Malignant Subdural Hematoma Associated with High-Grade Meningioma

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Abstract

A 70-year-old man, who had previously undergone surgical resection of left parasagittal meningioma involving the middle third of the superior sagittal sinus (SSS) two times, presented with recurrence of the tumor. We performed removal of the tumor combined with SSS resection as Simpson grade II. After tumor removal, since a left dominant bilateral chronic subdural hematoma (CSDH) appeared, it was treated by burr hole surgery. However, because the CSDH rapidly and repeatedly recurred and eventually changed to acute subdural hematoma, elimination of the hematoma with craniotomy was accomplished. The patient unfortunately died of worsening of general condition despite aggressive treatment. Histopathology of brain autopsy showed invasion of anaplastic meningioma cells spreading to the whole outer membrane of the subdural hematoma. Subdural hematoma is less commonly associated with meningioma. Our case indicates the possibility that subdural hematoma associated with meningioma is formed by a different mechanism from those reported previously.

Keywords
►high-grade meningioma
►recurrent chronic subdural hematoma
►outer membrane of subdural hematoma

Case Report

A 70-year-old man, who had previously undergone surgical resection of left parasagittal meningioma involving the middle third of the superior sagittal sinus (SSS) two times, presented with right lower limb weakness. The incidence of recurrent chronic subdural hematoma (CSDH) accounts for ~5 to 33% of postsurgical cases.1 CSDH recurs most frequently between 1 and 3 months after surgery.1 Early recurrence of CSDH is determined as relapse of symptoms or re-accumulation of the hematoma within 3 months following surgery.1 There are many etiologies for recurrence of CSDH.1,2 Subdural hematoma is a less frequent complication in meningioma.3 Besides, CSDH is rarely associated with meningioma.3–Table 1 summarizes previously reported cases of meningioma in association with CSDH.3–18 Although several mechanisms to cause subdural hematoma in meningioma have been previously reported,3,15,19 our case suggested a different mechanism from them. We describe a case of malignant subdural hematoma that rapidly and repeatedly recurred in association with meningioma.

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Table 1 Summary of previously reported cases of meningioma associated with chronic subdural hematoma

| No. | Author                  | Year | Sex | Age | Side     | Side | Location             | Histology     | Outcome |
|-----|-------------------------|------|-----|-----|----------|------|----------------------|---------------|---------|
| 1   | Cusick and Bailey⁴      | 1972 | F   | 47  | Bilateral| Right| Convexity            | Transitional  | Dead    |
| 2   | Modesti et al⁵          | 1976 | F   | 49  | Left     | Left | Parasagittal         | Meningothelial| SD      |
| 3   | Walsh et al⁶            | 1977 | F   | 77  | Right    | Right| Olfactory groove     | Meningothelial| Dead    |
| 4   | Sakai et al⁷            | 1981 | M   | 36  | Right    | Right| Sphenoid ridge       | Meningothelial| Dead    |
| 5   | Baskinis et al⁸         | 1984 | M   | 68  | Right    | Right| Convexity            | Angiomatous   | GR      |
| 6   | Tomita et al⁹           | 1985 | F   | 61  | Right    | Right| Convexity            | Meningothelial| GR      |
| 7   | Wang et al¹⁰            | 1985 | F   | 62  | Left     | Left | Convexity            | N/A           | N/A     |
| 8   | Itoyama et al¹¹         | 1987 | F   | 63  | Bilateral| Left | Sphenoid ridge       | Transitional  | GR      |
| 9   | Chen et al¹²            | 1992 | M   | 79  | Left     | Left | Convexity            | Meningothelial| MD      |
| 10  | PoZZi et al¹³           | 1993 | F   | 73  | Left     | Left | Convexity            | Transitional  | N/A     |
| 11  | Popovic et al¹⁴         | 1994 | F   | 47  | Right    | Right| Convexity            | Meningothelial| N/A     |
| 12  | Tanaka et al¹⁵          | 1994 | F   | 47  | Right    | Right| Convexity            | Meningothelial| GR      |
| 13  | Sinha and Dharker¹⁶     | 2001 | M   | 68  | Left     | Left | Convexity            | N/A           | GR      |
| 14  | Di Rocco et al³         | 2006 | M   | 72  | Right    | Right| Convexity            | Meningothelial| GR      |
| 15  | Czyz et al¹⁷            | 2011 | F   | 69  | Bilateral| Bilateral| Parasagittal | Microcystic | GR      |
| 16  | Nery et al¹⁸            | 2017 | F   | 85  | Left     | Left | Convexity            | Microcystic   | GR      |

Abbreviations: CSDH, chronic subdural hematoma; GR, good recovery; MD, moderate disability; N/A, not applicable; SD, severe disability.

Fig. 1 (a–c) Preoperative MRI showing recurrent left parasagittal meningioma located in the middle third of the superior sagittal sinus. (d–f) Postoperative MRI showing tumor removal combined with superior sagittal sinus resection as Simpson grade II without distinct dural tail sign. MRI, magnetic resonance imaging.
clinical history, such as head injury, antithrombotic therapy, coagulation disorders, and alcohol abuse. In addition, postoperative images revealed no signs of CSDH. The left subdural hematoma alone was treated by burr hole surgery, which was successful (►Fig. 2b). However, recurrence of CSDH occurred 5 days after surgery. Although a second burr hole evacuation of subdural hematoma was performed, a third evacuation was required owing to its rapid recurrence within 2 days after the second evacuation. Because CSDH eventually changed to acute subdural hematoma (►Fig. 2c), craniotomy was accomplished 10 days after the third hematoma evacuation (►Fig. 2d). The hematoma and outer membrane of the subdural hematoma were eliminated as much as possible. Furthermore, the dura mater within the craniotomy area was removed and replaced with artificial dura mater. Histopathological features of the outer membrane of the subdural hematoma showed anaplastic meningioma, WHO grade III. Unfortunately, the patient died of worsening of general condition despite aggressive treatment one and a half months since the onset of CSDH although the subdural hematoma had obviously not recurred. His brain was investigated by autopsy after death. Histopathology of brain autopsy demonstrated invasion of anaplastic meningioma cells spreading to the whole outer membrane of the subdural hematoma (►Fig. 3).

**Discussion**

Numerous causative factors for recurrence of CSDH have been addressed including advanced age, antithrombotic medications, coagulopathy, and various neuroimaging features of hematoma. Although subdural hematoma formation in meningioma is rare, several mechanisms have been proposed as follows: (1) bleeding of the tumor into the subdural space, (2) rupture of abnormal vascular networks supplying the tumor in the subdural space, and (3) collapse of the subdural vessels due to compression of the tumor.

No correlation between the occurrence of subdural hematoma and the location or histological characteristics of meningioma has been described. On the other hand, the malignant histological type has been reported with a high frequency in meningioma complicated with subdural
hematoma. Patil observed that a dural reaction of the meningioma formed the neomembrane similar to the outer membrane of CSDH despite neither subdural fluid collection nor blood clots. Moreover, they noticed that tumor cells were not expressed in the neomembrane originating from the meningioma. In our case, the outer membrane of the subdural hematoma was entirely infiltrated by meningioma cells. To the best of our knowledge, no previous report has investigated the outer membrane of subdural hematoma should be investigated. The subdural hematoma needs to be treated with caution when tumor infiltration is demonstrated in the outer membrane.

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Fig. 3 Histopathological photomicrograph of the brain autopsy. (a) H&E stain and (b) epithelial membrane antigen immunostain of coronal brain section showing the outer membrane of the subdural hematoma entirely infiltrated by meningioma cells. Magnification, ×10. (c) High-magnification image of the black dotted square box of the H&E stain revealing high cellular density, nuclear polymorphisms, and numerous mitoses, indicating anaplastic meningioma. Magnification, ×400. H&E, hematoxylin and eosin; SSS, superior sagittal sinus.
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