ScientificScholar®
Knowledge is power
Publisher of Scientific Journals

www.surgicalneurologyint.com

Surgical Neurology International

Editor-in-Chief: Nancy E. Epstein, MD, Professor of Clinical Neurosurgery, School of Medicine, State U. of NY at Stony Brook.

SNI: Trauma

Editor
Naveed Ashraf, M.S., M.B.B.S.
University of Health Sciences; Lahore, Pakistan

SNI
Open Access

Case Report

Subdural hygroma due to traumatic rupture of a middle cranial fossa arachnoid cyst that has transformed into a chronic subdural hematoma after burr hole operation: A case report

Seigo Kimura[1], Daiji Ogawa[1], Hirokatsu Taniguchi[1], Masahiko Wanibuchi[2]

[1]Department of Neurosurgery, Kouzenkai Yagi Neurosurgical Hospital, [2]Department of Neurosurgery and Neuroendovascular Therapy, Osaka Medical and Pharmaceutical University Hospital, Osaka, Japan.

E-mail: Seigo Kimura - seigo.kimura@ompu.ac.jp; Daiji Ogawa - daiji0117@yahoo.co.jp; Hirokatsu Taniguchi - taniguchi@kouzenkai.or.jp; Masahiko Wanibuchi - wanibuchi@ompu.ac.jp

***Corresponding author:**
Seigo Kimura,
Department of Neurosurgery,
Kouzenkai Yagi Neurosurgical Hospital, Osaka, Japan.

seigo.kimura@ompu.ac.jp

Received: 21 November 2024
Accepted: 07 February 2025
Published: 28 February 2025

DOI
10.25259/SNI_980_2024

Quick Response Code:

ABSTRACT

Background: Middle cranial fossa arachnoid cysts (MFACs) cause subdural hygromas due to head trauma or spontaneous rupture. We report the case of a patient who has performed burr hole surgery for subdural hygroma and chronic subdural hematoma (CSDH) caused by the rupture of an arachnoid cyst.

Case Description: A 30-year-old man fell off a motorbike and hit his head. Head computed tomography (CT) revealed left MFAC and left subdural hygroma. The subdural hygroma increased over time, and the symptoms of intracranial hypertension developed. Therefore, burr hole operation was performed without the use of a subdural drain. Approximately half a month after surgery, head CT revealed that the density of the arachnoid cyst and subdural hygroma increased and that the subdural hygroma transformed into CSDH. Therefore, a burr hole operation was performed again, and a hematoma cavity drain was left. After surgery, the symptoms of intracranial hypertension improved, and subdural collection did not recur.

Conclusion: The increase in CSDH may have disrupted the flap–valve mechanism of the arachnoid cyst and subdural collection. When performing a burr hole operation for a subdural hygroma caused by the rupture of an arachnoid cyst, placement of a subdural drain may be desirable, and consideration of the possibility of CSDH is necessary.

Keywords: Arachnoid cyst, Burr hole operation, Chronic subdural hematoma, Subdural hygroma

INTRODUCTION

Middle cranial fossa arachnoid cysts (MFACs) have been reported to cause subdural hygromas due to head trauma or spontaneous rupture.[8] If symptoms of intracranial hypertension develop as a result, treatment should be performed; however, several treatment methods have been reported, including burr hole operation, craniotomy, endoscopic surgery, and conservative treatment, and no consensus has been reached.[7] In this case, we performed a burr hole operation on a patient who had subdural hygroma caused by a ruptured arachnoid cyst due to head injury and presented with intracranial hypertension symptoms. After surgery, chronic subdural

hematoma (CSDH) occurred, and burr hole operation was performed again. Thus, we obtained favorable outcomes. Herein, we report the case of a patient who performed burr hole operations for subdural hygroma and CSDH caused by rupture of an arachnoid cyst.

CASE DESCRIPTION

A 30-year-old man fell off a motorbike and hit his head on October 15, 2023. The patient visited our hospital on October 20, 2023, because he had a headache since October 18, 2023. The patient's medical and family history was insignificant. On arrival, his Glasgow Coma Scale score was 15 (E4, V5, M6) with no neurological deficit. The blood pressure and pulse rate were 137/89 mmHg and 60/min, respectively. Head computed tomography (CT) revealed left MFAC and a small left subdural hygroma [Figures 1a-c]. However, because the cause of the headache was unknown, the patient returned home. However, because the headache continued and worsened, the patient visited our hospital again on October 31, 2023. His Glasgow Coma Scale score was 15 (E4, V5, M6) without neurological deficit. Head CT revealed an increase in the left subdural hygroma [Figures 1d-f]. Conservative treatment was administered using Goreisan (7.5 mg/day). The patient visited an ophthalmology hospital on November 24, 2023, because he had noticed diplopia since November 15, 2023. Although no obvious eye movement disorder and no papillary edema were observed, internal strabismus was noted in his left eye. The patient visited our hospital on November 30, 2023. Head CT revealed that the left subdural hygroma had increased further [Figures 1g-i]. Because headache and diplopia are believed to be caused by intracranial hypertension, a burr hole operation was performed on the same day. A clear, watery fluid that did not contain any visible blood leaked out, and after it was naturally discharged, the wound was sutured. Postoperative head CT revealed a slight improvement in the midline shift [Figures 2a-c]. Diplopia and headache improved after the operation; however, both symptoms remained. Head CT performed on December 6, 2023, revealed no obvious increase in the subdural hygroma [Figures 2d-f]. On December 14, 2023, the headache had almost disappeared; however, diplopia remained, and head CT revealed that the density of the arachnoid cyst and subdural hygroma had increased and that it had transformed into CSDH [Figures 2g-i]. On December 20, 2023, because the headache worsened, a head CT was performed, which revealed an increase in the CSDH and aggravation of the midline shift [Figures 2j-l]. Burr hole operation was performed through the same hole on the same day. The dark red hematoma was drained; the cavity was washed with 1500 mL of saline solution, and a hematoma cavity drain was left for 12 h. Postoperative CT revealed that the hematoma in the arachnoid cyst and CSDH had been drained [Figures 3a-c]. On the day after surgery, head CT revealed that the midline shift had improved [Figures 3d-f]. Then, 180 mL of the fluid was drained from the hematoma cavity drain, which was removed on the same day. The headache improved, and the diplopia gradually improved. On March 28, 2024, diplopia had completely resolved, and the subdural collection did not recur [Figures 3g-i].

DISCUSSION

Arachnoid cysts are congenital collections of fluid that develop within the arachnoid membrane due to splitting or duplication of the arachnoid membrane. Arachnoid cysts represent 1% of all traumatic intracranial mass lesions,[5] and they most frequently occur in the middle cranial fossa.[7] MFAC may cause intracranial hypertension symptoms due to subdural hematoma, subdural hygroma, or intracystic hematoma caused by trauma or spontaneous rupture.[10] MFACs have been reported to have a higher risk of rupture than other intracranial arachnoid cysts.[3,7] The following hypotheses have been formulated to explain the occurrence of subdural hygromas: (1) The connection between the cyst and subarachnoid space results from a minor head injury causing a flap–valve mechanism with cerebrospinal fluid flow from the subarachnoid space into the cyst. This increases the size and pressure of the cyst with rupture into the subdural space. (2) The Valsalva maneuver causes a transient increase in intracranial pressure (ICP) with rupture of the cyst into the subarachnoid space.[4] In this case, the rupture is believed to be caused by the former mechanism. According to Massimi *et al*., in their review of 446 patients, 142 presented with CSDH (33%), 157 presented with subdural hygroma (36.5%), 28 presented with CSDH plus intracystic bleeding (6.5%), 20 presented with acute subdural hematoma (4.5%), 11 presented with extradural hematoma (2.5%), 28 presented with intracystic bleeding alone (6.5%), and two presented with acute subdural hematoma plus intracystic bleeding (0.5%).[6] Therefore, CSDH and subdural hygromas may occur at approximately the same rate.

If intracranial hypertension symptoms are observed due to the accumulation of subdural collection caused by MFAC rupture, treatment should be considered.[6] Burr hole operation and craniotomy are the main surgical treatment modalities for subdural collections due to MFAC rupture, although conservative treatment has also been reported. Removal of the subdural collection and simultaneous microsurgical or endoscopic fenestration of the arachnoid cyst may be performed.[6] In cases of persistent subdural collection, a subdural–peritoneal shunt may be required.[9] In a previous review, subdural collection and arachnoid cysts were treated simultaneously in 21% of cases.[6] Not all patients were treated for arachnoid cysts. To the best of our knowledge, only three cases of subdural hygroma caused by

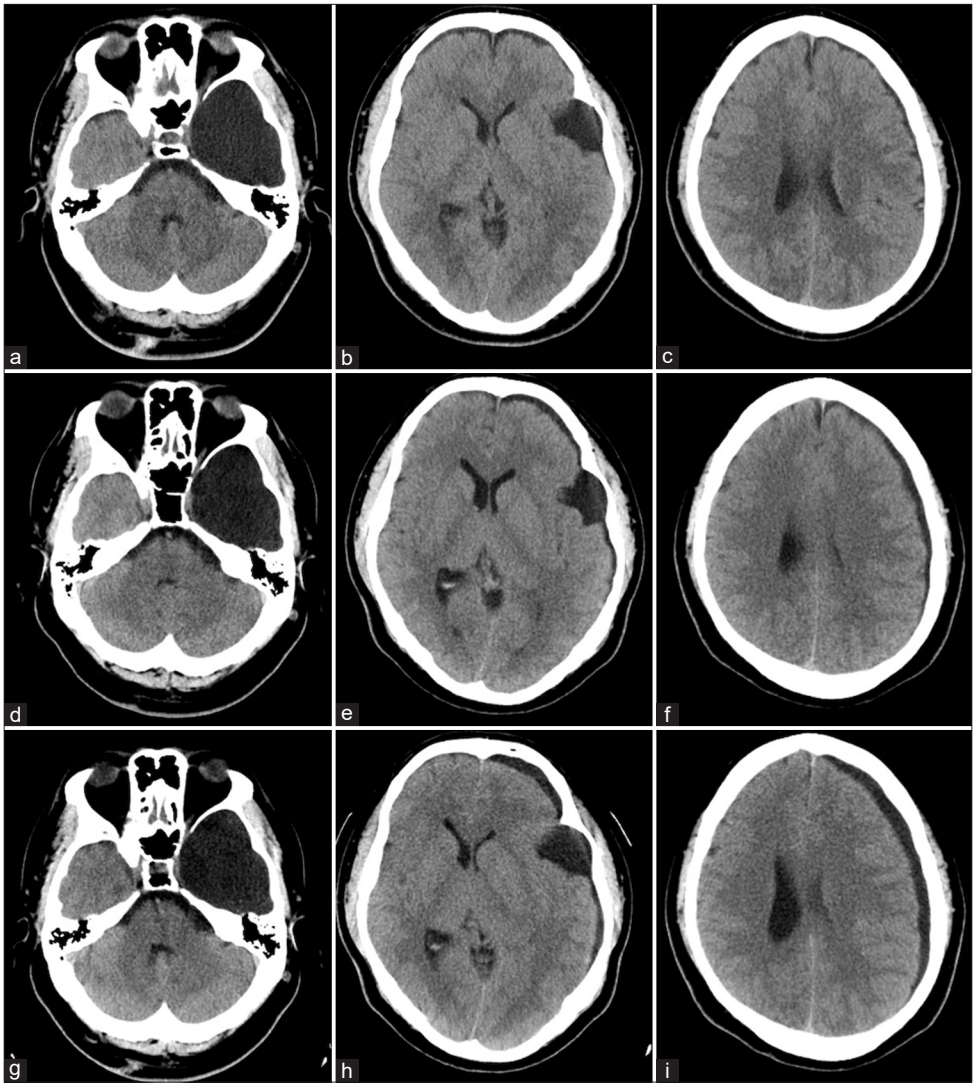

Figure 1: (a–c) Head computed tomography performed 3 days after the head trauma revealed a left middle cranial fossa arachnoid cyst and a small left subdural hygroma. (d-f) Head computed tomography performed 16 days after the head trauma revealed an increase in the left subdural hygroma. (g-i) Head computed tomography performed 43 days after the head trauma revealed that the left subdural hygroma had increased further.

MFAC rupture treated with burr hole operation alone have been reported,[2] and no case in which CSDH occurred after burr hole operation for subdural hygroma and then burr hole operation was performed again for the CSDH has been reported. In a previous report, cases treated with only burr hole surgery had high ICP; therefore, subdural drains were temporarily placed (24–72 h), and when the ICP decreased, the drains were removed, and good outcomes were obtained.[2] In the same report, a subdural–peritoneal shunt was added in a case in which the ICP remained high at 20–30 cm H2O. Because our patient presented with intracranial hypertension symptoms, we first performed an emergency burr hole operation to remove the subdural hygroma. We had limited experience with cases of subdural hygroma caused by a ruptured arachnoid cyst; therefore, we decided to treat it with a less invasive burr hole operation. No evidence indicated whether a subdural drain should be inserted into the subdural space, and to our knowledge, subdural drains have never been placed for subdural hygroma; therefore, the burr hole operation was performed without subdural drain placement. Moreover, a sudden evacuation of the subdural hygroma may lead to a venous rupture, resulting in blood collection and subdural hematoma formation; therefore, burr hole operation was performed under natural pressure to avoid venous rupture due to rapid drainage of the subdural hygroma. Consequently, head CT after 6 days of the first burr hole operation revealed no subdural hematoma due to venous rupture. In our patient, the symptoms were relieved by the

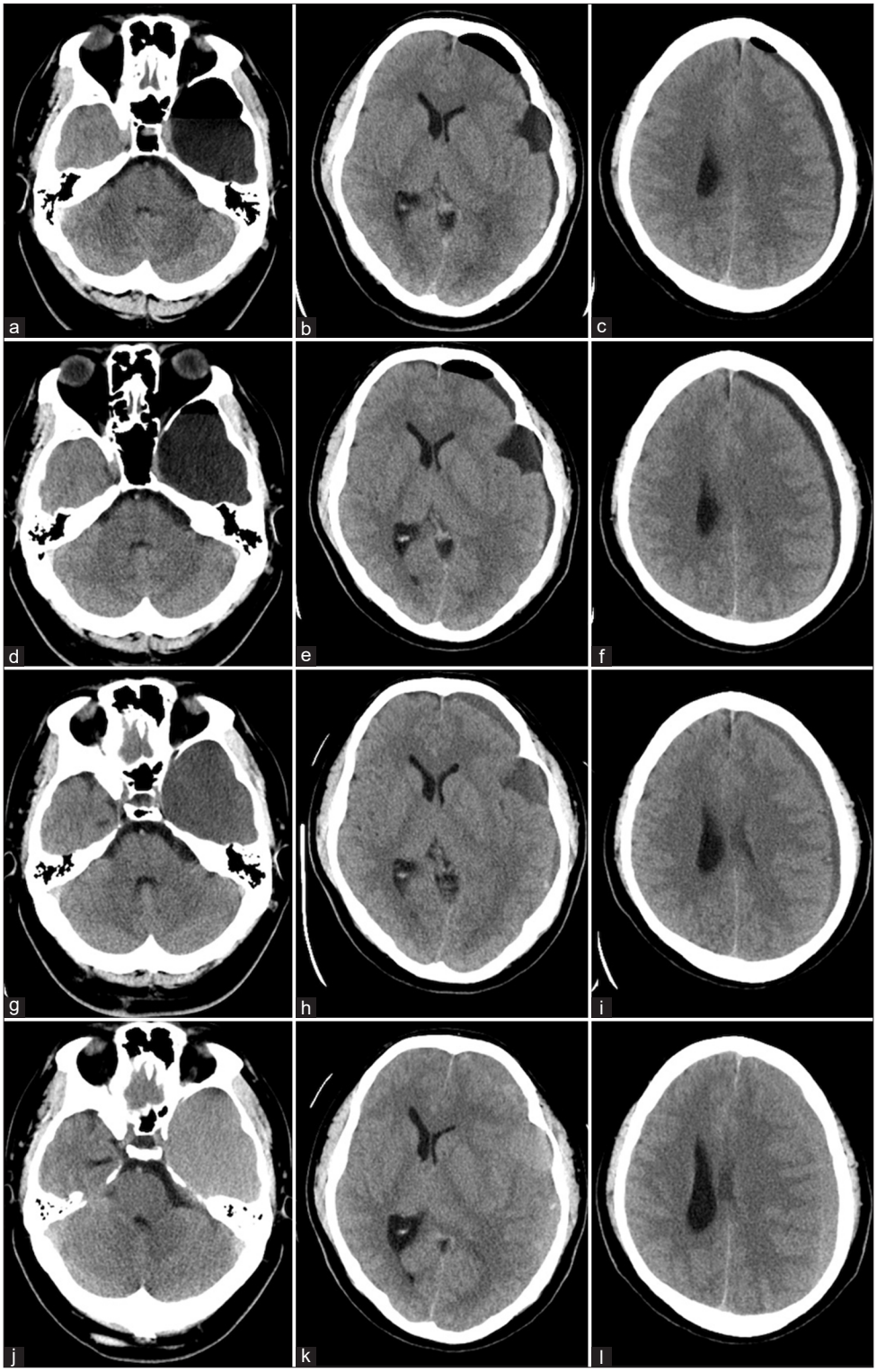

Figure 2: (a–c) Postoperative head computed tomography of the first burr hole operation revealed slight improvement in the midline shift. (d-f) Head computed tomography performed 6 days after the first burr hole operation revealed no obvious increase in the subdural hygroma. (g-i) Head computed tomography performed 14 days after the first burr hole operation revealed that the density of the arachnoid cyst and subdural hygroma had increased and that it had transformed into a chronic subdural hematoma. (j-l) Head computed tomography performed 20 days after the first burr hole operation revealed an increase in the chronic subdural hematoma and aggravation of the midline shift.

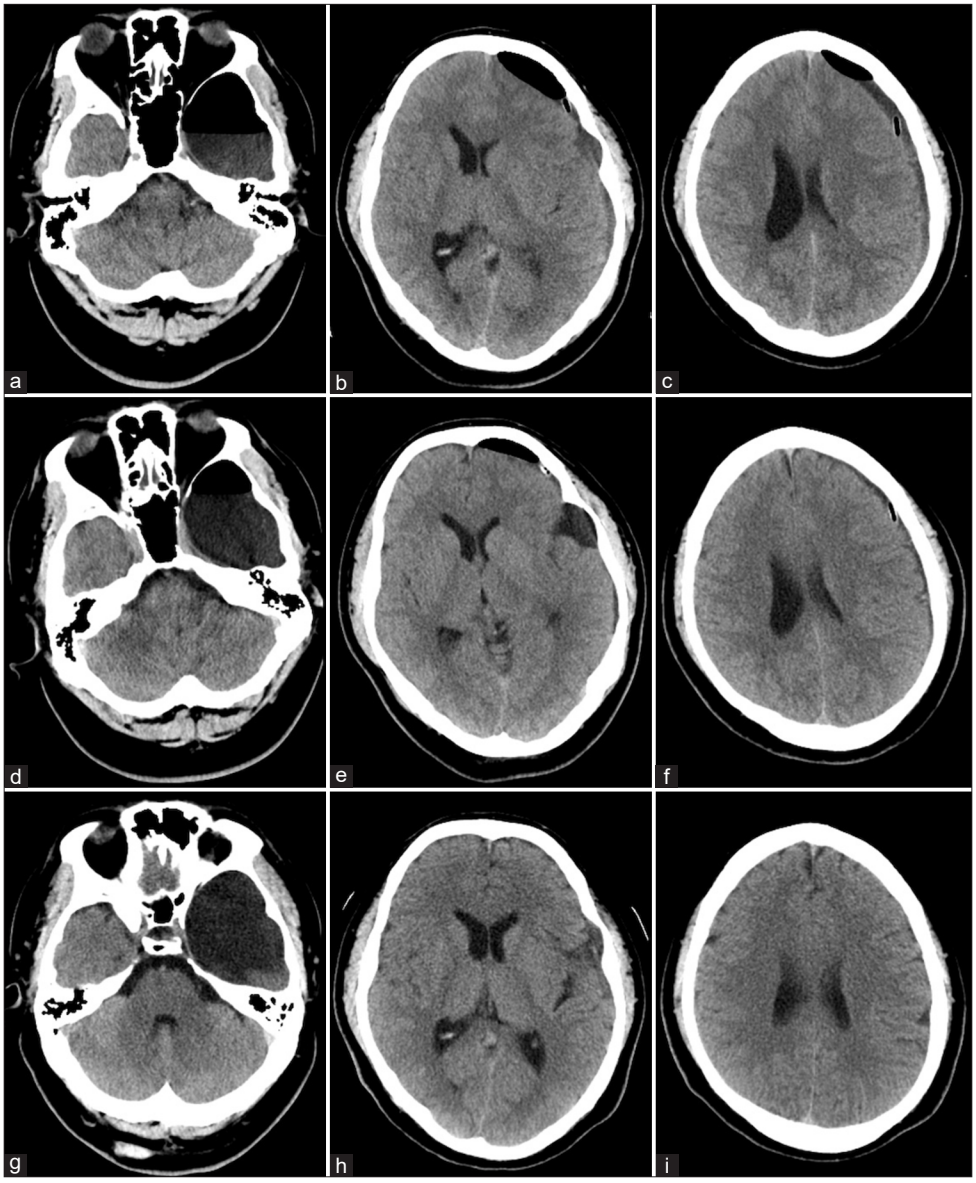

Figure 3: (a-c) Postoperative computed tomography performed after the second burr hole operation revealed that the hematoma in the arachnoid cyst and chronic subdural hematoma had been drained. (d-f) Head computed tomography performed on the day after the second burr hole operation revealed that the midline shift had improved. (g-i) Head computed tomography performed about 3 months after the second burr hole operation revealed no recurrence of the subdural collection.

burr hole operation. However, the ICP may not be completely relieved because a subdural drain was not inserted. During burr hole operation in similar cases, a subdural drain should be placed, and the ICP should be monitored for several days to observe if the ICP remained high at about 20–30 cm H2O or decreased. If the ICP remained high, microsurgical or endoscopic fenestration of the arachnoid cyst and a subdural–peritoneal shunt can be considered. Moreover, the production of cerebrospinal fluid formation in the arachnoid cyst will not cease; therefore, implanting a cerebrospinal fluid diversion procedure such as a shunt system can be crucial. However, treating the subdural hygroma caused by a ruptured arachnoid cyst without the shunt system as the foreign body, if possible, is desirable, considering it will lead to its permanent placement. Previously, not all cases were treated with the shunt system, but only burr hole operation or craniotomy and simultaneous microsurgical or endoscopic fenestration of the arachnoid cyst were performed for many. First, treating with these methods for subdural collection caused by MFAC rupture may be desirable.

The following are possible mechanisms by which subdural hygroma transforms into CSDH. A neomembrane forms if subdural hygroma with a bleeding component persists.[1] Bleeding in the subdural hygroma induces migration or proliferation of inflammatory cells derived from dural border cells, resulting in the accumulation of a layer of fibroblasts along the dura, which develops into the outer membrane of the hematoma. Therefore, subdural hygroma may transform into CSDH. The treatment methods for CSDH caused by ruptured arachnoid cysts also vary, similar to those for subdural hygroma. In our patient, no obvious postoperative bleeding was observed on the head CT performed after the first burr hole operation. However, slight persistent bleeding in subdural hygroma may cause CSDH. The second burr hole operation was performed for CSDH. The subdural drain was left in place for 12 h under atmospheric pressure. The hematoma was fully drained, including the bleeding within the arachnoid cyst. Postoperative CT revealed a decrease in the subdural collection, and the patient's symptoms improved. The subdural hygroma or CSDH did not recur. The subdural drain may have to decrease the intracranial hypertension to an appropriate level, or the growth of the CSDH may have disrupted the flap–valve mechanism of the arachnoid cyst and subdural collection, and therefore, the CSDH may have been improved by only the burr hole operation. Fortunately, our patient was cured after two burr hole surgeries. However, the occurrence of CSDH was not initially considered. When performing burr hole operations, the placement of a subdural drain may be desirable, and the possibility of CSDH should be considered. Furthermore, the addition of endoscopy, craniotomy, or shunt should be considered if necessary.

CONCLUSION

We performed burr hole operations on a patient with subdural hygroma caused by a ruptured arachnoid cyst due to head injury. After the operation, a CSDH occurred, and the burr hole operation was performed again. We achieved favorable outcomes. The growth of the CSDH may have disrupted the flap–valve mechanism of the arachnoid cyst and subdural collection. When performing burr hole operations for subdural hygroma caused by a ruptured arachnoid cyst, the placement of a subdural drain may be desirable, and the possibility of CSDH should be considered.

Ethical approval: Institutional Review Board approval is not required.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship: Nil.

Conflicts of interest: There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation: The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

REFERENCES

1. Ahn JH, Jun HS, Kim JH, Oh JK, Song JH, Chang IB. Analysis of risk factor for the development of chronic subdural hematoma in patients with traumatic subdural hygroma. J Korean Neurosurg Soc 2016;59:622-7.
2. Albuquerque FC, Giannotta SL. Arachnoid cyst rupture producing subdural hygroma and intracranial hypertension: Case reports. Neurosurgery 1997;41:951-6.
3. Cress M, Kestle JR, Holubkov R, Riva-Cambrin J. Risk factors for pediatric arachnoid cyst rupture/hemorrhage: A case-control study. Neurosurgery 2013;72:716-22.
4. Gelabert-González M, Fernández-Villa J, Cutrín-Prieto J, Garcìa Allut A, Martínez-Rumbo R. Arachnoid cyst rupture with subdural hygroma: report of three cases and literature review. Childs Nerv Syst 2002;18:609-13.
5. Iaconetta G, Esposito M, Maiuri F, Cappabianca P. Arachnoid cyst with intracystic haemorrhage and subdural haematoma: case report and literature review. Neurol Sci 2006;26:451-5.
6. Massimi L, Bianchi F, Benato A, Frassanito P, Tamburrini G. Ruptured sylvian arachnoid cysts: An update on a real problem. Childs Nerv Syst 2023;39:93-119.
7. Mori K, Yamamoto T, Horinaka N, Maeda M. Arachnoid cyst is a risk factor for chronic subdural hematoma in juveniles: Twelve cases of chronic subdural hematoma associated with arachnoid cyst. J Neurotrauma 2002;19:1017-27.
8. Slaviero F, Frighetto L, Azambuja ND Jr., Martins LS, Annes RD, Vanzin JR. Middle cranial fossa arachnoid cysts complicated with subdural collections. Arq Neuro Psiquiatr 2008;66:913-5.
9. Tinois J, Bretonnier M, Proisy M, Morandi X, Riffaud L. Ruptured intracranial arachnoid cysts in the subdural space: Evaluation of subduro-peritoneal shunts in a pediatric population. Childs Nerv Syst 2020;36:2073-8.
10. Wester K. Intracranial arachnoid cysts-do they impair mental functions? J Neurol 2008;255:1113-20.

How to cite this article: Kimura S, Ogawa D, Taniguchi H, Wanibuchi M. Subdural hygroma due to traumatic rupture of a middle cranial fossa arachnoid cyst that has transformed into a chronic subdural hematoma after burr hole operation: A case report. Surg Neurol Int. 2025;16:67. doi: 10.25259/SNI_980_2024