

Tension pneumocephalus after chronic subdural hematoma evacuation

The occurrence of postoperative [pneumocephalus](#) is a common event in [chronic subdural hematoma](#) after evacuation and is often trivial.

Pneumocephalus after chronic subdural hematoma (CSDH) evacuation is a potential predictor of hematoma recurrence.

When the intracranial air volume is significant, it creates intracranial hypertension causing tension pneumocephalus. The attending physicians should be aware of the possibility of occurrence of such complication. Treatment and prevention of pneumocephalus should also be well-known by the medical staff ¹⁾.

The risk of [tension pneumocephalus](#) developing after the evacuation of a [chronic subdural hematoma](#) has been cited as 2.5% ²⁾.

Meta-analysis

In a meta-analysis, following PRISMA guidelines, PubMed, Embase, Cochrane Library, and Web of Science online databases were queried using the keywords “pneumocephalus,” “pneumoencephalos,” “intracranial pneumatocele,” “pneumo encephalon,” “subdural air,” and “chronic subdural hematoma.” The results were limited to English-language articles. Through the online database, we identified a total of 276 articles and finally included 14 articles for meta-analysis. The results showed that the recurrence rate in the pneumocephalus group was higher than that in the control group, with a pooled OR of 3.35 (CI: 2.51-4.46, $P < 0.001$). There was no difference in recurrence rate between the no/few and moderate pneumocephalus groups (OR: 1.27, CI: 0.68-2.37, $P = 0.46$), but the recurrence rate of the large pneumocephalus group was significantly higher than that of the moderate group, with a pooled OR of 3.29 (CI: 1.71-6.32, $P < 0.001$). This study failed to show higher mortality and worse outcomes in the pneumocephalus group than in the control. Pneumocephalus after surgical evacuation of CSDH was associated with the recurrence rate of hematoma. Pneumocephalus affecting recurrence was correlated with gas volume, and moderate pneumocephalus may have less impact, while patients with large pneumocephalus are more likely to recur than those with moderate pneumocephalus. More prospective cohort studies are needed for further investigation and verification. This meta-analysis was registered (PROSPERO CRD42022321800) ³⁾

Case series

In a retrospective case series, Anagnostopoulos et al. from the Faculty of Medicine, University of Thessaly, [Larissa](#), evacuated CSDH using very low-pressure valve-controlled drains and recorded the neurological, radiological, and functional outcomes. Patients with primary CSDH, without previous neurosurgical intervention, and who did not receive antiplatelet or anticoagulant therapy the week prior to the index surgery, were included in the study. Exclusion criteria were the evacuation with other treatment techniques and incomplete data files. Patients were assessed according to the

Bender grading system to record their neurological status. The hematoma volume was estimated using the formula for ellipsoid volumes.

Thirty-six patients with a mean age of 73 years (± 9 years) fulfilled our eligibility criteria. Our technique was effective since it decreased the CSDH volume from 141 ml (IQR 97 ml) to 20.6 ml (IQR 26.59 ml; $p < 0.001$) and improved the neurological status according to the Bender grading system from two (IQR 0.25) to 1 (IQR 0). However, pneumocephalus and hematoma recurrence occurred in one case each (2.8%). At six months, all patients returned to their previous status, except for two patients (5.6%) who died due to irrelevant pathologies.

Valve-controlled CSDH evacuation aiming to decrease [postoperative pneumocephalus](#) and hematoma recurrence constitute an effective and safe alternative. However, larger randomized controlled studies are required to establish its role in CSDH management ⁴⁾.

The computerized tomography (CT) findings were analyzed in five cases of subdural tension pneumocephalus following surgery for chronic subdural hematoma. They were compared with CT scans in 14 cases of asymptomatic subdural pneumocephalus. In this study, two new CT findings were identified that suggest increased tension of the subdural air. Subdural air separates and compresses the frontal lobes, creating a widened interhemispheric space between the tips of the frontal lobes that mimics the silhouette of Mt. Fuji. The presence of air between the frontal tips associated with massive air inclusion over the frontal lobes presumably indicates increased tension of the subdural air. The "Mt. Fuji sign" was seen in four of the five cases with subdural tension pneumocephalus. The other finding was the presence of multiple small air bubbles scattered through several cisterns ("air bubble sign"). It is postulated that these air bubbles enter the subarachnoid space through a tear in the arachnoid membrane caused by increased tension of air in the subdural space. This finding was seen in four cases with subdural tension pneumocephalus. These two CT findings are helpful in making a diagnosis of subdural tension pneumocephalus following surgery for chronic subdural hematoma ⁵⁾.

Case reports

1985

After burr hole evacuation of bilateral chronic subdural hematomas. Subsequent treatment was effected with combined twist drill closed system drainage and continuous intrathecal infusion of a physiological solution. The clinical entity, tension pneumocephalus, and the use of continuous subarachnoid infusion and drainage as a method of cerebral reexpansion are discussed ⁶⁾.

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Guo X, Wu L, Ou Y, Yu X, Zhu B, Yang C, Liu W. Postoperative pneumocephalus and recurrence and

outcome of chronic subdural hematoma: a systematic review and meta-analysis. *Neurosurg Rev.* 2022 Dec 9;46(1):13. doi: 10.1007/s10143-022-01925-x. PMID: 36481957.

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Anagnostopoulos V, Brotis AG, Tzerefos C, Charalambidou A, Tasiou A, Karavelis A, Paterakis KN. Valve-controlled chronic subdural hematoma drainage: A feasibility study. *Brain Spine.* 2022 Nov 22;2:101693. doi: 10.1016/j.bas.2022.101693. PMID: 36506285; PMCID: PMC9729815.

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Caron JL, Worthington C, Bertrand G. Tension pneumocephalus after evacuation of chronic subdural hematoma and subsequent treatment with continuous lumbar subarachnoid infusion and craniostomy drainage. *Neurosurgery.* 1985 Jan;16(1):107-10. PubMed PMID: 3974807.

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