



# The Pathogenesis of Chronic Subdural Hematomas (CSDH): A Study on the Formation of Chronic Subdural Hematomas and Analysis of CT Findings

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## Learning Objectives

By the conclusion of this session, participants should be able to:

- 1) Identify a few theories regarding the pathogenesis of formation of CSDH
- 2) Discuss the multifactorial relationship of the origin of CSDH

## Introduction

The pathophysiology of CSDH remains unknown. The most accepted theory suggests rebleeding from immature vessels in neomembranes. Another theory suggests CSDH originate from subdural hygromas (SH). Since chronic rebleeding would be reflected in changes in chemical composition of CSDH while SH would require the presence of CSF, these theories could be tested.

## Methods

We studied the chemical composition and the presence of CSF in CSDH in 41 patients. The relationship of these components to the appearance of CSDH on CT scans was studied. In this prospective study, 58 samples (41 patients) treated surgically were analyzed. CSDH were evaluated for presence of CSF using beta-2 transferrin (B2T) and substances related to red blood cell hemolysis. They were compared to normal serum values and CT appearance of CSDH.

Table 1

	Positive $\beta$ 2T	Negative $\beta$ 2T
Unilateral	4	25
Bilateral	10	19
Total (%)	14 (24%)	44 (76%)

Presence of Beta-2 Transferrin in CSDH

## Results

Twenty four percent of the samples contained B2T. Total protein, LDH, total bilirubin, and RBC count in CSDH were statistically different when compared to normal serum, indicating an active process of rebleeding and hemolysis rather than plasma ultrafiltration. Concentrations did not correlate with specific CT scan appearance.

## Conclusions

The absence of CSF in CSDH in 76% of cases suggests most CSDH do not originate from SH. The presence of hemolysis/cell breakdown byproducts in all samples supports the hypothesis that the primary enlargement of CSDH develops through neomembrane and neovascular formation, rebleeding, and inhibition of blood coagulation. Our study confirms that the origin and enlargement of CSDH is multifactorial. CT scan findings do not correlate with the chemical composition or presence of CSF in CSDH.

## References - abbreviated

1. Bachmann-Harildstad, G. "Diagnostic values of beta-2 transferrin and beta-trace protein as markers for cerebrospinal fluid fistula." *Rhinology*, 2008. Vol 46: No 2; pg. 82-85.
2. Foben, E.S., Grossman, R., Atlas, Scott, Hacknej, D., Goldberg, H., Zimmerman, R., Bilarnick, L. MR Characteristics of Subdural Hematomas and Hygromas at 1.5T. *AJR* 153:589-95, 1989.
3. Fujisawa, H, Nomura, S., Kajiwara, K, Kato, S, Fujii, M, Suzuki, M. "Various magnetic resonance imaging patterns of chronic subdural hematoma: Indicators of the pathogenesis?" *Neurologia Medico-Chirurgica*, 2006. Vol 46: No 7; pg. 333-339.
4. Gardner, WJ. "Traumatic Subdural Hematoma: with particular reference to the latent interval." *Archives of Neurology and Psychiatry*, 1932. Vol 27: No 4; pg. 847-858.
5. Kristof, RA, Grimm, JM, Stoffel-Wagner, B. "Cerebrospinal fluid leakage into the subdural space: possible influence on the pathogenesis and recurrence frequency of chronic subdural hematoma and subdural hygroma." *Journal of Neurosurgery*, 2008. Vol 108: No 2; pg. 275-280.
6. Lee, KS. "The pathogenesis and clinical significance of traumatic subdural hygroma." *Brain Injury*, 1998. Vol 12: No 7; pg. 595-603.
7. Markwalder, TM. "The course of chronic subdural hematomas after burr-hole craniostomy with and without closed-system drainage." *Neurosurgery Clinics of North America*, 2000. Vol 11: No 3; pg. 541-546.
8. Nakaguchi, H, Tanishima, T, Yoshimasu, N. "Factors in the natural history of chronic subdural hematomas that influence their postoperative recurrence." *Journal of Neurosurgery*, 2001. Aug; Vol 95: No 2; pg. 256-262.
9. Normansell, DE, Stacy, EK, Booker, CF, Butler, TZ. "Detection of beta-2 transferrin in otorrhea and rhinorrhea in a routine clinical laboratory setting." *Clinical and Diagnostic Laboratory Immunology*, 1994. Jan; Vol 1: No 1; pg. 68-70.
10. Osborne, A. editor: *Diagnostic Imaging Brain* Amirys Publishing House, First Edition, August 2004 pp. 1,2,10-21.
11. Scotti, G, Terbrugge, K, Melancon, D, Belanger, G. "Evaluation of the age of subdural hematomas by computerized tomography." *Journal of Neurosurgery*, 1977. Sep; Vol 47: No 3; pg. 311-315.
12. So, SK, Ogawa, T, Gerberg, E, Sakimura, I, Wright, W. "Tracer accumulation in the subdural hygroma: Case report." *Journal of Nuclear Medicine*, 1976. Vol 17: No 2; pg. 119-121.
13. Stroobandt, G, Fransen, P, Thauvoy, C, Menard E. "Pathogenetic factors in chronic subdural haematoma and causes of recurrence after drainage." *Acta Neurochirurgica*, 1995. Vol 137: No 1-2; pg. 6-14.
14. Trotter, W. "Chronic subdural haemorrhage of traumatic origin, and its relation to pachymeningitis haemorrhagica interna." *The British Journal of Surgery*, 1914. Vol 2: No 6; pg. 271-291.