**Spine**

**SE 08 MS(SP)-01**

Comparison of the weight-bearing MRI findings and the surgical findings of the occult disc herniation that was underestimated on conventional recumbent MR images

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Conventional high-field magnetic resonance image (MRI) with the patients in the supine position is now widely available and remains the technique of choice for the investigation of the degenerative lumbar spine disorders. However, symptoms for the most of the degenerative spine diseases vary according to patients’ position and posture. It is a well-known fact that their symptoms get worsen when standing, sitting and walking, in particular. Scanning patients in a recumbent position may potentially miss the occult pathology, which can be revealed in a weight-bearing MRI. We were able to identify the occult pathology with the surgical intervention.

In this regard, we would like to compare the conventional MR and W-B MR images of the occult lesions, and show you how those lesions appeared in the surgical field.

**SE 08 MS(SP)-02**

Diverse MR imaging spectrum of spinal schwannomas

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PURPOSE: Spinal nerve schwannomas are considered as the most common primary spinal tumors. The majority of them exhibit typical imaging findings. But some spinal schwannomas with atypical imaging findings are difficult to distinguish from the other spinal tumors. The learning objectives of this exhibit are to review diverse imaging patterns of spinal schwannomas and to familiarize radiologists with the varied spectrum of these common tumors.

MATERIALS AND METHODS: We reviewed all pathologically confirmed spinal schwannomas from February 2009 to January 2018 in our institution (n = 254). We evaluated T1-, T2-signal intensity, enhancement pattern, location (extradural, intradural/ extramedullary, intramedullary and intraosseus), craniocaudal level of the tumors and assessed whether they have cystic changes, calcification, hemorrhage, prominent feeding vessels and/or syndromic features on CT/MR images. Also we retrospectively analyzed tricky cases that we did not give ‘schwannoma’ as the first differential diagnosis. This exhibit demonstrates pictorial case-based reviews.

RESULTS: Spinal schwannomas demonstrate diverse imaging patterns on MR image.

CONCLUSION: The knowledge of diverse MR imaging patterns of spinal schwannomas will help radiologists to distinguish spinal schwannomas showing uncommon imaging findings from the other spinal tumors.

Diverse MR imaging spectrum of spinal schwannomas

Cases

Case 1

63, F

[ Radiologic Report]

About 5.7x2.9x2.4 cm sized lobulated, dumbbell shaped, both IDEM and extradural mass at left side of T7.
- Bony erosion of T7 VB and left lamina, and widening of left T7/8 neural foramen.
- Mixed well-enhancing solid, and cystic components.
- Unusually large size for schwannoma.

→ DDx: 1. schwannoma at T7, with both intradural and extradural components. 2. chondrosarcoma/chordoma.

[Pathology Report]

Schwannoma with cystic change and hemorrhage.
Case 3

45, F

[Radiologic Report]
An IDEM mass (1.8x1.5x3.3 cm) from L1 body to L2 body level. Other several enhancing nodules from L1/2 to L3 mid body level. Prominent leptomeningeal enhancement.
→ DDx: 1. myxopapillary ependymoma with leptomeningeal seeding, most likely. 2. all leptomeningeal metastasis. 3. multiple schwannoma, least likely.

[Pathology Report]
Schwannoma

Case 2

45, M

[Radiologic Report]
2.6x1.9x2.5 cm well-circumscribed oval extradural mass at Rt. C1/2 level with avid enhancement, multiple dark foci, suggesting prominent tumor vessels.
→ Vascular origin tumor such as hemangiopericytoma or hemangioblastoma, probably.

[Pathology Report]
Schwannoma with old hemorrhage and hyalinization.

Case 4

65, M

[Radiologic Report]
About 11 x 6 mm dumb bell shaped extradural mass lesion at the L4/5 Rt. central to foraminale zone.
→ T1 LSL, T2 HS1 with rim enhancement.
→ DDx: 1. HVD. 2. schwannoma.

[Pathology Report]
Intradural extramedullary schwannoma with hemorrhage.
SE 08 MS(SP)-03
Paraspinal lean muscle mass measurement using spine MRI as a predictor of adjacent segment disease after lumbar fusion: A propensity score-matched analysis
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BACKGROUND: Adjacent segment disease (ASD) is a complication of spinal fusion due to increased stress and motion on adjacent segments. Several risk factors for the development of ASD have been proposed except for paraspinal muscles that are important components of the lumbar spine.

PURPOSE: To compare paraspinal muscle mass between patients with symptomatic ASD and those without ASD after lumbar fusion by using preoperative magnetic resonance imaging (MRI).

MATERIALS AND METHODS: Fifty ASD patients (mean age, 61.4 years; M:F = 13:37; mean body mass index [BMI], 25.1 kg/m²) who had undergone additional operation for ASD after lumbar fusion were age-, sex-, BMI-, and fusion segment-matched to 50 control patients. The total cross-sectional area (CSA) and functional CSA (FCSA; i.e., area containing only lean muscle tissue) were measured for the paraspinal muscle group (multifidus and erector spinae muscles) and the psoas muscles on preoperative MRI. The ratio of FCSA to the total CSA and the skeletal muscle index (SMI = muscle area [in cm²]/patient height² [in m²]) were calculated. The parameters were compared between the two groups by using the independent-sample t test.

RESULTS: The mean FCSA (2178.6 mm² vs. 2594.0 mm², p = 0.004), FCSA/total CSA ratio (45.4% vs. 52.2%, p = 0.001), and SMI_{FCSA} (8.8 vs. 10.6; p = 0.001) of the paraspinal muscle group were significantly smaller in the ASD patients than in the control patients. The mean SMI_{TotalCSA} of the psoas muscles were significantly lower in the ASD group than in the control group (8.3 vs. 9.2, p = 0.002). With the paraspinal and psoas muscle groups combined, total CSA was not significantly different, but the mean FCSA (3680.8 mm² vs. 4268.2 mm², p = 0.013), FCSA/total CSA ratio (53.3% vs. 58.6%, p = 0.004), SMI_{TotalCSA} (27.7 vs. 29.3, p = 0.049), and SMI_{FCSA} (14.9 vs. 17.3, p = 0.002) were significantly lower in the ASD group than in the control group. Other variables were not statistically different between the ASD and control patients.

CONCLUSION: The ASD patients had smaller paraspinal lean muscle mass, as indicated by the FCSA, lower FCSA/total CSA ratio, and SMI_{FCSA} of the paraspinal muscle group on preoperative MRI, than the control patients. Smaller lean muscle mass and higher degree of fat infiltration of the paraspinal muscle group can be predictors of ASD after lumbar spinal fusion.

SE 08 MS(SP)-04
Lumbar paraspinal compartment syndrome: A case report and disease review
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PURPOSE: 1. To present an uncommon case of compartment syndrome involving lumbar paraspinal region, diagnosed with magnetic resonance imaging.
2. To discuss correlation between pathologic mechanism and image finding.

CONTENTS:
1. Etiology and pathogenesis
2. Related anatomy
3. Role of imaging in diagnosis
4. Treatment and prognosis

SUMMARY: Radiologic study plays crucial role in making diagnosis. CT or MRI may demonstrate diffuse swelling and edematous condition as bulging contour of swollen muscle with diffuse hypodensity or hyperintensity on T2-weighted image. Decreased vascularity and impaired contrast enhancement can be observed reflecting ischemia and increased intracompartmental pressure. It also helps to evaluate extent of involved muscles and exclude differential diagnoses. Conservative treatment can be maintained when laboratory and symptomatic improvement is definite and no irreversible complication such as infarction, hemorrhage, and diffuse necrosis that usually require radiologic evaluation.
SE 08 MS(SP)-05
As easy as ABC: Postoperative CT and MR imaging findings after lumbar spinal surgery - What the radiologists should know
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PURPOSE:
1. Categorize various types of lumbar spinal surgeries
2. Understand different artifacts on CT and MRI
3. Design optimal protocol for postoperative CT and MRI
4. Recognize the usual position and appearance of spinal instrumentations
5. Identify different complications during postoperative course.

CONTENT ORGANIZATION:
Introduction
Types and instrumentations of spinal surgeries
Usual radiological findings in postoperative spine, including artifacts on CT and MRI
Protocol optimization on CT and MRI: using dual energy CT, MARS, and SEMAC
CT and MR imaging findings of post-operative complications including
1. Peri-instrumental complications, i.e. device loosening, breakage, subsidence
2. Postoperative infection
3. Recurrent disc vs. granulation tissue
4. Dural tear
Conclusion
References

MAJOR TEACHING POINTS:
1. Review the major categories of spinal surgeries.
2. Protocol optimization on CT and MRI after lumbar surgery.
3. Understand usual post-operative findings of spinal surgery on CT and MRI.
4. Recognize image findings of complications on CT and MRI in postoperative period.

Fig. 1. (a) Dural tear. 75-year-old female who underwent L4-L5-S1 laminectomy with posterior lumbar interbody fusion. In the days following surgery, T2-weighted (left) T2-weighted fat-saturation (right) sagittal image showed seroma communicating with CSF space in the region the dural tear site at posterior aspect of L4-L5 vertebral bodies. (b) Hardware loosening and subsidence. 72-year-old female who underwent bilateral transpedicular screw fixation with interbody fusion. In few months following surgery, Sagittal CT images showed loosening of both screws at S1 and subsidence of interbody metallic cage at L5/S1.

SE 08 MS(SP)-06
Determine to MRI scan of the lumbar spine abnormality
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PURPOSE: The association in the middle abnormalities in the lumbar spine and low back pain is contentious. We examined the epidemic of abnormal findings on magnetic resonance imaging (MRI) scans of the lumbar spine in people without back pain.

MATERIALS AND METHODS: Study is made for 100 patients who has diagnosed as asymptomatic people at Diagnostic Imaging Center, The First Central Hospital of Mongolia, Ulaanbaatar, from May 2015 to November 2016 after approval by hospital administration. There were two excitations for the T1-weighted axial and sagittal images, with one excitation for the T2-weighted sagittal images. The T1-weighted axial sequences were stacked slices extending from the inferior aspect of L3 through the inferior aspect of S1.

RESULTS: Thirty-six percent of the 100 asymptomatic subjects had normal disks at all levels. With the results of the two readings averaged, 52 percent of the subjects had a bulge at least one level, 27 percent had a protrusion, and 1 percent had an extrusion. Thirty-eight percent had an abnormality of more than one
intervertebral disk. The prevalence of bulges, but not of protrusions, increased with age. The most common nonintervertebral disk abnormalities were Schmorl’s nodes ( herniation of the disk into the vertebral-body end plate), found in 19 percent of the subjects; annular defects (disruption of the outer fibrous ring of the disk), in 14 percent; and facet arthropathy (degenerative disease of the posterior articular processes of the vertebrae), in 8 percent. The findings were similar in men and women.

CONCLUSION: On MRI examination of the lumbar spine, many people without back pain have disk bulges or protrusions but not extrusions. Given the high prevalence of these findings and of back pain, the discovery by MRI of bulges or protrusions in people with low back pain may frequently be coincidental.

SE 08 MS(SP)-07
Intraosseous spinal tumors: From the common to the rare
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BACKGROUND: A variety of bone tumors can be found in the spine. Hemangioma is the most common benign tumor. Metastatic disease is the most common malignant spinal tumor. Other primary intraosseous spinal lesions are more unusual but may exhibit characteristic imaging features that can help the radiologist develop a differential diagnosis.

PURPOSE: To provide systematic approach for diagnosis of vertebral tumor and to review intraosseous spinal lesions with highlight in imaging features, not only common tumor, but also rare intraosseous tumors and nontumorous lesions.

MATERIALS AND METHODS: We reviewed imaging features of pathologically confirmed intraosseous spinal lesions at our institute.

RESULTS:
1. Systematic approach for image interpretation: Age-based approach / Location-based approach / Imaging pattern-based approach
2. Imaging findings of common intraosseous spinal tumors: Hemangioma / Metastasis / Multiple myeloma & plasmacytoma / Aneurysmal bone cyst / Benign notochodal cell tumor (BNCT) / Bone island / Cavernous malformation / Chondrosarcoma / Chordoma / Giant cell tumor / Lipoma / Osteoblastoma / Osteochondroma / Osteoid osteoma / Osteosarcoma
3. Imaging findings of rare spinal tumors: Hibernoma / Chondroblastoma / Epithelioid angiosarcoma / Undifferentiated pleomorphic sarcoma
4. Other tumor like lesions: (focal) red marrow / (vertebral tophaceous) gout / Pigmented villonodular synovitis (PVNS) / Retro-odontoid (periodontoid) pseudotumor

CONCLUSION: This poster presentation will mainly serve as a teaching tool and reference guide for the general radiologist and for the radiologist-in-training, when dealing with a vertebral tumor. This poster presentation also highlights the characteristic imaging features which aid the process of imaging differential diagnosis.

SE 08 MS(SP)-08
Trauma that sends chills down the spine - Pictorial description of spectrum of imaging findings in patients with spinal injury
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Trauma to the spine may cause injury to the bony, soft tissue as well as the neural components. Different classification systems have been advocated over the years. In our institution, depending on the site of involvement- SLICS (Sub-axial Cervical Spine Injury Classification System) for subaxial cervical spine and TLICS (thoracolumbar injury classification and severity score) for thoracolumbar spine is used as these systems assist in clinical management and helps predict spinal stability. Patients were evaluated with plain X-ray and NCCT for assessment of osseous involvement and MRI for soft tissue (ligamentous and vascular injury) and neural involvement (spinal cord, conus and cauda equina, spinal nerves). Rarely, CT angiography was done in patients with vascular injuries (vertebral arteries in cervical spine and abdominal aorta in thoracolumbar injuries). Subsequently based on imaging parameters observed, scoring was done and the total score used to predict the need for surgery.

CT combined with MRI play a crucial role in detailed assessment of spinal injury, Clear demonstration of the injury morphology including different types of fractures (compression, burst), translation or distraction is done with CT and it is the modality of choice for the same, although subtle osseous injury not seen on CT may become conspicuous on MRI (e.g.: subtle compression fractures and bone marrow edema). MRI is modality of choice for assessment of the ligamentous complex and of the neural component. This along with the clinical information regarding the patient neurological status completes the scoring system which decides further management.
Spinal cord torn but no injury to bone? Traumatic spinal cord transection without osseous injury in an adult - A case report and literature review
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SCIWORA (spinal cord injury without radiographic abnormality) usually is applied for children and more commonly affects the cervical spine. More recently SCIWOCTET (spinal cord injury without CT evidence of trauma) is used; it is a subtype of SCIWORA and used to describe such injuries in adults. One case of thoracic spinal cord injury without CT abnormality in an adult is reported along with review of literature. The patient had complete paraplegia and a sensory level below D7 level. Radiological assessment was done with noncontrast CT as well as MRI spine and it revealed complete transection with retraction of dorsal spinal cord with PLC (posterior ligamentous complex) injury on MRI however no fracture of vertebral bodies and posterior elements or facet dislocation was seen on CT.

CONCLUSION: Although SCIWOCTET is very uncommon, it should still be kept in mind in acutely injured patients with typical clinical findings of cord transection as it has prognostic and therapeutic implications. Few such cases are reported in the past however most of those patients had predisposing factors like congenital canal stenosis or significant degenerative changes. Our patient had no such predisposing factors and the spinal canal diameter was well maintained at the described level.

Imaging characteristics of anomalies of notochordal development
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Notochord develops from the invagination of cells from the primitive node. The embryologic process which dates back to week 3 of development occurs immediately after the formation of the 3 germ layers. The primitive pit in primitive node continues into the notochordal process. There is merging of the notochordal process with the endoderm which results in transient communication of the amniotic cavity and the yolk sac. Abnormal persistence of this communication leads to formation of neurenteric canal and neurenteric cyst. Notochord once formed extends from primitive node caudally to the prechordal plate/buccopharyngeal membrane cranially. Notochord has an inductive effect during the formation of the neural tube (neurulation). Notochord regresses in the region of the vertebral body and gives rise to the nucleus pulposus in the intervertebral areas. After the cranial infolding of the developing fetus, the cranial most notochordal cells come in contact with the clivus at the skull base. Precisely, the point of contact with the clivus occurs thrice: at the posterior clivus, ventrally at the nasopharynx and at the dorsum sella. Persistence of extrasosseous portion notochord at these places can give rise to echordosis physaliphora and extrasosseous chordoma. Ecchordosis physaliphora is usually asymptomatic, benign proliferation of physaliforous cells. It projects intradurally into the prepontine cistern and remains attached to the posterior clivus via a bony stalk- its morphologic hallmark. It may evade detection since it follows CSF density/intensity. Extrasosseous chordoma typically lack the destructive features of classic chordoma and when in nasopharynx show a continuation into the median basal canal of clivus. It, however, retains the high T2 signal along with fibrous septations typical of a chordoma. The notochordal cell rests can rarely persist in the vertebral bodies where they may rarely transform into a chordoma, most commonly seen at the sacrococcygeal region followed by the clivus. A chordoma is destructive tumor that is locally aggressive with or without a soft tissue component.

Rarely, a benign counterpart of intervertebral proliferation of notochordal cells is encountered and has been called benign notochordal cell tumor. This entity lacks the typical features of osseous destruction and soft tissue component of the chordoma. The current presentation discusses the embryology of the notochord and the imaging features of the associated pathologies.
### Musculoskeletal-Informal Scientific Presentation

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