

# MRI of Epidural Cavernous Malformations of the Spine : Correlation with Surgical and Histopathologic Findings<sup>1</sup>

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**Purpose:** The purpose of this study is to describe Magnetic Resonance(MR) findings of two epidural cavernous malformations of the spine.

**Materials and Methods:** MR imaging was performed in 2 patients(29-year-old man and 54-year-old woman). Sagittal T1-, T2-weighted images and Gadolinium (Gd)-enhanced axial and sagittal images were acquired. Two patients had surgery and MR findings were compared with surgical and histopathological findings.

**Results:** MR imaging showed high- and low-signal intensity components of these lesions that were characteristic of an epidural cavernous malformation in one case. The other case showed a high signal intensity on T2- and strong enhancement on Gd-enhanced T1-weighted images. We think that the former may be due to mixed subacute and chronic hemorrhage and the latter may be due to blood within the endothelium-lined sinusoids without hemorrhage.

**Conclusion:** These findings were well correlated with the surgical and histo-pathological findings of cavernous malformation.

**Index Words :** Spine, cavernous malformation  
Spine, epidural space  
Spine, MRI

Cavernous malformations are uncommon vascular malformations of the central nervous system that may be generally found in cerebral hemisphere(1). In the spine, epidural lesions are uncommon in contrast to intramedullary and extramedullary intradural lesions (2). The majority of these epidural lesions are secondary to extension of vertebral hemangiomas, and purely epidural lesions are rare(3, 4). We report two cases of epidural cavernous malformation of the spine and present the MR findings correlated with the surgical and histopathological findings.

## CASE REPORTS

### Case 1

A 29-year-old man was presented to the this hospital complaining of weakness of the lower limbs with acute onset. Neurological examination revealed weak-

ness of both legs with absent knee jerk. He showed hypesthesia and hypoalgesia below T6 level. A myelogram showed decreased anteroposterior diameter at T3-T5 level by a large fusiform mass with a typical epidural configuration.

MRI of the thoracic spine demonstrated a posterior epidural mass at T3-T5 level. The mass showed small areas of mixed low- and high-signal intensity on T1-weighted images. These hypointensities were more marked on T2-weighted images and these hypointense areas showed no enhancement (Fig. 1). These findings were consistent with hemosiderin deposits.

At surgery, this was a dark reddish hematoma intermingled with fat tissue and enlarged abnormal vessels at T3-T5 level(Fig. 1). Histopathologic examination of the specimen showed organizing hemorrhage and thrombi with areas of irregular vascular spaces(Fig. 1).

### Case 2

A 54-year-old woman had progressive low back pain radiating to lower extremities since a month ago.

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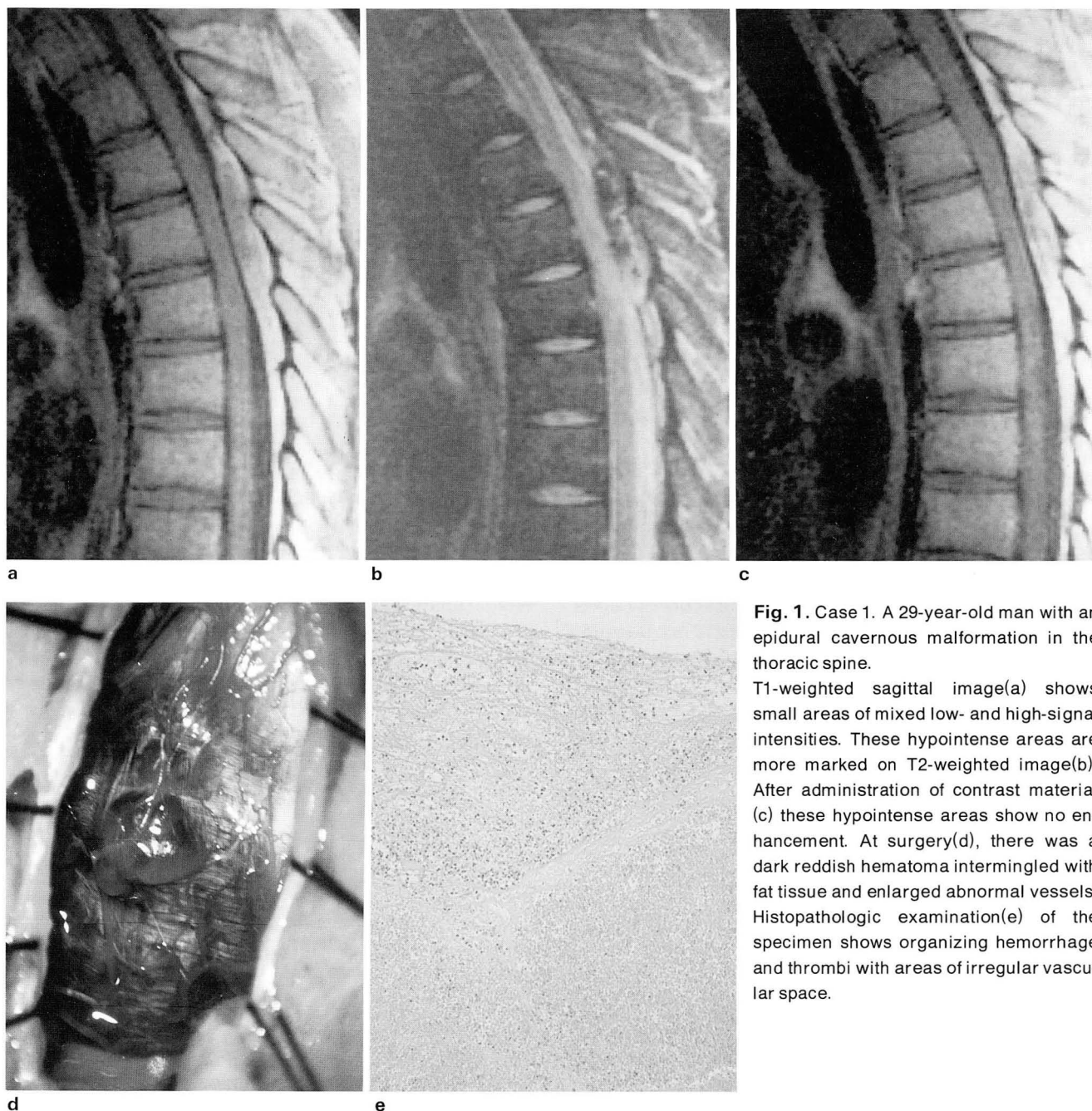
She had a history of a fall-down trauma 23 years ago and low back pain developed from that time.

Neurological examination on admission revealed sensory impairment in L2 dermatome and mild paresis of left knee without pathologic reflexes. She had no difficulty in micturition and defecation.

MRI showed a smooth, somewhat elongated, posterior epidural mass located at L2-L3 level. The mass had a homogeneous, intermediate signal intensity similar to that of the spinal cord on T1-weighted sagittal images. Sagittal T2-weighted images showed a homogeneous high-signal intensity similar to that of CSF. Sagittal and axial T1-weighted images obtained

after administration of contrast material demonstrated homogeneous enhancement of the mass and displaced dural sac to the right side by the mass. The lesion extended into the left intervertebral foramen with widening at L3-L4 level. At L2-L3 level, MR imaging showed ruptured disc material that compressed the anterior aspect of dural sac. The dural sac at L2-L3 level was severely compressed anteriorly and posteriorly by the ruptured disc material and the epidural mass (Fig. 2).

At surgery, a dark reddish mass that was located between the dura and ligamentum flavum at L2-L3 level and extended into the left intervertebral foramen at



**Fig. 1.** Case 1. A 29-year-old man with an epidural cavernous malformation in the thoracic spine.

T1-weighted sagittal image(a) shows small areas of mixed low- and high-signal intensities. These hypointense areas are more marked on T2-weighted image(b). After administration of contrast material (c) these hypointense areas show no enhancement. At surgery(d), there was a dark reddish hematoma intermingled with fat tissue and enlarged abnormal vessels. Histopathologic examination(e) of the specimen shows organizing hemorrhage and thrombi with areas of irregular vascular space.



**Fig. 2.** Case 2. A 54-year-old woman with epidural cavernous malformation in the lumbar spine. smooth, somewhat elongated, posterior epidural mass at L2-L3 level has a homogeneous, intermediate signal intensity on T1-weighted image(a) and ruptured disc material compresses the anterior aspect of the dural sac. T2-weighted image(b) shows a homogeneous high-signal intensity mass. Sagittal T1-weighted image(c) obtained after administration of contrast material demonstrates homogeneous enhancement of the mass. This mass extends into the left intervertebral foramen with widening at L3-L4 level(d). Histopathologic examination(e) of the postoperative specimen shows variable-sized endothelium-lined sinusoids consistent with cavernous malformation.

L3—L4 level was excised and the ruptured disc material at L2—L3 level was also excised(Fig. 2). Histopathologic analysis of the postoperative specimen showed variable-sized endothelium-lined sinusoids consistent with cavernous malformation(Fig. 2).

## DISCUSSION

Of the epidural tumors in the adult population, the proportion of tumors primarily involving the vertebrae is as high as 50 percent(5). The vast majority of these tumors will be metastases to bone and epidural

space, and a still smaller proportion will be benign or malignant tumors arising from the osseous or notochord structures of the spinal column(5). Purely epidural lesions are rare, and they contain vascular malformations, lymphoma, lipoma, meningioma, neurofibroma, metastatic lesions, etc.

Cavernous malformations are uncommon vascular malformations of the central nervous system that may be generally found in cerebral hemisphere(1). In the spine, these lesions usually occur in the vertebral body and epidural lesions are rare(3, 4). Of cavernous malformations that involve the epidural space, lesions



in the vertebral bodies with extension into the epidural space are much more common than are purely epidural(4, 6). Purely epidural spinal cavernous malformations account for less than 4% of spinal epidural masses(4). Grossly, the usual cavernous malformation is a red-blue, soft, spongy mass with 1 to 2 cm in diameter. Histologically, the mass is sharply defined, but not encapsulated, and made up of large, cavernous, vascular spaces, partly or completely filled with blood separated by a scanty connective tissue stroma. Intravascular thrombosis or rupture of channels may modify the histologic appearance(7). It is reported that an epidural cavernous malformation grossly showed a firm, red-purple mass and variable-sized endothelium-lined sinusoids within a fibrous stroma microscopically(4, 8). Recent articles have described the MR appearance of epidural cavernous malformation(8, 9), but the MR appearance of this lesion has not been fully documented.

In our case 1, T1-weighted MR images showed a mass with mixed areas of high signal and low signal intensity at the T3-T5 level. The hypointense areas were more marked on T2-weighted images. Selective reduction of T2 can occur with certain paramagnetic materials, such as hemosiderin(10, 11), and hemosiderin appears dark when compared with the surrounding tissue. Small areas of hyperintensity on T1- and T2-weighted images suggest subacute and chronic hematomas. These hematomas are known to have a relatively short T1 relaxation time, resulting in areas of increased signal intensity, which may be due to methemoglobin(12, 13). This correlates well with the pathologic findings of thrombi and old liquefied blood identified at microscopic examination. The presence of mixed subacute and chronic hemorrhage, suggested by mixed high- and low-signal intensity components of this lesion, are characteristic of cavernous malformation(14).

In case 2, T1-weighted MR images showed a well-circumscribed mass with intermediate signal intensity similar to that of the spinal cord. T2-weighted images demonstrated a high-signal intensity mass with slightly higher intensity than that of CSF. T1-weighted images after the administration of contrast material showed a strong enhancement. These findings might be due to the blood within the endothelium-lined sinusoids. Gd-DTPA enhanced axial images revealed the extension of the mass into the left intervertebral foramen at L3-L4 level and ruptured disc material that compressed the anterior aspect of the dural sac at L2-L3 level. In this case, MR findings of an epidural mass appeared those of the neoplastic condition. Diagnostic consideration based on MR findings and location included a meningioma and neurofibroma. Although not a typical lesion, this epidural mass appeared dumbbell-shaped. MR findings of an epidural mass with intervertebral neural foramen extension

were most consistent with a neurofibroma. Dumbbell-shaped cavernous malformations have been reported before(4, 9, 15). Padovani et al. (4) gave evidence of bony erosion and enlargement of the intervertebral foramen in dumbbell-shaped cavernous malformation. Thus, we must now include epidural cavernous malformation in the differential diagnosis of a dumbbell-shaped lesion because of the similar MR findings.

Of the purely epidural cavernous malformations that have been reported, most of the lesions are more common in posterior epidural space than anterior epidural space(4, 8, 9). In our two cases, all are in posterior epidural space. Thus, we think that vascular anatomy of the epidural space may be related to the higher incidence of epidural cavernous malformation in posterior epidural space and the reason for this should be investigated.

In summary, cavernous malformations are uncommon vascular malformations in the epidural space that show different stages of hemorrhage, calcification, and thrombi. The first case showed the characteristic findings, mixed subacute and chronic hemorrhage, of an epidural cavernous malformation. But the second case showed the MR findings similar to those of neoplastic condition. In the present cases, the MR findings are well correlated with the surgical and histopathologic findings.

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## 척추의 경막부위에서 발생한 해면상 혈관기형의 자기공명영상소견: 수술 및 병리학적인 소견과의 비교

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척추의 경막부위에서 발생하는 해면상 혈관기형은 매우 드문 질환으로서 저자들은 자기공명영상상 고신호강도와 저신호강도가 섞여 있어 전형적인 해면상 혈관기형의 소견을 보이는 한 예와 T2 강조영상 및 조영증강후의 T1 강조영상에서 강한 조영증강을 보인 또 다른 한 예를 보고한다. 전자는 아급성기와 만성기의 출혈이 섞여 있는 것으로 생각되며 후자는 출혈없이 상피내세포로 둘러싸여 있는 동양혈관(sinusoid)내에 혈액이 차 있는 것으로 생각되었으며 이러한 소견은 수술과 조직병리학적인 소견과 일치하였다.

## 연도별 전공의 연수교육 주제

년 도	기 별	주 제
1994년도	춘 계	HRCT of the Lung
	추 계	Use of Computer in Radiology
1995년도	춘 계	Neuroradiology
	추 계	Communication Skill(영상판독술)
1996년도	춘 계	논문 작성법
	추 계	Abdominal Radiology
1997년도	춘 계	Physics in Radiology
	추 계	Skeletal Radiology

## 1994년도 제16차 전문의 연수교육 안내

1. 일 시 : 1994년 6월 11일(토)
2. 장 소 : 설악파크호텔
3. 주 제 : 방사선과 침단영상의 임상적 응용
4. 사전등록 마감 : 1994년 4월 30일까지

시 간	연 제	연 사 소 속
06:00-13:00	회원친선대회(골프, 관광)	
14:00-14:40	Color Doppler Sonography	한 상 석(인제의대)
14:40-15:20	Helical(spiral) CT	이 재 문(가톨릭의대)
15:20-16:00	MR Angiography	한 문 희(서울의대)
	—— Coffee Break ——	
16:30-17:10	PET	이 중 두(연세의대)
17:10-17:50	PACS	최 형 식(삼성의료원)
17:50-18:30	간접촬영 필름 판독	임 정 기(서울의대)
18:30-	Garden Party 및 Recreation	