Primary bony tumors of the spine: Spectrum of Radiologic Findings

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Learning objectives

- To describe the CT and MR imaging appearance of primary benign and malignant bony tumors of the spine.
- To learn about differential diagnosis of primary spinal bone tumor.

Background

- Primary bone tumors of the spine are uncommon, representing less than 5% of all bone tumors.

- We report a retrospective study that evaluates 40 patients with primary spinal bone tumor: 25 males and 15 females with a mean age of 58.6 years (range, 20-78 years), seen during the four year-period from January 2009 to December 2012.

- Clinical data were not specific: back pain was the most common complaint (n=25), followed by radicular or spinal cord compression (n=15).

- Our patients underwent CT scan (n=26) and/or MR imaging of the spine (n=30).

- Diagnosis of primary benign and malignant bony tumors of the spine were confirmed by imaging findings and if necessary with histopathological analysis

Findings and procedure details

The results that were obtained:

- **Benign tumors**: osteoid osteoma (n=3), osteoblastoma (n=2), hemangioma (n=11), osteochondroma (n=1), giant cell tumor (n=1).

- **Malignant tumors**: osteosarcoma (n=4), chondrosarcoma (n=2), plasmacytoma (n=2), multiple myeloma (n=10), lymphoma (n=1), chordoma (n=1), Ewing's sarcoma (n=2).

- Radiologic evaluation of a patient who presents with osseous vertebral lesions often includes radiography, computed tomography (CT), and magnetic resonance (MR)
imaging. Because of the complex anatomy of the vertebrae, CT is more useful than conventional radiography for evaluating lesion location and analyzing bone destruction and condensation.

-The diagnosis of spinal tumors is based on patient age, topographic features of the tumor, and lesion pattern as seen at CT and MR imaging.

- Classification of Primary Spinal Tumors by Tissue of Origin (Fig. 1).

**Benign tumors**

**Bone-forming Tumors**

**Osteoid osteoma** (Fig. 2)

- Osteoid osteoma is a benign osteoblastic lesion characterized by a nidus of osteoid tissue or even mineralized immature bone, often surrounded by sclerotic reactive bone.
- Spinal ostoid osteoma accounts for 10% of an osteoid osteoma and 1% of spinal tumors
- They occur in the second decade of life with a 2:1 male predominance.

**Location**

The majority of spinal osteoid osteomas are located in the neural arch. The lumbar spine is most commonly affected, followed by the cervical, thoracic, and sacral segments.

**Symptoms**

- Painful scoliosis with radicular pain.
- Pain is intense at night and relieved by salicylates.

**Radiological patterns**

**Plain X-rays:**

Round or oval radiolucent nidus, with surrounding sclerosis in the neural arch.
**CT**

low-attenuation nidus with central mineralization and varying degrees of perinidal sclerosis.

**MRI**

- Low-to-intermediate signal intensity on T1WI and variable signal intensity on T2WI.
- Depending on the vascularity of the tumor and the presence of calcification, this lesion shows intense contrast enhancement.
- It may be associated with marrow edema that involves the pedicles and laminae and adjacent posterolateral parts of the vertebral body.

**Osteoblastoma**

- Osteoblastoma accounts for 1% of all primary bone tumors, with a male-female ratio of 2:1.
- Between 32% and 46% of osteoblastomas involve the spine.
- Ninety percent of osteoblastomas manifest in the 2nd and 3rd decades of life.

**Location**

- Osteoblastomas originate in the neural arch and often extend into the vertebral body.
- Spinal osteoblastomas appear with more or less equal frequency in the cervical, thoracic, and lumbar segments.

**Symptoms**

- Osteoblastoma causes dull, localized pain which is not relieved with salicylates, neurologic symptoms; scoliosis generally on the opposite side of the tumor
- May be asymptomatic

**Radiological patterns**

Plain X-rays:
Expansive lytic lesion of more than 1.5 cm in diameter with matrix mineralization and may appear sclerotic.

**CT (Fig. 3)**

Lesion larger than 1.5 cm in diameter with a well-defined margin, central calcification of the matrix and cortical expansion with demarcation by a thin bone shell. The lesion may show extensive matrix mineralization and appear sclerotic, or rarely, as an aggressive and destructive lesion.

**MRI (Fig. 4)**

- The calcified portions of the tumor give rise to low T1 and T2 signal, and the uncalcified portion displays moderately high T2 signal with characteristic inhomogeneous contrast enhancement.

- The lesion may be associated with characteristic peritumoral edema in bone and soft tissues (flare phenomenon). The edema in the bone marrow enhances homogeneously, more than the tumor itself.

**Vascular-forming Tumors**

**Hemangioma**

Hemangioma is the commonest benign tumor in the vertebrae (11%).

It is composed of thin-walled vessels lined by flat, bland endothelial cells infiltrating the medullary cavity between bone trabeculae.

**Location**

Most hemangiomas are seen in the thoracic and lumbar spine. They are usually confined to the vertebral body, although they may occasionally extend into the posterior elements.

**Symptoms**

Most spinal hemangiomas are asymptomatic. Occasionally, vertebral hemangiomas may increase in size and compress the spinal cord and nerve roots.

**Radiological patterns**
Plain X-rays

The classic "corduroy cloth" appearance is strongly associated with vertebral hemangiomas.

CT (Fig. 5)

Axial CT will show a multiple dots (polka-dot appearance) due to the thickened vertebral trabeculae.

MRI (Fig. 6)

On T1 and T2 Weighted MRI sequences, a bright, high intensity zone is seen. The signal will be more intense on the T2 due to its affinity to show water as very bright.

Cartilage-forming Tumors

Osteochondroma

- Spinal osteochondroma represents 1-4% of all solitary osteochondromas and 9% of all multiple osteochondromas.

- The lesion is composed of sheets of chondroblasts with variable amounts of chondroid matrix with chicken wire-like calcification.

Location

Commonly affect the cervical spine (50%) while multiple exostoses commonly involve the thoracolumbar spine. Most spinal lesions occur near the tip of the spinous or transverse processes, but may involve the vertebral body or pedicles.

Symptoms

Back pain is the most common symptom; however, neurologic symptoms may occur when the spinal canal or foramina are invaded.

Radiological patterns

Plain X-rays
Typical presentation: well-defined osteolytic lesion

**CT (Fig. 7)**
May demonstrate a geographic lesion with sclerotic borders and areas of calcifications.

**MRI (Fig. 8)**
Most lesions have hypo-intense areas on T2 WI. Low signal intensity on T2 WI represents immature chondroid matrix, calcifications, and hemosiderin.

*Unknown origin tumors*

**Giant cell tumor**

Giant cell tumor is composed of sheets of stromal ovoid mononuclear cells with uniformly distributed osteoblastic giant cells.

*Location*

The commonest location is the sacrum followed in descending order by the thoracic, cervical, and lumbar regions. Spinal lesions are seen in the vertebral bodies and may extend into the posterior elements.

*Symptoms*

- Patients present with radicular pain.
- A dramatic increase in lesion size can be seen in pregnancy due to hormonal stimulation.

*Radiological patterns*

**Plain X-rays**

Typically shows a lytic lesion with cortical expansion. A purely osteolytic pattern is also possible.

**CT**
Demonstrates absence of mineralization and the lack of a sclerotic rim at the margins of the tumor.

**MRI (Fig. 9)**

- The tumor usually has low to intermediate signal intensity on both T1WI and T2WI. Areas of high signal intensity can suggest relatively recent hemorrhage.

- Enhancement of the lesion reflects its vascular supply.

- Cystic areas, foci of hemorrhage, fluid-fluid levels, and a peripheral low-signal-intensity pseudocapsule may also be seen.

**Malignant tumors**

**Bone-forming Tumors**

**Osteosarcoma**

- Osteosarcoma of the spine accounts for 4% of all osteosarcoma and 4-14% of all primary spinal malignant tumors.

- It is a high-grade malignant osteoblastic lesion with varying amounts of osteoid production.

- Peak prevalence occurs during the 4th decade of life.

- Radiation therapy and Paget disease are usually implicated in cases of secondary osteosarcoma in elderly patients.

**Location**

- The thoracic and lumbar segments are involved with equal frequency, followed by the sacrum and the cervical column.

- In 79% of cases, the tumor arises in the posterior elements with partial vertebral body involvement.

- Involvement of two vertebral levels is seen in 17% of cases.

**Symptoms**
Patients may present with pain, signs of neurologic compression, or a palpable mass.

**Radiological patterns**

**Plain X-rays**

Typically reveal lesions with moth-eaten or permeative pattern of the transition zone with irregular cortical destruction.

**CT**

- Commonly shows a sclerotic lesion with matrix mineralization (80%).
- Ivory vertebra with marked mineralization in the vertebral body is seen in the rare sclerosing osteoblastic osteosarcoma, and purely lytic pattern is seen in telangiectatic osteosarcoma.

**MRI (Fig. 10)**

- The sclerotic lesion shows very low signal on both T1 and T2 sequences with enhancement of the soft-tissue component.
- Fluid-fluid levels have been described in association with telangiectatic osteosarcoma and it can be differentiated from aneurymal bone cyst by its thick solid parts around cystic lesions, matrix mineralization and aggressive course.

**Cartilage-forming Tumors**

**Chondrosarcoma**

- Spinal chondrosarcoma accounts for 7-12% of all chondrosarcomas and is the second most common primary malignant tumor of the spine in adults.
- This tumor occurs in patients aged between 30 and 70 years, and is more commonly found in men.

**Location**

The thoracic and lumbar spines are most frequently affected. It arises in the vertebral body (15%), posterior elements (40%), or both (45%).
**Symptoms**

Patients may present with pain, signs of neurologic compression, or a palpable mass.

**Radiological patterns**

**Plain X-rays**

Usually manifest as a large, calcified mass with bone destruction

True ossification may also be present, which sometimes corresponds to residual osteochondroma in cases of secondary chondrosarcoma.

**CT (Fig. 11)**

Depicts a mass with the characteristic chondroid matrix (punctate, flocculent, Comma shaped, arc like or ring like mineralization) and bone destruction, with extension through the intervertebral disk in approximately 35% of cases.

**MRI (Fig. 11)**

- Calcified matrix is detected as areas of signal void at MRI.

- Hyaline cartilage has a high water content, so the non mineralized areas have low to intermediate signal intensity on T1 WI and very high signal intensity on T2 WI.

**Hematopoietic Tumors**

**Plasmacytoma**

- Spinal involvement occurs in 25- 60% of patients with plasmacytoma. 70 % of patients are over 60 years of age.

- Plasmocytoma represents focal proliferation of malignant plasma cells without diffuse bone marrow involvement.

- These lesions are considered to represent the early stages of multiple myeloma.

**Location**
The thoracic spine is the commonest site involved, followed by lumbar spine, cervical spine and sacrum in descending order. The vertebral body is the most common site of involvement, but the tumor frequently extends to the pedicles.

Symptoms

Patients can be asymptomatic or may experience pain, nerve root irritation, and paraplegia.

Radiological patterns

Plain X-rays

Solitary expansile lytic lesion with thinning and destruction of cortex, and bubbly/trabeculated appearance. Characteristic

CT (Fig. 12)

- Commonly shows a sclerotic lesion with matrix mineralization (80%).
- Ivory vertebra with marked mineralization in the vertebral body is seen in the rare sclerosing osteoblastic osteosarcoma, and purely lytic pattern is seen in telangiectatic osteosarcoma.

MRI (Fig. 12)

It has low signal intensity on T1 WI, high signal intensity on T2 WI, and homogeneous marked contrast enhancement. The vertebral endplates may be partly destroyed but maybe also be partly sclerotic. Involvement of the intervertebral disk and adjacent vertebrae has been described. It may show a characteristic "mini brain".

Multiple myeloma

- Multiple myeloma is a neoplastic disorder of plasma B cells characterised by bone marrow infiltration and overproduction of monoclonal immunoglobulins.
- It accounts for approximately 10% of all haematological malignancies and 1% of all cancers with an increasing incidence, affecting four in every 100,000 per year.
- It predominantly affects patients in the seventh decade and has high morbidity and mortality.
**Location** *(Fig. 13)*

**Symptoms**

Clinical presentation of patients with multiple myeloma is varied, and includes:
- Bone pain, anaemia, renal failure / proteinuria, hypercalcaemia
- Presentation may also be with a complication, including:
  - pathological fracture, amyloidosis.
- Occasionally presentation is with polyneuropathy.

**Radiological patterns**

**Plain X-rays**

The vast majority of lesions are purely lytic, sharply defined / punched out with endosteal scalloping when abutting cortex. In only 3% of patients are the lesions sclerotic.

**CT**

CT findings in multiple myeloma consist of punched-out lytic lesions, expansile lesions with soft tissue masses, diffuse osteopenia, fractures, and, rarely, osteosclerosis.

**MRI (Fig. 14, 15)**

Typical myeloma lesions are marrow based and have low signal intensity on T1-weighted images, and a high signal intensity on T2-weighted sequences and STIR images and generally show enhancement on gadolinium-enhanced images.

**Lymphoma**

- Primary lymphoma of bone accounts for 1-3% of all lymphomas.
- The spine constitutes the fourth most common site for primary lymphoma of bone where non-Hodgkin lymphoma predominates.
- Spinal lesions are more frequent in men (8:1) and affect patients in the fifth to seventh decades of life.
**Location**

Spinal involvement may manifest as paraspinal, vertebral, and epidural involvement, either in isolation or combination.

**Symptoms**

Spinal lymphoma is commonly manifested by pain and neurologic and systemic symptoms.

**Radiological patterns**

**Plain X-rays**

The vertebral lymphoma has a non-specific appearance (sclerotic, lytic or mixed lesions).

**CT**

Appearance of the tumor is variable. The osteolytic pattern may be permeative, moth eaten, or rarely, geographic. Mixed osteolytic-osteosclerotic or purely osteosclerotic lesions are rare. The sclerotic (ivory vertebra) and mixed patterns are more common in Hodgkin disease. Additional findings may include pathologic fractures and soft-tissue masses.

**MRI (Fig. 16)**

- Lymphomatous infiltration appears as focal or diffuse areas of low signal intensity on T1-weighted images and variable signal intensity on T2-weighted images. Compressed vertebrae have been reported.

- Diffuse enhancement of the lesion is usually seen.

- A focus of bone marrow replacement and a surrounding soft-tissue mass without large areas of cortical bone destruction suggest lymphoma.

**Ewing's sarcoma**

These neoplasms are more common in children, with the peak incidence in the 2nd decade. A subtype, metastatic foci of Ewing sarcoma are more common than the primary lesions in the spine.
**Location**

- The sacrum is the most frequently involved site, followed by the lumbar spine. The cervical spine is the least frequently affected site.

- In the nonsacral spine, the majority (60%) of lesions originate in the posterior elements with extension into the vertebral body. More than one segment is involved in 8% of cases.

- The disk spaces are usually preserved.

**Symptoms**

- Presentation is non-specific with local pain being by far the most common symptom.

- Occasionally a soft tissue mass may be palpable.

- Pathological fractures also occur.

**Radiological patterns**

**Plain X-rays and CT**

- Most Ewing sarcoma are lytic, associated with a large paraspinal component, but this tumors may also be sclerotic or mixed.

- Soft tissue calcification is uncommon, seen in less than 10% of cases

**MRI (Fig.17)**

This lesions are non-specific and have intermediate signal intensity on T1-weighted images and intermediate to high signal intensity on T2-weighted images with heterogeneous but prominent contrast enhancement.

**Notochordal tumors**

**Chordoma**

- Chordoma is a rare malignant neoplasm arising from the remnants of the primitive notochord with characteristic physaliphorous cells.

- Chordomas generally occur in late middle age, with a peak prevalence in the 5th-6th decades. There is a 2:1 male-female ratio.
Location

- Chordomas most commonly arise in the sacrococcygeal region (50%), followed by the sphenoooccipital region (35%) and the vertebral bodies (15%).

- Spinal chordomas arise more frequently in the cervical spine than in the thoracic and lumbar regions. The most common site of involvement is the vertebral body but may also involve neighboring soft-tissues.

Symptoms

- Chordomas are slow-growing lesions, and frequently large when initially discovered.

- Symptoms are indolent with a gradual onset of neurologic symptoms, including pain, numbness, motor weakness, and incontinence or constipation in sacral lesions.

Radiological patterns

Plain X-rays

Typically manifests as a large destructive lesion of a vertebral body centered in the midline, associated with a soft-tissue mass, spanning several segments. There may be intervertebral disk involvement and of the sacroiliac joint in sacrococcygeal chordomas.

CT (Fig. 18)

Bone destruction can associate areas of punctuate or amorphous calcification and areas of low attenuation within the soft-tissue (given the myxoid properties of the tumor). Lesions of vertebral bodies above the sacrum are usually smaller, may show sclerosis and contain calcifications.

MRI (Fig. 19)

On T1-WI, chordomas are iso- or hypo-intense with focal hyperintense regions representing hemorrhage with myxoid and mucinous collections. On T2-WI, most chordomas have high signal intensity due to gelatinous substance with hypointense regions of fibrous separe and hemosiderin. The tumor shows heterogeneous or ring enhancement

Differential Diagnosis of Primary Spinal Tumors
Metastatic Disease (Fig. 20, 21, 22)

Metastases are the most common vertebral tumors. Osteolytic metastases occur more frequently than osteoblastic metastases. Some metastases have a mixed pattern, with areas of osteolysis and areas of sclerosis. Typically, metastases are multiple and of variable size with cortical disruption (osteolytic lesions). Vertebral compression fracture and epidural tumor are common in metastases. Some slow-growing metastases may mimic a primary bone tumor with mineralization and sclerotic margins.

Paget Disease (Fig. 23, 24)

Paget disease is a chronic metabolic disorder of abnormal bone remodeling in the adult skeleton. It is rare in patients less than 40 years old. In the spine, the vertebra is expanded. The typical "picture frame" vertebra shows a coarse and sclerotic peripheral trabecular pattern and central osteopenia. Other patterns of pagetic vertebrae include ivory vertebra and isolated posterior arch involvement. The pagetic bone marrow contains fatty areas with a heterogeneous distribution.

Brown tumor

Brown tumors are found in 1.5-13% of patients with renal failure and rarely involve the spine. They commonly occur in females in the third decade of life. Brown tumor is caused by increased osteoclastic activity and fibroblastic proliferation in patients with hyperparathyroidism. On radiographs, a brown tumor is seen as an area of osteolysis with jagged sharp outlines and no sclerotic rim. CT shows an osteolytic tumor of uniform tissue density replacing the cancellous bone of the vertebral body and neural arch with a spared cortex. MR imaging findings include a hypo-intense mass causing expansion of the involved vertebra in both T1- and T2-weighted images.

Langerhans cell histiocytosis (Fig. 25)

Vertebral involvement is seen in 8-25% of patients with Langerhans cell histiocytosis, with a peak prevalence between 5-10 years of age. Patients usually have pain, which subsides rapidly after bed rest. Pathology reveals Langerhans cells variably admixed with inflammatory and plasma cells. The imaging appearance consists of complete or incomplete collapse of a vertebral body, preservation of pedicles, posterior elements and adjacent disk spaces; absence of adjacent paravertebral soft-tissue shadow and increased opacity in the collapsed body.

Tuberculous spondylitis (Fig. 26, 27, 28)

Tuberculous spondylitis comprises 25-60% of bone and joint tuberculous infections. It commonly affects adults in their fourth and fifth decades of life. Lower thoracic
and lumbar vertebrae are the most common sites, whereas the sacrum and cervical region are less common sites. Imaging appearances suggestive of tuberculous infection are enhancing intra-osseous abscesses, subligamentous spread, large paravertebral softtissue abscesses, and soft-tissue calcifications. Compression fracture, gibbus deformity and scoliosis also occur.

**Hydatid disease (Fig. 29)**

Hydatid cysts of the spine occur in 1% of cases of hydatosis and 50% of skeletal hydatid cysts. It is common in males in their third to sixth decades. Spinal hydatid cysts are usually situated in the thoracic region. Signs of nerve compression including paraplegia are frequent. The imaging appearance is that of a multilocular cyst without reactive sclerosis, or an expansile lesion with a "blown-out" appearance. Hydatic cysts cause multiseptated lesions with minimal enhancement. While intra-osseous cysts show no calcification, extra-osseous cysts may calcify.

**Schwannoma (Fig. 30)**

Schwannomas are usually isolated lesions, except when they are associated with neurofibromatosis type 2. They arise from the nerve sheath, and large tumors may be mistaken for spinal tumors. Radiography, CT, and MR imaging may show widening of the affected foramen.

**Schmörl Node (Fig. 31)**

Schmörl nodes represent vertical disk prolapses through areas of weakness in the vertebral endplate. Schmörl nodes are often multiple and occur predominantly in the thoracolumbar spine. Recently formed Schmörl nodes can be painful and may be indistinguishable from inflammatory or tumoral disease in terms of signal intensity. The identification of endplate defects or intranuclear cleft bending of the disk at either CT or MR imaging is helpful in making the correct diagnosis of acute Schmörl nodes.

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**Fig. 1:** World Health Organization (WHO) Classification of benign and malignant bone tumors of the spine
Fig. 2: Osteoid osteoma of the left lateral mass of the 3rd cervical vertebrae in a 34-year-old man with cervical pain. Axial T2 WI shows concentric ring appearance: low signal intensity center (calcified nidus), surrounding intermediate signal intensity (uncalcified nidus) (arrow) and outer rim of signal void (reactive sclerosis) (arrowhead).

Fig. 3: Osteoblastoma of the left side Of L5 posterior arch in a 35-year-old woman with low back pain. Axial CT scan shows a diffuse osteoid matrix of the tumor (arrow)

Fig. 4: The same case as Fig3 Axial T2-WI shows a mass with heterogeneous low signal intensity( arrow) . Axial contrast-enhanced fat saturated T1-WI shows marked enhancement of the lesion (arrow) and inflammation of the surrounding soft tissue (asterisk).
**Fig. 5:** An axial CT scan images of the dorsolumbar spine demonstrate a coarse vertical trabeculae (polka dots) involving the vertebral bodies. The cortex is not thickened and the surrounding soft tissues are normal.

**Fig. 6:** Vertebral Hemangioma in a 80-year-old man with back pain Sagittal T1 and axial T2-weighted MR images show a well-circumscribed fatty lesion with coarse vertical trabeculae (polka dots).
Fig. 7: Non enhanced axial CT scan through the upper pelvis showed an elongated bony outgrowth from the posterior surface of superior right iliac wing with the cortical and the medullary continuation in to the lesion.

Fig. 8: T1 and T2-weighted MR images show a pedunculated osteochondroma of the right iliac crest containing yellow marrow. The cartilage cap of osteochondromas appears the same as cartilage elsewhere, with low signal on T1 and high signal on T2-WI (arrow). Enhanced axial T1-WI shows a heterogeneous enhancement of the mass (arrowhead).
Fig. 9: Giant cell tumour with aneurysmal bone cyst component (fluid fluid levels) in 15 year old male. Enhanced coronal T1-weighted MR image shows marked and heterogeneous enhancement and multiple cystic areas (arrow).
**Fig. 10:** Osteosarcoma of T10 in a 45-year-old man with dorsal pain. MRI reveal T10 involvement with marrow replacement of vertebral body and spinous process, which has low signal intensity on both T1WI and T2WI (arrow).
**Fig. 11:** Chondrosarcoma of the L4 vertebral body in a 41-year-old man with low back pain. (a) CT scan shows a large mass arising from the vertebral body with cortical disruption and ring and arc calcifications. (b) Axial T2-weighted MR image shows a high-signal-intensity lobulated mass with linear striations.

**Fig. 12:** Plasmacytoma. (A) Sagittal T2-weighted image shows compressed T12 vertebra with high signal intensity. (B) Axial CT scan in another patient shows mini brain appearance with curvilinear thickened cortical struts and irregularity of the vertebral body cortex. The lesion extends into both pedicles.
Fig. 13: Diagram - distribution of multiple myeloma

NB: Distribution mirrors that of red marrow in the older patient.
Fig. 14: Multiple myeloma in a 41-year-old woman MRI sagittal T1-WI of cervical and thoracic spine: diffuse permeative low signal myelomatous marrow lesions throughout the cervical and thoracic spine (arrow). MRI sagittal STIR sequence: diffuse high signal myelomatous marrow lesions throughout the cervical and thoracic spine (arrow).
Fig. 15: Multiple myeloma in a 40 man. MRI sagittal T1-WI: diffuse permeative low signal myelomatous marrow lesions throughout the thoracic and lumbar spine. MRI sagittal STIR sequence: diffuse high signal myelomatous marrow lesions throughout the cervical and thoracic spine. Gadolinium-enhanced fat-suppressed T1-WI: prominent enhancement of the lesions.
**Fig. 16:** B-cell lymphoma in a 70-year-old woman with low back pain and cauda equina syndrome. Sagittal T1 WI shows a low-signal-intensity spinal lesion spreading S1-S2 with surrounding soft-tissue extending into the epidural and prevertebral spaces Sagittal STIR: the lesion is hyperintense Sagittal and axial contrast-enhanced fat-saturated T1WI show heterogeneous enhancement of the lesion.

**Fig. 17:** Sacrococcygeal Ewing's sarcoma in a 25-year-old man with cauda equina syndrome. MRI shows a sacrococcygeal mass with low-signal-intensity on T1-WI (blue arrow), high-signal-intensity on STIR (red arrow) and prominent enhancement on contrast-enhanced fat-saturated T1-WI (arrowhead)
**Fig. 18:** Sacrococcygeal chordoma in a 60-year-old man. CT scan shows a midline soft tissue mass with amorphous calcifications.

**Fig. 19:** Chordoma in a 65-year-old man with low back pain and cauda equina syndrome. MRI shows a large well-defined mass arising from the sacrum. The mass shows low signal intensity on axial T1-WI (blue arrow), high signal intensity on T2-WI (red arrow) and prominent enhancement on axial contrast-enhanced fat-saturated T1WI (arrowhead).

**Fig. 20:** Malignant vertebral collapse in a 64-year-old man with lung carcinoma MRI shows: Low T1 and high T2 signal intensity in the L5 vertebral body with homogeneous enhancement after gadolinium administration (blue arrow), backward convexity of the posterior wall of the vertebral body, epidural extension (red arrow) and no evidence of disc damage.
Fig. 21: Vertebral metastasis in 58-year-old man with Squamous cell carcinoma of the lung. MRI shows 2 lesions in the T3-T4 vertebral bodies (blue arrows) which are hypointense on T1-WI, hyperintense on T2-WI with fat suppression « STIR ». The lesions enhance homogeneously on postcontrast T1-WI. A marked enhancing epidural component is present (red arrow).
Fig. 22: Vertebral metastasis in 50-year-old man with Biliopancreatic cancer. MRI shows two lytic lesions in the L3-L4 vertebral bodies (blue arrows) which are hypointense on T1-WI, heterogenously hyperintense on T2-WI. The lesions enhance on postcontrast T1-WI (yellow arrow) with prominent enhancing epidural component (red arrow).
Fig. 23: Paget disease of spine in different patients. A, Axial CT scan of T11 vertebra in 57-year-old man shows mixed lytic and sclerotic changes involving vertebral body and arch. B, Axial CT scan of 60-year-old man shows predominant osseous sclerosis of L5 vertebral body, ivory vertebra, that is extending into posterior osseous elements.

Fig. 24: Images obtained of 65-year-old man with Paget disease at spine. A, fat-suppressed T2-weighted displays abnormal intermediate and heterogeneous high signal intensity, respectively, in posterior aspect of T11 vertebra (arrows). B, Sagittal fat-suppressed T1-weighted MR image obtained after gadolinium administration reveals
marrow enhancement (black arrowhead) and marked cortical enhancement (white arrowheads) in involved vertebra.

Fig. 25: Langerhans cell histiocytosis in 6-year-old boy with intermittent cervical pain and stiffness for 8 months. MRI revealed a complete collapse of the C7 vertebral body « vertebra plana » (blue arrow).

Fig. 26: Tuberculous spondylitis in 30-year-old man. CT scan demonstrates collapse of T10 vertebral body (blue arrow) with paraspinal abscess (red arrow).
**Fig. 27:** Tuberculous spondylodiscitis in 30-year-old man with low back pain and paraparesis of the lower limbs MRI shows a partial destruction of T3-T4 vertebral bodies (blue arrows) with heterogeneous enhancement after gadolinium administration. Abscess is present in T3-4 disk space (red arrow) extending to paraspinal (yellow arrow) and anterior epidural spaces (green arrow).
Fig. 28: 30-year-old woman undergoing treatment for pulmonary tuberculosis who presented with back pain MRI shows irregularity and erosion of the endplates of D12-L1 (blue arrows). D12 and L1 vertebral bodies are heterogeneously hypointense on sagittal T1-WI, hyperintense on T2-WI with prominent enhancement after gadolinium administration. Paraspinal (yellow arrow) and epidural abscess (red arrow) are present.
**Fig. 29:** Hydatid disease involvement of the sacrum in a 30-year-old man who presented with cauda equina syndrome. MRI demonstrates sacral destruction and replacement by a multiloculated cystic mass (bleue arrow), which also occupies the spinal canal and extends up to the L5 vertebral body. Note the presence of multiple daughter vesicles (red arrow).

**Fig. 30:** Cervical schwannoma in 14-year-old boy with left lower limb, parathæsia and weakness MRI shows a Dumbbell shaped left sided mass (blue arrows), passes out of the C6/7 neural exit foramen which it markedly expands (red dotted line). The mass shows slight hypersignal intensity on T2-WI with avid enhancement following IV contrast.
administration. The cord is compressed and displaced to the right by the mass (yellow arrow).

**Fig. 31:** Schmörl node in 80-year-old man with low back pain. Both T1-WI and T2-WI show a well-defined hypo-intense lesion in the lower endplate of L3 (arrow). The lesion is connected with L3-L4 intervertebral disk.
Conclusion

The imaging findings of primary spinal bone tumor in conjunction with the patient’s age, gender and lesion location allows a high percentage of correct diagnosis. Imaging plays an important role in diagnosis, characterization and extension of bone tumors of the spine which will help to guide the treatment of these neoplasms.

Personal information

References


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