Tuberculous spondylitis: imaging features (About 25 cases)

Poster No.: C-0831
Congress: ECR 2019
Type: Scientific Exhibit
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Keywords: Infection, Abscess, Diagnostic procedure, MR, CT, Neuroradiology spine, Bones
DOI: 10.26044/ecr2019/C-0831

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**Aims and objectives**

The spine is the most frequent location of musculoskeletal tuberculosis.

Tuberculous spondylitis is defined as an infection by Mycobacterium Tuberculosis of one or more components of the spine: vertebra, intervertebral disc, paraspinal soft tissue or extradural space.

The infection begins in the anterior part of vertebral body, adjacent to the endplate.

Commonly related symptoms are back pain and lower limb weakness/paraplegia.

The purpose of this study was to determine the contribution of imaging in diagnosis, characterization of lesions, and the post-therapeutic surveillance of tuberculous spondylodiscitis.
Methods and materials

Retrospective study covering 25 cases of tuberculous spondylodiscitis, collected from Central Department of Radiology of Ibn Rochd University Hospital in Casablanca, over 18 months.

We reviewed 15 MRI and 20 CT studies obtained from 25 patients.

All MR Imaging was performed with 1.5 Tesla MRI using a surface coil or spine coil. Sagittal T1-Weighted spin echo, T2-Weighted spin echo and axial T2-Weighted spin echo were acquired in all cases.

In addition, T1-Weighted with fat saturation in sagittal and axial planes were obtained after intravenous administration of gadolinium.

On MR imaging various features of the imaging findings were evaluated, including signal intensity of the involved vertebral marrow and intervertebral disc on T1W, T2W and contrast-enhanced images, destruction of the vertebral bodies and vertebral end plate, extent of the vertebral body involvement, paraspinous soft tissue mass or abscess formation, degree of spinal canal compromise with or without cord or nerve root compression and alignment of the spine.
Results

The mean age of patients with tuberculous spondylitis was 44.5 years (range, 21-68 years).

Most common presenting neurological symptoms were back or neck pain (n=20), paraplegia in 14 cases.

Thoracic spine was the most common site of spinal TB involvement (n=10) followed by lumbar (n=13), and cervical (n=2).

Sacrum was involved in one case.

Imaging manifestations of tuberculous spondylitis include high signal intensity of intervertebral disc on T2W (n=11), intraosseous and paraspinal abscess (n=9), psoas abscesses (n=9), vertebral body destruction and extension into the epidural space, epidural abscess (n=8), spinal marrow edema (n=5), spinal marrow enhancement (n=7), and spinal cord or nerve root compression (n=16).

Epidemiology:

Tuberculous spondylitis is one of the more common infections of spine in countries where TB is prevalent. Unfortunately, the incidence of tuberculous spondylitis, as with other forms of TB, is on the rise, due to new multiple drug resistant strains.

Discitis represents approximately 50% of all musculoskeletal tuberculosis, and usually affects the lower thoracic and upper lumbar levels of the spine.

Pathogenesis and pathology:

The spine is involved due to hematogenous spread via the venous plexus of Batson (Fig. 1). There is usually a slow collapse of one or usually more vertebral bodies, which spreads underneath the longitudinal ligaments. This results in an acute kyphotic or "gibbus" deformity. This angulation, coupled with epidural granulation tissue and bony fragments, can lead to cord compression. Unlike pyogenic infections, the discs can be preserved. In late-stage spinal TB, large paraspinal abscesses without severe pain or frank pus are common, leading to the expression "cold abscess".

Clinical manifestations:

Symptoms may consist of local tenderness, limitations of motion and, in the late phases of the disease, severe spinal deformity (gibbus) attributed to an acute kyphotic angulation.
Neurological symptoms and complications may occur in the acute and late stages of the disease. Radicular pain, severe cauda equina syndrome, and spinal cord compression with paraplegia may result from edema, vascular engorgement, vertebral collapse, retropulsed debris, meningomyelitis or subarachnoid collections.

Manifestations of systemic TB may be present and include low-grade fever with evening rise, lethargy, malaise, night sweats, anorexia and weight loss.

Radiological features:

- Plain radiography:

Plain radiography of tuberculous spondylodiscitis may demonstrate loss of vertebral height, disk space narrowing, erosions, paravertebral masses, and soft tissue calcifications (Fig 2).

The most common variety of tubercular spondylitis (spondylodiscitis) occurs in the paradiscal region, and the least common is synovitis in the posterior facet joints (Fig.3)

However, plain radiography is insensitive for the early detection of vertebral TB.

A paravertebral abscess may hardly be recognized in the thoracic spine even with adequately penetrated views.

Furthermore, plain radiography is of limited value in evaluation of the posterior arch.

- Ultrasonography:

It is useful in demonstrating the paravertebral abscess and any associated lymphadenopathy. Beyond this, it does not provide useful information in most cases.

US-guided fine needle aspiration has become widely accepted for both culture and histological diagnosis.

- Computed tomography:

CT is of great importance in demonstrating small, early foci of bone infection and the extension of the bone and soft tissue involvement.

End plate destruction, fragmentation of the vertebrae, paravertebral calcifications, paravertebral or epidural abscesses are adequately demonstrated (tableau 1; Fig.4,5,6)
CT-guided fine needle aspiration has become widely accepted for both culture and histological diagnosis.

- **Magnetic resonance imaging:**

MRI plays a vital role in the diagnosis of spinal TB with a high sensitivity and specificity.

MRI features of Pott's spine are abnormal signal intensities, appearing hypointense on T1W and hyperintense on T2W sequences, with heterogeneous enhancement of the vertebral body.

Characteristic findings include destruction of two adjacent vertebral bodies and opposing end plates; destruction of intervening disk; vertebral body edema and occurrence of prevertebral, paravertebral and epidural abscesses. (Fig. 7,8,9,10)

MRI is especially useful in detecting the subclinical "spinal cord compression syndrome", in which the neuronal damage can be clearly seen and decompression is needed. (Fig. 11)

MRI plays also an important role in follow-up. Radiological response to treatment in the early follow#up period is around 6#8 weeks.

Our study presented three good to excellent sensitivity and specificity MR imaging features for spinal tuberculosis, end plate disruption, paravertebral soft tissue formation, and high signal of intervertebral disc on T2W.

In contrast to previous studies, most of the presented cases still presented with classic radiological pictures of "two vertebral disease with the destruction of the intervertebral disc".

**Differential diagnosis:**

Many infectious processes may have imaging findings similar to those of vertebral spondylodiscitis.

These include low-grade pyogenic infections, such as brucellosis, and other bacterial and fungal infections. Granulomatous diseases (sarcoidosis), traumatic and osteoporotic fractures, and primary and metastatic neoplasms may have features comparable to that of vertebral tuberculosis. (Table 2)

However, the diagnosis of tuberculosis is favored if a large, calcified paravertebral mass and absence of sclerosis or new bone formation are noted.
Characteristic features of brucellar spondylitis include gas within the disk, a minimal associated paraspinal mass, absence of kyphosis and a predilection for the lower lumbar spine. CT-guided fine needle biopsy may be necessary and allows prompt diagnosis and proper treatment.

-Differentiating spinal TB from neoplasm processus:

Isolated involvement of the posterior elements with sparing of the vertebral body, a feature that are more typical of neoplasm than infection process, does occur in spinal TB especially in countries where TB is epidemic. A reduced height of an intervertebral disc is only rarely seen in neoplastic forms.

-Differentiating spinal TB from pyogenic spondilitis:

It is important to differentiate tuberculous spondylitis from pyogenic spondylitis because proper treatment of the different types can reduce the rate of disability and functional impairment.

* Clinically, TB infection generally affects adults in fourth and fifth decades whereas peak incidence of pyogenic spondyloitis is seen in the sixth or seventh decades.

* The smooth margin of a cold abscess from TB, which is sub-ligamental spread without destruction of the paraspinal ligament, contrasts with the irregular margin of pyogenic abscesses, which proteolytic enzyme can destroy the paraspinal ligament.

* Posterior elements or multiple vertebral body involvement are less commonly encountered in pyogenic spondilitis.

* In addition, size of the paraspinal mass is larger in tuberculosis than in pyogenic infections.

* Collapse of the vertebral bodies is rarely seen in pyogenic spinal infection but common in spinal TB.

* In the chronic stage, tubercular spondylitis shows a slightly hyperintense signal of vertebral body on T1-Weighted images, whereas the non-tuberculous spondylitis shows low signal intensity.
Fig. 1: Batson venous plexus

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Fig. 2: lateral view (a) and anterior-posterior view (AP) (b) of plain lumbar spine radiograph reveals anterior-superior end plate destruction of L2 vertebral body with markedly reduced L1-2 intervertebral disc height and surrounding sclerosis (grey arrows), minimal degree of lateral subluxation is present of AP view. Paraspinal soft tissue shadows bilaterally are also noted (white arrows)

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**Fig. 3:** Diagrammatic representation of the frequency of location of tuberculosis of the vertebral column. 1 = paradiscal, 2 = central, 3 = anterior, 4 = appendicial, 5 = synovial

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Table 1: Clinico-radiological classification of typical tubercular-spondylitis

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Fig. 4: A 33 year old male with spinal tuberculosis. a- Reconstructed coronal images. b,c- Reconstructed sagittal images showing contiguous multi-level vertebral involvement in the lower thoracic levels with destruction and associated large paravertebral lobulated abscess (arrows).

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Fig. 5: A 31-year-old male presented with miliary pulmonary tuberculosis. He was admitted with back pain a- Pulmonary CT scan: Miliary deposits appear as 1-3 mm diameter nodules, which are uniform in size and uniformly distributed. b,c-computed tomography imaging show severe spondylitis at the L5-S1 level

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Fig. 6: CT scan of a 68 years old male with spinal tuberculosis a,b- Reconstructed sagittal images showing spondylitis at the D10-D11 level and extension into the epidural space and and prevertebral soft tissues (c,d)

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Fig. 7: A 38 year old male with spinal tuberculosis a-Post contrast T1 WI showing irregular peripherally rim enhancing intraosseous abscess without extension into epidural space.
b-Coronal T2W image showing large bilateral psoas muscle abscesses. c- T2 WI ans Post contrast T1 WI showing smooth well defined prevertebral collection and bilateral psoas muscle abscesses.

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**Fig. 8:** A 32 years old male patient with tuberculous spondylitis a,b- T2 WI shows complete destruction of D11-D12 vertebra resulting in kyphosis. d- sagital T1W post contrast image showing large psoas muscle abscesses.

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Fig. 9: In the same patients large bilateral psoas muscle abscesses and prevertebral collections.

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Fig. 10: Post contrast T1 WI showing irregular rim enhancing intraosseous abscess with extension into anterior epidural space

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**Fig. 11:** 45-year-old woman with neck pain and spinal cord compression syndrome. Sagittal T2-weighted shows high signal intensity of both vertebral bodies and disc space C6-C7 with destruction of the opposed end plates. Sagittal contrast-enhanced T1-weighted image shows marked enhancement of vertebral C6 and C7 spinal cord compression due to epidural extension of the lesion.

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**Table 2:** Differential diagnosis table of spinal tuberculosis

Fig. 12: A 58 year old male with multifocal tuberculosis a-sacral abscess with nerve root compression b-epidural abscess c-infratentorial tuberculomas. d-cavitary lung lesions

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Conclusion

Early diagnosis of tuberculous spondylitis is of paramount importance for appropriate management and for preventing complications, such as cold abscesses, sinus tracts, neurological weakness.

Imaging studies, namely MRI and CT, are important tools for: characterizing the lesion, performing biopsy, planning surgery, evaluating the success of treatment and detecting complications in the follow-up.

Magnetic resonance imaging (MRI) is the investigation method of choice for the diagnosis of spondylodiscitis because it presents some advantages including high sensitivity in early stages, better definition of paravertebral and epidural extension, spinal cord involvement and the possibility of distinguishing tubercular infection from those of other origin.

MRI is also the best procedure for differentiating typical and atypical spinal TB.
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