Case Report

Angiomatous Meningioma in the Craniocervical Junction

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1. Introduction
Angiomatous meningioma, characterized by an abundant vascular component, is a rare subtype of meningioma, accounting for 2.1% of meningiomas [1]. Angiomatous meningiomas arising from the spinal cord is even rarer. We herein report a case of angiomatous meningioma in the craniocervical junction.

2. Case Presentation
A 68-year-old man without notable comorbidity presented to our hospital with a 15-month history of pain in the back and left leg. He showed slight motor weakness (manual muscle testing 4 out of 5) in the upper extremities. Magnetic resonance imaging (MRI) demonstrated an intradural mass lesion at the craniocervical junction, which has low intensity on both T1- and T2-weighted imaging. Enhanced MRI with gadolinium-diethylenetriaminepentaacetic acid (Gd-DTPA) showed homogeneous enhancement without a dural tail sign (Figure 1). Computed tomography angiography using iodinated contrast agent revealed two feeding vessels arising from the right vertebral artery. Preoperative embolization of the feeding vessels was performed to reduce intraoperative bleeding. Gross total resection of the tumor was achieved by debulking and piecemeal resection. The tumor attachment to the dura mater was also resected (Simpson grade 1 resection). A histopathological examination confirmed the diagnosis of an angiomatous meningioma. The patient’s symptoms improved shortly after surgery.

Conclusions. We achieved gross total resection of spinal angiomatous meningioma arising in the craniocervical junction. A preoperative evaluation and embolization of the feeding arteries may help prevent massive intraoperative bleeding.
further covered with a bioabsorbable polyglycolic acid sheet and fibrin glue. The intraoperative blood loss, mainly due to bleeding from the tumor itself, was 567 ml. The drain was removed two days after surgery without noticeable cerebrospinal fluid leakage.

A histopathological examination showed numerous blood vessels making up most of the mass and intervening tumor cells. The blood vessels were variably hyalinized and thick-walled. The tumor cells had round nuclei with occasional intranuclear pseudoinclusions. Some whorls and psammoma bodies were present (Figure 4). Immunohistochemically, the tumor cells were positive for epithelial membrane antigen, and the MIB-1 index was <1%. The tumor was diagnosed as an angiomatous meningioma.

The patient’s symptoms, including back pain and leg pain, improved shortly after surgery. MRI obtained one year after surgery revealed decompression of the spinal cord and no sign of recurrence (Figure 5). The patient remained neurologically intact until he died of an unrelated cause 16 months after surgery.

3. Discussion

Spinal angiomatous meningioma is extremely rare. To our knowledge, a total of 16 cases have been reported (Table 1) [2–6]. Angiomatous meningiomas are classified as WHO grade 1 meningioma without aggressive nature, while motor and/or sensory deficits and bladder and rectal
disturbance can occur as the disease progresses. Spinal angiomatous meningiomas arise most commonly in the thoracic spine followed by the cervical spine [2–6]. The present case is the first report of angiomatous meningioma in the craniocervical junction.

The preferable treatment for angiomatous meningioma is Simpson grade 1 resection (total resection including dural attachment and abnormal bone) although some researchers suggested that Simpson grade 2 resection (total resection and dural coagulation) is sufficient [4, 7–10]. In the present case, we decided to perform Simpson grade 1 resection to reduce risk of potential recurrence. As angiomatous meningiomas are rich in small blood vessels, preoperative embolization to reduce tumor blood supply may be useful [11]. Contrarily, Wu et al. reported good control of intraoperative bleeding without using preoperative embolization. The
| Authors            | Age | Sex | Location | Treatment                           | Dural attachment | Blood loss | Follow-up | Outcome  |
|--------------------|-----|-----|----------|-------------------------------------|------------------|------------|-----------|----------|
| Gul et al. 2008 [2]| 25  | F   | T9-L2    | GTR                                 | NA               | NA         | NA        | NA       |
| Vij et al. 2012 [3]| 16  | M   | C2-C5    | GTR; piecemeal resection            | NA               | NA         | 3 d       | Dead     |
| Wu et al. 2015 [4] | 28  | M   | C2-C3    | Simpson grade II; piecemeal resection | Ventral          | 400        | 152 m     | No recurrence |
|                    | 56  | F   | C1-C3    | GTR; en bloc resection              | Nerve root       | 100        | 131 m     | No recurrence |
|                    | 54  | F   | T10-T11  | Simpson grade II; piecemeal resection | Ventral          | 500        | 120 m     | No recurrence |
|                    | 49  | M   | T1-T3    | Simpson grade II; en bloc resection | Dorsal           | 200        | 108 m     | No recurrence |
|                    | 43  | F   | T1       | GTR; en bloc resection              | Nerve root       | 100        | 99 m      | No recurrence |
|                    | 28  | F   | C2-C4    | GTR; en bloc resection              | Nerve root       | 100        | 86 m      | No recurrence |
|                    | 67  | F   | C7-T3    | Simpson grade II; en bloc resection | Lateral          | 300        | 72 m      | No recurrence |
|                    | 76  | F   | T4       | Simpson grade II; en bloc resection | Lateral          | 100        | 61 m      | No recurrence |
|                    | 41  | M   | T11-T12  | Simpson grade II; en bloc resection | Lateral          | 100        | 53 m      | No recurrence |
|                    | 54  | M   | C1-C2    | Simpson grade II; piecemeal resection | Ventral          | 600        | 32 m      | No recurrence |
|                    | 57  | M   | T12-L1   | Simpson grade II; piecemeal resection | Lateral          | 400        | 18 m      | No recurrence |
|                    | 42  | M   | C2-C3    | Simpson grade II; en bloc resection | Lateral          | 200        | 11 m      | No recurrence |
| Yang et al. 2016 [5]| 55  | F   | T6-T8    | Simpson grade II; en bloc resection | Dorsolateral     | NA         | 6 m       | No recurrence |
| Missori et al. 2017 [6]| 40  | M   | T3-T4    | GTR                                 | Nerve root       | NA         | 14 m      | No recurrence |
| Present case       | 68  | M   | O-C1     | Simpson grade II; piecemeal resection | Ventrolateral    | 567        | 11 m      | No recurrence |

M: male; F: female; C: cervical; T: thoracic; L: lumbar; GTR: gross total resection; RT: radiotherapy; CT: chemotherapy; NA: not available; d: day; m: month.
authors found that en bloc resection was associated with a significant reduction of intraoperative blood loss compared with piece-by-piece resection [4]. In the present case, even though we successfully embolized the feeding arteritis just prior to the surgery, we still observed substantial intraregional bleeding.

When spinal angiomatous meningioma is suspected, we recommend performing a preoperative evaluation of the feeder vessels using an angiogram. Subsequent embolization of the feeder vessels should be discussed, especially when the tumor is located ventrally, making en bloc resection difficult.

**Data Availability**

There are no available data supporting the results of this study as it is a case report.

**Conflicts of Interest**

The authors declare that they have no conflicts of interest.

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