Extra-axial CNS hemangioma (EAH) is an uncommon vascular tumor in the central nervous system. The common sites are parasellar region of the middle cranial fossa and epidural space of spine. There are totally 6 cases in our hospital since 1992, in which three lesions were located in the epidural space of spine, and the others were at the parasellar region of middle cranial fossa. We analyzed the imaging findings of these 6 cases including pre- and post-contrast enhanced computed tomography (CT) (n=5), magnetic resonance imaging (MRI) (n=6) and angiography (n=2).

Relative high attenuation lesion was noted on the pre-contrast CT scan, strong and homogenous contrast enhancing pattern on the post-contrast CT scan. The MRI appearances were iso- to low signal intensity (SI) on T1WI and high SI on T2WI. All tumors (6/6) were strongly and homogeneously enhanced by Gadolinium DTPA.

From the imaging appearances, the CT and MRI findings can offer some clues to differentiate the EAH from other tumors such as meningioma, neurogenic tumors, aneurysm.

**Key words:** extra-axial hemangioma, Computed tomography (CT); Magnetic resonance imaging (MRI)

Extra-axial CNS hemangiomas (EAH) are uncommon. The lesions often arise from the middle cranial fossa and epidural space of spine of middle aged women [1-4]. The original site of the hemangioma has often been postulated to be at the cavernous sinus. By reviewing the literatures [5-7], we found that most case reports were published by the Japanese doctors. The CT appearances of EAH in parasellar region resemble meningioma and; therefore, resulting in misdiagnosis.

EAH is also uncommon in the spinal canal. The most frequent locations are at the epidural space. The CT features and signal intensity (SI) characteristics on MRI are similar to those at the parasellar region. The image findings of spinal EAH are also similar to those of meningioma. The purpose of this study is to define the imaging findings of EAH on CT/CTA, MRI/MRA and angiography. The information may provide the clues for differentiating EAH from other tumors such as meningioma and aneurysm.

**MATERIAL AND METHODS**

During the last 10 years, we had 6 cases of surgically verified extra-axial CNS cavernous hemangiomas. Three lesions were located at spinal epidural space (two at T-spine, one at L-spine), and the other three lesions were at the parasellar region of the middle cranial fossa. The age distribution of these patients was from 25 to 67 years old. Four patients were male, and the other two patients were female. The radiological findings in these cases were reviewed retrospectively. All cases underwent MRI (n=6) and CT examination (n=5). Angiography was performed in 2 cases. Myelography and CT-myelography were performed only in one case (case No.5).

The MRI pulse sequences for parasellar EAH (n=3) included T1 weighted imaging (T1WI), T2 weighted imaging (T2WI), proton density weighted imaging (PDI), fluid attenuated inversion recovery (FLAIR) and postcontrast MR images and magnetic resonance angiography (MRA). For spinal EAH (n=3), the pulse sequences included T1WI, T2WI, Gradient...
echo and post-contrast MRI images. These pulse sequences were performed in Picker Vista (1.0 Tesla) and GE (1.5 Tesla) MRI scanners. Pre- and post contrast CT scan was performed in Siemens Somatom DR III and Picker (PQ2000) scanners. Angiography was performed in the Siemens Neurostar bi-plane digital subtraction angiography (DSA).

RESULTS

The summaries of the clinical symptoms and signs, lesion locations and radiological findings of these six cases were listed on table 1 and table 2. The MRI appearances of the parasellar EAH (n=3) were homogeneously iso- (1/3) or low (2/3) signal intensity (SI) on T1WI (Fig 1A) and well-demarcated, homogeneously high SI on T2WI (3/3) (Fig 2c). No peripheral rim of decreased signal intensity could be seen as a representation of hemosiderin deposition in any cases. All of these lesions were homogeneously enhanced by Gadolinium DTPA (3/3) (Fig 1b, 2d). For spinal EAH (n=3), epidural soft tissue mass with dural sac compression demonstrated low SI (3/3) on T1WI (Fig 3a), high SI (3/3) on T2WI (Fig 3b), and strong and homogeneous contrast enhancing pattern (n=3) on the post-contrast MR images (Fig 3c, Fig 4).

On CT, the parasellar EAH depicted adjacent bony erosions, without evidence of adjacent bony sclerosis. On the pre-contrast CT scan, the lesion had relatively high attenuation (Fig 2a). After contrast administration, EAH was strongly and homogeneously enhanced (Fig 2b). In spinal EAH, no evidence of bony erosion or bony sclerosis could be demonstrated. The lesions were also strongly and homogeneously contrast enhanced. The CT-myelography revealed the epidural mass (Fig 3d).

The angiography was performed in 2 patients, in whom only one case showed faint tumor stain at cavernous portion of internal carotid artery (ICA) (Fig 1c).

The microscopic appearance of surgical specimen in all six cases were composed of numerous homogeneously vascular channels of varying size lined with a single layer of endothelial cells. No evidence of prominent calcification or iron-laden macrophages was seen (Fig 5a, 5b).

DISCUSSION

As reviewed the literatures, 2/3 of the intra-axial CNS hemangiomas (IAH) demonstrate no tumor stain on angiography. In contrast, parasellar EAH showed

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age/sex</th>
<th>Location</th>
<th>S/S</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>34/M</td>
<td>parasellar</td>
<td>blurred vision</td>
</tr>
<tr>
<td>2.</td>
<td>67/M</td>
<td>parasellar</td>
<td>headache</td>
</tr>
<tr>
<td>3.</td>
<td>60/F</td>
<td>parasellar</td>
<td>diplopia</td>
</tr>
<tr>
<td>4.</td>
<td>57/F</td>
<td>T-spine</td>
<td>lower limb weakness</td>
</tr>
<tr>
<td>5.</td>
<td>25/F</td>
<td>T-spine</td>
<td>unstable gait</td>
</tr>
<tr>
<td>6.</td>
<td>63/M</td>
<td>L-spine</td>
<td>lower limb weakness</td>
</tr>
</tbody>
</table>

Table 1. Locations and clinical symptom and signs (S/S) of extra-axial CNS cavernous hemangioma

<table>
<thead>
<tr>
<th>Case No.</th>
<th>CT/CTA</th>
<th>MRI/MRA</th>
<th>DSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>homogenous enhancement</td>
<td>iso SI on T1WI, high SI on T2WI</td>
<td>faint tumor stain</td>
</tr>
<tr>
<td>2.</td>
<td>homogenous enhancement</td>
<td>low SI on T1WI, high SI on T2WI</td>
<td>no tumor stain</td>
</tr>
<tr>
<td>3.</td>
<td>no tumor stain on CTA</td>
<td>low SI on T1WI, high SI on T2WI</td>
<td>homogenous enhancement</td>
</tr>
<tr>
<td>4.</td>
<td>NA</td>
<td>low SI on T1WI, high SI on T2WI</td>
<td>tumor stain on MRA</td>
</tr>
<tr>
<td>5.</td>
<td>epidural soft tissue mass</td>
<td>low SI on T1WI, high SI on T2WI</td>
<td>on epidural space</td>
</tr>
<tr>
<td>6.</td>
<td>relative high attenuation lesion</td>
<td>low SI on T1WI, high SI on T2WI</td>
<td>homogenous enhancement</td>
</tr>
</tbody>
</table>

Table 2. The radiological appearances of extra-axial CNS cavernous hemangioma

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Location</th>
<th>MRI/MRA</th>
<th>DSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>parasellar</td>
<td>iso SI on T1WI, high SI on T2WI</td>
<td>faint tumor stain</td>
</tr>
<tr>
<td>2.</td>
<td>parasellar</td>
<td>low SI on T1WI, high SI on T2WI</td>
<td>no tumor stain</td>
</tr>
<tr>
<td>3.</td>
<td>parasellar</td>
<td>low SI on T1WI, high SI on T2WI</td>
<td>homogenous enhancement</td>
</tr>
<tr>
<td>4.</td>
<td>NA</td>
<td>low SI on T1WI, high SI on T2WI</td>
<td>tumor stain on MRA</td>
</tr>
<tr>
<td>5.</td>
<td>T-spine</td>
<td>low SI on T1WI, high SI on T2WI</td>
<td>on epidural space</td>
</tr>
<tr>
<td>6.</td>
<td>L-spine</td>
<td>low SI on T1WI, high SI on T2WI</td>
<td>homogenous enhancement</td>
</tr>
</tbody>
</table>

NA: not performed
Case No. 1-3 : The lesions were located over parasellar region
Case No. 4-6 : The lesions were located over spinal epidural space
delayed and persistent finely flecked tumor stain. Faint tumor stain could be detected on DSA.

On CT scan, the IAH presents as a well-demarcated, inhomogeneous, hyper-dense lesion [8,9]. This lesion typically shows reticulated appearance of mixed signal intensity on T2WI, and faint contrast enhancement on the post-contrast T1WI. There is frequently a low SI rim surrounding the tumor on both T1WI and T2WI, which indicates hemosiderin deposition [10-12]. These patterns suggest the possibility of easy bleeding on IAH. Thus, the reticulated core of mixed intensity with a prominent surrounding hypo-intense rim has been described as a diagnostic feature of IAH.

For intracranial EAH, the most frequent location is parasellar region, which is adjacent to cavernous sinus. It is conceivable that the tumors may cause mass effect to the cranial nerves within cavernous sinus, including CN III, IV, V1 and VI. The most common symptom is cranial nerve palsy such as blurred vision (case No. 1) and diplopia (case No. 3). The consistency of the tumor may not be firm since there is no evidence of ICA (cavernous segment) compression in our cases or in the literature. In spinal lesions, the most common symptoms result from dural sac compression, which include unstable gait (case No. 5) and lower limb weakness (case No. 4, 6).

On pre-contrast CT scan, spinal EAH shows relatively higher attenuation than that spinal cord. The lesions are located in the epidural space, which results in dural sac compression and spinal cord atrophy. On CT-myelography, the mass effect can be depicted clearly (Fig. 3d).

For parasellar EAH, the CT appearances are similar to those of spinal lesions. The attenuation

**Figure 1.** A 34-years-old man suffered from blurred vision (case No. 1). a. Coronal section MRI T1WI (800/20/2) (TR/TE/ Excitation). A lobulated soft tissue mass (arrow) is noted at left parasellar region with low SI. b. Coronal section post-contrast MRI T1WI (550/20/2). This lobulated mass (arrow) show homogeneous contrast enhancing pattern. c. Left carotid angiography. A faint tumor stain (arrow) is noted at the parasellar region.
value is relatively higher than the surrounding brain parenchyma. Bony erosion could be identified in only one case (case No. 1). Both intracranial and spinal EAH lesions had strong and homogeneous contrast enhancing pattern in the post-contrast CT scan.

The intracranial and spinal EAH had the similar signal intensity on MRI; that is, iso- to low SI on T1WI, high SI on T2WI, and homogeneously and strongly enhanced by Gadolinium. Absence of low signal intensity rim surrounding the tumor was observed, which indicates no hemorrhage into the surrounding brain or spinal cord tissue.

For parasellar EAH, MRI clearly shows the lateral wall of the cavernous sinus. The lateral wall of the sinus bulged outwards in these cases. Thus, MRI is useful for assessing the relationship of between the parasellar EAH and the cavernous sinus. Large parasellar EAHs in the middle cranial fossa are often dumbbell-shaped, suggesting the presence of different part inside and outside the cavernous sinus.

Meningioma and aneurysms should be included in the differential diagnosis of parasellar EAH. Due to the strong and homogeneous contrast enhancement pattern of extra-axial lesion, parasellar EAH is often misdiagnosed as meningioma. Some radiographic features could discriminate it from meningiomas, which include relative hypo- or iso- intensity on T2WI for meningioma. Presence of the adjacent bony sclerosis can also be helpful. In addition, tumor stain on the angiograms may delayed appears and persists for a
Figure 3. This patient suffered from unstable gait (case No.5). a. Sagittal section MRI T1WI (781/20/2). An epidural soft tissue mass (arrow) is noted at the T spine level with low SI. b. Sagittal section MRI T2WI (2640/80/1). The signal intensity of this mass shows homogeneous and high SI lesion (arrow). c. Post-contrast axial section MRI T1WI (770/20/20). Strong and homogeneous contrast enhancement (arrow) is noted in this mass. d. CT-myelography. This epidural soft tissue mass (arrow) shows dural sac compression.

Figure 4. The chief complaint of this patient was lower limb weakness (case No.6). Post-contrast axial section MRI T1WI (770/20/2). A homogeneous contrast enhancing mass (arrow) is well identified which extended through the neural foramen.
longer period of time because of slower circulation in hemangioma. Absence of signal-void pattern on MRI, virtually excludes the diagnosis of patent aneurysm. Due to homogeneous high SI on T2WI in EAH, we could differentiate EAH from thrombosed aneurysm.

For spinal EAH lesions, the differential diagnosis should include the meningioma and neurogenic tumor. The differential points between meningioma and hemangioma are similar to intracranial lesions, including homogeneous high SI on T2WI. The relationship between the neural foramen and adjacent nerve could be helpful to differentiate it from neurogenic tumor. In neurogenic tumor, it always grows along the spinal nerve and extends through the neural foramen. But in one case of this study (case No. 6) (fig 4), the EAH extend through the neural foramen. The neurogenic tumor is associated with cystic change; therefore it is not homogenous on MRI, especially on T2WI.

CONCLUSION

In our limited experience, the intracranial EAH lesions always have iso- to low SI on T1WI, homogeneously high SI on T2WI of the MRI and relatively faint or no visible tumor stain on angiograms. The spinal EAHs have low SI on T1WI, high SI on T2WI of the MRI. All EAH lesions have strong and homogeneous contrast enhancing pattern, no matter what the lesion located at parasellar or spinal area. On the pre-contrast CT scan, EAH always have relatively high attenuation value as that compared to the adjacent parenchyma. In addition, there is no evidence of calcification or hemosiderin deposition on the microscopic examination, which may indicate the different nature of IAH and EAH. These features can help us to make the differential diagnosis.

REFERENCES


Figure 5. The microscopic findings of extra-axial CNS hemangioma. The lesion is composed of variable sized numerous vascular channels lined with a single layer of endothelial cells. No evidence of prominent calcification or iron-laden macrophages was seen. (5a: 100X, HE stain), (5b: 400X, HE stain)
軸外中樞神經血管瘤的影像學表現

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軸外中樞神經血管瘤為不常見的中樞神經系統血管瘤。按照過去的報告，較多見的位置為中頸窩的土耳其鞍旁區域與脊柱的硬腦膜外空間。本研究收集本院自1992年以來的六個案例，其中三例位在脊椎，以硬腦膜外空間（epidural space）為主，另外三例出現在中頸窩的土耳其鞍旁區域。我們分析這六例的影像檢查發現，包括注射顯影劑前與後的電腦斷層（CT scan）（n=5），磁振造影（MRI）（n=6），及血管攝影（DSA）。

在注射顯影劑前的電腦斷層為高密度的病變，注射顯影劑之後，為均勻高強度的顯影。在磁振造影的影像表現為，注射顯影劑前的T1為主影像中（T1WI），為低至均勻的訊號表現，注射顯影劑後的T1為主影像中（T1WI）為均勻高強度的顯影。在T2為主影像中（T2WI）為均勻高強度的訊號表現，依據如此的訊號表現及影像特徵。需要與腦膜瘤、神經性腫瘤、動脈瘤鑑別。本文提供一些可能有用的鑑別診斷線索，以避免誤診。

關鍵詞：軸外中樞神經，血管瘤，腦膜斷層，磁振造影