Ossified thoracic spinal meningioma with hematopoiesis: A case report and review of the literature

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ABSTRACT

Meningiomas account for 25% of spinal tumors, and they are often located in the thoracic spine. The ossified subtype is even rarer, and those with hematopoiesis are rarely described. The mechanism of bone formation has not yet been clarified. A case of ossified spinal meningioma with hematopoiesis occurring in a 78-year-old woman is described. Magnetic resonance imaging revealed a lesion with a dural tail sign at the T9 level located dorsal to the spinal cord. Computerized tomography revealed a high density lesion, as high as the bone signal. Total resection was performed, and the symptoms improved. Pathological findings revealed many psammoma bodies (PBs), bone formation, and bone marrow with hematopoiesis. Both PBs and bone seemed to be based on the same background of calcified structures. This report is the second dealing with ossified spinal meningioma with hematopoiesis. The hardness of the tumor can make the operation more difficult, so that the operation should be performed carefully to avoid injuring the spinal cord.

Keywords: Spinal Cord; Meningioma; Ossification; Extramedullary Hematopoiesis; Spinal Tumor

1. INTRODUCTION

Spinal tumors are rare [1], and meningiomas account for 25% of such tumors [2-7]. Typically, meningiomas form intradural extramedullary tumors. They account for 40% of adult extramedullary lesions [2], and they are often located in the thoracic spine [2,4,6].

Ossified meningiomas account for approximately 1% of all meningiomas [8]. Even ossified spinal meningiomas are extremely rare and may be estimated to account for 0.7% - 5.5% of all spinal meningiomas [7,9,10]. There are only a few reported cases of bone formation with hematopoiesis [11].

Most meningiomas are benign and slow growing [5,8,12,13], and the goal of treatment should be total surgical resection [14]. The ossification type is an additional issue for treatment because of difficulty in resection [6,15,16].

A case of ossified thoracic meningioma with hematopoiesis and a literature review are presented.

2. CASE REPORT

A 78-year-old woman complained of right leg pain that needed a cane for three months. Two months before the operation, pain appeared in both legs that prevented knee extension, resulting in her having to walk on her knees. Detailed examination disclosed a thoracic spinal tumor, and she was referred to our hospital for further detailed examination in September.

Thoracic magnetic resonance imaging (MRI) revealed an intradural, extramedullary tumor at the T9 level located dorsal to the spinal cord. Computerized tomography revealed a high density lesion, as high as the bone signal. Total resection was performed, and the symptoms improved. Pathological findings revealed many psammoma bodies (PBs), bone formation, and bone marrow with hematopoiesis. Both PBs and bone seemed to be based on the same background of calcified structures. This report is the second dealing with ossified spinal meningioma with hematopoiesis. The hardness of the tumor can make the operation more difficult, so that the operation should be performed carefully to avoid injuring the spinal cord.
Figure 1. MRI (T2-weighted) of the 14 × 9 × 6 mm intradural extramedullary tumor at the T9 level. It is located dorsal to the spinal cord and compresses the spinal cord from the back. The tumor shows hypointensity. The lower part of the tumor shows the dural tail sign comparable finding (arrow).

Figure 2. CT A: (sagittal section): the intradural tumor with high density, as high as the bone signal, is located dorsal to the spinal cord. There is multiple osteophyte formation and narrowing of the inner vertebral spaces; B: (transverse section): the spinal cord is compressed from behind, slight convex scoliosis is also seen on the right side, and the 5/6 right intervertebral foramen is constricted.

Figure 3. A: The neoplastic lesion consists of elongated cells with indistinct cell borders, short spindle nuclei, PBs, and bone formation. The lamellar bone shows mosaic pattern. (H & E stain, original magnification ×200) B: Formation of mature bones including bone marrow with hematopoiesis is seen (H & E stain, original magnification ×100).

Figure 4. A: There are many PBs; some surrounded by hyaline tissue; B: Mature bone formation entrapping a PB; C: Mature bone formation without PB; D: Mature bones and PB formation (H & E stain, original magnification ×200).

3. PATHOLOGICAL EXAMINATION

The lesion measured 14.0 × 9.0 × 6.0 mm. The paraffin sections, stained with hematoxylin and eosin (H & E), revealed that the tumor consisted of bland elongated cells with indistinct cell borders and short spindle nuclei. There were psammoma bodies (PBs) and bone formation (Figure 3A). Neither mitotic figures nor necrosis was observed. Many mature bones with a mosaic pattern and bone marrow with hematopoiesis were evident (Figure 3B).

There were areas with crowded PBs (Figure 4A), but the PBs were not always continuous with ossification. There were various combinations of patterns, with gathering of PBs with surrounding hyaline connective tissue (Figure 4A), mature bone entrapping a PB (Figure 4B), mature bone formation without a PB (Figure 4C), and bone formation adjacent to the PBs (Figure 4D). Based on these findings, the lesion was diagnosed as an ossified thoracic meningioma.

4. LITERATURE REVIEW

There have been only 16 reported cases of ossified spinal meningioma in PubMed, including the present case (Table 1). The age range was 15 - 78 years, with a male: female ratio of 2:14, showing clear female predominance. Six cases were reported to have bone marrow formation, but only 2 cases had evidence of hematopoiesis.

5. DISCUSSION

Intraspinal tumors are rare [1]. Meningiomas are com-
Table 1. Reported cases of ossified spinal meningioma.

<table>
<thead>
<tr>
<th>No</th>
<th>Year</th>
<th>Age/sex</th>
<th>Location</th>
<th>Size (mm)</th>
<th>Bone marrow</th>
<th>Symptom (Location)</th>
<th>Operation/Result</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1928 [17]</td>
<td>16/F</td>
<td>T9/D</td>
<td>15</td>
<td>ND</td>
<td>Pain (back and right side below the costal margin), dysbasia, loss of sensation, urinary incontinence</td>
<td>L/TR</td>
<td>SI</td>
</tr>
<tr>
<td>2</td>
<td>1972 [16]</td>
<td>70/F</td>
<td>T1-2/V</td>
<td>20 × 13</td>
<td>ND</td>
<td>Weakness (legs), urinary incontinence.</td>
<td>L(T1-4)/TR</td>
<td>SI</td>
</tr>
<tr>
<td>3</td>
<td>1993 [18]</td>
<td>75/F</td>
<td>T8-9/DL</td>
<td>ND</td>
<td>ND</td>
<td>Ataxic gait, progressive numbness and spastic paraplegia (lower extremities)</td>
<td>L(T7-10)/TR</td>
<td>SI</td>
</tr>
<tr>
<td>4</td>
<td>1994 [19]</td>
<td>75/F</td>
<td>T9-10/V</td>
<td>ND</td>
<td>+</td>
<td>Pain (legs), dysbasia, Numbness (legs)</td>
<td>SR</td>
<td>ND</td>
</tr>
<tr>
<td>5</td>
<td>1994 [19]</td>
<td>60/F</td>
<td>T6-8/D</td>
<td>ND</td>
<td>+</td>
<td>Dysbasia, numbness and weakness (legs)</td>
<td>TR</td>
<td>ND</td>
</tr>
<tr>
<td>6</td>
<td>1996 [20]</td>
<td>45/M</td>
<td>Foramen magnum, C1-3/L</td>
<td>ND</td>
<td>+</td>
<td>Headache (occipital), numbness (hand peripheral) hypoesthesia (arm peripheral)</td>
<td>L(C1-2)/TR</td>
<td>SI</td>
</tr>
<tr>
<td>7</td>
<td>1996 [20]</td>
<td>74/F</td>
<td>T9/D</td>
<td>ND</td>
<td>ND</td>
<td>Dysbasia, numbness (leg), hypoesthesia, urinary disturbance</td>
<td>TR</td>
<td>SI</td>
</tr>
<tr>
<td>8</td>
<td>1999 [9]</td>
<td>68/F</td>
<td>Cervicothoracic/Encircling the spinal cord</td>
<td>ND</td>
<td>ND</td>
<td>Dysesthesias, spasms (lower extremities)</td>
<td>PR</td>
<td>SR</td>
</tr>
<tr>
<td>9</td>
<td>1999 [21]</td>
<td>73/F</td>
<td>T5/DL</td>
<td>10 × 10 × 10</td>
<td>+</td>
<td>Dysbasia, numbness and weakness (legs)</td>
<td>TR</td>
<td>SI</td>
</tr>
<tr>
<td>10</td>
<td>2001 [15]</td>
<td>15/M</td>
<td>T4/DL</td>
<td>30 × 15 × 10</td>
<td>ND</td>
<td>Severe pain (back), progressive paraparesis, urinary incontinence</td>
<td>L(T4, 5)/TR</td>
<td>SI</td>
</tr>
<tr>
<td>11</td>
<td>2006 [22]</td>
<td>70/F</td>
<td>T11/DL</td>
<td>ND</td>
<td>ND</td>
<td>Pain (back), weakness (legs), numbness (below the umbilicus) loss of sensation</td>
<td>L(T5-7)/TR</td>
<td>SI</td>
</tr>
<tr>
<td>13</td>
<td>2009 [22]</td>
<td>76/F</td>
<td>T8 and T11-T12/D</td>
<td>ND</td>
<td>ND + and Hematopoiesis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>2011 [8]</td>
<td>75/F</td>
<td>T3-T5</td>
<td>ND</td>
<td>ND</td>
<td>Paresthesia and hyposthenia (legs)</td>
<td>TR</td>
<td>NR</td>
</tr>
<tr>
<td>16</td>
<td>2012</td>
<td>78/F</td>
<td>T9/D</td>
<td>14 × 9 × 6</td>
<td>+ and Hematopoiesis</td>
<td>Pain and numbness (legs)</td>
<td>L(T8-10)/TR</td>
<td>SI</td>
</tr>
</tbody>
</table>

M: Male; F: Female; D: Dorsal to spinal cord; V: Ventral to spinal cord; L: Lateral to spinal cord; DL: Dorsolateral to the spinal cord; ND: No data; L: Laminectomy; R: Resection; PR: Partial resection; SR: Subtotal resection; TR: Total resection; SI: Symptoms improved; NR: No recurrences; ND: No data; Present case.
The present case showed remarkable PBs formation. The hyalinized collagen surrounding the PBs was continuous with those attached to bone formation. There was also an area where bone entrapped a PB. Though there were no transitions between PB and bone, they seemed to be related. Both PB and bone might be based on same background tendency to develop calcified structures.

Licci et al. stated that the presence of lamellar bone in the lesion is sometimes reported; however, the formation of hematopoietic tissue in the marrow space is rarely mentioned [11]. Therefore, the present case is only the second case of ossified spinal meningioma with hematopoietic bone marrow. Mathew et al. suggested two mechanisms of de novo extramedullary hematopoiesis within meningiomas. First, the induced neoplastic growth of meningeal cells may cause erythroid differentiation in the multipotent stem cells. Second, the quiescent heterocellular rest that were isolated during development may develop proliferative changes and differentiation by the increased oxygen and nutritional demands of the tumor cells [28]. Licci et al. mentioned that a third mechanism of menenchymal multipotentiality of meningeal or meningiomatous cells could cause hematopoietic differentiation [11].

Because of spatial restriction, symptoms are more frequent with spinal meningiomas than with cranial meningiomas [19]. The most common symptoms are pain [7, 10,12], followed by muscle weakness such as paresis or plegia, and sensory loss such as hypoesthesia, paresthesia, or anesthesia [12]. In the cases of spinal ossified meningiomas, muscle weakness is more frequent (Table 1).

There are some reports mentioning difficulty in resection for calcified or ossified meningiomas [6-8,15,16]. In the present case, probably because the tumor was dorsal to the spinal cord and it was not too large, the operation was not difficult.

When the tumors are resected completely, the symptoms improve [6,11,15,16,21,22,27]. However, when the tumor is not resected completely because of its hardness or large size, the symptoms remain [9].

In conclusion, spinal ossified meningiomas with hematopoietic bone marrow are extremely rare. The histogenesis of the bone and hematopoiesis is still unknown. The hardness of the tumor makes surgery more difficult, but a good outcome is expected with total resection of the tumor. Careful surgery is needed for hard tumors to avoid spinal cord injury.

REFERENCES


