Case Report

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Sporadic Intradural Extramedullary Hemangioblastoma Not Associated with von Hippel-Lindau Syndrome: A Case Report and Literature Review

폰 히펠린다우 증후군과 관련 없는 특발성 경막 내 수외 혈관모세포종: 증례 보고와 문헌 고찰

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Hemangioblastomas are low-grade, highly vascular tumors that are usually associated with von Hippel-Lindau syndrome. Hemangioblastomas most commonly occur in the cerebellum, and intradural extramedullary hemangioblastoma of the cauda equina is very rare, especially in patients without von Hippel-Lindau syndrome. Herein, we report a case of intradural extramedullary hemangioblastoma of the cauda equina that was not associated with von Hippel-Lindau syndrome, with a focus on its imaging characteristics and differential diagnoses. We compared the clinical presentation and imaging features of our case with those of previously reported cases in the review of the literature.

Index terms Spine; Cauda Equina; Hemangioblastoma; von Hippel-Lindau Syndrome

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INTRODUCTION

Hemangioblastomas are low-grade, highly vascular tumors that account for 1–3% of

all central nervous system tumors, and they most often occur in the cerebellum. Hemangioblastomas are rarely observed in the spine, with an incidence of only 1–5% of all spinal cord tumors (1). Intradural extramedullary (IDEM) hemangioblastomas, especially in the lumbar spine, are also very uncommon. Most cases of IDEM hemangioblastoma affect the cervical or thoracic spine (2). In addition, many spinal hemangioblastomas are associated with von Hippel-Lindau (VHL) syndrome. In fact, isolated IDEM hemangioblastoma of the cauda equina without VHL syndrome is extremely rare, with only 24 cases reported till date. The radiologic features of isolated IDEM hemangioblastoma of the cauda equina are difficult to differentiate from those of other hypervascular tumors in the lower lumbar spine, especially those not associated with VHL syndrome. Moreover, none of the previous case reports focused on the imaging characteristics and differential diagnosis of hemangioblastoma.

Herein, we present a rare case of a sporadic IDEM hemangioblastoma in a patient without a clinical diagnosis of VHL syndrome, and focused on the imaging features and differential diagnosis. In addition, we compared the clinical and radiologic features of our case with those of the previously diagnosed 24 cases.

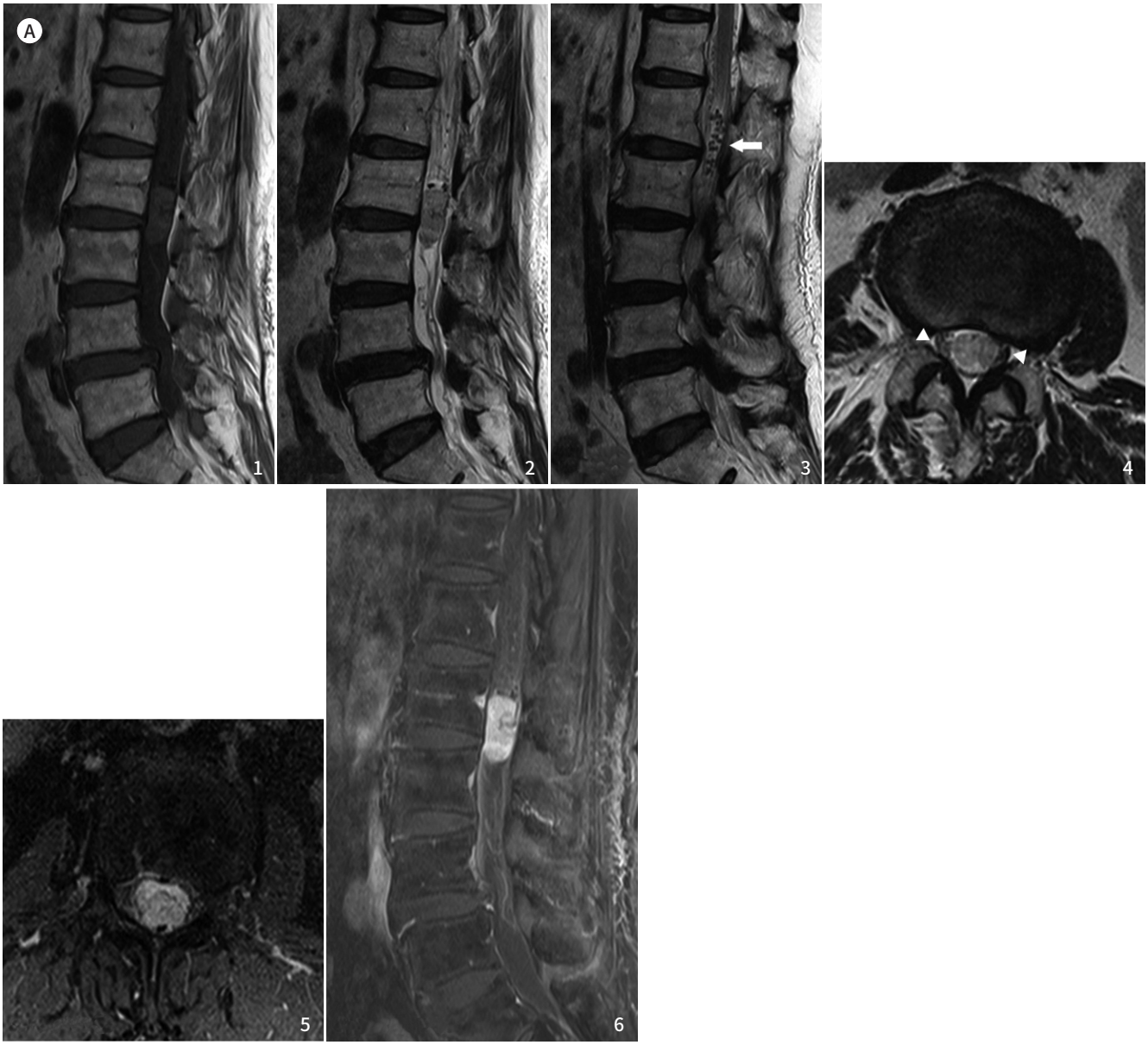
CASE REPORT

A 70-year-old female presented with pain in the left buttock and in the posterior part of the lower limb since 1 year. The pain increased in intensity and did not improve despite taking medications and epidural injections. The patient's family history was unremarkable. Physical examination revealed paresthesia in the left S1 and S2 dermatomes. However, there was no sign of motor weakness. Lumbosacral spinal radiography revealed thoracolumbar scoliosis and degenerative changes. MRI revealed a 2.7-cm well-defined IDEM mass at the L2–3 spinal level (Fig. 1A). This mass was characterized by isointensity on T1-weighted imaging (T1WI) and heterogeneous hyperintensity on T2-weighted imaging (T2WI), compared to the intensity of the spinal cord (Fig. 1A). The nerve roots of the cauda equina were peripherally displaced on axial scans (Fig. 1A 4th, arrowheads). Post-contrast fat-saturated T1WI revealed intense enhancement of the lesion (Fig. 1A 5th, 6th). Multiple dilated, tortuous vessels with signal voids were observed in the IDEM compartment extending from the T11 to the L2 level (Fig. 1A 3rd, arrow). These imaging features indicated that the presence of a hypervascular tumor. On the basis of these findings, we considered a differential diagnosis of ependymoma, paraganglioma, or hemangioblastoma. It was thought to be a hypervascular tumor, and angiography was planned. The patient underwent bilateral L1–L4 lumbar artery arteriography for preoperative embolization, and no feeders to the tumor were detected.

The patient underwent L2 laminectomy and L3 partial laminectomy through a midline incision. Durotomy revealed a well-defined, firm, lobulated mass with an orange-red hue. The mass was intermingled with the nerves of the cauda equina, and there were dilated vascular channels at both poles of the tumor (Fig. 1B 1st, 2nd). The tumor was dissected circumferentially by preserving all nerve roots of the cauda equina, and en bloc resection was performed. The dilated venous channels that entered and left the tumor capsule were coagulated and sharply divided. Frozen section biopsy initially indicated a diagnosis of paraganglioma.

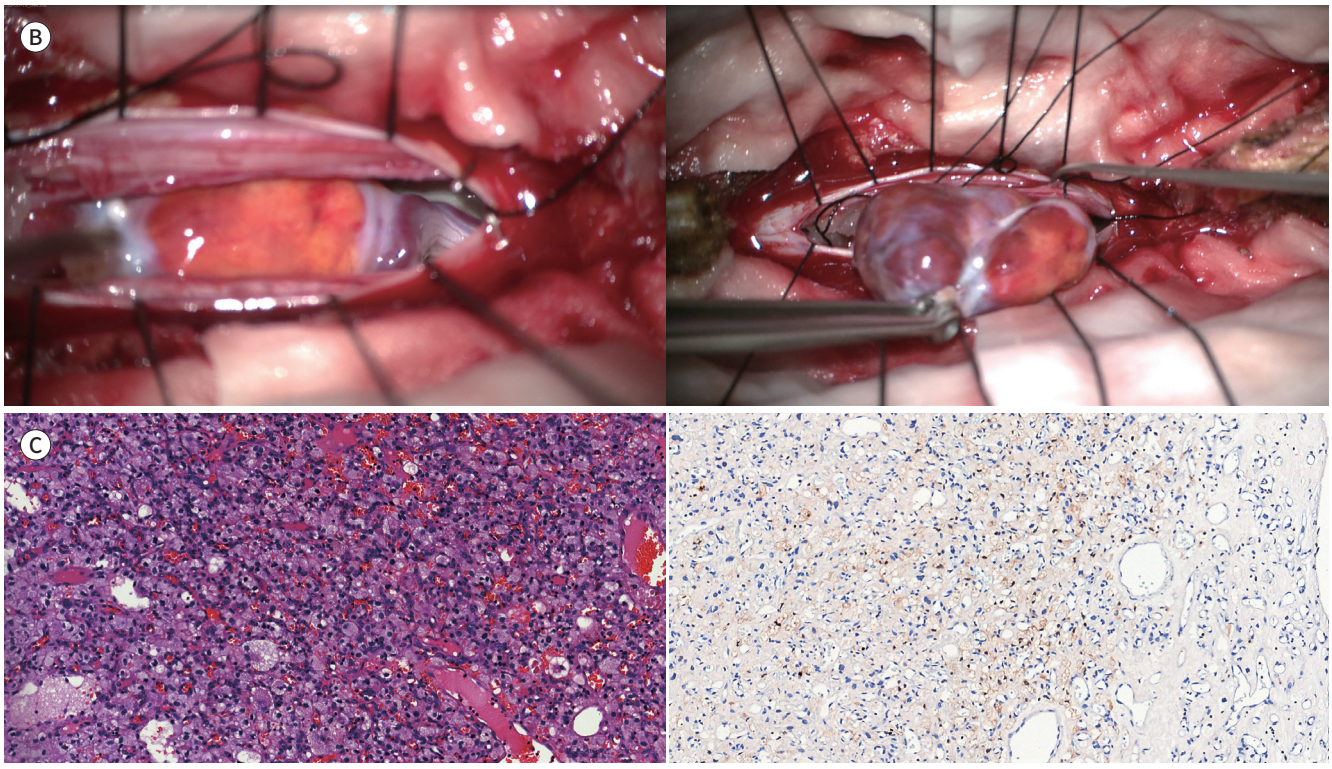
Histopathology revealed a highly vascular tumor composed of different-sized vascular

Fig. 1. Intradural extramedullary hemangioblatoma not associated with von Hippel-Lindau syndrome in a 70-year-old female.
A. MRI shows a well-defined intradural extramedullary mass at the L2–3 vertebral level. The mass is isointense on T1-weighted imaging and heterogeneously hyperintense on T2-weighted imaging (A1–A4). A signal void of the tortuous feeding vessel is observed in the proximal portion of the mass (A3, arrow). An axial T2-weighted image shows the intradural mass filling most of the thecal sac with peripheral displacement of the nerve roots (A4, arrowheads). Post-contrast fat-saturated T1-weighted imaging shows intense enhancement of the lesion (A5, A6).



channels with intervening stromal cells (Fig. 1C 1st). No atypia or mitotic figures were observed. Accordingly, a histopathologic diagnosis of hemangioblastoma was made and the diagnosis was confirmed on the basis of immunohistochemistry findings. Immunohistochemical staining revealed that the tumor was positive for S100 (Fig. 1C 2nd), and the Ki-67 proliferative index was 3%. Among ependymoma, paraganglioma, and hemangioblastoma, only paraganglioma is positive for synaptophysin, which was negative in the current case. Accordingly, the tumor was diagnosed as a hemangioblastoma [World Health Organization

Fig. 1. Intradural extramedullary hemangioblatoma not associated with von Hippel-Lindau syndrome in a 70-year-old female.
B. Intraoperative photographs of the tumor. During durotomy, a firm, lobulated, orange-reddish tumor was observed with dilated and tortuous vessels in its periphery. En bloc resection was performed.
C. Pathologic features of the hemangioblastoma. The tumor has a proliferation of variably sized capillaries, and neoplastic cells show pink to clear foamy cytoplasm with fine vacuoles (left, hematoxylin and eosin staining; × 200). Immunohistochemically, the tumor cells are positive for S-100 staining (right, × 200).



(WHO) grade I].

After treatment, the patient did not have any pain in the left buttock and lower extremity. Postoperative MRI confirmed complete excision of the tumor. In addition, screening for VHL syndrome revealed negative results.

DISCUSSION

Hemangioblastomas are benign, slow-growing, highly vascular tumors that are considered grade I tumors per the WHO classification of central nervous system tumors. Hemangioblastomas most commonly occur in the cerebellum and in the intramedullary location of the spine, with 8% of spinal hemangioblastomas being IDEM hemangioblastomas (3). However, IDEM hemangioblastomas not associated with VHL syndrome are very rare, with the incidence of these tumors in the cauda equina being unknown. Our literature review revealed 24 cases of cauda equina hemangioblastomas without VHL syndrome, and their characteristics are summarized in Table 1.

Patients with IDEM hemangioblastomas were more often men (male-to-female ratio of 16:9), with an age range of 33 to 70 years. The locations of the lesion included the filum terminale (n = 14), cauda equina (n = 7), conus medullaris (n = 2), and unknown (n = 2). All lesions

Table 1. Reported Cases of Spinal Hemangioblastomas of the Cauda Equina Not Associated with von Hippel-Lindau Syndrome

	Cases (%)
Characteristics	
Age (years)	52.0 ± 13.5
Sex	
Male	16 (64)
Female	9 (36)
Origin of tumor	
Cauda equina	7 (28)
Conus medullaris	2 (8)
Filum terminale	14 (56)
Unknown	2 (8)
Presenting symptoms	
Sensory only	14 (56)
Motor only	1 (4)
Sensory and motor	6 (24)
Sensory and sphinctor	2 (8)
No symptom	1 (4)
Unknown	1 (4)
MR Imaging characteristics	
Signal intensity on T2WI or FS T2WI	
Hyperintense	9 (36)
Isointense	2 (8)
Hypointense	2 (8)
Heterogeneous	3 (12)
N/A	9 (36)
Signal intensity on T1WI	
Isointense	7 (28)
Hypointense	4 (16)
N/A	14 (56)
Gd enhancement	
Enhancement study (+)	22 (88)
N/A	3 (12)
Degree	
Avid, intense enhancement	13 (59.1)
Not mentioned	9 (40.9)
Homogeneity	
Homogeneous	9 (40.9)
Heterogeneous	2 (9.1)
Not mentioned	11 (50)
Cystic component	
Positive	4 (16)
Negative	19 (64)
N/A	2 (8)

Table 1. Reported Cases of Spinal Hemangioblastomas of the Cauda Equina Not Associated with von Hippel-Lindau Syndrome (Continued)

	Cases (%)
Feeding vessel	
Positive	17 (68)
Negative	7 (28)
N/A	1 (4)
Angiography	
Yes	11 (44)
No	14 (56)
Preoperative embolization	
Yes	3 (12)
No	22 (88)
Tumor origin resection	
Yes	15 (60)
No	7 (28)
Unknown	3 (12)
Postoperative outcome	
Improved	16 (64)
Temporary sensory or motor disturbance	3 (12)
Continued sensory change	1 (4)
Unknown	5 (20)

Reference articles of the table are added as a Supplementary Materials in the online-only Data Supplement.
FS = fat-saturated, Gd = gadolinium, N/A = not available, T1WI = T1-weighted image, T2WI = T2-weighted image

were surgically removed, and the symptoms of most of the patients improved after surgery.

The published cases share several imaging features. The majority of the cases showed a well-defined, enhancing mass with serpentine flow voids of tortuous and convoluted vessels. In fact, 21 of 22 cases showed homogeneous enhancement and 17 of 24 cases showed tortuous feeding vessels. MRI revealed isointensity or isointensity to hypointensity on T1WI and hyperintensity on T2WI or fluid-sensitive imaging. The mass had a cystic component in 3 cases.

The current case exhibited MRI findings similar to those of previously reported cases. The mass in the current case showed isointensity on T1WI and heterogeneous hyperintensity on T2WI, as compared to the intensity of the spinal cord. Post-contrast fat-saturated T1WI revealed intense enhancement of the lesion. Prominent vessels were observed in the IDEM location above the lesion.

The differential diagnosis of a mass in the cauda equina includes schwannoma, meningioma, paraganglioma, myxopapillary ependymoma, carcinoma metastasis, and hemangioblastoma (4). Among them, carcinoma metastasis can be differentiated owing to its multiplicity (5). Among the remaining tumor types, hypervascular tumors, paraganglioma, myxopapillary ependymoma, and hemangioblastoma show similar imaging findings and require further differentiation.

Paragangliomas are usually isointense to the conus medullaris on T1WI, but might be hy-

pointense. On T2WI, paragangliomas are hyperintense and sometimes heterogeneous owing to subacute blood clots (6). Serpentine flow voids are a frequent feature attributed to the hypervascularity of the lesion or to the congested veins, which are compressed by the mass (6). Hypointense margins are usually observed on T2 or proton density (PD)-weighted images; these findings are indicative of an intradural well-encapsulated tumor and are attributed to the paramagnetic effect of hemosiderin or ferritin from previous hemorrhages (6).

Myxopapillary ependymomas present when larger and sausage-shaped, spanning more than one vertebral level, but small oval tumors are also seen. They tend to be hypointense to isointense compared to the intensity of the normal spinal cord on T1WI as well as hyperintense on PD-weighted imaging and T2WI. The signal intensity may also be affected by blood products (7), and calcification may also lead to regions of low T2 signal intensity. Peripheral tortuous vascular structures are one of characteristic finding of myxopapillary ependymoma, however, those are commonly observed in all the 3 tumor types.

Paragangliomas and myxopapillary ependymomas in the filum terminale or cauda equina have imaging characteristics very similar to those of hemangioblastomas. The similar MRI features of those tumors make it challenging to distinguish hemangioblastomas from paragangliomas or myxopapillary ependymomas.

During the differential diagnosis of tumors in the cauda equina, it is important to differentiate hypervascular tumors from other tumors. Accordingly, having knowledge that the tumor is a hypervascular tumor before surgery and performing angiography and preoperative embolization can reduce the risk of bleeding during surgery. Conway et al. (8) recommended embolization for patients with hemangioblastomas that were fed by vessels located away from the region where surgery was performed and that were not expected to be encountered immediately during resection. In the literature review, we noted that preoperative embolization was performed in 3 cases and none of the patients had embolization-related complications (9, 10).

In conclusion, hemangioblastoma should be considered in the differential diagnosis if a prominent vascular structure is observed along with a well-enhancing IDEM tumor at the cauda equina. In particular, as such a hypervascular tumor has a high risk of bleeding during surgery, physicians should be clinically aware of this type of tumor before surgery. Preoperative embolization should be considered as a treatment option, as it can reduce the risk of intraoperative bleeding.

Supplementary Materials

The online-only Data Supplement is available with this article at http://dx.doi.org/10.3348/jksr.2020.0040.

Author Contributions

Conceptualization, U.M., L.E., L.J.W.; data curation, U.M., L.E.; formal analysis, U.M., L.E.; investigation, U.M., L.E.; methodology, L.J.W., K.Y., A.J.M., K.H.S.; project administration, L.E.; resources, U.M., L.E.; supervision, L.E.; visualization, U.M., L.K.S.; writing—original draft, U.M., L.E., L.J.W., L.K.S.; and writing—review & editing, L.J.W., L.K.S., K.Y., A.J.M., K.H.S.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

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폰 히펠린다우 증후군과 관련 없는 특발성 경막 내 수외 혈관모세포종: 증례 보고와 문헌 고찰

엄미경[1,2] · 이영준[1*] · 이준우[1] · 이규상[3] · 강유선[1] · 안중모[1] · 강흥식[1]

혈관모세포종은 저등급, 고혈관성 종양으로 주로 소뇌에 발생한다. 드물게 척추에 발생하는 경우 대부분 수내에 발생하며 본히펠린다우 증후군(von Hippel-Lindau syndrome)과 연관이 있는 경우가 많다. 하지만 경막 내 수외 종양으로 척수 말총에 본히펠린다우 증후군이 없이 발생하는 혈관모세포종은 극히 드물어 현재까지 24예만이 보고되어 있다. 우리는 본히펠린다우 증후군이 아닌 환자에서 척수 말총에 생긴 경막 내 수외 혈관모세포종의 특징적인 영상 소견과 그 감별진단에 초점을 맞춰 보고하고자 한다. 또한 문헌 고찰을 통해 이전에 보고되었던 증례들과 임상 양상 및 영상 소견을 비교하여 분석하였다.

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