INTRODUCTION

Spinal tumours are one of the rarest tumours, comprising 4-8% of tumours arising from the Central Nervous System. However, these lesions can cause significant morbidity, including limb dysfunction and mortality. 1 In general, extradural tumours are the most common, comprising 60% of all spinal tumours, with the majority of lesions originating in the vertebrae. The most common extradural tumours are metastases, whereas primary bone tumours are much less common. Intradural extramedullary tumours are the second most common, comprising 30% of all spinal tumours, with meningiomas and nerve sheath tumours (schwannomas and neurofibromas) being the most common. Intramedullary tumours are rare spinal tumours, comprise 10% of all spinal tumours, and most often occur in the cervical region of the spinal cord. Astrocytomas and ependymomas are the most common types of intramedullary tumours, with ependymomas occurring approximately twice as frequently as astrocytomas.2 Schwannomas and meningiomas are considered some of the most common IDEM tumours. Nevertheless, the most prevalent IDEM tumour remains a subject of controversy.3,4 Typically, there are three classifications for the site of primary spinal cord tumours: intramedullary (IM), intradural extramedullary (IDEM), and extradural (ED). An important factor that has significantly propelled notable progress in primary spinal cord tumour surgery was the implementation of magnetic resonance imaging (MRI). From January 2003 to March 2019, Seoul National University Hospital identified multiple cases. 55.6% of patients in this study were diagnosed with IDEM (sensitivity: 93%, specificity: 92%, PPV: 93%, and NPV: 91 percent), followed by IM (21%), ED (19%; sensitivity: 88%, specificity: 97%, PPV: 90%, and NPV: 97 percent), and ED (PPV: 85%, NPV: 98%). The remaining patients were diagnosed in two locations of the spinal cord, including intradural and extradural and intramedullary and extramedullary.5 In 2000, the World Health Organization (WHO) issued a new comprehensive classification of central nervous system neoplasms. This tumour classification is based on the fact that each type of tumour results from the abnormal growth of a specific type of cell. Because tumour characteristics correlate with cell type, tumour classification can determine appropriate therapeutic options and predict prognosis. The new WHO classification provides parallel grading systems for each tumour type and standards for communication between various health centers worldwide.6 The location is essential in determining the differential diagnosis of a spinal tumour. MRI plays a
central role in the imaging of spinal tumors and makes it easier to classify spinal tumors as extradural, intradural-extramedullary, or intramedullary. Although this classification is too simple because lesions can be located in several compartments, it is helpful in tumor characterization. MRI is also essential in evaluating vertebral lesions. Precise prediction of a tumor's pathology and location helps presurgical planning and counseling with improved surgical outcomes.

MRI exhibited high sensitivity in determining the location of tumors. In cases where the tumor simultaneously invades intradural and extradural compartments, MRI validity has been documented to be compromised. Additionally, IDEM incorrectly diagnosed ten cases as IM. Several cases were interpreted as having an intradural part, which was purely an extradural tumour. Predicting the involvement of the intradural component was difficult. It was challenging to predict the extent of intradural component involvement. Therefore, adequate consideration of intra-dural and extra-dural tumour components would be required for perplexing instances. The diagnostic validity of MRI was demonstrated by its high sensitivity and specificity. Notably, most malignancies were identified during the initial and subsequent examinations. However, caution should be exercised when interpreting this figure due to its general nature. A critical consideration in clinical practice pertains to the ability to differentiate between malignancies whose image characteristics converge. Alternatively stated, the accuracy with which an MRI can diagnose a puzzling tumor is critical. MRI has certain limitations for detecting lymph node (LN) metastases, particularly in the thorax and diaphragm region, due to its susceptibility to artifacts of motion and organ pulsation. This results in a 79% to 82% reduction in diagnostic accuracy for N-staging and lung metastasis detection compared to CT.

The patient's prognosis will be influenced by the diagnostic testing utilised. The characteristics of the primary tumor largely determine survival prognoses. The patients who have spinal

Figure 1. Spine MRI with gadolinium contrast demonstrated intradural extramedullary solid mass predominantly in the central spinal cord at the level of Th 5-7, measuring +/- 1.6 x 1.2 x 5 cm, that appear isointense on T1WI, T2WI, there's heterogeneous contrast enhancement after contrast administered. The mass causes severe spinal canal narrowing at this level; press the right traversing nerve root of Th 6, Th 7, and bilateral exiting nerve root of Th 6. A) T1, B) T2, C) T1FS+C, D)T2

Figure 2. Sagittal Whole Spine MRI with gadolinium contrast demonstrated multiple intramedullary lesions in the spinal cord at the levels C2, C2-3, C4-5, C6, T3-4, T5, T6, T10 and T11, with largest size +/- 1.3 x 0.7 x 0.9 cm at T10, and medulla oblongata, cerebellum, which appear iso-hyperintense on T1WI, hyperintense with hypointense area in peripher on T2WI, strong contrast enhancement after contrast administered. There is also syrinx in almost the entire area of the spinal cord, which causes spinal cord enlargement. A) T1 of cervicothoracic, B) T2 of cervicothoracic, C) T1FS of cervicothoracic, D) T1 of thoracolumbar, E) T2 of thoracolumbar, F) T1FS of thoracolumbar
metastases face survival rates varying from 9% (for lung cancer) to 44% (for breast or prostate cancer) after two years. Typically, a mere 10% to 20% of patients who are diagnosed with spinal metastases survive for two years. The physician must consider this fact when determining the invasiveness and nature of any treatment. Thus, this study aimed to show the role of MRI in spinal tumours.

CASE DESCRIPTION

Case 1
A 42-year-old woman was referred from the clinic with weakness in her lower limbs for 4 years. The complaint was felt when the patient went to work, then suddenly fell and couldn't stand again. The previous history of trauma was denied. The patient also complained of numbness in both legs, a thick feeling in the soles of the feet, and pain in both legs when moved. On physical examination, motoric function 5/5/5, Babinski Reflex D & S, Sensibility disorders of all qualities at and below the level of Th 8 dermatome.

On MRI examination, there’s an intradural extramedullary solid mass predominantly in the central spinal cord at the Th 5-7 level, measuring +/- 1.6 x 1.2 x 5 cm. On the T1WI sequence, the lesion shows an isointense signal. T2WI sequence shows isointense signal. After giving contrast, there’s heterogeneous contrast enhancement. The mass causes severe narrowing of the spinal canal at this level, pressing the proper traversing nerve root of Th 6, Th 7, bilateral exiting nerve root of Th 6 and causing cerebrospinal fluid flow obstruction at the level of Th 5-7 (Figure 1). The patient undergoes surgery, and the histopathology results in impressive Transitional Meningioma, CNS WHO Grade I.

Case 2
A 26-year-old woman was referred from the clinic with complaints of weakness in her right leg for the last 2 years. Previously, the patient had a history of trauma from falling from a motorbike in a sitting position. Complaints have worsened in the previous 3 months. The thighs feel weaker than the legs. The patient also complained of numbness in the right

Figure 3. Axial Brain MRI with gadolinium contrast demonstrated multiple cystic masses with mural nodule intraaxial infratentorial in the left cerebellum +/- 5.0 x 1.8 x 2.1 cm, which appear hypointense with hyperintense mural nodule component on T1WI/FLAIR, hyperintense with isointense mural nodule component on T2WI, with flow void around mural nodule, substantial contrast enhancement in mural nodul after contrast administered, no restricted diffusion on DWI/ADC, and no blooming artefact on SWI/Phase Image. The mass pushes the fourth ventricle to the right, obstructing the central canal. A) T1, B) T2, C) Flair, D) T1+C, E) DWI, F) ADC, G) SWI, H)Phase.

Figure 4. Sagittal Spine MRI with gadolinium contrast demonstrated intradural extramedullary mass at the level of CV C7-T1, which appears isointense to muscle on T1WI, slightly hyperintense on T2WI, and there's contrast enhancement after contrast was administered. Axial and Coronal T2 MRI shows the mass extent into the right neural foraminal and gives the dumbbell an appearance. Mass also narrows the spinal cord, pressing the right and left traversing nerve root of Th1. A) T1, B) T2 C) T1 FS+C, D-F) T2
calf that spread to the right foot. The patient also felt stiffness in the right neck spread to the right shoulder. On physical examination, paresthesia was found at the spinal cord S1 and S2 dermatomes level, with hypesthesia at and below the level of the Th 10 dermatome.

On Whole Spine MRI examination, there are multiple intramedullary lesions in the spinal cord at the levels C2, C2-3, C4-5, C6, T3-4, T5, T6, T10 and T11, with size largest +/- 1.3 x 0.7 x 0.9 cm at T10, and medulla oblongata, cerebellum, which appear isointense to the spinal cord on T1WI sequence, iso-hyperintense signal on T2WI, strong contrast enhancement after contrast administered. There is also syrinx, which causes enlargement of almost the entire spinal cord (Figure 2). The patient also did an MRI Head examination, which showed multiple cystic masses with mural nodule intra-axial infratentorial in the right and left cerebellum, right cribriform fossa, and cervical spinal cord, which push the fourth ventricle to the right, obstructing the central canal and causing active communicating hydrocephalus, suggestive hemangioblastomatosis (Figure 3). The patient undergoes surgery, and histomorphology results in impressive Hemangioblastoma.

Case 3
A 41-year-old man with lower back pain, especially when sitting for a long time, has improved when resting since 2 years ago. The patient also complained of weakness in both legs. The patient could stand but had difficulty walking. Patients also feel numbness on the bottom of the thighs to the tips of the left and right toes. Normal urine and bowel habits. On physical examination, motoric strength: | 5 | 5 | 5 | 5 | 5, Sensory: Bilaterally anaesthesia at and below level Th 6.

On the Spine MRI examination, there’s intradural extramedullary mass at the level of CV C7-T1, dumbbell-shaped, which shows isointense to muscle on T1WI, slightly hyperintense on T2WI, and there’s contrast enhancement after contrast administered. The mass extent into the right neural foraminal and gives a shape appearance, narrows the spinal cord, presses the right and left traversing nerve root of Th1, and causes partial obstruction of cerebrospinal fluid at this level, expecting schwannoma (Figure 4).

Case 4
A 51-year-old man with complaints of weakness in both lower limbs for 8 days and getting worse since 5 days ago. The patient initially felt weakness in both lower limbs but could still do activities independently, including walking and bathing. 5 days ago, the patient suddenly could not move his lower legs. The previous history of trauma was denied. The patient has never received treatment before for this complaint. The patient also complained of numbness and not feeling anything in both legs, which appeared along with the weakness. The patient has experienced pain in the back at the level of the back for the last 1 month, and because of this complaint, the patient tends to lie down more often. The patient also has difficulty urinating for the last 1 month, and since the last 1 week, the patient did not feel when the patient wanted to urinate or defecate. The patient has a history of HCC, which is known since 2 years ago. On physical examination, motoric strength: | 5 | 5 | 5 | 5 | 5, Sensory: Bilaterally anaesthesia at and below level Th 6.

On Spine MRI examination, there is a solid extradural mass at the level of CV Th 3-5, which causes severe narrowing of the spinal canal and partial obstruction of CSF flow at the level of Th 4-6, press the spinal cord anteriorly at this level. There’s also bone marrow replacement on CV C2-4, Th1-7, right and left Th 6 pedicles, and processus spinous C5-Th4 (Figure 5). So, we suspected it was a metastatic process. The patient underwent a biopsy examination, and histomorphology results showed an impressive metastasis lesion.

DISCUSSION
Spinal tumours are tumours that arise from the spinal cord or spinal column. The incidence of spinal tumours is relatively rare but has a high morbidity rate. In determining the differential diagnosis of a tumour, location is essential. MRI
is a necessary modality for diagnosis so that appropriate treatment can be carried out. MRI examination is beneficial in classifying spinal tumours and narrowing the differential diagnosis. Each subtype of spinal tumour can be differentiated based on the location of the tumour, whether intramedullary, intradural extramedullary, or extradural, and also the signal intensity characteristics of the tumour. Understanding the MRI appearance of each type of spinal tumour is very important for precise diagnosis to determine the best treatment.1,3

Meningioma is one of the most common types of spinal tumours, accounting for around 24%-46% of all spinal tumours. Spinal meningiomas are common in middle-aged women. The location is intradural extramedullary, and they are most often at the level of the thoracic spine. Meningioma is a benign and slow-growth tumour. Generally asymptomatic, but neurological deficits are also common. MRI is the gold standard examination for the diagnosis of spinal meningioma. The typical signal intensity of spinal meningioma is iso to slightly hyperintense on T2WI after administration of gadolinium contrast, showing homogeneous enhancement. In the case reported above, the patient is female, 42 years old. This is in accordance with the epidemiology of spinal schwannoma, which is most common in middle-aged women. The location of the mass in the patient was in the spinal cord at the level of the thoracic level; this is in accordance with the literature; the most common location is at the thoracic vertebral level. On MRI, an intradural extramedullary mass was found, which showed an isointense signal to the spinal cord on T1WI and T2WI sequences, and after contrast administration, there was homogeneous contrast enhancement.11,13

Schwannoma is a benign nerve sheath tumour that often occurs in peripheral nerves and subcutaneous tissue. Tumours can occur at any age, with a peak incidence at the age of 40-60 years without a particular gender predilection. MRI of spinal schwannoma shows a mass with iso or hypo signal intensity compared to the spinal cord on T1WI and hyperintense on T2WI; there's contrast enhancement when contrast is administered, and it most often arises from the dorsal sensory nerve root in the lumbar region. A more hyperintense focal area on T2WI indicates cystic degeneration, whereas hypointense indicates haemorrhage, hypercellularity, or collagen deposition. If neuroforaminal extension occurs, it can show a dumbbell shape. Tumor heterogeneity does not always indicate malignant change. In the case above, it happened at 48, by the epidemiology of spinal schwannoma, with a peak incidence at 40-60 years. Despite its predilection, the thoracic spinal cord level is not the most common location for spinal schwannoma. The patient's MRI examination is in accordance with the literature, which shows an isointense signal to the muscle on T1WI, hyperintense on T2WI, and strong contrast enhancement after administration of Gadolinium contrast.12,13

Hemangioblastoma is a vascular neoplasm of the central nervous system most commonly found in the cerebellum. Hemangioblastoma can occur sporadically or as part of von Hippel Lindau syndrome. Patients with spinal hemangioblastoma have a mean age onset of 30 years. Symptoms of spinal hemangioblastoma are similar to other spinal canal tumours, such as sensory changes, motor disturbances, and pain. The MRI image of spinal hemangioblastoma usually shows a hypo-isointense signal compared to the spinal cord on T1WI, iso-hyperintense on T2WI, and intense contrast enhancement after contrast injection. A visible flow void can be due to prominent blood vessels if the mass size is large enough. Most spinal hemangioblastomas are located at the thoracic and cervical spinal cord levels. A cyst or syrinx accompanies 50% of spinal hemangioblastomas. Around 23% of patients had a dilated spinal cord. In the case above, the patient was 27 years old; this is in accordance with the literature that metastases have an onset of +/- 30 years. The patient's MRI image is in accordance with the literature where an isointense image is obtained on T1WI and T2WI, and there's contrast enhancement after administration of Gadolinium contrast. There was also bone marrow replacement in multiple cervical and thoracic vertebral bodies.15

Regarding this study, MRI has an essential role in spinal tumour diagnosis. This study provided several cases related to spinal tumours and the role of MRI in finding the tumour. However, this study only focuses on the spinal tumour diagnostic. Thus, we could not follow up on the patient's condition. However, the strength of this study was that we provided several cases of spinal tumours to show the role of MRI in diagnosing them.

CONCLUSION

Spinal tumours can cause significant morbidity in terms of pain and motoric and sensory disturbance and also can cause mortality. Therefore, diagnosis and prompt management may be essential. In determining the differential diagnosis, tumour location is critical. In spinal tumours, a radiology examination has a crucial role in determining the mass's location, size, and extent. Also, it plays an essential role in the follow-up and monitoring of the response to therapy. MRI is the best imaging modality because it can
identify and localise tumours and classify spinal tumours as extradural, intradural-extramedullary, or intramedullary, thereby narrowing the differential diagnosis. Understanding the type and MRI appearance of spinal tumours is very important for a more accurate diagnosis so that the best treatment can be determined.

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All of the authors have been contributed in the manuscript preparation

**CONFLICT OF INTEREST**
None

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**REFERENCES**