HONORED GUEST LECTURE

Overcoming a Bad Outcome: Thoughts From a Colleague

H. Hunt Batjer, MD, Salah G. Aoun, MD, Rudy J. Rahme, MD, and Bernard R. Bendok, MD

Neurosurgery has many unique features as a medical discipline, but perhaps the most significant of these attributes concerns surgical complications. Although all medical disciplines must cope with adverse outcomes, in neurosurgery, the stakes are so high for our patients that a bad result can have disastrous implications not only for the patient but also for the surgeon. Developing a mental framework to help cope with these events is critical. The elements of such a framework include acceptance of the fact that complications will occur in each of our practices. We must do everything possible to minimize these events and to ensure that each complication serves as an important learning and maturation event that actually makes us better over time. The challenge is to strike a balance between achieving and maintaining deep empathy with our patients and their families and becoming so emotionally involved with them that a poor outcome paralyzes us going forward. There is a clear analogy in the world of sports in which even elite athletes can have their confidence shaken and develop what is commonly called "the yips" in which they can no longer make fluid physical maneuvers to accomplish their goals. Such lapses in confidence in neurosurgery can result in misjudgments and technical errors. Our hope is that this discussion will help create a framework for striking this balance.

CLINICAL VIGNETTES

Clinical Case 1

I (H.H.B.) was consulted by a colleague on a 77-year-old woman presenting with intermittent brief episodes of loss of consciousness. They were witnessed by her son, and she was easily and quickly arousable after each episode. He took her to a hospital where a cardiac workup was negative but a brain magnetic resonance imaging (MRI) study was positive. This MRI study (Figure 1) demonstrated a roughly 8-mm carotid aneurysm projecting into the dominant mesial temporal lobe. There was abnormal T2 signal around the fundus and fluid-attenuated inversion-recovery abnormality. As I talked with her, the possibility that she might be having partial seizures as a manifestation of that inflammatory reaction came to mind. There was also concern that this abnormal signal around an intact aneurysm might be a marker for biological instability. She was presented at our institutional cerebrovascular conference, and because of her age, our neurology colleagues argued for a conservative approach. After further thinking about her situation overnight, I called her the next morning and strongly recommended that she be treated. She agreed, but her husband has Alzheimer disease so she needed several days to make arrangement for his care. Two nights later, she presented to a local emergency room essentially brain dead from catastrophic rupture of her aneurysm.

Clinical Case 2

A 37-year-old violinist had stopped playing about 5 months before and stopped driving 3 months before my review. She had developed severe truncal and appendicular ataxia and wild nystagmus. On my first and second visits with her, it was crystal clear that her husband was very bizarre. Her imaging studies demonstrated a large posterior fossa mass with brainstem compression with imaging features consistent with a dermoid cyst. She agreed to surgical therapy. The cyst was evacuated intraoperatively, and we were peeling the capsule off the floor of the fourth ventricle. As we got toward the inferior pole, the planes became more difficult. We discussed whether to leave a small disk of capsule material or to continue with the dissection. I went ahead and finished the capsule removal uneventfully. She awakened with significant weakness in all 4 extremities and difficulty swallowing. Fortunately, she improved rapidly. Within a few days, she was transferred to our neurosurgical ward. On the next Sunday morning, a resident staff was making rounds and found the husband at the patient's door. He stated that he was not coping well. When the staff went in to examine the patient, she stated that her husband had beaten her the night before. The authorities were called, and he was escorted out of the hospital. The following day, her mother arrived from Korea, and we had a lengthy discussion when I made rounds in the evening. The patient was improving very dramatically. We talked about her resuming her musical career within a month or 2, and she appeared very upbeat. Her mother recommended that her husband be allowed back to the hospital and the patient agreed. Two hours after my visit with her, the nurse left her room briefly, leaving the patient alone with her husband. When the nurse returned 10 minutes later, the patient was apnic and asystolic. The husband was standing at the bedside and stated that "she does not look right." A cardiopulmonary resuscitation effort was undertaken and was ultimately successful, although she died 48 hours later as a result of brain hypoxia during the arrest. The husband became a person of interest in the unexpected death.

0148-396X

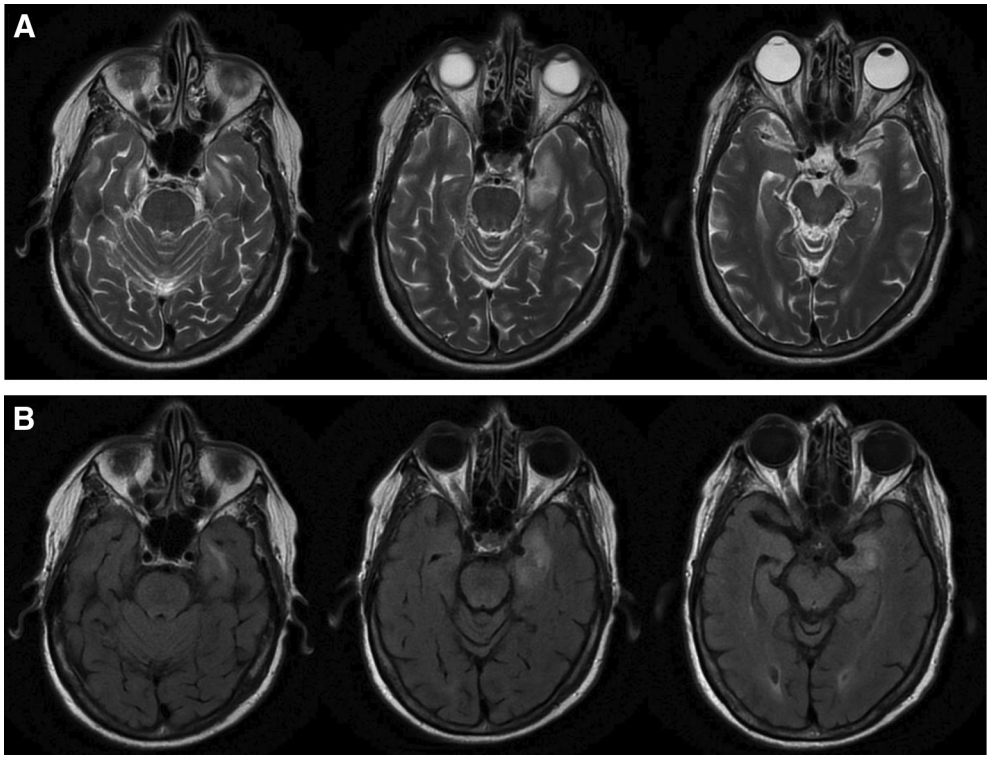

FIGURE 1. A, axial T2-weighted brain MRI showing the left carotid aneurysm projecting into the left temporal lobe with abnormal T2 signal around the fundus. B, fluid-attenuated inversion-recovery sequence of the brain MRI showing signal abnormality surrounding the aneurysm in the temporal lobe.

Both of these cases clearly illustrate how the decisions we make have dramatic implications for our patients. In the first case, I could have been more aggressive with an alarming imaging picture and forced the patient to undergo treatment earlier. In the second case, I could have achieved a better result in the early going had I been conservative coming across the fourth ventricle. To state the obvious, our decisions really matter. Treating the diseases we do is not like treating the measles. When patients are informed that they have a malignant brain tumor or some other catastrophic illness, their lives are changed forever.

Despite our best training and best intent, we make mistakes. Here is one of mine. Figure 2 illustrates the case of a patient who came in with a good-grade subarachnoid hemorrhage from a pericallosal aneurysm. I approached the lesion from the left side hemispherically, and although the brain was a bit tight, I got a very nice look at the anatomy. I got what looked to be a very acceptable clip application; our neuromonitoring remained okay; and we closed. She awakened with an ipsilateral lag deficit. An emergent angiogram clearly showed that I had advanced the clip too far and had occluded the contralateral pericallosal artery. We rushed back to the operating room for clip adjustment, but she was left with an anterior cerebral infarction, as illustrated in Figure 3. This was truly an unacceptable mistake for an experienced vascular surgeon.

LAYING THE GROUNDWORK

The healthy physician-patient relationship begins at the first meeting. In our field, that moment is critical and should not involve the physician sitting in a chair staring into a computer in an electronic medical record. It is all about the human touch. I use my first name and not "doctor" to try to eliminate any uneasiness on the part of the patient or family. Patients can usually figure out that I am a physician because of the white coat and the collection of residents and students with me. Once that initial contact is made and the history, physical examination, and imaging studies are discussed, the critical aspects of the decision analysis are undertaken. I believe it is highly important to involve the patient in that thought process. Patients listen to the discussion about the natural history risk and any associated treatment risks, and it is important for them to hear us think through the problem. Their involvement in this process is paramount and helps create joint ownership of the problem. It is critical to make sure that patients truly understand the disease process and what will be involved in any treatment option. We like to think of ourselves as the fighter pilots of the medical domain, but there is a critical difference. When a fighter pilot makes a mistake, he or she usually pays the ultimate price. When we make a mistake, our patient pays the price.

The decision-making process in cerebrovascular disease is complicated. For example, consider the small anterior communicating artery aneurysm illustrated in Figure 4. This is a small asymptomatic morphologically homogeneous lesion. What would you do if the patient is 73 years old? How about if he or she was 35 years old with 2 first-degree relatives who died of subarachnoid hemorrhage? What about the case illustrated in Figure 5? Obviously, this is a more complicated lesion with abnormal morphology and a clear daughter sac. Would your thought process be different in this

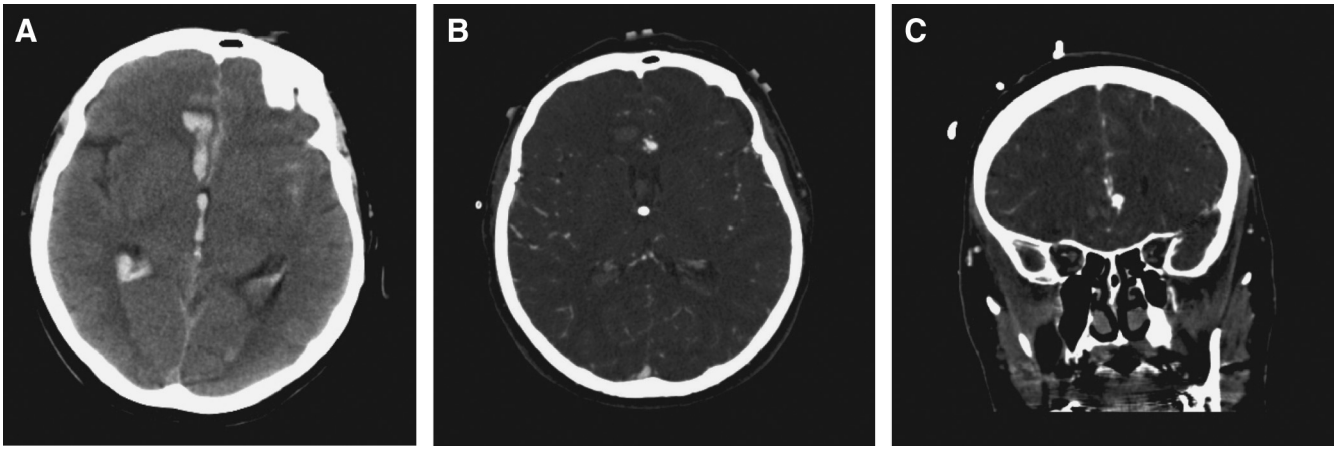

FIGURE 2. A, brain computed tomography scan showing a subarachnoid hemorrhage with intraventricular hemorrhage. B and C, computed tomography angiograms showing the pericallosal aneurysm.

incidentally discovered lesion? What about the case illustrated in Figure 6? Now we are dealing with a large incidental carotid bifurcation aneurysm with an exceedingly broad base with calcifications detected on the computed tomography scan. In this situation, we clearly are dealing with a higher-risk natural history, but unfortunately, we are also dealing with a higher-risk set of treatment options, both endovascular and surgical. This problem was further magnified by the fact that the lesion under consideration is a giant aneurysm, as illustrated in Figure 7. What about the arteriovenous malformation illustrated in Figure 8? Obviously, this is a complex lesion involving the parietal occipital area with unfortunate extension deep into the basal ganglia. The patient under consideration was asymptomatic. A healthy approach in this situation would be to emphasize the good news. "You do not need surgery! The arteriovenous malformation has been there for many years and has not hurt you. You do not need to modify your lifestyle. We will keep track of you over time. If it ever acts up, we have a number of possibilities…." It would be very damaging to state the other side of the coin such as "This is a disastrous lesion. To treat it would result in paralysis or death. There is simply nothing we can do." These starkly different approaches can have lifelong implications on the way the patient lives his or her life.

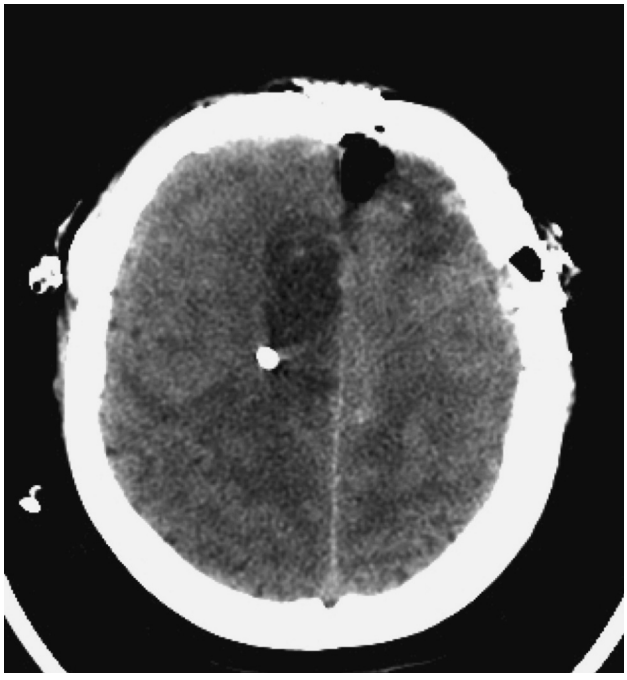

FIGURE 3. Brain computed tomography scan showing an anterior cerebral infarction.

PREVENTING BAD OUTCOMES

Incredible efforts across the country, and in fact across the globe, have focused on patient safety. This is obviously very important and in the patient's best interest. In our domain, which involves a meticulous workup with appropriate involvement of consultants from neuroanesthesiology and critical care, other neurosurgeons, neuroradiologists, etc, we have to fight to control the operating room environment and to ensure not only that the correct people are in the room but also that all of the needed equipment is present and functional. We also have considerable leeway to ensure that

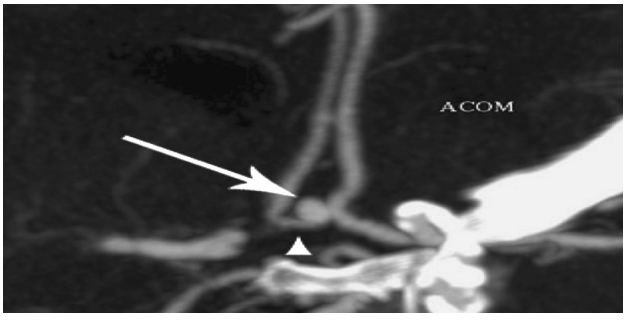

FIGURE 4. Computed tomography angiogram showing a small homogeneous anterior communicating artery (ACOM) aneurysm.

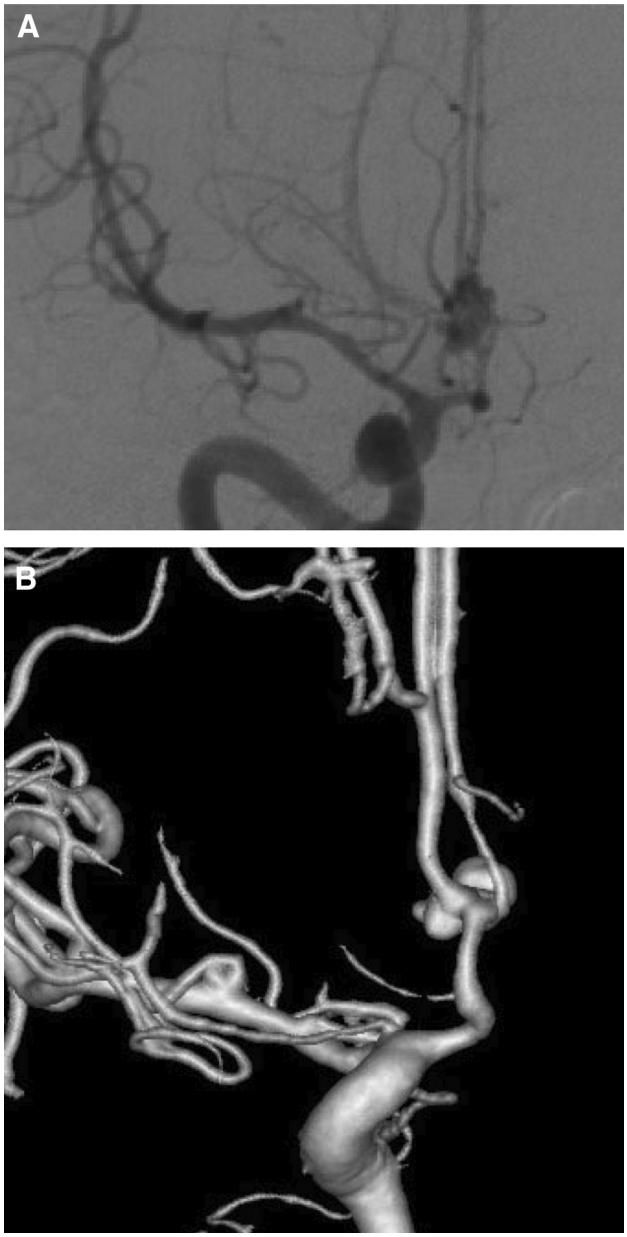

FIGURE 5. Cerebral angiography (A) with 3-dimensional reconstruction (B) showing an anterior communicating artery aneurysm with abnormal morphology and a daughter sac.

elective procedures are conducted at the proper time of the day. To embark on a 6- to 8-hour complex procedure that is totally elective starting at 4 or 5 PM makes no sense whatsoever and puts the patient in harm's way. At that time, the surgical team members are less fresh than they would have been at the start of the day, and often there are a second anesthesia team and nursing team with whom to deal.

A brief point about experience and intuition: Experience is critical and helps the surgeons mature and develop better judgment over time. Intuition is the development of a sense of impending trouble. The surgeon hears "little bells" go off when

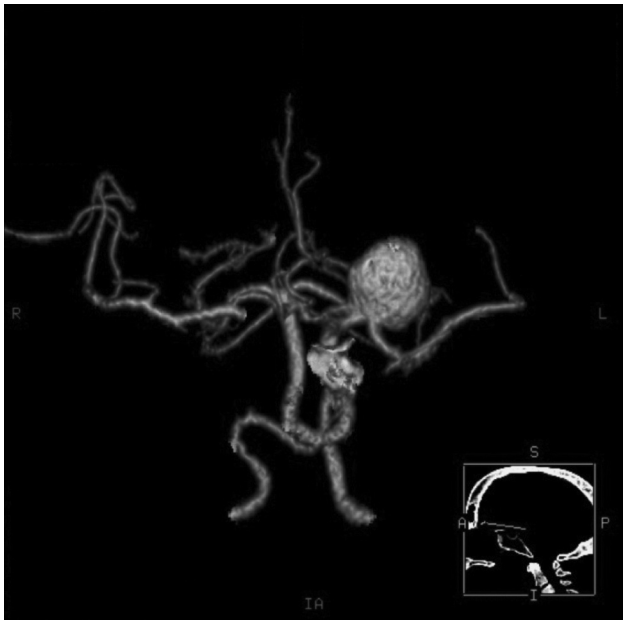

FIGURE 6. Three-dimensional reconstruction of a computed tomographic angiogram showing a large broad-based carotid bifurcation aneurysm.

a situation is developing that reminds him or her of a case from the past in which a tragedy occurred. This is a very critical aspect of surgical learning, and these bells need to be listened to. On the other hand, both experience and intuition and the reactions they engender are backward looking. As we mentor young colleagues, our experiences and intuition can provide a safety net to avoid adverse outcomes that simply reproduce the learning process of the mentor. That noble strategy must be balanced, however, with the fact that we have to empower our young colleagues to be creative and to look at problems in a more open-minded way. Their intellect and talent will help create novel strategies that their mentors never considered. This balance is indeed perhaps the biggest challenge and highest honor for an academic neurosurgeon. Therefore, in practicing in large tertiary and quaternary referral centers, we must remember that although we must do everything humanly possible to protect our patients, we must also never forget that we serve as "court of last appeal." Can you envision a safe strategy for the patient illustrated in Figure 9? This is a 43-year-old woman 1 year out from an endovascular procedure with increasing ataxia and somnolence. How about the case illustrated in Figure 10? This is a 66-year-old man with headaches, confusion, and a spastic hemiparesis. Management of this giant aneurysm will put this patient in harm's way (and is also his only hope for survival).

UNCONTROLLABLE ARTERIAL BLEEDING

There are no circumstances in any surgical discipline more disruptive than uncontrollable arterial hemorrhage. When this occurs, it is critical that the surgeon reacts properly. The elegant microsurgical procedure has just turned into a life-threatening salvage procedure. The first step in

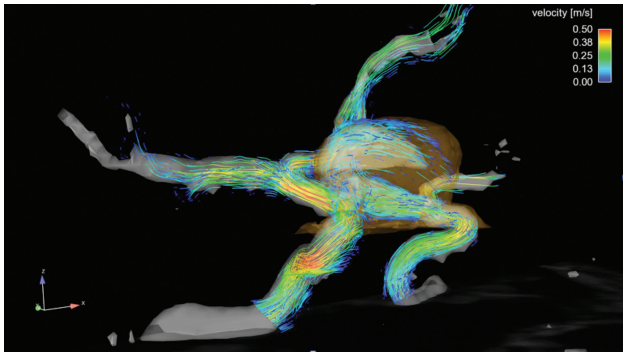

FIGURE 7. Four-dimensional imaging of a giant aneurysm showing the flow velocity within the aneurysm.

recovery is to alert the neuroanesthesia and nursing teams that the game has just changed. Starting with an athletic posture at the microscope with good balance and the use of the mouth piece, the surgeon can begin to attack the problem. I try to immediately achieve what I call an "autosympathectomy." I try to shut down all movement and gently exhale. A quick instrument exchange allows the surgeon to have 2 suctions to initiate control while he or she thinks about exactly where he or she is in the surgical procedure, what the cause of the hemorrhage is, and what the options are from here. I always think about my mentor, Duke Samson, who stated, "This bleeding will not kill him, but what you do next might."

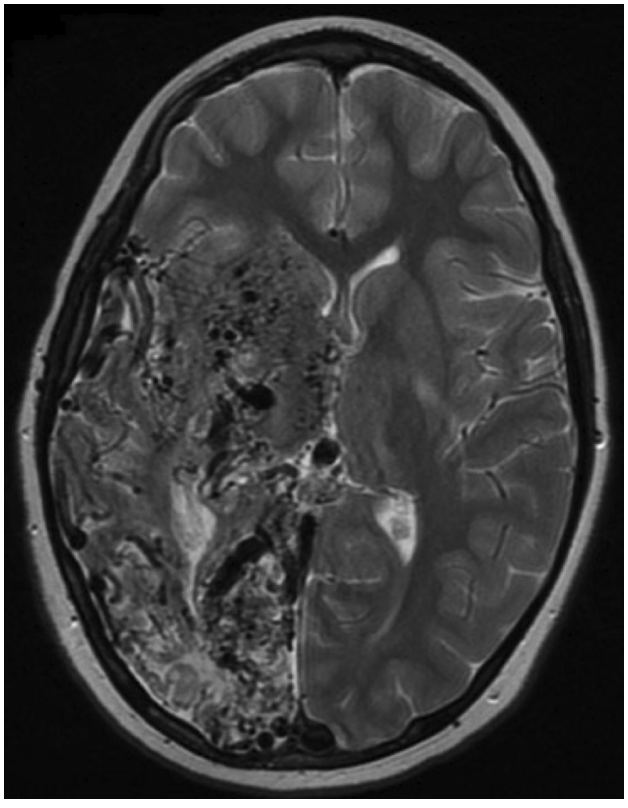

FIGURE 8. Axial T2-weighted brain MRI showing a complex parieto-occipital arteriovenous malformation.

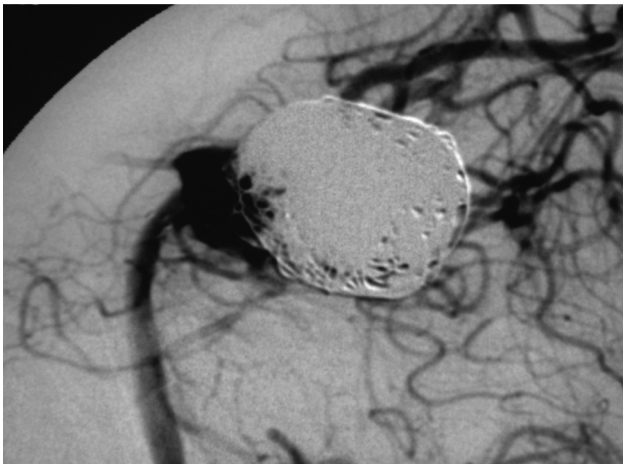

FIGURE 9. Digital subtraction angiogram revealing a partially occluded basilar tip aneurysm.

Let us take the case of a 79-year-old woman who was seen 1 year earlier with a 1-cm asymptomatic carotid bifurcation aneurysm. She was treated conservatively then and was presenting with an acute third nerve palsy and headaches. Her aneurysm had at least doubled in size over that year. A trial balloon test occlusion was done because of concerns that flow into the middle cerebral artery might not preserved. During the balloon test occlusion, she became immediately confused and had a hemispheric flow reduction revealed by the single-photon study. For that reason,

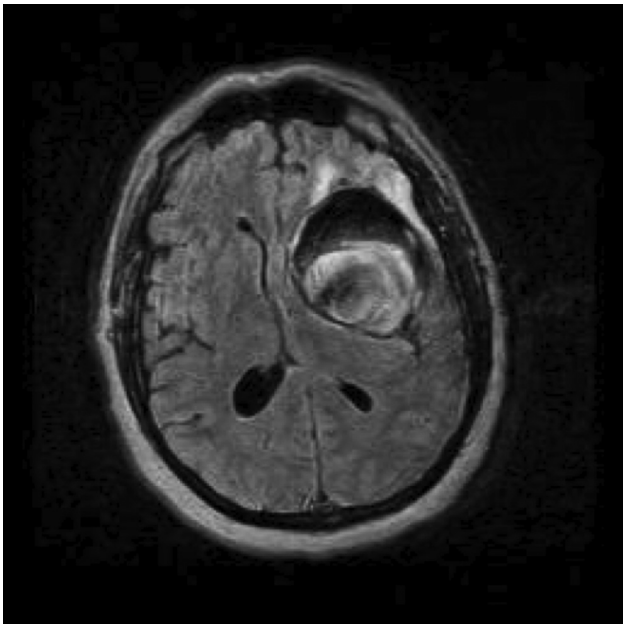

FIGURE 10. Axial fluid-attenuated inversion-recovery brain MRI showing a giant thrombotic middle cerebral artery aneurysm.

a prophylactic extracranial-intracranial bypass was constructed, and within 3 minutes, sudden and unprovoked spontaneous rupture of the aneurysm occurred. The usual fire drill began with manual cervical carotid compression followed by an aggressive approach to the cranial base, identification of the optic nerve, and placement of a temporary clip on the carotid. As is often the case, it was necessary to resect part of the orbital cortex of the frontal lobe to secure access. In this case, we ultimately got a good reconstruction, but as one might expect, this elderly patient was left with some neurological deficits from the procedure.

Each event in the management of the intraoperative complication in the above patient is a standard part of our surgical heritage. How can we do better? A 21-year-old man with a complex history of aplastic anemia and multiple medical problems suffered a subarachnoid hemorrhage in another state. He had poor endovascular access and was referred to us 1 month after hemorrhage for treatment of his basilar trunk aneurysm. We placed a femoral sheath for assistance with proximal control. As I was dissecting around the sixth cranial nerve, I noted that the nerve itself was densely adhesive with a daughter sac projecting off the aneurysm. I did not quite have room to slip a clip across the neck because of the adherence of the sixth cranial nerve. This was one of those situations in which I was hearing "the little bells" telling me to stop and to advance the occlusive balloon before the next phase in the critical dissection. I was so close to having the nerve freed, however, that I continued and ultimately got the aneurysm bleeding. I tried to force a clip, which resulted in avulsion of the sac from the clival dura. I went quickly down to the cisterna magna and put a temporary clip on the ipsilateral vertebral artery, which was codominant. This did not slow the bleeding down a great deal. Our neuroanesthesiologist, Dr Tony Koht, walked behind me and quietly asked, "Would you like us to stop the heart?" I had no idea what he was talking about but quickly responded in the affirmative. He administered a dose of adenosine, and we got immediate cessation of the hemorrhage with asystole, giving us just the right amount of time to collapse the sac and to slide a clip into place. The patient made a complete recovery without even a trace of sixth nerve dysfunction. That patient was saved by a creative solution brought to the table by a quick-thinking neuroanesthesiologist.

OKAY, A MAJOR COMPLICATION HAS OCCURRED, WHAT NEXT?

Leaving the operating room after a major disaster has unfolded is a difficult experience. It is important to restore calm after the frenzied activity that has just occurred. The surgeon must re-create a professional demeanor after the crisis and acknowledge colleagues for their excellent help during the stressful time. They should be encouraged that the ultimate outcome may still be good (because it might). At that point, I like to organize my thoughts and dictate the operative notes while the details are still very fresh in my mind. It is critical that all of the detailed observations made during the case get translated into the record because many such patients end up back in the operating room, and being able to look back on exactly what you saw and did is important. When that task is complete, the surgeon heads to the waiting room to see the family. This is a critical encounter in which an honest and gentle discussion is held. The demeanor of the surgeon that is the most helpful to the family includes apathy, humility, sadness over what occurred, and cautious optimism. For example, in a tumor case, one can clearly state that it is only the frozen section that we are working off of, and the diagnosis may change. If the patient is still under anesthesia, one truly never knows how he or she will wake up. It is important to give the family time to absorb the news and ask questions for clarification. I will never forget a young woman with 2 young children who had a subarachnoid hemorrhage from a basilar aneurysm. I traveled out of state to assist another surgeon and encountered a very primitive microscope and quite an unruly operative crew. The microscope was very difficult to move around, and as I worked my way down the sylvian fissure, I had to have a couple technicians move the base of the microscope with each adjustment of the objectives. Predictably, the aneurysm ruptured very prematurely, and at that moment, I had no access to the basilar trunk. I finally got a temporary clip on the basilar, which slowed things down a bit, but my period of temporary occlusion during the dissection exceeded all thresholds that I am familiar with, and at the 35-minute mark, I finally got a good look at the neck and got a clip across it safely. I was talking to the grieving family, informing them that I doubted that she had a chance to make a meaningful recovery, when one of the assistants came into the waiting room and kept tapping me on the shoulder. I finally looked at him and he said, "You should come look; she is waking up great." In a specialty riddled with so many disappointments, it is important to savor those rare moments when we truly get lucky.

When it is clear that a patient has a severe deficit, discussions with the family need to be clearly focused. I like to let family members know that we are dealing with a marathon and not a 100-yard dash. They need to know that their surgeon and surgical team will be with them for the duration. It is critical to lay out expectations for the intensive care unit course, step-down ward, ward, and rehabilitation facility. Every neurosurgeon knows that some of the most remarkable relationships that we have with our patients and their families come out of true adversity with a catastrophic outcome. I have a number of names in mind of individuals who have become lifelong friends.

LESSONS LEARNED

One of the few advantages of aging is that we acquire a number of experiential data points that lead to clarity regarding surgical indications and technical nuances. Figure 11A illustrates a patient with a right-sided subarachnoid hemorrhage whose imaging studies demonstrated a right carotid bifurcation aneurysm. As the dissection unfolded during surgery, the ruptured aneurysm was clearly seen, and the anterior aspect of the neck was beautifully exposed in the clutch of the A1 segment. Fresh blood obscured a bit of the posterior neck, and I remember one of our residents thinking

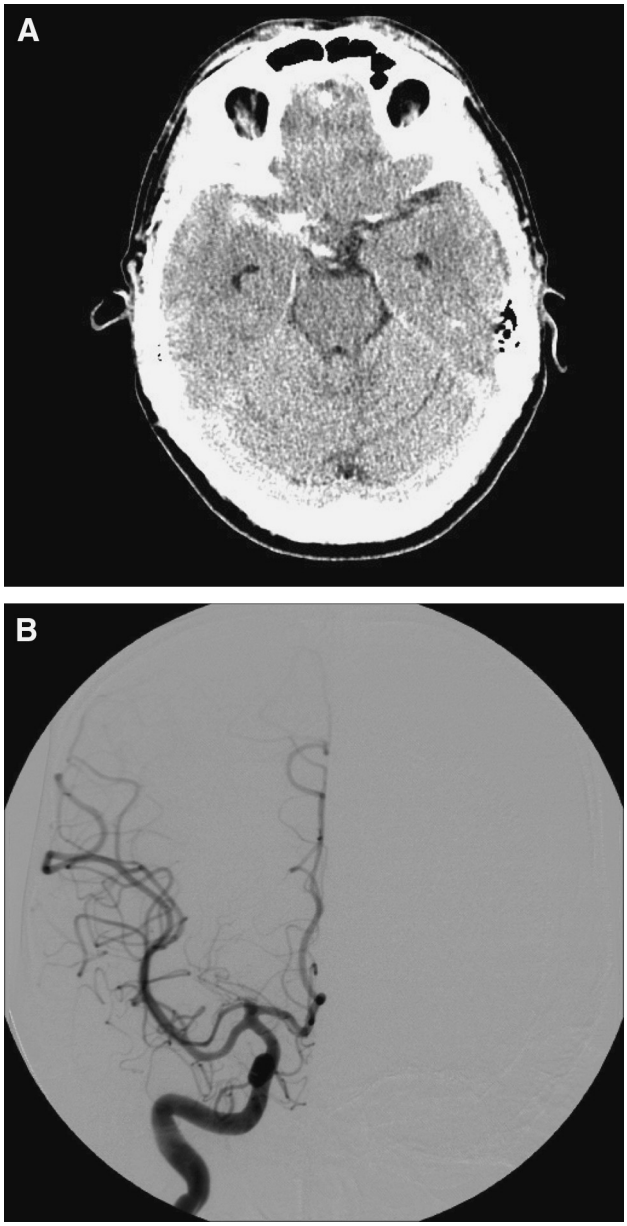

FIGURE 11. A, axial brain computed tomography scan showing right-sided subarachnoid hemorrhage. B, digital subtraction angiogram revealing the presence of an accessory middle cerebral trunk.

that it would be safe to clip the lesion at this point. Things did not look quite right. The M1 segment was quiet small and thin walled even compared with the A1 segment. A quick look back at the preoperative angiogram clarified that indeed there was an accessory middle cerebral trunk (Figure 11B). Further dissection behind the distal neck identified that origin and saved the patient from a potentially major complication.

Another example is a patient in her mid-50s who had suffered a subarachnoid hemorrhage. Our outside information suggested a P1-P2 dissection-related fusiform aneurysm. When the outside angiogram was studied (Figure 12A), that seemed to be the case. However, it was unclear why there was such a paucity of distal posterior cerebral irrigation on that side. Fortunately, the anatomy that looked a little odd was studied further with a more detailed angiogram. Remarkably, the study showed that the normal P1 and P2 wrapped around the ambient cistern, and a complete hairpin turn occurred wherein the distal posterior cerebral artery traveled back anteriorly around the cerebral peduncle and gave off a saccular aneurysm projecting medially, only for the distal posterior cerebral artery to arise from the sac and travel back into the normal occipital course (Figure 12B and 12C). That knowledge allowed a very safe subtemporal procedure that obliterated her ruptured aneurysm and preserved flow.

Lessons Learned From Revascularization Procedures

In contemporary cerebrovascular practice, most bypass procedures are performed not for ischemic disease states but in the management of complex and giant intracranial aneurysms. Figure 13 illustrates the case of a man presenting with a focal neurological deficit. The patient had a giant thrombotic middle cerebral artery aneurysm. On detailed imaging, this proved to be a dissection-related M1 aneurysm with a patent channel through the thrombotic mass terminating in the distal M1 branch, which quickly bifurcated. We have seen a number of these lesions, and their management is a challenge, to say the least. We felt that we needed to place a high-volume bypass graft before trapping the aneurysm and emptying its contents. A radial artery was harvested. The proximal anastomosis was performed off the external carotid artery in the neck, and temporary clips were applied to the efferent channel. To my disappointment, on performance of the arteriotomy, a sleevelike plaque simply fell out of the lumen of the distal M1. This left a vessel with very little integrity. As the distal anastomosis was constructed, sutures repetitively pulled out of the recipient vessel resulting in closing a temporary occlusion time of >1 hour. This is in a sense a perfect storm in which we rendered a substantial volume of tissue ischemic and then reperfused it with a very high-volume high flow graft. The rest of the procedure went uneventfully, with a clip reconstruction allowing 1 anterior temporal branch to be in continuity with the internal carotid artery. Within 12 hours, the patient suffered a substantial intracerebral hemorrhage requiring reoperation. He subsequently developed a brain abscess in this area and had a very protracted, difficult course. Amazingly, the human spirit ultimately triumphed, and this patient made a pretty decent functional recovery with a spastic right hemiparesis. His referring physician was kind enough to send a photograph of him during a return visit in the southeast part of the United States.

With that unhappy experience as background, we were soon consulted on a 12-year-old patient with essentially an identical aneurysm except that her lesion did not contain thrombus. Her superficial temporal artery was reasonable, and I resisted the temptation to put a large graft in place. The superficial temporal artery was extremely effective at carrying

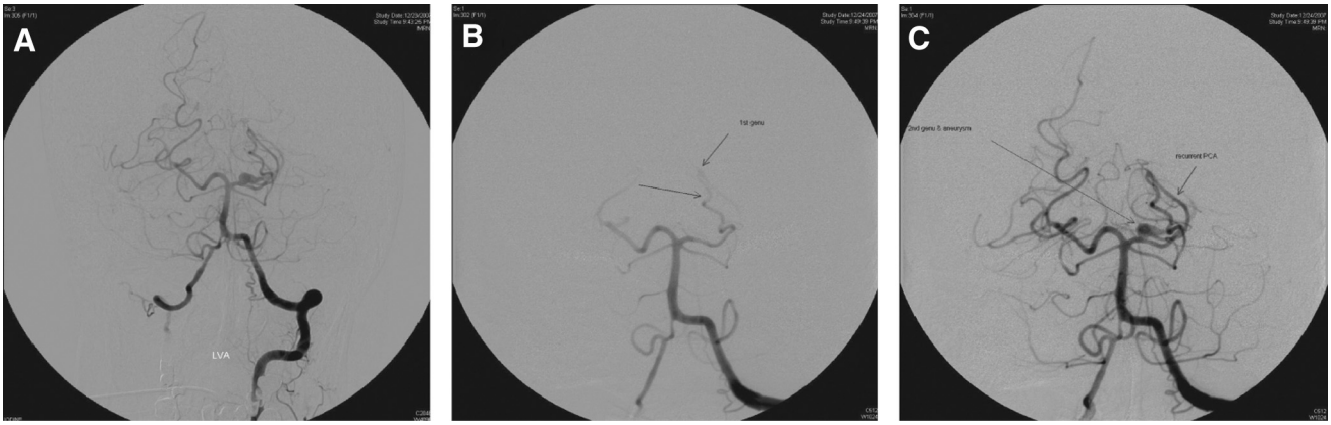

FIGURE 12. A, digital subtraction angiogram revealing a right-sided P1-P2 dissection-related fusiform aneurysm. B and C, digital subtraction angiogram showing the anatomy of posterior circulation. LVA, left vertebral artery; PCA, posterior cerebral artery.

the entire distal middle cerebral circulation, and she escaped without consequence. Figure 14 illustrates the case of a 51-year-old man who presented with a crescendo headache pattern and was found to have a giant thrombotic right middle cerebral artery aneurysm with a good deal of fluid-attenuated inversion-recovery MR signal and low density on the computed tomography scan. The computed tomographic angiogram clarified that this was indeed a saccular lesion, but one of the efferent middle cerebral branches came out of the neck and went in a recurrent or shunt angle direction back along the M1. In my experience, this is a warning sign that you may not be able to keep the vessel patent in spite of what might appear to be a perfect clip application. For that reason, after exposure, a superficial temporal artery bypass was constructed into that branch at risk, and then temporary occlusion was achieved, followed by evacuation of the contents of the aneurysm and clip reconstruction. As expected, the recurrent branch coming off the anterior aspect of the sac was perfectly preserved from the extraluminal perspective but filled only via the patent superficial temporal artery bypass. Another similar case is illustrated by Figure 15. This 61-year-old man with a new seizure disorder was found to have a complex thrombotic middle cerebral artery aneurysm with the efferent circulation coming out of the sac. Again, a superficial temporal artery graft was constructed that successfully carried all of the distal middle cerebral territory. A final bypass case is illustrated in Figure 16. This 42-year-old man presented with a crescendo headache pattern and visual loss involving the left eye. He was found to have a giant carotid ophthalmic aneurysm with substantial thrombosis and dense calcification in the aneurysm neck. Because of the calcification, I had significant concerns about whether we would be able to preserve the patency of his carotid artery. For that reason, a preliminary bypass was constructed that gave us a safety margin in case we encountered trouble. Ultimately, it was possible to crush the neck with a Betcher dissector, and a successful reconstruction was feasible.

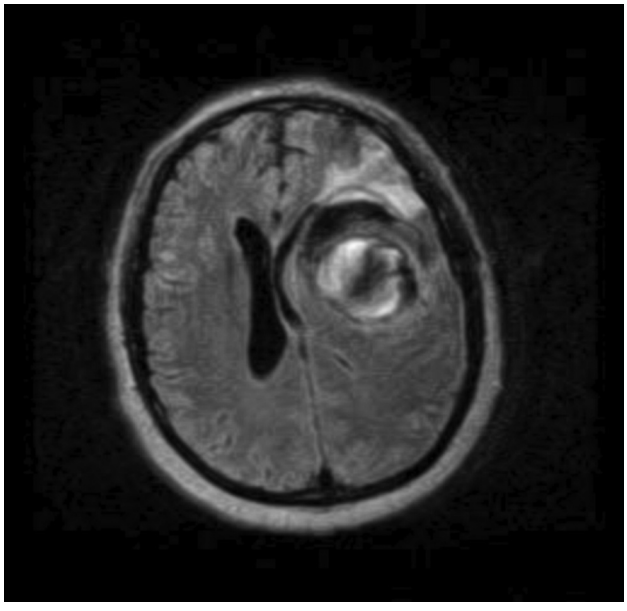

FIGURE 13. Axial fluid-attenuated inversion-recovery brain MRI showing a giant thrombotic middle cerebral artery aneurysm.

The theme of these experiences seems to be that one should look toward smaller rather than larger bypass conduits. The superficial temporal artery can provide considerable circulation in these settings. The larger and higher-flow grafts require additional ischemia time to construct and are a real threat to tissue rendered ischemic during the bypass procedure. Hopefully, the ELANA (excimer laser-assisted nonocclusive anastomosis) technique down the road will eliminate some the problems associated with these giant aneurysms.

DESPITE THE BEST-LAID PLANS…

Sometimes even careful preparation and seemingly flawless execution are not rewarded by successful clinical outcome. A particularly poignant example of this occurred in the patient illustrated in Figure 17. This middle-aged man had a concussive injury after a motor vehicle accident. Persisting headaches led to imaging. He was found to have a giant basilar apex aneurysm projecting up into his third ventricle. The lesion

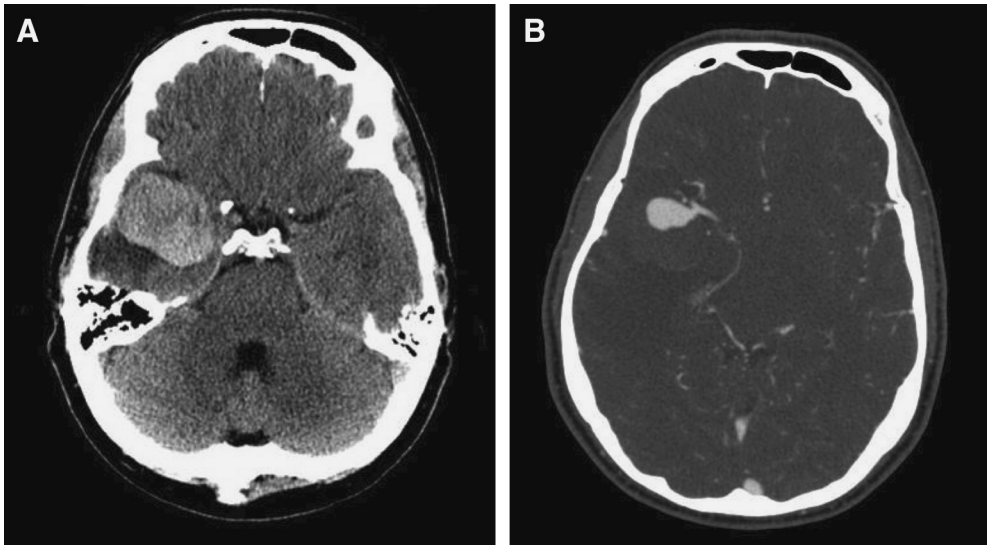

FIGURE 14. Axial computed tomography scan (A) and computed tomography angiogram (B) showing a giant thrombotic middle cerebral artery aneurysm.

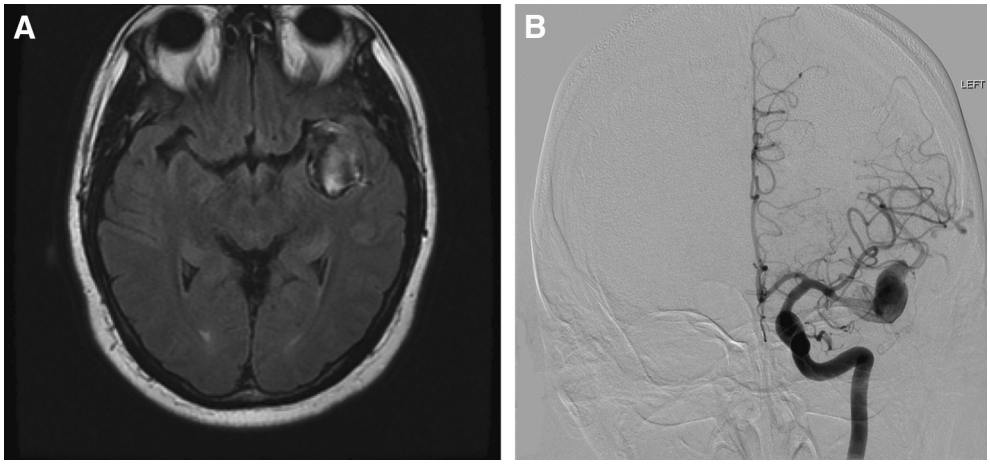

FIGURE 15. A, axial T1-weighted brain MRI showing a left giant thrombotic middle cerebral artery aneurysm. B, cerebral angiogram showing the efferent circulation coming out of the aneurysm sac.

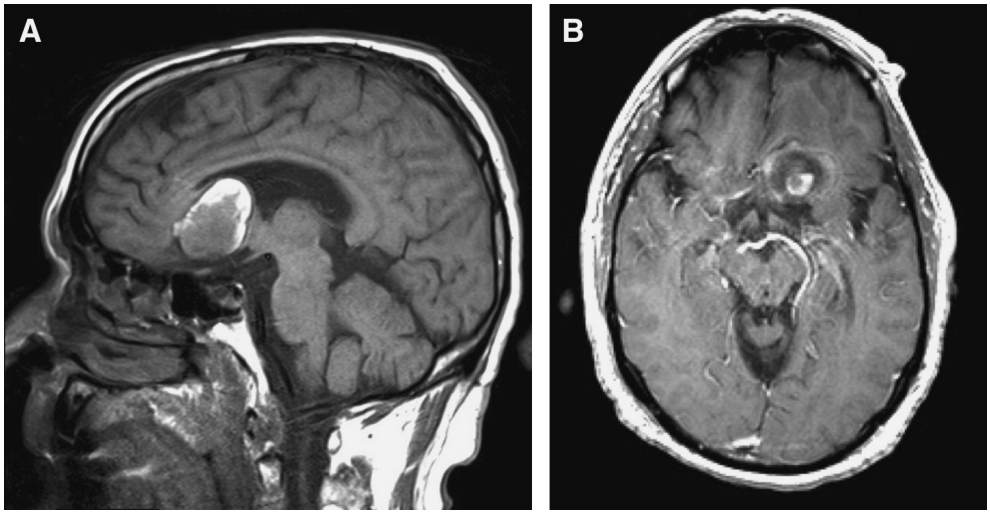

FIGURE 16. Sagittal T1-weighted (A) and fluid-attenuated inversion-recovery (B) brain MRI showing a giant carotid ophthalmic aneurysm.

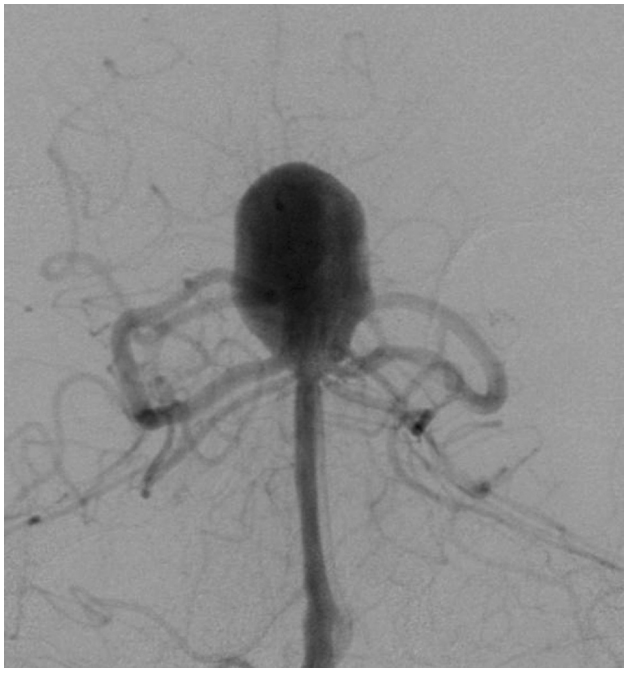

FIGURE 17. Cerebral angiogram showing a giant basilar tip aneurysm.

was quite broad based, and our endovascular colleagues were not keen to try to reconstruct it. He was taken to the operating room. A temporary clip was applied via a transsylvian extended lateral approach. Definitive clipping was achieved with a very short fenestrated blade to occlude the distal neck, followed by a conventional clip superior to the ipsilateral P1 segment. We got a beautiful look in all aspects of this reconstruction and saw no perforators whatsoever that looked problematic. All our neuromonitoring signals remained stable. Unbelievably, the patient awakened with a dense neurological deficit and what evolved into a complete posterior cerebral infarction on the contralateral side despite all 4 efferent vessels remaining patent. I have simply no explanation for this disaster.

HOW TO HELP THE SURGEON

Operative neurosurgery is no different from any high-end athletic endeavor. An experience like the case just mentioned challenges one's competence. It is critical for our next patients that we do not develop the yips. It is important to put things in perspective and to begin the process of renewal and recovery. The surgeon is wiser and has more experience to bring to bear. The surgeon must avoid feeling sorry for himself or herself but rather save that sentiment for the patient and family. Take a moment to let it sink in, and then come back better and stronger. Finally, do not desert the patients and their families.

Shortly after that basilar aneurysm described above, a 60-year-old woman came to us with a severe headache of 2 weeks' duration requiring narcotics. She was found to have an extremely challenging vertebral confluence/basilar trunk aneurysm with a dumbbell-shaped appearance. A posterior larger lobe projected back into the brainstem, and a smaller lobe projected into the clivus. This is not the kind of case you like to see after a disaster. At surgery, an early and unfortunate intraoperative rupture occurred that required temporary occlusion. The basilar and both ventricles were occluded for a little over 20 minutes. Remarkably, she came through it completely unscathed. Perhaps another case of blind luck.

CONCLUSION

Sadly, bad outcomes will remain a part of our specialty. We must do everything humanly possible to minimize their frequency. Patients and families must be informed, not frightened (they already are). A career in cerebrovascular surgery has left the following indelible impressions:

1. Never give up in surgery. It ain't over until it's over, and you never know….
2. Achieve a balance psychologically in which you remember prior experiences, both good and bad, and use those lessons to avoid future problems, but also use creativity to explore novel strategies to solve longstanding problems.
3. Never desert the patient.
4. Never stop learning from your mistakes.

Disclosure

The authors have no personal financial or institutional interest in any of the drugs, materials, or devices described in this article.