surgical work performed by the neurosurgeon. In addition, methods for creating a compliance and review system as well as for audit preparation are discussed. After this course, participants should be able to personally apply ICD-9 and CPT coding, accurately describe the necessary items to fulfill Medicare documentation guidelines for surgical as well as evaluation and management coding, and adapt their current documentation practice to reduce the risk of failing an audit.

PC12 Computer Skills - Basic Database Design

Room 211

Course Director: Joel D. MacDonald
Faculty: Thomas Ellis, Richard Day, Harold Pikus, Derek Duke

Learning Objective: This course is geared towards those interested in developing basic skills in database design. The basic elements of database design, construction management and implementation will be presented and discussed using FileMaker Pro (FileMaker Inc. product). Participants will be provided a series of exercises to complete on desktop computer stations with instructor supervision. These exercises will include construction and implementation of basic database elements. After completion of this course, participants will be able to discuss the basic concepts of database design and utilize FileMaker Pro to create, manage and implement a basic database.

1:00 pm - 5:00 pm Afternoon Practical Courses (PC13-PC20)

PC13 Microsurgical Dissection Techniques

Room 007D

Course Director: John Diaz Day
Faculty: Michael L. Levy, Christian Matula, Robert E. Harbaugh

Learning Objective: The microscopic anatomy of the brain, brain stem, cisterns, and ventricles will be presented in a multimedia assisted, lecture format to the neurosurgical resident in training. After this symposium, participants will be able to discuss the complexity of the microsurgical anatomy of the brain, cranial nerves, and skull base, and to discuss three-dimensional intracranial relationships and merits of selected operative approaches.

PC14 Image-Guided Spinal Navigation

Room 007ABC

Course Directors: Kevin T. Foley, Isabelle M. Germano
Faculty: J. Patrick Johnson, Gerald E. Rodts, Jr., William D. Tobler, Clifford Solomon, Iain H. Kalfas, Kenneth I. Lipow, Michael G. Fehlings, Stephen M. Papadopoulos

Learning Objective: Upon completion of this course, participants will be able to identify the applications for spinal stereotaxis, identify and avoid common pitfalls associated with spinal localization, and assess the merits of systems currently available for this technique.

Saturday, September 23

PC15 Microvascular Decompression for Trigeminal Neuralgia and Other Cranial Nerve Syndromes

Room 214CD

Course Directors: Harry R. van Loveren, Hae Dong Jho
Faculty: Khaled M. Abdel Aziz, Michael R. Chicoine, Madgy El-Kalliny, Michael Link, Abhay Sanan, Mario Zuccarello, Sebastian Froelich, Walter C. Jean, Jeffrey T. Keller

Learning Objective: Upon completion of this course, participants will be able to identify the indications for microvascular decompression in the management of trigeminal neuralgia, hemifacial spasm, disabling positional vertigo, glossopharyngeal neuralgia and spasmodic torticollis. Participants will perform microsurgical dissections to understand the relevant anatomy in the different surgical procedures. Techniques of complication avoidance will be stressed.

PC16 Lumbosacral Fusion: Cages, Dowels, and Pedicle Screws

Room 207AB

Course Directors: Regis W. Haid, Jr., Christopher I. Shaffrey
Faculty: Jens Chapman, Steven L. Ondra, Joseph T. Alexander, Robert F. Heary, Rick Sasso, Daniel Resnick, Marc E. Eichler, Barry Birch, Seth M. Zeidman, Charles Kuntz, IV, Michael J. Rauzzino, John Knightly, Nathan E. Simmons, Mark McLaughlin

Learning Objective: After this course, participants will be able to describe the indications, contraindications, uses and benefits of lumbar and lumbosacral fusion. A variety of techniques employing cages, ALIF, PLIF and pedicle screws will be discussed. Participants may have the option to learn techniques on sawbones models.

PC17 Pediatric Traumatic CNS Injury and Critical Care

Room 217C

Course Directors: P. David Adelson, John Ragheb
Faculty: Ann-Christine Duhaime, Thomas G. Luerssen, Douglas L. Brockmeyer, Michael D. Partington, W. Bruce Cherny

Learning Objective: The goal of this course is to discuss the pathophysiologic treatment and critical care issues in traumatic pediatric CNS injuries. A panel discussion will follow at the end for audience participation and case management issues/complications to be presented. After this course, participants will appraise key issues in the management of pediatric neurological injuries.

PC18 Internet and Office Applications

Room 211

Course Director: David McKalip
Faculty: Joel D. MacDonald, Richard P. Bucholz, Tom Ellis, Catherine Hamma

Learning Objective: The basic features of the Internet will be described and demonstrated. The basic elements of web page design and creation using HTML will be demonstrated and discussed. The participants will complete exercises on a computer desktop terminal. After this course, participants will be able to discuss the basic mechanics of the Internet and some of the advanced features. They will be able to describe how these functions apply to office practice.

PC19 Movement Disorders: Pathophysiology, Diagnosis, Treatment

Room 206A

Course Directors: Roy A. E. Bakay, Andres M. Lozano
Faculty: Steven B. Wilkinson, Richard K. Simpson, Jr., Philip A. Starr, Ali R. Rezai

Learning Objective: The practical aspects of functional stereotactic surgery will be presented via lecture, video presentation and equipment demonstration. The primary emphasis will be on Parkinson's disease, but tremor, dystonia and hemiballismus will also be discussed. Upon completion of this course, participants will be able to list patient selection criteria, select preoperative evaluation studies, and describe intraoperative technique. Participants will also be able to discuss anatomical and physiological target localization techniques.

PC20 Anterior Circulation Aneurysms

Room 217AB

Course Directors: Christopher S. Ogilvy, Fady T. Charbel
Faculty: Jacques J. Morcos, Winfield S. Fisher, III, Christopher Putman

Learning Objective: The anatomical considerations for the surgical treatment of supratentorial intracranial aneurysms will be presented, reviewed, and discussed through the use of lectures, video case presentations, and anatomical dissections utilizing a surgical anatomical based analysis. Upon completion of the course, participants will be able to describe the anatomic considerations for specific aneurysms by location, intraoperative management techniques, and discuss cranial surgical exposures helpful in the management of anterior circulation aneurysms.

SCIENTIFIC PROGRAM
PRACTICAL COURSES

Sunday-At-A-Glance

8:00 am	5:00 pm	All Day Practical Courses (PC21-PC25)
8:00 am	12 noon	Morning Practical Courses (PC26-PC34)
1:00 pm	5:00 pm	Afternoon Practical Courses (PC35-PC44)
6:30 pm	9:00 pm	Opening Reception

All courses will be held at the Henry B. Gonzalez Convention Center except PC21 and PC 23 which will be held at the University of Texas. Please see course information for further details. Tickets are required and may be purchased in the CNS Registration Area.

8:00 am - 5:00 pm All Day Practical Courses (PC21-PC25)

PC21 Microvascular Reconstruction

This course to be held off-site at the University of Texas, Room 252A

Course Directors: Philip E. Stieg, David W. Newell, Dennis G. Vollmer
Faculty: Richard G. Ellenbogen, Gavin Britz, Neil Martin, Jayashree Srinivasan, Howard Yonas

Learning Objective: After this course, participants will be able to discuss the indications for and practical aspects of microvascular reconstruction of the cranial vasculature. Hands-on experience with microvascular anastomosis will be provided.

PC22 Temporal Bone – Acoustic Surgery

Room 007ABC

Course Directors: Steven L. Giannotta, John Diaz Day
Faculty: Anil Nanda, Carl B. Heilman, Takanori Fukushima

Learning Objective: After this course, participants will be able to recognize the indications and contraindications for the various approaches to acoustic neuromas; identify the bone and neurovascular anatomy in the temporal region; identify the sequential operative steps for successful removal of tumors in this region; and prevent, identify, and treat the common intraoperative and postoperative complications associated with surgical treatment of acoustic tumors.

PC23 Exposure and Surgery of the Peripheral Nerves

This course to be held off-site at the University of Texas, Room 1.236S/1.284T

Course Directors: David G. Kline, Allan H. Friedman
Faculty: Eric L. Zager, Robert L. Tiel, Allan J. Belzberg, Daniel H. Kim, Rajiv Midha, Allan Maniker

Learning Objective: This course will include a hands-on dissection lab with cadavers. Following completion of this course, participants will be able to identify the appropriate exposures for specific nerve injuries and entrapment syndromes, perform the anatomical exposure for peripheral nerves, and understand the indications and contraindications for surgical treatment of peripheral nerve disorders.

PC24 Neuroaugmentation for Pain Control

Room 217AB

Course Director: Kenneth A. Follett
Faculty: Jaimie M. Henderson, Samuel J. Hassenbusch, Claudio Feler, Robert M. Levy, Richard Osenbach, Joel L. Seres, Jamal Taha

Learning Objective: Upon completion of this course, participants will be able to explain the rationale for spinal cord stimulation, peripheral nerve stimulation, and spinal drug infusions for pain control; describe the patient selection process for neuroaugmentative pain control techniques; describe techniques for implantation and management of stimulation and infusion therapies; and describe complications, complication management, and outcomes of neuroaugmentative procedures for pain control.

PC25 Thoracoscopic Spinal Surgery

Room 217CD

Course Director: Curtis A. Dickman
Faculty: J. Patrick Johnson, Charles J. Riedel, R. John Hurlbert, Dean G. Karahalios, Noel I. Perin, Ronald I. Apfelbaum

Learning Objective: The indications, fundamental principles, and techniques for thoracoscopy will be taught using lectures and hands-on experience with sawbones models, spine specimens, and endoscopic simulations. After this course, participants will be able to recognize the role of thoracoscopic spine surgery for disc herniations, paraspinal tumors, sympathectomy, and spinal instability. Participants will also be able to describe the anatomy and surgical approaches for the various endoscopic spinal procedures.

8:00 am - 12 noon Morning Practical Courses (PC26- PC34)

PC26 Managing and Building a Neurosurgical Practice Using Marketing, Media and the Internet

Room 215

Course Director: Warren R. Selman
Faculty: David McKalip, Richard A. Roski, Craig A. Van Der Veer, Catherine Gilmore

Learning Objective: Using lecture, discussion, and question and answer sessions, this interactive course will help participants understand how to survive and prosper in the present health care environment. Upon completion of this course, participants will be able to describe techniques for practice management and marketing.

PC27 Nursing in Neurosurgery

Physician attendees will not be awarded CME credits for this course.

Room 007D

Course Director: John C. Steck
Faculty: Frank T. Culicchia, Christopher R. Mascott, Donald D. Dietze, Jr.

Learning Objective: Following completion of this course, the neuroscience nurse will be able to identify the symptoms and signs indicative of acute change in neurological status, assess likely etiologies of common neurosurgical emergencies, and describe timely diagnostic and therapeutic maneuvers for identified conditions.

PC28 Functional Cerebral Mapping

Room 207AB

Course Directors: Nicholas M. Barbaro, Mitchel S. Berger
Faculty: Michael M. Haglund, Carl J. Sartorius

Learning Objective: This course is designed as the first part of a two-part course on the techniques of cortical mapping used in neurosurgery. The indications, techniques and limitations of cortical mapping used in the resection of cerebral neoplasms will be demonstrated in didactic sessions and in a hands-on approach. Integration with frameless stereotaxic techniques will also be demonstrated. Upon completion of this course, participants will understand the indications and techniques of cortical mapping, and be able to apply these techniques in the removal of cerebral neoplasms. (Part 2: PC44)

PC29 Anterolateral Skull Base Approaches

Room 006ABCD

Course Directors: Harry R. van Loveren, Jeffrey T. Keller
Faculty: Anil Nanda, Michael J. Link, Michael R. Chicoine, Abhay Sanan, Magdy El-Kalliny, Troy Payner, Sami Rosenblatt, Adam Lewis, Glen L. Keiper, Jr., Shih-Sing Liu, Mario Zuccarello, Walter C. Jean, Sebastian Froelich, Khaled M. Abdel Aziz

Learning Objective: Anterior skull base approaches to the medial sphenoid wing will be taught through lecture and hands-on cadaver experience. Upon completion of this course, participants will be able to describe the surgical anatomy of the medial sphenoid wing. They will also be able to select approaches between operative regions that will result in more complete resection of tumors in this region with the least morbidity.

SCIENTIFIC PROGRAM
PRACTICAL COURSES

PC30 Minimally Invasive Techniques for the Lumbar Spine

Ballroom C2

Course Directors: Maurice M. Smith, Noel I. Perin, Carl Lauryssen
Faculty: Seong Oh, Robert F. Heary, Tom Mehalic, Steven T. Onesti, Bruce M. McCormack, Christopher G. Paramore, Kevin T. Foley

Learning Objective: After this course, participants will be able to recognize the indications and limitations of minimally invasive techniques in the lumbar spine. Participants will have knowledge of the different surgical techniques and their applications.

PC31 Basic Computer Skills: Computers Made Easy

Room 211

Course Director: Joel D. MacDonald
Faculty: Terry Mott

Learning Objective: This course will be directed towards individuals interested in gaining familiarity with desktop personal computing. The focus of the course will be primarily on basic skills associated with personal computers. After completion of this course, participants will be familiar with the setup of a basic personal computer as well as its functions. They will be able to power up the computer and launch basic applications. Participants will be able to use a word processor to generate basic documents, initiate electronic communication via e-mail and understand the principles of the Internet. They will also be familiar with the terminology associated with personal computing and basic computer applications.

PC32 Endovascular Techniques in Stroke

Room 205

Course Director: Lee R. Guterman
Faculty: Richard D. Fessler, Adnan I. Qureshi, Andrew J. Ringer, Stanley H. Kim

Learning Objective: This course will focus on the identification of patients with acute stroke and provide a greater understanding of treatment modalities for these patients and the indications for endovascular approaches. After completion of this course, participants will be able to formulate treatment plans for patients with acute stroke, perform catheter-based treatments in a stroke model, use coils to treat aneurysms in a bench top model, and identify the indications for coil occlusion of aneurysms.

PC33 Stereotactic Radiosurgery

Ballroom C3

Course Director: Bruce E. Pollock
Faculty: Eben Alexander, III, David W. Andrews, John M. Buatti, David Martin, Kris A. Smith, Reinhard Wurm

Learning Objective: The principles of current and developing stereotactic radiosurgery for the management of brain tumors, vascular malformations, and functional disorders will be reviewed. Basic radiobiology pertinent to radiosurgery, dose selection parameters, and clinical criteria for patient selection for these techniques, as well as complication avoidance and management will be presented. The information will be presented through lecture, case discussions and hands-on use of different radiosurgery workstations. Upon completion of this course, participants will be able to define the role of stereotactic radiosurgery for specific patients with brain disease, appraise the specifics of each radiosurgical technology, and discuss complication management.

PC34 Critical Care for Neurotrauma

Room 206B

Course Directors: Alex B. Valadka, Donald W. Marion
Faculty: Peter B. Letarte, Christopher D. Sturm, Michael G. Fehlings, Geoffrey Manley

Learning Objective: This course will review current concepts regarding management of neurotrauma patients and systemic and neurologic pathophysiology after trauma. Both traumatic brain injury and spinal cord injury will be discussed. After this course is completed, participants will be able to describe the major pathophysiologic changes occurring after central nervous system trauma and formulate appropriate treatment strategies.

1:00 pm - 5:00 pm Afternoon Practical Courses (PC35 - PC44)

PC35 Vertebroplasty

Room 205

Course Directors: Lee R. Guterman, Richard D. Fessler
Faculty: Stanley H. Kim, Demetris Lopes, Andrew Ringer

Learning Objective: This course will focus on developing an understanding of vertebroplasty techniques, and identifying appropriate patients for this procedure. Hands-on experience will be provided. After this course, participants will be able to discuss the indications for vertebroblasty. They will also be able to describe how to perform the procedure.

PC36 Spinal Deformity and Scoliosis in Adults: Surgical and Management Options

Room 216AB

Course Directors: Stephen L. Ondra, Mark N. Hadley
Faculty: Nevan G. Baldwin, Robert F. Heary

Learning Objective: This seminar is directed towards practicing neurosurgeons and residents who wish to enhance knowledge of treatment principles for patients with spinal deformities and scoliosis. Special emphasis will be given to how these principles apply to all neurosurgeons who perform spinal fusions. The seminar will focus on cervical, thoracic and thoracolumbar spinal deformities. The natural history, pathophysiology, biomechanics and treatment strategies of these deformities will be discussed. Case presentations and a hands-on workshop utilizing sawbones will demonstrate the principles involved in treatment of these deformities. Upon completion of the seminar, participants will be able to evaluate patients with spinal kyphotic deformities and scoliosis, and apply these treatment principles to all patients undergoing spinal fusion.

PC37 Technological Advances: Programmable Devices in Practice

Room 215

Course Director: Joseph R. Madsen
Faculty: Jeffrey W. Campbell, Rodolfo Hakim, Thorkild V. Norregard

Learning Objective: This half-day course combines didactic lectures, discussion, and hands-on demonstrations to acquaint neurosurgeons and allied professionals with the goals and techniques of such programmable devices as peripheral and central nervous system stimulators, programmable pumps, and variable-pressure shunt valves. The course should be of interest to those planning to establish a program for the use of one or more of these new devices. Practical issues, such as the composition of teams to coordinate reprogramming, will be emphasized. Upon completion of the course, participants should be able to describe indications, techniques, and strategies for use of programmable devices.

PC38 Intracranial Endoscopy

Room 214AB

Course Directors: David F. Jimenez, Paul A. Grabb
Faculty: Kerry R. Crone, Michael Gaab, John G. Frazee, Wesley A. King, Alan R. Turtz

Learning Objective: This course is aimed as an introduction to basic neuroendoscopic surgery and techniques of intracranial endoscopy presented relevant to specific disease management. Third ventriculostomy and colloid cyst surgery techniques will be presented on video and hands-on models. The use of the endoscope as an adjunct to skull base and aneurysm surgery will also be demonstrated. Upon completion of this course, participants will be able to evaluate whether the neuroendoscope could be a tool to add to their practice.

PC39 Lateral Skull Base Approaches

Room 006ABCD

Course Directors: Donald C. Wright, Sunil J. Patel
Faculty: Brian Holmes, Duc H. Duong, Christopher Bogaev, Tom Ellis

Learning Objective: Following completion of this course, participants will be able to identify the indications and contra indications for various surgical approaches to lesions in this location, identify the bone and neurovascular anatomy specific to this region, describe the sequential operative steps for surgical approaches, assess the controversies regarding operative issues of resectability and vascular reconstruction, and identify and manage the common operative, intraoperative, and postoperative complications associated with surgery in this region.

SCIENTIFIC PROGRAM
PRACTICAL COURSES

PC40 Digital Images and Presentations

Room 211

Course Directors: Joel D. MacDonald, Richard Day
Faculty: Tom Ellis, Tonya Hines, Catherine Hamma

Learning Objective: This course is appropriate for individuals interested in learning more about digital imaging. The process of digital image capture, image manipulation and image publication will be demonstrated and discussed. Participants will complete a series of exercises using digital cameras, flatbed scanners, and digital video cameras to capture digital images. A series of manipulations will then be applied to these captured images using standard digital image editing software. Finally, the techniques for incorporating digital images into presentations will be discussed and demonstrated. Following completion of the course, participants will be able to discuss the basic elements of digital image capture, manipulation and publication. They will also be able to use various forms of digital image capture such as digital cameras, flatbed scanners, and video capture devices. Participants will be able to incorporate these digital images after basic manipulation in presentation software.

PC41 Grants: Getting Started, Applications and Funding

No CME credits will be awarded for this course.

Room 007D

Course Director: Michael D. Walker
Faculty: Thomas P. Jacobs, Edward A. Neuwelt, Gary K. Steinberg

Learning Objective: This course is dedicated to the development and promotion of basic science and clinical science research grant proposals among practicing neurosurgeons. Participants will be able to describe how to design a grant, timesaving and technical preparation details, and how to pursue research project funding.

PC42 Anterior Approaches to the Lumbar Spine

Room 214CD

Course Directors: Richard G. Fessler, Gerald E. Rodts, Jr.
Faculty: Daniel H. Kim, Daniel May, Ben Guiot, Robert F. Heary, Joseph T. Alexander, Christopher I. Shaffrey, Eric J. Woodard, Kee Kim

Learning Objective: This course is intended for neurosurgeons, general surgeons, and neurosurgery residents and fellows. Anatomical considerations and clinical indications for anterior approaches to the lumbar spine will be discussed by experienced spine surgeons. Didactic lectures and cadaver lab dissection (under the guidance of the faculty) will allow the participants to learn important aspects of open transperitoneal, retroperitoneal, thoracoabdominal, and laparascopic anterior lumbar surgery. Emphasis will be placed on understanding the pertinent anatomy and dissection techniques as well as on complication avoidance. After this course, the participant will be able to describe and diagram the approaches to the lumbar spine in detail.

PC43 Critical Care Acute Stroke/Neurovascular

Room 206A

Course Directors: Joshua B. Bederson, Issam A. Awad, Alex B. Valadka
Faculty: Warren B. Selman, Christopher S. Ogilvy, Thomas J. Leipzig, Robert H. Rosenwasser, Joseph M. Zambramski, Veronica Chiang

Learning Objective: This course will discuss diagnostic and therapeutic options and perioperative management in the following conditions: ischemic stroke, intracerebral hemorrhage, subarachnoid hemorrhage and vasospasm. After this course, participants will be able to describe the diagnosis and treatment of ischemic stroke, including the use of tissue plasminogen activator and decompressive craniectomy; describe the pathophysiology and treatment of subarachnoid hemorrhage, including prevention of early rebleeding and treatment of vasospasm; and discuss treatment options of intraparenchymal hemorrhage.

PC44 Brain Mapping and Surgery for Epilepsy

Room 207AB

Course Directors: Isabelle M. Germano, Nicholas M. Barbaro
Faculty: P. David Adelson, Robert R. Goodman, Dennis D. Spencer, William F. Bingaman

Learning Objective: This course is designed as the second part of a two-part course on the techniques of cortical mapping used in neurosurgery. This course is designed to demonstrate the use of cortical mapping techniques used in epilepsy surgery. The indications, evaluation, and techniques of surgical resection used in the treatment of epilepsy will be demonstrated in both didactic and hands-on sessions. Integration of frameless stereotaxy with open techniques will be demonstrated. Upon completion of this course, participants will be able to describe and apply the techniques of cortical mapping and resection in the treatment of epilepsy. (Part 1: PC28)

The Congress of Neurological Surgeons gratefully acknowledges the following companies for providing educational grants in support of the Annual Meeting and the 2000 Resident and Fellow Educational Fund.

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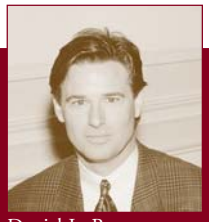
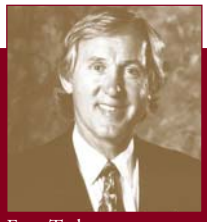
Monday-At-A-Glance

7:30 am - 11:45 am	General Scientific Session I
8:20 am - 8:35 am	Edward R. Laws, Jr., Honored Guest Presentation
9:00 am - 4:30 pm	Exhibits Open
9:20 am - 10:20 am	Coffee with Exhibitors
10:20 am - 10:25 am	Distinguished Service Award
10:25 am - 11:05 am	Fran Tarkenton, Special Guest Presentation
11:05 am - 11:45 am	Presidential Address
11:45 am - 12:30 pm	Visit Exhibits & Pick Up Lunch for Seminars
12:30 pm - 2:00 pm	Luncheon Seminars
2:00 pm - 5:00 pm	Special Course I
2:00 pm - 5:30 pm	Section on Cerebrovascular Surgery I
2:00 pm - 5:30 pm	Section on Stereotactic and Functional Surgery I
2:00 pm - 5:30 pm	Section on Tumors I
2:00 pm - 5:30 pm	Section on Neurotrauma and Critical Care I
2:00 pm - 5:30 pm	Council of State Neurosurgical Societies/General Interest
3:30 pm - 4:00 pm	Refreshments with Exhibitors

General Scientific Session I • 7:30 am - 11:45 am, Lila Cockrell Theatre


Edward R. Laws, Jr.


Daniel L. Barrow


Fran Tarkenton

Brain Tumor Management: Present and Future

Learning Objectives: Following this session, participants will be able to review the biology of glial tumors and issues relevant to surgical practice. Participants will be able to apply information regarding radiation techniques, chemotherapy, and other novel approaches to patients with intrinsic brain tumors.

Moderator: Jack Rock
Presiding Officer: Issam A. Awad

7:30 - 7:45	Cerebral Gliomas: How Tumor Biology Affects Management	Joseph M. Piepmeier
7:45 - 8:00	Fifty Years of Neurosurgery Argues in Favor of Glioma Resection	Raymond Sawaya
8:00 - 8:15	Fifty Years of Neurosurgery Argues Against the Importance of Glioma Resection	L. Dade Lunsford
8:15 - 8:20	Introduction of the Honored Guest	Daniel L. Barrow
8:20 - 8:35	Honored Guest Presentation Indications for Glioma Surgery: When to Biopsy and When to Resect	Edward R. Laws, Jr.
8:35 - 8:50	Radiation Realities for Malignant Gliomas	Michael W. McDermott
8:50 - 9:05	An Appraisal of Chemotherapy: In the Blood or in the Brain?	Mitchel S. Berger
9:05 - 9:20	New Innovations and Developments for Brain Tumors	Mark L. Rosenblum
9:20 - 10:20	Coffee with Exhibitors	
10:20 - 10:25	Distinguished Service Award Presentation	Daniel L. Barrow
10:25 - 10:30	Special Guest Presentation Introduction	Daniel L. Barrow
10:30 - 11:05	Special Guest Presentation "What Losing Taught Me About Winning"	Fran Tarkenton
11:05 - 11:15	Introduction of the President	Mark N. Hadley
11:15 - 11:45	Presidential Address	Daniel L. Barrow
11:45 - 12:30	Visit Exhibits & Pick Up Lunch for Seminars	

All Seminars will be held at the Henry B. Gonzalez Convention Center from 12:30 – 2:00 pm. Tickets are required and may be purchased in the CNS Registration Area. Redeem lunch tickets at Booth 788.

M01/M01R

International Luncheon and Program
Extreme Neurosurgery: Operating in Hostile Environments

Room 214A

Moderators: Russell J. Andrews, Richard G. Perrin, Gail L. Rosseau
Faculty: Ismail Hakki Aydin, Lee Finney, Armando Basso, Robert J. Dempsey

Learning Objective: This seminar will discuss the performance of neurosurgery in extreme environments such as earthquakes and other natural or human disasters. Participants will review how neurosurgical teams respond to large-scale emergencies and be able to prioritize neurosurgical emergency care.

M02/M02R

Management of Craniovertebral Junction Abnormalities

Room 214C

Moderator: H. Louis Harkey, III
Faculty: Dennis E. McDonnell, Dean G. Karahalios, John Strugar

Learning Objective: This seminar will discuss the management of congenital and acquired disorders of the craniovertebral junction. Participants will be able to discuss different approaches to diagnosis and treatment of specific congenital, neoplastic and degenerative disorders.

M03/M03R

Case Management: Cervical Spondylotic Myelopathy

Room 214D

Moderator: Vincent C. Traynelis
Faculty: Paul K. Maurer, Gary L. Rea, Carl Lauryssen, Nachshon Knoller, Ronald I. Apfelbaum

Learning Objective: In this seminar, the moderator will present cases of cervical spondylotic myolopathy to be discussed by the faculty and attendees. Participants will be able to review different approaches for the diagnosis and treatment of degenerative cervical spine disease.

M04/M04R

Management of Thoracolumbar Fractures

Room 006A

Moderator: Dennis J. Maiman
Faculty: Allan D. Levi, Patrick W. Hitchon, J. Patrick Johnson, Perry Ball, Brian G. Cuddy

Learning Objective: This seminar will address the diagnosis and treatment of fractures and other trauma to the thoracolumbar spine. Participants will be able to review the radiologic classifications, different surgical approaches, and strategies for reconstruction in the setting of thoracolumbar fractures.

M05/M05R

Current Surgical Options for Lumbar Discectomy: Comparison of Results

Ballroom C1

Moderator: Volker K. H. Sonntag
Faculty: Maurice M. Smith, Donald L. Hilton, Lawrence Borges

Learning Objective: This seminar will discuss different approaches for the management of lumbar disc disease causing back pain or radiculopathy. Participants will be able to describe the different approaches currently available for lumbar disc disease, and discuss their specific advantages and disadvantages.

SCIENTIFIC PROGRAM
LUNCHEON SEMINARS

M06/M06R — Spinal Infections: Contemporary Diagnosis and Management

Room 215

Moderator: Christopher G. Paramore
Faculty: Daria D. Schooler, William S. Rosenberg, Thomas T. Lee

Learning Objective: This seminar will discuss the clinical problems posed by patients who may harbor a spinal infection. Participants will be able to discuss how to identify patients with spinal infections and recommend appropriate treatment.

M07/M07R — Case Management: Gliomas

Room 217A

Moderator: Mitchel S. Berger
Faculty: Joseph M. Piepmeier, Frank T. Vertosick, Jr., Deborah L. Benzil, Michael A. Vogelbaum

Learning Objective: This seminar will discuss multi modality management of patients with glial neoplasms. The moderator will present cases to the faculty for discussion with the attendees. Participants will be able to review different surgical, radiotherapeutic and chemotherapeutic approaches to patients with glial tumors.

M08/M08R — Brain Tumor Irradiation: Strategies and Controversies

Room 208

Moderator: Mark Bernstein
Faculty: Christer E. Lindquist, Volker Sturm, David W. Andrews, Keith M. Rich

Learning Objective: This seminar will discuss different radiation methods for patients with benign and malignant brain tumors. Participants will be able to discuss the advantages and disadvantages of radiosurgery, radiation therapy, brachytherapy and single dose or fractionated regimens and recommend appropriate therapies for individual situations.

M09/M09R — Controversies in Pituitary Surgery

Ballroom C2

Moderator: William T. Couldwell
Faculty: Bruce E. Mickey, Nelson M. Oyesiku, Carl B. Heilman, Armando Basso, Hae Dong Jho

Learning Objective: This seminar will discuss the problems posed by patients with pituitary tumors. The participant will be able to review when transsphenoidal or transcranial approaches are indicated and discuss the specific methods for determining hormonal cures after surgery. Participants will also be able to describe the indications for repeat surgery.

M010/M010R — Surgical Approaches to the Anterior and Central Skull Base

Room 207B

Moderator: Donald C. Wright
Faculty: Bruce M. McCormack, Linda L. Sternau, Akio Morita, James P. Chandler, Vinko Dolenc

Learning Objective: This seminar will describe the different surgical approaches for patients with anterior skull base lesions. Participants will be able to review the anatomic basis for selecting different skull base approaches, techniques of reconstruction, and the roles of adjuvant therapies.

M011/M011R — Optimizing Outcomes in Acoustic Tumor Surgery: Practical and Technical Considerations

Room 206B

Moderator: Mark E. Linskey
Faculty: L. Dade Lunsford, Donlin M. Long, John Diaz Day

Learning Objective: This seminar will describe different methods to manage patients with acoustic tumors, including microsurgical resection and stereotactic radiosurgery. Participants will be able to review the indications and outcomes associated with different techniques and discuss the practical controversies between different approaches.

M012/M012R Anterior Circulation Aneurysms: Options and Approaches

Room 205

Moderator: H. Hunt Batjer
Faculty: Robert F. Spetzler, Michael T. Lawton, Michael B. Horowitz, Yuichiro Tanaka, Joel D. MacDonald

Learning Objective: This seminar will describe the surgical and endovascular approaches to patients with anterior circulation aneuryms. Outcomes associated with each approach will be discussed. Participants will be able to select individual strategies for specific patients based on available data from the different approaches.

M013/M013R Poor-Grade Aneurysm Patients: Surgical and ICU Management

Room 206A

Moderator: Joshua B. Bederson
Faculty: Thomas A. Kopitnik, Jr., Neil A. Martin, Jacques J. Morcos, J. Max Findlay, Nobuo Hashimoto

Learning Objective: This seminar will discuss the management of patients with severe subarachnoid hemorrhage, both in the operating room and intensive care unit settings. Participants will review techniques for the medical and surgical management of poor-grade aneurysm patients.

M014/M014R Management of Cavernous and Paraclinoidal Vascular Lesions

Room 214B

Moderator: Arthur L. Day
Faculty: Jacques Dion, Kazuhiro Hongo, Sunil J. Patel, Harry R. van Loveren

Learning Objective: This seminar will discuss the diagnosis and treatment of patients with vascular lesions that involve the cavernous sinus and related structures. Participants will be able to describe different radiologic techniques that can be used to identify the anatomy of cavernous and paraclinoidal vascular lesions and formulate an appropriate management plan for these entities.

M015/M015R Current and Emerging Technologies for Monitoring Head-Injured Patients

Ballroom C3

Moderator: M. Ross Bullock
Faculty: Jamie S. Ullman, David McKalip, Donald W. Marion, Howard Yonas

Learning Objective: This seminar will discuss current technologies for monitoring patients after head trauma. Management of intracranial pressure, cerebral blood flow, oxygen tension, and cardiopulmonary function will be discussed. Participants will review the roles of current and new technologies for head injury patients and how these may best be used to improve outcomes.

M016/M016R Craniosynostosis: Controversies in Treatment

Room 207A

Moderator: James T. Goodrich
Faculty: J. Gordon McComb, David F. Jimenez, Mark R. Proctor, Timothy B. Mapstone

Learning Objective: This seminar will describe the available techniques used for children with craniosynostosis. Specific controversies between approaches will be discussed. Participants will be able to review the advantages and disadvantages of different surgical and non-surgical methods for children with cranial deformities.

M017/M017R Pediatric Spine Surgery

Room 006B

Moderator: Richard G. Ellenbogen
Faculty: Dachling Pang, Douglas L. Brockmeyer, Peter B. Dirks

Learning Objective: This seminar will describe the indications and techniques for spinal surgery in children. Specifically, congenital and neoplastic disorders will be discussed. Participants will review techniques for the diagnosis and management of children with different spinal disorders.

SCIENTIFIC PROGRAM
LUNCHEON SEMINARS

M018/M018R — Surgical Management of Tremor: Role of Thalamotomy, Chronic Thalamic Stimulation, and Stereotactic Radiosurgical Thalamotomy

Room 217D

Moderator: Andres M. Lozano
Faculty: Steven B. Wilkinson, Philip A. Starr, Gerhard M. Friehs, Ajay Niranjan

Learning Objective: This seminar will discuss the role of different surgical techniques for the management of tremor. The advantages and disadvantages of thalamotomy, deep brain stimulation and radiosurgery will be described. Participants will review the indications, results and complications associated with different techniques for the management of medically refractory tremor.

M019/M019R — Current Management of Medically Refractory Spasticity: From Rhizotomy to Baclofen Pump

Room 211

Moderator: John R. W. Kestle
Faculty: Howard Weiner, Raymond Stefko, James M. Drake, Marion Walker

Learning Objective: This seminar will discuss the management of spasticity in children and adults. Participants will be able to review the indications for different approaches including drug therapy, intrathecal baclofen, rhizotomy, and stimulation.

M020/M020R — Neurosurgical Management of Athletic Injuries

Room 006D

Moderator: Michael L. Levy
Faculty: Joseph Maroon, Stephen M. Papadopoulos, Dennis G. Vollmer, Julian E. Bailes, Jr.

Learning Objective: This seminar will discuss the role of neurosurgeons in the management of athletic injuries. Diagnosis and treatment following head and spinal injuries will be emphasized. Participants will be able to review the methods used to diagnose athletic injuries, identify factors associated with return to activity, and discuss methods to determine the risks of further injury.

M021/M021R — Ablative Surgery for Intractable Pain: What Works and Why Are We Not Utilizing These Procedures More Often?

Room 006C

Moderator: Giovanni Broggi
Faculty: Yucel Kanpolat, John P. Gorecki, Nicholas M. Barbaro, Alain C.J. de Lotbiniere, John J. Moossy

Learning Objective: This seminar will discuss different surgeries for the management of intractable pain. Participants will be able to review the roles of different ablative surgeries for the management of pain and identify which procedures are associated with good outcomes for individual pain disorders.

M022/M022R — Surgical Management of Brachial Plexus Pathology

Room 218

Moderator: Eric L. Zager
Faculty: Rajiv Midha, Allan H. Friedman, Robert L. Tiel, John Park, David G. Kline

Learning Objective: This seminar will discuss the surgical management of different brachial plexus disorders including injuries and tumors. Participants will be able to review techniques for the diagnosis and surgical management of brachial plexus disorders and identify which types of surgeries are appropriate for specific patients.

M023/M023R Spinal Cord Injury Management

Room 217B

Moderator: Michael G. Fehlings
Faculty: Russell P. Nockels, R. John Hurlbert, Daniel K. Resnick, Barth A. Green

Learning Objective: This seminar will describe the different management strategies appropriate for patients with spinal cord injury. Both medical and surgical approaches will be discussed. Participants will review the acute medical and surgical management of spinal cord injury, indications for acute surgery and techniques of spinal reconstruction.

M024/M024R Case Management: Unruptured Aneurysms

Room 217C

Moderator: David G. Piepgras
Faculty: Marc R. Mayberg, Frank T. Culicchia, Edward W. Mee, Yoko Kato, Michael Horowitz

Learning Objective: This seminar will discuss the management of specific patient cases with unruptured aneurysms. The moderator will present cases to the faculty for discussion with the attendees. Participants will review the indications for surgery in patients with unruptured aneurysms, expected management outcomes and indications for observation or endovascular surgery.

M025/M025R Publishing Scientific Articles in Neurosurgery

No CME credits awarded for this seminar.

Room 216B

Moderator: Michael L.J. Apuzzo
Faculty: Peter McL. Black, Philip E. Stieg, Christopher M. Loftus, Daniel Sullivan, Edward R. Laws, Jr.

Learning Objective: This seminar will discuss the process for publication of a scientific article in the neurosurgical literature. The focus will be on creation of a structured scientific article. Participants will learn how to create an interesting and focused neurosurgical publication that meets the goals of the research project and maximizes the opportunities for publication.

M026/M026R Neurotrauma Issues for the Neurosurgeon: Coverage, Procedures, and the Roles of Physician Extenders

Room 216A

Moderator: John H. McVicker
Faculty: Thomas E. Hoyt, Alex B. Valadka

Learning Objective: This seminar will discuss the roles of the neurosurgeon in the management of neurotrauma. An emphasis will be made on the community neurosurgical perspective. The seminar will describe the leadership role of the neurosurgeon in neurotrauma and the roles of non-neurosurgeon physicians, nurses or physician assistants. Participants will review how neurosurgeons can appropriately and efficiently manage patients with traumatic injuries.

Special Course I

The Fine Art of Neurosurgery • 2:00 pm - 5:00 pm, Lila Cockrell Theatre

Learning Objectives: Participants will learn about the history of neurosurgery, describe ways to enhance the scope of their practice and learn skills in writing on neurosurgical topics. In addition, participants will learn about the roles of physicians with medical support teams in extreme outdoor activities.

Course Directors: Liliana C. Goumnerova, William A. Friedman

2:00 - 2:10 What is a Neurosurgeon? ..... Jeffrey W. Campbell

2:10 - 2:30 Honored Guest Presentation
Doctors in Opera ..... Edward R. Laws, Jr.

2:30 - 2:50 The Neurosurgeon as Book Collector ..... James T. Goodrich

2:50 - 3:10 The Neurosurgeon as Art Collector ..... Michael Salcman

3:10 - 3:30 Neurosurgery and Travel ..... Daniel F. Kelly

3:30 - 4:00 Refreshments with Exhibitors

4:00 - 4:30 Neurosurgery, Adventure, and Mount Everest ..... Neil A. Martin

4:30 - 4:45 The Neurosurgeon as Performer ..... Andre Olivier

4:45 - 5:00 Neurosurgeons Writing for the Popular Press ..... Frank T. Vertosick, Jr.

Section on Cerebrovascular Surgery I

Unruptured Intracranial Aneurysms • 2:00 pm - 5:30 pm, Ballroom C1

Learning Objectives: Participants will be able to discuss factors associated with deciding whether or not to treat an aneurysm with surgery. Participants will be able to discuss new developments in the field of treatment of cerebrovascular disease.

Moderators: Christopher S. Ogilvy, B. Gregory Thompson

2:00 - 2:20 The Argument for No Treatment ..... David G. Piepgras
2:20 - 2:50 The Drake Award; Introduction ..... Issam A. Awad
Charles Drake Lecture: The Argument for Surgical Treatment:
The Risks and Efficacy ..... Robert F. Spetzler
2:50 - 3:30 Oral Posters 1-13
Moderator: B. Gregory Thompson, Jr.
3:30 - 4:00 Refreshments with Exhibitors
4:00 - 5:30 Open Papers 700-709
Moderators: Bob Carter, Robert H. Rosenwasser
See pages 119-123 for details
Galbraith Award

Section on Cerebrovascular Surgery I – Oral Posters

2:50 pm - 2:53 pm 1 **Early Decompressive Craniectomy for Massive Brain Infarction**
Oscar Suarez-Rivera, Mario Izurieta, Francisco Escobedo, Rogelio Revuelta, Fernando Barinagarrementeria, Carlos Cantu, Jose Santos

2:53 pm - 2:56 pm 2 **Epilepsy in AVM Patients: Resolution of Medically Intractable Epilepsy Following AVM Treatment**
Steven D. Chang, Robert Dodd, Gary K. Steinberg

2:56 pm - 2:59 pm 3 **Experience with High Resolution Magnetic Resonance Angiography for the Evaluation of Acute Subarachnoid Hemorrhage**
Adam S. Arthur, Paul House, Joel D. MacDonald, Jay Tsuruda, Dennis Parker, Henry Buzzwell, Richard Schmidt

2:59 pm - 3:02 pm 4 **Breakthrough Hemorrhage After EC-IC Bypass Surgery for Cerebral Ischemia**
Fady T. Charbel, Yaser Abdel Maksoud, Luke Corsten, Xinjian Du, Zhao Meide, G. Frank Sun, Kern Guppy, James Ausman

3:02 pm - 3:05 pm 5 **Clinical and Technical Factors Affecting the Endovascular Management of Vertebral Origin Stenosis**
Felipe C. Albuquerque, Patrick Han, Robert F. Spetzler, Cameron G. McDougall

3:05 pm - 3:08 pm 6 **Long-Term Angiographic Follow-Up in Young Patients with Aneurysmal SAH.**
Jaakko Rinne, Antti Ronkainen, Ritva Vanninen, Tapani Saari, Juha Hernesniemi, Matti Vapalahti

3:08 pm - 3:11 pm 7 **Long-Term Follow-Up of Angioplasty for Cerebral Vasospasm**
Jayashree Srinivasan, Anne Moore, Joseph Eskridge, David W. Newell

3:11 pm - 3:14 pm 8 **Giant Aneurysms of Childhood**
Larry T. Khoo, Michael Levy, J. Gordon McComb, Steven Giannotta

3:14 pm - 3:17 pm 9 **EC-IC Bypass: Experience in 23 Patients with Poor Cerebrovascular Reserve**
Fernando L Gonzalez, Joseph M. Zabramski, Robert.F. Spetzler

3:17 pm - 3:20 pm 10 **CT Based Assessment of Acute Stroke**
Megan M Kilpatrick, Howard Yonas, Amin B. Kassam, Lawerence R. Wechsler, Steven Goldstein, James Gebel, Charles A. Jungreis

3:20 pm - 3:23 pm 11 **Correlation of Transcranial Doppler and Stable Xenon Computed Tomography in Subarachnoid Hemorrhage**
Amin B. Kassam, Allan Scarrow, Howard Yonas, Michael Horowitz, Amy Roach, Eileen Roach, Christopher Ashton

3:23 pm - 3:26 pm 12 **Novel Endothelial Protective Effects of Endothelin Antagonism in Human Saphenous Veins: Implications for Cerebral Revascularization**
Aaron S. Dumont, Subodh Verma, Fina Lovren, Garnette R. Sutherland, John H. McNeill, Christopher R. Triggle, Todd J. Anderson

3:26 pm - 3:29 pm 13 **Occurrence of Symptomatic Vascular Malformations in Hereditary Hemorrhagic Telangiectasia**
Cormac O. Maher, David G. Piepgras, Robert D. Brown, Bruce E. Pollock, Jonathan A. Friedman

Section on Cerebrovascular Surgery I – Open Papers

4:00 pm - 4:09 pm	700	Galbraith Award **Prospective Use of Intraoperative Angiography in 520 Consecutive Cerebral Aneurysms** *Gordon Tang, C. Michael Cawley, Daniel L. Barrow*
4:09 pm - 4:18pm	701	**Combined Surgical and Endovascular Outcome in the Treatment of Paraclinoid Aneurysms** *Brian L. Hoh, Christopher S. Ogilvy, Bob S. Carter, In Sup Choi, Ronald F. Budzik, Christopher M. Putman*
4:18 pm - 4:27 pm	702	**Identification of Vascular Endothelial Growth Factor (VEGF) as a Flow-Regulated Mediator of Angiogenesis** *Adel M. Malek, Ike Lee, Seigo Izumo, Seth Alper*
4:27 pm - 4:36 pm	703	**Early Results Comparing Stenting with Endarterectomy for Treatment of Symptomatic Carotid Stenosis: A Randomized Community Hospital-Based Trial** *James R. Bean, William Brooks, Timothy Coleman, Michael Jones, Rick McClure*
4:36 pm - 4:45pm	704	**Induction of DNA Fragmentation and Caspase-3 Cleavage after Experimental Intracerebral Hemorrhage** *Nicholas M. Boulis, Chao Gong, Jun Qian, Danielle E. Turner, Julian T. Hoff, Richard F. Keep*
4:45 pm - 4:54 pm	705	**Identifying Patients at Risk for Post-Procedural Morbidity Following Treatment of Incidental Intracranial Aneurysms: The Role of Aneurysm Size and Location** *Vallabh Janardhan, Robert M. Friedlander, Sarajune Dagen, Philip E. Stieg*
4:54 pm - 5:03 pm	706	**Phenotypic Modulation of Smooth Muscle Cells in Human Cerebral Aneurysmal Walls** *Norio Nakajima, Shinji Nagahiro, Toshiaki Sano, Junichiro Satomi, Koichi Satoh*
5:03 pm - 5:12 pm	707	**Penetration of the Blood-Brain-Barrier by Oxidized Vitamin C Improves Outcome in Both Reperfused and Non-Reperfused Stroke** *Judy Huang, Szilard Kiss, Ryan McTaggart, David Agus, Tanvir Choudhri, Louis Kim, J. Mocco, William Mack, David Pinsky, William Fox, David Golde, E. Sander Connolly, Jr.*
5:12 pm - 5:21pm	708	**PICA Aneurysms: Management and Outcome Analysis of 111 Consecutive Cases** *Subrata Ghosh, Troy Paynor, Thomas J. Leipzig, Terry Horner*
5:21 pm - 5:30 pm	709	**Surgical Revascularization of the Posterior Circulation for Ischemic Disease. A Recent Experience** *Eric S. Nussbaum, Paul J. Camarata, Leslie A. Sebring, Don Erickson*

Section on Stereotactic and Functional Surgery I

Update on Epilepsy Surgery • 2:00 pm - 5:30 pm, Ballroom C3

Learning Objectives: Participants will be able to discuss paradigms of epilepsy surgery and how potential epilepsy patients may be evaluated using sophisticated imaging studies and intraoperative localization and navigation devices. Participants will be able to discuss new developments in the field of stereotactic and functional surgery.

Moderators: Philip L. Gildenberg, G. Rees Cosgrove

2:00 - 2:20 Shifting Paradigms in Epilepsy Surgery ..... Dennis D. Spencer
2:20 - 2:40 Opening Anatomic Doors for Epilepsy Surgery ..... Michael J. O'Connor
2:40 - 2:50 Discussion
2:50 - 3:30 Oral Posters 33-45
Moderator: Philip L. Gildenberg
3:30 - 4:00 Refreshments with Exhibitors
4:00 - 5:30 Open Papers 710-719
Moderators: Philip L. Gildenberg, G. Rees Cosgrove
See pages 124-128 for details
Stereotactic and Functional Neurosurgery Resident Award

Section on Stereotactic and Functional Surgery I – Oral Posters

2:50 pm - 2:53 pm **33** **Pallidal Deep Brain Stimulation with a Monopolar Electrode for Treatment of Parkinson's Disease**
Joachim K. Krauss, Thomas J. Loher, Thomas Pohle, Sabine Weber, Jean-Marc Burgunder

2:53 pm - 2:56 pm **34** **Multisensor Tissue Identification for Neurosurgery: The NASA Smart Probe Project**
Russell J. Andrews, R. Mah, A. Aghevli, K. Freitas, M. Guerrero, R. Papasin

2:56 pm - 2:59 pm **35** **Pharmacological Characterization of Sigma Receptors in the Hippocampus of Intractable Epilepsy Patients**
Grace M. Gonzalez, Anthony J. Caputy

2:59 pm - 3:02 pm **36** **Functional Hemispherectomy in Malformation of Cortical Development**
James J. Evans, Sin-Soo Jeun, Eldad Hadar, William E. Bingaman

3:02 pm - 3:05 pm **37** **In-Vivo Electrical Brain Impedance in Patients with Generalized Dystonia Treated by Continuous Bilateral Stimulation of the Internal Globus Pallidus - Preliminary Results**
Simone Hemm, Nathalie Vayssiere, Laura Cif, Philippe Coubes

3:05 pm - 3:08 pm **38** **Inhibitory Post-Synaptic Potentials in the Amygdala of the In Vivo Rat**
Joseph C.T. Chen, Eric J. Lang

3:08 pm - 3:11 pm **39** **Long-Term Outcome Analysis of Multiple Subpial Transection in Multi Lobar and Bihemispheric Seizure Foci**
Matthew R. Johnson, Arun Angelo Patil, Daniel J. Tomes, Richard V. Andrews

3:11 pm - 3:14 pm **40** **Seizure Outcome after Surgery for Ganglioglioma/DNET**
William E. Bingaman

3:14 pm - 3:17 pm **41** **Surgically Treated Cortical Dysgenesis: Incidence and Outcome**
William E. Bingaman, Imad Najm, Elaine Wyllie, Prakash Kotagal, Hans Luders

3:17 pm - 3:20 pm **42** **Image-Guided Frameless Robotic Sterotaxic Radiosurgery to Spinal Lesions**
Daniel H. Kim, Quyne Le, David Martin, Martin Murphy, John Adler

3:20 pm - 3:23 pm **43** **Magnetic Source Imaging: Guidance of Gamma Knife Epilepsy Surgery**
David John Yeh, Joseph R. Smith, Don W. King, Yong D. Park, Mark R. Lee, Gregory P. Lee, Patrick Jenkins

3:23 pm - 3:26 pm **44** **Wavelet- and Complexity-Based Neural Networks for Lesion Targeting in Pallidotomy**
Jennifer L. Hamilton, Evangelia Micheli-Tzanakou, Richard M. Lehman

3:26 pm - 3:29 pm **45** **Results of Selective Amygdalohippocampectomy in the Treatment of Medically Intractable Epilepsy**
Eldad J. Hadar, William E. Bingaman

Section on Stereotactic and Functional Surgery I – Open Papers

4:00 pm - 4:09 pm	710	**Stereotactic and Functional Neurosurgery Resident Award** **TMS-PET as a Measure of Functional Effective Connectivity of the Human Supplementary Motor Area** *Nitin Tandon, Peter Fox, Shalini Narayana, Meenakshi Iyer, Jack Lancaster, Dennis G. Vollmer*
4:09 pm - 4:18 pm	711	**Gamma Knife Surgery for Epilepsy Related to Hypothalamic Hamartomas** *Jean Regis, Fabrice Bartolomei, Tatsuhia Takakura, Tomokatsu Hori, Oskar Schrottner, Gherard Pendlshi, Hiroshi Inoue, Katsuhori Arita, Aizik Wolf, Patrick Chauvel*
4:18 pm - 4:27 pm	712	**In Vivo Optical Mapping of Neocortical Epilepsy and Surround Inhibition** *Theodore H. Schwartz, Tobias Bonhoeffer*
4:27 pm - 4:36 pm	713	**Early-Onset Generalized Dystonia: Neurosurgical Treatment by Continuous Bilateral Stimulation of the Internal Globus Pallidus in Fifteen Patients** *Philippe Coubes, Agathe Roubertie, Nathalie Vayssiere, Simone Hemm, Laura Cif, Sylvie Tuffery, Bernard Echenne, Philippe Frerebeau*
4:36 pm - 4:45pm	714	**Functional Outcomes after Gamma Knife Thalamotomy for Essential Tremor and MS-Related Tremor** *Ajay Niranjan, Douglas S. Kondziolka, Susan Baser, Rock Heyman, L. Dade Lunsford*
4:45 pm - 4:54 pm	715	**Patterns of Motor fMRI Activation: A Classification of Plasticity** *Alexandre C. Carpentier, R. T. Constable, M. J. Schlosser, Joseph M. Piepmeier, Dennis D. Spencer, Issam A. Awad*
4:54 pm - 5:03 pm	716	**The Response to Pallidal Surgery for Dystonia is Dependent on the Etiology** *Ahmed Alkhani, Farooq Khan, Anthony E. Lang, William D. Hutchison, Jonathan Dostrovsky*
5:03 pm - 5:12 pm	717	**Proton Beam Radiosurgery of the Rodent Hippocampus: MRI, Neurophysiologic, Histologic, and Behavioral Findings** *Jonathan L Brisman, Andrew J. Cole, G. Rees Cosgrove, Marc R. Bussiere, Allan F. Thornton, James Rabinov, Maria Bradley-Moore, E. Terra Hedley-Whyte, Jay S. Loeffler, Paul H.Chapman, Nicholas T. Zervas*
5:12 pm - 5:21pm	718	**Epileptogenicity in Focal Cortical Dysplasias: Correlation with Histopathological Changes** *William E. Bingaman, Imad Najm, Zhong Ying, Thomas Babb, Richard Prayson, S. Rona, K. Yacubova, S. Wang, Dileep Nair, Eldad Hadar, Elaine Wyllie, Hans Luders*
5:21 pm - 5:30 pm	719	**Mapping of the Human Medullary Surface for Vasomotor Response** *Sunil J. Patel, Christian Vera, Diana Vincent, Susan Harvey*

Section on Tumors I

Molecular Genetics of Gliomas for Diagnosis and Investigation
2:00 pm - 5:30 pm, Ballroom C2

Learning Objectives: Participants will be able to describe the molecular genetics of gliomas. Participants will explain how basic research has impacted the management of gliomas. Participants will be able to discuss new developments in the field of treatment of brain tumors.

Moderators: Joseph M. Piepmeier, Gene H. Barnett

2:00 - 2:15 The Molecular and Cellular Origins of Primary Brain Tumors ..... Eric C. Holland
2:15 - 2:30 Genetic Changes in Brain Tumor Progression ..... John Cowell
2:30 - 2:50 Molecular Genetics and the Management of Gliomas ..... J. Gregory Cairncross
2:50 - 3:30 Oral Posters 59-71
Moderators: Linda M. Liau, Ronald E. Warnick
3:30 - 4:00 Refreshments with Exhibitors
4:00 - 5:30 Open Papers 720-729
Moderators: James T. Rutka, Michael W. McDermott
See pages 129-133 for details
Preuss Award
Tumor Young Investigator Award

Section on Tumors I – Oral Posters

2:50 pm - 2:53 pm **59** **Part I: Combination Therapy of Malignant Glioma Cells with 2-5A-Antisense Telomerase RNA and Recombinant Adenovirus p53 In Vitro**
Tadashi Komata, Yasuko Kondo, Shoji Koga, Song-Chu Ko, Leland W.K. Chung, Seiji Kondo

2:53 pm - 2:56 pm **60** **Retrospective Analysis of Gamma Knife Stereotactic Radiosurgery and LINAC Fractionated Radiotherapy for the Treatment of Acoustic Schwannomas: Comparative Observations of 115 Tumors in 110 Patients Treated at One Institution**
David W. Andrews, Oscar Suarez, H. Warren Goldman, Beverly Downes, Greg Bednarz, Benjamin W. Corn, Maria Werner-Wasik, Jeffrey Rosenstock, Walter J. Curran, Jr.

2:56 pm - 2:59 pm **61** **Temozolomide (TMZ) versus Procarbazine (PCB) in Recurrent Glioblastoma Multiforme (GBM): Progression-Free Survival (PFS) and Patient Physical Function**
Michael Prados, David Mcdonald, W.K. Alfred Yung, Sara Zaknoen, Jeffrey Olson

2:59 pm - 3:02 pm **62** **Clinical Experience of Active and Adoptive Immunotherapy in Malignant Brain Tumors**
Esam A. Elkhatib, Lucia Zamorano, Geoffrey Barger, Gary Wood, Roy Baynes, Kenneth Levin, Ramiro Pârez-de la Torre, Sandra Kugelman, Fernando Diaz

3:02 pm - 3:05 pm **63** **Cancer Therapy Using a Self-Replicating Nucleic Acid Vaccine**
Han Ying, Wolfgang W. Leitner, Rong-fu Wang, Kari K. Irvine, Christopher J. Wheeler, Keith L. Black, Nicholas P. Restifo

3:05 pm - 3:08 pm **64** **Rapid Whole-Brain Metabolite Specific (MEPSI) Imaging of Brain Tumors**
Adam N. Mamelak, Robert Morgan, J. Michael Tyszka

3:08 pm - 3:11 pm **65** **Systemic Immunotherapy (GM-CSF) Potentiates the Effects of Interstitial Chemo-immunotherapy in the Treatment of Experimental Intracranial Tumors**
Raymond I. Haroun, Jeannette M. Liu, John F. Reavey-Cantwell, Khan W. Li, Chetan Bettegowda, Betty Tyler, Henry Brem

3:11 pm - 3:14 pm **66** **Coacervate Microspheres Mediate Sustained Local Delivery of Recombinant Adenoviruses for Experimental Malignant Glioma Therapy**
Jeffery A. Williams, Xuan Yuan

3:14 pm - 3:17 pm 67 **Integration of the Metabolic Data of Positron Emission Tomography in Neuronavigation**
De Witte Olivier, Marc Levivier, Beno't Pirotte, David Wikler, Serge Goldman, Jacques Brotchi

3:17 pm - 3:20 pm 68 **The Specific Inhibitor of Epidermal Growth Factor Receptor (EGFR) Tyrosine Kinase, Iressa (ZD1839), Is Active Against EGFR Over-Expressing Intracranial Tumors**
Amy B. Heimberger, Gary E. Archer, David T. Price, Roger E. McLendon, Allan H. Friedman, Henry S. Friedman, Darell D. Bigner, John H. Sampson

3:20 pm - 3:23 pm 69 **Biological Markers in Recurrent Meningiomas**
Hancq Sabine, I. Salmon, R. Kiss, B. Pirotte, D. Baleriaux, J. Brotchi

3:23 pm - 3:26 pm 70 **New Form of Adjuvant Chemotherapy in the Treatment of Medulloblastoma: Result of a Retrospective Study of Radiotherapy with and without Intense Chemotherapy**
Kou Nakagawa, Masahiro Saito, Yoshiaki Kumon, Shiro Ohue, Haruhisa Ichikawa, Shinsuke ohta, Saburo Sakaki

3:26 pm - 3:29 pm 71 **Intracranial Delivery of O6-Benzylguanine Reduces Intracranial Levels of O6-Alkylguanine-DNA Alkyltransferase**
Raymond I. Haroun, Khan W. Li, Betty Tyler, Jonathan Radosta, M. Eileen Dolan, Henry Brem, Jon Weingart

Section on Tumors I – Open Papers

4:00 pm - 4:09 pm 720 **Preuss Award**
A Novel Genetic Syndrome of Posterior Fossa Tumors of Infancy Secondary to Germline Mutation of hSNF5
Michael D. Taylor, N. Gokgoz, I. Andrulis, T. G. Mainprize, P. Jun, James M. Drake, James R. Rutka

4:09 pm - 4:18pm 721 **Tumor Young Investigator Award**
Vaccination of Recurrent Malignant Glioma Patients with Tumor-Lysate Pulsed Dendritic Cells Elicits a Potent T-Cell Anti-Tumor Response
John S. Yu, Christopher J. Wheeler, Paul M. Zeltzer, Divina Nacis-Finger, Paul K. Lee, Robert Prins, William H. Yong, Reid C. Thompson, Mary Riedinger, Wenuan Zhang, Keith L. Black

4:18 pm - 4:27 pm 722 **Dendritic Cell Vaccination of Patients with Malignant Glioma Elicits Systemic and Intracranial T-Cell Response**
Keith L. Black, Christopher J. Wheeler, Paul M. Zeltzer, Divina Nacis-Finger, Paul K. Lee, Robert Prins, William H. Yong, Reid C. Thompson, Mary Riedinger, Wenuan Zhang, John S. Yu

4:27 pm - 4:36 pm 723 **UCN-01 Induced Apoptosis in 9L Glioma Cells Provides an Effective Antigen Source For Dendritic Cells That Yields a Potent Therapeutic Vaccine Strategy in an Intracranial Glioma Model**
Timothy F. Witham, Melanie Erff, Hideho Okada, William H.Chambers, Ian F. Pollack

4:36 pm - 4:45pm 724 **Radiation Necrosis Following Gamma Knife Radiosurgery: A Case-Controlled Comparison of Treatment Parameters and Long-Term Clinical Follow-Up**
Lawrence S. Chin, Lijun Ma, Steven DiBiase

4:45 pm - 4:54 pm 725 **Identification and Characterization of Pescadillo, a Novel BRCT-Domain Containing Gene with Increased Expression in Glioblastoma**
Gregory D. Foltz, Jim Schuster, Peter Nelson, Leroy Hood, Richard Morrison

4:54 pm - 5:03 pm 726 **Tumor Fas (APO-1/CD95) Upregulation Results in Increased Apoptosis and Survival in Rats with Intracranial Malignant Glioma**
Bruce Frankel, Sharon L. Longo, Michele Kyle, Gregory W. Canute, Timothy C. Ryken

5:03 pm - 5:12 pm 727 **Endoscopic Endonasal Transsphenoidal Surgery: Advantages and Pitfalls**
Hae-Dong Jho, In-Sung Park

5:12 pm - 5:21pm 728 **The Characterization of Tumor Apoptosis After Experimental Radiosurgery**
Timothy F. Witham, Hideho Okada, Wendy Fellows, Ronald L.Hamilton, John C. Flickinger, William H. Chambers, Ian F. Pollack, Douglas S. Kondziolka

5:21 pm - 5:30 pm 729 **Gene Therapy for Recurrent Glioblastoma: Interim Report**
Isabelle M. Germano, Susan Morgello, Savio Woo, Kalmon D. Post

Section on Neurotrauma and Critical Care I

Spinal Trauma • 2:00 pm - 5:30 pm, Room 007AB

Learning Objectives: Participants will be able to describe the use of radiographs for evaluation of cervical spine trauma.
Participants will be able to discuss the rationale for management of spinal cord injury with steroids.
Participants will be able to discuss new developments in the field of treatment of trauma.

Moderators: Martin C. Holland, Perry Ball

2:00 - 2:25 Radiographic and Clinical Clearance of the Cervical Spine in Trauma ..... Donald W. Marion
2:25 - 2:50 The Use of Steroids for Spinal Cord Injury ..... Michael G. Fehlings
2:50 - 3:30 Oral Posters 85-97
Moderator: Perry Ball
3:30 - 4:00 Refreshments with Exhibitors
4:00 - 5:30 Open Papers 730-739
See pages 134-138 for details

Synthes Awards for Resident Research in Spinal Cord and Spinal Column Injury

Section on Neurotrauma and Critical Care I – Oral Posters

2:50 pm - 2:53 pm **85** **Gender Effects Mask Underlying Pattern of Data in Brain Injury Outcomes: Re-Analysis of Tirilazad**
Elana Farace, Andrew I.R. Maas, Chantal Hukkelhoven, Ewout Steyerberg, Mark E. Shaffrey

2:53 pm - 2:56 pm **86** **Functional Reorganization of Adult Rat Barrel Cortex Following Induced Central Lesion**
Tien T. Nguyen, Takamichi Yamamoto, Richard T. Stevens, Charles J. Hodge, Jr.

2:56 pm - 2:59 pm **87** **Timing of Surgery Following Spinal Cord Injury: The Effect on Non-Neurological Outcome**
Todd W. Vitaz, Christopher B. Shields, George H. Raque

2:59 pm - 3:02 pm **88** **The Usefulness of Proton MR Spectroscopy in the Evaluation and Clinical Outcomes of Traumatic Brain Injury**
Lori A. Shutter, Barbara Holshouser, Karen A. Tong, Austin R. T. Colohan

3:02 pm - 3:05 pm **89** **Further Neuroprotective Characterization of Indomethacin as a Direct Free Radical Scavenger**
Yukio Ikeda, Kiyoshi Matsumoto, Kenji Dohi, Youichi Imaizumi, Hiroyuki Jimbo, Motohiko Shimazu, Munetaka Hayashi, Ken Sasaki

3:05 pm - 3:08 pm **90** **Epidemiology of Spinal Cord Injury in Patients with Odontoid Fractures**
James S. Harrop, Ashwini Sharan, Gregory Przybylski

3:08 pm - 3:11 pm **91** **Longterm Outcome for Patients Undergoing Decompressive Surgery for the Management of Malignant Intracranial Hypertension Following Head Injury**
John Sinclair, Charles Agbi

3:11 pm - 3:14 pm **92** **Epidemiology of Tracheostomy in Complete Cervical Spinal Cord Injuries**
James S. Harrop, Edward Scheid, Ronald Benitez, Gregory J. Przybylski

3:14 pm - 3:17 pm **93** **Bedside Ventriculostomy in the Neurosurgical ICU for the Treatment of Acute Hydrocephalus**
Ben Zion Roitberg, Naimath Khan, M.Serdar Alp, Tamir Hersonskey, Fady T. Charbel, James I. Ausman

3:17 pm - 3:20 pm **94** **Guidelines for the Management of Minor Traumatic Brain Injuries in the West Indies**
Odette A. Harris, Randolph Cheeks, Paul G. Matz

3:20 pm - 3:23 pm **95** **The Importance of Decompressive Craniectomy in Severe Head Injuries**
Ullrich Meier, Frank Stefan Zeilinger, Oliver Henzka

3:23 pm - 3:26 pm **96** **Expanded Use of Lumbar Drainage for Controlling Raised Intracranial Pressure**
Jeffrey E. Catrambone, Santiago Figuereo, Walter Johnson, Austin Colohan

3:26 pm - 3:29 pm **97** **Outcomes of Neurological Injuries Associated with Recreational Winter Sports**
Achilles K. Papavasiliou, Morris L. Rivera, Douglas M. Franz, Perry A. Ball

Section on Neurotrauma and Critical Care I – Open Papers

4:00 pm - 4:09 pm 730 **A Highly Specific Cyclooxegenase-2 Inhibitor Improves Neurological Recovery in a Rat Traumatic Brain Injury Model**
Amir S. Malik, Raj K. Narayan, Kenneth I. Strauss

4:09 pm - 4:18 pm **Synthes Award for Resident Research**
Brain and Craniofacial Injury – *Roman Hlatky*, Poster 354A, "Time Course of Cerebral Autoregulation in Severly Head-Injured Patients Using Dynamic Testing"

731 **Spinal Cord and Spinal Column Injury**
Extensive Axon Regeneration in the Adult Rat Corticospinal Tract after Spinal Cord Injury
Deepa Soni, Larry Benowitz, Nina Irwin, Joseph R. Madsen

4:18 pm - 4:27 pm 732 **Role of the mGluR1 Metabotropic Glutamate Receptor in Spinal Cord Injury**
Nicolas Phan, Michael G. Fehlings

4:27 pm - 4:36 pm 733 **MRA for the Diagnosis of Vertebral Artery Injury Associated with Cervical Spine Trauma**
Santiago J. Figuereo, Nathan R. Weldon, Austin R. T. Colohan

4:36 pm - 4:45pm 734 **A Prospective Population-Based Study of Pediatric Trauma Patients with a Field Glasgow Coma Score of 13-14**
Michael Y. Wang, Pamela Griffith, Judy Sterling, J. Gordon McComb, Michael L. Levy

4:45 pm - 4:54 pm 735 **Minocycline Reduces Post-traumatic Brain Injury by Inhibition of the Caspase-1 Cell Death Cascade**
Robert M. Friedlander, Victor Ona, Philip E. Stieg, Mingwei Li

4:54 pm - 5:03 pm 736 **The Effect of Group II & III Metabotropic Glutamate Receptor Activation on Neuronal Injury in a Rodent Model of Traumatic Brain Injury**
Marike Zwienenberg, Qin Zhi Gong, Robert F. Berman, J. Paul Muizelaar, Bruce G.Lyeth

5:03 pm - 5:12 pm 737 **Unilateral Decompressive Craniectomy for Children with Severe Head Injuries. Report of 7 Cases and Review of the Literature**
Nedal A. Hejazi, Alfred Witzmann, L. K. H. Feldkirch

5:12 pm - 5:21pm 738 **Biphasic Elevation of Prostaglandin E2 and Thromboxane B2 Concentrations Following Spinal Cord Injury**
Daniel K. Resnick, Catherine F. Cechvala

5:21 pm - 5:30 pm 739 **The Effects of Ethanol on Heat Shock Protein Expression Following Traumatic Brain Injury**
Steven A. Dutcher, Julie Pilitsis, Bill D. Underwood, Paul D. Walker, Fernando G. Diaz, Daniel B. Michael

Council of State Neurosurgical Societies

2:00 pm – 5:30 pm, Room 007CD

Learning Objectives: Participants will be able to describe current standards in terms of coding. Participants will be able to describe the interactions of neurosurgical organizations with the United States government. Participants will be able to discuss new developments in the field of current socioeconomic problems.

Moderators: James Bean, A. John Popp

2:00 - 2:30 Coding and Reimbursement ..... James Bean
2:30 - 3:00 Washington Committee Update ..... A. John Popp, Katie O. Orrico
3:00 - 3:10 Questions
3:10 - 3:30 Oral Posters 27-32
Moderator: Lyal G. Leibrock
3:30 - 4:00 Refreshments with Exhibitors
4:00 - 5:30 Open Papers 740-749
Moderators: James Bean, A. John Popp
See pages 139-143 for details
CSNS Resident Award
CSNS Young Neurosurgeons Award

Council of State Neurosurgical Societies – Oral Posters

3:10 pm - 3:13 pm 27 **Spine Surgeons Accurately Estimate the Probability of Favorable One-year Postoperative Outcomes for Lumbar Patients**
Robert J. Morlock, Richard E. Ward, David R. Nerenz, Michael J. Rauzzino, Edward Benzel, Peter Dempsey, Edward Feil, William Krauss, Bernard Pfeifer, Michael Schneier, Scott Erwood

3:13 pm - 3:16 pm 28 **The Impact of Surgical Navigation on Hospital Stay, Charges, and Costs**
Rajnik Raab, Maryann Sakmyster, Michael Schulder

3:16 pm - 3:19 pm 29 **Organ Donation Rates in a Neurosurgical Intensive Care Unit**
John Dickerson, Alex B. Valadka, Tina LeVert-Cole, Kimberly Davis, Mary Kurian, Claudia S. Robertson

3:19 pm - 3:22 pm 30 **Vestibular Neurectomy for Intractable Vertigo: Efficacy of Simplified Retrosigmoid Approach**
Joung H. Lee, Toru Fukuhara, Gordon B. Hughes, Sam E. Kinney

3:22 pm - 3:25 pm 31 **Vasospasm in Childhood Aneurysmal Subarachnoid Hemorrhage**
Larry T. Khoo, Michael L. Levy, Steven Giannotta, J. Gordon McComb

3:25 pm - 3:28 pm 32 **Impact of Tobacco Smoking on Severity of Subarachnoid Hemorrhage and Risk of Vasospasm**
Satish Krishnamurthy, Sanat Dixit, Sid Chandela, Stephen K. Powers, Kevin M. Cockroft

Council of State Neurosurgical Societies – Open Papers

4:00 pm - 4:09 pm 740 **CSNS Resident Award**
Comparison of Hospital Costs for Interventional MRI-Guided Surgery vs. Frameless
Chris Lycette, Gregory Rubino, Keyvan Farahani, Pablo Villablanca, Barbara Van de Wiele

4:09 pm - 4:18pm 741 **CSNS Young Neurosurgeons Award**
Length of Stay Differences Between Electively and Non-Electively Admitted Craniotomy Patients
Marc S. Schwartz, Sharon Habiniak, Debra Pukis, Donna Dibble, Todd Scrime, John B. Waldman

4:18 pm - 4:27 pm 742 **Is Outpatient Trial for Spinal Cord Stimulation More Cost-Effective Than Inpatient Trial?**
Frank P. Hsu, Farhad Limonadi, Zvi Israel, Kim Burchiel

4:27 pm - 4:36 pm 743 **Socioeconomic Impact of a Network for Telematic Neurosurgical Consultation in the Treatment of Head Injured Patients**
Giuliano Faccani, Fulvio Massaro, Maurizio Berardino, Silvana Borgarello

4:36 pm - 4:45pm 744 **The Role of Anthropometry in the Assessment and Treatment of Craniosynostosis and Deformational Plagiocephaly**
Mark R. Proctor, Ram Burvin, John Mulliken

4:45 pm - 4:54 pm 745 **Delays in the Treatment of Patients with Subarachnoid Hemorrhage**
Michael Y. Wang, Steven L. Giannotta

4:54 pm - 5:03 pm 746 **Posterior Cervical Foraminotomy. A Follow-Up Study of 67 Surgically Treated Patients with Compressive Radiculopathy**
Nedal A. Hejazi, Alfred Witzmann, L. K. H. Feldkirch

5:03 pm - 5:12 pm 747 **The Impact of Using the Traumatic Brain Injury Guidelines on Outcomes in a Community Hospital Setting**
Sylvain Palmer, Mary Kay Bader, Azhar Quereshi, Jacques J. Palmer, Thomas Shaver, Marcello Borzatta, Commie Stalcup

5:12 pm - 5:21pm 748 **Increased Perioperative Risk in Obese Patients Undergoing Elective Posterolateral Lumbar Fusions with Pedicle Fixation**
Gregory J. Przybylski, Dennis J. Maimam, James P. Hollowell, Sanford Larson

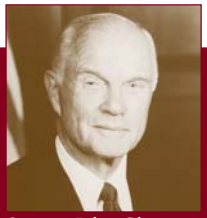
5:21 pm - 5:30 pm 749 **Neurosurgical Management of Concussions in Rugby Football**
Elana Farace, Jeff T. Barth, Donna K. Broshek, Jeff A. Hollier, Kevin B. DeAngelo, Mark E. Shaffrey

Tuesday-At-A-Glance

7:30 am - 11:45 am	General Scientific Session II
9:00 am - 4:30 pm	Exhibits Open
9:00 am - 9:50 am	Coffee with Exhibitors
11:00 am - 11:45 am	Senator John Glenn, 1st Annual Walter Dandy Orator
11:45 am - 12:30 pm	Visit Exhibits & Pick Up Lunch for Seminars
12:30 pm - 2:00 pm	Luncheon Seminars
2:00 pm - 5:15 pm	Special Course II
2:00 pm - 5:30 pm	Section on Disorders of the Spine and Peripheral Nerves I
2:00 pm - 5:30 pm	Section on Tumors II
2:00 pm - 5:30 pm	Section on Stereotactic and Fuctional Surgery II
2:00 pm - 5:30 pm	Section on Pediatrics I
2:00 pm - 5:30 pm	Section on Pain I
3:30 pm - 4:00 pm	Refreshments with Exhibitors

General Scientific Session II • 7:30 am - 11:45 am, Lila Cockrell Theatre


Paul Sanberg


Senator John Glenn

Redefining Neurosurgery: Restorative Surgeries and Future Technology

Learning Objectives: Participants will be able to describe the research efforts that will form the basis of new procedures and technologies important for the management of patients with neurodegenerative diseases or focal neurologic disorders.

Moderator: Andres M. Lozano
Presiding Officer: Stephen M. Papadopoulous

7:30 - 7:50	Neurosurgery for the 21st Century: What Does Neurobiology Justify?	Paul Sanberg
7:50 - 8:05	Surgical Drug-Delivery for Neurodegenerative Diseases	Andres M. Lozano
8:05 - 8:20	Neurotransplantation for Parkinson's Disease and Huntington's Disease: Lessons Learned from Clinical Trials	Thomas B. Freeman
8:20 - 8:35	Cellular Therapies for Neurodegenerative Diseases: Where Does the Future Lead?	Douglas S. Kondziolka
8:35 - 9:00	Bioengineering and Recovery: What Is Possible?	Roy A. E. Bakay
9:00 - 9:50	Coffee with Exhibitors	
9:50 - 9:55	Think First	Jeffery M. Lobosky
9:55 - 10:00	CNS Fellowship Presentations	Daniel L. Barrow
10:00 - 10:05	Presidential Acknowledgement	Daniel L. Barrow
10:05 - 10:20	Solving Delivery Problems: Intracerebral Navigation	Ralph G. Dacey, Jr.
10:20 - 10:35	Technology from the Military: Battlefield Before Hospital	James M. Ecklund
10:35 - 10:50	Evaluating New Surgeries: Proof Before Practice	Stephen J. Haines
10:50 - 11:00	CNS Resident Award Presentation	Abhaya V. Kulkarni
11:00 - 11:05	Introduction of Dandy Orator	Daniel L. Barrow
11:05 - 11:45	1st Annual Walter Dandy Orator	Senator John Glenn
11:45 - 12:30	Visit Exhibits & Pick Up Lunch for Seminars	

SCIENTIFIC PROGRAM
LUNCHEON SEMINARS

All Seminars will be held at the Henry B. Gonzalez Convention Center from 12:30 - 2:00 pm. Tickets are required and may be purchased in the CNS Registration Area. Redeem lunch tickets at Booth 788.


Issam A. Awad


Edward R. Laws, Jr.

T27/T27R Resident/Honored Guest Luncheon

Room 205

Moderator: Issam A. Awad
Faculty: Edward R. Laws, Jr.

Learning Objective: Residents will be able to review and discuss with the honored guest, his thoughts on neurosurgery – past, present, and future.

T28/T28R Intracerebral Hematoma: Treatment Options and Controversies

Room 206A

Moderator: R. Loch Macdonald
Faculty: B. Gregory Thompson, Jr., Murat Gunel, Mario Zuccarello, Austin R. T. Colohan, Kiyoshi Kuroda

Learning Objective: Participants will be able to discuss the different approaches to diagnosis and treatment of intracerebral hematomas and the different controversies as to their management.

T29/T29R Management of Lesions at the Cervicothoracic Junction

Room 208

Moderator: Edward C. Benzel
Faculty: Gregory R. Trost, Andrea L. Halliday, Charles J. Riedel, George R. Cybulski, Fraser C. Henderson

Learning Objective: Participants will review the diagnostic radiologic classifications, different surgical approaches, and strategies for management of these lesions at the cervicothoracic junction.

T30/T30R Case Management: Lumbar Spondylolysis/Spondylolisthesis

Ballroom C1

Moderator: Richard G. Fessler
Faculty: Joseph T. Alexander, Stephen M. Papadopoulos, Christopher I. Shaffrey, Deepak Awasthi, Phillip Kissel

Learning Objective: Participants will be able to review different approaches to the diagnosis and treatment of degenerative lumbar spine disease, as well as future and novel therapeutic strategies.

T31/T31R Sympathetic vs. Neuropathic Pain: Differences in Pathophysiology and Treatment

Room 206B

Moderator: Richard K. Osenbach
Faculty: Richard K. Simpson, Jr., Samuel J. Hassenbusch, George T. Mandybur, Kenneth A. Follett

Learning Objective: Participants will be able to differentiate the pathophysiology between these two conditions as well as the treatment options currently available with both the advantages and disadvantages of each.

T32/T32R Biology of Bone Fusion and Techniques of Bone Grafting

Ballroom C3

Moderator: Russell P. Nockels
Faculty: Michael J. Rauzzino, Ben Guiot, Michael A. Morone, John Wahlig, Michael Groff

Learning Objective: Participants will be able to describe the approaches necessary to obtain adequate fusion at the different spine levels and reasoning behind the different fusion techniques.

T33/T33R Outcomes Assessment for Spinal Surgery

Room 217A

Moderator: Paul C. McCormick
Faculty: Beverly C. Walters, Stephen J. Haines, Peter G. Gerszten

Learning Objective: This seminar will discuss the benefits and different strategies for outcomes assessment for spinal surgery. Participants will be able to review the basic principles behind the outcomes assessment, the different methods used in the assessment, and the ways that data can be utilized to optimize patient care in order to improve outcomes.

T34/T34R Novel Therapies for Malignant Gliomas

Ballroom C2

Moderator: Henry Brem
Faculty: Mark Bernstein, Jeffrey J. Olson, Linda M. Liau, Timothy C. Ryken

Learning Objective: This seminar will discuss the current and novel therapies for the treatment of malignant gliomas. Participants will be able to review the present standard of care for the treatment of high grade gliomas as well as, and more importantly, the future novel therapies that will likely soon be available as adjuvant treatment for patients with these tumors.

T35/T35R Case Management: Intracranial Meningiomas

Room 211

Moderator: Donald C. Wright
Faculty: Ossama Al-Mefty, Kris A. Smith, John G. Golfinos, Amin B. Kassam

Learning Objective: In this seminar the moderator will present cases of intracranial meningiomas which will be discussed by the faculty and attendees. Participants will be able to review the different skull base approaches to these tumors and the diagnosis and specific treatment of meningiomas throughout the intracranial space. Participants will be able to describe strategies for reconstruction following tumor resection.

T36/T36R Technical Issues and Complication Avoidance in Pituitary Surgery

Room 215

Moderator: Martin H. Weiss
Faculty: Ernst H. Grote, Andrew Parent, Nelson M. Oyesiku, Hae Dong Jho, Ivan Ciric

Learning Objective: This seminar will discuss the different approaches to pituitary surgery with a focus on complication avoidance. Participants will be able to review the different surgical approaches, decision making, both preoperatively and intraoperatively, and describe strategies to lessen the incidence of complications during pituitary surgery.

T37/T37R Third Ventricular Tumors: Open, Stereotactic, and Endoscopic Approaches

Room 207A

Moderator: Jeffrey N. Bruce
Faculty: Michael L. J. Apuzzo, Gerard S. Rodziewicz, James T. Rutka, Adam Lewis

Learning Objective: This seminar will discuss the different approaches to third ventricular tumors. Participants will be able to discuss the different diagnostic approaches as well as the different treatment options in the approach of this complex problem. The specific surgical approaches will include open, stereotactic, and endoscopic and participants will be able to explain the basis for understanding the optimal approach for particular tumors as it relates to location, tumor type, etc.

T38/T38R Complication Avoidance and Management in Cranial Base Surgery

Room 216A

Moderator: Thomas C. Origitano
Faculty: Gail L. Rosseau, Jacques J. Morcos, Mark E. Linskey

Learning Objective: This seminar will address the specific management issues in regard to cranial based surgery. Participants will be able to discuss and review the different diagnostic approaches, surgical options, and complication avoidance in patients during cranial base surgery.

SCIENTIFIC PROGRAM
LUNCHEON SEMINARS

T39/T39R Cerebral Aneurysm Surgery: Complication Avoidance and Management

Room 207B

Moderator: Winfield S. Fisher, III
Faculty: Arnold B. Vardiman, Christopher C. Getch, C. Michael Cawley, Hirotoshi Sano

Learning Objective: This seminar will discuss the diagnosis and management of patients with cerebral aneurysms. Participants will be able to review the different surgical approaches and strategies for the treatment of anterior and posterior circulation aneurysms and intraoperative strategies to lessen complications.

T40/T40R Multimodality Management of AVMs

Room 214B

Moderator: Philip E. Stieg
Faculty: Evandro de Oliveira, Shigeru Miyachi, Michael T. Lawton, Masaaki Yamamoto, David Levy

Learning Objective: This seminar will discuss the multimodality management of patients with arteriovenous malformations (AVM). The different diagnostic options, as well as surgical and non-surgical procedures, will be discussed. Participants will be able to review each of the different management options in patients with AVMs and discuss the specific methods and reasons for optimal management in different patient types and presentations.

T41/T41R Vascular Augmentation Techniques for Cerebral Ischemia

Room 216B

Moderator: Howard Yonas
Faculty: Fernando G. Diaz, David W. Newell, Kiyohiro Houkin, Craig A. Van Der Veer, J. Max Findlay

Learning Objective: This seminar will discuss the different surgical techniques for vascular augmentation for cerebral ischemia. Participants will be able to review the diagnostic options and decision making for each of the revascularization procedures. Participants will be able to list the specific methods for preoperative and intraoperative management as well as the indications for surgical intervention.

T42/T42R Case Management: Carotid Disease

Room 214C

Moderator: Christopher M. Loftus
Faculty: Mark H. Camel, Shunro Endo, Robert E. Harbaugh, Robert H. Rosenwasser, A. John Popp

Learning Objective: In this seminar, the moderator will present cases of carotid disease that will be discussed by the faculty and attendees. Participants will be able to review the different diagnostic options and indications for surgical and non-surgical intervention. Participants will be able to list techniques for the different radiologic techniques available in order to best formulate an appropriate management plan.

T43/T43R Contemporary Management of Head Injury

Room 217B

Moderator: Donald W. Marion
Faculty: Daniel F. Kelly, Jamshid Ghajar, Jeffrey M. Lobosky, Thomas A. Kingman, Howard Eisenberg

Learning Objective: This seminar will discuss the contemporary management of head injury. Participants will be able to review the management issues, both in the acute and chronic setting and within the intensive care unit. Participants will be able to describe surgical management as well as techniques for the management of intracranial pressure.

T44/T44R Management of Posterior Fossa and Brain Stem Tumors in Children

Room 006A

Moderator: Ian F. Pollack
Faculty: Liliana C. Goumnerova, Jon D. Weingart, Jeffrey Wisoff, John R. W. Kestle

Learning Objective: This seminar will discuss the management issues of children with posterior fossa and brain stem tumors. Participants will be able to review the different surgical, radiotherapeutic, and chemotherapeutic approaches to these children as well as discuss the surgical versus non-surgical decision making in these patients.

T45/T45R Chiari Malformation and Syringomyelia: Controversies in Management

Room 214A

Moderator: Karin M. Muraszko
Faculty: Ulrich Batzdorf, Alain C.J. de Lotbiniere, Thomas H. Milhorat, David H. Shafron, Toshiaki Abe

Learning Objective: This seminar will discuss the controversies and problems in the management of Chiari malformations and syringomyelia. Participants will be able to describe the different diagnostic options as well as the decision making for surgical versus non-surgical care. Participants will be able to review the presentation, diagnosis, and management, particularly the advantages and disadvantages as they relate to this topic.

T46/T46R Managing Complex Myelomeningoceles

Room 006B

Moderator: Alexa I. Canady
Faculty: John Ragheb, Timothy M. George, Reizou Shirane, Bermans Iskander

Learning Objective: This seminar will focus on the problems posed by children with complex myelomeningoceles. Participants will be able to review the basic embryology and pathobiology as well as the different surgical procedures, including cutaneous and muscular flaps, necessary to obtain closure in these complex cases. Participants will be able to list the indications for ventriculoperitoneal shunt placement.

T47/T47R Functional Brain Mapping Techniques

Room 006C

Moderator: Isabelle M. Germano
Faculty: Dan Silbergeld, Mitchel S. Berger, Michael M. Haglund, Michael Schulder, Kim J. Burchiel

Learning Objective: This seminar will discuss the available techniques for functional brain mapping. Participants will be able to describe specific issues pertaining to present technology, including both the advantages and disadvantages of different systems, and the utilization of that information for preoperative and intraoperative planning. Participants will be able to review the different techniques presently available and those that will likely be useful in the near future.

T48/T48R Intracranial Navigation Systems: What is Nice and What is Necessary

Room 214D

Moderator: Richard D. Bucholz
Faculty: Thomas M. Moriarty, Eiju Watanabe, Matthew Howard

Learning Objective: This seminar will discuss the current technologies available for intracranial navigation and stereotactic localization. Participants will be able to review which of the current and new technologies for intracranial navigation are absolutely necessary and list the other available technologies and their indications.

T49/T49R Pediatric Epilepsy Surgery

Room 217D

Moderator: Robert E. Maxwell
Faculty: Frederick A. Boop, P. David Adelson, Joseph R. Madsen, Andre Olivier, Benjamin Carson

Learning Objective: This seminar will discuss the indications and preoperative evaluation of children with intractable seizures. Participants will be able to review the pathobiology, evaluation techniques, and decision making for epilepsy surgery in the pediatric population. Participants will be able to list the different surgical techniques and their indications. Participants will be able to review the prognosis and outcome for the different techniques, and seizure problems will also be discussed by the faculty and attendees.

T50/T50R Current Clinical Applications of Spinal Cord Stimulation

Room 218

Moderator: Jaimie M. Henderson
Faculty: Giancarlo Barolat, Richard B. North, John C. Oakley, John P. Gorecki, Ricardo Segal

Learning Objective: This seminar will describe the current indications and techniques for the use of spinal cord stimulation. Participants will be able to review the pathophysiology, indications for its use, and different technological applications that are presently available. Participants will be able to describe the different techniques that can be used in clinical practice and the evaluation necessary in the decision making for the optimal approach and application.

T51/T51R — Peripheral Nerve Surgery: Clinical and Electrical Diagnosis, Surgical Exposure, and Results

Room 006D

Moderator: Allan J. Belzberg
Faculty: David G. Kline, Richard J. Moulton, Vinko Dolenc

Learning Objective: This seminar will discuss and describe the clinical indications, diagnosis, and surgical approach to patients with peripheral nerve injury. Participants will be able to review the different surgical methods and intraoperative techniques in order to optimize the long-term outcome. Participants will be able to review the prognosis and long-term results and describe optimal management of the patient who has suffered peripheral nerve injury.

T52/T52R — Diagnosis and Management of Child Abuse

Room 217C

Moderator: Michael David Partington
Faculty: Ann-Christine Duhaime, Mark S. Diaz, Peter B. Dirks, Judge Peter Sakaii

Learning Objective: This seminar will discuss the role of the neurosurgeon in the diagnosis and management of child abuse. Participants will be able to review the different evaluative options as well as discuss the pathophysiology and biomechanics necessary to understand certain levels of injury and to assist in re-creation of the mechanism of injury. Participants will be able to discuss the different medical and legal aspects for the treating physician and describe the optimal techniques and approach to dealing with the medical/legal system.

Special Course II

Endovascular Neurosurgery: State of the Art • 2:00 pm - 5:15 pm, Lila Cockrell Theatre

Learning Objectives: Following this course, participants will be able to describe the new developments within the practice of endovascular neurosurgery. Participants will be able to discuss the applications of endovascular procedures for arteriosclerotic disease, aneurysms, and vascular malformations.

Course Directors: Christopher S. Ogilvy, Neil A. Martin

2:00	2:15	Radiology	Cameron G. McDougall
2:15	2:45	Devices	Stanley L. Barnwell
2:45	3:00	Training	Robert H. Rosenwasser
3:00	3:30	Stents: Extra- and Intracranial	Lee R. Guterman
3:30	4:00	Refreshments with Exhibitors	
4:00	4:15	Biology of the Blood Vessel and Future Applications	Giuseppe Lanzino
4:15	4:35	Aneurysms	Robert H. Rosenwasser
4:35	4:55	AVMs	Michael B. Horowitz
4:55	5:15	Pitfalls	Jacques Dion

Section on Disorders of the Spine and Peripheral Nerves I

Management of Disorders of the Cervical Spine • 2:00 pm - 5:30 pm, Ballroom C1

Learning Objectives: Participants will be able to recognize and describe the treatment of the following cervical spinal disorders: rheumatoid arthritis, trauma, and degenerative disease.

Moderators: Robert F. Heary, Ziya L. Gokaslan

2:00 - 2:15 Rheumatoid Arthritis of the Cervical Spine ..... H. Louis Harkey, III

2:15 - 2:30 Cervical Spine Trauma ..... Mark N. Hadley

2:30 - 2:45 Degenerative Disease of the Cervical Spine ..... Regis W. Haid, Jr.

2:45 - 2:50 Discussion

2:50 - 3:30 Oral Posters 111-123
Moderator: Robert F. Heary

3:30 - 4:00 Refreshments with Exhibitors

4:00 - 5:30 Open Papers 751-760
Moderators: Vincent C. Traynelis, Stephen M. Papadopoulos
See pages 144-149 for details

Section on Disorders of the Spine and Peripheral Nerves I – Oral Posters

2:50 pm - 2:53 pm **111** **Evaluation of 11th Rib Extrapleural-Retroperitoneal Approach to the Thoracolumbar Junction**
Miriam Y. Kim, Paul C. Nolan, Joel A. Finkelstein

2:53 pm - 2:56 pm **112** **A Biomechanical Comparison of Fixation Techniques at the Cervicothoracic Junction**
Larry T. Khoo, Thomas Hedman, Srinath Samudrala

2:56 pm - 2:59 pm **113** **The Biomechanical Effects of Lumbar Fusion on the Adjacent Vertebral Motion Segment**
Larry T. Khoo, Fleming Chu, Thomas Hedman, Srinath Samudrala

2:59 pm - 3:02 pm **114** **Posterior Instrumentation Strategies Following Tumor Resection at the Cervicothoracic Junction**
Jeremy C. Wang, Mark Bilsky, Viswanathan Rajaraman, Patrick Boland

3:02 pm - 3:05 pm **115** **Pedicle Screw Fixation in Cancer Patients: Experience with 85 Cases**
Daryl R. Fourney, Ziya L. Gokaslan

3:05 pm - 3:08 pm **116** **Microsurgical Anatomy of the Superior Laryngeal Nerve and Recurrent Laryngeal Nerve**
Daniel H. Kim, Ashkan Monafred, Andrew C. Kam

3:08 pm - 3:11 pm **117** **The "H" Modification of the Transoral Approach to the Craniocervical Junction**
Larry T. Khoo, Uttam K. Sinha, Erica Bennett, Srinath Samudrala

3:11 pm - 3:14 pm **118** **Thoracolumbar Burst Fractures: A Meta-Analysis of Anterior Versus Posterior Surgical Treatment**
David F. Antezana, Mesfin A. Lemma, Uri M. Ahn, Nicholas U. Ahn, David Cohen, John Kostuik

3:14 pm - 3:17 pm **119** **Anterior Cervical Spine Fusion with the Aid of Threaded C-BAK Cages. Experience in 85 Myelopathic Patients with a Minimum of One-Year Follow-Up**
Ely Ashkenazi, Michael Millgram, Nahshon Rand, Yizhar Floman

3:17 pm - 3:20 pm 120 **The Effect of the Prone Position on Intraocular Pressure in Anesthetized Patients Undergoing Spine Surgery**
Carl Lauryssen, Mary Ann Cheng, Tom McHugh, Reny Tempelhoff

3:20 pm - 3:23 pm 121 **Molecular Mechanisms of Cell Death in Human Cervical Spondylotic Myelopathy: Role of FAS and P75 Dependent Apoptosis**
Michael G. Fehlings, Wen Ru Yu, P. Shannon, L.H.S. Sekhon

3:23 pm - 3:26 pm 122 **Direct Anterior Screw Fixation for Odontoid Fractures: Indications, Timing, and Outcome**
Russell R. Lonser, Ronald I. Apfelbaum, Robert Veres, Adrian Casey

3:26 pm - 3:29 pm 123 **Biomechanical Comparison of the Pullout Strength of a 4.0 mm Titanium ASIF Screw and Washer Construct vs. Buttress Plate Construct for Cervical Spine Fusion Stability**
Lisa A Ferrara, A. Wakefield, R. Dryer, R. McLain, I. Lieberman

Section on Disorders of the Spine & Peripheral Nerves I – Open Papers

4:00 pm - 4:09 pm 751 **Percutaneous Vertebroplasty for Pain Relief and Spinal Stabilization**
John D. Barr, Michelle Barr

4:09 pm - 4:18pm 752 **Surgical Repair of Brachial Plexus Injury: A Multinational Survey of Experienced Peripheral Nerve Surgeons**
John L. Moriarity, Michael Dorsi, Allan J. Belzberg

4:18 pm - 4:27 pm 753 **Progressive Cervical Kyphosis: Management and Outcome in 71 Consecutive Cases**
Charles L. Wolff, Michael Kilburn, Thomas Moore, Mark N. Hadley

4:27 pm - 4:36 pm 754 **Cadaveric Fibula and Locking Cervical Plate in 361 Cases**
Scott A. Shapiro, Francesca Tekula, Jill Donnaldson, Raj Bindal, Todd Abel

4:36 pm - 4:45pm 755 **Long-Term Follow-Up of Treated Posttraumatic Syringomyelia: Role of Magnetic Resonance Imaging in the Evaluation of Outcome**
Eve C. Tsai, Michael G. Fehlings, Charles Tator

4:45 pm - 4:54 pm 756 **Anterior Cervical Microforaminotomy for Cervical Radiculopathy in 161 Patients**
Hae-Dong Jho, Woo-Kyung Kim

4:54 pm - 5:03 pm 757 **Impacted PLIF: Posterior Lumbar Interbody Fusion with Machined, Pre-sized Allograft**
Kevin T. Foley, Thomas T. Lee, Ramesh L. Sahjpaul

5:03 pm - 5:12 pm 758 **The Influence of an Artificial Cervical Joint versus Fusion on Adjacent Level Motion in the Treatment of Cervical Disc Disease**
Crispin C. Wigfield, James Robertson, Newton Metcalf, Ilana Langdon

5:12 pm - 5:21pm 759 **PLIF with Allograft Bone: A Comparison of Cylindrical Dowels and Impacted Wedges**
Bryan B. Barnes, Mark McLaughlin, Gerald E. Rodts, Jr., Regis W. Haid, Jr.

5:21 pm - 5:30 pm 760 **Polyethylene Glycol in the Treatment of Experimental Spinal Cord Injury**
Scott A. Shapiro, Richard Borgens, Riyi Shi, Jill Donnaldson, Todd Able

Section on Tumors II

Advances in Neuroimaging for Management of Brain Tumors
2:00 pm - 5:30 pm, Ballroom C2

Learning Objectives: Participants will be able to explain the role of neuroimaging in the management of brain tumors.

Moderators: Mitchel S. Berger, Mark Bernstein

2:00 - 2:12 Magnetic Resonance Spectroscopy ..... Michael W. McDermott

2:12 - 2:24 Functional MRI ..... Joseph M. Piepmeier

2:24 - 2:36 Magnetoencephalography/Magnetic Source Imaging ..... Ali R. Rezai

2:36 - 2:50 Multimodality Integration for Surgical Navigation ..... Gene H. Barnett

2:50 - 3:30 Oral Posters 72-84
Moderators: Gene H. Barnett, Anthony L. Asher

3:30 - 4:00 Refreshments with Exhibitors

4:00 - 5:30 Open Papers 761-770
Moderators: James T. Rutka, Ronald E. Warnick
See pages 149-154 for details

Mahaley Clinical Research Award

Section on Tumors II – Oral Posters

2:50 pm - 2:53 pm 72 **Gamma-Irradiation-Induced Neural Precursor Cell Apoptosis is p53 and Caspase-9 Dependent but Bax Independent**
Jeffrey R. Leonard, Cleta D'Sa-Eipper, Kevin A. Roth

2:53 pm - 2:56 pm 73 **Correlation of Tumor Size, Internal Auditory Canal Pressure and Hearing Preservation in Vestibular Schwannomas**
Peter H. Nguyen, J. Keith Preston, Mark Pyle, Behnam Badie

2:56 pm - 2:59 pm 74 **Correlation between Bradykinin-Induced Blood-Tumor Barrier Permeability and B2 Receptor Expression in Experimental Brain Tumors**
Kamlesh Asotra, Yunhui Liu, Kazuhiro Hashizume, Zutang Chen, Ken Samoto, Nagendra Ningaraj, Keith L. Black

2:59 pm - 3:02 pm 75 **Molecular Cloning and Characterization of BAkt 1: A Novel Transcription Factor that Interacts with Akt**
John L. Moriarity, K. Joseph Hurt, Henry Brem, Solomon H. Snyder

3:02 pm - 3:05 pm 76 **Frequent Allelic Loss of 1p34-36 In Sporadic and Familial Chordomas**
Sivakumar Jaikumar, A. O. Vortmeyer, S.D. Pack, M. Husain, Z. Zhuang, E. H. Oldfield

3:05 pm - 3:08 pm 77 **Part II: Combination Therapy of Malignant Glioma Cells with 2-5A-Antisense Telomerase RNA and Recombinant Adenovirus p53 In Vivo**
Tadashi Komata, Yasuko Kondo, Shoji Koga, Song-Chu Ko, Leland W.K. Chung, Seiji Kondo

3:08 pm - 3:11 pm 78 **Vaccination of Patients with Recurrent Malignant Astrocytoma with Autologous Whole Cell Vaccine and Granulocyte Macrophage Colony Stimulating Factor (GM-CSF)**
Andrew E. Sloan, Hari Sundrum, Lucia Zamorano, Fernando Diaz, Roy Baynes, Gary Wood

3:11 pm - 3:14 pm 79 **Spinal Brachytherapy with I125 for Malignant Tumors**
Nicholas Theodore, W. Huang, Neil Duggal, Leland Rogers, Volker K.H. Sonntag, Curtis A. Dickman

3:14 pm - 3:17 pm 80 **Glioblastoma Multiforme (GBM) Arising in the Field of Gamma Knife Radiosurgery for Vestibular Schwannoma: Case Report and Review of the Literature**
Abhijit Guha, A. Shamisa, M. Bance, W. Halliday, C. Tator, S. Wong

3:17 pm - 3:20 pm 81 **Image Analysis and Automatic Cell Segmentation of Malignant Glial Cells**
Manali Barua, Nick Wetjen, Zita Sibenaller, William Street, Timothy Ryken

3:20 pm - 3:23 pm 82 **Initial Experience in Cancer Antigen Specific Adoptive Immunotherapy in Malignant Brain Tumors**
Esam A Elkhatib, Lucia Zamorano, Andrew Sloan, Gary Wood, Roy Baynes, Geoffrey Barger Kenneth Levin, Ramiro Pârez-de la Torre, Sandra Kugelman, Fernando Diaz

3:23 pm - 3:26 pm 83 **Adenoviral-Mediated Anti-bcl-2 Hammerhead Ribozyme Induces Apoptosis in Malignant Glioma Cells**
Terrence D. Julien, Bruce Frankel, Sharon Longo, Edward Shillitoe, Sandra Gibson, Timothy Ryken, Gregory Canute

3:26 pm - 3:29 pm 84 **Extended Transsphenoidal Approach for the Extra-Capsular Resection of Midline Suprasellar and Anterior Skull Base Lesions**
George J. Kaptain, David A. Vincent, Jason P. Sheehan, Edward R. Laws Jr.

Section on Tumors II – Open Papers

4:00 pm - 4:09 pm 761 Mahaley Clinical Research Award
Phase III Multicenter Trial of GLI 328 HSV-Tk Gene Therapy in Newly Diagnosed Glioblastoma Multiforme (GBM)
Ronald E. Warnick, on behalf of the GLI 328 International Study Group

4:09 pm - 4:18pm 762 **Analysis of In Vivo Gene Expression Profile of Pituitary Adenomas Using cDNA Microarrays**
Prithvi Narayan, Cheng-Orn Evans, A. Young, A. S. Neish, D. J. Brat, M. R. Brown, J. S. Parks, Nelson M. Oyesiku

4:18 pm - 4:27 pm 763 **Observer Variability in the Grading of Glioma Specimens Using Standard Grading Systems**
Beverly C. Walters, Edward M. Stopa

4:27 pm - 4:36 pm 764 **Transgenic Mouse Model of Malignant Astrocytoma: Specific Astrocyte Specific Expression of Activated RAS**
Abhijit Guha, H. Ding, S. Macmaster, L. Roncari, X. Wu, N. Lau, P. Shannon, D. Gutmann, A. Nagy

4:36 pm - 4:45pm 765 **Molecular Cloning, Genomic Structure, Mapping and Mutational Analysis of Human Suppressor of Fused (hSu(fu)), a Candidate Tumour Suppressor Gene for Medulloblastoma/PNET on Chromosome 10q24.3**
Michael D. Taylor, D. Hogg, L. Liu, T. G. Mainprize, S. Scherer, J. Skaug, W. Dura, James R. Rutka

4:45 pm - 4:54 pm 766 **Identification and Characterization of VASP, a Motility-Related Gene with Aberrant Expression in Glioblastoma**
Gregory D. Foltz, Abel Jarell, Jim Schuster, Masazumi Matsumura, Lindi Farrell, Peter Nelson, Dan Silbergeld

4:54 pm - 5:03 pm 767 **cDNA Microarray Hybridization Analysis of Invasive Versus Non-Invasive Pituitary Tumors**
Linda M. Liau, Daniel F. Kelly, Thomas Kremens, Bethsabe Romero, Stanley F. Nelson, M. Beatriz Lopes, Edward R. Laws, Jr.

5:03 pm - 5:12 pm 768 **Paclitaxel: Polilactofate Microspheres Versus 9L Gliosarcoma: Efficacy, Toxicity, Pharmacology**
Kevin A. Walter, Khan Li, Wenbin Dang, Greg Troiano, Betty Tyler, Henry Brem

5:12 pm - 5:21pm 769 **Imaging Convection-Enhanced Delivery (CED) in the Primate Brain Using CT and MRI Surrogate Tracers**
Tung T. Nguyen, Yashdip Pannu, Cynthia Sung, Robert Dedrick, Martin Brechbiel, Kayhan Garmestani, Markus Beitzel, Alex Yordanov, Edward H. Oldfield

5:21 pm - 5:30 pm 770 **Surgery of the Third Ventricle: Technical Considerations**
Basant K. Misra

Section on Stereotactic and Functional Surgery II

Update on Stereotactic Radiosurgery • 2:00 pm - 5:30 pm, Ballroom C3

Learning Objectives: Participants will be able to explain the role of radiosurgery as it pertains to the management of neurosurgical diseases. Participants will be able to describe the devices used for radiosurgery. Participants will be able to discuss new developments in the field of stereotactic and functional surgery.

Moderators: Douglas S. Kondziolka, Allan J. Hamilton

2:00 - 2:20 Radiosurgery for "Non-Radiosurgeons": Devices and Applications ..... Douglas S. Kondziolka

2:20 - 2:40 Microsurgery and Radiosurgery: How They Work Together to Improve Clinical Outcomes ..... Bruce E. Pollock

2:40 - 2:50 Discussion

2:50 - 3:30 Oral Posters 46-58
Moderator: Douglas S. Kondziolka and Allan J. Hamilton

3:30 - 4:00 Refreshments with Exhibitors

4:00 - 5:30 Open Papers 771-780
Moderators: Andres M. Lozano, Alain C. J. de Lotbinere
See pages 154-159 for details

Section on Stereotactic and Functional Surgery II – Oral Posters

2:50 pm - 2:53 pm 46 **Chronic Electrical Stimulation of the Subthalamic Nucleus in Patients with Prior Pallidotomy**
Martin Zonenshayn, Alon Y. Mogilner, Ali R. Rezai, Djordje Sterio, Aleksandar Beric

2:53 pm - 2:56 pm 47 **Stereotactic Radiotherapy versus Single and Hypo-Fractionated LINAC-Based Stereotactic Radiosurgery for Acoustic Neuromas**
James Forage, C. Cabatan Awang, R. Wallace, T. Solberg, J. Ford, M. Selch, A.A.F.De Salles

2:56 pm - 2:59 pm 48 **The Use of RAS Coordinate Targeting to Localize Residual Tumor in an Intraoperative MRI Environment**
Todd W. Vitaz, Stephen Hushek, Thomas Moriarty, Christopher B. Shields

2:59 pm - 3:02 pm 49 **Long -Term Outcome of Bilateral Thalamic DBS**
Fredrick Junn, Shaun O'Leary

3:02 pm - 3:05 pm 50 **Hypofractionated Image Guided Stereotactic Radiosurgery for Lesions Near the Anterior Visual Pathways**
Vivek K. Mehta, Quynh-Thu Le, Steve D. Chang, Martin Murphy, Dave Martin, John Adler

3:05 pm - 3:08 pm 51 **Objective Quantification of Physiological Properties Contained within Stereotactic Pallidotomy Microelectrode Recording Tracks**
David L. Kirschman, Michael A. Gordon, Steven B. Wilkinson

3:08 pm - 3:11 pm 52 **Endoscopy Assisted Microvascular Decompression for Hemifacial Spasm**
Yong Ko, Suck-Jun Oh, Kwang-Myung Kim, Seong-Hoon Oh, Young-Soo Kim

3:11 pm - 3:14 pm 53 **The Relationship of Magnetic Source Imaging (MSI) to Ictal Electrocorticography (ECoG), Magnetic Resonance Imaging and Surface Grid Recordings**
Ganesh Rao, Robert E. Gross, M. Peter Heilbrun, Andy Dean, Fumisuke Matsuo, Jeffrey Lewine, Michael Fumke

3:14 pm - 3:17 pm 54 **Multielectrode Recording Stability in Control of Neuroprostheses**
Gordon K. Nakata, Nicho Hatsopoulos, Beverly Walters, John Donoghue

3:17 pm - 3:20 pm 55 **Thalamic VIM Deep Brain Stimulation for Essential and Other Tremor Syndromes**
Alexandra J. Golby, Helen Bronte-Stewart, Gerald D. Silverberg, Gary Heit

3:20 pm - 3:23 pm 56 **The Use of Frameless Image-Based Radiosurgery in the Treatment of Spinal Vascular Malformations: Preliminary Experience with the Cyberknife**
Adetokunbo A. Oyelese, Steven D. Chang, John R. Adler

3:23 pm - 3:26 pm 57 **Pituitary Fossa Revisited: The Impact of Neuronavigation**
Theophilos S. Paleologos, John P. Wadley, Michael Powell, Anthony Cheesman, David G.T. Thomas

3:26 pm - 3:29 pm 58 **Epilepsy Surgery Guided by the Mobile High Field Intraoperative MR System**
Taro Kaibara, Garnette R. Sutherland, S. Terence Myles

Section on Stereotactic and Functional Surgery II – Open Papers

4:00 pm - 4:09 pm 771 **Preliminary Analysis of RTOG 9508: A Phase III Prospective Randomized Trial Comparing Whole Brain Irradiation Alone vs. Whole Brain Irradiation Plus Stereotactic Radiosurgery for Patients with Two or Three Brain Metastases**
David W. Andrews, Charles Scott, Paul Sperduto, Michael Schell, Maria Werner-Wasik, William R. Demas, Janice K. Ryu, James Fontanesi, Marvin Rotman, Walter J. Curran

4:09 pm - 4:18pm 772 **Fractionated Stereotactic Radiotherapy for Acoustic Neuromas**
Jeffery A. Williams

4:18 pm - 4:27 pm 773 **Borders Localization in Microelectrode-Guided Posteroventral Pallidotomy**
Gao Guodong, Zhang Hua, Zhao Zhenwei, Li Young-Lin, Wang Xualian

4:27 pm - 4:36 pm 774 **Selection of Functional Hemispherectomy Techniques Based on Patient Pathology: A Retrospective Review of Forty-five Patients Treated with Functional Hemispherectomy at the Cleveland Clinic Foundation**
Sin-Soo Jeun, James J. Evans, Eldad Hadar, William E. Bingaman

4:36 pm - 4:45pm 775 **A Proposed Grading System to Predict Outcomes after Arteriovenous Malformation Radiosurgery**
Bruce E. Pollock, John C. Flickinger

4:45 pm - 4:54 pm 776 **The Effect of Deep Brain Stimulation on the Concentration of Amino Acid Neurotransmitters in a Rat Model of Parkinson's Disease**
Richard K. Simpson, Wen Huang

4:54 pm - 5:03 pm 777 **Chronic GPi Stimulation for Treatment of Cervical Dystonia and Choreoathetotic Head Movements**
Joachim K. Krauss, Thomas J. Loher, Thomas Pohle, Sabine Weber, Jean-Marc Burgunder

5:03 pm - 5:12 pm 778 **Clinical Implementation of Robotic Open Neurosurgery: The Beginning of a New Era**
Lucia Zamorano, Ramiro Perez-de la Torre, Esam Elkhatib, Abhilash Pandya, Qing Hang Li

5:12 pm - 5:21pm 779 **Use of a Near-Infrared Intracranial Probe for Localization During Stereotactic Surgery for Movement Disorders**
Cole A. Giller, Maureen Johns, Hanli Liu, Richard Dewey, Padraig O'Suilleabhain

5:21 pm - 5:30 pm 780 **Deep Brain Stimulation of the Subthalamic Nucleus for Parkinson's Disease: Technical Approach and MRI-Verified Lead Location in 44 Implants**
Philip A. Starr, Chadwick Christine, Deborah Byrd, Nadja Lindsey, William Marks Jr.

Section on Pediatric Neurosurgery I

Pediatric Movement Disorders • 2:00 pm - 5:30 pm, Room 007AB

Learning Objectives: Participants will be able to explain the medical and surgical management of pediatric movement disorders in detail. Participants will be able to discuss new developments in the field of treatment of pediatric patients.

Moderators: Frederick A. Boop, Mark Souwedaine

2:00 - 2:15 Diagnosis and Medical Management of Pediatric Movement Disorders ..... Terrance Edgar

2:15 - 2:30 Surgical Approaches for Pediatric Movement Disorders ..... I. Richard Abbott, III

2:30 - 2:50 Case Presentations

2:50 - 3:30 Oral Posters 137-149
Moderator: Frederick A. Boop

3:30 - 4:00 Refreshments with Exhibitors

4:00 - 5:30 Open Papers 781-790
Moderator: Frederick A. Boop
See pages 159-164 for details

Section on Pediatric Neurosurgery I – Oral Posters

2:50 pm - 2:53 pm **137** **Multimodality Treatment of Pediatric Vascular Disease**
Arun P. Amar, George Teitelbaum, Felipe Albuquerque, Don Larson, J. Gordon McComb, Michael Levy

2:53 pm - 2:56 pm **138** **The Risk of Infectious Complications of Shunt Taps**
Mark D. Krieger, Michael L. Levy, J. Gordon McComb

2:56 pm - 2:50 pm **139** **Intracranial Sepsis in Children. The Continuing Problem with Diagnosis.**
Sanjeev Bassi, Tim Jones, Nick Jones Vivienne Weston, Jonathan Punt

2:50 pm - 3:02 pm **140** **Split-Cord Malformations Associated with Distal Tethering in Children. Is Untethering Indicated?**
Hulda Magnadottir, Mark Krieger, J. Gordon McComb, Michael Levy

3:02 pm - 3:05 pm **141** **Delayed Loss of Ambulation in Patients with Open Neural Tube Defects**
SooHo Choi, Daniel Han, Richelle A. Lampa, Shervin Aminpour, J. Gordon McComb, Michael Levy

3:05 pm - 3:08 pm **142** **Can We Shorten the Duration of Treatment for CSF Shunt Infections?**
William E. Whitehead, John R.W. Kestle

3:08 pm - 3:11 pm **143** **Meningioangiomatosis: Clinical Presentation and Management**
George I. Jallo, Karl Kothbauer, Rick Abbott, Fred Epstein

3:11 pm - 3:14 pm **144** **The Prevalence of Pediatric Spinal Trauma in an Inner City Hospital**
Catherine A. Ruebenacker, Richard P. Schlenk, Sean Xie, Peter W. Carmel

3:14 pm - 3:17 pm **145** **Percutaneous Drainage of Intraabdominal Pseudocysts and Comprehensive Literature Review**
Philipp R. Aldana, Andrew Jea, Maria Penate, John Ragheb, Glenn Morrison

3:17 pm - 3:20 pm 146 **Metastatic Versus Primary Lesions of the Pediatric Spine: Presentation and Surgical Experience**
Mark A. Liker, Roger Hsiung, Jones George, Michael L. Levy, J. Gordon McComb

3:20 pm - 3:23 pm 147 **Reduction of Transfusion Rates in the Surgical Correction of Sagittal Synostosis**
Stephen J. Hentschel, Paul Steinbok, D. Douglas Cochrane, John Kestle

3:23 pm - 3:26 pm 148 **Use of Intraoperative MRI for Treatment of Intracranial Cysts in Children**
Todd W. Vitaz, Thomas Moriarty, Stephen Hushek, Christopher B. Shields

3:26 pm - 3:29 pm 149 **Multiple Revolution Spiral Osteotomy for Cranial Reconstruction in Sagittal Synostosis**
Nitin Tandon, Micam W. Tullous, Patricia A. Mancuso, Matthew N. Henry, Dennis G. Vollmer

Section on Pediatric Neurosurgery I – Open Papers

4:00 pm - 4:09 pm 781 Vagal Nerve Stimulation in Children with Medically Refractory Epilepsy
Ravish V. Patwardhan, Martina Bebin, Jan Mathisen, Paul A. Grabb

4:09 pm - 4:18pm 782 Radiosurgery for Childhood Intracranial Arteriovenous Malformations
Elad I. Levy, Ajay Niranjan, Todd P. Thompson, Alan M. Scarrow, Douglas S. Kondziolka, John C. Flickinger, L. Dade Lunsford

4:18 pm - 4:27 pm 783 Infant and Child Homicide from Abuse in Los Angeles County
Michael Y. Wang, Pamela Griffith, Deanne Tilton, J. Gordon McComb, Michael L. Levy,

4:27 pm - 4:36 pm 784 Multiple Subpial Transections in the Surgical Management of Pediatric Epilepsy
Jeffrey P. Blount, James T. Rutka, William Langburt, Hiroshi Otsubo, O. Carter Snead

4:36 pm - 4:45pm 785 Real-Time Functional Brain Mapping as an Aid to Preoperative Planning in Pediatric Patients
Alan T. Villavicencio, J.C. Leveque, Jeffrey R. Petrella, James Voyvodic, Timothy George, Herbert E. Fuchs, Gregory McCarthy

4:45 pm - 4:54 pm 786 Intraoperative Urodynamic Monitoring for the Release of Tethered Cord Syndrome
Hani A. Abdel Aziz, Enrique Ventureyra

4:54 pm - 5:03 pm 787 Tethered Cord Syndrome in Children with the Conus in a Normal Position: Results and Proposed Surgical Criteria
Monica C. Wehby, Patrick O'Holloran, Jodi Wallis

5:03 pm - 5:12 pm 788 Neurologic and Urodynamic Outcome After Micro-surgical Release of Tethered Cord in Adults: Long-Term Follow-Up in 21 Consecutive Cases
Devanand A. Dominique, Sidney B. Radomski, Magdy Hassouna, Michael G. Fehlings

5:12 pm - 5:21pm 789 Retethering of the Spinal Cord, Causes, Diagnosis and Treatment, Our Clinical Experience
Hani A. Abdel Aziz, Enrique Ventureyra

5:21 pm - 5:30 pm 790 Molecular Biology and Genetics of Hydrocephalus
Jogi V. Pattisapu, Xingang Cai

Section on Pain I

Minimally Invasive Procedures for Spinal Pain Syndromes • 2:00 pm - 5:30 pm, Room 007CD

Learning Objectives: Participants will be able to describe minimally invasive procedures for pain syndromes. Participants will be able to list the advantages and disadvantages of each treatment modality. Participants will be able to discuss new developments in the field of treatment of pain.

Moderator: Jaimie M. Henderson

2:00 - 2:15 Epiduroscopy ..... John P. Gorecki

2:15 - 2:30 Facet Denervation ..... Richard B. North

2:30 - 2:45 IDET/Intradiscal Therapy ..... Peter C. Gerszten

2:45 - 2:50 Discussion

2:50 - 3:30 Oral Posters 163-175
Moderator: Jaimie M. Henderson

3:30 - 4:00 Refreshments with Exhibitors

4:00 - 5:30 Open Papers 791-800
Moderator: Jaimie M. Henderson
See pages 164-169 for details

Ronald Tasker Award

Section on Pain I – Oral Posters

2:50 pm – 2:53 pm **163** **Surgical Treatment of Trigeminal Neuralgia Due to Cryptic Arteriovenous Malformations of the Trigeminal Nerve Root Entry Zone**
Richard J. Edwards, Hugh B. Coakham

2:53 pm – 2:56 pm **164** **Long-Term Outcome Analysis of Dorsal Column Spinal Cord Stimulators**
John Hain, Lyal G. Leibrock, William E. Thorell, Daniel J. Tomes

2:56 pm - 2:59 pm **165** **Adjunctive Use of Rigid Endoscopy During Posterior Fossa Surgery for Cranial Neuropathies**
Harel Deutsch, Wesley King, Phillip Wackym, Dennis Poe, John Shiau, Chandranath Sen

2:59 pm - 3:02 pm **166** **Intrathecal Opioids: Reasons for Changing from Morphine Therapy**
Zvi Israel, Larisa Jefferies, Kim J. Burchiel

3:02 pm - 3:05 pm **167** **Oxygen Free Radicals in the Genesis of Chronic Pain**
Yukio Ikeda, Kiyoshi Matsumoto, Kenji Dohi, Youichi Imaizumi, Hiroyuki Jimbo

3:05 pm - 3:08 pm **168** **Treatment of Post-traumatic Syringomyelia with Extradural Decompressive Surgery**
Langston T. Holly, J. Patrick Johnson, Jeffrey E. Masciopinto, Ulrich Batzdorf

3:08 pm - 3:11 pm **169** **Experimental Treatment of Guinea Pig Sciatic Nerve Injury with Topical Polyethylene Glycol**
Jill W. Donaldson, Riyi Shi, Richard Borgens, Scott Shapiro

3:11 pm - 3:14 pm **170** **Outpatient Lumbar Microdiscectomy Performed at a Military Hospital**
Mick J. Perez-Cruet

3:14 pm - 3:17 pm 171 **Transforaminal Percutaneous Endoscopic Discectomy in the Management of Lateral Lumbar Disc Herniations**
Sean M. Lew, Thomas F. Mehalic, Kristen L. Fagone

3:17 pm - 3:20 pm 172 **Diagnosis and Management of Vertebral Osteomyelitis in Patients with Spinal Metastases**
Miltos Sugiultzoglu, Mark Bilsky, Martin Zonenshayn, Patrick Boland

3:20 pm - 3:23 pm 173 **Percutaneous Endoscopic Cervical Discectomy**
Ji-Young Lee, Sang Ho Lee, Ho Yeon Lee

3:23 pm - 3:26 pm 174 **Thoracoscopic Discectomy of the Herniated Thoracic Discs**
Ho-Yeon Lee, Sang Ho Lee, Sang Rak Lim, Sang Hyub Jeon, Byung Ju Jeong

3:26 pm - 3:29 pm 175 **Percutaneous Vertebroplasty of Vertebra Plana**
John D. Barr, J. Michael Mervart, Georges Z. Markarian

Section on Pain I – Open Papers

4:00 pm - 4:09 pm 791 **Ronald Tasker Award**
Increased Spinal Cord Alpha2-Adrenergic Receptor Binding in a Rat Model of Neuropathic Pain
James W. Leiphart, Cynthia Dills, Robert M. Levy

4:09 pm - 4:18pm 792 **Standard Percutaneous Cordotomy Compared with a Novel MRI-Guided Stereotactic Frameless Technique**
Alan T. Villavicencio, J.C. Leveque, Ketan R. Bulsara, John P. Gorecki

4:18 pm - 4:27 pm 793 **Trigeminal Neuralgia in Patients with Multiple Sclerosis: Strategy for Surgical Treatment**
Nikunj K. Patel, Thanos Athanasiou, Yvonne Clarke, Shelley Renowden, Hugh B. Coakham

4:27 pm - 4:36 pm 794 **Vertebroplasty: Perils and Pitfalls**
Michael K. Landi, Walter Grand, Douglas B. Moreland

4:36 pm - 4:45pm 795 **Management of Compressive Symptoms Caused by Implanted Spinal Cord Stimulation Electrodes**
Ashwini D. Sharan, James E. Harrop, Giancarlo Barolat

4:45 pm - 4:54 pm 796 **A Role of Percutaneous Radiofrequency Neurotomy of Posterior Primary Rami**
Jung Y. Park, Tai Hyung Cho, Yong Ku Chung, Jung Keun Suh, Hoon Kap Lee, Ki Chan Lee

4:54 pm - 5:03 pm 797 **Imaging Neurovascular Compression in Patients with Trigeminal Neuralgia**
Kim J. Burchiel, Zvi Israel

5:03 pm - 5:12 pm 798 **Effects of Trigeminal Neuralgia or its Management on the Trigeminal Nerve and Regional Structures: An Evaluation with High Resolution Imaging**
Ajay Jawahar, Douglas S. Kondziolka, Emanuel Kanal, L. Dade Lunsford

5:12 pm - 5:21pm 799 **Efficacy of an Analgesic Epidural Paste Following Lumbar Decompressive Surgery: Long-Term Follow-Up of a Prospective Randomized Double-Blind Controlled Trial**
Aaron S. Dumont, Nicholas Theodore, Volker K. H. Sonntag, R. John Hurlbert

5:21 pm - 5:30 pm 800 **A Prospective, Randomized Controlled Investigation of Pain Control Options Following Lumbar Microscopic Diskectomy**
Phillip A. Tibbs, Jimmi Hatton, Christie Sparkman-Johnson, Tina Brooks, Robin Bower

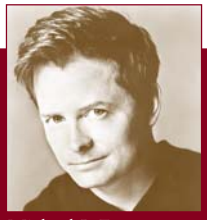
Wednesday-At-A-Glance

7:30 am - 11:45 am	General Scientific Session III
9:00 am - 4:00 pm	Exhibits Open
9:15 am - 10:15 am	Coffee with Exhibitors
11:25 am - 11:45 am	Michael J. Fox, Special Guest Presentation
11:45 am - 12:30 pm	Visit Exhibits & Pick Up Lunch for Seminars
12:30 pm - 2:00 pm	Luncheon Seminars
2:00 pm - 5:00 pm	Special Course III
2:00 pm - 5:30 pm	Section on Disorders of the Spine and Peripheral Nerves II
2:00 pm - 5:30 pm	Section on Cerebrovascular Surgery II
2:00 pm - 5:30 pm	Section on Neurotrauma and Critical Care II/General Neurosurgery
2:00 pm - 5:30 pm	Section on Pediatrics II/General Interest
2:00 pm - 5:30 pm	Section on Pain II/General Neurosurgery
3:30 pm - 4:00 pm	Refreshments with Exhibitors

General Scientific Session III • 7:30 am - 11:45 am, Lila Cockrell Theatre


James N. Weinstein


Roy A. E. Bakay


Michael J. Fox

Spinal Surgery Outcomes: The Basis of Practice

Learning Objectives: Following this session, participants will be able to review current methods of defining clinical outcomes in spinal surgery, indications and techniques of spinal fusion. Participants will be able to discuss the management of spinal cord injury, and issues relevant to the return to activities following spinal surgery.

Moderator: Michael G. Fehlings
Presiding Officer: Issam A. Awad

7:30 - 7:45	The Need for Outcomes Studies: What Are We Doing in Neurosurgery?	Paul C. McCormick
7:45 - 8:15	Determining Outcomes in Spinal Surgery: Orthopedic Initiatives	James N. Weinstein
8:15 - 8:30	Do the Outcomes Data Support Interbody Lumbar Fusion?	Regis W. Haid, Jr.
8:30 - 8:45	Intradiscal Electrothermy: Indications and Results	William Welch
8:45 - 9:00	Acute Interventions in Spinal Cord Injury: What Do We Know, What Should We Do?	Michael G. Fehlings
9:00 - 9:15	Returning to Sports After Spine Surgery: What Do the Outcomes Allow?	Julian E. Bailes, Jr.
9:15 - 10:15	Coffee with Exhibitors	
10:15 - 10:30	Decision Making in Degenerative Cervical Spine Surgery	Volker K.H. Sonntag
10:30 - 10:40	CNS International Committee Report	Richard G. Perrin
10:40 - 11:00	Special Lecture: Joint Replacement in Neurosurgery: Artificial Disks	Vincent C. Traynelis
11:00 - 11:25	Special Lecture: Research, Funding, and Clinical Trials: Translating New Therapies to Patients	Roy A. E. Bakay
11:25 - 11:30	Introduction of Special Guest	Daniel L. Barrow
11:30 - 11:45	Special Guest Presentation	Michael J. Fox
11:45 - 12:30	Visit Exhibits & Pick Up Lunch for Seminars	

SCIENTIFIC PROGRAM
LUNCHEON SEMINARS

All Seminars will be held at the Henry B. Gonzalez Convention Center from 12:30 - 2:00 pm. Tickets are required and may be purchased in the CNS Registration Area. Redeem lunch tickets at Booth 788.

W53/W53R Current Management of Odontoid Fractures

Ballroom C1

Moderator: Michael G. Fehlings
Faculty: Nevan G. Baldwin, Paul M. Arnold, John A. Wilson, Jr., Christopher E. Wolfla, William Welch

Learning Objective: This seminar will address the diagnosis and management of fractures of the odontoid process of the second cervical vertebra. Participants will be able to describe the recognition of each fracture type and different strategies for their management.

W54/W54R Single-Level Cervical Disk Disease: Optimal Surgical Management

Room 214A

Moderator: Emily D. Friedman
Faculty: Charles A. Fager, Stephen M. Papadopoulos, Volker K. H. Sonntag, Phyo Kim, Scott Shapiro

Learning Objective: This seminar will discuss the different surgical strategies for the management of single-level cervical disk disease. Participants will be able to review the different methods and philosophies for handling single-level cervical disk problems.

W55/W55R Vertebroplasty: Indications and Techniques

Room 214B

Moderator: Brian G. Cuddy
Faculty: Jacques Dion, Lee R. Guterman, Richard G. Fessler, Sean Lavine

Learning Objective: This seminar will discuss the increasingly popular technique of vertebroplasty. Participants will be able to discuss the different indications for the use of this technique and the details of its technical execution.

W56/W56R Career Options and Tracks in Neurosurgery

Room 217D

Moderator: Paul J. Camarata
Faculty: James R. Bean, Robert H. Rosenwasser, Edie E. Zusman, Austin R. T. Colohan

Learning Objective: This seminar will describe the various careers and practice types available to neurosurgeons today. Participants will be able to review the various career options, including solo and group private practice, salaried employment, and academic practice. Participants will be able to evaluate their own career path and options.

W57/W57R Multidisciplinary Management of Failed Back Syndrome

Ballroom C2

Moderator: Richard B. North
Faculty: Charles D. Ray, Robert J. Hacker, Samuel J. Hassenbusch, John J. Moossy

Learning Objective: This seminar will discuss the methods utilized for the management of the failed back syndrome by practitioners of varied disciplines. Participants will be able to discuss the advantages of each modality and their appropriate uses.

W58/W58R Management Strategies for Spinal Neoplasms

Room 217B

Moderator: Richard G. Perrin
Faculty: Gregory Brandenberg, Robert F. Heary, Mark H. Bilsky, Peter C. Gerszten

Learning Objective: This seminar will address the strategies for management of spinal neoplasms. Participants will be able to describe non-operative and operative treatments of metastatic tumors of the spine. Participants will be able to evaluate appropriate stabilization techniques for use after resection of these tumors.

W59/W59R Intraoperative Spinal Navigation: Current Technology and Practical Applications

Room 206A

Moderator: Iain H. Kalfas
Faculty: Kevin T. Foley, Allan J. Hamilton, Gerald E. Rodts, Jr., Hiroshi Nakagawa

Learning Objective: This seminar will describe the currently available techniques for intraoperative localization during spinal operations. Participants will be able to discuss the current methods of computer-aided navigation including infrared, mechanical, and sonic localizers. Participants will be able to discuss the advantages and limitations of each technology.

W60/W60R Case Management: Brain Metastases

Room 207A

Moderator: Douglas S. Kondziolka
Faculty: Raymond Sawaya, Kris A. Smith, John G. Golfinos, Anthony L. Asher, Thomas C. Witt

Learning Objective: In this seminar, the moderator will present cases of metastatic tumors in the brain for discussion by the faculty and attendees. Participants will be able to describe the operative and non-operative techniques for management of brain metastases, including surgical resection, stereotactic radiosurgery, and radiation therapy. Participants will be able to discuss the treatment options available for each patient and recommend appropriate treatment.

W61/W61R Treatment of Craniopharyngiomas

Room 211

Moderator: Timothy B. Mapstone
Faculty: Dachling Pang, Philip H. Cogen, Bruce E. Pollock, Ian F. Pollack

Learning Objective: This seminar will describe the different methods for managing patients with craniopharyngiomas. Participants will be able to discuss the advantages and disadvantages of each treatment strategy in both newly diagnosed and recurrent cases of craniopharyngioma.

W62/W62R Pineal Region Tumors

Room 207B

Moderator: Michael L. J. Apuzzo
Faculty: Gerard S. Rodziewicz, Patrick J. Kelly, Eben Alexander, III

Learning Objective: This seminar will discuss the available treatment modalities for tumors in the pineal region, both germ cell and non-germ cell types. Participants will be able to discuss the various surgical approaches for resection, the role of stereotactic biopsy, and the use of radiation treatment.

W63/W63R Management of Skull Base Meningiomas

Room 217A

Moderator: Kevin J. Gibbons
Faculty: Thomas C. Origitano, Jon H. Robertson, Leonard I. Malis, Bruce E. Mickey, Christopher Duma, Michael L. Levy

Learning Objective: This seminar will discuss the diagnosis and treatment of patients with meningiomas in skull base locations. Participants will be able to discuss the treatment options, including surgical approach and radiotherapy for skull base meningiomas and their appropriate application in practice.

W64/W64R Coding for the Spine: Case Examples

Room 217C

Moderator: Richard A. Roski
Faculty: Gregory J. Przybylski, James P. Hollowell

Learning Objective: This seminar will discuss the application of CPT coding in spine surgery. Participants will be able to utilize the coding guidelines for spine surgery in their own practice.

W65/W65R Treatment Strategies for Spinal Cord Tumors

Room 206B

Moderator: Abijit Guha
Faculty: Paul D. Sawin, Allan J. Belzberg, T. Glenn Pait, Paul C. McCormick

Learning Objective: This seminar will discuss the diagnosis and management of intrinsic tumors of the spinal cord proper. Participants will be able to compare the techniques applicable to surgical resection and appropriate patient selection for resection.

W66/W66R Neuroanatomy Topics for Cranial Base Surgery

Ballroom C3

Moderator: Ossama Al-Mefty
Faculty: Albert L. Rhoton, Jr., Chandranath Sen, Luis A. B. Borba, John Diaz Day, Mitesh V. Shah

Learning Objective: This seminar will discuss the neuroanatomical knowledge necessary for the successful practice of skull base surgery. The seminar will review the important vascular and neurologic structures encountered in skull base approaches. Participants will be able to discuss the anatomical relationships of brain structures and use that knowledge in the operating room.

W67/W67R Posterior Circulation Aneurysms

Room 007A

Moderator: Steven L. Giannotta
Faculty: Duke S. Samson, Jeffrey E. Thomas, Michael B. Horowitz, H. Hunt Batjer

Learning Objective: This seminar will discuss the management of aneurysms of the vertebrobasilar system. The seminar will review the role of surgical clipping and endovascular methods of aneurysm obliteration. Participants will be able to evaluate which patients and which aneurysms are best treated by surgical, endovascular, or expectant management.

W68/W68R Instability of the Subaxial Cervical Spine: Current Concepts in Management

Room 007B

Moderator: Michael J. Caron
Faculty: Vincent C. Traynelis, R. John Hurlbert, Seth M. Zeidman, Noel I. Perin

Learning Objective: This seminar will discuss the management of cervical spine instability below the second cervical vertebra. Participants will be able to describe stabilization methods and their appropriate utilization.

W69/W69R Management of Penetrating CNS Injuries

Room 006C

Moderator: James M. Ecklund
Faculty: Bizhan Aarabi, Brian T. Andrews, Martin C. Holland, Nelson M. Oyesiku

Learning Objective: This seminar will discuss the current management of penetrating cranial and spinal injuries. The seminar will review the operative treatment of these injuries and the important adjunctive medical treatments including antibiotic administration. Participants will be able to describe the medical and surgical treatment of penetrating injuries.

W70/W70R Management of Acute Cerebral Ischemia

Room 006D

Moderator: Howard Yonas
Faculty: John G. Frazee, Yoshiaki Shiokawa, Lee R. Guterman, Iver Langmoen

Learning Objective: This seminar will describe the diagnosis and management of acute cerebral ischemia. The seminar will review the operative and non-operative treatments for cerebral ischemia. Participants will be able to discuss the appropriate use of endovascular reperfusion strategies and the appropriate use of open surgical revascularization.

W71/W71R Pediatric Head Injury

Room 006A

Moderator: P. David Adelson
Faculty: Thomas G. Luerssen, Ann-Christine Duhaime, Mark R. Proctor

Learning Objective: This seminar will discuss the management of children with head injuries. Idiosyncrasies of head injury specific to the pediatric population will be discussed. Participants will be able to discuss the management of elevated intracranial pressure in the pediatric age group and the role of operative intervention in the management of traumatic mass lesions.

W72/W72R Managing Shunt Complications

Room 006B

Moderator: James M. Drake
Faculty: Cheryl A. Muszynski, Joseph R. Madsen, John R. W. Kestle

Learning Objective: This seminar will describe the management of complications related to ventricular shunting procedures. The seminar will review the management of infections, proximal and distal shunt occlusions, and techniques for the avoidance of complications. Participants will be able to discuss the management of complex shunt problems.

W73/W73R Moya Moya Syndrome in Adult and Pediatric Patients

Room 208

Moderator: Gary K. Steinberg
Faculty: Daniel A. Wecht, Philip E. Stieg, Toshio Matsushima

Learning Objective: This seminar will discuss the management of the Moya Moya syndrome in both pediatric and adult patients. Diagnosis and evaluation of ischemic syndromes will be discussed. Participants will be able to discuss techniques for revascularization and their appropriate application.

W74/W74R Case Management: Advanced Parkinson's Disease and Dystonia

Room 205

Moderator: Andres M. Lozano
Faculty: Frederick A. Lenz, G. Rees Cosgrove, Robert E. Wharen, Jr., Ali R. Rezai, Richard K. Simpson, Jr.

Learning Objective: In this seminar, the moderator will present videotaped cases of actual patients with advanced Parkinson's disease and dystonia for discussion by the faculty and attendees. The seminar will review the available techniques for stereotactic lesioning and deep brain stimulation in the thalamus, globus pallidus, and subthalamic nucleus. After the review of actual cases, participants will be able to describe the most effective surgical treatment for patients with advanced movement disorders.

W75/W75R Indications for Epilepsy Surgery: Who Should Get Surgery, Which Operation and When?

Room 214C

Moderator: Nicholas M. Barbaro
Faculty: Kaveh Khajavi, Youssef G. Comair, Webster H. Pilcher, Raul Marino, Jr.

Learning Objective: This seminar will discuss the use of surgical techniques in the management of epilepsy patients. The seminar will review the different surgical procedures and their technical variations. Participants will be able to discuss the advantages of each surgical approach and the selection of patients for surgical treatment.

W76/W76R Trigeminal Neuralgia: Treatment Options

Room 214D

Moderator: Kim J. Burchiel
Faculty: Jamal Taha, Amin Kassam, Andrew G. Shetter, Ronald Brisman

Learning Objective: This seminar will discuss the currently available treatment strategies for trigeminal neuralgia. Participants will be able to discuss the risks and the long-term efficacy of microvascular decompression, percutaneous rhizolysis procedures, and stereotactic radiosurgery.

W77/W77R Medicolegal Issues in Neurosurgery

Room 215

Moderator: Fernando G. Diaz
Faculty: Alan M. Scarrow, Harold D. Portnoy

Learning Objective: This seminar will review the legal issues confronting the practicing neurosurgeon. Participants will be able to discuss the neurosurgeon's greatest exposure for malpractice liability, the obtaining of informed consent, and the legal risks associated with new and investigational devices and treatments.

Special Course III


Edward R. Laws, Jr.

General Neurosurgical Practice after 2000
2:00 pm - 5:00 pm, Lila Cockrell Theatre

Learning Objectives: Following this course, participants will be able to review surgical and technical issues relevant to current and future neurosurgical practice.

Course Directors: Stephen M. Papadopoulos, Vincent C. Traynelis

2:00	2:15	What Clinical Problems Can Be Solved by 2010 (Brain)?	Issam A. Awad
2:15	2:35	What Clinical Problems Can Be Solved by 2010 (Spine)?	Edward C. Benzel
2:35	2:55	Honored Guest Presentation Background and Skills for a Neurosurgeon in 2010	Edward R. Laws, Jr.
2:55	3:15	What New Technologies Do We Really Need?	Matthew Howard
3:15	3:30	How Many Neurosurgeons Do We Need?	Martin H. Weiss
3:30	4:00	Refreshments with Exhibitors	
4:00	4:20	A Curriculum for Neurosurgery: Past, Present, and Future	Vincent C. Traynelis
4:20	4:40	Subspecializiation and Certification: What is the Future?	Donald O. Quest
4:40	5:00	Informatics and Telemedicine	Joel D. MacDonald

Section on Disorders of the Spine and Peripheral Nerves II

The Management of Tumors of the Spine and Spinal Cord • 2:00 pm - 5:30 pm, Ballroom C1

Learning Objectives: Participants will be able to discuss the management of tumors of the spine and spinal cord in detail, including metastatic tumors, primary tumors of the spine, and intradural tumors. Participants will be able to discuss new developments in the field of treatment of diseases of the spine and peripheral nerves.

Moderators: Robert F. Heary, Gerald E. Rodts, Jr.

2:00 - 2:15 Management of Metastatic Tumors ..... Timothy C. Ryken

2:15 - 2:30 Management of Primary Tumors of the Spine ..... Curtis A. Dickman

2:30 - 2:45 Management of Intradural Tumors ..... Paul C. McCormick

2:45 - 2:50 Discussion

2:50 - 3:30 Oral Posters 124-136
Moderator: Robert E. Heary

3:30 - 4:00 Refreshments with Exhibitors

4:00 - 5:30 Open Papers 801-810
Moderators: Michael G. Fehlings, Nevan G. Baldwin
See pages 169-174 for details

Section on Disorders of the Spine and Peripheral Nerves II – Oral Posters

2:50 pm - 2:53 pm **124** **Spontaneous Disc Space Infections in Adults**
Cormac O. Maher, Jonathan A. Friedman, Lynn M. Quast, Michael J. Ebersold

2:53 pm - 2:56 pm **125** **Transforaminal Lumbar Interbody Fusion: A Clinical Series**
Praveen V. Mummaneni, William S. Rosenberg

2:56 pm - 2:59 pm **126** **PET Imaging as an Adjunct in the Management of Indeterminate or Suspicious Osseous Lesions of the Spine**
Mark H. Bilsky, Eric Lis, Steven Larson

2:59 pm - 3:02 pm **127** **Anatomical Considerations of Superior Laryngeal Nerve During Anterior Cervical Spine Procedures**
Hooman Melamed, Mitchell B. Harris, Deepak Awasthi

3:02 pm - 3:05 pm **128** **Vertebral Coccidioidal Infection: The Barrow Neurological Institute Experience**
Nicholas Theodore, Luis F. Gonzalez, Christina B. Spetzler, Randall W. Porter, Geoffrey Zubay, Jonathan Hott, Curtis A. Dickman, Volker K. H. Sonntag

3:05 pm - 3:08 pm **129** **Image Guidance and Improved Accuracy of C1-C2 Transarticular Screw Placement**
J. Patrick Johnson, Orin Bloch, Chinyere Obasi, Langston T. Holly, Jongsoo Park, Kee D. Kim, J. Pablo Villablanca

3:08 pm - 3:11 pm **130** **Threaded Cortical Bone Dowels for Lumbar Fusion: One Year Results**
Bryan B. Barnes, Mark McLaughlin, Gerald Rodts, Regis Haid

3:11 pm - 3:14 pm **131** **Correction Techniques in the Neurosurgical Management of Adult Lumbar Scoliosis**
Russ P. Nockels, David Leppla, Michael Rauzzino

3:14 pm - 3:17 pm 132 **Kyphosis Reduction in Thoracic Disc Surgery**
Ross R. Moquin, John Stockel, Kenneth Curley

3:17 pm – 3:20 pm 133 **Anterior Cervical Arthrodesis Using DOC Dynamic Stabilization Implant for Improvement in Sagittal Angulation and Controlled Settling**
Bikash Bose

3:20 pm – 3:23 pm 134 **Microsurgical Wedge Corpectomy without Bone Grafting for Cervical Spondylosis with Myelopathy and Radiculopathy: Experience with Seventy-Eight Operated Levels**
W. Michael Vise

3:23 pm – 3:26 pm 135 **PLIF Versus Circumferential Fusion in Degenerative Lumbar Diseases: Over One Year Follow-Up**
Seong Hoon Oh, Yong Ko, Young Soo Kim

3:26 pm – 3:29 pm 136 **Molecular Mechanisms of Cell Death after Spinal Cord Injury: Role FAS and P75 Death Receptor Signaling**
Steven Casha, Wen Ru Yu, Michael G. Fehlings

Section on Disorders of the Spine and Peripheral Nerves II – Open Papers

4:00 pm - 4:09 pm 801 **Use of Image Guidance in Complex Spinal Reconstructions**
Robert F. Heary, Richard P. Schlenk, Ceslovas Vaicys, Thomas J. Sernas, Margaret Black

4:09 pm - 4:18pm 802 **Cadaveric Tibia and Anterior Z-Plate Fixation Following Thoracic/Lumbar Corpectomy as Compared to a Posterior Thoracic/Lumbar Vertebral Body Resection and Posterior Instrumentation**
Scott A. Shapiro, Raj Bindal, Todd Abel, Jill Donnaldson, Francesca Tekula

4:18 pm - 4:27 pm 803 **Predictive Value of Magnetic Resonance Imaging in the Evaluation of Fatty Filum Terminale**
Ketan R. Bulsara, Ali R. Zomorodi, Herbert E. Fuchs, Timothy M. George

4:27 pm - 4:36 pm 804 **Comparison of FluoroNav and Standard Fluoroscopy for Placement of Thoracic Pedicle Screws**
Andrew T. Dailey, Darrel S. Brodke, Matthew T. Rondina, Thomas H. Jansen, Kent N. Bachus

4:36 pm - 4:45pm 805 **Recovery after Complete Spinal Cord Injury in Rats Following Transplantation of hNT Neurons**
Shahram Makoui, Sam Saporta, Donald Smith, David W. Cahill

4:45 pm - 4:54 pm 806 **Virtual Fluoroscopy Improves Lumbar Pedicle Screw Placement Accuracy**
Kevin T. Foley, Ramesh L. Sahjpaul, Gerald E. Rodts, Jr.

4:54 pm - 5:03 pm 807 **Thoracic Pedicle Screws Are a Safe and Effective Alternative**
Robert F. Heary, Richard P. Schlenk, Ceslovas Vaicys, Thomas J. Sernas, Margaret Black

5:03 pm - 5:12 pm 808 **Thoracolumbar Vertebral Reconstruction for Metastatic Spinal Tumors**
Jongsoo Park, J. Patrick Johnson

5:12 pm - 5:21pm 809 **Pre-Instrumentation Vertebroplasty in the Management of Degenerative Deformity with Severe Osteoporosis**
David W. Cahill

5:21 pm - 5:30 pm 810 **Transatlas Approach for Resection of the Dens of Axis**
Ugur Tyre, M. Necmettin Pamir

Section on Cerebrovascular Surgery II

Occlusive Cerebrovascular Disease • 2:00 pm - 5:30 pm, Ballroom C2

Learning Objective: Participants will be able to describe the various treatment modalities for carotid and intracranial ischemic disease. Participants will be able to list the risks and benefits of surgical and endovascular therapies. Participants will be able to discuss new developments in the field of treatment of cerebrovascular disease.

Moderators: Winfield S. Fisher, III, Joshua B. Bederson

2:00 - 2:10 Carotid Angioplasty and Stenting ..... Lee R. Guterman

2:10 - 2:20 Carotid Endarterectomy ..... Christopher M. Loftus

2:20 - 2:30 Endarterectomy and Stenting Outcome Studies ..... Robert E. Harbaugh

2:30 - 2:40 Angioplasty vs. Surgery Trials ..... Marc R. Mayberg

2:40 - 2:50 Intracranial Angioplasty and Stenting ..... Stanley L. Barnwell

2:50 - 3:30 Oral Posters 14-26
Moderator: Joshua B. Bederson

3:30 - 4:00 Refreshments with Exhibitors

4:00 - 5:30 Open Papers 811-820
Moderators: Jacques J. Morcos, Michael T. Lawton
See pages 174-179 for details

Section on Cerebrovascular Surgery II – Oral Posters

2:50 pm – 2:53 pm **14** **Following the Stented Carotid by Doppler Ultrasonography**
Andrew J Ringer, John German, Lee R. Guterman, L. Nelson Hopkins

2:53 pm – 2:56 pm **15** **Changes in Gene Expression Do Not Mediate Resolution of Vasospasm after Subarachnoid Hemorrhage in Primates**
R. Loch Macdonald, Zhen-Du Zhang, Baktiar Yamini, Shigeki Ono, Linda S. Marton, Taro Komuro, Bryce Weir

2:56 pm – 2:59 pm **16** **Post Procedural Hemodynamic Instability after Carotid Angioplasty and Stenting**
Demetrius K. Lopes, Adnan I. Qureshi, Andreas R. Luft, Mudit Sharma, Vallabh Janardhan, Lee R. Guterman, L. Nelson Hopkins

2:59 pm - 3:02 pm **17** **The Effects of Hypothermia on Intracerebral Hemorrhages**
Ender Korfali, Ahmet Bekar, Gulsen Korfali, Ferda Kahveci

3:02 pm - 3:05 pm **18** **Endovascular Treatment of Intracranial Aneurysms Using Guglielmi Detachable Coils in Awake Patients: Safety and Feasibility**
Stanley H. Kim, Adnan I. Qureshi, Fareed K. Suri, Jehanzeb Khan, Richard D. Fessler, Andrew J. Ringer, Lee R. Guterman, L. Nelson Hopkins

3:05 pm - 3:08 pm **19** **Ruptured Intracranial Aneurysms: Initial Detection by 3D CT Angiography Only Followed by Triage to Surgical or Endovascular Intervention**
Raj W. Raab, C.D. Hunt, J. Farkas

3:08 pm - 3:11 pm **20** **Effects of Acute and Chronic Cigarette Smoking on Cerebrovascular Reactivity and Pressure Autoregulation: Role of Nitric Oxide Pathway**
Fangyi Zhang, Benjamin J. Remington, Shane Sprague, G. Alexander West, Dennis G. Vollmer

3:11 pm - 3:14 pm **21** **Effect of Spontaneous Nitric Oxide Donor (FK409) on Cerebral Vasospasm after Subarachnoid Hemorrhage in Rabbits**
Masaki Nakajima, Isao Date, Kenji Takahashi, Motoyoshi Satoh, Keiji Iseda, Takashi Ohmoto

3:14 pm - 3:17 pm 22 **CT-Angiography, Sylvian Hematoma Removal and Hemicraniectomy Can Facilitate Management of Patients Presenting in Poor Grade after MCA Aneurysm Rupture**
Edward R. Smith, Bob S. Carter, Christopher S. Ogilvy

3:17 pm - 3:20 pm 23 **Clinical and Angiographic Outcome of Gamma Surgery for Dural Arteriovenous Fistulous Malformations**
George J. Kaptain, Charles G. DiPierro, David Kallmes, Dheerendra Prasad, Melita Steiner, Ladislau Steiner

3:20 pm - 3:23 pm 24 **Is Basilar Artery Percutaneous Transluminal Angioplasty Safe and Effective?**
Bassem Y. Sheikh, Masayauki Ezura, Akira Takahashi, Takashi Yoshimoto

3:23 pm - 3:26 pm 25 **Perfusion Weighted Magnetic Resonance Imaging (PWI) of Luxury Perfusion is Correlated with Technetium-SPECT in Primate Stroke**
William Mack, Marcelo Oppermann, Judy Huang, J. Mocco, Tanvir Choudhri, Robert DelaPaz, Alexander Khandji, Sulli Popilskis, E. Sander Connolly, Jr.

3:26 pm - 3:29 pm 26 **Neuroprotection by Mg-Gluconate During Reperfusion in a Rat Model of Transient Focal Ischemia**
Ramin Rak, Humayun Khalid, Amal Nadel, Demirez T. Fossett, William B. Weglicki, Anthony J. Caputy

Section on Cerebrovascular Surgery II – Open Papers

4:00 pm - 4:09 pm 811 **Multimodality Treatment Approach in 424 Arteriovenous Malformations (AVMs): Improved Outcome in High Risk Lesions**
Brian L. Hoh, Paul H. Chapman, Jay S. Loeffler, Christopher M. Putman, Ronald F. Budzik, In Sup Choi, Christopher S. Ogilvy

4:09 pm - 4:18pm 812 **Repeat Gamma Surgery for Arteriovenous Malformations**
Iftikhar Ul Haq, Dheerendra Prasad, Melita Steiner, Ladislau Steiner

4:18 pm - 4:27 pm 813 **Intracerebral Infusion of Human Recombinant Apolipoprotein E3 Reduces Global Ischemic Brain Injury in Apolipoprotein E Deficient Mice**
John C. Wellons, III, Huaxin Sheng, Jose Pineda, Gary W. Massey, Robert D. Pearlstein, David S. Warner, Daniel T. Laskowitz

4:27 pm - 4:36 pm 814 **Results of Combined Stereotactic Radiosurgery and Transarterial Embolization for Low-Risk Dural Arteriovenous Fistulae of the Transverse and Sigmoid Sinuses**
Jonathan A. Friedman, Bruce E. Pollock, Douglas A. Nichols, Deborah A. Gorman, Robert L. Foote, Scott L. Stafford, Michael J. Link

4:36 pm - 4:45pm 815 **Treatment of Intracranial Disease with Endovascular Stents**
Richard D. Fessler, Adnan I. Qureshi, Andrew J. Ringer, Lee R. Guterman, Baruch B. Lieber, L. Nelson Hopkins

4:45 pm - 4:54 pm 816 **Surgical Treatment and Outcomes of Large and Giant Paraclinoid ICA Aneurysms**
Christopher G. Gaposchkin, Arthur L. Day, Pamela J. Lafrentz

4:54 pm - 5:03 pm 817 **Improvement of Cerebrovascular Reserve Capacity in Patients with Symptomatic Internal Carotid Occlusion after EC-IC Bypass Surgery**
Fady T. Charbel, Xinjian Du, Kern Guppy, Meide Zhao, Yaser Abdel Maksoud, James Ausman

5:03 pm - 5:12 pm 818 **Growth and Potential de novo Generation of Cerebral Vascular Malformations. Incomplete Embolization of Cerebral AVMs Leads to Neoangiogenesis**
Ulrich Sure, Nick Butz, Jurgen Schlegel, Siegfried Bien, Helmut Bertalanffy

5:12 pm - 5:21pm 819 **Treatment of Cerebral Vasospasm with Intrathecal Sodium Nitroprusside/Thiosulfate in the Neurosurgical Intensive Care Unit**
Jeffrey E. Thomas, Erol Veznedaroglu, Megan McGee Gillespie, Thomas Forget, Robert H. Rosenwasser, Marco Silva, Lee Buono, Nancy Chavla

5:21 pm - 5:30 pm 820 **Treatment of Intracranial Atherosclerotic Disease Using Stent-Supported Angioplasty: A Series of 24 Patients**
Adel M. Malek, Randall T. Higashida, Constantine Phatouros, Todd Lempert, Philip Meyers, Christopher Dowd, Van Halbach

Section on Neurotrauma and Critical Care II

Refractory Intracranial Hypertension: Point–Counterpoint • 2:00 pm - 5:30 pm, Ballroom C3

Learning Objectives: Participants will be able to compare surgical to medical treatment for refractory intracranial hypertension. Participants will be able to discuss new developments in the field of treatment of trauma.

Moderators: Martin C. Holland, Perry Ball

2:00 - 2:25 Decompressive Surgery ..... Christopher S. Ogilvy

2:25 - 2:50 Barbiturate Therapy ..... Alex B. Valadka

2:50 - 3:30 Oral Posters 98-110
Moderator: Perry Ball

3:30 - 4:00 Refreshments with Exhibitors

4:00 - 5:30 Open Papers 821-830
Moderators: Martin C. Holland, Perry Ball
See pages 179-184 for details

Section on Neurotrauma and Critical Care II/ General Neurosurgery – Oral Posters

2:50 pm - 2:53 pm **98** **Predicting Delayed Growth in Traumatic Cerebral Contusions**
Lori E. Summers, Carlos M. Gutierrez, Christopher R. Mascott, Ruth Bristol, Manish Jain, Dzung H. Dinh

2:53 pm - 2:56 pm **99** **Quality of Life and Decisions about Acute Neurosurgical Intervention**
Pennie S. Seibert, D. Peter Reedy, Jean Basom, Christian G. Zimmerman

2:56 pm - 2:59 pm **100** **Decreased Intracranial Temperature as an Early Prognostic Sign of Brain Death**
Kostas N. Fountas, E.Z.Kapsalaki, C.H.Feltes, H.F. Smisson III, K.W. Johnston, J. S. Robinson Jr.

2:59 pm - 3:02 pm **101** **Growing Skull Fractures**
Naim-Ur Rahman

3:02 pm - 3:05 pm **102** **Clinical Evaluation of a Ventriculostomy with a Microimplantable Strain Gauge Sensor**
Federico C. Vinas, Mark Gorman, Setti Rengachary, William Coplin, Manuel Dujovny, Daniel Michael

3:05 pm - 3:08 pm **103** **A Sodium Sliding Scale for the Treatment of Diabetes Insipidus – A Novel Approach to Fluid Management**
Scott Lee, Jason I. Lifshutz, Jeffery Lobel, Austin Colohan

3:08 pm - 3:11 pm **104** **Biomechanical Stability of Posterior Cervical Lateral Mass Plating Systems: Comparison of Constrained Versus Semi-Constrained Screw-Slot Connections**
Denis J. DiAngelo, Kevin T. Foley, Bobby J. McVay, Kristine M. Olney

3:11 pm - 3:14 pm **105** **MCA Occlusion in Cynomologous Macaques Results in Impaired Motor Planning with the Ipsilateral Extremity**
Ben Zion Roitberg, Marina E. Emborg, Naimath Khan, Noam Alperin, Jeffrey H. Kordower, James I. Ausman

3:14 pm - 3:17 pm **106** **Atypical Form of Spinal Tuberculosis**
Naim-Ur Rahman

3:17 pm - 3:20 pm 107 **Real Time Continuous Intraoperative EMG Recording as an Adjunct to Complex Spinal Surgery: A Prospective Study in 291 Consecutive Patients**
Joseph A. Shehadi, Roger Sargeant, Michael G. Fehlings

3:20 pm - 3:23 pm 108 **The Use of Gadolinium as an Intra-Arterial Contrast Agent for Digital Subtraction Angiography in Patients with Renal Insufficiency**
Ray Chu, Eric S Nussbaum, Sean O Casey, Leslie A Sebring

3:23 pm - 3:26 pm 109 **Preliminary Results with the Atlantis Anterior Cervical Plate System in 105 Patients**
Christopher D. Kager, Jonathan D. Sherman, Mario Zuccarello

3:26 pm - 3:29 pm 110 **Delayed Facial Nerve Palsy Following Acoustic Neuroma Resection**
Gerald A. Grant, D. Kyle Kim, Robert Rostomily, Donald Farrell, Marc R. Mayberg, H. Richard Winn

Section on Neurotrauma and Critical Care II/ General Neurosurgery – Open Papers

4:00 pm - 4:09 pm 821 **Selective Inhibition of Cyclooxygenase 2 Results in Decreased Late Phase Prostaglandin E2 and Thromboxane B2 Concentrations**
Daniel K. Resnick, Catherine F. Cechvala

4:09 pm - 4:18pm 822 **Intracranial Transplantation of Bone Marrow Cells Cultured with Neurotrophic Factors Improves Functional Outcome in Adult Male Wistar Rats after Traumatic Brain Injury**
Asim Mahmood, Dunye Lu, Yi Li, Michael Chopp

4:18 pm - 4:27 pm 823 **The Relationship Between Contamination and Infection in Penetrating Brain Trauma: A Multivariate Analysis**
Raj Mehta, Bizhan Aarabi, Joseph Herman

4:27 pm - 4:36 pm 824 **A Multicenter Prospective Randomized Controlled Trial on the Efficacy of Mild Hypothernia for Severely Head-Injured Patients with Low Intracranial Pressure**
Tadahiko Shiozaki, Toshiaki Hayakata, Hiroshi Tanaka, Takeshi Shimazu, Hisashi Sugimoto

4:36 pm - 4:45pm 825 **Pupillometer**
Lawrence F. Marshall, Thomas A. Genneralli, William Taylor

4:45 pm - 4:54 pm 826 **Outcome Following Moderate Closed Head Injury**
Todd W. Vitaz, Jennifer Jenks, Laura McIlvoy, George Raque, Christopher B. Shields

4:54 pm - 5:03 pm 827 **Predictors of Successful Extubation in Neurosurgical Patients**
Stephen B. Tatter, Andrew M. Namen, E. Wesley Ely, M. A. Lucia, D. L. Case, Scott Landry, Edward F. Haponik, John A. Wilson, Jr., Steven S. Glazier, Charles L. Branch, Jr., David L. Kelly, Jr.

5:03 pm - 5:12 pm 828 **Phase II Escalating Dose Clinical Trial of Dexanabinol in Severe Head Trauma**
Nachshon Knoller, Lion Levi, Nisim Razon, Igal Shoshan, Eli Reichental, Zvi H. Rappaport, Aviva Fridman, Anat Biegon

5:12 pm - 5:21pm 829 **Effect of Selective Brain Cooling by Intravascular Perfusion of Cold Crystalloid Solution on Cold Brain Injury in Dogs**
Motomasa Furuse, Tomio Ohta, Tohru Ikenaga, Yu Min Liang, Naofumi Isono, Toshihiko Kuroiwa

5:21 pm - 5:30 pm 830 **New Non-invasive Sonographic Technology for Intracranial Volume/Pressure Monitoring**
Kostas N. Fountas, Vytenis Deltuva, Joe Sam Robinson, Jr., A. Ragauskas

Section on Pediatric Neurosurgery II / General Interest

Management of Pediatric Brachial Plexus Injuries • 2:00 pm - 5:30 pm, Room 007C

Learning Objectives: Participants will be able to recognize pediatric brachial plexus injuries and describe the treatment of these lesions. Participants will be able to discuss new developments in the field of treatment of pediatric patients.

Moderators: Jeffrey Wisoff, Paul Grabb

2:00 - 2:40 Diagnosis and Treatment of Pediatric Brachial Plexus Injuries ..... John P. Laurent

2:40 - 2:50 Discussion

2:50 - 3:30 Oral Posters 150-162
Moderators: Jeffrey Wisoff, Paul Grabb

3:30 - 4:00 Refreshments with Exhibitors

4:00 - 5:30 Open Papers 831-840
Moderators: Jeffrey Wisoff, Paul A. Grabb
See pages 184-189 for details

Section on Pediatric Neurosurgery II / General Interest – Oral Posters

2:50 pm – 2:53 pm **150** **Subfascial Implantation of Intrathecal Baclofen Pump in Children Reduces Complication Rates**
Howard L. Weiner, Debra A. Sala

2:53 pm – 2:56 pm **151** **Intraoperative Blood-Product Transfusion Requirements in the Pediatric Spinal Tumor Population**
Mark A. Liker, Roger Hsiung, Jones George, Michael L. Levy, J. Gordon McComb

2:56 pm - 2:59 pm **152** **Intraspinal Clear Cell Meningiomas: Management Strategy**
George I. Jallo, Karl Kothbauer, Michelle Silvera, Fred Epstein

2:59 pm – 3:02 pm **153** **Flushing in Relation to a Possible Rise in Intracranial Pressure: Documentation of an Unusual Clinical Sign**
Gregory W. Hornig

3:02 pm – 3:05 pm **154** **Intraparenchymal, Positive-Pressure Alpha-Interferon and Intraventricular Ribavirin for Subacute Sclerosing Panencephalitis (SSPE)**
Stephen B. Tatter

3:05 pm – 3:08 pm **155** **Refuting Untenable Mechanisms of Fatal Head Injury and G Force Calculations in the Prosecution of Child Abuse**
W. Michael Vise, Rebecca J. Wooten, David H. Pearce

3:08 pm – 3:11 pm **156** **The Neurosurgical Legacy of Charles G. Drake, M.D.**
Aaron S. Dumont, Subodh Verma, Taro Kaibara, Garnette R. Sutherland

3:11 pm – 3:14 pm **157** **Stimulation of Hering's Nerve (Cranial Nerve IX) in Epilepsy Control**
Ravish V. Patwardhan, R. Shane Tubbs, Cheryl Killingsworth, Dennis Rollins, William M. Smith, Raymond Ideker

3:14 pm – 3:17 pm **158** **Warfarin Related Chronic Subdural Hematomas – Should Warfarin Be Discontiued after Surgical Evacuation?**
Vivek A. Gonugunta, Neil Buxton

3:17 pm – 3:20 pm 159 **Randomized, Blinded, Prospective Comparison of Dalteparin and Low Dose Subcutaneous Heparin for Prevention of Venous Thromboembolic Complications in Patients Undergoing Craniotomy**
R. Loch Macdonald, Chris Amidei, Joseph Baron, Bryce Weir, Javad Hekmatpanah, Fred Brown, Robert Erickson, David Frim, Nalin Gupta

3:20 pm – 3:23 pm 160 **A History of Therapeutic Electrical Stimulation of the Human Brain**
Alon Mogilner, Ali R. Rezai

3:23 pm – 3:26 pm 161 **Chemically Modified Tetracyclines Inhibit Solid Tumor Growth in Brain Tumor Models In Vivo**
Raymond I. Haroun, Khan W. Li, Betty Tyler, Chris Guerin, Brad Zerler, Henry Brem

3:26 pm – 3:29 pm 162 **Differential Roles of p53 and p16 in Vascular Endothelial Growth Factor and Thrombospondin-1 Expressions in Human Glioma Cells**
Kou Nakagawa, Hironobu Harada, Yoshiaki Kumon, Shiro Ohue, Haruhisa Ichikawa, Shinsuke Ohta, Saburo Sakaki

Section on Pediatric Neurosurgery II / General Interest – Open Papers

4:00 pm - 4:09 pm 831 **Intraventricular Pressure Changes Following Third Ventriculo-Cisternostomy for Aqueductal Stenosis**
David M. Frim, Liliana C. Goumnerova, Dawn Lathrop

4:09 pm - 4:18pm 832 **Childhood Cerebellar Astrocytomas: Natural History Following Surgical Resection**
Diane K. Sierens, Tadanori Tomita, David G. McLone

4:18 pm - 4:27 pm 833 **The Use of Intraoperative Magnetic Resonance Imaging for the Treatment of Pediatric Brain Tumors**
Mark R. Proctor, Elizabeth A. Eldredge, Ferenc A. Jolesz, Liliana C. Goumnerova, R. Michael Scott, Peter McL. Black

4:27 pm - 4:36 pm 834 **Event Related Potentials (ERPs) for Memory: Toward Localization of Cognitive Functions in Children**
Joseph R. Madsen, Daniel S. Rizzuto, Michael Kahana

4:36 pm - 4:45pm 835 **Magnetic Resonance Spectroscopy of Thalamic Tumors in Children**
Ashwini D. Sharan, James E. Harrop, Peter Sun, Zhiyue J. Wang, Leslie N. Sutton

4:45 pm - 4:54 pm 836 **Manual Manipulation and Reduction of Post-traumatic Atlantoaxial Rotatory Sublaxation in Children**
Muhammad Jalaluddin, David Moss

4:54 pm - 5:03 pm 837 **Delayed Cerebrovascular Complications of Intrathecal Colloidal Gold in Childhood Medulloblastoma**
Eric S. Nussbaum, Leslie A. Sebring, Joe Neglia, Don Erickson

5:03 pm - 5:12 pm 838 **Relative Risk of Shunt Failure as a Function of Time Following Placement**
Alan T. Villavicencio, J.C. Leveque, Herbert G. Fuchs, Timothy George

5:12 pm - 5:21pm 839 **Role of Repeat Neuro-endoscopic Third Ventriculostomy (NTV)**
Vivek A. Gonugunta, Neil Buxton, Maria Cartmill, Michael Vloberghs

5:21 pm - 5:30 pm 840 **Drainage of the Cortical Subarachnoid Space in Slit Ventricles Syndrome**
Geoffrey P. Zubay, Harold L. Rekate

Section on Pain II / General Neurosurgery

Trends in Intrathecal Polyanalgesia • 2:00 pm - 5:30 pm, Room 007D

Learning Objectives: Participants will be able to discuss the latest developments in the area of intrathecal analgesia. Participants will be able to discuss new developments in the field of treatment of pain.

Moderator: Samuel J. Hassenbusch

2:00 - 2:40 Trends in Polyanalgesia ..... Kim J. Burchiel, Richard D. Penn, Samuel J. Hassenbusch

2:40 - 2:50 Discussion

2:50 - 3:30 Oral Posters 176-188
Moderator: Samuel J. Hassenbusch

3:30 - 4:00 Refreshments with Exhibitors

4:00 - 5:30 Open Papers 841-850
Moderators: Kenneth A. Follett, Samuel J. Hassenbusch
See pages 189-194 for details

Section on Pain II / General Neurosurgery – Oral Posters

2:50 pm - 2:53 pm **176** **Clinical Results from Brachytherapy of Recurrent Malignant Gliomas Using an Inflatable Balloon Catheter and Liquid I-125 Radiation Source**
Stephen B. Tatter, Edward G. Shaw, Mark L. Rosenblum, Tom Mikkelsen, Alessandro Olivi, Dennis A. Vollmer, Jeffrey J. Olson, Stuart Grossman, for the NABTT CNS Consortium

2:53 pm - 2:56 pm **177** **Epilepsy Surgery in Glial Tumors Presenting with Seizures**
Sung Mok Whee, Seung-Chyul Hong, Dae-Won Seo, Seung Bong Hong, Jong Hyun Kim

2:56 pm - 2:59 pm **178** **The Development of the Penfield Dissectors: An Untold Story**
Joseph A. Shehadi, William Feindel

2:59 pm - 3:02 pm **179** **Surgical Resection of Primary Insular Tumors: Complication Avoidance**
Nancy E. Olansen, Franco DeMonte, Raymond Sawaya, Ian McCutcheon, Ziya Gokaslan, Eric Holland, Dima Abi-Said, Wei-Ming Shi, Frederick Lang

3:02 pm - 3:05 pm **180** **Posterior Circulation Aneurysm Surgery: Improved Results with Combined SSEP and BAEP Monitoring**
Steven D. Chang, Gordon Sakamoto, Jaime R. Lopez, Gary K. Steinberg

3:05 pm - 3:08 pm **181** **Immuno-Gene Therapy for Metastatic Intracerebral Breast Cancer**
Roberta P. Glick, Terry Lichtor, Praveen Deshmukh, Risha Moser, Edward P. Cohen

3:08 pm - 3:11 pm **182** **Conbination Radiosurgery with Cytokine Gene Transfected Tumor Cell Vaccination: A New Strategy Against Metastatic Brain Tumors**
Norimoto Nakahara, Hideho Okada, Timothy Witham, Jason Attanucci, Wendy Fellows, Michael Lotze, William Chambers, Ian Pollack

3:11 pm - 3:14 pm **183** **Clinical Experiences with a New Hydrostatic Valve in Shunt Therapy**
Frank Stefan Zeilinger, Ullrich Meier, Thomas Reyer, Dieter Kintzel

3:14 pm - 3:17 pm 184 **Identification of the Corticospinal Tracts Using BOLD and Diffusion fMRI in Patients with Brain Tumors**
Michael Schulder, Martin Ollenschleger, Wen-Ching Liu, Andrei Holodny

3:17 pm - 3:20 pm 185 **Lumbar Ommaya Reservoir for Treatment of Carcinomatous Meningitis**
Otakar R. Hubschmann, Joseph M. Koziol, Arthur M. Gilman

3:20 pm - 3:23 pm 186 **Function of Ventriculoperitoneal Shunts during Laparoscopy**
James Miller, Peter Lennarson, Vincent C. Traynelis

3:23 pm - 3:26 pm 187 **Vasomotor Mapping of the Medulla Oblongata**
Sunil J. Patel, Christain Vera

3:26 pm - 3:29 pm 188 **Conscious Neurological Monitoring Dural Spinal Diagnostic and Interventional Endovascular Procedures**
Andrew J. Ringer, Stanley H. Kim, Adnan I. Qureshi, Richard D. Fessler, Lee R. Guterman, L. Nelson Hopkins

Section on Pain II / General Neurosurgery – Open Papers

4:00 pm - 4:09 pm 841 **Epidural Infusion vs. Intrathecal Morphine Injection in the Selection of Patients for Chronic Opioid Therapy**
Valerie C. Anderson, Kim J. Burchiel, Beverly Cooke

4:09 pm - 4:18pm 842 **Long-Term Effectiveness of Continuous Intrathecal Opioid Treatment in Alleviating Malignant and Chronic Benign Pain**
Evan Hermanson, Lyal G. Leibrock, Daniel J. Tomes, William E. Thorell

4:18 pm - 4:27 pm 843 **Glossopharyngeal Neuralgia: A Ten-Year Experience in 200 Patients**
Amin B. Kassam, Atul Patel, Michael Horowitz, Howard Yonas, Peter Jannetta

4:27 pm - 4:36 pm 844 **Magnetoencephalography: A Non-Invasive Method for Possible Prediction of Epidural Spinal Cord Stimulation Success**
Martin Zonenshayn, Joshua J. Schulman, Ali R. Rezai, Eugene Kronberg, Alon Y. Mogilner, Urs Ribary, Rodolfo R. Llinas

4:36 pm - 4:45pm 845 **Management of Trigeminal Neuralgia: Predictors of Outcome for Microvascular Decompression**
Elizabeth C. Tyler-Kabara, Amin B. Kassam, Michael Horowitz, Louisa Urgo, Costas Hadjipanayis, Howard Yonas, Peter Jannetta

4:45 pm - 4:54 pm 846 **A Prospective Study to Assess the Use of MRA in the Diagnosis of Neurovascular Compression in Patients with Trigeminal Neuralgia and Hemifacial Spasm: Comparison with Surgical Findings**
Nikunj K. Patel, Yvonne Clarke, Shelley Renowden, Hugh B. Coakham

4:54 pm - 5:03 pm 847 **Management of Atypical Trigeminal Neuralgia: Predictors of Outcome for Microvascular Decompression**
Elizabeth C. Tyler-Kabara, Amin B. Kassam, Michael Horowitz, Louisa Urgo, Costas Hadjipanayis, Howard Yonas, Peter Jannetta

5:03 pm - 5:12 pm 848 **Somatotopic Arrangement of Human Postgasserian Fibers in Trigeminal Neuralgia: A Computerized Analysis Using the Multi-Electrode Technique**
Eduardo A. Karol, Marcelo Larramendy, Mariano Socolovsky, Jose Leston, Ariel Szvalb

5:12 pm - 5:21pm 849 **A Comparison of Intrathecal Morphine, Cordotomy, Midline Myelotomy, and Sacral Rhizotomy for the Treatment of Visceral and Somatic Cancer Related Pain**
Kenneth M. Little, Linda Rubin, Ketan R. Bulsara, John P. Gorecki

5:21 pm - 5:30 pm 850 **Sphenopalatine and Maxillary Nerve Block and Denervation for Face Pain**
J. Brett Gentry, Samuel J. Hassenbusch, Cheryl Keenan

Thursday-At-A-Glance

7:30 am - 11:15 am	General Scientific Session IV
8:10 am - 8:30 am	Edward R. Laws, Jr., Honored Guest Presentation
9:45 am - 10:15 am	Coffee Break

General Scientific Session IV • 7:30 am - 11:15 am, Lila Cockrell Theatre


Edward R. Laws, Jr.

Controversies in Sellar and Skull Base Surgery: Indications, Outcomes, and Costs

Learning Objective: Following this session, participants will be able to review the indications for surgical and medical management of selected pituitary and cranial base disorders, including the rationale for observation or irradiation.

Moderator: Richard G. Ellenbogen

Presiding Officer: Mark N. Hadley

7:30 - 7:50	Medical Management of Pituitary Tumors: Agonists or Agony?	Kamal Thapar
7:50 - 8:10	The Expanding Role of Endoscopy: Indications and Instruments	Hae Dong Jho
8:10 - 8:30	Honored Guest Presentation Pituitary Tumor Surgery: Long-Term Surgical Outcomes and Expectations	Edward R. Laws, Jr.
8:30 - 8:45	The Direction of Skull Base Surgery: More or Less Aggressive?	John Diaz Day
8:45 - 9:00	The Small, Symptomatic Skull Base Meningioma: Resection	Ossama Al-Mefty
9:00 - 9:15	The Small, Symptomatic Skull Base Meningioma: Radiosurgery	Christer E. Lindquist
9:15 - 9:30	Petroclival Meningiomas: Combined Resection and Radiosurgery	Takamasa Kayama
9:30 - 9:45	Functional Outcomes in Skull Base Surgery: What is Acceptable?	Franco de Monte
9:45 - 10:15	Coffee Break	
10:15 - 10:35	Surgical Repair of Cranial Nerves	Laligam N. Sekhar
10:35 - 10:55	Outcomes in the Management of Skull Base Malignancies	Chandranath Sen
10:55 - 11:15	Joint Ventures at the Skull Base: Defining the Roles of Neurosurgeons and Non-Neurosurgeons	Thomas C. Origitano

Section on Cerebrovascular Surgery I

700 Galbraith Award

Prospective Use of Intraoperative Angiography in 520 Consecutive Cerebral Aneurysms

Gordon Tang, C. Michael Cawley, Daniel L. Barrow

Introduction: The indications for intraoperative angiography (IOA) during aneurysm surgery remain unclear. Prior retrospective or non-consecutive series are skewed from selection bias based on surgeon's preferences or aneurysm complexity. To define its use, we report the results of a prospective use of IOA.

Methods: IOA was prospectively used in the surgical treatment of 520 consecutive aneurysms irrespective of location, size or complexity.

Results: Fifty-one of 520 aneurysms (9.8%) demonstrated IOA findings leading to revision of surgery. Residual aneurysm (61%) was the most frequent finding leading to clip revision. Thirty-one percent of revisions were due to vessel compromise. Aneurysms of the proximal ICA were the most frequently altered with the superior hypophyseal and clinoidal locations having the highest revision rates, 31% (8/26) and 43% (6/14), respectively. Although other aneurysms of the anterior circulation had lower revision rates, less challenging locations such as aneurysms of the posterior communicating artery still had a substantial revision rate of 9%. In the posterior circulation, the revision rate was 10.3%. Aneurysm size predicted need for revision. Giant aneurysms underwent revision in 28% (12/43) of cases while aneurysms 15-25mm were revised in 19% (13/70). In a logistic regression model, factors providing statistical significance were the superior hypophyseal ($p<0.001$) and clinoidal ($p<0.001$) locations as well as giant ($p=0.005$) and large ($p=0.028$) size. There was a trend of lower revision rates for Acomm and MCA locations. Eighty-eight patients underwent both intraoperative and post-operative angiography. Five discrepancies were noted (95% accuracy). Four were flow-related with one was due to residual aneurysm. Complications occurred in 1% of cases.

Conclusion: The proximal carotid location and large aneurysm size significantly predict revision of surgery following IOA. IOA also leds to unexpectedly frequent revisions in less complex aneurysms. Low complication rates, high accuracy and unexpected readjustments favor a more indiscriminate use of IOA.

701

Combined Surgical and Endovascular Outcome in the Treatment of Paraclinoid Aneurysms

Brian L. Hoh, Christopher S. Ogilvy, Bob S. Carter, In Sup Choi, Ronald F. Budzik, Christopher M. Putman

Introduction: Advances in surgical and endovascular techniques have improved treatment for paraclinoid aneurysms. A team approach of surgery and endovascular coiling can provide the optimal treatment for each individual patient. Patients considered high surgical risks can be treated endovascularly, whereas they might not have been treated in previous surgical series.

Methods: From 1991 to 1999, the neurovascular team treated 238 paraclinoid aneurysms in 216 patients at the Massachusetts General Hospital. The modality of treatment for each aneurysm was chosen based on anatomic and clinical risk factors, with endovascular treatment offered to patients considered to have higher surgical risks. There were 180 aneurysms treated by direct surgery, 57 by endovascular occlusion, and one aneurysm by surgical EC-IC bypass and endovascular ICA balloon occlusion. Locations were: transitional 12 (5%), carotid cave 11 (5%), ophthalmic 131 (55%), posterior carotid wall 38 (16%), and superior hypophyseal 46 (19%). Lesions contained completely within the cavernous sinus were excluded from this analysis.

Results: Overall clinical outcomes were 86% excellent or good, 7% fair, 4% poor, and 3% dead. The surgically-treated patients experienced 90% excellent or good outcomes, 6% fair, 2% poor, and 3% dead. The endovascular-treated patients had 74% excellent or good outcomes, 12% fair, 10% poor, and 4% dead. The overall major and minor complication rate from surgery was 29% with surgery-related permanent morbidity of 6%, and 0% mortality. The overall major and minor complication rate from endovascular treatment was 21% with endovascular-related permanent morbidity of 3%, and 2% mortality. There was 69% improved visual outcome in patients who presented with visual symptoms, 25% no change, 6% worsened vision, and 3% new visual deficits. In general, angiographic efficacy was lower in the endovascularly treated group.

Conclusions: A combined team approach of direct surgery and endovascular coiling can allow for good outcome in the treatment for paraclinoid aneurysms, including high-risk lesions that might not have been treated in previous surgical series.

Section on Cerebrovascular Surgery I

702

Identification of Vascular Endothelial Growth Factor (VEGF) as a Flow-Regulated Mediator of Angiogenesis

Adel M. Malek, Ike Lee, Seigo Izumo, Seth Alper

Introduction: Hemodynamic factors have long been proposed to play a role in the regulation of blood vessel growth and structure, as manifested in the increased caliber of high-flow arterial feeders to AVMs and conversely in the regression of arteries in low-flow states. Vascular Endothelial Growth Factor (VEGF) is a potent autocrine growth stimulator known to play a crucial role in embryonic vascular development and survival of newly formed vessels. We hypothesized that the endothelial production of VEGF may be regulated by prevailing hemodynamic factors.

Methods: In order to reproduce physiologic flow, we exposed brain microvascular (BMEC) and aortic endothelial cells (BAEC) to fluid shear stress using a cone-plate device in vitro.

Results: Fluid shear stress was found to rapidly increase levels of VEGF mRNA expression in BMEC in a biphasic manner with a transient response at venous-level shear magnitude (4 dyn/cm2) and a sustained 2.5-fold increase in response to arterial magnitude shear (20 dyn/cm2). BMEC alignment and elongation were accompanied by induction of short, fine actin fiber bundles along the alignment axis, distinct from the long actin stress fibers and cables induced in sheared BAEC. The rapid VEGF mRNA increase was not associated with any significant change in expression of the flk1 VEGF receptor. Shear-conditioned medium partially reproduced the shear-dependent increase in BMEC VEGF mRNA, whereas conditioned medium from C6 glioma cells inhibited both basal and shear-induced increases in VEGF mRNA. Shear induced both VEGF mRNA and peptide release in endothelial cells of human origin.

Conclusion: In conclusion, we have identified hemodynamic shear stress as a potent regulator of the angiogenic growth factor VEGF in a species- and vascular bed-independent manner. This finding defines a feedback loop of hemodynamic control of angiogenesis which has major implications to the pathophysiology of AVMs, cerebral ischemia, and tumor vessel homeostasis.

703

Early Results Comparing Stenting with Endarterectomy for Treatment of Symptomatic Carotid Stenosis: A Randomized Community Hospital-Based Trial

James R. Bean, William Brooks, Timothy Coleman, Michael Jones, Rick McClure

Introduction: Advances in endovascular techniques may have made carotid percutaneous transluminal angioplasty and stenting (PTAS) as effective as carotid endarterectomy (CEA), along with less risk, shorter hospital stay, reduced cast, and patient preference. These are preliminary results of a prospective randomized trial comparing carotid PTAS with CEA in a community hospital.

Methods: Seventy-eight patients within 6 weeks of carotid ischemia were randomly assigned to CEA or PTAS (Wallstent, Boston Scientific). Forty-two underwent CEA, 36 received PTAS; 3 crossed over from PTAS to CEA when stents could not be deployed. Patient demographics and degree of stenosis were similar between groups.

Results: One death occurred with CEA (due to MI); none with PTAS. CEA complications were cranial nerve injury (2%) and incisional (2%); PTAS complications were temporary carotid sinus-related (33%) and access site problems (8%). One PTAS-related femoral occlusion led to B/K amputation. Hospital stay for uncomplicated PTAS was 1.8 days, compared to 2.7 days for CEA. PTAS with any complications stayed 13.3 days, while CEA with complications stayed 3.0 days. Return to normal activity was similar for uncomplicated cases (PTAS 12 d. vs. CEA 16 d.), but PTAS with complications extended recovery six-fold vs. CEA (120 d. vs. 21 d.) Average hospital costs for PTAS were 28% higher ($7347 vs. $5704). Stenosis did not recur in either group by duplex scanning.

Conclusions: PTAS and CEA are similarly effective for symptomatic carotid stenosis. However, PTAS complications significantly prolong hospital stay and recovery periods. Hospital costs are comparable and patient preference favors neither.

Section on Cerebrovascular Surgery I

704

Induction of DNA Fragmentation and Caspase-3 Cleavage after Experimental Intracerebral Hemorrhage

Nicholas M. Boulis, Chao Gong, Jun Qian, Danielle E. Turner, Julian T. Hoff, Richard F. Keep

Objective: Mechanisms underlying neural injury in intracerebral hemorrhage (ICH) remain uncertain. The present studies investigated cell death surrounding ICH and its association with caspace-3 activation.

Methods: ICH was produced in adult rats by injection of 100 ml autologous blood into the right basal ganglia and controled for with saline injections. Terminal dexoynucleotidyl transferase-mediated dUTP-biotin in situ nick end labeling (TUNEL) was used to quantify cells containing DNA fragmentation surrounding the clot. Caspase-3 activation surrounding the clot was quantified by Western blotting and immunohistochemistry. Double labeling was used to compare TUNEL and caspace-3 distribution and identify the cell types affected. TUNEL positive cells were quantified 1 day after injection of thrombin.

Results: TUNEL positive cells appeared in the ICH model but not saline control brains at 6 hours and lasted more than two weeks after ICH with a peak at 3 days. Western blot analysis revealed that the rise in immunoreactivity (IR) for the activated caspase-3 precedes that of DNA fragmentation, peaking 1 day after ICH and declining thereafter. Immunohistochemistry for caspase-3 showed nuclear translocation of caspase-3 after ICH. Double-labeling studies demonstrated that both neurons and astrocytes surrounding the clot were TUNEL positive. Additionally, TUNEL and activated caspace-3 were colocalized to the same cells. Lastly, intracerebral thrombin injection elicited DNA fragmentation similar to that seen following injection of blood.

Conclusion: Double-stranded breaks in genomic DNA and induction of caspase-3 were demonstrated in brain adjacent to parenchymal hematoma. These results provide evidence that cell loss after ICH is associated with activation of caspace-3.

705

Identifying Patients at Risk for Post-Procedural Morbidity Following Treatment of Incidental Intracranial Aneurysms: The Role of Aneurysm Size and Location

Vallabh Janardhan, Robert M. Friedlander, Sarajune Dagen, Philip E. Stieg

Objective: A decision to treat Incidental Intracranial Aneurysms (IIAs) relies on understanding the risks of treatment and weighing them against the risks of aneurysm rupture. While the natural history of IIAs is being studied, the morbidity/mortality associated with treating IIAs and factors associated with poor outcome need to be clearly established.

Methods: 160 IIAs were treated surgically (n=152) or endovascularly (n=8) in a consecutive series of 125 patients. Aneurysms were graded based on size into small/medium (<13mm) and large/giant (>/=13mm) and based on location into anterior and posterior circulation aneurysms. Post-procedural morbidity was defined as a new neurologic deficit associated with a score >/=3 on the Modified-Rankins Scale or <24 on the Mini-Mental Status Examination. Logistic regression analysis was used to identify predictors of post-procedural morbidity from retrospectively collected data on demographic, clinical and angiographic characteristics of the patients.

Results: Treatment of IIAs was not associated with any mortality and was associated with morbidity in 13.6% (17/125) and 6.4% (8/125) of patients at 1-month and 6-months respectively. In the logistic regression model, treatment of aneurysms (>/=13mm) [odds ratio(OR) 0.30; 95% confidence interval(CI) 0.09-0.96] and posterior circulation aneurysms [OR 0.24; 95% CI 0.06-0.95] were independently associated with post-procedural morbidity. Sub-group analysis showed that 75% (6/8) and 38% (3/8) of patients with poor outcome (n=8) had aneurysms with broad and calcified necks respectively. Age, co-morbidities, multiple aneurysms, specific aneurysm location and history of sub-arachnoid hemorrhage from a different aneurysm were not predictive of poor outcome.

Discussion/Conclusion: We have shown that IIAs can be safely and effectively treated without any mortality and the associated morbidity is less than previously reported. A combination of angiographic variables can be helpful in identifying patients at risk for post-procedural morbidity.

Section on Cerebrovascular Surgery I

706

Phenotypic Modulation of Smooth Muscle Cells in Human Cerebral Aneurysmal Walls

Norio Nakajima, Shinji Nagahiro, Toshiaki Sano, Junichiro Satomi, Koichi Satoh

Introduction: Vascular smooth muscle cells (SMCs) can change their phenotype under stress. Contractile and synthetic phenotypes were markedly different in their expression of smooth muscle myosin heavy chain (MHC) isoforms: Contractile type SMCs expressed both SM1 and SM2, whereas synthetic type SMCs expressed SMemb but not SM2. To determine whether phenotypic modulation of SMCs plays a role in the formation, growth and rupture of aneurysms, we determined the phenotype of SMCs in ruptured and non-ruptured aneurysmal walls.

Methods: Thirty-two specimens from aneurysmal walls were studied; 31 were resected at operation and one specimen was obtained at autopsy. Seven control arteries were obtained at autopsy. Semiserial sections were subjected to immunohistochemical staining with antibodies to alpha-smooth muscle actin (alpha-SMA), desmin and MHC isoforms; SM1, SM2 and SMemb.

Results: In control cerebral arteries, SMCs in the medial layer were strongly immunostained for alpha-SMA, desmin, SM1 and SM2; immunoreactivity for SMemb was faint or weakly positive. SMCs in both non-ruptured and ruptured aneurysmal walls showed no staining for desmin; the expression of alpha-SMA was well preserved. Compared with control cerebral arteries, in 4 of 11 non-ruptured aneurysmal walls the staining intensity of SMCs for SMemb was clearly increased. In ruptured aneurysmal walls, the expression of SM2 was lower than in control cerebral arteries and in non-ruptured aneurysmal walls.

Conclusion: Our study suggests that in aneurysmal walls, SMCs are of a different phenotype than in normal cerebral arteries. In the latter, they express the contractile phenotype while in non-ruptured aneurysms, some SMCs express the synthetic phenotype. SMCs in ruptured aneurysmal walls may have lost the contractile and the synthetic phenotype before rupture. The observed phenotypic modulation of SMCs in aneurysmal walls appears to be related to a remodeling of the aneurysmal wall and to a rupture mechanism.

707

Penetration of the Blood-Brain-Barrier by Oxidized Vitamin C Improves Outcome in Both Reperfused and Non-Reperfused Stroke

Judy Huang, Szilard Kiss, Ryan McTaggart, David Agus, Tanvir Choudhri, Louis Kim, J. Mocco, William Mack, David Pinsky, William Fox, David Golde, E. Sander Connolly, Jr.

Introduction: Thrombolytic restoration of blood flow in stroke may generate cytotoxic reactive oxygen species. Lack of blood-brain-barrier (BBB) penetration precludes ascorbate (AA) as an exogenously administered antioxidant. However, dehydroascorbic acid (DHA, oxidized vitamin C) enters the brain via facilitative glucose transporters (GLUT1). We hypothesized that intravenous DHA would improve outcome after stroke due to its distinct BBB permeability.

Methods: Reversible (n=67) or nonreperfused (n=54) ischemia was created by intraluminal middle cerebral artery occlusion in mice pretreated with vehicle, 250 mg/kg AA, lowDHA (40 mg/kg), or intermediateDHA (250 mg/kg). Separately, intermediateDHA or highDHA (500 mg/kg) was administered after permanent ischemia with a 15 minute (n=39) or 3-hour delay (n=38). Cerebral blood flow, intracerebral hemorrhage grade, neurological score, infarct volume (% ipsilateral hemisphere), and mortality were expressed as means±SEM and compared using the student's t-test.

Results: DHA caused dose-dependent increases in perfusion, accompanied by reductions in neurological deficit and infarct volume (Reperfused: vehicle 54±6%, AA 58±4%, lowDHA 22±4%, intermediateDHA 12±2%; Nonreperfused: vehicle 51±6% and AA 46±6% vs. intermediateDHA 26±5%, $p<0.05$ for all three outcomes in both cohorts). Both doses reduced mortality by 50% and did not increase intracerebral hemorrhage (p=ns). Postischemic DHA (15min and 3h) protected animals similarly (decreased neurological deficit, 6 to 9-fold reduction in infarct volume, and 66% reduction in mortality, $p<0.05$), suggesting a longer delay threshold that remains to be defined. In contrast, AA treatment did not improve neurological function, infarct volume, or survival.

Conclusions: Unlike exogenous AA, oxidized vitamin C confers in vivo, dose-dependent neuroprotection in reperfused and nonreperfused stroke, even with delayed administration. Non-enzymatic free radical scavengers offering BBB permeability may represent safe, readily available pharmacologic therapies for stroke.

Section on Cerebrovascular Surgery I

708

PICA Aneurysms: Management and Outcome Analysis of 111 Consecutive Cases

Subrata Ghosh, Troy Paynor, Thomas J. Leipzig, Terry Horner

Introduction: Posterior inferior cerebellar artery(PICA) aneurysms are rare, comprising 0.5% to 3% of all intracranial aneurysms. We report a retrospective review of 111 consecutive cases of PICA aneurysms admitted between 1980 to 1999 and discuss their outcome based on their clinical status at admission and at follow-up.

Methods: 104 patients admitted acutely due to ruptured aneurysms and 7 patients admitted electively were included in the study. Management strategies included direct surgical obliteration by clipping, trapping of aneurysms with surgical bypass, endovascular coiling and medical management.

Results: 75 patients underwent surgical treatment, 3 patients received coiling alone and 3 other underwent both surgery and coiling. Medical treatment alone was offered to 15 patients due to poor grade at presentation or advanced age and/or associated comorbid conditions. In the remaining 15 patients, PICA aneurysms discovered angiographically during treatment for other ruptured intracranial aneurysms were left untreated. Mortality was 2.5% (2/78) in the surgically treated group and 8% (9/111) overall. Complications leading to permanent morbidity at follow-up (>1 year) was 15% (17/111) overall. In the surgically treated group, good outcome was achieved in 93% (73/78) cases while 2 patients had fair and 3 had bad outcome.

Conclusion: Our results show that excellent results can be acheived with surgical treatment in most cases. Overall outcome depends upon various factors including, but not limited to, clinical grade at presentation, age, comorbidity, geometry of aneurysms and available armamentarium of treatment options. Only infrequently were complex skull base approaches necessary to successfully obliterate these aneurysms. 2 cases of fusiform PICA aneurysms required trapping of aneurysms with occipital artery-PICA and PICA-PICA bypass. Since the base of PICA aneurysms often involve parent vessel wall significantly, present status of endovascular therapy is not frequently applicable.

709

Surgical Revascularization of the Posterior Circulation for Ischemic Disease. A Recent Experience

Eric S. Nussbaum, Paul J. Camarata, Leslie A. Sebring, Don Erickson

Introduction: To assess the current practice of surgical revascularization of the posterior circulation at our institution, 25 consecutive cases referred for surgical consideration over the past five years were retrospectively reviewed. All patients had a diagnosis of vertebrobasilar insufficiency.

Methods: Seventeen patients were managed with anticoagulation alone or with endovascular therapy (typically angioplasty and stenting of the vertebral artery). Eight patients had repeated transient ischemic attacks (TIA) refractory to anticoagulant therapy and were considered appropriate candidates for posterior circulation revascularization procedures. Average length of follow-up was 1.8 years; no patient was lost to follow-up.

Results: A spectrum of surgical procedures was employed including vertebral artery transposition (2), carotid-vertebral bypass in the neck (3), and occipital artery-PICA bypass (3). Overall outcome was good in all cases. Six of eight patients have remained symptom-free after surgery. No patient suffered a perioperative stroke. One patient suffered two postoperative TIAs identical to his preoperative symptoms. He was restarted on anticoagulation and has had no further events. Another patient had a delayed TIA 8 months after surgery, at which time her bypass was found to be occluded. She has remained stable on anticoagulation as well. With the waning enthusiasm for cerebral revascularization following the Cooperative Study on extracranial-intracranial bypass, few centers have remained proficient in posterior circulation revascularization. Improved endovascular techniques have further narrowed the role of open surgical revascularization in this setting.

Conclusion: This presentation reviews our recent experience with surgical revascularization of the posterior circulation, a technique which we feel remains an important option in the management of carefully selected individuals with vertebrobasilar ischemic symptoms that are refractory to maximal medical management.

Section on Stereotactic and Functional Surgery I

710 Stereotactic and Functional Neurosurgery Resident Award

TMS-PET as a Measure of Functional Effective Connectivity of the Human Supplementary Motor Area

Nitin Tandon, Peter Fox, Shalini Narayana, Meenakshi Iyer, Jack Lancaster, Dennis G. Vollmer

Introduction: Traditional understanding of human brain connectivity is either from lesional data or from extrapolation of animal electrophysiological data to humans. Functional imaging reflects task activated neural systems but does not detail the connectivity of individual areas. We performed Transcranial Magnetic Stimulation (TMS) of the right supplementary motor area (R-SMA) in combination with [15O]H2O Positron Emission Tomography (PET), to assess its cerebral connectivity. In animals, the SMA has direct corticospinal output. However, there are no data confirming the presence of direct spinal efferents from the human SMA.

Methods: TMS was delivered to the R-SMA in seven right handed normal subjects using a B shaped coil (CadwellTM). The TMS paddle was positioned 1.2 cm anterior to the location of primary motor cortex (M1) for the right hand, and 1 cm off midline. This R-SMA location was determined by a metanalysis of functional imaging database. The subjects were scanned at rest and during TMS. Two subjects, in whom SMA stimulation produced complex, synergistic motor movements on the left side, also underwent EMG recording from multiple muscle groups during both SMA and primary motor cortex stimulation. The movements produced with SMA stimulation were exaggerated with volitional activity and were phenomenologically different from the focal contractions produced by the stimulation of primary motor cortex.

Results: Statistical parametric images of z scores of PET count changes between rest and TMS activation, SPI{z} were made. The activation sites correspond with SMA projections. The EMG recordings in two subjects revealed that the contraction latencies of individual muscle groups were identical during both SMA and M1 stimulation.

Conclusions: TMS-PET is a powerful method for elaborating the functional connectivity of the human brain. In addition, to our knowledge, this is the first unequivocal demonstration of the existence of direct corticospinal efferents from the human supplementary motor area.

711

Gamma Knife Surgery for Epilepsy Related to Hypothalamic Hamartomas

Jean Regis, Fabrice Bartolomei, Tatsuhia Takakura, Tomokatsu Hori, Oskar Schrottner, Gherard Pendlshi, Hiroshi Inoue, Katsuhori Arita, Aizik Wolf, Patrick Chauvel

Introduction: Drug resistant epilepsy associated with Hypothalamic Hamartomas (HH) can be cured by microsurgical resection of the lesion. Morbimortality risk of microsurgery in this area is significant. Gamma Knife Surgery (GKS) reduced invasivity seems to be well adapted in this indication. In order to evaluate the safety and efficacy of GKS in this unfrequent pathology we organized a multicenter retrospective study.

Methods: Ten patients were treated in 7 different centers. The follow-up was superior to 12 months for the 8 patients (median 28 months, mean 35, range 12-71months). All patients had severe drug-resistant epilepsy including frequent gelastic and generalized tonic or tonicoclonic attacks. Median age was 18,5 (range 2-34) and 3 patients had precocious puberty. All patients had sessile HH. The median marginal dose was 15,25 Gy (range 12-20). Two patients were treated two times (at 19 and 49 months) due to unsufficient efficacy.

Results: All the patients were improved. Four patients were seizure free, one had rare nocturnal seizures, one had some rare partial seizures and no more generalized attacks and two were only improved with a reduction in frequency of seizures but persistance of some rare generalized seizures. A clear correlation between efficacy and dose was observed in this series. The marginal dose was superior to 17 Gy for all the patients in the successful group and inferior to 13 Gy for all the patients in the " improved " group. No side effect was reported except for po•kilothermia in one patient. Behavior was clearly improved in two patients (with only slight improvement of their epilepsy).

Conclusion: We report the first series demonstrating that Gamma Knife Surgery can be a safe and effective treatment of epilepsy when related to HH. We advocate marginal doses superior or equal to 17 Gy and partial dose planning when necessary for avoidance of critical surrounding structures.

Section on Stereotactic and Functional Surgery I

712

In Vivo Optical Mapping of Neocortical Epilepsy and Surround Inhibition

Theodore H. Schwartz, Tobias Bonhoeffer

Introduction: Outcome following surgical resection for neocortical epilepsy has been disappointing. Localization of epileptogenic zones is restricted by the sampling limitations inherent in electrophysiological techniques. We used optical imaging of intrinsic signals, which can record the optical signals associated with neuronal activity from large cortical areas with sub-millimeter resolution, to generate maps of spontaneously active interictal, ictal and secondary mirror foci.

Methods: Optical reflectance was recorded with a cooled CCD camera at 707nm in visual and somatosensory cortex of 10 adult anesthetized ferrets. Intracortical iontophoresis of bicuculline methiodide and 4-aminopyridine was used to generate interictal and ictal foci. Optical data was correlated with field potential and extra-cellular single unit recordings.

Results: Interictal foci were circular with a sharp border and a radius of 2.84 (±1.59) mm2. Each spike elicited a focal increase in blood flow and metabolism that generated an optical signal with a 0.3-5% change in reflectance. A large region of a negative optical signal, correlating well with electrophysiologically recorded inhibition, was seen in the surrounding cortex. Ictal onset zones were localized to regions as small as 1-2 mm2 and when non-propagating, were surrounded by a strong inverted optical signal, most likely reflecting inhibitory control mechanisms. Ictal events elicited huge reflectance changes ranging from 30-60%. The optical signal from mirror foci was well localized but had a smaller amplitude (0.4%), area and a delayed onset.

Conclusion: Optical epilepsy maps can be generated within a matter of seconds from spontaneously active foci and may someday replace ECoG in the intraoperative identification of epileptogenic cortex.

713

Early-Onset Generalized Dystonia: Neurosurgical Treatment by Continuous Bilateral Stimulation of the Internal Globus Pallidus in Fifteen Patients

Philippe Coubes, Agathe Roubertie, Nathalie Vayssiere, Simone Hemm, Laura Cif, Sylvie Tuffery, Bernard Echenne, Philippe Frerebeau

Background: We report on the results of continuous electrical stimulation of the globus pallidus internus (GPi) in fifteen patients (11 girls, mean age 14), with idiopathic early onset generalized dystonia (mean follow-up 12 months). The study received the approval of the National ethical committee. All the families gave written informed consent.

Design/Methods: 11 girls and 4 boys, with medically intractable generalized dystonia lasting from 1 year to 18 years 3 months, were selected for deep brain stimulation. Before surgery, seven patients were bedridden and four were cachectic fed by gastrostomy. Mean age at surgery was 14,2 years +/- 5.5 (8 to 26). Two electrodes were stereotactically implanted in the GPi, using Leksell frame and MRI, under general anesthesia. Electrical pulse generators (ITREL II, Medtronic), delivering continuous high frequency stimulation, were subcutaneously implanted in the abdominal area. Movement disorders were scored pre and postoperatively, at selected intervals, by the Burke-Marsden-Fahn's Dystonia Rating Scales (clinical and functional). Pain was also evaluated.

Results: BMFDRS (mean value) was reduced from 69,5, preoperatively, to 9,4 postoperatively. The mean percentage of improvement was 83,9% at latest follow-up. For the 7 DYT1 children the BMFDRS was dramatically reduced from 61,5 preoperatively to 3,4 postoperatively, resulting in an average improvement of 93,3%. One important result is that the disappearance of dystonic movements and, subsequently, of the functional rehabilitation is progressive. Thirteen patients managed to walk without aid, nine of them had a tota1ly normal living. Pain rapidly and completely disappeared under stimulation.

Conclusion: GPi stimulation is a new treatment of idiopathic generalized dystonia. Early surgical management plays a key role in the prognosis of operated patients.

Section on Stereotactic and Functional Surgery I

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Functional Outcomes after Gamma Knife Thalamotomy for Essential Tremor and MS-Related Tremor

Ajay Niranjan, Douglas S. Kondziolka, Susan Baser, Rock Heyman, L. Dade Lunsford

Introduction: Patients with disabling essential tremor (ET) or MS-related tremor may be poor candidates for radiofrequency thalamotomy or thalamic stimulation, either due to advanced age or concurrent medical illness. We evaluated patients after gamma knife thalamotomy to determine the effectiveness of radiosurgery for medically refractory non-parkinsonian intention tremor.

Methods: Over a three-year period, 16 patients (8 men and 8 women) with median age of 75 years (range, 38 to 92) underwent radiosurgical thalamotomy for ET (n=12) or MS tremor (n=4). The median duration of tremor was 10 years (range, 1 to 30 years). The V.I.M. thalamic nucleus was targeted using volume acquisition and fast inversion recovery MRI sequences. A single 4-mm isocenter was used to deliver a median dose of 140 Gy (range, 130 to 150 Gy). Items from the Tolosa-Fahn tremor rating scale (writing, drawing, tremor) were used before and after radiosurgery to evaluate outcomes.

Results: All 16 patients noted improvement in tremor. 8 of 12 ET patients had complete or near-complete tremor arrest, while four additional patients noted more than 50% reduction in tremor. For ET, activities of daily living improved in all 12 patients and handwriting in 11/12 patients. The onset of improvement was noted at a median of 6 weeks (range, 1 to 12 weeks). The violent action tremor in all four MS patients was improved. One patient noted transient contralateral arm weakness at 8 months. No patient had a recurrence of tremor. At 4 months, MRI showed a 4-5mm thalamotomy lesion with a small rim of increased signal in the thalamus on long TR images.

Conclusion: Stereotactic radiosurgery for ET and MS-related tremor is safe and effective for patients who may be poor candidates for other procedures. Despite no physiologic targeting, the biologic effect of radiosurgery appears to impact positively on tremor.

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Patterns of Motor-fMRI Activation: a Classification of Plasticity

Alexandre C. Carpentier, R. T. Constable, M. J. Schlosser, Joseph M. Piepmeier, Dennis D. Spencer, Issam A. Awad

Objective: Functional MRI (fMRI) of the motor cortex is a powerful tool in pre-operative plannings of surgical procedures in the Rolandic region. Little is known about the patterns of fMRI activation associated with various pathologic lesions in that region or their relation to functional deficits before or after surgery.

Methods: 20 controls and 30 patients (rolandic pathologies included: 10 vascular malformations, 10 congential cortical abnormalities, 10 tumors) were studied using fMRI and a hand motor paradigm. Changes in position or amplitude of the motor activation on the lesion side were compared with the activation pattern obtained in the contralateral hemisphere. A classification scheme based on hemispheric (a)symmetry, mass effect, and plasticity was used to compare maps between subjects, and relative to hand motor dexterity and weakness. “Grade 0”= no plasticity effect (Grade0A: no mass effect, Grade0B: mass effect, Grade0C: mass effect and activations’ asymmetry). “Grade 1”= plasticity effects (Grade1A: no mass effect and activations’ asymmetry, Grade1B: new ipsilateral activated areas, Grade1C: new contralateral activated areas).

Results: There was 89.5% inter-observer agreement on classification. Displacement of activation by mass effect was more likely with tumors. True plasticity was observed in cases of congenital cortical abnormalities, while various patterns of fMRI activation were associated with vascular malformations. Neurologic deficits were more frequent with increasing mass effect or in association with plasticity.

Conclusions: The classification scheme reflects the degree of motor reorganization that has occurred because of the lesion. Congenital cortical malformations suggested a much higher level of reorganization of the motor hand area in these pathologies compared to vascular malformations or tumors. The scheme appears to provide an excellent means for classifying patients according to their fMRI for a hand motor paradigm. Future studies will address risks of surgical intervention and patterns of functional recovery in relation to baseline fMRI grading.

Section on Stereotactic and Functional Surgery I

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The Response to Pallidal Surgery for Dystonia is Dependent on the Etiology

Ahmed Alkhani, Farooq Khan, Anthony E. Lang, William D. Hutchison, Jonathan Dostrovsky

Introduction: The role of Globus pallidus surgery in the treatment of dystonia of various etiologies is largely unknown.

Methods: Twelve patients with various forms of medically refractory dystonia underwent MRI imaging and microelectrode recording guided GPi pallidotomy or pallidal Deep Brain Stimulation (DBS). Patients were evaluated before and after surgery using the Burke-Fahn-Marsden Dystonia rating scale. The primary evaluation was at 3 months with follow-up ranging 6m to 3 years.

Results: Patients were divided into 3 groups. Group I (n=6) had dystonia without structural brain damage (normal MRI), Group II n=3 had dystonia secondary to metabolic/anoxic brain injury (abnormal MRI) and group III (n= 3) had dystonia after extensive structural damage secondary to encephalitis or stroke. Three group I patients (ages 9-17 years) with early-onset autosomal dominant generalized torsion dystonia (all tested positive for DYT1 gene mutation) had bilateral pallidotomy. Three patients age 50-55 with idiopathic adult onset generalized dystonia (I), cervical dystonia (1) or tardive dystonia (1) underwent bilateral GPi DBS. Group I patients had striking benefit with improvement is dystonia scales of 50-85% at 3 months and 2 patients gaining the ability to walk. Interestingly, the improvement was delayed and progressive in each case. Patients (n=3) in group II with Huntington's disease, dystonia with Glutaric aciduria type 1 or birth injury had mild benefit (less than 50% improvement) with bilateral GPi DBS or pallidotomy. Patients in group III with symptomatic hemidystonia including 2 patients with post-encephalitic dystonia and 1 with post stroke dystonia had no improvement with surgery. The presence of normal preoperative brain images correlated with a good response to pallidal surgery.

Conclusion: Our results are indicate that the response to pallidal surgery depends on the etiology of the dystonia.

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Proton Beam Radiosurgery of the Rodent Hippocampus: MRI, Neurophysiologic, Histologic, and Behavioral Findings

Jonathan L. Brisman, Andrew J. Cole, G. Rees Cosgrove, Marc R. Bussiere, Allan F. Thornton, James Rabinov, Maria Bradley-Moore, E. Terra Hedley-Whyte, Jay S. Loeffler, Paul H.Chapman, Nicholas T. Zervas

Introduction: Despite exponential growth in the use of stereotactic radiosurgery as a clinical neurosurgical tool, our understanding of the basic biological effects of radiation on the brain remains limited. We therefore studied MRI characteristics, in vivo hippocampal neurophysiology, histology, immunocytochemistry, and visuospatial memory in rodents after varying dosages of proton beam irradiation to one hippocampus.

Methods: 39 rats received unilateral dorsal hippocampal single fraction proton beam irradiation with nominal dosages of 5-130 cobalt gray equivalents (CGE) to the 90% isodose line. Three months later, visuospatial memory was tested using the Morris water maze. 23 animals were then studied with T2-weighted MRI imaging. 20 rats were evaluated with paired-pulse intrahippocampal microelectrode recordings, sacrificed and their brains evaluated with both nissl and immunocytochemical staining. 50 micrometer brain sections were stained for GAD, HSP-72, parvalbumin, and somatostatin. Three control animals underwent sham surgery but did not receive radiation.

Results: Dosages of 90 CGE and 130 CGE resulted in decreased performance in the Morris water maze, and increased signal on T2-weighted MRI, smaller or absent granule cell field potentials, tissue necrosis and vascular proliferation, restricted to the irradiated side. In animals receiving 60 CGE, HSP-72 was markedly upregulated in the irradiated hippocampus and cortex . Brains receiving 90 CGE and 130 CGE had a decrease in parvalbumin staining in the irradiated cortex only. No asymmetries were noted in somatostatin and GAD expression.

Discussion/Conclusions: Three months after stereotactic radiosurgery the radiated rat hippocampus undergoes necrosis at a dosage between 60 CGE and 90 CGE with associated abnormalities in MRI imaging, intrahippocampal recordings and visuospatial memory testing. Alterations in HSP-72 and parvalbumin expression may explain why irradiation diminishes seizure activity and suggests that dosages of 60 CGE or less would be important in studying the effects of radiosurgery in experimental animal seizure models.

Section on Stereotactic and Functional Surgery I

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Epileptogenicity in Focal Cortical Dysplasias: Correlation with Histopathological Changes

William E. Bingaman, Imad Najm, Zhong Ying, Thomas Babb, Richard Prayson, S. Rona, K. Yacubova, S. Wang, Dileep Nair, Eldad Hadar, Elaine Wyllie, Hans Luders

Purpose: Focal cortical dysplasias (CD) are frequent pathological substrates of medically intractable epilepsy. The in situ epileptogenicity of these lesions as well as its relationship with histopathological changes remains unknown. The purpose of this study is to correlate the cellular patterns of CDs with the expression of focal cortical epileptogenicity as assessed by direct extraoperative electrocorticographic (ECoG) recordings using subdural grids.

Methods: The histopathological, morphological, and immunocytochemical findings in cortical tissue resected from 18 patients with medically intractable epilepsy due to CD were correlated with in situ ECoG patterns recorded from subdural grids. Epileptogenic areas exhibiting ictal (with or without interictal spikes) activities were identified and separated during surgery from non epileptic cortical regions.

Results: Epileptogenic cortical areas were characterized by abnormalities of horizontal and columnar dyslamination, dysmorphic neurons, higher NMDA 2A/B subunit immunoreactivity in all cases studied. Six patients had evidence of balloon cells in the cortical mantle and the subcortical white matter. Balloon cells were found in the epileptogenic specimens in only 2/6 patients. The balloon cells showed immunocytochemical features characteristic of both glial and neuronal cells.

Conclusion: This study provides evidence for the cellular changes in epileptic CDs and show the heterogeneity in the expression of epileptogenicity in various histopathological substrates of CDs. Epileptogenicity was mainly restricted to the dysplastic areas devoid of balloon cells in the majority of patients. The presence of severe cellular abnormalities (balloon cells) is not usually associated with in situ epileptogenicity. Further studies are needed to elucidate the nature and the potential role(s) of balloon cells in CD-induced epileptogenicity.

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Mapping of the Human Medullary Surface for Vasomotor Response

Sunil J. Patel, Christian Vera, Diana Vincent, Susan Harvey

Introduction: Pulsatile vascular compression of the ventro-lateral medulla has been implicated as the etiology of neurogenic essential hypertension. While the neural network involved in vasomotor control has been well studied in animals, it has not been physiologically determined in humans. A more detailed knowledge of the exact anatomy and physiologic function of this area of the medullary surface would furthur aid in studies regarding neurogenic hypertension.

Method: We used bipolar electrode stimulation and recorded blood pressure responses in order to exactly identify the so called vasomotor center in the human medulla. This mapping of the medullary surface was done in patients undergoing posterior fossa surgery. We will present our findings from 15 patients.

Results: A side difference in the response to stimulation was realized. In addition, we have found that stimulation of the mid- to inferior retro-olivary sulcus produces a hypertensive response, while stimulation of an area slightly caudal to this produces an initial hypotensive response.

Discussion: We are presently conducting a study with more specific measures of central sympathetic outflow with dual bipolar electrodes in order to explain the initial hypotensive response that was observed. We will discuss the implications of the observations we have made so far and explain these findings on the basis of known animal data on the underlying neural network. Both the site specific response to stimulation and the noted laterality further support some the clinical observations made in patients with neurogenic essential hypertension.

Section on Tumors I

720 Preuss Award

A Novel Genetic Syndrome of Posterior Fossa Tumors of Infancy Secondary to Germline Mutation of hSNF5

Michael D. Taylor, N. Gokgoz, I. Andrulis, T. G. Mainprize, P. Jun, James M. Drake, James R. Rutka

Background: Loss of heterozygosity on chromosome 22q11 is found in rhabdoid tumors of the kidney and CNS. Recently, the hSNF5 gene on chromosome 22q11 was found to be bilaterally deleted in renal rhabdoid tumors. The mechanism by which deletion of hSNF5 leads to neoplasia is currently not known.

Methods: We present a family in which multiple members have been diagnosed with posterior fossa tumors in infancy including rhabdoid tumor and choroid plexus carcinoma. After obtaining informed consent from family members, peripheral blood samples were collected so that RNA and DNA could be extracted. Using PCR, RT-PCR and sequencing, we performed a mutational analysis of the hSNF5 gene in this family as a possible cause for the high incidence of malignancy observed.

Results: We have identified a truncated hSNF5 cDNA transcript from leukocyte cDNA from affected family members, some unaffected family members as well as tumour cDNA. Sequencing of this abnormal transcript revealed fusion of exon 6 to exon 8. Subsequent sequencing of exon 7 and surrounding intronic sequences from genomic DNA revealed a splice site mutation G-A in the 3' splice site of exon 7. This mutation affects the conserved splice site recognition site for exon 7 and accounts for the loss of exon 7 in the mature cDNA. This mutation (loss of exon 7), results in a subsequent frameshift and generation of a premature stop codon.

Conclusions: We have identified a family with a high incidence of posterior fossa tumours of infancy who have a truncating germline mutation in the tumour suppressor gene hSNF5. This suggests that germline hSNF5 mutations predispose to a novel autosomal dominant syndrome of familial pediatric brain tumours with incomplete penetrance. In the future, we recommend that families with a high incidence of pediatric brain tumours be examined for germline hSNF5 mutations.

721 Tumor Young Investigator Award

Vaccination of Recurrent Malignant Glioma Patients with Tumor-Lysate Pulsed Dendritic Cells Elicits a Potent T-Cell Anti-Tumor Response

John S. Yu, Christopher J. Wheeler, Paul M. Zeltzer, Divina Nacis-Finger, Paul K. Lee, Robert Prins, William H. Yong, Reid C. Thompson, Mary Riedinger, Wenuan Zhang, Keith L. Black

Introduction: In this phase I trial for patients with recurrent malignant glioma, patients' peripheral blood dendritic cells (DC) were pulsed with tumor lysate peptides from surgical specimens.

Methods: Three biweekly intradermal vaccinations of tumor lysate-pulsed DCs were administered. Mononuclear cells were isolated through leukapheresis which allows us to obtain a thousand-fold more dendritic cells (10E9 cells) than from phlebotomy alone.

Results: Nine patients have been treated so far. This included 3 females and 6 males. Two patients with anaplastic astrocytoma and 7 patients with GBM were treated. Three patients had recurrence of tumor during the mean follow-up of 13 months. One of these patients progressed to death. Eight patients are alive. No serious adverse events were noted. Cytotoxicity assay demonstrated robust antigen-specific T-cell activity developing after vaccination. Only those patients with pathology consistent with GBM were included in a survival analysis. There were 7 patients in the study group and 51 patients in the control group of patients with recurrent GBM who underwent reoperation. There were no statistically significant differences between the study and control groups for age (44.0 ± 9.1 years vs. 53.0 ± 13.8 years, p = 0.09) and gender (57% male vs. 55% male, p=0.78). The median survival for the study and control groups were 392 and 153 days, respectively. The estimated probability that a patient will survive to 191 days or more is 0.85 for the study group and 0.50 for the control group. The Mantel Cox log rank test revealed that the survival curves for the two groups were significantly different (p = 0.003). The Cox regression model demonstrated a significant relationship between study group membership and increased survival (p=0.02).

Conclusion: This study demonstrates the feasibility, safety, and biological activity of dendritic cell immunotherapy for patients with recurrent malignant glioma.

Section on Tumors I

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Dendritic Cell Vaccination of Patients with Malignant Glioma Elicits Systemic and Intracranial T-Cell Response

Keith L. Black, Christopher J. Wheeler, Paul M. Zeltzer, Divina Nacis-Finger, Paul K. Lee, Robert Prins, William H. Yong, Reid C. Thompson, Mary Riedinger, Wenuan Zhang, John S. Yu

Introduction: This is the first report of an immunotherapy trial for malignant glioma using dendritic cells. In a phase I trial, patients' peripheral blood DCs were pulsed with peptides eluted from the surface of autologous brain tumor cells.

Methods: Three biweekly intradermal vaccinations of peptide-pulsed DCs were administered. Seven patients with glioblastoma multiforme and two patients with anaplastic astrocytoma were treated. No significant adverse effects were observed.

Results: Four of seven patients developed significant systemic T cell cytotoxicity against autologous glioma tumor cells after DC vaccination. Two of four patients who underwent reoperation for recurrent gadolinium enhancing tumor demonstrated a robust cytotoxic (CD8+) and helper (CD4+) T cell infiltration in focal areas of tumor. Study patients with pathology consistent with GBM were included in a survival analysis. Therefore, the two patients with AA in the study group were excluded; for the survival analysis there were 7 patients in the study group and 42 patients in the control group of patients with newly diagnosed patients with GBM treated at our institution. There were no statistically significant differences between the study and control groups for age (54.4 ± 11.3 years vs. 55.9 ± 14.5 years, p = 0.79), gender (42% male vs. 50% male, p=0.77) and those with image complete resection (50% vs. 58% image complete, p=0.22). The median survival for the study and control groups were 455 and 257 days, respectively. The Mantel Cox log rank test revealed that the survival curves for the two groups were significantly different (p = 0.04).

Conclusion: Therefore, dendritic cell vaccination in patients with malignant glioma elicited anti-tumor T cell responses both systemically and intracranially in a subset of patients. This phase I study demonstrated the feasibility, safety and bioactivity of an autologous peptide-pulsed dendritic cell vaccine for malignant glioma.

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UCN-01 Induced Apoptosis in 9L Glioma Cells Provides an Effective Antigen Source For Dendritic Cells That Yields a Potent Therapeutic Vaccine Strategy in an Intracranial Glioma Model

Timothy F. Witham, Melanie Erff, Hideho Okada, William H.Chambers, Ian F. Pollack

Introduction: Our preliminary studies using a syngeneic 9L glioma/Fischer rat model indicate that tumor apoptotic bodies provide a potent source of antigen for delivery to dendritic cells (DCs). In these studies, 7-hydroxystaurosporine (UCN-01), a signal transduction inhibitor, was utilized for induction of glioma cell apoptosis. Subcutaneous vaccination with apoptotic body-pulsed DCs was initiated on the day of intracranial (i.c.) tumor implantation. However, no long-term (>90 days) survivors were observed. We have explored this treatment approach using an intensified vaccination schedule in animals harboring established i.c. tumors as an attempt to affect long-term survival.

Methods: Rats (N=32) underwent i.c. injection of 1x104 9L cells. The vaccination schedule for this experiment consisted of injections on days 3,4,7; 10,11,14; 17,18,21; and 24,25,28 following tumor implantation. For each series of injections (ie Day 3,4,7), the respective cells were either injected immediately (Day 3,10,17,24), incubated for 24 h in vitro prior to injection (Day 4,11,18,25), or incubated for 96 h in vitro prior to injection (Day 7,14,21,28). Subcutaneous vaccinations consisted of HBSS (N=8), DCs (1x106) (N=8), separate injection of DCs (1x106) and UCN-01 treated 9L (2x105) (N=8), or DCs(1x106) co-cultured with UCN-01 treated 9L(2x105) (N=8).

Results: Survival was statistically longer for those animals treated with a glioma apoptotic body-pulsed DC vaccine relative to animals receiving separate injection of apoptotic glioma cells and DCs, DCs alone, or vehicle treated controls (p=0.01, p<0.0001, p<0.0001 respectively, Log Rank Analysis). Long-term survival was demonstrated in 75% (6/8) of cases with this vaccination approach.

Conclusions: An intensified vaccination strategy utilizing glioma apoptotic body-pulsed DCs shows substantial therapeutic efficacy in a 9L rat i.c. tumor model. Because of the efficacy and applicability of DC-based vaccination approaches, clinical implementation of an apoptotic body-pulsed DC vaccine for high-grade gliomas is being developed as a phase I clinical trial at our center.

Section on Tumors I

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Radiation Necrosis Following Gamma Knife Radiosurgery: A Case-Controlled Comparison of Treatment Parameters and Long-Term Clinical Follow-Up

Lawrence S. Chin, Lijun Ma, Steven DiBiase

Introduction: Radiation necrosis is the only significant complication of Gamma Knife radiosurgery. We studied treatment plan parameters in patients with radiation necrosis to determine if risk factors for necrosis could be identified. The clinical course of patients with radiation necrosis was also evaluated.

Methods: 286 patients were treated with Gamma Knife radiosurgery by the lead author (LSC) between 9/94 and 12/98. Of 243 patients that were followed for at least 15 months or until death, 17 patients developed radiation necrosis and were prospectively tracked. 17 non-necrosis patients were randomly selected as case controls on the basis of lesion histology. Integral dose-volume histograms were calculated from the original treatment plan and were used to determine various dose-volume parameters. To assess the validity of Kjellberg's 1% and Flickinger's 3% isonecrosis risk lines, we plotted our dose/diameter results against their data. Clinical outcome was assessed by the time for resolution of symptoms and radiographic abnormalities.

Results: The treatment plan variables that were associated with a greater risk of necrosis were increased tumor integral dose (total dose under the curve), increased tumor volume, and increased 10 Gy volume (total volume receiving a dose of at least 10 Gy). Other risk factors included repeat radiosurgery to the same lesion and glioma histology. Kjellberg's 1% risk line predicted a 5% risk of radiation necrosis and Flickinger's 3% risk line predicted a 3% risk. Median time to develop necrosis was 4 months and symptomatic and radiographic recovery times were 7.5 and 10.5 months respectively.

Conclusions: We recommend prospective tumor volume determination and DVH calculation for all radiosurgery treatments. Since the risk for necrosis is greater with larger tumor volumes, attention to plan conformity and the 10 Gy volume will help prevent radiation necrosis. If possible, repeat radiosurgery to the same tumor volume should be avoided.

725

Identification and Characterization of Pescadillo, a Novel BRCT-Domain Containing Gene with Increased Expression in Glioblastoma

Gregory D. Foltz, Jim Schuster, Peter Nelson, Leroy Hood, Richard Morrison

Introduction: Alterations in the p53 tumor suppressor gene are associated with the development and progression of astrocytic tumors. We applied cDNA microarray analysis to a p53-deficient mouse model to identify alterations in gene expression that accompany loss of p53 function during malignant transformation of cultured astrocytes.

Methods: A cDNA microarray containing 1500 non-redundant sequence verified clones was constructed from an enriched cDNA library derived from late passage p53-/- astrocytes. Fluorescently labelled cDNA probes derived from early passage p53+/+ and late passage p53-/- astrocytes were cohybridized. Differential gene expression was quantified with Imagquant software. Increased expression of Pescadillo was confirmed by Northern Blot analysis. The full-length mouse sequence was obtained with 5' and 3' RACE supplemented by primer walking.

Results: Several genes exhibited increased expression (>2-fold) with loss of p53 function. Pescadillo, a novel uncharacterized gene, showed a 3-4 fold increased expression which was confirmed by Northern Blot analysis in malignant astrocytes and human GBMs. A mouse multi-tissue Northern Blot confirmed high levels of expression during embryonic development with low levels of expression in adult brain. The full length mouse pescadillo cDNA shares 79 and 83% sequence homology to zebrafish and human homologues respectively. Sequence analysis revealed a BRCA1 carboxy terminal domain (BRCT), bipartite nuclear localization signals and several conserved sequences for covalent attachment of SUMO-1.

Discussion/Conclusion: Pescadillo has been shown to be essential for embryonic neurodevelopment in zebrafish. The presence of a BRCT domain suggests a functional role in cell cycle checkpoint regulation, DNA replication and repair. Aberrant expression of Pescadillo in malignant astrocytes provides a potential target for therapeutic intervention in the treatment of high-grade gliomas.

Section on Tumors I

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Tumor Fas (APO-1/CD95) Upregulation Results in Increased Apoptosis and Survival in Rats with Intracranial Malignant Glioma

Bruce Frankel, Sharon L. Longo, Michele Kyle, Gregory W. Canute, Timothy C. Ryken

Objective: A majority of high-grade astrocytomas express the apoptosis-inducing receptor Fas; however, little is known about its functional or prognostic significance. The goal of this study is to clarify the relationship between Fas expression, apoptosis, and survival.

Methods: The apoptotic index (AI) was determined by TUNEL assay in 51 high-grade astrocytomas and correlated with the extent of Fas expression, and survival. Subsequently, Fas expression was quantified using flow cytometry in several human GBM cell lines and a malignant rat glioma line, before (36B10-) and after Fas upregulation (36B10-Fas) by gene transfer. Cytotoxicity studies and propidium iodide flow cytometry were used to evaluate the functional significance of Fas expression. Finally, the effect of Fas upregulation on survival was examined in rats with intracranial implantation of 36B10- or 36B10-Fas transfected cell lines.

Results: A significant correlation between AI and Fas expression was demonstrated in patients with high-grade astrocytomas. Tumors with higher Fas levels had greater AIÕs than those with lower levels (0.81% vs. 0.43%) (P = 0.017); however, no difference in survival was seen between groups.

The low Fas expression, exhibited by all GBM lines, correlated with a limited susceptibility to Fas-mediated cytotoxicity. After Fas upregulation, the percent of cells undergoing apoptosis after exposure to Fas-triggering antibodies increased from 4% (36B10-) to 27% (36B10-Fas). Fas upregulation in a rat glioma model resulted in a 75% increase in median survival from 14 days (36B10-) to 24.5 days (36B10-Fas)(P = .0005).

Conclusions: Although the degree of Fas expression in high-grade astrocytomas correlates with the AI, no overall differences in survival could be demonstrated between patients with tumors expressing high vs. low Fas levels. The overall low rate of apoptosis in high-grade astrocytomas is related to low surface Fas expression. By increasing Fas expression, rates of Fas-mediated apoptosis and survival increase.

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Endoscopic Endonasal Transsphenoidal Surgery: Advantages and Pitfalls

Hae-Dong Jho, In-Sung Park

Objective: Advantages and pitfalls of endoscopy in our transsphenoidal surgery is reviewed.

Material and methods: From 1993 through 1999, 160 patients had undergone endoscopic endonasal operations at the University of Pittsburgh. One hundred and twenty-eight patients had pituitary adenomas and the remaining patients had other skull base lesions. Twenty-four patients had recurrent tumors. Sixty-eight patient had hormone non-functioning adenomas, thirty-five had prolactinomas, sixteen had ACTH-secreting adenomas and nine had growth-hormone secreting adenomas.

Results: Among 68 patients with hormone non-functioning adenomas, total removal was achieved in 53 (78 %) patients and subtotal resection in 15 (22 %) patients. Among 35 patients with prolactimonas, 21 (60 %) patients had normal postoperative prolactin levels. Among 16 patients with Cushing's disease, 11 patients completely resolved their symptoms with normalized cortisol levels. Among 9 patients with acromegaly, 8 patients had normal IGF-1 levels with growth hormone less than 2 ng/ ml postoperatively. Outpatient surgery was performed in two patients and 67 % of 160 patients stayed only overnight in the hospital. The advantages noted have been a wide-angled view of the sphenoidal-sinus anatomy, a close-up view of the anatomy, an angled view at the anatomical corners, easy accessability to the skull-base ranging from the crista galli to foramen magnum, quick postoperative recovery, minimal postoperative discomfort, and short hospital stays. The main pitfalls are a steep learning curve, the lack of ideal endoscopes and the inadequacy of surgical instruments.

Conclusion: Despite the pitfalls, the future of endoscopic endonasal transsphenoidal surgery seems to be promising.

Section on Tumors I

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The Characterization of Tumor Apoptosis After Experimental Radiosurgery

Timothy F. Witham, Hideho Okada, Wendy Fellows, Ronald L.Hamilton, John C. Flickinger, William H. Chambers, Ian F. Pollack, Douglas S. Kondziolka

Introduction: The biological effects of stereotactic radiosurgery on intracranial tumors are not well characterized, but may involve induction of DNA damage that triggers programmed cell death. We sought to evaluate whether radiosurgery induces apoptosis in an experimental glioma model and to determine whether an increase in apoptotic cell death within glial tumors correlates with improved animal survival.

Methods: Fischer 344 rats harboring established (day 7) intracranial 9L gliosarcomas (1x 105 cells) underwent radiosurgery (35Gy to 50% isodose, n=24) or no radiosurgery (controls, n=10). Animals were sacrificed at 6, 12, 24, 48, or 72 hrs after treatment and in situ tumor apoptosis was assessed by specific staining in a blinded fashion. Apoptotic cells were recorded as a percent of the total tumor cells counted. Additional animals were randomized to control (n=32) or radiosurgery (35 Gy to 50% isodose, n=32) groups at day 7 after intracranial 9L (1x 105 cells) implantation and observed for up to 150 days post-implantation.

Results: The overall mean percent of apoptotic cells in 9L tumors of controls was 1.38% compared to 3.32% in tumors of radiosurgery treated animals (p=0.002). Increased apoptosis was noted at 6 hrs following radiosurgery and remained elevated at 72 hrs. Log-rank analyses of Kaplan-Meier curves revealed a survival advantage for radiosurgery treated animals relative to controls($p<0.0001$).

Conclusions: Radiosurgery increases apoptosis in the rat intracranial 9L gliosarcoma and this effect may correlate with improved survival. Radiosurgery-induced apoptosis may have utility for potentiating the effects of biological agents for CNS neoplasia that depend on antigen delivery to host immune effectors.

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Gene Therapy for Recurrent Glioblastoma: Interim Report

Isabelle M. Germano, Susan Morgello, Savio Woo, Kalmon D. Post

Introduction: The long-term consequences of adenoviral-mediated conditional cytotoxic gene therapy for gliomas remains poorly characterized. Recent laboratory data showed chronic brain inflammation and persistent herpes simplex virus (HSV) thymidine kinase (tk) expression in survivors of gliomas treated by adenovirus-mediated gene therapy. recent data from an animal study shows detection of active brain inflammation three months after gene therapy administration. To the best of our knowledge, these findings have never been reported in humans.

Methods: We recently started a phase I human trial of adenovirus (ADV) HSV-tk/Ganciclovir (GC) complex for recurrent glioblastoma. Our interim report is pertinent to the clinical results of the first cohort of five patients treated with the ADV-HSV-tk/GC complex (1x1010 PFU). Additionally, we report the histological findings of three brain specimens examined 30 days, 3 months and 12 months after gene therapy, respectively. Immunohistochemistry for LCA, CD79A, CD43, KP1 was used to characterize inflammatory changes. Polymerase chain reaction (PCR) to identify the tk gene was performed on formalin-fixed material.

Results: There was no evidence of adenoviral shedding in this study. Two patients are alive without evidence of recurrent tumor over 12 months after administration of gene therapy. Three patients died: 12 month, 30 days, and 11 months after gene therapy. In all cases the death was not a consequence of the gene therapy. Histological examination of the brain, showed perivascular infiltrates in the resection/tumor cavity. This was particularly pronounced 30 days and 3 months after administration of gene therapy. However, it was also persistent at 12 months. PCR results were negative in the brain and all examined organs.

Conclusions: These interim results show that ADV-HSV-tk/GC complex can be safely administered in patients with recurrent glioblastoma.

Section on Neurotrauma and Critical Care I

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A Highly Specific Cyclooxegenase-2 Inhibitor Improves Neurological Recovery in a Rat Traumatic Brain Injury Model

Amir S. Malik, Raj K. Narayan, Kenneth I. Strauss

Introduction: Basic neurotrauma research has focused on understanding the cellular cascades that may result in secondary damage following Traumatic Brain Injury (TBI). One inflammatory cascade is the production of vasoactive prostaglandins. These diffusible factors can promote vasodilatation or vasoconstriction, changes in vascular permeability, and alterations in platelet aggregation. These may initially be adaptive responses; however, if they persist they may lead to vasospasm, loss of cerebral autoregulation, edema formation and altered cellular metabolism. In clinical TBI and animal models, prostaglandin levels have been shown to rise acutely following injury. Cyclooxygenases (COX1 and COX2) catalyze the first step in the formation of prostaglandins from arachidonic acid, producing free radicals in the process. Free radicals may damage cell membranes (via lipid peroxidation), endangering tissue integrity. COX2 inhibitors have been shown to limit prostaglandin production post injury, decrease infarct size after temporary focal ischemia, and suppress hypermetabolism.

Methods: We employed one of the third generation, highly specific COX2 enzyme inhibitor in a rat Lateral Cortical Impact Model of TBI. DFU [5,5-dimethyl-3(3-flourophenyl)-4(4-methylsulphonyl) phenyl-2(5H)-furanone, Merck-Frosst] was given intraperitoneally twice a day (1mg/kg, initiating 30 min before injury and continuing for 3 days) following TBI.

Results: DFU treatment (n=12) improved complex coordination by 75% on the Beam Walk test ($p<0.05$, Scheffe) compared to the injured/vehicle littermates (n=15). DFU treatment revealed a trend towards improvement in Neuroscore (lateral pulsion, forelimb flexion and hindlimb extension, $p=0.0553$). DFU markedly improves neurological performance compared to vehicle-treated littermates.

Conclusion: These findings suggest exciting potential for this agent in the pharmacological treatment of TBI, and support the consideration of a clinical trial.

731 Synthes Award for Resident Research in Spinal Cord and Spinal Column Injury

Extensive Axon Regeneration in the Adult Rat Corticospinal Tract after Spinal Cord Injury

Deepa Soni, Larry Benowitz, Nina Irwin, Joseph R. Madsen

Background: The inability of axons to regenerate after injury is perplexing. Although limited axonal outgrowth has been demonstrated with peripheral nerve grafts, Schwann cell implants, and various nerve growth factors, successful regeneration of severed CST axons with functional restoration is yet to be achieved. In earlier studies, we found that inosine, a purine nuceleoside, was a potent promoter of axogenesis in vitro. Consequently, we wanted to test its in vivo role in conjunction with cellular implants in promoting CST axon regeneration after SCI.

Methods: Adult, male S.D. rats (N = 42) underwent unilateral transection of their CSTs, 1mm rostral to the pyramidal decussation. Cellular implants consisting of either neural stem cells or olfactory ensheathing cells (OECs) were transplanted into the lesions immediately following injury. Osmotic minipumps implanted into either the axotomized or nonaxotomized sensorimotor cortex, continuously delivered inosine (experimental, N = 22) or PBS (control, N = 20) for 14 days. After the treatment period, biotinylated dextran amine (BDA) was used to trace axon trajectories. The animals were perfused 2 weeks later.

Results: We found that inosine stimulated the growth of hundreds and in some cases thousands of axons that descended into the denervated CST white matter-a typically inhibitory terrain and frequently extended laterally into the denervated gray matter. The control animals had an average of 10% of newly sprouted axons when compared to the inosine-treated animals. The difference between the two groups was significant at $P = 0.015$ (x2 test). The growth of new axons was confirmed with antibodies to the growth-associated protein, GAP-43. The cellular implants formed tissue bridges across portions of the lesions, serving as a conduit for axon regeneration.

Conclusions: Inosine, a naturally occurring metabolite without any known adverse effects, in conjunction with cellular implants have a potentially significant role in promoting CST axonal regeneration after SCI.

Section on Neurotrauma and Critical Care I

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Role of the mGluR1 Metabotropic Glutamate Receptor in Spinal Cord Injury

Nicolas Phan, Michael G. Fehlings

Introduction: Previous results from our laboratory suggested a potential role for the mGluR1 receptors in the mechanism of spinal cord injury(SCI). Group I mGluRs(mGluR1 and 5) are coupled to phospholipase C/phosphoinositol hydrolysis, which leads to the release of internal Ca2+ stores. In this study, we first sought to confirm these results using an antagonist with a greater potency for group 1 mGluRs as well as modulators of intracellular calcium. Secondly, we adapted our in vitro model of SCI to the mouse in order to test the response of mGluR1 knockout mice to SCI.

Methods: A dorsal column segment is isolated from the spinal cord of adult rats and mice, maintained in vitro and injured by compression for 15 sec with a clip having a 2g closing force. Compound action potential (CAP) recordings are measured across the injury site for a duration of 2 hours.

Results: Under control conditions, the compound action potential (CAP) in rats was reduced to 59.70±8.86% (n=9). In a zero calcium solution, the CAP recovered to 84.14±3.39% (n=5, $p<0.0001$). Blockade of group I mGluRs PHCCC(10mM) resulted in an electrophysiological recovery of 84.91±9.35% (n=7, $p<0.0001$). Depletion of IP3-sensitive internal Ca2+ stores with thapsigargin resulted in an electrophysiological recovery of 80.03±5.10% (n=5, $p<0.0001$). Dorsal columns extracted from wild-type mice revealed a recovery of CAP of 60.0±11.6% (n=4) following injury. Western immunoblots and immunohistochemistry revealed the presence of mGluR1 in both rat and mouse spinal cord white matter, and its absence in knockout mice.

Conclusion: These results are consistent with the hypothesis that inactivation mGluR1 after spinal cord injury improves electrophysiological recovery in white matter. Further experiments using mGluR1 knockout mice will be performed in order to elucidate the role mGluR1 in acute traumatic SCI.

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MRA for the Diagnosis of Vertebral Artery Injury Associated with Cervical Spine Trauma

Santiago J. Figuereo, Nathan R. Weldon, Austin R. T. Colohan

Introduction: The vertebral arteries are prone to occlusion or stenosis after cervical spine lesions. These injuries are rarely symptomatic and their symptoms may be attributed to associated lesions (e.g. head injury. Diagnosis is necessary to prevent progressive brain stem infarction and for planing procedures with risk of injury to the vertebral vessels (e.g., posterior lateral mass plating). Magnetic Resonance Angiography (MRA) has a high sensitivity, specificity and superb resolution in the evaluation of the extracranial cervical vasculature. We investigate the use of MRA in the diagnosis of traumatic vertebral injury.

Methods: With IRB approval and appropriate consent, 25 patients with cervical spine fractures were studied. An MRA of the vertebro-basilar system was obtained regardless the type of fracture. The incidence of vertebral artery injury was calculated.

Results: Patient ages were between 13 and 84 years, 17 males (68%) and 8 females (32%). Mechanism of injury included motor vehicular accident (19 cases for76%), snowboard, falls and bike accidents (2 cases each for 8%). Levels involved included C7 (8 cases for 32%), C6 and C2 (4 cases each for 16%). Vertebral artery flow disruption was diagnosed in 6 cases for a 24% incidence.

Discussion/Conclusion: Our results are similar to previously described incidence of vertebral artery injury in cervical trauma (24 Ð 46%) using conventional angiography. Some types of cervical spine trauma are specifically associated to vertebral artery injuries. As previously reported, 33% of our cases were related to foramen transversarium involvement. We also confirmed a significant association between unilateral facet dislocations and vertebral artery injuries (50% of cases). MRA is an efficient tool in the diagnosis of traumatic vertebral artery disruption since it is noninvasive and easy to perform as an addendum to the spine Magnetic Resonance Image (MRI) obtained at the time of initial evaluation of cervical spine injury.

Section on Neurotrauma and Critical Care I

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A Prospective Population-Based Study of Pediatric Trauma Patients with a Field Glasgow Coma Score of 13-14

Michael Y. Wang, Pamela Griffith, Judy Sterling, J. Gordon McComb, Michael L. Levy

Introduction: Considerable controversy surrounds the appropriate evaluation of children with mild alterations in consciousness after trauma (Glasgow Coma Scale score of 13-14). To determine the incidence of intracranial lesions in pediatric patients with a field Glasgow Coma Score (GCS) of 13 or 14.

Methods: We undertook a population-based, multi-center prospective study of all patients transported by Emergency Medical Services over a twelve-month period in Los Angeles County. This area has 2.4 million children, 13 designated Trauma Centers, and 69 receiving hospitals.

Results: 8,488 patients in the pediatric age group (less than 15 years old) were transported by EMS for injuries. Of these, 209 had a documented field GCS of 13 or 14. 157 were taken to Trauma Centers and 135 (86%) received head computed tomography (CT) scans. 43 (27.4%) had an abnormal CT scan, 30 (19.1%) had an intracranial hemorrhage, and five required a neurosurgical operative procedure for hematoma evacuation. Positive and negative predictive values of deteriorating mental status (0.500/0.844), loss of consciousness (0.173/0.809), skull fracture (0.483/0.875), and extracranial injuries (0.205/0.814), were poor predictors of intracranial hemorrhage.

Conclusion: The incidence of intracranial injury in pediatric patients with mild alterations in consciousness in the field is significant. The great majority of these patients will not require operative intervention, but the implications of missing these hemorrhages can be severe for this subgroup of head injured patients. It is recommended that, since clinical criteria and skull x-rays are poor predictors of intracranial hemorrhage, all children with a field GCS of 13 or 14 routinely have a screening non-contrast enhanced CT scan.

735

Minocycline Reduces Post-traumatic Brain Injury by Inhibition of the Caspase-1 Cell Death Cascade

Robert M. Friedlander, Victor Ona, Philip E. Stieg, Mingwei Li

Introduction: We have previously demonstrated that caspase-1 plays an important functional role mediating cell death and neurological dysfunction following experimental traumatic brain injury in mice. The synthetic tetracycline derivative minocycline has been shown to inhibit caspase-1 expression. The mechanism of minocycline-mediated caspase-1 inhibition is presently unknown. Searching for novel interventions to block caspase-1 activity with the goal of ameliorate the consequences of traumatic brain injury, we evaluated weather minocycline could inhibit post-traumatic caspase-1 activation and reduce brain injury.

Methods: the controlled cortical impact brain injury model was used. Motor strength and coordination were evaluated using a RotaRod on days 1 through 4 following trauma. Lesion volume was quantified in a blinded fashion 4 days following the injury using H+E staining. Caspase-1 activity was quantified using a mature IL-1 beta ELISA. Minocycline hydrochloride was administered by intraperitoneal route twice a day.

Results: a) Post-traumatic caspase-1 activation was inhibited by 64% in minocycline treated mice when compared to vehicle treated controls ($p<.005$, n=6/group); b) Neurological motor performance was improved by 68% in treated mice ($p<.05$, n=8/group); c) Lesion volume was reduced by 65% in treated mice (p.05, n=8/group).

Conclusions: We have demonstrated that minocycline is an effective agent for reducing brain injury following trauma. This mechanism appears to be related to its ability to inhibit caspase-1 activation. Minocycline might play a role in the treatment of brain injury in humans, in combination with other neuroprotective agents.

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The Effect of Group II & III Metabotropic Glutamate Receptor Activation on Neuronal Injury in a Rodent Model of Traumatic Brain Injury

Marike Zwienenberg, Qin Zhi Gong, Robert F. Berman, J. Paul Muizelaar, Bruce G.Lyeth

Introduction: The role of metabotropic glutamate receptor activation after traumatic brain injury (TBI) is not well known. In vitro studies suggest that Group II and III metabotropic glutamate receptors may mediate neuroprotection, and these receptors may thus be a potential target in the development of therapeutic strategies. To further elucidate the role of group II and III metabotropic glutamate receptors, we examined the effects of two selective agonists on neuronal degeneration after in vivo TBI.

Methods: Fifty-four male Spraque- Dawley rats were subjected to lateral fluid percussion brain injury followed by injection of DCGIV (2 dicarboxycyclopropyl-glycine: group II) or PPG ((R,S) -4- phosphonophenylglycine: group III) in the CA 2-3 area of the hippocampus. The following dosing regimens were used in each study. DCGIV: vehicle (n=7), 20 fmol (n=8), 100 fmol (n=6), and 500 fmol(n=6). PPG: vehicle (n=7), 8nmol (n=5), 40 nmol (n=7), and 200 nmol (n=7). All animals were sacrificed 24 hours after TBI. Four 50 mm brain sections were obtained from each animal and stained with the fluorochrome Fluoro-Jade. The number of degenerating (Fluoro-Jade positive) neurons in the CA 2-3 area of the hippocampus of each brain section were counted.

Results: The highest dose of DCGIV significantly reduced the number of Fluoro-Jade positive, degenerating neurons ($p<0.001$). Lower doses of DCGIV were associated with a decreased but not statistically significant number of Fluoro-Jade positive neurons. In contrast, no difference in the number of Fluoro-Jade positive neurons was found between vehicle and the drug PPG.

Conclusion: Modulation of group II metabotropic glutamate receptors with a selective agonist protects neurons against in vivo TBI. These receptors may thus be a promising target for future neuroprotective drugs. The role of group III receptors is uncertain and further studies are needed to evaluate their potential as targets for therapeutic agents in TBI.

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Unilateral Decompressive Craniectomy for Children with Severe Head Injuries. Report of 7 Cases and Review of the Literature

Nedal A. Hejazi, Alfred Witzmann, L. K. H. Feldkirch

Introduction: Severe head injuries in children (under 15 years of age) have many features that differentiate them from head injuries in adults. In such cases, nonsurgical treatment can not always prevent fatal herniation. In the literature, reports state that when decompressive crainiectomy was performed on children with severe head injury, the outcome was more beneficial than when it was performed on adults.

Methods: We report on seven cases of children with severe head injury, presented with decorticate posturing and treated by unilateral decompressive craniectomy (UDC). The aim of the UDC was to decompress the midbrain and the brainstem. Therefore we performed a limited procedure recovering the temporobasal region. All patients were presented with GCS scores of 3 to 5, and had bilateral brain edema with compression of the lateral ventricles, the third ventricle, and the perimesencephalic cisterns in their CT scans on admission.

Results: Postoperatively, all patients showed good recovery within 5 weeks (GCS score 15). The original bone flap was reimplantated 4 to 9 weeks after decompression. UDC has an advantage over nonsurgical treatment of children with severe brain injury, and should be considered in their management. If the operation can be accomplished within the first six hours after injury, the potential to influence the outcome is higher.

Conclusion: The relevant literature is reviewed, and the alternative treatment modalities are discussed critically, in an attempt to determine the value of the UDC procedure, and to define the clinical parameters that might identify those children most likely to benefit from this technique.

Section on Neurotrauma and Critical Care I

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Biphasic Elevation of Prostaglandin E2 and Thromboxane B2 Concentrations Following Spinal Cord Injury

Daniel K. Resnick, Catherine F. Cechvala

Background: Inflammatory metabolites of arachadonic acid likely play a significant role in secondary injury following spinal cord trauma. The nature and time course of the expression of these mediators of inflammation has not been well described.

Methods and Materials: 28 adult long evans rats were subject to spinal cord injury using the NYU impactor. Animals were sacrificed between 2 and 72 hours following injury and the injured segments of spinal cord were harvested. Prostaglandin E2 (PGE2) and Thromboxane B2 (TxB2) levels were measured via an enzyme immune assay.

Results: Both PGE2 and TxB2 levels rose following injury. The concentration of TxB2 increased dramatically by 2 hours following injury, declined slowly until 24 hours following injury, and then rose gradually until declining again between 48 and 72 hours following injury. PGE2 concentrations also rose through 4 hours following injury. Concentrations then declined transiently until a second peak occurred approximately 48 hours following injury.

Conclusion: Elevated concentrations of arachadonic acid metabolites can be detected in the injured segment of the spinal cord for at least 72 hours following injury. There is a previously undescribed biphasic pattern to the production of these metabolites. The significance of this finding is discussed in the context of our current understanding of the process of secondary spinal cord injury.

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The Effects of Ethanol on Heat Shock Protein Expression Following Traumatic Brain Injury

Steven A. Dutcher, Julie Pilitsis, Bill D. Underwood, Paul D. Walker, Fernando G. Diaz, Daniel B. Michael

Introduction: The Traumatic Brain Injury (TBI) National Database Management Center reports that 52% of TBI victims have have positive blood ethanol (ETOH)levels at injury. ETOH influence Heat Shock Protein(HSP) expression (Calabrese et al, Free Radic. Biol. Med. 24: 1998).Our group has previously reported changes in expression of HSP following TBI in human tissue and animal models (Dutcher et al.; J Neurotrauma 15:6 1998).

Hypothesis: The presence of ETOH effects HSP biosynthesis following TBI.

Methods: Human brain tissue was collected during craniotomy, in accordance with hospital and federal regulations (45CFR46), and processed by Northern and Western analysis for HSP expression using non-TBI tissue for comparison. Blood ETOH levels were determined at the time of hospitalization by standard methods. Statistical analysis used studentized Tukey & ANOVA.

Results: Preliminary results would suggest that ETOH intoxication increases the expression of Heat Shock Proteins following human TBI.

Conclusion: These preliminary results support the hypothesis that ETOH influences HSP gene expression following TBI. Study of post TBI and ischemic gene alteration has led to molecular treatment strategies
(e.g. bFGF therapy). This study suggests the effect of ETOH intoxication on post TBI gene expression should be considered in the design of such treatment.

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Council of State Neurosurgical Societies

740 CSNS Resident Award

Comparison of Hospital Costs for Interventional MRI-Guided Surgery vs. Frameless

Chris Lycette, Gregory Rubino, Keyvan Farahani, Pablo Villablanca, Barbara Van de Wiele

Introduction: The cost of new technology in neurosurgery is being closely scrutinized. We compare the factors associated with hospital costs and the hospital costs associated with interventional MRI-guided (iMR) tumor removal and frameless neuronavigation-guided tumor removal.

Methods: The length of hospital stay (LOS), the length of ICU stay (ICU), the operative time (OR time), and the variable direct costs (VD Cost) were compared for 32 patients who underwent iMR-guided tumor resection (iMR group) and 32 patients who underwent BrainLab (Heimstetten, Germany) neuronavigation-guided tumor removal (OR group) from 1998-present.

Results: For the iMR group (n=32): LOS = 5.6 +/-3.9 days (2-20 days); ICU = 2.53 +/-1.8 days (0-11days); OR time = 9.5 +/- 2.4 hrs (3.5-14.25 hrs); and VD Cost = $10,958 +/- $4,495 ($3,403-$27,527). For the OR group (n=32): LOS = 5.5 +/- 3.5 days (2-15 days); ICU = 2.2 +/- 1.2 days (1-7 days); OR = 6.7+/-1.9 hrs (3.75-12 hrs); VD Costs = $10,231 +/- $3,111 ($6,619-$21,716).

Conclusion: This preliminary analysis demonstrates that length of stay, ICU days and variable direct costs were similar for the two groups studied. The iMR group's costs were $727 higher than the OR group's costs. Because iMR-guided surgery involves multiple imaging sessions, the average OR time is 2.8 hrs (41% increase) longer for the iMR group than the OR group and is a major contributor to the iMR group's higher hospital cost. We expect that this cost will drop because the OR time for iMR-guided surgery has steadily declined with increasing experience.

IMR-guided surgery appears to offer many safety and efficacy advantages over frameless neuronavigation. While the initial capital equipment investment involved in building an iMR suite may be sizeable, the actual operating costs of iMR-guidance do not differ significantly from conventional neuronavigation guidance.

741 CSNS Young Neurosurgeons Award

Length of Stay Differences Between Electively and Non-Electively Admitted Craniotomy Patients

Marc S. Schwartz, Sharon Habiniak, Debra Pukis, Donna Dibble, Todd Scrime, John B. Waldman

Introduction: Clinical Pathway Guidelines (CPGs) have been used in many institutions to standardize patient care and reduce hospital length of stay (LOS). In our hospital, a university medical center, a CPG has been utilized for all craniotomy patients, excluding trauma and sub-arachnoid hemorrhage, since 1997. This CPG specifies a 4 day LOS and has resulted in overall decreased LOS compared to historic controls. However, in the last 1.5 years, LOS has plateaued, with no significant further lessening.

Methods: In order to understand the factors associated with extended LOS, CPG data from July to December 1999 were analyzed. During that time, 55 patients were entered in the CPG (mean LOS = 7.6 days; median = 4 days; mode = 3 days). Admissions were analyzed by surgeon, insurance carrier, diagnosis, discharge disposition, and admission source. Most significant and useful of these variables was admission source.

Results: Patients electively admitted had a mean LOS of 4.4 days, while those admitted via the emergency room or transfer had a mean LOS of 16.1 days ($p<0.001$). Over the 6-month period, there were a total of 224 extra days of LOS, defined as days of hospitalization beyond the allotted 4. Of these, a total of 42 days were among electively-admitted patients (19%), while 182 days were among the others (81%, 11.1 days per patient).

Conclusion: Especially given diagnosis-based insurer reimbursement patterns, LOS plays a pivotal role in successful hospital management. These data suggest that in order to make significant additional gains in reducing hospital LOS, attention should be focused on those craniotomy patients not electively admitted for surgery. Of course, the differences seen may reflect the unavoidable inefficiencies of caring for urgently or emergently admitted and operated patients. If this is the case, the development of alternate and higher reimbursement levels for these categories of patients could be supported.

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Is Outpatient Trial for Spinal Cord Stimulation More Cost-Effective Than Inpatient Trial?

Frank P. Hsu, Farhad Limonadi, Zvi Israel, Kim Burchiel

Introduction: Cost-effectiveness is an important issue in conducting spinal cord stimulation implant trials. For outpatient trials, percutaneous electrode is placed as an outpatient procedure and the patient is discharged to home on the same day of surgery for the adjustment of stimulation parameters. The candidate returns one week later to be assessed if implantation or removal of the generator is indicated. For the inpatient trials, the patient is admitted to the hospital after the placement of electrode and the efficacy is determined for the next two days. If implantation is decided then it is performed within the same hospitalization before the patient is discharged.

While it may seem that outpatient trial is more cost-effective since the hospitalization charges are avoided in the process, factor such as increased rate of infection negatively impact on the cost-effectiveness of conducting outpatient trials.

Methods: We performed a retrospective review of the experience at Oregon Health Sciences University between the time period of 1988 and 1999. Spinal cord stimulation was conducted on an inpatient and outpatient basis from 1988 to 1994 and from 1994 to 1999, respectively.

Results: While there is almost no infection in the inpatient trial group (n=92) the infection rate for the outpatient trial group is 6.2% (n=113), which is consistent with the literature.

The impact of an infection on a successfully tried implant is tremendous since the loss of from the cost of the hardware is more significant compared to the hospitalization costs saved in the outpatient trials.

Conclusion: We plan to present our retrospective data in the poster to support our hypothesis that inpatient trials for the spinal cord stimulation maybe more cost-effective long-term considering that infection requires the removal of expensive hardware. We will also review the rate of unsuccessful trial and removal in each group. Although our data suggest that this is the case, a prospective and randomized study is required to truly examine the issue.

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Socio-Economic Impact of a Network for Telematic Neurosurgical Consultation in the Treatment of Head Injured Patients

Giuliano Faccani, Fulvio Massaro, Maurizio Berardino, Silvana Borgarello

Introduction: Information technology has an important role in the delivery of high quality health care services. In many countries neurosurgical care is concentrated in regional centres which often necessitates the inter-hospital transfer of patients with head injury for optimal management. In 1997 we implemented DEAnet, a wide area network for delivery of neurosurgical care. The aim of this study is to evaluate the socio-economic impact of the DEAnet in the management of head injured patients.

Material and Method: In a wide area with about 3,000,000 of residents, 33 CT-scanners are available in the Emergency Services of the peripheral hospitals provided with operating room and Intensive Care Unit. A network for transmission of diagnostic images endowed with clinical data from the peripheral hospitals to four neurosurgical units has been implemented. This regionalized head trauma care allows real time neurosurgical consultation avoiding unnecessary patient transfers because only the cases requiring neurosurgical care are trasnsferred. In this stage of the project fifteen peripheral hospitals endowed with CT-scanner and Intensive Care Unit has been connected with four Neurosurgical Departments.

Results: Over one year period, 549 telematic consultations regarding 464 patients, have been required to our Department: 126 cases were transferred and 93 operated on. Three hundred thirty-eight patients have been managed in the peripheral hospitals. The cost for each patient transfer is about $200 so the global cost saving over one year can be estimated in $67,600. The decreased length of hospital stay in the peripheral hospitals due to the adoption of reliable guidelines over a wide area has to be added to the benefits of the network. Moreover reduction of morbidity related to minor head injury is expected.

Conclusion: DEAnet has led to significant cost saving by more appropriate transfer of head injured patients to neurosurgical units.

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The Role of Anthropometry in the Assessment and Treatment of Craniosynostosis and Deformational Plagiocephaly

Mark R. Proctor, Ram Burvin, John Mulliken

Purpose: In the current era outcome analysis is the ultimate measure of clinical success in all fields of medicine. However, in the specialty of craniofacial disorders there has been little systematic tracking of the results of treatment. This had led to multiple treatments for the same condition, with no ability to compare the efficacy of the various treatments. Methods of analyzing results include CT scanning, cephalometry, photogrammetry, and subjective analysis, all of which have been inconsistently applied. Cranial anthropometry is a well-established methodology to document the results of operative and non-operative treatments of craniofacial disorders. In this presentation the techniques and advantages of anthropometry, as it relates to the neurosurgical treatment of common cranial anomalies, will be reviewed.

Methods: The records of patients with cranial vault anomalies were reviewed to determine how cranial anthropometry is used at our institution for pre- and post-treatment assessment. The usage of the technique intra-operatively for the correction of skull shape towards age appropriate norms is also examined.

Results: Cranial anthropometry is an objective, quantitative, reproducible, and cost-efficient technique that involves no patient exposure to radiation. The established anthropometric norms allow translation of objective measurements into cosmetically acceptable results. The technique is applicable to all forms of craniosynostosis and deformational plagiocephaly. The systematic and objective documentation of outcomes has altered the treatment strategies for various cranial asymmetries at our institution. The intraoperative use of these methods has both objectively and subjectively improved surgical results.

Conclusions: Anthropometry is a safe and effective means of analyzing outcomes of treatment for craniofacial disorders. Systematic usage of this technique will allow for comparison of different treatment algorithms among multiple craniofacial centers, with the goal of standardizing treatment strategies for the care of children with cranial anomalies.

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Delays in the Treatment of Patients with Subarachnoid Hemorrhage

Michael Y. Wang, Steven L. Giannotta

Introduction: Aneurysmal subarachnoid hemorrhage can have devastating consequences, but the early identification of these patients can lead to early interventions to reduce the risks of rebleeding, vasospasm, and increased intracranial pressure. This study examines the characteristics of those patients who had a delay in presentation or transfer to a facility equipped to treat these patients.

Methods: Cases of angiographically documented subarachnoid hemorrhage treated at the Los Angeles County General Hospital were retrospectively reviewed. An interval of three or more days between the onset of hemorrhage symptoms and admission to our hospital was defined as delayed. Case records of the most recent 285 patients with 380 aneurysms treated at the Los Angeles County General Hospital were reviewed. One hundred twenty-two patients (42.8%) experienced a delay in admission. Records were available for 86 patients (70.5%).

Results: Delays in presentation did not differ by ethnicity. Delays were classified as: patient-related (26.7%), delay to obtain an angiogram (19.8%), transportation-related (17.4%), initial misdiagnosis (17.4%), and radiographic misinterpretation (9.3%). Twenty-one presented to an urgent care or outpatient clinic, of which 19 were sent home. Twelve patients made three or more visits to a physician before being diagnosed.

Eighteen patients suffered a re-rupture before admission to our hospital. Nine of these were due to patient delay, with a re-rupture prompting an emergency visit, and four cases were the result of a radiographic misdiagnosis.

Conclusion: Delays in the diagnosis and treatment of aneurysmal subarachnoid hemorrhage are frequent. Increased public awareness of the signs of a "Brain Attack," as well as improved physician education about subarachnoid hemorrhage should reduce delays in consultation and referral.

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Posterior Cervical Foraminotomy. A Follow-Up Study of 67 Surgically Treated Patients with Compressive Radiculopathy

Nedal A. Hejazi, Alfred Witzmann, L. K. H. Feldkirch

Introduction: A retrospective study was conducted on 67 patients who underwent posterior cervical foraminotomy (PCF) for unilateral intraforaminal soft and hard disc disease.

Methods: Neurologic impairment, employment, and severity of associated signs were assessed preoperatively and at a 3.1-year average follow-up (range, 1.5-7 years).

Results: Diminution or complete disappearance of radicular symptomatic was observed in 62 cases (93%), 3 months to 3 years after surgery. Minimal neurologic deficits persisted in 5 cases (7%). Neck pain improved in 62 cases, remained unchanged in three cases, and progressed in two cases with preoperative severe deficits. Fifty-three (79%) patients returned to their previous occupation, only 7 (10%) retired prematurely on the basis of disc disease alone. Based on the functional economic outcome rating scale of Prolo, 60 patients (90%) showed excellent economic outcome. The posterior cervical foraminotomy is an efficient means of decompressing lateral spinal roots compromised by soft disk herniations or osteophytic spurs, without the risk of an anterior approach with or without fusion.

Conclusion: Careful patient selection and microsurgical technique are essential in obtaining consistent, excellent results. The recent trend in Neurosurgery and other specialities toward minimally invasive techniques and key-hole operations favours the posterior approach additionally.

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The Impact of Using the Traumatic Brain Injury Guidelines on Outcomes in a Community Hospital Setting

Sylvain Palmer, Mary Kay Bader, Azhar Quereshi, Jacques J. Palmer, Thomas Shaver, Marcello Borzatta, Commie Stalcup

Introduction: Traumatic brain injury poses a serious public health challenge. Treatmnet pardigns have dramatically shifted with the introduction of the American Association of Neurolocial Surtons Guidelines for the Management of Severe Head Injury, and invasive monitoring of cdrebral metabolism. Implementation fo the guiedlines positively effects patient outcome and can ber successfully intyorduced in a community hospital setting.

Methods: Data was collected both retrospectively and prospectively from the records of 2970 trauma patients. A cohort of 93 patients was selected. Thirty seven patients were treated before the implementaton of the guidelines and these were statistically compared to 56 patients treated after the implementation fo the guidelines.

Results: Implementation of the guidelines resulted in a six times higher odds ratio of a good outcome. A GCS score of greater than eight was associated with a 7.68 times higher odds ratio of a good outcome compared to a GCS score of less than eight. Odds ratio of a good outcome decreased by a factor of 0.92 for each one year increase in age of patients starting at age 9. A dedicated neurotrauma team and comprehensive treatment algorithms are critical elements to this success. Hospital charges increased by more than $86,000 per patient, but are justifiable in the face of significantly improved outcomes.

Conclusion: Implementation of a Traumatic Brain Injury protocol in a community hospital setting is practical and efficacious. Appropriate invasve monitoring of systmic and cerebral parameters guides care decisions. The protocol results in an increase in resource utilization but it also results in statistically improved outcomes justifying the increase in expenditures.

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Increased Perioperative Risk in Obese Patients Undergoing Elective Posterolateral Lumbar Fusions with Pedicle Fixation

Gregory J. Przybylski, Dennis J. Maimam, James P. Hollowell, Sanford Larson

Introduction: Although obesity may increase perioperative risk, several studies have failed to support this assumption. While others have identified more frequent wound infections, greater surgical morbidity and mortality have not been consistently associated with obesity. This study examined a large series of patients undergoing similar surgery to determine whether obesity increases perioperative risk.

Methods: A retrospective review of 250 consecutive patients undergoing elective instrumented posterolateral lumbar fusions was performed. Individual body mass index (BMI) was calculated and patients were compared based on BMI. Anesthesia and hospital records were reviewed. Parameters compared include patient demographics, anesthesia and operative time, estimated blood loss (EBL), fluid replacement, and perioperative complications. Statistical comparison was performed with ANOVA and t-tests using a $p<0.05$ level of significance.

Results: 61 patients in Group1 had a BMI<25, 91 patients in Group2 had a BMI of 25-29, and 98 patients in Group3 had a BMI>30. Group3 required thirty additional minutes of anesthesia time (intubation to extubation) when compared with the others ($p<0.05$). However, this was related to operative time (skin-to-skin) since Group3 similarly required thirty additional minutes of operative time when compared with the others ($p<0.086$). EBL was 700cc greater in Group 3 ($p<0.0064$) and 400cc greater in Group2 ($p<0.089$) when compared with Group1. Likewise, postoperative infections and early postoperative mortality were observed more commonly in Group3 ($p<0.05$).

Conclusions: This represents one of the largest series examining the effects of obesity on operative risk in elective surgery. Elective instrumented posterolateral fusion in obese patients is associated with greater perioperative risk including anesthetic time, EBL, and postoperative infection and mortality. Although similar increased perioperative risk may not occur in other surgery, these increased risk factors should be considered when counseling patients preoperatively and assessing whether to proceed with major elective surgery.

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Neurosurgical Management of Concussions in Rugby Football

Elana Farace, Jeff T. Barth, Donna K. Broshek, Jeff A. Hollier, Kevin B. DeAngelo, Mark E. Shaffrey

Background: Although rugby is a contact sport played without the benefit of helmets, the incidence of concussion is lower than in other sports, including American football and rugby. In concussions, pre-season neurocognitive data is needed for comparison to judge if players are asymptomatic before they are released to return to play. The purpose of this study was to determine the impact of rugby concussions on neurocognitive function in a women's college rugby team.

Methods: Thirty-five players (age=19) were tested pre- and post-season with standard neuropsychological tests of memory and attention.

Results: Pre-season, 6 of the 35 players (17%) reported having had at least one previous concussion, and 16/35 (46%) reported at least one previous instance of loss or alteration of consciousness (AOC). A cross-sectional analysis indicated that players with previous AOC performed significantly worse on measures of attention and memory. Players who sustained a documented concussion during the year were re-tested, along with an age-matched control, within the week following injury and again after three months. Players with new concussion showed significant deficits on tests of memory and attention compared to baseline and matched control's performance. T-1 and diffusion-weighted MRI imaging did not reveal any structural or functional changes in concussed players, even in the face of significant performance declines.

Conclusions: Although the incidence of concussion in rugby is lower than expected, significant neurocognitive sequelae result. Pre-season neuropsychological data is important for proper judgement of cognitive symptomatolgy before making return to play recommendations. Further research is needed to determine differences in the mechanism of injury in rugby vs. American football, as helmet use appears to be correlated with higher incidence of concussion. An analysis of the mechanics of 'textbook' tackles in rugby and football will be presented.

General Scientific Session II

750 CNS Resident Award

Cerebrospinal Fluid Shunt Infection: A Prospective Study of Risk Factors

Abhaya V. Kulkarni, James M. Drake, Maria Lamberti-Pasculli

Introduction: Infection is one of the most devastating complications of CSF shunts, yet the risk factors for its development are not well known. In this study, we prospectively analyzed the peri-operative risk factors for CSF shunt infection in a consecutive cohort of children.

Methods: All CSF shunt operations (insertions and revisions) at the Hospital for Sick Children, Toronto were observed by a research nurse. Several variables were recorded, including the duration and time of day of the operation, the number of persons in the operating room, the lowest body temperature, the presence of holes in surgical gloves, and several other variables. We followed all children post-operatively for 6 months for the development of CSF shunt infection. A Cox proportional hazards model was used to analyze the relationship of the variables to the development of shunt infection.

Results: Of 299 eligible patients, thirty-one (10.4%) developed shunt infection. Only three variables were significantly associated with an increased risk of infection: a) the presence of a post-operative CSF leak (hazard ratio (HR)=19.16, 95% confidence interval (CI)=6.96-52.91); b) prematurity (HR=4.72, 95%CI=1.71-13.06); and c) the number of times the shunt system was touched in the presence of breached surgical gloves (HR=1.07, 95%CI=1.02-1.12). No other variables were significant.

Conclusions: Three significant risk factors for shunt infection have been prospectively identified. Changes in clinical practice should be aimed at addressing these risk factors: a) Great care should be taken intra-operatively to avoid a post-operative CSF leak. b) Alternatives to CSF shunting in premature infants should be studied. c) Surgeons should minimize manual contact with the shunt system and consider the use of double gloves.

Section on Disorders of the Spine & Peripheral Nerves I

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Percutaneous Vertebroplasty for Pain Relief and Spinal Stabilization

John D. Barr, Michelle Barr

Introduction: Pain relief and spinal stabilization were assessed following treatment of vertebral compression fractures and neoplasms by percutaneous vertebroplasty.

Methods: 150 vertebrae in 85 patients were treated with percutaneous vertebroplasty. 74 patients with 133 vertebrae had symptomatic, osteoporotic fractures and had failed medical therapy. 11 patients with 17 vertebrae had primary or metastatic neoplasms. Vertebroplasties were performed using fluoroscopy, combined CT and fluoroscopic guidance, or CT alone. Polymethylmethacrylate cement mixed with barium sulfate to increase radiopacity was injected into the vertebrae. Pain levels were assessed before and after treatment.

Results: Among the 74 patients treated for osteoporotic fractures, almost all rated their pre-operative pain level as a "ten". Following vertebroplasty, 69 patients had significant pain relief and 5 no significant change. Eight patients experienced recurrent painful episodes. In three cases, the new pain was unrelated to vertebroplasty. Four patients had new fractures. One patient developed new radicular pain at the level treated two years after vertebroplasty. Spinal stabilization was achieved in 10 of 11 patients with neoplasms. No further vertebral compression occurred in 10 patients and spinal canal compromise was prevented. 4 of the 5 patients with neoplasms treated primarily for pain had significant pain reduction. The remaining patients were treated primarily for spinal stabilization. Four (5%) patients in our series developed relatively minor complications. One patient developed a transient radicular neuritis. One patient had a urinary tract infection and one had non-bacterial dysuria, both related to urinary catheter placement. One patient developed a transient post-operative fever related to atelectasis.

Discussion/Conclusions: Percutaneous vertebroplasty is a promising new minimally invasive therapy for spinal lesions. Percutaneous vertebroplasty provided significant pain relief in a high percentage of patients with osteoporotic fractures. Percutaneous vertebroplasty provided spinal stabilization in patients with malignancies, but did not produce consistent pain relief. Complications were minor and infrequent.

Section on Disorders of the Spine & Peripheral Nerves I

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Surgical Repair of Brachial Plexus Injury: A Multinational Survey of Experienced Peripheral Nerve Surgeons

John L. Moriarity, Michael Dorsi, Allan J. Belzberg

Introduction: Surgical repair of the brachial plexus is one of the most complex problems facing the peripheral nerve surgeon. The purposes of this study were multiple: 1) to determine what, if any, is the consensus regarding general and specific approaches to brachial plexus repair, 2) to provide the less experienced practitioner with a brief and rapid overview of a variety of brachial plexus injuries and 3) to help define questions for future clinical study by identifying areas in which multiple experts use significantly different approaches to the same injury.

Methods: Literature review and the membership of various professional organizations generated a list of 126 peripheral nerve surgeons. Each received a survey containg a list of general questions and textual/graphical descriptions of four clinical cases (birth related upper plexus palsy, and three adult cases: total, upper and lower plexus avulsion). In total, 49 surgeons (39%) returned completed questionnaires.

Results: As a group, the 49 respondents represented three continents and 22 countries. In response to general issues there was generally good agreement. For example, eighty percent (40/59) of respondents preferred CT myelography to detect preoperative root avulsion while 73% (36/49) of respondents felt that elbow flexion was the most important for motor recovery. We have tabulated and graphically represented the most frequent nerve transfers employed in each of the clinical cases. As will be presented, there was a significant divergence of opinion in each.

Conclusions: Surgical repair of the brachial plexus is a complex problem and not unexpectedly, experienced practitioners often disagree about what if any is the best surgical approach. This study helps to underscore that fact and helps identify areas worthy of future clinical study.

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Progressive Cervical Kyphosis: Management and Outcome in 71 Consecutive Cases

Charles L. Wolff, Michael Kilburn, Thomas Moore, Mark N. Hadley

Introduction: Seventy-one consecutive surgical patients have been studied prospectively to assess the effect of cervical spinal reconstruction in the treatment of progressive kyphotic deformity with neck pain, radiculopathy and/or myelopathy. Follow-up included assessment of neurological symptoms/signs, pain, extent of correction, incidence of fusion/internal fixation success, development of adjacent level disease and the need for further surgery. Mean follow-up was 3.6 years in 69/71 patients.

Methods: Treatment was individualized for each patient. Halo traction was used in 18 patients prior to surgery (mean pre-op angulation -18). 94% were operated upon via a single approach, 66 ventral, 1 dorsal. Four were treated vental and dorsal at same sitting.

Results: 41/43 patients with neck pain improved. Two have chronic pain. One has new onset pain. 40/45 patients with radiculopathy improved. One new C5 radiculopathy (transient). 40/44 patients with myelopathy improved, none worse. Correction improved deformity in all patients (mean pre: -14, mean post: +6.3, mean change +20). Complications (11) from the primary procedure, 5 non-operative. Six required re-operation: 1 CSF leak, 1 strut extrusion, 2 interbody graft collapse/pseudo., 2 required dorsal augmentation of primary ventral procedure. Late complications: 4 have required surgery for adjacent level disease: (2 required adjacent ACDF at 1 and 4 yrs post-op. 2 with spasticity required TX of adjacent level stenosis at 6 and 7 yrs post-op.)

Conclusion: Treatment of symptomatic cervical kyphosis can provide lasting benefit. Pain from deformity and signs of radiculopathy and myelopathy can be improved following successful reconstruction. Patients with greatest pre-op deformities (-15) present greatest challenges and have highest risk of initial treatment failures. They are best treated with traction and fusion with internal fixation. They are most likely to require a combination of procedures. Restoration of sagittal balance with stability following neural decompression is the key to long-term success.

Section on Disorders of the Spine & Peripheral Nerves I

754

Cadaveric Fibula and Locking Cervical Plate in 361 Cases

Scott A. Shapiro, Francesca Tekula, Jill Donnaldson, Raj Bindal, Todd Abel

Introduction and Methods: 361 cases that underwent anterior cervical discectomy or corpectomy with cadaveric fibula fusion(202 with grafton)and internal fixation using the locking cervical plate were compared 10 126 consecutive autologous iliac crest fusions using chi-square analysis.

Results: Pathology in the fibula group included radiculopathy in 183, myelopathy in 130, 24 tumors,9 facet dislocations/disc herniation, 10 burst fractures, 5 autologous iliac crest graft collapse pseudoarthrosis. In the fibula/plate group, there were 157 single level ACD fusions, 110 multi-level ACD fusions, 50 single body corpectomy, 35 multiple body corpectomies and 9 single level ACD fusion with posterior fusion. Peri-operative complications included transient hoarseness in 3 cases, severe airway swelling in 1 burst fracture and 1 graft fracture reoperated. There were no transfusions, infections, neurologic injuries, or deaths. Mean time in the hospital for the non-traumtic cases was 1.1 days. The mean followup is 70 months(6-102 months). Long-term complications include 2 multi-level corpectomy with bent or broken screws (1 reoperated), 2 traumatic plate and/or graft fractures reoperated, and 1 pseudoarthrosis/plate fracture reoperated. At 1 year, there was 99% radiographic fusion, with no motion, no kyphosis, no symptomatic screw plate backout and no progressive fibular graft collapse. Compared to 126 iliac crest fusions, there were fewer graft related complications ($p<0.001$).In the single level ACD there was a greater complete relief of neck pain with fibula/plates as compared to iliac crest ($p<0.02$). Time until return to work was shorter for the fibula/plate group by 5-6 weeks ($p<0.05$). Plate complication due to graft subsidence in multi-level corpectomies was 1/35 (3%).

Conclusion: Cadaveric fibula/locking plate fusion is superior to iliac crest in the first 6 years after any cervical fusion.

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Long-Term Follow-Up of Treated Posttraumatic Syringomyelia: Role of Magnetic Resonance Imaging in the Evaluation of Outcome

Eve C. Tsai, Michael G. Fehlings, Charles Tator

Introduction: We sought to examine the value of magnetic resonance imaging (MRI) in the long-term management of posttraumatic syringomyelia.

Methods: From our syringomyelia database of 141 cases, 25 patients (mean 44 yrs) with posttraumatic syringomyelia and preoperative MRI were assessed to correlate clinical outcome, change in syrinx size, and the need for further surgery.

Results: Initial surgical treatment included: syringopleural (n=12), syringosubarachnoid (n=7) or syringoperitoneal (n=2) shunts, or other (n=4). Mean clinical and MRI follow-up was 3.5 and 3.8 years, respectively. MRI initially showed syrinx size decrease in 18, increase in 2, and no change in 2. Postoperative MRI was not obtained in 3 due to metal artifact or patient refusal. Initial clinical results were improvement or stabilization in 16 and deterioration in 9. Of the 16 with improved or stabilized symptoms, 5 subsequently deteriorated (mean operation to deterioration time 8 months). All 14 patients with deterioration underwent further surgery. The MRI after deterioration or postoperative follow-up showed syrinx enlargement in 8, no change in 1, and a decrease in 3.

Conclusions: Long-term clinical and MRI follow-up are essential in managing posttraumatic syringomyelia. Clinical deterioration may occur despite MRI evidence of cyst decompression suggesting other mechanisms of neural degeneration in these patients.

Section on Disorders of the Spine & Peripheral Nerves I

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Anterior Cervical Microforaminotomy for Cervical Radiculopathy in 161 Patients

Hae-Dong Jho, Woo-Kyung Kim

Objective: A new technique of anterior microforaminotomy was developed and used in 161 patients by the senior author (HD JHO) for the treatment of discogenic cervical radiculopathy. Surgical outcomes are reported.

Materials and methods: Anterior microforaminotomy technique has been used in 161 patients with discogenic cervical radiculopathy at the University of Pittsburgh Medical Center from 1992 to 1999. Eighty-three were men and seventy-eight were women. Age ranged from 26 to 79 years (median 47). Follow-up period ranged six months to seven years (median three years). Postoperatively, all obtained MR scans as well as dynamic lateral-view roentgenograms. Fifteen patients (9.3 %) had undergone previous cervical disc operations at the same operated level.

Results: Pathology was soft disc herniation in 92 patients (57 %), spondylotic spurs in 53 patients (33 %), and combination of both in 16 patients (10 %). No patient showed radiographic evidence of spinal instability postoperatively. Surgical outcomes were excellent in 100 patients (78.1 %), good in 25 patients (19.5 %), fair in 3 patients (2.4 %). Postoperative complications were transient worsening of weakness in two patients, and transient Horner's syndrome in three patients, and discitis in one patient .

Conclusion: Anterior foraminotomy technique provided satisfactory surgical outcomes in 161 patients with cervical discogenic radiculopathy.

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Impacted PLIF: Posterior Lumbar Interbody Fusion with Machined, Pre-sized Allograft

Kevin T. Foley, Thomas T. Lee, Ramesh L. Sahjpaul

Purpose: To assess the utility of impacted, machined allograft for posterior lumbar interbody fusion used in conjunction with laminar autograft and pedicle screw fixation.

Materials and Methods: Thirty-three patients (mean age: 50.5 years) with intractable mechanical low back and radicular pain from spondylolisthesis, post-operative instability, recurrent herniated disc, or lumbar degenerative disc disease were treated. Two pre-sized, machined cortical allografts (Regeneration Technologies, Incorporated) and laminectomy autograft were used for PLIF. Pedicle screw fixation was performed with the titanium TSRH system. Forty levels of impacted PLIF were performed in 33 patients. Mean follow-up was 14.5 months (range: 12-19 months). Radiographs were obtained at 1, 3, 6, and 12 months, then as needed.

Results: No neurological or infectious complications were noted, including no retraction-related radiculopathy. Mean hospital stay was 3.2 days. 29 of 33 patients reported significantly reduced lower back pain. Thirty of 32 patients with radicular pain noted significant improvement. By 6 months, 30 of 33 patients had returned to previous occupation and level of activity. Radiographic fusion was noted in 31 patients (94%), with two patients having partial graft incorporation at the time of most recent follow-up.

Conclusions: Impacted PLIF seems to be effective for relief of mechanical low back and radicular pain associated with several lumbar spine disorders. Fusion rates compare favorably to other procedures. Relatively short hospital stays may be secondary to the avoidance of extensive paraspinous muscle dissection and graft harvesting. Retraction-related radiculopathy is minimized by the narrow width of the implants. Fusion assessment is aided by the lack of metallic interbody devices.

Section on Disorders of the Spine & Peripheral Nerves I

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The Influence of an Artificial Cervical Joint versus Fusion on Adjacent Level Motion in the Treatment of Cervical Disc Disease

Crispin C. Wigfield, James Robertson, Newton Metcalf, Ilana Langdon

Introduction: To compare the influence of an artificial cervical joint against interbody fusion on changes in angulation occuring at adjacent levels in the treatment of degenerative cervical spinal disease.

Method: Comparison of adjacent level cervical vertebral angular displacement taking into consideration the extent of disc degeneration as determined by pre-operative MRI scans.

Subjects: Two cohorts of patients were identified who had either received an artificial cervical joint following single level discectomy (n=12) or an autologous bone graft fusion (n=13).

Outcome measures: Angular measurements at levels adjacent to that undergoing surgery were calculated from plain radiographs taken at 6 monthly intervals. The data obtained was subjected to statistical analysis including FisherÕs exact test.

Results: The fusion group showed a significant increase in adjacent level movement at 12 month follow-up compared to the joint patients ($p < 0.001$). The main increase in movement occurred at discs that were pre-operatively regarded as normal ($p < 0.02$). An overall reduction in adjacent level movement was seen in patients receiving the joint though this was compensated for by movement provided by the artificial joint itself.

Conclusions: Fusion results in increased motion at adjacent levels. The increase in adjacent level motion comes from those discs that appear radiologically normal prior to surgery. Artificial cervical joints may have a protective influence on adjacent spinal levels and are beneficial in preserving motion in the cervical spine.

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PLIF with Allograft Bone: A Comparison of Cylindrical Dowels and Impacted Wedges

Bryan B. Barnes, Mark McLaughlin, Gerald E. Rodts, Jr., Regis W. Haid, Jr.

Objective: The objective of the study was to compare preliminary outcome data and complication rates related to the use of allograft cylinders and impacted wedges for posterior lumbar interbody fusion (PLIF).

Method: We retrospectively reviewed a series of 71 patients who underwent PLIF with allograft bone and supplemental pedicle screw fixation. Outcomes, fusion rates, and complication rates were calculated for 2 groups of patients: those in which cylindrical dowels were used and those who had rectangular impacted wedges placed. Outcomes were asessed using a modified Prolo outcome scale. Osseous union was determined radigraphically using lumbar radiographs and/or computerized tomography.

Results: 33 patients underwent PLIF using cylindrical dowels; there were 38 patients who had rectangular impacted wedges placed. Mean follow-up for the PLIF with cylindrical dowels group was 12 months. Overall fusion rate for the cylindrical dowel group was 95%, with good or excellent outcome in 70% of the patients. Complications included 3 permanent nerve root injuries. The mean follow-up for the group of patients who underwent PLIF with rectangular wedges was 24 weeks. 72% of rectangular wedge patients had good or excellent outcomes. All PLIF with rectangular wedge patients demonstrated early evidence of osseous union. There were no nerve root injuries in the rectangular wedge group. There was a significantly higher incidence of nerve root injuries with cylindrical dowels as compared to rectangular wedges ($p<.05$).

Conclusions: Preliminary outcome data in our series demonstrates a 9% incidence of nerve root injury in patients undergoing PLIF with cylindrical dowels; this represents a statistcally significant difference when comparison is made to those patients undergoing PLIF with rectangular impacted wedges (no nerve root injuries). The authors attribute this difference to the diminished need for nerve root retraction when placing rectangular impacted wedges when compared to cylindrical dowels.

Section on Disorders of the Spine & Peripheral Nerves I

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Polyethylene Glycol in the Treatment of Experimental Spinal Cord Injury

Scott A. Shapiro, Richard Borgens, Riyi Shi, Jill Donnaldson, Todd Able

Introduction: Polyethylene glycol (PEG) is a known membrane fusogen with the potential to seal axonal membrane disruption.

Methods: Strips of isolated guinea pig spinal cord maintained in vitro in a double sucrose gap recording chamber and they conducted normal compound action potentials (CAP) with stimulation. Following sharp transection (n=20) or standarized crush of the mid-cord segment, CAP's were eliminated in all. The faces of the severed segments were pressed together and PEG (MW 1400-3500d) was applied through a micropipette for 2 minutes and to both the severed and crush injuries.

Results: CAP's were immediately restored for both the severed and crushed group in all animals and never in controls ($p<0.001$). Recovered CAP's in the severed group were 5% of preinjury peak amplitude. Histological evidence for membrane fusion was evident on high resolution light and EM and by the diffusion of intracellular fluroscent dyes through fused axons (n=12). The crushed group treated with PEG recovered CAP's significantly greater than controls with 19% of preinjury peak amplitude reached ($p<0.0001$ Student t-test). In vivo guinea pig cord crush injury (n=25) elimimated all CAP's. PEG for 2 minutes led to an immediate recovery of CAP but not in controls. Behavioral recovery of the cutaneous trunchi muscle reflex (CTM) occurred in 80% of the PEG treated group and 0 in the controls ($p<0.005$). Only 14% of controls recovered the CTM by day 4. No control recovered CAP's and 92% of the PEG group recovered CAP's achieving 40% of preinjury peak amplitude nearly immediately ($P<0.005$).

Conclusion: Polyethylene glycol application to both severed and crushed spinal cord axons appears to seal membrane injury of some but not all axons, and allows for the return of conduction thru the injury with measurable physiologic recovery.

Section on Tumors II

761 Mahaley Clinical Research Award

Phase III Multicenter Trial of GLI 328 HSV-Tk Gene Therapy in Newly Diagnosed Glioblastoma Multiforme (GBM)

Ronald E. Warnick, on behalf of the GLI 328 International Study Group

Introduction: GLI 328 is a vector producer cell (VPC) line of murine origin engineered to produce replication-deficient retroviruses carrying the Herpes simplex type 1 thymidine kinase (HSV-Tk) gene.

Methods: Patients with newly diagnosed GBM were randomized to receive standard therapy (maximal tumor resection and 60 Gy radiation) with or without adjuvant gene therapy (intra parenchymal VPC injection at surgery followed by a 14 day course of intravenous ganciclovir beginning two weeks after surgery).

Results: 248 patients entered this multicenter trial, 124 in both arms which were well-balanced for known prognostic factors. The median times to tumor progression and survival were similar in each group (26 and 51 weeks respectively). Serious, immediate postoperative complications were more frequent in the gene therapy arm including postoperative hematoma (7% vs. 1%), thrombo embolism (6% vs. 3%), and a fatal case of infection associated with ganciclovir-induced neutropenia. The overall mortality rate was comparable between the two treatment groups. There was no evidence for the presence of replication-competent retrovirus in peripheral blood samples and autopsy specimens of patients in the experimental arm.

Conclusions: This phase III trial failed to show a survival advantage for gene therapy as an adjuvant to the standard therapy of resection and radiotherapy for GBM. The technique for administering gene therapy was shown to be feasible but associated with a higher incidence of local complications. There was no evidence of recombination events leading to wild-type retrovirus. The reasons for the failure of the study will be discussed with respect to the underlying gene therapy concept; key aspects being the optimization of gene delivery, tumor killing, and immuno inflammatory interactions.

Section on Tumors II

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Analysis of In Vivo Gene Expression Profile of Pituitary Adenomas Using cDNA Microarrays

Prithvi Narayan, Cheng-Orn Evans, A. Young, A. S. Neish, D. J. Brat, M. R. Brown, J. S. Parks, Nelson M. Oyesiku

Introduction: The molecular pathogenesis of the majority of pituitary adenomas is unknown. We have used cDNA microarrays, a powerful new tool for analyzing genes to examine differential in vivo gene expression in adenomas. To the best of our review there are currently no published reports using this technique in adenomas or similar findings.

Methods: The expression of over 7,075 genes was examined in normal pituitary, PRL, GH, ACTH, and non-functional (NF) adenomas. RNA was extracted from tumors taken at surgery. Sequences for GEM Microarray fabrication were generated by PCR and then arrayed by robotics on glass slides. Probes were fluorescently labeled, hybridized and then scanned at 10 microns to detect Cy3 and Cy5 fluorescence providing electronic images with 65,536 color resolution and a 16 color log scale. Images were analyzed by Incyte GEMtoolsä software.

Results: 127 genes including 6 ESTs were differentially expressed (>/< 2-fold). Several genes known to be important in tumorigenesis in other neoplasms were differentially expressed in adenomas. Most interestingly, the folate receptor (+2.5 fold in NF), ornithine decarboxylase (+2.3 fold in GH), c-mer protooncogene tyrosine kinase (+4.8 fold in ACTH), Wilms' tumor suppressor regulated nov gene (+2.4 fold in PRL), and TGFb receptor III (+2.3 fold in PRL, and +2.5 fold in ACTH) were upregulated. Vimentin (-2.9 to -3.7 fold) and spermidine/spermine N1-acetyltransferase (-1.7 to -2.9 fold) were downregulated in all tumors.

Expression of hormone mRNA correlated with immunohistochemistry (FSH, LH, and TSH were strongly downregulated in all; and Pit 1 was upregulated in PRL and GH, and downregulated in ACTH and NF adenomas), providing internal controls.

Conclusion: Our data show that distinct expression profiles can be successfully generated using cDNA microarrays in pituitary adenomas. Some of these differentially expressed genes are involved in oncogenesis and could be key candidates in pituitary tumorigenesis.

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Observer Variability in the Grading of Glioma Specimens Using Standard Grading Systems

Beverly C. Walters, Edward M. Stopa

Introduction: A previous study showed considerable variability in blind interpretation of H&E stained glioma stereotactic biopsies among experienced neuropathologists, without knowledge of the clinical data or access to special stains. The pathologists were asked to use their customary grading scheme. This raised the question of potential improvement in observer agreement by the standardization of the grading scheme. The purpose of this study was to determine if four well-established grading schemes could diminish interobserver and intraobserver disagreement.

Methods: Thirty H&E stained stereotactic biopsies were sent to four experienced neuropathologists along with descriptors of the Kernohan, Ringertz, Mayo-St. Anne, and WHO grading schemes. Observers were asked to grade specimens according to each scheme. Fifteen of the specimens were sent twice. The pathologists were blinded to which these were, and to the ultimate diagnosis of the tumor. Variability was assessed using the Kappa statistic, measuring agreement beyond chance.

Results: Observer reliability was not improved by any of these well known grading systems. In fact, a diminution in agreement occurred when pathologists deviated from their customary grading scheme in an effort to conform to the grading schemes studied. As in our previous study, this was especially true in the intermediate grades, while the most malignant and most benign had the best agreement, although still poor.

Discussion/Conclusion: Randomized controlled trials and non-randomized (Phase I) clinical trials of therapy in primary brain tumors rely upon pathological grading for entry and for stratified analysis. Although our analyses do not duplicate all of the factors taken into consideration during the formulation of a tumor grade, they suggest that there are inherent difficulties in the subjective interpretation of typical grading systems, particularly in the intermediate grades. Furthermore, they suggest that appropriate clinical data and special stains may be required for the accurate diagnosis of cerebral neoplasms.

Section on Tumors II

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Transgenic Mouse Model of Malignant Astrocytoma: Specific Astrocyte Specific Expression of Activated RAS

Abhijit Guha, H. Ding, S. Macmaster, L. Roncari, X. Wu, N. Lau, P. Shannon, D. Gutmann, A. Nagy

Introduction: Based on the known molecular pathogenesis of malignant astrocytomas (GBMs), involving mitogenic signals from wild and mutant epidermal growth factor receptors (EGFR) transduced through activation of the ras pathway, we have used embryonic stem (ES) cell transgenesis to create transgenic mouse models of GBMs. The transgenes are under regulation of the astrocyte specific glial fibrillary acidic protein (GFAP) promoter.

Methods: The GFAP-12VRas transgenic mice developed GFAP positive multifocal astrocytomas postnatally. The tumors were infiltrative, highly cellular with nuclear pleomorphism and high mitotic index, vascular with increased VEGF expression, all features of human GBMs.

Results: Isolated astrocytoma lines were tumorgenic in vitro and in vivo, with sensitivity to farnesyl transferase inhibitors (FTI), similar to human GBMs. Molecular analysis of the astrocytoma cells revealed aberrations similar to human GBMs, including cell cycle regulatory proteins such as p16, p53, PTEN, Rb, EGFR and CDK4.

Conclusion: Therefore, this transgenic mouse GBM model has molecular and pathological similarities to human GBMs, and can serve to increase our understanding of these tumors and also be a better pre-clinical model for testing novel therapeutics agents for this currently terminal human cancer.

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Molecular Cloning, Genomic Structure, Mapping and Mutational Analysis of Human Suppressor of Fused (hSu(fu)), a Candidate Tumour Suppressor Gene for Medullo-blastoma/PNET on Chromosome 10q24.3

Michael D. Taylor, D. Hogg, L. Liu, T. G. Mainprize, S. Scherer, J. Skaug, W. Dura, James R. Rutka

Background: The majority of sporadic medulloblastomas show overactive Shh signaling. Mutations in upstream pathway members including Shh, Patched, and Smoothened have been found in only 20% of medulloblastomas; thus the etiology of overactive Shh signaling in most medulloblastomas is unknown. We hypothesized that downstream inhibitors of Shh identified in Drosophila would be conserved in H. sapiens and might function as tumor suppressor genes.

Methods: Using the NCBI TblastN program we identified a human EST highly homologous to Drosophila su(fu), a downstream inhibitor of hedgehog signaling. We designed nested primers for RACE on a human fetal brain library. Race clones were used to screen the Roswell Park Cancer Institute BAC Library. BACs were subcloned into pBluescript, subclones were screened by PCR and sequenced to determine the genomic structure and exon/intron boundries. RT-PCR of hSu(fu) was performed in 30 MB to determine expression patterns. Mutational analysis was performed by ampification of exons with surrounding intronic sequences followed by direct sequencing.

Results: We identified a human cDNA with high homology to Drosophila su(fu). A genomic screen identified two BACs, 124G18 and 2F13 that contain genomic hSu(fu). hSu(fu) has 12 exons and maps to chromosome 10q24.3, a locus that frequently shows loss of heterozygosity in MB. hSu(fu) is expressed in medulloblastomas. A truncating mutation with loss of the wild type allele was found in one MB and was not observed in corresponding germline DNA.

Conclusions: We have cloned a novel human cDNA for a gene in the Shh pathway and determined its genomic structure. The finding of a somatic, truncating mutation with loss of the wild-type allele in a gene that maps to a region known to show LOH in MB suggests that hSu(fu) is a tumour suppressor gene for MB.

Section on Tumors II

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Identification and Characterization of VASP, a Motility-Related Gene with Aberrant Expression in Glioblastoma

Gregory D. Foltz, Abel Jarell, Jim Schuster, Masazumi Matsumura, Lindi Farrell, Peter Nelson, Dan Silbergeld

Objective: Increased motility is a hallmark of malignant glioma invasion that leads to poor prognosis. Identification of genes associated with increased motility is critical for understanding the molecular basis of this biologic behavior. High-throughput cDNA microarray technology is a powerful new technology useful for comprehensive screening of tumor-related genes.

Methods: Subpopulations of human glioblastoma cells were selected using the radial dish assay to isolate highly motile astrocytes (HMA). Fluorescently labelled cDNA probes derived from HMA, and from the original unselected cell population (controls), were cohybridized to a cDNA microarray constructed from 9000 nonredundant ESTs selected from multiple human tumors and normal tissues. Increased vasodilator-stimulated phosphoprotein (VASP) expression was confirmed by Northern Blot analysis. A monoclonal antibody was used to characterize VASP expression by Western Blot and single-cell immunofluorescence.

Results: cDNA microarray results revealed seven genes with consistently increased expression in HMA relative to controls. VASP exhibited the highest level of expression with a 3-4 fold increase. Three genes were down-regulated. Tumor specific expression of VASP was confirmed by Northern and Western Blot analyses, comparing different pairs of tumor (3/3) vs. margin (0/3), glioblastomas (5/5) and normal brain (0/2). Single cell immunofluorescence confirmed the localization of VASP to cell processes and cytoskeleton in cultured malignant human astrocytes.

Conclusions: VASP was recently identified as a key component of filopodia extension during cell migration, cytoskeletal related signal transduction, and cell-cell adhesion. Aberrant increased expression of this motility-related gene in malignant human gliomas provides a potential tumor cell marker and therapeutic target.

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cDNA Microarray Hybridization Analysis of Invasive Versus Non-Invasive Pituitary Tumors

Linda M. Liau, Daniel F. Kelly, Thomas Kremens, Bethsabe Romero, Stanley F. Nelson, M. Beatriz Lopes, Edward R. Laws, Jr.

Introduction: Although the majority of pituitary tumors are non-invasive and remain benign, a proportion will exhibit invasive behavior. To gain insight into which genes may be involved in the invasive phenotype of pituitary tumorigenesis, we examined 21 pituitary neoplasms using an 18,000-gene cDNA microarray.

Methods: Ten pituitary tumors were designated as "invasive" and 11 as "non-invasive" based on imaging studies and clinical behavior. cDNA made from pooled mRNA generated from the 10 invasive tumors were labeled with the fluorescent dye Cy5 (red); cDNA samples from pooled mRNA the 11 non-invasive adenomas were labeled with a second fluorescent dye, Cy3 (green). Using a high-throughput arrayer, we determined the relative abundance of 18,000 genes in invasive versus non-invasive groups using a custom-built two-color laser scanning fluorimeter.

Results: Seventeen genes (7 known and 10 ESTs) were found to be differentially overexpressed in the invasive tumors, while twenty-eight clones (12 known and 16 ESTs) were more prevalent in the non-invasive group. Of the genes found to be differentially expressed in invasive pituitary tumors, one encodes for a regulator of pituitary cell type differentiation (DSIP), one is involved in vascular proliferation (Tissue Factor), one stimulates tumor cell motility (autotaxin), and one is a cell adhesion molecule (selectin P). Western blot analysis and RT-PCR confirmed the differential expression of these genes in invasive pituitary tumors.

Conclusion: We have identified some potentially interesting and previously undescribed genes that are putatively involved in the invasive phenotype and malignant progression of pituitary tumors. Further studies of these genes may be helpful in understanding the molecular tumorigenesis and prognosis of these neoplasms.

Section on Tumors II

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Paclitaxel: Polilactofate Microspheres Versus 9L Gliosarcoma: Efficacy, Toxicity, Pharmacology

Kevin A. Walter, Khan Li, Wenbin Dang, Greg Troiano, Betty Tyler, Henry Brem

Introduction: Paclitaxel is a microtubule-binding agent with potent activity versus glioma in vitro, but which has had minimal efficacy in clinical trials [NABTT]. To improve the efficacy of paclitaxel we have incorporated it into a polyphosphoester [PPE] polilactofate microsphere matrix and evaluated the formulation as a controlled-release therapy for glioma in an animal model.

Methods: Paclimer (10% paclitaxel in polilactofate microspheres) was synthesized by co-emulsion of polymer and paclitaxel in polyvinylalcohol [PVA]. Paclimer was mixed with polyethylene glycol [PEG-1000] 50% w/w and pressed into 10 mg discs. Toxicity, efficacy, and biodistribution studies were performed in Fischer 344 rats.

Results: Rats receiving intracranial Paclimer implants exhibited normal behavior and weight gain. A cohort of seven animals was alive at 25 weeks post implantation without sequelae. Histology performed at days 7, 14, 30 and 100 days post-implant revealed astrocytes in arrested mitosis within 1 cm the implant site. Astrocytes in more distant areas of the brain were normal. An acute neutrophil and subacute/chronic macrophage response was elicited which was similar in intensity to polycarboxypropane-sebacic acid [PCPP-SA, Gliadel]. Animals with established 9L intracranial gliosarcomas, treated with Paclimer microspheres showed improved survival versus control animals. Median survivals = 35 days, Paclimer, n=10; 16 days, blank microspheres, n=10, $p<0.0001$, Kaplan-Meier method. Mathematical modeling of paclitaxel diffusion into brain cortex and biodistribution studies performed in cynomologous monkeys confirm that Paclitaxel is capable of penetrating 4-5 cm from a biodegradable implant at a log higher concentration than the LD90 for Paclitaxel versus glioma cell lines.

Conclusion: Studies with 3H-paclitaxel in the rat model confirm delivery of cytotoxic concentrations of paclitaxel to the periphery. Paclimer has recently been entered in clinical trials for ovarian cancer and a phase I trial against malignant brain tumors is planned.

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Imaging Convection-Enhanced Delivery (CED) in the Primate Brain Using CT and MRI Surrogate Tracers

Tung T. Nguyen, Yashdip Pannu, Cynthia Sung, Robert Dedrick, Martin Brechbiel, Kayhan Garmestani, Markus Beitzel, Alex Yordanov, Edward H. Oldfield

Introduction: The utility of delivery of macromolecules by CED would be enhanced by the ability to visualize distributions of the infusions in real time and to measure reliably, accurately, and non-invasively in vivo concentration. This would permit analysis of dose-dependent efficacy and toxicity of therapeutic compounds.

Methods: We synthesized albumin-linked tracers (albumin-iopanoic acid and albumin-gadolinium-DTPA) for use as surrogate tracers during interstitial CED. Volumes of 130ul, 200ul and 235ul of albumin-IPA and 130ul, 180ul and 235ul of albumin-(Gd-DTPA) were co-infused with C14-albumin into the putamen of rhesus monkey (N=6) by convection. Following infusion, the animals were scanned and sacrificed and their brains were harvested for quantitative autoradiography (QAR). The CT and MRI volumes of distribution (Vd) were compared to the Vd of 14C-albumin by QAR. Analysis of concentration was also performed. Neurotoxicity of the tracers was studied in rats.

Results: The distributions of the surrogate tracers were clearly seen on CT and MRI. The shapes of imaged volumes were identical to those seen on QAR. The contrast and radioactivity of the volumes were homogeneously distributed with "square wave" line profiles. With CT the slope of the Vd versus volume of infusion (Vi) plot was 2.83 and 4.68 using two different methods, compared to 4.27 using quantitative autoradiography. For MRI, the Vd/Vi slope was 4.07 and 3.95 using two different methods, compared to 4.62 with QAR. Tissue concentrations of albumin-IPA in individual pixels can be determined from Hounsfield units on CT scanning. No neurotoxicity was noted in rats 1 mo. after infusion.

Discussion/Conclusion: We synthesized macromolecular surrogate tracers that can be used to accurately monitor CED in real-time. Non-invasive measurement of concentration is possible and neurotoxicity did not occur with the tracers. These surrogate tracers should enhance the utility of CED in the brain.

Section on Tumors II

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Surgery of the Third Ventricle: Technical Considerations

Basant K. Misra

Introduction: The purpose of this presentation is to highlight the lessons learnt from operating on anterior third ventricular tumours over the last 13 years through a limited transcallosal approach and enumerate the various modification for safe surgery.

Methods: One hundred and four patients with anterior and mid third ventricular lesions were operated by the author between 1987 and June 1999 through a limited anterior transcallosal section. There were 21 malignant tumours and 83 benign lesion: 70 colloid cysts, 2 each of craniopharyngioma, meningioma, arachnoid cyst, cavernoma and 5 other lesions.

Results: Following lateral ventricular entry, the transforaminal route was preferred and utilized in 76 cases. The other routes to 3rd ventricle: interfornicial (21 cases) and subchoroidal (2 cases) were used only if the lesion presented in these potential spaces rather than at the foramen of Monro. This concept of choosing the least invasive way led to the development of a new approach by the author: the «subfornicial - suprachoroidal» approach where the potential corridor between the body of the formix and choroidal fissure was developed to reach the lesion. No veins were sacrificed. This approach has been used with excellent outcome in 5 cases. There was one mortality in this series of 104 cases.

Discussion & Conclusion: Based on this experience the author makes the following recommendations for optimal outcome with minimal invasion. A linear midline skin incision (instead of a flap), right parasagittal pericoronal craniotomy (even when the lesion is presenting on the left foramen of Monro), communicating the lateral ventricles through the roof rather than through the septum are preferred. A longish bone window is better so that appropriate corridor can be chosen in an area with no veins. The don'ts are: coagulating cortical veins even anterior to coronal suture, incising any margin of foramen of Monro, handling both fornices, excessive coagulation of ependyma and free cottonoids in the ventricle. These steps evolved over the years, towards safe third ventricular surgery, will be demonstrated.

Section on Stereotactic and Functional Surgery II

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Preliminary Analysis of RTOG 9508: A Phase III Prospective Randomized Trial Comparing Whole Brain Irradiation Alone vs. Whole Brain Irradiation Plus Stereotactic Radiosurgery for Patients with Two or Three Brain Metastases

David W. Andrews, Charles Scott, Paul Sperduto, Michael Schell, Maria Werner-Wasik, William R. Demas, Janice K. Ryu, James Fontanesi, Marvin Rotman, Walter J. Curran

Purpose: To compare survival, local control, toxicity, cause of death and quality-of-life in patients with two or three brain metastases treated with whole brain radiation (WBRT) plus stereotactic radiosurgery (SRS) (Group 1) versus WBRT alone (Group 2).

Methods: Study design involved multi-institutional prospective randomization into two groups, Group 1 receiving 37.5 Gy WBRT in 15 fractions followed by SRS, and Group 2 receiving 37.5 Gy WBRT alone. Eligibility stipulated stable systemic disease and MRI scan with up to three brain metastases each within size constraints. Melanoma, hypernephroma and CNS lymphoma were excluded. Mini-mental status exams, Karnofsky Performance Status (KPS) and steroid requirements were monitored.

Results: Between 3/96 and 5/99 144 patients were randomized at 26 RTOG institutions, with data currently complete for 139. Patient characteristics and accrual were balanced between groups, with 69 patients accruing to Group 1 and 70 to Group 2. There were no grade 4 or 5 toxicities in either group, and rates were 4% and 0%, and 5% and 2% for acute and delayed grade 3 toxicities in Groups 1 and 2, respectively. There was no significant difference in overall survival between the two groups with median survival times of 5.3 and 6.7 months, for Groups 1 and 2, respectively ($p=0.59$). This remained true when both Groups were analyzed by recursive partitioning analysis (RPA class 1 or 2), KPS (70-80 v. 90-100), age, systemic tumor control, histology, or number of organs involved. Brain metastases control rates were not significantly different when reported by institution.

Conclusion: There is no survival advantage in patients with 2 or 3 metastases when SRS is added to WBRT at initial therapy. Brain metastases tumor control and quality-of-life data remain to be analyzed in central review. RTOG 9508 remains open for accrual of single brain metastasis patients.

Section on Stereotactic and Functional Surgery II

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Fractionated Stereotactic Radiotherapy for Acoustic Neuromas

Jeffery A. Williams

Introduction: Compared to radiosurgery, fractionated stereotactic radiotherapy (FSR) for acoustic neuromas (AN) allows higher tumor dose (Gy) and spares facial and auditory function.

Methods: Over the past 5 years 120 consecutive patients (pts) had FSR for AN. Eighty pts (45 M; 35 F) (Age 56.8 +/- 1.7 y) have follow-up > 6 months and are described. Prior to FSR the speech reception threshold (SRT) (dB) was higher (47.0 +/- 3.9 vs. 17.0 +/- 2.6 ($p<0.001$)) and the speech discrimination (SD) (%) was lower (69.1 +/- 3.6 vs. 93.0 +/- 2.5 ($P<0.001$)), for treated vs. opposite sides. For simulation pts had non-invasive, repeat fixation and enhanced spiral CT. Disparate collimators and arc weightings achieved conformality for the prescription isodose (80%) given via the LINAC (10 MeV). For FSR 70 pts had 5 daily fractions (25 Gy total) and 10 pts had 10 fractions (30 Gy total). To spare facial and auditory function for larger AN, fractions were smaller (3 Gy vs. 5 Gy)for the 30 Gy vs. 25 Gy regimens. Volumes (cc) of AN were larger for the 30 Gy vs. 25 Gy FSR: 8.52 +/- 1.37 vs. 1.31 +/- 0.23 $p < 0.001$). The clinical follow-up is 1.1 +/- 0.11 y (0.53 - 4.6 y).

Results: After FSR hearing was preserved: After FSR (mean 1.1 +/- 0.23 years) the speech reception threshold (dB) was (44.2 +/- 4.7 and the speech discrimination (%) was 55.4 +/- 4.6 (both NS vs. before FSR). MRI enhancement decreased in 36 of 80 AN (30 of 70 vs. 6 of 10 pts for 25 Gy vs. 30 Gy). Volume decreased 18% (3%-50%) in 31 of 80 AN (20% for 25 of 70 having 25 Gy; 11% for 6 of 10 having 30 Gy (NS). No tumor increased and no patient had facial weakness.

Conclusion: These results show that FSR for AN may both spare normal function and provide durable control.

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Borders Localization In Microelectrode-Guided Posteroventral Pallidotomy

Gao Guodong, Zhang Hua, Zhao Zhenwei, Li Young-Lin, Wang Xualian

Objective: To explore the application of border localization in microelectrode-guided pallindotomy by microelectrode mapping techniques, the authors of this paper introduced the techniques of using microelectrode to recognize the borders of posteroventral pallindum and its surrounding anatomical structures, and easily and effectively to localize the optimal target in pallindum.

Methods: Making use of the structures in the posterventral pallidum that can be used in microelectrode localization procedures, the authors first identified the original target by computer tomographic (CT) scanning, which would be later modified by intraoperative microelectrode localization. The borders of the posterventral pallidum were mapped out by microelectrode recording techniques and then the results of the microelectrode mapping were analyzed to identify the final target by the anatomical characters of posterventral pallidum. After the localization, lesions were made in the target region.

Results: In the total 900 patients treated in this way, 886 (98.4%) patients had no localization-related complications, and only four patients (0.44%) suffered visual field deficit and ten patients (1.11%) suffered facial/limb weakness (7 facial weakness and 3 limb weakness).

Conclusion: The methods described in the paper and safe and precise in target localization in microelectrode-guided posterventral pallindotomy, which makes the operation easy and less prone to complications.

Section on Stereotactic and Functional Surgery II

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Selection of Functional Hemispherectomy Techniques Based on Patient Pathology: A Retrospective Review of Forty-five Patients Treated with Functional Hemispherectomy at the Cleveland Clinic Foundation

Sin-Soo Jeun, James J. Evans, Eldad Hadar, William E. Bingaman

Introduction: Rasmussen introduced the functional hemispherectomy to avoid late complications of anatomic hemispherectomy. Various modified techniques for functional hemispherectomy have been developed by other surgeons, such as Delalande, Villemure, and Schramm. These techniques include hemispherotomy, modified functional hemispherectomy, hemispherical deafferentiation, and peri-insular hemispherectomy. In this report we describe the surgical anatomy of these techniques and the specific indications of each technique, which depend on the underlying pathology.

Method: We performed a retrospective clinical analysis of 45 functional hemispherectomies performed at Cleveland Clinic Foundation between 1990 and 1999. The etiologies included: perinatal infarction (PNI), 14 patients; malformation of cortical development/ hemimegalencephaly (MCD/H), 13 patients; Sturge-Weber disease (SWD), 7 patients; Rasmussen's encephalitis (RE), 5 patients; and other, 6 patients.

Results: The classic functional hemispherectomy (Rasmussen-type) was used for ten patients (6 with MCD/H, 1 with SWD, 1with RE, 2 with PNI). The modified functional hemispherectomy was used for twenty-nine patients (7 with MCD/H, 5 with SWD, 4 with RE, 7 with PNI). The peri-insular hemispherectomy was used for six patients (5 with PNI, 1 with SWD). There was no surgical mortality and the surgical complications are discussed. Outcome was 76% of Engel IA (34/45), 7% of Engel II (3/45), 13% of Engel III (6/45) and 4% of Engel IV (2/45).

Conclusion: Selection of the appropriate method of functional hemispherectomy, when based on patient pathology, can lead to good seizure outcome in the majority cases. In particular, we recommend classic functional hemispherectomy for MCD/H and peri-insular hemispherectomy for perinatal infarction.

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A Proposed Grading System to Predict Outcomes After Arteriovenous Malformation Radiosurgery

Bruce E. Pollock, John C. Flickinger

Introduction: Grading scales designed to predict patient outcomes after surgical resection of AVMs have proven unreliable for radiosurgery.

Methods: An AVM radiosurgery grading system was developed based on the multivariate analysis of 220 consectutive patients with angiographic follow-up treated between 1987 and 1991 (Group 1). The grading system was tested on a separate group of 124 consecutive patients with angiographic follow-up treated between 1990 and 1996 at a different center (Group 2).

Results: The dependent variable in the analysis was excellent patient outcomes (complete AVM obliteration without new neurologic deficit). One hundred twenty-one of 220 Group 1 patients (55%) had an excellent outcome. Five variables correlated with excellent outcomes: AVM volume (P=0.001), age (P<0.001), location (P<0.001), no prior embolization ((P=0.02), and number of draining veins (P<0.001). Regression analysis modeling permitted the removal of two significant variables (prior embolization, number of draining veins), resulting in the following equation: AVM score=(0.1)(volume,cc)+(0.02)(age,yrs)+(0.3)(location;frontal/ parietal=0,temporal/occipital/cerebellar=1,basal ganglia/thalamus/brainstem=2). Seventy-three of 124 Group 2 patients (59%) had excellent outcomes. All variables in the model remained significant for Group 2 patients: volume (P=0.01), age (P=0.01), and location (P<0.001). Testing of the grading system on Group 2 patients showed the AVM score predicted patient outcomes after radiosurgery (P<0.0001). All patients with an AVM score < 0.9 had excellent outcomes compared to 35% of patients with an AVM score > 2.0.

Conclusions: The AVM grading system strongly correlated with patient outcomes after single-session radiosurgery for both patient groups despite significant differences in preoperative patient characteristicas and dose prescription guidelines at the two centers. Although prospective verification of this model is needed, use of this AVM grading system permits more accurate predictions of patient outcomes after AVM radiosurgery.

Section on Stereotactic and Functional Surgery II

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The Effect of Deep Brain Stimulation on the Concentration of Amino Acid Neurotransmitters in a Rat Model of Parkinson's Disease

Richard K. Simpson, Wen Huang

Introduction: Deep brain stimulation has been shown to modify the symptoms of Parkinson's disease. The mechanism underlying this effect remains largely unknown. A direct electrical influence is highly likely. However, a change in the neurochemistry of the structures involved is also possible. The present study examined the effect of deep brain stimulation of rats on the neurochemical environment of basal ganglia associated with Parkinson's disease using microdialysis.

Methods: Male Sprague-Dawley rats were treated with 6-hydroxydopamine and identified using apomorphine. A microdialysis probe (100,000 daltons) was placed in either the globus pallidus or substantia nigra. Unipolar stimulation (cathode) of the subthalamic nucleus was achieved using 0.25 mm needle electrodes at 150 Hz, for 100 usec duration, and 1-3 mA. Dialysis samples were obtained as a 1 hour control, then hourly for three hours of continuous stimulation, followed by a 1 hour no stimulation post-recovery sample. Amino acids studied were glycine and glutamate using HPLC.

Results: Rats subjected to 6-hydroxydopamine showed that glutamate concentrations within the substantia nigra were significantly elevated in only the post-recovery phase. Likewise glutamate was significantly elevated within the globus pallidus only during early stimulation. Glycine concentrations were dramatically elevated in the globus pallidus during the entire stimulation period (26.0+/-4.0 vs. 5.1+/-0.9 mgr/ml after 2 hours) and distinctly low in the substantia nigra (3.0+/-0.7 vs. 20.4+/-1.8 mgr/ml after 2 hours), compared to controls.

Conclusion: Increased amounts of glycine within the globus pallidus during subthalamic nucleus stimulation suggests that the mechanism of deep brain stimulation may be, in part, by inhibitory amino acid neurotransmitter modulation.

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Chronic GPi Stimulation for Treatment of Cervical Dystonia and Choreoathetotic Head Movements

Joachim K. Krauss, Thomas J. Loher, Thomas Pohle, Sabine Weber, Jean-Marc Burgunder

Introduction: Treatment of patients with cervical dystonia (CD)who do not benefit from medical treatment or local botulinum toxin injection is challenging. Pallidotomy has been described to relieve generalized or hemidystonia. Deep brain stimulation (DBS) is an alternative to lesioning. In this prospective study we have investigated the effect of pallidal DBS for treatment of CD and choreoathetotic head movements.

Methods: Eight patients with a history of chronic dystonia were included. Four patients with pure cervical dystonia were assessed with the modified Toronto Western Spasmodic Torticollis Rating Scale (TWSTRS). Two patients had marked retrocollis, and two suffered from pronounced lateral and sagittal shift. One patient presented with an unusual phasic type of CD. In three other patients with severe and rapidly progressive cervical myelopathy secondary to the underlying movement disorder pallidal DBS was used as an adjunct to spinal surgery. Two of these patients presented with choreoathetotic head movements due to infantile cerebral palsy and one patient had generalized dystonia with marked CD. Targets were defined by stereotactic CT and microelectrode recording. All patients except one underwent simultaneous bilateral surgery.

Results: In all patients dystonia improved with a delay. No surgically-related complications occurred. There were highly significant improvements of the TWSTRS subscores for total severity, pain and functional disability at a mean follow-up of 15 months. There was also a marked amelioration of choreoathetotic head movements which, however, was less dramatic than improvement of CD. At a mean follow-up of 12 months the symptoms secondary to cervical myelopathy were stabilized as compared to preoperatively in those three patients who underwent spinal surgery including multilevel cervical laminectomies and corporectomies.

Discussion/Conclusion: Pallidal DBS is effective in complex CD and it may be used as an adjunct in patients with choreoathetotic head movements who undergo spinal surgery for treatment of cervical myelopathy.

Section on Stereotactic and Functional Surgery II

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Clinical Implementation of Robotic Open Neurosurgery: The Beginning of a New Era

Lucia Zamorano, Ramiro Perez-de la Torre, Esam Elkhatib, Abhilash Pandya, Qing Hang Li

Introduction: To describe the new application of robotic open neurosurgery in the standard surgical cases and to report morbidity.

Material and methods: We present our initial experience with NeuroMate(TM) System ISS (Integrated Surgical Systems, Davis, CA) adapted to standard open neurosurgical procedures. It consists of a robotic arm assembly and a PC-based positioning system. The extensive capabilities permit frame and frameless approaches. The localizing unit consists of an implantable base that allows the insertion of different helicopter-shaped devices. They include CT or MRI imaging localizers and an intra-operative localizer. Registration can be achieved in two different ways: a) using a stereotactic head ring and the corresponding localizer or b) using the frameless helicopter localizing unit. The intra-operative localizer consists of 4 microphones mounted in the helicopter shaped device and a similar helicopter mounted in the distal end of the robot that consists of 4 sonic emitters. NeuroMate automatically and accurately ensures the correct stereotactic angular and spatial positioning of surgical instruments, thereby reducing potential human errors.

Results: There were 15 patients operated on, including 6 stereotactic ventriculoperitoneal shunts placement, 5 craniotomies for tumor resection, 3 radioactive implant placement and 1 case of stereotactic biopsy. No complications were reported associated with its application. In all cases there was a very fast intra-operative registration and high degree of accuracy.

Conclusions: Robotic neurosurgery is a new and promising field to be challenged in the next century specially for its fast intraoperative registration and optimal localization.

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Use of a Near-Infrared Intracranial Probe for Localization During Stereotactic Surgery for Movement Disorders

Cole A. Giller, Maureen Johns, Hanli Liu, Richard Dewey, Padraig O'Suilleabhain

Introduction: We report the use of a near-infrared probe to distinguish gray-white tissue boundaries to provide localization during stereotactic surgery. Device. A 1.1 mm diameter probe was constructed having at its tip a near-infrared emitter and 6 detectors. The probe traverses a stereotactic holder to record light absorption at 500 to 1000 nm. The slope of the final segment of the absorption curve was computed as the "NIR index".

Methods: 39 subjects were studied with IRB approval during temporal lobectomy (3) or stereotactic surgery (36). Measurements were obtained every 1 mm from the cortical surface.

Results: Index values were obtained from gray and white matter of the resection bed and the specimen of the 3 lobectomies. The values from white matter were significantly higher than those from gray (2.56 + 0.37 vs. 0.82 + 0.23, SD, $p<0.001$). These results were previously reported. In the 44 stereotactic tracks, depths of structures were measured from MRI and CT scans and compared to depth measured by the NIR index. Differences in the near-infrared index allowed identification of the cortical gray-white junctions, adjacent sulci, centrum semiovale, caudate nucleus, ventricle, white matter capsule superior to thalamus, thalamus, putamen and globus pallidus. The internal medullary lamina of the globus pallidus could be detected in some cases. In our one electrode implantation into the subthalamic nucleus, the substantia nigra was easily detected as a sharp drop in the NIR index. There was no related morbidity.

Discussion: This index distinguishes white and gray matter with a resolution of 1 mm. The technique is extremely easy in practice and the equipment is inexpensive (about $4000). Future studies will address potential to guide stereotactic surgery.

Section on Stereotactic and Functional Surgery II

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Deep Brain Stimulation of the Subthalamic Nucleus for Parkinson's Disease: Technical Approach and MRI-Verified Lead Location in 44 Implants

Philip A. Starr, Chadwick Christine, Deborah Byrd, Nadja Lindsey, William Marks Jr.

Introduction: Deep brain stimulation (DBS) of the subthalamic nucleus (STN) is an emerging technique for the treatment of Parkinson's disease (PD). We report our technical approach and the lead locations as measured on postoperative MR scans.

Methods: 44 quadripolar DBS leads (Medtronic model 3387) were implanted in 31 PD patients. Surgical method included: MR-based stereotaxy using T2-weighted fast spin echo imaging, microelectrode recording (2-5 penetrations), and intraoperative test stimulation through the DBS lead in bipolar mode, contacts 2 and 1, 60 microseconds, 185 Hz, 0-10 Volts. Lead location was measured on postoperative MR (T-2 weighted FSE imaging).

Results: On stereotactic MR scans in the coronal plane, the STN was visualized as a signal hypointensity lateral to the red nucleus. The center of the nucleus with respect to the midcommisurral point was: 2-5 mm posterior, 11-13 mm lateral, and 3-6 mm inferior. In all cases, the STN was recognized electrophysiologically as a region of densely packed cells discharging in an irregular pattern at a frequency of 20-60 Hz. In all but two cases, cells responsive to passive limb movements were identified in STN. Side effects from intraoperative test simulation included dysarthria, contralateral paresthesias, and diplopia. Post operative MR showed that the coordinates of the contact array center, with respect to the midcommissural point, ranged from: Lateral 9.5-13.5 mm, Vertical -3 to -6 mm, and AP -1 to -5 mm (within STN in all cases). MRI showed no hemorrhages. Mean improvement in motor UPDRS scores off medications for the first 16 unilateral implants at 3 months was 21%.

Conclusions: Using the above described technical approach to STN-DBS, postoperative MRI documented that DBS electrodes were placed into the STN in all 44 cases, with a hemorrhage rate of zero.

Section on Pediatric Neurosurgery I

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Vagal Nerve Stimulation in Children With Medically Refractory Epilepsy

Ravish V. Patwardhan, Martina Bebin, Jan Mathisen, Paul A. Grabb

Objective: The effects of vagal nerve stimulation (VNS) in children with medically refractory epilepsy upon their seizure frequency and quality of life were analyzed retrospectively.

Methods: Thirty-eight children ages 11 months to 16 years were implanted with vagal nerve stimulators. Age of seizure onset, duration of epilepsy, and seizure type and frequency were recorded preoperatively. Age, length of follow-up,and seizure type and frequency were recorded postoperatively. Change in quality of life (QOL) was assessed by the caretakers on a scale of negative (much worse) to positive 1 (much improved).

Results: Median follow-up was 9 months (range 7 to 15 months). 10,14,7,and 7 children had a greater than 90% reduction, a 50 to 90% reduction, less than 50% reduction, and no reduction in seizure frequency, respectively. Seizure frequency was reduced by 76%, 63%, 44%, and 42% in atonic, absence, complex partial, and generalized tonic-clonic seizures, respectively. The mean QOL score was 0.61 with 86% children being scored at 0.5 or greater. VNS of greater than 6 months was associated with greater seizure reduction (p equal 0.05) and higher QOL score (p less than 0.01). Seizure reduction was greater in children with onset of epilepsy beyond one-year of age (p less than 0.05). The age of the child and duration of epilepsy were not associated with the degree of seizure reduction.

Conclusion: VNS provided greater than 50% seizure reduction in 24 of 38 children (63 percent). VNS for six months or greater and onset of epilepsy beyond one-year of age were associated with a more favorable response to VNS. Atonic seizures were the most responsive seizure type to VNS. Quality of life was improved in the majority of children with VNS.

Section on Pediatric Neurosurgery I

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Radiosurgery for Childhood Intracranial Arteriovenous Malformations

Elad I. Levy, Ajay Niranjan, Todd P. Thompson, Alan M. Scarrow, Douglas S. Kondziolka, John C. Flickinger, L. Dade Lunsford

Introduction: The optimum management of intracranial arteriovenous malformations (AVMs) in children remains controversial. Children with intracranial AVMs present a special challenge to therapeutic decision making because of the early recognition of future life-long risk of hemorrhage, if managed conservatively. The goals of radiosurgery are to achieve complete AVM obliteration and to preserve neurological function. We present long-term outcomes in a series of children managed by radiosurgery.

Method: Fifty-three consecutive children with a minimum 36-month imaging follow-up after radiosurgery were reviewed. The median age at treatment was 12 years (range, 2-17). Thirty-one children (58%) presented after their first intracranial hemorrhage, two (4%) after a second hemorrhage and one (2%) after five bleeds. Nineteen children (36%) presented with unruptured AVMs and a total of 25 children (47%) had neurological deficits. AVMs were graded as Spetzler-Martin Grade I (2%), Grade II (23%), Grade III (36%), Grade IV (9%), and Grade VI (30%). Median AVM volume was 1.7 ml (range, 0.11-10.2). Median margin dose was 20 Gy (range, 15-25).

Results: Results were stratified by AVM volumes: <3ml (Group I), >3ml to < 10ml (Group II) and > 10 ml (group III). Twenty-eight patients (80%) in Group I and 11 (64.7%) in Group II achieved complete obliteration. The only patient in group III did not obliterate. Complications included brain stem edema (n=1) and transient pulmonary edema (n=1). Four patients had hemorrhages at 30, 40, 84, and 96 months post radiosurgery. Multivariate logistic regression analysis demonstrated that only volume significantly correlated with obliteration rates (p= 0.0109).

Conclusion: Radiosurgery is safe and efficacious for selected children with AVMs. The obliteration rates and the attendant low morbidity indicate a primary role for stereotactic radiosurgey for pediatric AVMs.

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Infant and Child Homicide from Abuse in Los Angeles County

Michael Y. Wang, Pamela Griffith, Deanne Tilton, J. Gordon McComb, Michael L. Levy

Introduction: Child abuse is a leading cause of infant and childhood deaths, and the majority of these deaths are due to head trauma. We reviewed 1997 data compiled by a multi-agency child death review team which serves Los Angeles County. This approach utilizes the resources of the departments of the health, social services, coroner, district attorney, and law enforcement.

Method: Los Angeles County contains a population of 2.4 million infants and children. During this twelve month period, 191 child deaths were investigated by the coroner. Accidents accounted for 84 deaths, most commonly due to drowning or maternal substance abuse. Sixty-one deaths were due to homicide, 20 were due to suicide, and 26 were of an undetermined cause.

Results: Forty-five of the 61 cases of homicide were caused by caretakers or family members. Sixty-two percent of perpetrators were male. Homicides were five times more common with African American children and twice as common with Hispanics when compared with Caucasians. Forty-four percent of victims were under one year of age. One-third of cases had a previous record of child protective services. The cause of death in homicides was head trauma in 27%, multiple trauma in 22%, gunshot wounds in 16%, suffocation in 13%, and trauma to the torso in 9%. Twenty percent of these families had a known history of domestic violence, and 20% had a known history of substance abuse.

Conclusion: Head trauma was the most frequent cause of death in cases of proven infant/child homicide. Neurosurgeons should maintain a high level of suspicion for the stigmata of abuse, as one-third of cases occurred in families where abuse had been reported. Preventive education efforts must target ethnic minority groups, and particular attention should be directed at detecting abuse in developmentally delayed children.

Section on Pediatric Neurosurgery I

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Multiple Subpial Transections in the Surgical Management of Pediatric Epilepsy

Jeffrey P. Blount, James T. Rutka, William Langburt, Hiroshi Otsubo, O. Carter Snead

Intro: Multiple subpial transection (MST) is a technique that is being increasingly used in the surgical management of epilepsy . It allows the interruption of intracortical horizontally oriented fibers and spares the vertically or radially oriented fibers. As such it impairs the generation of epileptiform spikes but preserves the tissue's capability for normal neurologic function. As such it allows treatment of epileptiform activity in eloquent cortex. There are currently no published reports of the use of this technique in pediatric patients.

Methods: Retrospective medical record review

Results: Between 1996 and 2000 28 pediatric patients (age 18 or less) (19 female, 9 male) underwent multiple subpial transections at the Hospital for Sick Children. At least 6 months follow-up is available for all. Preoperative seizure patterns and frequencies varied widely. All were refractile to medical management. All underwent placement of subdural grid array and mapping of epileptogenic foci. Twenty five patients underwent simultaneous frontal or temporal tissue removal (Group 1) and 3 underwent MST alone (Group 2). Hemiparesis (new or worse) was transiently noted in 9 patients and dysphasia in 6 patients. One patient demonstrated psychiatric deterioration 4 months following surgery. For patients in group 1 23/25 are Engel class I or II. For patients in group 2, 2 /3 are Engel class I or II.

Conclusion: These preliminary observations suggest that multiple subpial transections represent a useful, safe and effective tool in the surgical treatment of epileptogenic foci in eloquent cortex in pediatric patients.

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Real-Time Functional Brain Mapping as an Aid to Preoperative Planning in Pediatric Patients

Alan T. Villavicencio, J.C. Leveque, Jeffrey R. Petrella, James Voyvodic, Timothy George, Herbert E. Fuchs, Gregory McCarthy

Introduction: Real-time functional MR (fMR) brain mapping is a new technique that allows for immediate progressive analysis of acquired data. We tested the utility of this technique as a preoperative planning tool in pediatric neurosurgical patients scheduled to undergo craniotomy and cortisectomy for anatomic lesions.

Methods: Five subjects (age range 6-14 years) underwent fMR scanning while performing fine motor or language tasks. All examinations were conducted on the day of surgery. Scanning was performed on a GE 1.5T magnet using echoplanar gradient-echo imaging. Images were analyzed in real-time using customized software. Statistical correlation maps were generated for each task and overlaid onto anatomic data. Activation maps and head motion plots were generated and displayed progressively during each scan.

Results: All examinations were well-tolerated and completed in less than 35 minutes, including processing time. Satisfactory activation in the expected locations of the motor strip or receptive and expressive language areas was demonstrated in the left frontal and temporal lobes.

Conclusion: Unlike standard functional MRI analysis, which typically takes a number of hours, ongoing results of these investigations were displayed throughout scanning, and immediate post-scan images were available for intraoperative use. Real-time fMR can be used for routine preoperative planning in pediatric patients to produce reliable activation maps utilizing easily performed language and motor tasks. This technique is ideally suited in this patient population for defining the relationship between potentially resectable lesions and functionally eloquent brain areas, and can be quickly and reliably performed on the day of surgery with immediate results.

Section on Pediatric Neurosurgery I

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Intraoperative Urodynamic Monitoring for the Release of Tethered Cord Syndrome

Hani A. Abdel Aziz, Enrique Ventureyra

Introduction: The Tethered spinal cord presents potentially grave neurological and urologic implications. Presenting symptoms may include progressive spinal or lower limb deformity, back and leg pain, motor and sensory deficit of the lower limbs and progressive urinary and stool incontinence. Intraoperative monitoring of the spinal cord and nerve roots is an important surgical adjunct to assist in the complete untethering with preservation of neurological function. Although there are different methods of intraoperative monitoring previously evaluated the value of intraoperative urodynamic monitoring has not been properly addressed.

Methods: Since 1981 we have utilized intraoperative urodynamic monitoring extensively during 248 untethering procedures. The urologic history was retrospectively correlated with preoperative and postoperative urodynamic assessment of 210 consecutive dysraphic children. The mean age of our patients was 6 years (7 day to 18 years & 8 months).

Results: 105 (50%) patients reported to have preoperative bladder problems and 130 (61.9%) showed abnormal preoperative urodynamic studies. Intraoperative Urodynamic monitoring was used to evaluate the viability of neural elements that required section during the untethering procedure. Grade I untethering was achieved in 226 (91.1%) procedures while only 22 (8.9%) has grade II using Killors grading system. Five patients (2%) reported Dysuria post operatively and only one patient (0.4%) proved to have UTI. No other urinary complications were found. Intraoperative time was not significantly affected by the urodynamic monitoring procedure. Post operatively 119 patients (91.6%) Urologically Impaired children improved to a better class while 6 patients (8 %) remained the same and only one patients (0.4%) worsened. 36 patients (17.1%) achieved normal voiding and 67 (31.9%) were capable of adequate spontaneous voiding with intermittent catheterization. None of the patients with normal urodynamic status had urologically changed.

Conclusion: Intraoperative urodynamic monitoring is a useful adjunct to improve the urologic outcomes of patients undergoing untethering of their spinal cords.

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Tethered Cord Syndrome in Children with the Conus in a Normal Position: Results and Proposed Surgical Criteria

Monica C. Wehby, Patrick O'Holloran, Jodi Wallis

Introduction: Children with spina bifida occulta who present with signs and symptoms of tethered cord syndrome are often denied surgery because the MRI demonstrates a conus terminating within the normal range.

Methods: 50 children with a conus at L2 or above underwent lysis of the filum and were followed for greater than six months. Of the 50 children (17 male and 33 female), five were lost to follow-up. Of the remaining forty-five, the ages ranged from 4-18 years (mean 8.3). Surgical criteria were 1) spina bifida occulta, 2) progressive bladder instability, 3) urology/nephrology evaluation to confirm neurogenic etiology, and 4) one or more of the following: bowel involvement (fecal incontinence/chronic constipation), lower extremity weakness/gait changes, reflex/tone abnormalities, sensory disturbances, scoliosis, orthopedic abnormalities/limb length discrepency, or cutaneous stigmata.

Results: Forty-one of the 45 children (91%) showed improvement or resolution of all symptoms, and the remaining 4 children showed improvement or resolution of some symptoms with stability in others. No child had progression of symptoms and there were no operative complications.

Conclusion: Our results indicate that children selected by these criteria for tethered cord syndrome with spina bifida occulta may benefit from this low risk procedure.

Section on Pediatric Neurosurgery I

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Neurologic and Urodynamic Outcome After Micro-surgical Release of Tethered Cord in Adults: Long-Term Follow-Up in 21 Consecutive Cases

Devanand A. Dominique, Sidney B. Radomski, Magdy Hassouna, Michael G. Fehlings

Introduction: The appropriate timing of surgical intervention and neurological/ urological outcome in adult patients with tethered cord syndrome remains uncertain. We report our surgical experience, with long-term follow-up, in twenty-one consecutive adult patients (10 men and 11 women) treated for the management of their tethered cord.

Methods: All patients underwent formal pre- and post-operative urodynamic evaluation and intra-operative, SSEP, EMG, and urodynamic monitoring. An independent retrospective chart review was performed to assess clinical outcome. Our patients ages ranged from 15 to 59 years, with a mean of 35 years. The most common presenting complaint in our series was urinary/ sexual dysfunction in 14 patients, followed by pain and weakness.

Results: Operative findings revealed 7 cases of split cord malformation and lipomyelomeningocele, 5 cases of fatty filum terminale, and 1 dermoid and 1 myelomeningocele. A mean post-operative follow-up of 40 months revealed subjective and functional improvement in 15 patients and the remainder clinically stabilized.

Discussion/ Conclusion: In our experience, those patients with severe urinary dysfunction do not significantly improve after surgical release. However, of the 14 patients who had urological and sexual dysfunction prior to surgery, >50% reported functional improvement, after micro-surgical release. We conclude that early micro-surgical release of a tethered cord may improve or at least inhibit neurologic deterioration. This procedure should be undertaken prior to the development of an overt neurogenic bladder.

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Retethering of the Spinal Cord, Causes, Diagnosis and Treatment, Our Clinical Experience

Hani A. Abdel Aziz, Enrique Ventureyra

Introduction: Retethering of the spinal cord after untethering operation was underestimated in the past where most of the neurological deterioration was attributed to the natural history in-patients with spinal dysraphisim.

Methods: In our institute 210 patients underwent untethering operations for the tethered spinal cord from 1981 to 1999. Thirty-one patients (14.76%) got retethering needed further intervention. Two patients underwent three operations for rethethering, Five patients underwent two operations and 24 patients had one operation for retethering.

Results: The most common primary cause for tethered cord was post Myelomeningocele in 18 patients (58.1%), followed by Caudal Lipoma in 8patients (25.8%) and in complex cases in 4 patients (12.9%) of the cases while only one patient ((3.2 %) of the cases had Tight filum terminal as the primary cause of the tethered cord syndrome . most the patient presented with progressive neurological deterioration most commonly was urological deterioration . The most sensitive test in detecting retethering was Urodynamic monitoring comparing the status preoperatively , post-opeatively and with recurrence of symptoms . MRI studies was sensitive but not specific . the most common cause of retethering was found to be Adhesions at site of previos operation followed by having incomplete operation in the previous untethering due to different causes . Using Tutoplast in the previous operations enhanced the risk of adhesions in 67.3% of the cases . On the other hand Gor-tex was used in 32% of the cases since 1996 with only one patient had rethering and it was found to be to technical problem in inserting the graft .

Conclusion: Retethering is one of the complications of untethering of the spinal cord operations and it present with neurological deterioration and it can be reduced by having complete operations in the first time and the usage of Gor-Tex to decrease adhesions . Follow-up Urodynamic study is a sensitive test for retethering .

Section on Pediatric Neurosurgery I

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Molecular Biology and Genetics of Hydrocephalus

Jogi V. Pattisapu, Xingang Cai

Introduction: Hydrocephalus is an etiologically heterogeneous disease. Its causes include trauma, subarachnoid hemorrhage, infection (meningitis), and various developmental/genetic abnormalities. The pathogenesis of hydrocephalus is still poorly defined, despite significant scientific advances and improved understanding of basic cellular mechanisms during health and disease.

Methods: We reviewed the recent advances in molecular biology and genetics of hydrocephalus, and offer our attempt at a more unifying approach for its cause in various conditions.

Results: A discussion of hydrocephalus models will be presented, including: 1) Cell adhesion molecule L1 (LICAM)- the only gene recognized to cause human hydrocephalus. L1CAM is a single transmembrane molecule involved in neuronal cell adhesion, neurite outgrowth and pathfinding, neuronal migration and myelination, and memory/learning. 2) Transforming growth factor §1 (TGF-§1)- a multifunctional cytokine. Overexpression of TGF-§1 in the transgenic mouse brain has been shown to cause severe hydrocephalus. The mechanism is related to increased production of extracellular matrix components.
3) Forkhead/winged helix- member of a large family of evolutionarily conserved DNA-binding proteins. Disruption of this gene causes severe hydrocephalus in a mouse model (mechanism unknown). 4) Otx2- a head organizer during morphogenesis. The heterozygotic mice of mutant Otx2 gene develop hydrocephalus, with edematous changes of the periventricular white matter. This mechanism is also unclear.

Conclusion: Other genetic variations and related molecules/pathways will be reviewed. It is proposed that our understanding of hydrocephalus should be revisited in view of the recent advances in molecular biology and genetic mutations.

Section on Pain I

791 Ronald Tasker Award

Increased Spinal Cord Alpha2-Adrenergic Receptor Binding in a Rat Model of Neuropathic Pain

James W. Leiphart, Cynthia Dills, Robert M. Levy

Introduction: Previous studies have demonstrated that intrathecally administered tizanidine, an alpha2-adrenergic agonist, produces neuropathic pain specific analgesia in the chronic constriction injury (CCI) rat model of neuropathic pain. Several receptors, including the mu-opioid receptor, are increased in CCI spinal cords. A similar increase in alpha2-adrenergic receptors may underlie intrathecally administered tizanidine's neuropathic pain analgesia specificity. This study was performed to test the hypothesis that there is an increase in superficial dorsal horn alpha2-adrenergic receptors in the spinal cord of CCI rats.

Methods: CCI rats were compared to unoperated rats, with three rats in each group. In the CCI rats, four 4x0 chromic gut sutures were tied loosely around the sciatic nerve as described by Bennett and Xie (1988). One week after surgery, pain tests were performed to verify neuropathic pain. The rats were then perfused and L3-L6 spinal segments were cut and thaw mounted onto microscope slides. These slides were bathed in various concentrations of [3H]yohimbine with and without cold ligand, and exposed to film. The dorsal horn regions of the resulting autoradiographs were analyzed for maximum binding as a measure of receptor concentration using the Scatchard transformation.

Results: The maximum binding was statistically significantly ($p<0.01$) greater for the CCI rats than the unoperated rats for both the affected and contralateral sides. CCI affected was 40.8 pmol/mm2, CCI contralateral was 33.0 pmol/mm2, unoperated right was 24.8 pmol/mm2 and unoperated left was 23.2 pmol/mm2.

Conclusions: These results demonstrate that there are increased spinal cord dorsal horn alpha2-adrenergic receptors induced by the CCI model of neuropathic pain. These results are consistent with prior findings of changes in other receptor types in CCI rat spinal cords, and they may provide a mechanism for the neuropathic pain specificity of intrathecally administered tizanidine.

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Standard Percutaneous Cordotomy Compared with a Novel MRI-Guided Stereotactic Frameless Technique

Alan T. Villavicencio, J.C. Leveque, Ketan R. Bulsara, John P. Gorecki

Introduction: The use of intraoperative myelography as a radiologic guidance for percutaneous cordotomy is a primitive and outdated neuroimaging technique. The only significant advance in cordotomy in the last 30 years has been CT-guided percutaneous cordotomy. The goal of this study was to demonstrate the feasability of frameless techniques in high cervical cordotomy.

Methods: We describe 8 patients with intractable pain treated using a frameless, magnetic resonance-guided, stereotactic, percutaneous cordotomy technique in combination with standard physiologic localization procedures. Results were compared with those from 28 patients who underwent percutaneous cordotomy in the last 5 years using physiologic localizing techniques only.

Results: Seven of eight patients (88%) who underwent the frameless, stereotactic technique had excellent pain relief after a single lesion, the other (12%) required 2 lesions. There were no complications. These patients had shorter average operative times than the 28 patients who underwent the standard technique, and also demonstrated no recurrence of pain in the follow-up period. Patients in the non-stereotactic group, on average, required a higher number of lesions (2.6) and eight (28%) of these patients had incomplete pain relief achieved during surgery. However, the surgeon was reluctant to continue making lesions based on physiologic data alone. Three patients in the non-stereotactic group had mild weakness postoperatively and one had changes in bladder function.

Conclusions: These data suggest that use of intraoperative frameless stereotaxy provides surgeons with accurate information that helps to guide the operative approach and precisely tailor the trajectory and depth of the electrode. It also appears to reduce patient discomfort and operative time, and potentially increases the safety and efficacy of the procedure.

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Trigeminal Neuralgia in Patients with Multiple Sclerosis: Strategy for Surgical Treatment

Nikunj K. Patel, Thanos Athanasiou, Yvonne Clarke, Shelley Renowden, Hugh B. Coakham

Introduction: The role of percutaneous procedures and Partial Sensory Rhizotomy (PSR) in the treatment of trigeminal neuralgia (TGN) in Multiple Sclerosis (MS) patients is well established. Recent developments in Magnetic Resonance Imaging (MRI) techniques can identify neurovascular compression as a cause for TGN.

Methods: We reviewed the outcomes of 23 patients with MS and TGN treated surgically and report the successful use of Microvascular Decompression (MVD) in 3 patients. All patients had shown no response to medical treatment and were treated surgically. Radiofrequency Lesioning (RFL) was the first-line surgical treatment and often repeated. Cases non-responsive to medical treatment and RFL were investigated with MRI and MRA.

Results: Three cases showed evidence of neurovascular compression, of which, 2 were treated with MVD, and 1 with combination MVD and PSR due to the florid history of MS. Five cases showed no evidence of neurovascular compression and were treated with PSR. Follow-up of patients treated with RFL, in MS and non-MS (idiopathic) cases, showed an increased TGN recurrence rate in the MS group (mean 23.76 +/- 3.19 months) versus the non-MS group (mean 43.17 +/- 5.38 months) with significant p value = 0.0034. In MS patients, satisfaction scores showed a difference (not statistically significant) between patients treated with MVD and PSR or both (75.2 +/- 31.7%) compared to patients treated with RFL (62.8 +/- 24.1%). There was no difference in outcomes with PSR treatment in MS and non-MS cases. With increased recurrence rates of TGN in patients treated with RFL in MS patients, there is an increased requirement for further intervention.

Conclusion: MS patients should be investigated with MRI and MRA to elucidate cases with neurovascular compression. MS patients with neurovascular compression can be effectively treated with MVD with or without combination PSR. Exclusion of neurovascular compression and/or the presence of pontine demyelinating plaque is an indication for PSR.

Section on Pain I

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Vertebroplasty: Perils and Pitfalls

Michael K. Landi, Walter Grand, Douglas B. Moreland

Objective: Methylmethacrylate vertebroplasty using a laser guided fluoroscopic technique was evaluated for accuracy, radiation reduction and safty.

Methods: Forty patients with pain from radiographically confirmed osteoporotic compression fractures of the thoracic and lumbar spine, without improvement after conservative treatment, underwent 55 levels of vertebroplasty by four neurosurgeons. A laser guided percutaneous transpedicular approach was used to instrument the vertebral body with an 11-gauge trochar. Intravenous contrast was injected into the vertebral body prior to methylmethacrylate to evaluate the venous anatomy. Barium or Tungsten powder was added to the methacrylate for radio-opacity. Perioperative IV antibiotics were given. All procedures were performed in an operating room with a mobile c-arm fluoroscope.

Results: All patients had successful instrumentation of the vertebral body using the laser guided transpedicular approach. 11% (6/55) required bilateral transpedicular injections for adequate vertebral body filling. 87% (35/40) of the patients experienced dramatic pain relief. Complications: 5.5% (3/55) major - required surgical decompression, 5.5% (3/55) minor - two asymptomatic pulmonary emboli, one post-operative headache requiring admission suggestive of a CSF leak that resolved. There were no infections.

Conclusion: Percutaneous transpedicular vertebroplasty is a valuable technique in the management of refactory pain resulting from compression fractures. The laser guided method allows safe accurate percutaneous instrumentation of the vertebral body with reduced radiation to the surgeons hands and the patient. The percutaneous approach complication rate in this series is 0-1.8% (assuming actual CSF leak). Major complications were related to methylmethacrylate delivery and occured early in the learning curve. The overall complication rate was 11% (6/55). Complication avoidance is reviewed.

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Management of Compressive Symptoms Caused by Implanted Spinal Cord Stimulation Electrodes

Ashwini D. Sharan, James E. Harrop, Giancarlo Barolat

Introduction: Spinal cord stimulators (SCS) have become an accepted modality for the treatment of many chronic pain syndromes. Achieving adequate paresthesia coverage is often challenging. Once obtained, complications related to hardware insertion may necessitate repositioning or reinsertion of the implant which may preclude ever again obtaining proper paresthesia coverage. We present the management on ten cases where patients had compressive symptoms related to implanted plate electrodes in the dorsal epidural space.

Methods: We retrospectively reviewed the charts on over 1500 patients with spinal cord stimulators implanted by the senior author from 1985-2000. Ten patients were identified with symptoms which were attributable to compression of the nervous elements. These charts and films were further analyzed. The patients symptoms were further classified as that of axial pain, radicular pain, and myelopathy.

Results: Of the ten (nine women, and one man) implanted patients, four patients presented with myelopathy, four with radicular pain, and two with symptoms consistent with axial pain. All patients had their symptoms relieved by laminectomy without removal of the electrodes.

Discussion: Chronic neural compression can occur as complications from the insertion of SCS. These symptoms may be difficult to identify in a population with chronic pain and pre-morbid pathology. Vigilance to these symptoms is paramount. We have now managed ten patients who had excellent paresthesia coverage and pain relief from their spinal cord stimulator and they did not wish to have their implants removed. With strategic laminectomies, we were able to relieve the patients compressive symptoms without having to explant the hardware.

Conclusion: Achieving paresthesia coverage and pain relief remains challenging. Compressive symptoms related to implanted SCS insertion do not necessarily require explantation of hardware.

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A Role of Percutaneous Radiofrequency Neurotomy of Posterior Primary Rami

Jung Y. Park, Tai Hyung Cho, Yong Ku Chung, Jung Keun Suh, Hoon Kap Lee, Ki Chan Lee

Introduction: The purpose of this study is to prospectively evaluate the role of facetal deneravation (radiofrequency neurotomy of medial branch of posterior primary ramus) in selected patients with low back pain based on two temporary diagnostic blocks (saline and lidocaine) in double-blinded fashion.

Methods: A total of 63 patients who met all inclusion criteria and responded to temporary block were included. Main inclusion criteria were axial and predominantly psedudoradicular pain exacerbated by extension and facetal irritation but not associated with clinical signs of motor, sensory deficits, sciatic compression, and radiographic findings suggestive of prominent disc or lesions of roots and cord. These patients had more than 6 months of pain and failed to obtain substantial benefits from at least 4-6 weeks of intense physiotherapy. Eighteen patients who had previously undergone lumbar disc surgeries but had persistent low back pain were also included.

Results: RF procedure was done under local anesthetics and performed according to side(s) of pain with modified technique. Minimal follow-up period was 24 months. Initial responders (>50% of pain relief) were 74.6 % (47/63). At 6 month, this was reduced to 60.3% but 52.3% were still responders at 2-year follow-up. Variables found to be not significant but have tendency to be related to outcome were positive sign of "4", bilaterality, older age. Variables such as sex, age, and previous surgery showed no significant relationship to outcome. There were no major neurologic complications.

Conclusion: These results indicate that this procedure may play a role in management of patients with specific clinical syndrome, presumably chronic low back pain of mechanical origin from facet joints or surrounding structures. It is considered safe and repeatable. Similar results obtained in patients with previous disc surgery may also have a role in management of selected patients with failed back surgery syndrome.

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Imaging Neurovascular Compression in Patients with Trigeminal Neuralgia

Kim J. Burchiel, Zvi Israel

Introduction: In a prospective trial, a sequential series of patients with trigeminal neuralgia (typical and atypical), underwent T2 and 3D-TOF MRI imaging (MRA source images) to determine the rate at which neurovascular compression (NVC) of the trigeminal nerve could be detected by pre-operative imaging. MRI studies were evaluated by a neuroradiologist without knowledge of either the nature or the side of the patient's pain.

Methods: Twenty-two patients had MRI imaging, and eighteen patients had a retromastoid craniectomy for microsurgical exploration of the region of the trigeminal nerve. Of the four patients who did not have surgery, two had positive MRI indication of NVC, but remain on medical management; one had MS, and no NVC on MRI; one showed no NVC, but later proved to have a neurotropic nasopharyngeal tumor of the mandibular nerve root.

Results: Of the remaining 18 patients that had surgery, 13 had both positive NVC on MRI, and a confirmed arterial cross-compression at the time of surgery ; three had both positive NVC on MRI, and a confirmed venous cross-compression at the time of surgery (true positive rate = 89%); one had negative NVC on MRI, and a confirmed venous cross-compression at the time of surgery (false negative rate = 6%); one had negative NVC on MRI, and an equivocal venous cross-compression at the time of surgery (true negative rate = 6%).

Conclusion: This preliminary study demonstrates that trigeminal NVC may be reliably imaged in patients with trigeminal neuralgia, and may play an important role in patient selection and surgical decision making in patients with trigeminal neuralgia.

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Effects of Trigeminal Neuralgia or its Management on the Trigeminal Nerve and Regional Structures: An Evaluation with High Resolution Imaging

Ajay Jawahar, Douglas S. Kondziolka, Emanuel Kanal, L. Dade Lunsford

Objective: To identify imaging changes that occur in the trigeminal nerve and its regional brain structures in patients with Trigeminal Neuralgia (TN).

Material and Methods: 275 patients with trigeminal neuralgia were evaluated with volume acquisition, 1 mm contrast-enhanced MRI as part of TN radiosurgery. Images were evaluated by two independent observers, one of which was blinded to patient clinical information. The findings were then correlated with the previous therapeutic interventions received by the patients for trigeminal neuralgia.

Results: 97 patients had no prior TN surgery while 178 patients had one or more previous procedures (microvascular decompression [MVD], radiofrequency or glycerol rhizotomy, radiosurgery). 159 scans (58%) showed some imaging abnormality in the area of the trigeminal nerve and brainstem. The diameter of the nerve varied from 2-6 mm (mean, 4 mm). Seventy-five nerves (27.2%) showed distortion of the anatomical course as a result of prior surgery. After MVD, 31% had perineural scarring, 24% a brainstem infarct, and 17% persistent vascular compression. After glycerol rhizotomy, 30% had perineural scarring and 24% had vascular compression. After RF rhizotomy, 20% had perineural scarring and 40% vascular compression. After radiosurgery, 19/25 (76%) had nerve enhancement. A dolicho-ectatic vascular mass was found in 5.4%.
Conclusion: In most patients, vascular compression cannot be identified with high-resolution imaging. Most surgeries lead to some distortion, atrophy, or scarring of the nerve. The incidence of brainstem changes after MVD was high and correlated with facial sensory loss.

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Efficacy of an Analgesic Epidural Paste Following Lumbar Decompressive Surgery: Long-Term Follow-Up of a Prospective Randomized Double-Blind Controlled Trial

Aaron S. Dumont, Nicholas Theodore, Volker K. H. Sonntag, R. John Hurlbert

Introduction: We have previously demonstrated the conclusive efficacy of a single-dose epidural analgesic "paste" in the control of postoperative pain in patients undergoing lumbar decompressive surgery followed for up to 3 months postoperatively. Subsequently, we have analyzed our long-term (1-year) follow-up data to quantitatively evaluate any potential long-term effects of paste treatment.

Methods/Results: Sixty patients undergoing routine elective lumbar decompressive surgery were randomized to receive either active or placebo paste. Patients were followed as inpatients and outpatients for 12 months postsurgery. Comparability between groups was ensured, and pain control was evaluated with multiple measures. Patients receiving active paste demonstrated significantly lower pain scores and better general health perception (as measured with the Short Form 36) for up to 6 weeks postoperatively. There were no significant differences between groups in these outcome measures at 6 months and 1-year follow-up. Additionally, inpatient and outpatient oral narcotic consumption was lower in the active paste treatment group, compared to placebo paste group, for up to 6 weeks following surgery. No significant differences in narcotic consumption were ascertained at 6 months and 1-year follow-up.

Conclusions: The application of an epidural analgesic paste during lumbar decompressive surgery significantly enhances pain control, reduces oral narcotic consumption and improves overall health perception for up to 6 weeks postoperatively. No significant differences were demonstrated between the treatment groups in these outcome measures at 6 months and 1-year follow-up. Hence, the application of an analgesic epidural paste imparts significant benefit for up to 6 weeks following surgery without harmful long-term sequelae. Implementation of this efficacious and safe pain management strategy may evolve into a new standard of care in patients undergoing lumbar discectomy or laminectomy.

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A Prospective, Randomized Controlled Investigation of Pain Control Options Following Lumbar Microscopic Diskectomy

Phillip A. Tibbs, Jimmi Hatton, Christie Sparkman-Johnson, Tina Brooks, Robin Bower

Introduction: Lumbar microscopic diskectomy (LMD) patients at the University of Kentucky Chandler Medical Center receive patient-controlled analgesia (PCA) for pain control post-operatively. The purpose of this study was to compare PCA to an alternative pain regimen (APR) using intra-operative bupivicaine and post-operative ketoralac (scheduled every 6h) with supplemental acetaminophen/oxycodone as needed.

Methods: The hypothesis was that no difference would be observed in pain control, length of stay (LOS), or adverse effects (AE). During the clinic visit, 19 patient (12M/7F) were prospectively randomized to PCA and 15 (10M/5F) to APR. Pain scale scores were recorded every 4h and overall pain satisfaction was determined at discharge. Monitoring included sedation status, vital signs, nausea, vomiting, constipation, itching, headache, time to unassisted ambulation, urination, and oral intake.

Results: There was no difference in age or weight between the groups. No differences were observed in pain scores or sedation status at any time. Both groups rated pain control good to very good. Time to ambulation, urination and oral intake was 4.2, 8.0 and 8.2h for PCA patients compared to 3.6, 5.9 and 5.4h for the APR group. Fourteen PCA patients required medications for nausea, itching and headache versus five APR patients ($p<0.05$). Heart rate was consistently higher (81 vs. 69 bpm $p<0.05$) in PCA patients. LOS was longer (20.5h vs. 15h $p<0.05$) in the PCA group. Preliminary cost estimates were lower in the APR group (4.5K vs. 5.2K PCA).

Conclusion: The APR was as effective as PCA in LMD patients with fewer AE,and decreased time to ambulation, urination, oral intake, LOS and costs.

Section on Disorders of the Spine & Peripheral Nerves II

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Use of Image Guidance in Complex Spinal Reconstructions

Robert F. Heary, Richard P. Schlenk, Ceslovas Vaicys, Thomas J. Sernas, Margaret Black

Introduction: Complex spinal reconstructive surgery can be greatly aided by the use of screws to stabilize vertebral bony elements. Image guidance represents a surgical adjunct which allows for improved accuracy in placing screws into non-visualized portions of the vertebra. Image guidance can obviate the need for bony removal (laminotomy) which would otherwise be required to safely place screws into narrow bony regions.

Methods: Over a 28 month period, 31 patients (15 males, 16 females), with a mean age of 44 years (range 22-70 years) underwent spinal surgeries with image guidance. Surgery was performed for degenerative (13), traumatic (10), infectious (4), inflammatory (2), and congenital (2) conditions. A total of 220 screws were placed with image guidance. Screws were placed in the cervical (44), thoracic (97), lumbar (59), and sacral (20) regions. Posterior surgeries were performed in 26 patients and 5 patients had AP surgeries. Real-time fluoroscopy was utilized in all cases. Postoperatively, plain film radiographs were performed on all patients and CT scans were obtained in the majority of patients. The mean duration of clinical and radiographic follow-up was 6 months. There were no nerve root or spinal cord injuries and no vascular injuries resulting from inaccurate screw placement. There were no postoperative spine infections.

Results: This analysis demonstrates that image guidance permits safe, accurate placement of screws into areas of the vertebra which were previously inaccessible by conventional techniques. The length of surgery was initially prolonged due to the need to register bony landmarks intraoperatively; however, with experience, image guidance eventually shortened the operating time for some of the procedures. There was no “learning curve” with respect to the accuracy of this technique.

Conclusion: This technique is particularly useful with cases involving C1-C2 transarticular screws, thoracic pedicle screws, and in patients undergoing revision surgery. Image guidance is a useful surgical adjunct which may eventually eliminate the need for intraoperative fluoroscopy.

Section on Disorders of the Spine & Peripheral Nerves II

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Cadaveric Tibia and Anterior Z-Plate Fixation Following Thoracic/Lumbar Corpectomy as Compared to a Posterior Thoracic/Lumbar Vertebral Body Resection and Posterior Instrumentation

Scott A. Shapiro, Raj Bindal, Todd Abel, Jill Donnaldson, Francesca Tekula

Introduction: Traumatic/pathologic fractures of thoracic/lumbar vertebral bodies with cord compression and kyphosis can be approached via anterior and posterior approaches. It remains to be determined what is the best way to reconstruct the spine.

Methods: We compared 77 cases that underwent anterior reconstruction/internal fixation with 26 cases that underwent a posterior internal fixation using Chi Square analysis. Overall mean followup was 3.1 years (6 mos-8 years). 77 cases underwent an anterior thoracic/lumbar corpectomy for trauma (41) or neoplasia (36) and were reconstructed with cadaveric tibia and a Z-plate. All underwent distraction on the Z-plate bolts to allow correction of the kyphosis. 72 had an anterior approach alone and 5 underwent a compbined anterior/posterior approach. Of the 41 burst fractures (38 with neurologic deficit and 3 with pain/kyphosis), 40 underwent successful anterior fixation alone including 30 with a posterior column fracture or posterior ligamentous injury.

Results: Overall there was no infection, neurologic deterioration or long-term graft/hardware failure. The mean preoperative kyphosis was 22 degrees with a mean correction of 19 degrees. 26 cases of traumatic/pathologic vertebral body fracture underwent posterior internal fixation alone including 23 transpedicular corpectomies and 2 anterior corpectomies. There was 4/26 (15%) hardware/graft failure which was significantly more ($p=0.005$). Mean preoperative kyphosis was 24 degrees with a mean correction of 3 degrees long-term which was significantly less than the anterior group ($p<0.005$).

Conclusion: Following vertebral body fracture with retropulsion and kyphosis, anterior corpectomy, tibia and Z-plate reconstruction is superior to posterior internal fixation alone. Distraction on the Z bolts does not weaken them and allows for correction of the kyphosis with an appropriate length tibia. Burst fractures with posterior column injury can be treated with an anterior approach alone in most instances.

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Predictive Value of Magnetic Resonance Imaging in the Evaluation of Fatty Filum Terminale

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Introduction: The goal of this study was to determine if MRI characteristics of fatty fila can be used to predict symptomatic versus asymptomatic patients.

Methods: We retrospectively reviewed lumbosacral MRI scans in three groups of patients with fatty fila between 1994-1999. Group I patients (n=6) had incidental fatty fila detected as part of metastases or infection workup. Group II patients (n=17)had isolated low back pain, but were neurologically intact. Group III patients (n=15) had neurological impairments. These patients underwent lumbosacral laminectomies with division of the filum (n=13) or only removal of the herniated disc (n=2). Several MRI characteristics were assessed: a) location of the conus medullaris; b)filum thickness; c)distance of fat from conus.

Results: The mean age of the patients were; Group I- 50 years; Group II- 44 years; Group III- 22 years). The majority of patients in all three groups had the conus located at or above the L1-L2 level (92%). The remainder (8%) had the conus below L2 and were neurologically impaired. The average filum thickness was 3mm in all groups. The distance of fat from the conus varied: Group I-37mm; Group II- 46mm; Group III- 18mm.

Conclusions: Based on these data, the following conclusions can be made: 1) Patients were likely to have neurological deficits at a younger age (<22 y.o. in Group III vs. 47 y.o. in Groups I & II). 2) In the majority of patients, the level of the conus medullaris was normal. 3) However, a conus level below L2 was associated with neurological deficits (Group III, n=3). 4) Filum thickness did not correlate with clinical presentation. 5)Most importantly, fat in the filum within 18mm of the conus medullaris was most predictive of neurological deficits (Group III patients).

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Comparison of FluoroNav and Standard Fluoroscopy for Placement of Thoracic Pedicle Screws

Andrew T. Dailey, Darrel S. Brodke, Matthew T. Rondina, Thomas H. Jansen, Kent N. Bachus

Introduction: Despite its wide use in the lumbar spine,pedicle screw fixation has not been universally accepted in the thoracic spine. Morphometric data has shown the thoracic pedicles to be much more narrow in transverse diameter, particularly in the T4-T7 region. However, studies have appeared in the literature illustrating the use of pedicle screws for thoracic trauma or deformity with pedicle perforation rates of 15-25%.

Methods: Recently, the combination of image-guided surgery and fluoroscopy or virtual fluoroscopy has been introduced to improve the ease and accuracy of pedicle screw placement and reduce radiation exposure to the surgeon. This study is an in vitro comparison of a freehand fluoroscopically guided technique with that using virtual fluoroscopy in the placement of thoracic pedicle screws. Six cadaveric spines (freehand n=3, FluoroNav n=3) with ribs intact were instrumented from T1-T12. Preoperative CT scans were performed to assess pedicle size and orientation. Pedicles larger than 5.5mm were instrumented with 5.5mm diameter screws, while those ranging from 4.5-5.5mm had 4.5mm screws placed. Any pedicle less than 4.5mm was not instrumented. The freehand technique was performed using an entry point at the intersection of the superior border of the transverse process and the lateral 2/3 of the facet. Fluoroscopic images (OEC 9600) in the lateral and AP planes were used to guide the pedicle finder. In the spines instrumented with FluoroNav, the dynamic reference arc was applied to the spinous process of the vertebrae, AP and lateral fluoroscopy images were acquired (OEC 9600 with calibration device attached), and then three adjacent vertebrae were instrumented using the image guided awl and pedicle finder. Postoperatively, CT scans were performed utilizing 3mm cuts with 1 mm overlap to assess accuracy of screw placement.

Discussion/Conclusion: Accuracy of pedicle screw placement was graded as follows: Grade 0 - no pedicle perforation, Grade 1 - threads out only, Grade 2 - ð core screw diameter outside the pedicle and Grade 3- screw entirely outside the pedicle. Accuracy was confirmed with visual inspection of the dissected spine. In the freehand spines, 17 % of screws had Grade 2 perforations, 23% had Grade 1 perforations and 60% were Grade 0. With FlouroNav guidance, there were no Grade 2 perforation, 17% Grade 1 perforations and 83% were Grade 0. Combining Grade 0 and 1 perforations, accuracy was 83% with freehand vs. 100% with FlourNav ($p<.05$). Only 5% of perforations using either technique were medial perforations and all were Grade 1 perforations. The amount of fluoroscopy time was reduced by greater than 60% using the FlouroNav technique with the same number of pedicles instrumented in each group. Virtual fluoroscopy improved accuracy of screw placement and reduced the amount of radiation exposure secondary to C-arm fluoroscopy.

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Recovery after Complete Spinal Cord Injury in Rats Following Transplantation of hNT Neurons

Shahram Makoui, Sam Saporta, Donald Smith, David W. Cahill

Introduction: Functional recovery after complete spinal cord injury (SCI) remains very rare. We investigated the behavioral and electrophysiological consequences of immediate versus delayed transplantation of hNT neurons into the contused segment of rat spinal cords in a weight drop model.

Methods: In this study, rats underwent a 10 gram weight drop contusion induced complete SCI. Animals were divided into four cohorts of 10 including laminectomy alone (Group 1), laminectomy and SCI (Group 2), laminectomy and SCI and immediate transplantation (Group 3) and laminectomy and SCI and two week delayed transplantation (Group 4). Baseline behavioral and somatosensory (SSEP) and motor evoked potentials (MEPs) were obtained prior to injury. The animals in Group 3 underwent immediate transplantation with hNT cells throughout the contused segment after SCI. Two weeks after injury, all animals underwent a second set of EPs and behavioral tests. Only animals with evidence of complete paraplegia based on MEPs and motor tests were included in the experiment (Group 2 n=8; Group 3 n=5; Group 4 n=6). At this juncture, all six animals of Group 4 underwent hNT cell transplantation. All four cohorts were then maintained for a total of 8 weeks post transplantation at which point a final set of EPs and behavioral tests were obtained.

Results: All Group 1 animals remained at normal baseline behavioral and electrophysiologic state. Group 2 animals remained completely paraplegic with no EP recovery. 2/5 surviving animals of Group 3 had MEP and SSEP recovery, 1/5 recovered to weight-bearing status. In Group 4, all six surviving animals had MEP and SSEP recovery and moderate recovery of motor function, 1/6 regained ambulation. Immunohistochemical analysis demonstrated survival and integration of transplanted hNT neurons.

Conclusion: Transplantation of hNT neurons after complete SCI has potential therapeutic value and warrants further investigation.

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Virtual Fluoroscopy Improves Lumbar Pedicle Screw Placement Accuracy

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Purpose: Conventional techniques for lumbar pedicle screw insertion yield screw misplacement rates, based upon CT data, ranging from 21% to 41%. Virtual fluoroscopy combines standard C-arm fluoroscopy with image-guided surgical technology. The purpose of this study was to determine whether virtual fluoroscopy could improve lumbar pedicle screw placement accuracy compared to conventional techniques.

Methods: Titanium, 6.5 mm diameter pedicle screws were placed bilaterally from L1 to L5 in 3 fresh cadavers. On one side, the screws were placed using a conventional technique supplemented by standard fluoroscopy; on the other, virtual fluoroscopic guidance was used (FluoroNav, Medtronic Surgical Navigation Technologies, Broomfield, CO). Post-insertion radiographs and thin-section CT scans were obtained. The scans were reconstructed on an image-guided surgery workstation and reformatted along the screw trajectories. Screw misplacement rates were determined and the degree of pedicle violation was measured.

Results: Screw misplacement rates were 6.7% (1/15) with virtual fluoroscopy and 20% (3/15) using the conventional technique. The single misplaced screw with virtual fluoroscopy violated the lateral pedicle wall at L1 by 0.2 mm and had been placed into a 6.3 mm diameter pedicle. The three misplaced screws using conventional guidance involved lateral pedicle perforation at L1 (6.7 mm diameter, 4 mm violation), L1 (8.5 mm diameter, 2.0 mm violation), and L2 (9.0 mm diameter, 2.5 mm violation). Screw trajectories were judged to be ideal for all 15 virtual fluoroscopic screws and for 11/15 standard screws (73%).

Conclusions: Virtual fluoroscopy provides for more accurate placement of lumbar pedicle screws than conventional insertion techniques. Its use seems to be particularly advantageous for smaller pedicles.

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Thoracic Pedicle Screws Are a Safe and Effective Alternative

Robert F. Heary, Richard P. Schlenk, Ceslovas Vaicys, Thomas J. Sernas, Margaret Black

Introduction: Screws placed in the pedicles of the thoracic spine provide a biomechanically superior form of stabilization when compared to standard posterior stabilization techniques. Tranditional thoracic stabilization techniques (hooks, rods, cables) immobilize the posterior column of the spine. Thoracic pedicle screws provide for stabilization of the posterior, middle, and anterior columns of the spine.

Methods: Twenty one patients (8 males, 13 females) with a mean age of 42 years (range 22-76 years) had placement of thoracic pedicle screws over a 2 year period. Surgery was performed for trauma (12), infection (5), congenital (2), degenerative (1), and neoplastic (1) conditions. Revision surgery to correct an iatrogenic spinal deformity from a prior failed procedure was performed in 7 patients. Nine patients had ASIA class A spinal cord injuries and 12 had incomplete lesions (ASIA classes C-E). A total of 141 screws were placed (T1- T4: 43, T5- T8: 43, T9- T12:55). Image guidance (Stealth) was utilized in 12 patients. Posterior surgeries were performed in 13 patients and 8 patients had AP surgeries. Real-time fluoroscopy was utilized in all cases; however, the images were often suboptimal in the upper thoracic spine.

Results: Postoperatively, plain film radiographs were performed on all patients. The mean duration of clinical and radiographic follow-up was 6 months. There were no nerve root, spinal cord, or vascular injuries resulting from inaccurate screw placement. A single patient required revision surgery for a laterally placed left T5 screw which was in close proximity, but did not violate, the aorta. There were no postoperative spine infections.

Conclusion: Pedicle screws offer numerous advantages to the destabilized thoracic spine. Thoracic pedicle screws: allow for shorter construct lengths; do not diminish the space available for the spinal cord; immobilize all 3 columns of the spine; effectively correct and maintain the correction of kyphotic deformity; frequently eliminate the need for anterior surgery; and decrease the need for postoperative use of external orthoses. Pedicle screws, used throughout the thoracic spine, are a safe and effective alternative compared to existing stabilization techniques.

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Thoracolumbar Vertebral Reconstruction for Metastatic Spinal Tumors

Jongsoo Park, J. Patrick Johnson

Introduction: Spinal metastases occur frequently in patients with breast, lung, and renal carcinoma, and most recent publications support aggressive surgical intervention with favorable outcomes. The purpose of this study is to assess the functional outcomes of patients who underwent major thoracolumbar spinal reconstruction and particularly with regard to functional status, quality of life and survival.

Methods: We have analyzed 58 patients with metastatic spinal tumors who were treated with anterior vertebrectomy and reconstruction from 1993 to 1999. The predominant tumors include lung, breast, and renal cancers. The most common presenting symptoms were back pain (92%), followed by lower extremity weakness or numbness (60%). All patients underwent transthoracic vertebrectomies or retroperitoneal lumbar vertebrectomies (includes 14% multilevel vertebrectomies). Vertebral body reconstruction was accomplished with titanium mesh cages or femoral shaft allograft anterior plate or screw-rod fixation. Supplemental posterior reconstruction was required in patients with circumferential disease.

Results: Post-operatively, 85% of patients had improvement in pain symptoms. Improvement of neurological deficit occurred in 60% of patients, and one patient was worsened. One year survival rate was 65%, and all patients who were ambulatory after surgery remained so until the time of death. Hardware failure occurred in two patients that required reoperation. There was no intraoperative or perioperative mortality.

Conclusions: The results indicate that major anterior thoracolumbar vertebral reconstruction can improve quality of life in cancer patients with spinal metastases by improvement of pain control and maintaining ambulation during their remaining life.

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Pre-Instrumentation Vertebroplasty in the Management of Degenerative Deformity with Severe Osteoporosis

David W. Cahill

Introduction: In an aging population, severe lumbar stenosis is often coupled with sagittal and/or coronal plane deformity and severe osteoporosis. Pedicle-fixated instrumentation often fails in patients with osteoporosis secondary to screw pullout or vertebral fracture. Methylmethacrylate vertebroplasty is now widely used for the management of osteoporotic compression fractures. For the past five years, we have performed intraoperative MMA vertebroplasties on unfractured vertebrae just prior to screw implantation.

Method: 17 elderly (aged 68- 82), osteoporotic patients (15 female) underwent multisegmental lumbar laminectomies combined with interbody (14) and posterior segmental (17) instrumentation. 3 additional patients underwent multisegmental thoracolumbar corpectomies followed by anterior fusion and anterolateral instrumentation. In each case bilateral transpedicular MMA vertebroplasty was performed on each vertebra to be instrumented with pedicle or transverse screws. Screws were then implanted while the polymer was still liquid.

Results: With follow-up of 6 months to 5 years, there have been no screw pullouts, no fractures of instrumented vertebrae, no neurologic injuries, no deaths, and no reoperations for failure. Intraoperative deformity corrections have been maintained in the long-term and are objectively better than those obtained in a similar group of patients treated without intraoperative vertebroplasty. There was one posterior wound infection which required debridement.

Discussion: In this small series, intraoperative MMA vertebroplasty of vertebrae to be instrumented appears to have significantly improved curve correction and restoration of lordosis, eliminated failure secondary to screw pullout or pedicle fracture and to have been associated with no apparent complications.

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Transatlas Approach for Resection of the Dens of Axis

Ugur Tyre, M. Necmettin Pamir

Introduction: The transcondylar approach for resection of the dens of axis has been introduced by Al-Mefty as an alternative to the classical transoral approach. This technique allows the surgeon to view the craniovertebral junction from a lateral perspective. It has advantages including a close proximity to the lesion, a wide and sterile operative field, and the ability to perform occipitocervical fusion during the same procedure.

Methods: We examined the surgical approaches to dens of axis from lateral perspective with 5 cadaveric heads.

Results: The removal of the lateral mass of the atlas was found to provide adequate exposure for resection of the dens. Following this, the extreme lateral-transatlas approach was utilized for 5 patients with basal invagination and rheumatoid arthritis successfully in our institution from a period of September 1998 to September 1999. Unilateral occipitocervical fusion was performed following resection of the dens at the same procedure. No postoperative complications were observed and there has been no craniocervical instability at this point.

Conclusion: The extreme lateral-transatlas approach for resection of the dens was found to be a safe and effective technique. Knowledge of the anatomy of this region, especially the V3 segment of vertebral artery is essential for the success of this procedure. In this report we describe the surgical technique of this approach and our clinical experiences.

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Multimodality Treatment Approach in 424 Arteriovenous Malformations (AVMs): Improved Outcome in High Risk Lesions

Brian L. Hoh, Paul H. Chapman, Jay S. Loeffler, Christopher M. Putman, Ronald F. Budzik, In Sup Choi, Christopher S. Ogilvy

Objective: The management of intracranial arteriovenous malformations (AVMs) can be complex, particularly high risk lesions such as Spetzler-Martin grade IV-VI, deep-seated (thalamus, basal ganglia, brain stem), and motor strip AVMs. A multimodality neurovascular team which utilizes direct surgery, radiosurgery, and transarterial embolization can offer the safest treatment combination for each lesion based on its unique clinical and anatomic characteristics. By using a combination of therapies, the risks of treatment can be minimized.

Methods: From 1989 to 1999, our neurovascular team of neurosurgeons, radiation oncologists, and neurointerventionalists treated 424 intracranial AVMs. AVM presentation was by: 45% intracranial hemorrhage, 24% seizure, 6% neurological deficit, 5% bruit or tinnitus, and 20% incidental or other. Treatment was by: 24% surgery alone, 16% radiosurgery alone, 19% embolization alone, 28% surgery with adjunctive embolization, 8% radiosurgery with adjunctive embolization, 3% surgery and radiosurgery, and 2% surgery, radiosurgery, and embolization. Spetzler-Martin classification of the AVMs was: 9% grade I, 27% grade II, 40% grade III, 19% grade IV, 4% grade V, and 2% grade VI ("inoperable"). There were 55 (13%) deep-seated lesions and 19 (4.5%) motor strip lesions.

Results: Clinical outcome was assessed at the time of discharge and at longterm followup and graded according to the Glasgow Outcome Scale. Outcomes at discharge were 81.1% excellent (GOS 5), 10.3% good (GOS 4), 6.0% fair (GOS 3), 1.0% poor (GOS 2), and 1.7% dead (GOS 1). At longterm followup (range: 3 months-11.2 years, median: 1.5 years), outcomes were 81.6% excellent, 8.6% good, 4.6% fair, 0.5% poor, and 4.6% dead. One-third of deaths were due to unrelated causes at long-term followup. The overall surgery-related major and minor complication rate was 25.8% with a 5.2% permanent morbidity and 1% mortality. The overall radiosurgery-related major and minor complication rate was 7.4% with a 3.3% mortality (all mortality from delayed AVM hemorrhage). The overall embolization-related major and minor complication rate was 6.6% with a 4.1% permanent morbidity and 0.4% mortality. Long-term outcomes in Spetzler Martin grade I, II, III, IV, V, and VI AVMs were 96.3%, 94.1%, 92.8%, 86.2%, 72.7%, and 66.7% favorable (GOS 5 and 4), respectively. Long-term outcomes were 87.3% favorable in deep-seated lesions, and 94.7% favorable in motor strip lesions.

Conclusions: A multimodality treatment approach of direct surgery, radiosurgery, and transarterial embolization can employ a wide array of therapeutic combinations to safely treat AVMs, including high risk lesions.

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Repeat Gamma Surgery for Arteriovenous Malformations

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Purpose: To analyze the role and outcome of repeat Gamma surgery in the management of arteriovenous malformations (AVM) that fail Gamma surgery and identify the factors associated with failure and assess incidence of complications.

Material and Methods: Ninety five patients with residual AVM nidus underwent repeat Gamma surgery between January 1989 to October 1997 at a median of forty five months (range 20-144 mo) after the first treatment. The median age was 26 (range 4-70 yrs).There were 51 males and 45 females. The mean AVM volume was 0.9 cc (range 0.1- 9.0 cc). Follow-up after second treatment ranged from 11months to 120 months (mean 35.6 months). Follow-up MRI was carried out every six months until no flow void was visualized when cerebral angiography was performed to confirm obliteration of the AVM. End point of the study was 2 years after the second treatment.

Results: Total obliteration following second treatment was obtained in 48 (58.5 %) cases; subtotal obliteration (early venous opacification without nidus) was observed in 12 (14.6%) and partial obliteration (persistent nidus of any size) was achieved in 22 (26.8 %) of patients. In a separate work with more than 1000 years of follow-up no hemorrhages were observed in a group of subtotally obliterated AVMs. Following second Gamma surgery 3 (3.6%) hemorrhages occurred during a total of 266 years at risk resulting in 1.12 % annual incidence of hemorrhage. Radiation induced neurological deficits appeared in three cases and were permanent in one case. There was no mortality. The predominant cause for failure was a combination of inadequate localization and incomplete coverage with an adequate dose of the nidus at the first treatment. A number of cases failed due to recanalization of the embolized portions of the nidus.

Conclusion: The possibility of added benefit in upto 73% of cases failing first gamma surgery for AVM , and the potential to increase the overall cure rate from two gamma surgeries with the low incidence of interval hemorrhage during the latency period , and the low morbidity indicate that repeat Gamma surgery should be carried out if Microsurgery is not expected to give better outcome in AVMs failing the first gamma surgery.

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Intracerebral Infusion of Human Recombinant Apolipoprotein E3 Reduces Global Ischemic Brain Injury in Apolipoprotein E Deficient Mice

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Introduction: Endogenous murine apolipoprotein E (apoE) has previously been demonstrated to play a role in modulating selective neuronal death following transient forebrain ischemia. This experiment examined the effect of exogenous human apoE replacement on neuronal injury following near-complete forebrain ischemia in apoE-deficient mice.

Methods: ApoE deficient mice were pretreated for seven days with intraventricular human recombinant apoE3 at 60 mcg/ml (n=14), 240 mcg/ml (n=14), or vehicle (n=15). Mice were then anesthetized with halothane and exposed to severe forebrain ischemia (nine minutes of bilateral common carotid occlusion and systemic hypotension). After three days recovery, brain injury was determined histologically. Another group of apoE deficient mice (n=15) were subjected to unilateral intraparenchymal apoE3 infusion (240mcg/ml) and nine minutes forebrain ischemia.

Results: Hippocampal CA1 and CA3 and neocortical damage was reduced in mice given intraventricular apoE3 (60 mcg/ml) compared to vehicle ($p<0.05$). No additional benefit was conferred by administration of higher apoE3 concentrations (240 mcg/ml). Infusion of apoE3 into the cortical parenchyma reduced hippocampal CA1 damage compared to the contralateral hemisphere ($p<0.05$).

Conclusion: Administration of human recombinant apoE3 reverses the increased neuronal susceptibility to near-complete transient forebrain ischemia known to occur in apoE deficient mice. This is consistent with prior reports demonstrating an important role for apoE in modulating the CNS response to global ischemia.

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Results of Combined Stereotactic Radiosurgery and Transarterial Embolization for Low-Risk Dural Arteriovenous Fistulae of the Transverse and Sigmoid Sinuses

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Introduction: Most dural arteriovenous fistulae (DAVF) of the transverse and sigmoid sinuses do not have angiographic features associated with intracranial hemorrhage. We report our experience with staged radiosurgery and transarterial embolization of DAVFs involving the transverse and sigmoid sinuses.

Clinical Material: Between 1991 and 1998, 25 patients with DAVFs of the transverse and/or sigmoid sinuses were treated with stereotactic radiosurgery; 22 of these patients also underwent transarterial embolization. Two patients were lost to follow-up. Clinical data, angiographic findings, and follow-up of the remaining 23 patients were collected prospectively. The mean clinical follow-up after radiosurgery was 50 months (range, 20-99 months).

Results: Eighteen women and 5 men with a mean age of 57 years underwent radiosurgery (range, 33-79 years). Twenty-two of 23 patients presented with pulsatile tinnitus as the primary symptom; two patients had a prior intracerebral hemorrhage. Cognard classifications of the dAVFs were: I in 12 patients (52%), IIa in 7 patients (30%), and III in 4 patients (18%). After treatment, symptoms resolved (n=20) or improved significantly (n=2) in 96% of patients. One patient (4%) was clinically unchanged. No patient sustained an intracerebral hemorrhage or radiation-related complication during follow-up. Seventeen patients had angiographic follow-up at a mean of 21 months after radiosurgery (range, 11-38 months). Total or near-total obliteration (>95%) was seen in 11 patients (65%), while 6 patients had greater than 50% reduction (35%). Two patients had recurrent tinnitus, and underwent repeat radiosurgery and embolization at 38 and 21 months after the first procedure, respectively.

Conclusion: Staged radiosurgery and transarterial embolization provides symptom relief and a high angiographic cure rate for patients with low-risk DAVFs of the transverse and sigmoid sinuses. This combined approach is a safe and effective management strategy for patients without angiographic risk factors for hemorrhage, and for elderly patients with significant co-morbidities.

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Treatment of Intracranial Disease with Endovascular Stents

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Introduction: Technological and pharmacologic advances, as well as improved understanding of hemodynamic alterations associated with endovascular stents, has led to increased deployment of stents for intracranial. We present our clinical experience using endovascular stents for primary treatment of intracranial atherosclerotic disease and intracranial aneurysms.

Patients and Methods: Stents were placed intracranially in 29 patients. No patient with acute subarachnoid hemorrhage was treated with stent placement as initial therapy. All patients with atherosclerotic disease had documented ischemic symptoms in the vascular distribution considered for stenting. Each patient underwent diagnostic cerebral angiography and pretreatment with antiplatelet therapy. The stents were placed via a transfemoral approach after the administration of systemic anticoagulation, local anesthesia, and intravenous. Following the procedure, anticoagulation was not reversed and patients were admitted to the intensive care unit.

Results: Twenty-one intracranial stents were deployed for 18 aneurysms in 17 patients, and 12 stents were placed in 12 patients with intracranial atherosclerotic disease. There were 10 women and 7 men with aneurysms, and 3 women and 9 men with symptomatic atherosclerotic disease. The average ages were 46.9 years (range 15-58) and 61.2 years (range 43-74), respectively. In the aneurysm group, there was one periprocedural death (5.9%) and one transient hemiparesis (5.9%). One patient receiving a stent for atherosclerotic disease suffered an intracerebral hemorrhage (5.9%) without sequelae.

Conclusions: Elective primary stenting of aneurysms and symptomatic atherosclerotic lesions can be performed with low morbidity and comparable mortality to open surgical procedures.

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Surgical Treatment and Outcomes of Large and Giant Paraclinoid ICA Aneurysms

Christopher G. Gaposchkin, Arthur L. Day, Pamela J. Lafrentz

Introduction: The presentation and surgical outcomes of 140 patients harboring 154 large (10-24 mm) or giant (>25 mm) paraclinoid ICA aneurysms were evaluated.

Methods: The mean age at presentation was 55 years, and 94% were females. The aneurysm type included ophthalmic artery (46%), superior hypophyseal (27%), clinoidal segment (25%), and dorsal variant (2%). The clinical presentation included incidental (40%), nonspecific symptoms (headaches)(18%),visual loss (19%), blurred vision (6%),or SAH (18%).

Results: All aneurysms were treated by a single surgeon. Anterior clinoidectomy and direct surgical clipping was sufficient to cure all lesions, which was confirmed angiographically in 88% of cases. A mean follow-up time of 11.5 months was available. There were 6 deaths in the series (4%), all due to cerebral infarction. Four of these involved ipsilateral MCA infarctions within 24 hours of surgery, while two involved infarction from unrelated causes. 122 patients harboring 133 aneurysms (86%) had excellent (N=114) or good (N=19) outcomes. Patients sustaining a new isolated postoperative ipsilateral nasal field cut were considered good instead of excellent. Fifteen patients (10%) had fair outcomes, who were able to sustain independent living despite significant visual loss (N=10) or minor perioperative strokes (N=4). Six patients (4%) had poor outcomes, due to stroke (N=2), vasospasm (N=3), or cerebellar hemorrhage (N=1).

Conclusion: In the majority of cases, large and giant paraclinoid aneurysms can be safely treated surgically. The principal hazards of treating these aneurysms are stroke and visual loss. In this series, the overall rate of perioperative cerebral infarction was 6%. Patients who experienced stroke were older (mean=63 years). Significant visual deterioration occurred in 6%, while 12% had minor postoperative visual deficits. Despite these challenges, one-third of patients presenting with visual loss had a significant improvement in their vision following surgery.

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Improvement of Cerebrovascular Reserve Capacity in Patients with Symptomatic Internal Carotid Occlusion after EC-IC Bypass Surgery

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Introduction: Recent studies have shown that patients with symptomatic internal carotid artery (ICA) occlusion with impaired cerebrovascular reserve capacity (CRC) have an increase risk for stroke. The purpose of this study was to measure the changes in CRC in these patients before and after extracranial to intracranial (EC-IC) bypass surgery using a strict criteria based on CRC for patient selection.

Methods: Between January 1999 to December 1999, 30 consecutive patients with symptomatic ICA occlusion and CRC were studied using Xenon/computed tomography. CRC was calculated as the percentage change from baseline flow after a vasodilatory challenge. The selection criteria for bypass surgery was: 1) CRC below 5% averaged four levels in the ipsilateral middle cerebral artery or 2) steal phenomenon observed at one level in the ipsilateral hemisphere (worst area). Sixteen patients each met one of these criteria and underwent superficial temporal artery to middle cerebral artery bypass. CBF and CRC measurements were done 1 week and 3 months after surgery. Statistical analysis using paired t-test compared the effect of EC-IC bypass surgery on CRC.

Results: For these 16 patients CRC calculated in the ipsilateral MCA, worst area and contralateral MCA were Ð0.9±20.8%, Ð29.4± 12.5% and 13±28.4%. One week after surgery the new CRC was 27.5 ±19.3%, 43.6± 17.6 and 40.4±33.8%. After 3 months these CRC values were 27.4 ±15.2%, 35.6± 26 and 45.2±16%. There were statistical significance before and after surgery in these three areas. There were no cerebral accidents in any of these patient at this time.

Conclusion: Using our criteria for patient selection for EC-IC bypass surgery based on measurement of CRC using Xenon CT, we have observed significant improvement in cerebrovascular reserve capacity. We believe our criteria identifies a new subgroup of patients that would benefit from EC-IC bypass surgery.

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Growth and Potential de novo Generation of Cerebral Vascular Malformations. Incomplete Embolization of Cerebral AVMs Leads to Neoangiogenesis

Ulrich Sure, Nick Butz, Jurgen Schlegel, Siegfried Bien, Helmut Bertalanffy

Introduction: So far, both arteriovenous malformations (AVMs) and cavernomas have been considered as congenital malformations. A recent survey of the literature has shown the potential de novo generation of cavernomas in both familiar and sporadic cavernoma patients as well as paediatric AVM patients. It was therefore of interest to determine the biological behaviour of these lesions more detailed.

Methods: The proliferative, angiogenetic and neoplastic capacity of the endothelium of 13 recently treated (1997-1998) cavernomas and 25 AVMs was studied. Immunohistochemical stains for the proliferating cell nuclear antigen (PCNA), MIB-1, the vascular endothelial growth factor (VEGF), Flk-1 receptor and the p53 (tumor suppressor gene) protein were carried out using standard staining techniques.

Results: Nuclear positive immunostaining of endothelial cells was observed in the specimens of both cavernomas and AVMs for PCNA (80%), MIB-1 (12%), and Flk-1 (80%). The p53 protein was detected in the endothelial cells of 30% of the specimens. In patients with AVMs treated with incomplete embolization prior to surgery (n=18), the expression of VEGF was sigificantly higher (72%) when compared to patients who did not have endovascular treatment (28%).

Discussion: These results suggest a high rate of vascular proliferation and angiogenesis of cavernomas and AVMs. Furthermore, these cerebral vascular malformations might bear a certain non-developmental neoplastic capacity. The increased level of angiogenesis in only partially obliterated AVMs underscores the need for a radical and complete occlusion of cerebral AVMs in order to avoid recurrences and further morbidity.

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Treatment of Cerebral Vasospasm with Intrathecal Sodium Nitroprusside/Thiosulfate in the Neurosurgical Intensive Care Unit

Jeffrey E. Thomas, Erol Veznedaroglu, Megan McGee Gillespie, Thomas Forget, Robert H. Rosenwasser, Marco Silva, Lee Buono, Nancy Chavla

Introduction: We have recently reported our early clinical experience with intrathecal sodium nitroprusside (ITSNP) for the treatment of vasospasm (Stroke 30(7): 1409-1416, 1999). We currently report the results of ITSNP administration in the intensive care unit without cerebral angiography.

Methods: Patients were selected for treatment according to previously published criteria. All patients presenting with Grade 3 clinical or radiographic SAH and cerebral aneurysm secured by either microvascular or endovascular means were eligible for treatment. Of 10 patients so treated, 9 were ineligible for prophylactic ITSNP because of elevated intracranial pressure. Thus the majority of patients developed vasospasm by either transcranial Doppler (TCD) or examination criteria before receiving treatment. ITSNP/thiosulfate was delivered by ventriculostomy catheter as previously described. Care was taken to ensure accurate ventriculostomy placement, CSF access, meticulous sterile technique and complete photoprotection. TCD measurements and examination were used to monitor responses to treatment. Several patients had confirmatory angiography. No patient underwent angioplasty.

Results: Two patients died: one of intractable vasospasm established before ITSNP treatment and one of pulmonary complications unrelated to vasospasm. 8 of 10 patients had a clear response to treatment as demonstrated by TCD (decreased MCA index) and/or clinical exam (reversal of delayed neurologic deficit). Recurrence was the rule and ITSNP treatments over 7 - 10 days was necessary for all patients. No complication related to the treatment itself was identified. Outcome at 3 months is good to excellent (independent without motor or speech deficit) in all survivors.

Conclusions: These observations suggest that ITSNP is a safe and potentially effective treatment for cerebral vasospasm that may be useful in the intensive care setting without the need for cerebral angiography. Where observed, angiographic responses are consistent with an impact of ITSNP at the level of the microcirculation.

Section on Cerebrovascular Surgery II

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Treatment of Intracranial Atherosclerotic Disease Using Stent-Supported Angioplasty: A Series of 24 Patients

Adel M. Malek, Randall T. Higashida, Constantine Phatouros, Todd Lempert, Philip Meyers, Christopher Dowd, Van Halbach

Introduction: Intracranial atherosclerotic disease (IAD) is associated with a significant risk of stroke even when treated with anti-platelet agents or systemic anticoagulation. For the subset of patients in whom medical therapy has failed, therapeutic options are limited to surgical bypass grafting or endovascular intervention.

Methods: We present our clinical experience in the treatment of 24 patients with symptomatic and medically recalcitrant IAD using stent-suported angioplasty. Twenty-two men and two women (mean age = 64 years, range 35 - 84), with symptomatic intracranial lesions in the anterior (n = 10) and posterior (n = 14) circulations, respectively, underwent intracranial stent angioplasty using flexible coronary balloon-mounted low-profile stents. Two-thirds of patients had suffered a previous infarct at the time of therapy, and one-third were neurologically.

Results: The anatomical locations of the lesions was as follows: 10 in the intracranial vertebral artery, 10 in the internal carotid artery (6 petrous, 3 cavernous, 1 supraclinoid segment), 3 in the basilar artery, and 2 in the middle cerebral artery. Technical success was achieved in all but 2 patients (92%). Angiographic stenosis was reduced from a mean of 76.3% to 2.4%. Clinical and neurological follow-up was obtained at a median duration of 11.8 months. The mortality and permanent morbidity of the procedure were found to be significantly better in patients undergoing treatment for symptomatic IAD on an elective basis than in patients with evolving or established infarcts. At latest follow-up, stent-supported angioplasty had yielded sustained relief of symptoms in all patients treated on an elective basis and improvement in neurologic deficit in the stroke survivors.

Conclusion: In conclusion, our findings suggest that intracranial stent-supported angioplasty is an emerging endovascular therapy which may be of value in patients with symptomatic IAD which is unresponsive to best medical management.

Section on Neurotrauma and Critical Care II/General Neurosurgery

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Selective Inhibition of Cyclooxygenase 2 Results in Decreased Late Phase Prostaglandin E2 and Thromboxane B2 Concentrations

Daniel K. Resnick, Catherine F. Cechvala

Background: Cyclooxygenase 2 (Cox-2) catalyzes the conversion of arachadonic acid into prostaglandins and eicosanoids. Cox-2 expression is increased immediately following spinal cord injury. We sought to evaluate the effect of Cox-2 inhibition on the concentration of these inflammatory mediators following spinal cord injury.

Methods and Materials: 56 adult long evans rats underwent spinal cord injury with the NYU impactor. 4 rats were used as sham controls. Injured rats were divided evenly into drug (SC58125, 3 mg/kg) and control (vehicle only) groups. Rats were sacrificed at various timepoints between 2 and 72 hours following injury. Injured segments of the spinal cord were immediately harvested. Thromboxane B2 (TxB2) and prostaglandin E2 (PGE2) levels were assessed using an enzyme immune assay.

Results: There was no significant effect of SC58125 on either PGE2 or TxB2 levels during the first 12-24 hours after injury. At 24 hours following injury, levels of both metabolites rose significantly in the control group but remained steady or declined in the treated group. This effect was maximal at 48 hours following injury and was statistically significant for PGE2 and approached significance for TXB2.

Conclusion: There is a biphasic production of arachadonic acid metabolites following spinal cord injury. The initial production of these metabolites is not influenced by Cox-2 inhibition. In contrast, administration of a selective Cox-2 inhibitor significantly decreases the late rise in the concentrations of PGE2 and TxB2. The significance of these findings is discussed in context of prior work concerning the modulation of secondary injury responses following spinal cord injury.

Section on Neurotrauma and Critical Care II/General Neurosurgery

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Intracranial Transplantation of Bone Marrow Cells Cultured with Neurotrophic Factors Improves Functional Outcome in Adult Male Wistar Rats after Traumatic Brain Injury

Asim Mahmood, Dunye Lu, Yi Li, Michael Chopp

Introduction: This study was designed to examine the effects of bone marrow (BM) cells cultured in vitro with or without neurotrophic factors, brain-derived neurotrophic factor (BDNF), and nerve growth factor (NGF) and transplanted into adult male Wistar rats (n = 28) subjected to traumatic brain injury (TBI).

Methods: BM cells harvested from donor Wistar rats were cultured in vitro with either the culture medium containing BDNF and NGF (conc. 100 ng/ml each) or not. Control and experimental animals were then traumatized by controlled cortical impact. One day after the impact either the placebo, phosphate-buffered saline (PBS) or BM cells cultured with or without BDNF and NGF were transplanted adjacent to the site of injury. Another set of animals did not receive any intracranial implants. Motor function of the animals was evaluated by rotarod test both before and after the injury.

Results: All animals were sacrificed 8 days after TBI, and the brain sections were stained by H & E as well as immunohistochemistry. Histological examination revealed that after transplantation, BM cells survived, proliferated, and migrated toward the injury site. The group treated with BM cultured with BDNF and NGF had a significantly higher number of BM cells than the group treated with BM cells cultured without BDNF and NGF ($p < 0.05$). In both groups, some of the transplanted BM cells showed positive staining for astrocytic (GFAP) and neuronal markers (Neu N and MAP-2) when stained with double-label immunohistochemistry, suggesting neuronal and astrocytic differentiation of these cells.

Conclusion: The groups treated with BM implants cultured with or without BDNF and NGF had significantly better motor function than the groups receiving no treatment or receiving the placebo (PBS) ($p < 0.05$). However, the improvement was significantly more in the group treated with BM cells cultured with neurotrophic factors than without them ($p < 0.05$).

823

The Relationship Between Contamination and Infection in Penetrating Brain Trauma: A Multivariate Analysis

Raj Mehta, Bizhan Aarabi, Joseph Herman

Introduction: The significance of wound contamination and its relationship with CNS infection following penetrating brain trauma remains to be elusive.

Methods: Bacterial contamination (aerobic and anaerobic) of the incurred wounds, retained bone fragments, and brain tracks was prospectively studied in 119 patients with penetrating brain trauma over a 4-year period. The mean time past injury was 48.8 hours.

Results: Thirty-two percent of the incurred wounds and brain tracks, and 22% of the retained bone fragments were contaminated with organisms. Gram positive organisms (mainly Staph species) tended to be more frequent in scalp lacerations (58.5%), while gram negative organisms frequently contaminated retained bone fragments (53.6%) and brain tracks (60%). Acinetobacter species was encountered most frequently in the latter two groups. Thirteen of 119 (11%) patients developed deep infections (two abscesses and 11 meningitides). Two patients in the retained bone fragment group (2/26 or 7.7%) and four patients in each of the incurred wound and brain track study (4/38 or 10.5%) developed deep wound infection—all with gram negative organisms. Univariate and multivariate analysis (SPSS Windows version #9) failed to show any significant relationship between wound contamination and subsequent infection. This was seen after controlling for CSF leak, retained bone fragment, air sinus involvement, age, mode, lobes involved and GCS score.

Conclusion: Retained bone fragments and CSF leaks were found to predict infection after controlling for the above covariates. It is concluded that contaminating organisms may not have significant relationship with deep infections following penetrating brain injury.

Section on Neurotrauma and Critical Care II/General Neurosurgery

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A Multicenter Prospective Randomized Controlled Trial on the Efficacy of Mild Hypothernia for Severely Head-Injured Patients with Low Intracranial Pressure

Tadahiko Shiozaki, Toshiaki Hayakata, Hiroshi Tanaka, Takeshi Shimazu, Hisashi Sugimoto

Introduction: The criteria for the use of mild hypothermia (34'C) to severely head-injured patients have not been standardized. This study was performed to determine whether mild hypothermia is essential for the treatment of severely head-injured patients with low intracranial pressure (ICP) by conventional therapies.

Methods: Between February 1998 and November 1999, 85 severely head-injured patients in 11 centers were entered into a multicenter prospective randomized trial. All patients fulfilled the following criteria: 1) ICP was maintained below 25 mmHg by fluid restriction, hyperventilation, administration of mannitol, and/or high-dose barbiturate therapy; 2) a Glasgow Coma Scale score of 8 or less on admission. After conventional therapies, patients were divided randomly into the two groups: mild hypothermia group (HT group; n = 41) and normothermia group (NT group; n = 44). The HT group underwent mild hypothermia (34'C) therapy for 48 hours followed by rewarming at the rate of 1'C per day for 3 days, while the NT group underwent normothermia (37'C) therapy for 5 days.

Results: The two groups were similar with respect to prognostic factors such as age, neurological status, or the level of ICP. There was no significant difference between the two groups in clinical outcome at 3 months after injury. During the initial two weeks, however, the incidences of pneumoniae, leukocytopenia, thrombocytopenia, hypernatremia, hypokalemia, and hyperamylasemia were significantly higher in the HT group than that in the NT group (P<O.05, by X2 tests). There was also a significantly greater use of neuromuscular blocking agents in the HT group (p = 0.030, by X2 tests).

Discussion and Conclusions: We recommend normothermia therapy for the treatment of severely head-injured patients whose ICP can be maintained below 25 mmHg with conventional therapies, because mild hypothermia therapy does not convey any advantage over normothermia therapy in such patients.

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Pupillometer

Lawrence F. Marshall, Thomas A. Genneralli, William Taylor

Introduction: We prospectively studied the dynamics of pupillary responsiveness using a new hand held point and shoot Pupillometer in 51 patients with potentially catastrophic disease of the nervous system and in 40 normals.

Methods: The variables determined by the Pupillometer which provides an immediate printout of pupillary dynamics, as well as a video, included measurements of pupillary size, latency, constriction velocity and the two phases of pupillary dilation. Elevated intracranial pressure (ICP) above 20 millimeters of mercury almost always produced decreased constriction velocity on the side of the mass normal mean 1.16, vs. 0.39 millimeters per second P<.01. The latency appeared to be affected only by higher ICPs and the relationship of dilation velocity to ICP was found to be much more complex.

Results: Quantitative comparisons were also made of pupillary size measured to 1/10 of a millimeter compared to that of nursing personnel and a ruler. The average error in pupils in excess of 2.5 millimeters in size by the nurse was 1.1 millimeters. With pupils greater than 5 millimeters the error was approximately 2 millimeters. Occasional abnormalities in pupillary responsiveness where the pupil was called unresponsive by the examiner but yet was found to have a small degree of constriction were not uncommon, and was found in 3 of 14 patients with a fixed and unreactive pupil.

Conclusion: We conclude that a new handheld Pupillometer can produce highly accurate, quantitative pupillary measurements, report them accurately and quickly, and that a clear relationship exists between the pupillary constriction velocity and ICP. Specific examples will be shown. The influence of sedating agents and anesthetics including Morphine, and Propofol will also be discussed.

Section on Neurotrauma and Critical Care II/General Neurosurgery

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Outcome Following Moderate Closed Head Injury

Todd W. Vitaz, Jennifer Jenks, Laura McIlvoy, George Raque, Christopher B. Shields

Introduction: Little is known about the outcome following moderate traumatic brain injury (TBI) (GCS8-12). Most patients regain consciousness, however the full magnitude of long-term cognitive and functional deficits are unknown.

Method: We conducted a prospective study evaluating the outcome of patients suffering moderate TBI between October, 1995 and March, 1998. Long-term outcome was assessed by telephone interviews.

Results: A total of 106 patients were included. Average length of ICU and total hospital stay were 9.3 and 15.5 days. The average admission GCS was 9.4 with an average improvement of 4.9 prior to discharge. The presence of multi-system trauma did not affect outcome; however, age >45, and initiation of enteral feedind after post-injury day four and the presence of pneumonia were all associated with longer lengths of stay and increased complication rates. Seventy-three (69%) patients were contacted for follow-up at an average of 27.5 months following their injury. Glascow outcome scores were- 5: 43%; 4: 42%; 3: 9%; 1: 6%. Seventy-three percent of the respondents returned to full-time work. Questions regarding cognitive and functional status revealed appreciable problems in a majority of patients.

Conclusions: Pneumonia, age >45 and delay in enteral feeding all increase the length of acute care hospital stay following moderate TBI. In addition, the subjective, cognitive, emotional and functional problems following such injuries are quite extensive and long lasting. Physicians should be aware of these long-term sequela so they can provide the appropriate support and treatment to these patients following moderate TBI.

827

Predictors of Successful Extubation in Neurosurgical Patients

Stephen B. Tatter, Andrew M. Namen, E. Wesley Ely, M. A. Lucia, D. L. Case, Scott Landry, Edward F. Haponik, John A. Wilson, Jr., Steven S. Glazier, Charles L. Branch, Jr., David L. Kelly, Jr.

Introduction: A ventilator weaning protocol incorporating daily screens (DS), prompts, and spontaneous breathing trials (SBT) performed by respiratory therapists has been associated with superior outcomes in medical patients. Since the interaction between lung mechanics and sensorium are major determinants of safe extubation we studied the predictive value of these variables in neurosurgical patients for the first time.

Methods: To identify useful predictors of extubation we prospectively assessed 100 mechanically ventilated neurosurgical patients. After obtaining informed consent variables assessed in relation to extubation outcomes included Glasgow Coma Scale (GCS), respiratory rate (f), tidal volume (Vt), arterial partial pressure of oxygen (PaO2), fraction of inspired oxygen (FiO2), and P/F=PaO2/FiO2.

Results: Overall, 109 extubations were attempted, 76 in patients with a GCS > 8, and 33 with a GCS < 8. A successful extubation not associated with any complication or reintubation occurred in 53% (58/109) of attempts. 29% of patients requires tracheostomy.

Multivariate analysis demonstrated that GCS ($p<0.0001$) and P/F ($p<0.0001$) were independent predictors of successful extubation. The odds of successful extubation increased with each incremental increase in GCS by 13.5% ($p<0.0001$). GCS > 8 was associated with success in 75% vs. 33% for GCS <8 ($p<0.0001$). Patients passing a DS had fewer ventilator days ($p<0.02$), lower mortality ($p<0.001$) and lower cost ($p<0.0003$). Patient age, gender, race, or neurologic diagnosis did not predict successful extubation.

Conclusion: In mechanically ventilated neurosurgical patients GCS and P/F predict successful extubation. A daily screeening thus provides useful information. Ventilator weaning protocols warrant further study by neurosurgical intensivists as a way to lower costs and improve outcomes.

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Phase II Escalating Dose Clinical Trial of Dexanabinol in Severe Head Trauma

Nachshon Knoller, Lion Levi, Nisim Razon, Igal Shoshan, Eli Reichental, Zvi H. Rappaport, Aviva Fridman, Anat Biegon

Introduction: Dexanabinol is a novel non-psychotropic cannabinoid-derived neuroprotective agent. The purpose of the current trial was to establish the safety of escalating doses of dexanabinol (3 doses, 48-200mg) in severe head injury.

Methods: The double blind, placebo controlled, randomized, escalating dose study commenced 10/1996 and ended 1/2000. One hundred and one patients with severe head injury (GCS 4-8) were enrolled in 6 Israeli Neurotrauma centers following protocol approval by the IRBs and the Israeli Ministry of Health. The drug or placebo (vehicle) was adminstered as a single intravenous dose within 6hrs of injury. Hemodynamic parameters, ICP and CPP were continuously monitored over the first 3 days in the ICU. Adverse medical events, blood chemistry and hematology were evaluated over a six months follow-up period. GOAT, GOS and DRS were evaluated at 10days and 1,3,6months postinjury.

Results: The demographics of the patients were those characteristic of the severe head trauma population. Randomization was successful in The first two doses. In the third(200mg) cohort, the drug group had significantly more severe, high-risk patients. Dexanabinol was found to be safe and well tolerated over the dose range tested. Dexanabinol had no effect on blood pressure. There were no severe or moderate adverse events attributable to the drug. Elevations of ICP above 25mmHg were substantially inhibited in all three Dexanabinol treated groups. There was no significant difference in 6 months outcome between the drug and placebo, although a trend towards an increase in good neurological outcome was evident in the first two groups. Detailed analyses directed at dose selection are ongoing.

Didcussion/Conclusions: Dexanabinol was found to be safe and well tolerated in severe head injury and to improve ICP/CPP management. A Pivotal clinical trial will commence late 2000.

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Effect of Selective Brain Cooling by Intravascular Perfusion of Cold Crystalloid Solution on Cold Brain Injury in Dogs

Motomasa Furuse, Tomio Ohta, Tohru Ikenaga, Yu Min Liang, Naofumi Isono, Toshihiko Kuroiwa

Introduction: Selective brain cooling is expected to have more cerebroprotective effects owing to no temperature limit. We have developed a selective brain cooling by intravascular perfusion of cold crystalloid solution. We evaluated its effects on traumatic brain injuries, comparing extracellular concentration of glutamate and lactate in the cooled dog with those in the non-cooled dog.

Methods: Microdialysis probes were implanted into the bilateral parietal cortices of beagle dogs. Cold injury was made in the right parietal cortex near the microdialysis probe after intravenous administration of Evans-blue (20mg/kg). Thereafter, cold Ringer's solution was infused into the right vertebral artery after ligation of 3 other arteries to the brain in the neck in the cooling group (n=9). Brain temperature was maintained at about 25 degrees Centigrade for 1 hour. Hemodiluted blood was dialyzed, rewarmed, and returned subsequently to the body. In 7 non-cooled dogs, 3 neck arteries except for one vertebral artery were ligated for 1 hour after injury. Four hours after injury, the range of extravasation of Evans-blue was examined.

Results: The extracellular concentration of glutamate in the non-cooling group increased significantly in the injured hemisphere, comparing to the normal hemisphere ($P<0.03$). On the other hand, those in the cooling group did not increase bilaterally. Although there was no significant change in extracellular concentrations of lactate in either group, the concentrations in the cooling group increased gradually during cooling. However, the lactate/pyruvate ratio was lower and the extravasation of Evans-blue was significantly smaller in the cooling group than in the non-cooling group ($P<0.01$).

Conclusion: Selective brain cooling by cold crystalloid solution suppresses excitatory neurotransmitter and reduces posttraumatic brain edema, as the effects of cerebroprotection. Although mild hypoxemia was anticipated during cooling, it did not reach the critical threshold with respect to extravasation of Evans-blue.

Section on Neurotrauma and Critical Care II/General Neurosurgery

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New Non-invasive Sonographic Technology for Intracranial Volume/Pressure Monitoring

Kostas N. Fountas, Vytenis Deltuva, Joe Sam Robinson, Jr., A. Ragauskas

Introduction: The hypothesis of study was that the ultrasound speed and attenuation in the parenchymal acoustic path which is crossing the brain can provide information about ICP and intracraniospinal media volume dynamics.

Methods: New sonographic neurodiagnostic system "Vittamed" was used for non-invasive investigation of the parenchymal acoustic path . This system provides real-time information about the time -of -flight of the ultrasonic signals that passes through the intracranial media. We designed this study in order to prove that the diagnostic information obtained non -invasively, using "Vittamed" system, can provide all data that the invasive ICP monitors do. Theoretical model of ultrasound propagation through cerebral parenchyma was developed. The animal study was performed on 10 piglets. Animals were anesthetized, intubated and artificially ventilated, they were fitted with intraparenchymal Camino V420 and non-invasive "Vittamed" monitoring systems. ICP value and ICP waves were simultaneously recorded and evaluated by both monitors. Clinical simultaneous monitoring was performed on 10 head injured patients in ICU. In order to stimulate the ICP changes in both parts of the work we used several neurodiagnostic tests such as Queckenstedt, body tilting. manittol infusion , CO2 reactivity , breathing hold and hyperventilation.

Results: There was a significant correlation between invasively and non-invasively measured ICP data during all neurodiagnostic tests($r=0,97, 0,98, p<0.001$). The uncertainty of non-invasively measured ICP absolute values was less than ± 2 mmHg during long-term monitoring. The shape of non-invasively registered ultrasound velocity pulse waves has more clearly expressed arterial and venous peaks comparing with invasively recorded ICP pulse waves.

Discussion: New non-invasive sonographic monitor provides the same diagnostic information as invasive ICP monitors. The individual calibration for measurement of absolute ICP value can be done using the absolute ICP value non-invasive measurement method through the human eye.

Conclusions: A new sonographic technology can be used for evaluation of ICP dynamics and ICP absolute value with accuracy of AAMI standard. It also could be applied for a of spinal cord injury monitoring.

Section on Pediatric Neurosurgery II/General Interest

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Intraventricular Pressure Changes Following Third Ventriculo-Cisternostomy for Aqueductal Stenosis

David M. Frim, Liliana C. Goumnerova, Dawn Lathrop

Objectives: Endoscopic third ventriculo-cisternostomy (3VC) has become the procedure of choice for the treatment of hydrocephalus due to aqueductal stenosis. Despite the many patients that have undergone this procedure, CSF pressure dynamics after the tubular aqueduct is replaced by a third ventricular floor ostomy are not known. We sought to study the postural changes in intraventricular pressure (IVP) seen in the first 3 months after 3VC.

Methods: 18 patients undergoing endoscopic 3VC for hydrocephalus due to aqueductal stenosis were implanted at the time of surgery with ventricular catheters connected to a pressure telemonitoring device (TeleSensor; Radionics) . These patients were monitored for postural IVP dynamics postoperatively at intervals for up to 3 months.

Results: 15 of the patients exhibited a stereotypic time course in postural IVP that consisted of: (1) an elevation of early postoperative supine IVP (to as high as 30 cm of water) coupled with a steep drop in IVP with elevation of the head; (2) an intermediate period of low to normal supine IVP with a shallower drop in IVP with head elevation; and (3) late reconstitution of postural IVPs indistinguishable from unshunted patients. These patients experienced resolution of their preoperative symptoms. Three of the patients demonstrated early postoperative elevations in supine IVP that did not drop below 10 cm of water with full elevation of the head. Symptoms consistent with hydrocephalus never abated and these 3 patients required early VP shunting. One of the patients with resolved symptoms was noted to have a change in the IVP postural curve at 3 months postoperatively with failure of IVP to drop below 10 with maximal head elevation; she also demonstrated enlarging ventricles and recapitulation of symptoms and underwent VP shunting. In

patients with "normalized" postural IVPs, MR imaging three months postoperatively revealed some decrease in ventricular size and evidence of flow through the third ventriculo-cisternostomy.

Conclusions: After an initial period of adjustment, postural IVP after 3VC returns to an unremarkable baseline despite the novel CSF pathway into the prepontine cistern. This may represent maturation of the breach through the third ventricular floor or brain recovery from a perioperative period of high pressure. We also conclude that IVP dynamics are not significantly affected by the loss of aqueductal anatomy.

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Childhood Cerebellar Astrocytomas: Natural History Following Surgical Resection

Diane K. Sierens, Tadanori Tomita, David G. McLone

Objectives: Cerebellar astrocytomas in children are usually benign, but natural history following surgical resection has not been well described. We reviewed our own series of cerebellar astrocytomas to identify factors influencing prognosis following resection without adjuvant therapy (AT).

Material and Methods: From 8/1981 thorugh 3/1998, one-hundred children had cerebellar astrocytoma resected at our institution. 50 patients had total resection, confirmed by postoperative imaging (Group 1), 26 patients had total resection but postoperative imaging showed questionable residual tumor (Group 2) and 24 had subtotal resection (Group 3). Tumor locations were classified into the hemisphere(35), the vermis(29), the IV ventricle (25) and the cerebellar peduncle(11). The nature of tumor included solid tumor(40), mural tumor with cyst(36), cyst within tumor(18) and mixed(6). The progression-free survival (PFS) was correlated with these factors.

Results: The 5- and 10-year PFS were 80% and 73%. The 5 year PFS was 100% in Group 1, 65% in group 2 and 55% in group 3 (p=0.016). Significant risk factors were IV ventricle location, solid tumor and brainstem involvement. A significant number of residual tumor were stable or involuted (17 of Group 2 and 11 of Group 3). Only 23 needed therapy for recurrences.

Conclusion: Cerebellar astrocytomas are benign, and residual tumors can be safely observed without AT because of high stability/involution rates.

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The Use of Intraoperative Magnetic Resonance Imaging for the Treatment of Pediatric Brain Tumors

Mark R. Proctor, Elizabeth A. Eldredge, Ferenc A. Jolesz, Liliana C. Goumnerova, R. Michael Scott, Peter McL. Black

Objective: Magnetic resonance therapy (MRT) is a new technology in which the patient is operated on within a specialized MR scanner while concurrent imaging is performed. We report on the safety and efficacy of this technology for the management of pediatric patients.

Methods: The records and imaging studies of all pediatric patients with brain tumors treated at the MRT facility in the Brigham and Women's Hospital from June, 1997 to March, 2000 were reviewed to determine type of lesion, adequacy of tumor removal, and morbidity of the technology in this patient population.

Results: Nineteen children ranging in age from 3-16 years (mean 7yrs) underwent a total of twenty procedures. Anesthesia was induced at the Children's Hospital and the patients transported to the MRT facility. Seventeen patients underwent craniotomy for resection of their lesion, one needle biopsy only, one transphenoidal resection, and one thermal laser ablation for deep thalamic astrocytoma. Twelve patients were operated on for residual or recurrent tumor following conventional surgery, and eight patients underwent their initial procedure in the MRT. Eleven lesions were located in the cerebral hemispheres, 6 in the cerebellum, 2 in the brain stem and one in the pituitary. The majority of cases are low-grade glioma, but also include GBM, PNET, hamartoma, adenoma and metastasis. Total resection by MR criteria was attempted in fifteen patients and succeeded in twelve. Mean surgical time was five hours. There were no complications or operative morbidity. Two patients have returned to the OR for radiographic recurrence tumor, ten and six months after their MRT surgery.

Conclusions: MRT is a safe technology for use in pediatric brain tumor patients. It has permitted localization and complete resection of tumors which could not excised, or were considered unresectable, by standard techniques.

Section on Pediatric Neurosurgery II/General Interest

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Event Related Potentials (ERPs) for Memory: Toward Localization of Cognitive Functions in Children

Joseph R. Madsen, Daniel S. Rizzuto, Michael Kahana

Introduction: A critical problem in epilepsy neurosurgery is the definition of functional cortical areas in relation to epileptogenic regions. We analyzed intracranial recordings from epileptic children and teenagers while they performed a working memory task (Sternberg, 1966).

Methods: In this task, a series of items are presented, followed by a probe; the subjects task is to indicate whether or not the probe item was in the series. The excellent spatial and temporal resolution afforded by intracranially implanted electrodes (depth electrodes and subdural electrode arrays), enabled us to simultaneously examine the topography and dynamics of electroencephalographic activity synchronized to stimulus events within the task. We analyzed event related potentials (ERPs) in two variants of the Sternberg working memory task, one using consonants as stimuli and the other using spatial patterns (two-dimensional compound sine-wave gratings). Across three subjects, we recorded from 236 electrode locations.

Results: The ERP waveforms for positive and negative probes were significantly different at 31 of the 236 recording sites, with a number of sites in the left temporal lobe showing sensitivity to the probe's status as early as 250 ms. In effect, the electrical signals from these brain regions distingushed whether the answer to a question is true or false at an earlier time point than the subject could consciously report the answer.

Conclusion: The dynamics and topography of ERPs sensitivity to different stimulus dimensions are examined and evaluated in the context of current models of working memory. These "memory ERPs" are analogous to other types of evoked potentials used routinely for cortical functional mapping, and may in the future provide a practical approach to mapping higher functions in pediatric epilepsy patients.

835

Magnetic Resonance Spectroscopy of Thalamic Tumors in Children

Ashwini D. Sharan, James E. Harrop, Peter Sun, Zhiyue J. Wang, Leslie N. Sutton

Introduction: Diagnosis of thalamic tumors usually necessitates biopsy. Magnetic resonance spectroscopy (MRS) is as non-invasive modality which has been used to characterize the tissue properties of pediatric brain tumors. We explored MRS to determine if thalamic tumor histology's could be correlated with spectra ratios of choline (Cho), creatine (Cr), and N-acetyl-aspartate (NAA).

Methods: The pathology and MRS was reviewed from 21 children were reviewed. Data was acquired on Siemens Magnetom Vision 1.5T using single voxel or chemical shift imaging techniques. Ten patients had twelve different biopsy procedures and MRS performed to grade suspected tumor. Eleven patients without any evidence of thalamic pathology undergoing MRI were additionally studied to establish thalamic controls. Cho, Cr, and NAA peaks and ratios were converted to that of 1cc voxel and compared for tumors and controls.

Results: From the eleven control patients, mean Cho=7.72, Cr=6.47, Naa=10.14, and Cho/NAA=0.76. MRS obtained on 6 instance of low grade astrocytoma revealed Cho-9.14, Cr=5.41, NAA=3.61, Cho/NAA=2.95. Three patients with high grade astrocytomas revealed Cho=13.02, Cr=9.12, NAA=4.72, and Cho/NAA=3.14. Statistical analysis of the Cho/NAA ratio revealed significant difference between the control and low-grade tumor as well as the control and high-grade tumor. There was a consistent trend towards increasing levels of choline and Cho/NAA with higher astrocytoma grade. MRS on other tumor diagnoses such as PNETs, germinoma, ependymoma, and ganglioglioma are also presented.

Discussion/Conclusion: The MRS data preliminarily suggests that tumor histology may correlate with Cho and Cho/NAA ratios. With increasing experience, MRS may offer an alternative to biopsy of deep seated intracerebral lesions in the future.

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Manual Manipulation and Reduction of Post-traumatic Atlantoaxial Rotatory Sublaxation in Children

Muhammad Jalaluddin, David Moss

Objective: The purpose of this study is to emphasise the effectiveness of our non surgical technique for management of Atlantoaxial Rotatory Sublaxation in children.

Methods: We have treated 26 children with Traumatic Atlantoaxial Rotatory Sublaxation by Manual Manipulation, Reduction and Bracing from Jan.1992 to Jan.2000. Six were girls and twenty were boys. All presented with torticollis, neck pain and fixed neck position after trauma. All had plain cervical radiograph and CT scan to document Atlantoaxial Rotatory Sublaxation.25 were reduced under conscious sedation. One required general anesthesia. 4 children underwent reduction with flouroscope guidence. 2 children were reduced in the CT scan room. The rest were reduced in ER or ICU.All had post reduction plain cervical spine radiograph and CT scan and they were kept in rigid cervical spine collar with chin support for six weeks.

Results: All 26 patients had immediate correction of torticollis.24 (92.3%) had permanent reduction. 2 (7.7%) had recurrence that recquired posterior fusion. All 26 patients remained neurologically intact.

Conclusion: Manual Manipulation, reduction and bracing is an effective method of treatment for Traumatic Atlantoaxial Rotatory Sublaxation.

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Delayed Cerebrovascular Complications of Intrathecal Colloidal Gold in Childhood Medulloblastoma

Eric S. Nussbaum, Leslie A. Sebring, Joe Neglia, Don Erickson

Introduction: Intrathecal colloidal gold has been used in the past as an adjunctive treatment of childhood neoplasms including medulloblastoma and leukemia. We describe the long-term follow-up of a series of patients who received intrathecal colloidal gold therapy at the University of Minnesota with an emphasis on the high incidence of delayed cerebrovascular complications.

Methods: Between 1967 and 1970, 14 children with posterior fossa medulloblastoma underwent surgical resection, external beam radiotherapy, and intrathecal colloidal gold instillation. Ages ranged from 2 to 14 years; long-term follow-up was established in all cases.

Results: Of the 14 original patients, 6 died within 2 years of treatment from persistent or recurrent medulloblastoma. All 8 surviving patients suffered significant neurovascular complications, 5 to 20 years following treatment. Three patients suffered fatal aneurysmal subarachnoid hemorrhage, and five developed ischemic symptoms or hemorrhage from a severe vasculopathy resembling moya moya syndrome. Bilateral surgical revascularization procedures consisting of direct STA-MCA anastomosis, omental flap transfer, or pial synangiosis have stabilized the disease progression in 3 patients. Although colloidal gold provided for long-term survival in a number of cases of childhood medulloblastoma, our experience suggests that the severe cerebrovascular side-effects fail to justify its use.

Conclusion: The unique complications associated with colloidal gold therapy as well as their management are presented. We recommend routine screening of any long-term survivors to exclude the presence of an intracranial aneurysm and to document the possiblity of moya moya syndrome.

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Relative Risk of Shunt Failure as a Function of Time Following Placement

Alan T. Villavicencio, J.C. Leveque, Herbert G. Fuchs, Timothy George

Introduction: Shunts for hydrocephalus are associated with an unacceptably high rate of failure. Although it is generally accepted that the longer a shunt remains in place, the less likely it is to fail, this has never been substantiated objectively. The goal of this study was to describe the relative incidence of shunt failure as a function of time following placement in a large number of patients.

Methods: We reviewed the records of all patients who had undergone shunt placement or revision for hydrocephalus between April 1992 and February 1998. Operative data was prospectively collected in a computerized. This data was complimented by retrospective chart review.

Results: 447 patients underwent a total of 826 shunt placements or revisions. Average age of the patients at the time of catheter placement was 7.57 years. Average follow-up for all patients was 36 months (range 3-93 months). Of the 826 shunt placements within this time period, 461 (55.8%) failed within the time of follow-up and required revision. Kaplan-Meier (shunt survival curve) and log-rank analyses were used to account for differing periods of observation and for patients lost to follow-up. This analysis demonstrated a 10% incidence of shunt failure within 2 weeks ($p<0.0001$). Further analysis demonstrated an 18% failure rate at 1 month, 30% at 3 months, 37% within 6 months, 45% within 1 year and 53% within 2 years of shunt placement. Differences in failure rates were statistically significant between each subsequent interval time point ($p<0.0009$ in all cases).

Conclusions: The likelihood of a shunt failing decreases exponentially as a function of time following placement. This data may have important clinical and financial implications with regards to the evaluation and management of patients with shunted hydrocephalus.

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Role of Repeat Neuro-endoscopic Third Ventriculostomy (NTV)

Vivek A. Gonugunta, Neil Buxton, Maria Cartmill, Michael Vloberghs

Introduction: When endoscopic third ventriculostomy fails, if time permits, further investigations by MRI should be done in order to try and explain the cause of the failure. In selected cases, a repeat NTV may alleviate the problem and we present our experience of such repeat NTVs.

Methods: Out of the 120 Pediatric NTVs performed in our institute from 1994-98, 45 were performed for shunt complications (Secondary NTVs) and 75 were for denovo hydrocephalus (Primary NTVs), with an overall success rates of 52% for primary NTVs and 44% for secondary NTVs. Of the failed NTVs, after repeat MRI, we could perform repeat NTVs in ten children.

Findings: On repeat endoscopy, reseal of the earlier NTVs was found in four cases, with success in one case after repeat NTV.Four other children, two secondary and two primary, presented with a patent ventriculostomy on imaging, but a "second membrane" was present, which we identified as Lillequist's membrane. Repeat NTV, opening this membrane was successful in three of them and failed in one with underlying Dandy-Walker malformation. Multiple membranes were found in a child with communicating hydrocephalus, and reclosure of the intraventricular cyst blocking the access to the NTV was found in another child and both of these repeat NTVs failed.

Conclusion: Of the ten children in whom a repeat procedure was carried out, 4 were ultimately successful. Where reseal of the ventriculostomy was found, the common denominator in three of the four cases was the predominance of disease process, e.g., post-hemorrhagic or post-meningitic hydrocephalus, which is an adverse factor for success of NTV. Repeat NTV is only useful and is worth performing when a preferably single, anatomical structure can be demonstrated by further imaging e.g. persistent Lillequist or other accessible membrane at the level of the clivus.

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Drainage of the Cortical Subarachnoid Space in Slit Ventricles Syndrome

Geoffrey P. Zubay, Harold L. Rekate

Introduction: Patients with intermittent or recurrent proximal shunt obstruction may present without ventriculomegaly at the time of shunt failure. We postulate that this form of slit ventricle syndrome (SVS) results from the inability of ventricular shunts to access the cortical subarachnoid space (CSAS). This hypothesis has been tested with shunt strategies designed to access this source of cerebrospinal fluid (CSF).

Methods: All 22 patients treated had SVS. All were diagnosed with slit ventricles by magnetic resonance (MR) imaging or CTH imaging. Six patients were achondroplastic dwarfs with hydrocephalus, five patients had Chiari II malformations, ten patients had hydrocephalus with no underlying disorder, and one patient had a brain tumor. Preoperative testing was performed to evaluate the continuity of the CSAS with ventricular CSF. All patients underwent placement of either a lumboperitoneal shunt or a cisternal shunt with removal of a pre-existing ventriculoperitoneal shunt.

Results: T2-weighted MR imaging techniques uniformly demonstrated that the CSAS was volumetrically significant in comparison to the ventricles in the setting of SVS. All patients demonstrated continuity of the CSAS with the ventricular space by preoperative testing. Subsequent placement of either a lumboperitoneal or cisternal shunt resulted in dramatic improvement of the patients' symptoms, and in many cases, radiographically demonstrated enlargement of the ventricular spaces.

Discussion/Conclusion: Intermittent or recurrent ventricular catheter obstruction in patients with ventricles which do not expand at the time of shunt failure benefit from shunt strategies that are intended to access the CSAS.

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Epidural Infusion vs. Intrathecal Morphine Injection in the Selection of Patients for Chronic Opioid Therapy

Valerie C. Anderson, Kim J. Burchiel, Beverly Cooke

Introduction: We showed recently that intrathecal opioids delivered via implanted infusion system can reduce pain and improve function long-term among patients with severe nonmalignant pain. However, patient selection remains a critical problem and the optimal method of screening patients prior to implantation of permanent infusion system is undefined. We report here on the first prospective, randomized comparison of epidural infusion vs. intrathecal injection screening of patients for chronic opioid therapy.

Methods: Participants were randomized (1:1) to continuous epidural infusion or 1 mg intrathecal morphine injection screening. Standardized measures of pain (VAS, McGill Pain Questionnaire) and function (Sickness Impact Profile, Profile of Mood States) were assessed at baseline and after 3 and 6 months of chronic therapy. Pharmacological and device-related complications were monitored throughout study. Procedural costs were collected from hospital billing records.

Results: Subjects (N= 23) had a mean age of 56 ± 12 yrs. 65% were diagnosed with FBSS. At baseline, groups were matched with respect to age, pain intensity and prior surgeries for pain. Overall, the number of hospital days and total costs of screening were significantly less in the injection group ($P < 0.001$). There were no significant between-group differences in VAS pain, McGill, SIP or POMS scores after 3 months of intrathecal opioid infusion. No serious complications were experienced during screening by patients in either group. Pharmacological complications were mild in both groups, but were more common after injection; however, after 3 months of chronic infusion, the frequency of pharmacological complications was indistinguishable between groups. Procedural difficulties were more common among the injection group.

Discussion/Conclusions: Intrathecal injection appears to be as safe and more cost-effective than continuous epidural infusion for selection of patients for chronic opioid therapy. Both methods are equally likely to identify patients whose pain is responsive to chronic intrathecal opioid.

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Long-Term Effectiveness of Continuous Intrathecal Opioid Treatment in Alleviating Malignant and Chronic Benign Pain

Evan Hermanson, Lyal G. Leibrock, Daniel J. Tomes, William E. Thorell

Introduction: Intrathecal opioid administration is an effective alternative for treatment of chronic pain. For long-term chronic pain control, a permanent pump is implanted to deliver intrathecal opioids in a continuous fashion.

Methods: To assess long-term (>2 years) effectiveness of continuous intrathecal opioid administration, the study reviewed the chart history of 59 patients who, between 1989 and 1998, underwent permanent pain pump implantation. Standardized follow-up with phone interviews were used to collect outcome data.

Results: Twenty-two of the study patients (37%) were able to be contacted. The remaining patients were either unable to be located (22 patients) or known to be deceased (15 patients) from causes unrelated to pump implantation. Time from pump implantation to interview averaged 4.5 years (range 2.2-7.3 years). Of the patients contacted, 4 individuals had undergone elective pain pump removal despite receiving adequate pain relief with its use. The remaining 18 patients were using the pump at the time of the interview for control of either malignant (1 patient) or chronic benign (17 patients) pain. The average patient age was 64 years old (range 42-84 years). Sixteen of the patients contacted (89%) considered the opioid pump effective at relieving their pain, with the average relief being 60%. Fourteen of the patients contacted (78%) required supplemental oral pain medications for break-through pain control. Complications of pump implantation included pump malfunction (2 patients), programming error resulting in overdose (2 patients), constipation related to the intrathecal opioid (2 patients), and pump pocket seroma (1 patient). Six patients suffered intrathecal catheter complications, including catheter fractures (5 patients) and catheter dislodgement (1 patient). Nine patients reported battery failure occurring in the study period, with average battery life lasting 52 months (range 42-61 months).

Conclusion: The study suggests long-term continuous intrathecal opioid administration may effectively control chronic pain.

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Glossopharyngeal Neuralgia: A Ten-Year Experience in 200 Patients

Amin B. Kassam, Atul Patel, Michael Horowitz, Howard Yonas, Peter Jannetta

Significance: Glossopharyngeal Neuralgia (GPN) is a rare condition with significant morbidity that often results in ability to maintain nutrition. Medical managment for this condition has not been very effective, resulting in a variety of surgical procedures ranging from nerve section to microvascular decompression (MVD). Over the past ten years we have operated on over 200 patients with GPN.

Methods: A retrospective review of our database was undertaken to identify patients with typical GPN. A functional outcomes scale was developed and patients were subjected to a telephone interview reporting on patient satisfaction, relief of symptoms and complications. Univariate and multivariate analysis was performed to identify predictors of good outcome.

Results: Overall immediate sucess rate exceeded 80% with 10% experiencing partial relief. The incidence of lower cranial dysfunction was 18% though this was substantially lower when only patients over the last two years were considered. Overall patient outcomes and satisfaction was best within the typical GPN group, i.e., when the pain syndrome was restricted to the throat and palate.

Conclusion: Glossopharyngeal neuralgia is a rare condition, which is likely underdiagnosed. Microvascular decompression is a safe and effective form of therapy for typical GPN.

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Magnetoencephalography: A Non-invasive Method for Possible Prediction of Epidural Spinal Cord Stimulation Success

Martin Zonenshayn, Joshua J. Schulman, Ali R. Rezai, Eugene Kronberg, Alon Y. Mogilner, Urs Ribary, Rodolfo R. Llinas

Introduction: The precise mechanism of pain processing and epidural spinal cord stimulation remains poorly understood. Thalamocortical dysrhythmia is a recently characterized syndrome which physiologically links neuropathic pain, Parkinson's disease, major depression, as well as other neuropsychiatric illnesses to a common central mechanism. Patients suffering from these disorders exhibit chronically excessive low-frequency theta activity (4-8 Hz), as well as an increase in coherence between high- and low-frequency thalamocortical oscillations.

Epidural dorsal column stimulation is a frequent surgical procedure employed in the treatment of neuropathic pain. Given that up to one-third of patients undergoing a technically successful spinal cord stimulation (SCS) trial fail to experience significant pain relief, we sought to determine whether there were any neurophysiological differences between these two groups.

Methods: A whole-head 148-channel magnetometer array (4-D Neuroimaging, San Diego, CA) was used to record 5-10 consecutive minutes of spontaneous brain activity in the stimulator on and off states from 5 patients who underwent successful SCS implants (Medtronic, Minneapolis, MN), 2 patients who failed an SCS trial, 2 patients with mild neuropathic pain not necessitating surgical treatment, and 2 control subjects at the baseline and during a thermal (cold water hand immersion) pain state.

Results: Spectral analysis using the multitaper technique demonstrated that the 2 patients who failed SCS had significantly elevated theta/alpha (8-12 Hz) power ratios as compared to controls and remaining patients. No significant difference was found within the latter 2 groups. Moreover, the cross-correlation between spectral amplitudes at different frequencies in the 2 patients who failed SCS exhibited markedly abnormal levels of coherence when compared to the other patients and controls. In addition, the coherence levels in the 5 patients who underwent SCS did not exhibit significant differences between the stimulator on versus off states. No distinction in levels of coherence was noted in the 2 control subjects between the baseline and thermal pain states.

Conclusion: The presence of thalamocortical dysrhythmia in patients suffering from chronic pain appears to predict which patients will fail spinal cord stimulation therapy, as their pain is generated by abnormal intrinsic brain activity. Additionally, these findings suggest that the beneficial effects of SCS are occurring outside the brain. Further studies may reveal that techniques such as magnetoencephalography may provide adjunctive information in the screening of neurostimulation candidates.

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Management of Trigeminal Neuralgia: Predictors of Outcome for Microvascular Decompression

Elizabeth C. Tyler-Kabara, Amin B. Kassam, Michael Horowitz, Louisa Urgo, Costas Hadjipanayis, Howard Yonas, Peter Jannetta

Significance: Microvascular decompression (MVD) is a safe and effective treatment of trigeminal neuralgia (TN) refractory to medical management. We have previously reported an efficacy rate of 75% at one-year following MVD. We postulated that certain patient characteristics would determine likelihood of response to MVD.

Methods: We randomly selected 100 patients from the 1864 patients that have undergone MVD for typical TN. Thirty were locked into a validation set and the remaining seventy were used to determine the predictive factors. Using a focussed consensus group a questionnaire of predictors was developed with weighted elements. A univariate and multivariate analysis was undertaken to examine the predictive power of each element and impact on recurrence. Functional outcomes were determined apriori as follows: excellent (no pain off medications), good (significant relief of pain requiring low dose medication), and poor (no pain control still on medication). Once individual predictors were assessed they were then validated by applying them to the locked data set.

Results: In the analysis group 81.4% had complete relief while 18.6% had partial relief following MVD with a 38.5% incidence of recurrence. Within the validation group 86.7% had complete relief and 13.3% had partial relief. The recurrence rate was 33.3%. When examining the individual characteristics within the Typical TN group there was no significant effect of preoperative deficits, side, sex, age, and previous procedures (MVD, glycerol rhizotomy, and radiofrequency). Furthermore associated symptoms of bilateral TN, glossopharyngeal neuralgia and tinnitus did not impact on outcome.

Conclusions: If a patient is identified as having typical TN they enjoy an excellent result with MVD in 81% of cases. There are no patient characteristics that proved to be predictive of outcome within the typical TN group. We are now in the process of comparing the typical TN against atypical TN to determine differences in prognosticators.

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A Prospective Study to Assess the Use of MRA in the Diagnosis of Neurovascular Compression in Patients with Trigeminal Neuralgia and Hemifacial Spasm: Comparison with Surgical Findings

Nikunj K. Patel, Yvonne Clarke, Shelley Renowden, Hugh B. Coakham

Introduction: Vascular compression in the pathogenesis of Trigeminal Neuralgia (TGN) and Hemifacial Spasm (HFS) is recognised as a well established entity. Microvascular Decompression (MVD) is a recognised treatment for both disorders. Recent advances in Magnetic Resonance Imaging (MRI) techniques are able to accurately diagnose neurovascular compression. The aim of this study was to determine the sensitivity an specificity of Magnetic Resonance Angiography (MRA) with gadolinium contrast, in diagnosing neurovascular compression in patient with TGN and HFS.

Methods: Sixty-six patients were investigated prior to posterior fossa surgery with MRI and MRA. Sixty-four patients had TGN, 1 had HFS and 1 had both TGN and HFS. The investigation was matched to 1 consultant neuroradiologist (co-author) who was blinded to the clinical diagnosis and to the side of symptomology. The imaging results were compared to the operative findings.

Results: In 51 patients MRA showed the presence of neurovascular compression in accordance with surgical findings. Six cases had no neurovascular compression either on MRA or intraoperatively. One prediction of neurovascular compression was false, and 5 results were false negative. Based on surgical findings, the sensitivity of MRA was 91.0% and the specificity 85.7%. MRA was successful in predicting neurovascular compression for both cases of HFS. In 11 cases MRA predicted bilateral compression of the trigeminal nerves of which only 2 cases had clinically bilateral TGN. In 4 cases MRA revealed greater compression on the side of clinical symptomology and in 4 cases MRA revealed equal bilateral compression. In only 1 case was compression on the asymptomatic side predicted as being greater.

Conclusion: We conclude that MRA with gadolinium contrast is an extremely sensitive and specific method for demonstrating compression for TGN and HFS. As a result posterior fossa surgery can be recommended with confidence, and MVD remains the treatment of choice for TGN at the author's centre.

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Management of Atypical Trigeminal Neuralgia: Predictors of Outcome for Microvascular Decompression

Elizabeth C. Tyler-Kabara, Amin B. Kassam, Michael Horowitz, Louisa Urgo, Costas Hadjipanayis, Howard Yonas, Peter Jannetta

Significance: Atypical trigeminal neuralgia (ATN) may not be a separate entity but rather a transitional form of typical TN. However it is difficult to select those patients that will respond to microvascular decompression (MVD). We postulated that certain patient characteristics would determine likelihood of response.

Methods: We randomly selected 100 patients from the 683 patients that have undergone MVD for ATN TN. Thirty were locked into a validation set and the remaining seventy were used to determine the predictive factors. Using a focussed consensus group a questionnaire of predictors was developed with weighted elements. A univariate and multivariate analysis was undertaken to examine the predictive power of each element and impact on recurrence. Functional outcomes were determined apriori as follows: excellent (no pain off medications), good (significant relief of pain requiring low dose medication), and poor (no pain control still on medication). Once individual predictors were assessed they were then validated by applying them to the locked data set.

Results: In the analysis group 48.6% had complete relief, 42.9% had partial relief, and 8.6% failed MVD with a 62.9% incidence of recurrence. Within the validation group 53.3% had complete relief and 43.3% had partial relief with a recurrence rate of 80%. When examining the individual characteristics within the ATN group there was no significant effect of preoperative deficits, side, sex, age, and previous procedures. We are currently are examining the response of ATN to tegretol as a predictor of outcome.

Conclusions: Patients with ATN obtain significant immediate relief with MVD but have high recurrences. The response to tegretol may prove to be a critical marker in identifying the subgroup of ATN patients likely to enjoy longstanding pain control from MVD. We are now in the process of comparing the typical TN against atypical TN to determine differences in prognosticators.

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Somatotopic Arrangement of Human Postgasserian Fibers in Trigeminal Neuralgia: A Computerized Analysis Using the Multi-Electrode Technique

Eduardo A. Karol, Marcelo Larramendy, Mariano Socolovsky, Jose Leston, Ariel Szvalb

Introduction: In an attempt to minimize residual current morbidity after thermocoagulation in trigeminal neuralgia a multielectrode technique was described. Out of 331 thermocoagulations for trigeminal neuralgia performed since 1974,the present report describes the somatotopic organization of postgasserian fibers found using such technique in the last 128 consecutive procedures.

Methods: An outer needle is introduced into the inner third of the oval foramen avoiding blind and suboptimal positions. The multielectrode is then introduced so its four succesive 2.9mm caps protrude at the tip of the outer needle. All verbal and motor responses after electrical stimulation at each of the caps from 0,05V at 5 (and 75) Hz are recorded in one to 6 tracks on each procedure. Whenever possible,verbal responses were codified within thirty three possible responses corresponding to various subsegments of the three trigeminal divisions. All responses at or behind the first cap, at, in front or behind the second and third caps and at or in front of the fourth cap were recorded. Only responses elicited under 0,5V were considered for inclusion in the somatotopic map (or the performance of lesions). The smallest safest target can then be chosen knowing the segment of division located in front and behind. Lesions could never exceed the size of the chosen target.

Results: The somatotopic arrangement of postgasserian fibers is described using a computarized protocol for thermocoagulation in trigeminal neuralgia,to analyze statistically the set of histograms obtained in all procedures. Basal maps are shown both in typical and atypical neuralgia.

Discussion and Conclusions: Selective small lesions performed with a precise knowledge of the threshold and respective arrangement of each trigeminal subsegment within a known physiological map are shown to be useful to minimize unnecesary morbidity from percutaneous thermocoagulation in trigeminal neuralgia.

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A Comparison of Intrathecal Morphine, Cordotomy, Midline Myelotomy, and Sacral Rhizotomy for the Treatment of Visceral and Somatic Cancer Related Pain

Kenneth M. Little, Linda Rubin, Ketan R. Bulsara, John P. Gorecki

Introduction: Part of the challenge of managing cancer-related pain lies in its complex nature. Patients with pelvic disease, for example, often report both somatic and visceral pain. Interventions such as cordotomy and intrathecal morphine (ITM) have shown variable results while midline myelotomy (MM) seems to effectively treat visceral pain. It is our goal to combine clinical and anatomical evidence to develop a rational approach to different types of cancer-related pain. METHODS: A chart review of all patients who underwent surgical treatment of cancer-related pain from 1995 to 1999 was performed. Patients with pelvic pain who initially underwent ITM trial were selected. Pain was categorized as visceral or somatic.

Results: Fourteen patients were identified (n=14); 7 with visceral pain and 7 somatic. For ITM, 0/7 visceral pain patients reported adequate relief while 6/7 somatic paitients reported adequate relief (p< .01). For cordotomy, 0/3 visceral patients achieved adequate pain relief while 3/4 somatic patients achieved adequate pain relief (p, .01). 3 of 3 visceral patients who proceded to MM reported adequate relief; the single somatic patient who went on to MM reported adequate pain relief. Two visceral patients proceded to sacral rhizotomy; one reported adequate pain relief.

Discussion: Visceral pain responded will to MM and poorly to ITM and cordotomy. Other studies have shown a more favorable response to ITM and cordotomy in cancer-related pain, most likely because the quality of pain was not carefully assessed. Our data confirm previous reports that MM is an effective treatment for visceral pain.

Conclusion: Visceral pain tends to respond better to ITM and lesioning ventrolateral, somatic pathways. By choosing procedures based on the type of pain, it is possible to maximize efficacy while avoiding ineffective operations.

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Sphenopalatine and Maxillary Nerve Block and Denervation for Face Pain

J. Brett Gentry, Samuel J. Hassenbusch, Cheryl Keenan

Introduction: Face pain involving the orbit, lateral nose, cheek, and teeth is a complex problem for neurosurgeons. Depending on the exact location of the pain, sphenopalatine ganglion or maxillary nerve block and denervation can be an effective means of treatment. Unfortunately, this technique is not widely used or known by neurosurgeons. The purpose of this paper is to review the technique and our experience at MD Anderson hospital.

Methods: The medical records of 5 patients that underwent sphenopalatine ganglion or maxillary nerve block and denervation at MD Anderson between 1996-2000 were reviewed. All patients are presently being followed at 4 to 48 months. The technique for block and denervation involves placing a needle below the midpoint of the zygoma through the coronoid notch. The needle is inserted until it reaches the pterygopalatine fossa. Stimulation of the maxillary nerve will produce paresthesias in the cheek and/or upper lip. Stimulation of the sphenopalatine ganglion will produce paresthesias in the nose. Once the correct anatomic area is identified, block or radiofrequency is performed.

Results: Greater than 50% pain relief was obtained in all patients except one. One patient received a block only. Three patients required 2 denervation procedures. One patient required 6 denervation procedures. There were no major complications. The most common adverse effect was numbness of the cheek or upper lip.

Discussion/Conclusion: Sphenopalatine ganglion and maxillary nerve blocks and denervations can be an effective means for treating a specific subset of patients with face pain. Sphenopalatine ganglion block or denervation can be used for pain that is involving the inferior orbit or lateral nose. Maxillary nerve block or denervation is more effective for pain involving the cheek, upper lip or teeth. Patient selection is very important for good results to be obtained.

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