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Research Article

Role of MRI in the evaluation of spinal tuberculosis

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ABSTRACT

Background: MRI is now the preferred imaging modality and preferred technique to define the activity and extent of infection for patients with suspected spinal tuberculosis. The objective of the study was to describe various radiological features of spinal tuberculosis (TB) on magnetic resonance imaging (MRI) and to assess its role in evaluation of the extent of disease.
Methods: MRI images of 40 patients with proven Spinal Tuberculosis were retrospectively analyzed to determine the pattern of occurrence of various pathological lesions and extent of soft tissue involvement. Clinical features of the patients were also noted. Post-operative and follow up cases were excluded from the study.
Results: The majority of the 40 patients were males (n=26) in the 31-40 years age group (50%). The most common clinical presentation was backache (77%) with a localized kyphotic deformity followed by fever (62.5%), malaise (47.5%) and weight loss (22.5%). The Thoracic spine was the commonest site of the disease (37.5%) followed by the thoracolumbar region (27.5%). An intervertebral disc involvement, pre and paravertebral collections, subligamental extension of the abscess were commonly seen, with an epidural collection occurring in more than 75 % of the cases. In addition few cases (n=5) also showed intramedullary and intradural involvement.
Conclusions: The MRI scan is highly sensitive in the detection of various pathological processes of spinal tuberculosis and their pattern of occurrence. The extent of soft tissue involvement disease is best assessed by MRI which help in guiding the surgical treatment as well as to monitor the response to treatment during follow up.

Keywords: Spinal tuberculosis, Magnetic resonance imaging, Epidural, Abscess enhancement

INTRODUCTION

Tuberculosis (TB) is caused by Mycobacterium tuberculosis. TB is more common particularly in developing countries. The most common extrapulmonary location of TB is the spine, accounting for more than 50% of musculoskeletal TB.[1] In the developing countries, the disease has an aggressive course, particularly in children and young adults resulting in abscess formation. Consequently, neurologic complications and spinal deformities are frequently observed.[2]

Magnetic resonance imaging (MRI) is now the preferred imaging modality for patients with suspected spinal TB.[3] MRI is the most valuable method for detecting early disease and is preferred technique to define the activity and extent of infection. It shows not only bony involvement but also the edema and soft tissue swelling.[4] TB of spine is caused primarily by hematogenous spread of pulmonary infection in most of the cases. The infection typically begins from the anterior part of vertebral body, spreads to the disc and causes bone destruction and formation of abscess. Subligamental extension of abscess beneath the anterior longitudinal ligament and the intervertebral disc is involved with subsequent loss in disc height. As the vertebral bodies collapse into each other, a sharp angulation (or kyphos) develops. Caseation and cold abscess formation may extend into the neighboring vertebra or escape into the paravertebral soft tissue. Cord compression and edema is noted either due

to pressure by the abscess or displaced bone or due to involvement of spinal artery resulting in neurological deficits.[4] It is also important to differentiate between tuberculosis and pyogenic spondylitis. Disc involvement is seen early in pyogenic infection and later in tuberculosis. Calcification is characteristic of tuberculosis.[4] The purpose of the study is to describe various radiological features of spinal tuberculosis and evaluate the role of MRI in assessing the extent of disease.

METHODS

The study was conducted at Department of Radiodiagnosis, KR hospital, Mysore Medical College and Research Institute, Mysore. MRI case records of 40 patients with proven tuberculosis between 2013 to 2014 were retrospectively reviewed and relevant clinical history was also noted. Diagnosis was based on history, clinical examination and investigations. Investigations included were CBC, ESR, Sputum cytology and histological demonstration of acid-fast bacilli in the lesion, demonstration of growth of mycobacterium on culture of tissue or ascitic fluid, satisfactory therapeutic response to drug treatment in patients with clinical, or radiological and operative evidence of spinal TB.

The MRI scan was performed in 1.5 T GE MRI scanner. The following MRI sequences were studied: Sagittal and axial T1 weighted (T1 FRFSE), Sagittal and axial T2 weighted (T2 FRFSE), Coronal and sagittal STIR sequences followed by post-contrast T1 weighted sequences in axial, coronal and sagittal planes. Post-contrast sequences T1W were obtained by using intravenous administration of gadodiamide (GdDTPA-BMA) of 0.1 mmol/kg doses.

The following features were assessed by MRI:

- Compartment of spine involved: Epidural/ Intradural/ Intramedullary/ Multiple
- Epidural involvement assessed for the following
    1. Extent of vertebral involvement: body / posterior involvement – signal changes.
    2. Wedging or compression.
    3. Involvement of disc.
    4. Subligamentous extension.
    5. Extent of abscess: Epidural / paravertebral / psoas.
    6. Spinal cord changes.
- Intradural/ intramedullary: Nature and enhancement of the lesions.

The scans were independently reviewed by two radiologists and any disagreement in findings was resolved by consensus.

RESULTS

The study included total 40 patients, with an age range of 21-60 years with majority of them in the 31-40 year age group (Table 1). There were 26 males (65%) and 14 females (35%) (Table 1).

MRI scan showed that most affected level of the spine was thoracic spine with Thoracic vertebrae were being the most common affected vertebra seen in 37.5% (Table 2) of the cases followed by thoracolumbar (27.5%), and lumbar vertebra (22.5%). Various clinical presentations such as fever, backache, weight loss, malaise were noted with most common being backache (77%) in 31 cases (Table 3).

Intervertebral disc involvement was seen in 85% of the cases with an epidural component occurring in 77% of the cases (Table 4). Cord oedema was noted in 10% of the cases.

Table 1: Age and sex distribution.

Age group	Male (26)	Female (14)	Percentage (overall)
21-30	2	1	7.5
31-40	13	7	50
41-50	7	4	27.5
51-60	4	2	15

Table 2: Regional distribution of TB spine.

Region	No of cases	Percentage
Cervical	3	7.5
Thoracic	15	37.5
Thoracolumbar	11	27.5
Lumbar	9	22.5
Multiple levels	2	5

Table 3: Clinical profile of patients with spinal TB.

	Fever	Backache	Malaise	Weight loss
No of cases	25	31	19	9
Percentage	62.5	77	47.5	22.5

Table 4: Extent of tuberculosis spine in various compartments.

Features	No of cases	Percentage
Intervertebral disc involvement	34	85
Wedge collapse of body	19	47.5
Complete destruction of vertebra	7	17.5
Subligamental extension	19	47.5
Epidural collection	31	77.5

Intradural involvement	3	7.5
Intramedullary involvement	2	5
Pre and paravertebral collections	23	57.5

Figure 1: Sagittal T2 WI showing multiple level involvement. Prevertebral collection with subligamental extension is seen in the cervical region (white arrow) and thoracic region. Note the hyperintensity of affected cervical vertebrae (arrow head).Wedge collapse of T6 vertebra with an epidural component (black arrow) and adjacent cord edema is also noted.

Figure 2: T1+C image showing enhancement of involved thoracic vertebra which was not seen in Figure 1 (arrow). Smooth irregular enhancement of prevertebral collection is also seen.

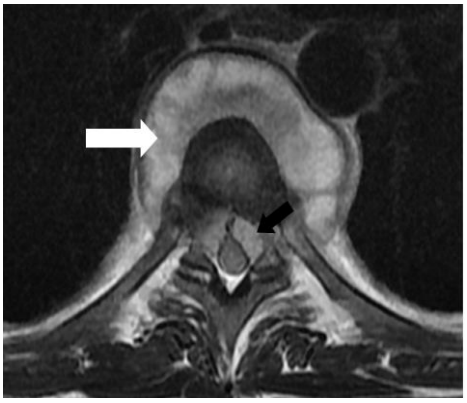

Figure 3: T2 WI showing smooth well defined prevertebral collection (white arrow) and epidural component(black arrow).

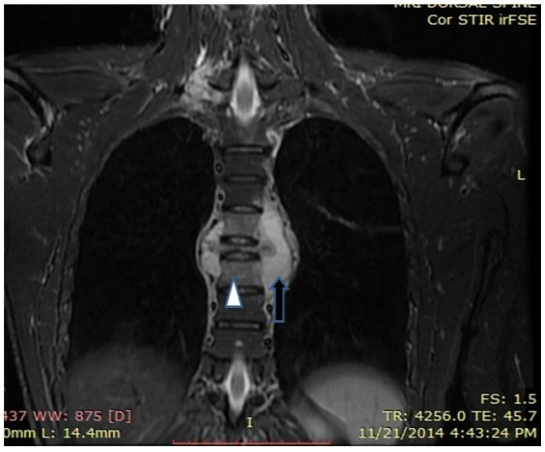

Figure 4: Post contrast T1 WI image showing bilateral peripherally rim enhancing paravertebral collections at T4 and T5 vertebral level with enhancement of the affected vertebrae.

Figure 5: T2 WI shows complete destruction of T10-T11 vertebra resulting in kyphosis.

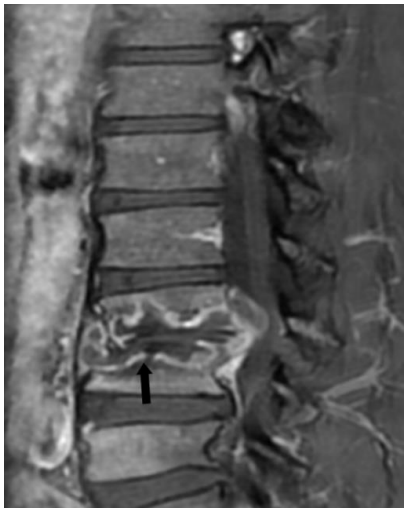

Figure 6- Post contrast T1 WI showing irregular peripherally rim enhancing intraosseous abscess with extension into anterior epidural space.

Figure 7: Sagittal T1W post contrast image showing nodular enhancement in thoracic cord suggestive of intramedullary involvement.

Figure 8: Coronal T1W post contrast image showing large bilateral psoas muscle abscesses with enhancement of L3 and L4 vertebrae.

DISCUSSION

Tuberculosis has prevailed as a major public health issue especially in developing countries in which poverty, malnutrition, overcrowding ,poor hygienic conditions and the presence of drug-resistant strains are the predisposing factors which aid in spread of the disease. Tuberculosis of the spine is clinically important form of extrapulmonary tuberculosis accounting for majority of the musculoskeletal tuberculosis cases.[1] First described in 1782 by Percival Pott, a British orthopedic surgeon usually occurs due to haematogenous seeding of the vertebra from a distant source. The disease usually begins as a focal lesion which is a combination of osteomyelitis and arthritis. Typically, more than one vertebra is involved and usually affects the anterior aspect of the vertebral body adjacent to the subchondral plate and from there on spreads to involve adjacent intervertebral discs. As the disc is vascularized in children it can be a primary site where as in adults, disc disease is secondary to the spread of infection from the vertebral body. Further with involvement of bone, wedge collapse (figure 1) and vertebral destruction (figure 5) occurs which results in kyphosis. Epidural abscess formation (figure 2) results in narrowing of the spinal canal diameter with resultant cord compression and neurological deficits.[5]

In the present study, we have attempted to depict the various spectrum of presentations of spinal TB with clinical correlation.

The regional distribution of vertebra in our study was similar to the findings of DJ Kotzke[5] and Sajid Ansari.[10] Shanley DJ[6] evaluated radiographic manifestations of tubercular spondylitis like intraosseous and paraspinal abscess formation as seen in our study mentioned in Figure 4 & 6 and Figure 8, paraspinal abscesses in the lumbar region gravitate along the psoas sheath which can extend to the femoral region and cause erosion of overlying skin.[5,6]

MRI is the gold standard of imaging in TB Spondylitis due to its superior soft tissue resolution and multiplanar capability. The classic pattern of spread starting anteriorly and moving to involve opposing vertebrae via subligamentous spread is clearly seen on MRI. As was observed in our study, T1- weighted images usually show hypointense signal within the affected vertebral marrow. On T2-weighted images a relative hyperintensity within the diseased tissues.[7] Meningeal involvement which indicate active inflammation and rim enhancement around intraosseous and paraspinal soft tissue abscesses, which are rarely seen in non-tubercular abscesses are best demonstrated on contrast enhanced MRI.[8]

In our study, we had 2 cases showing intramedullary tuberculomas (Figure 7), On MRI tuberculomas appear as low or intermediate signal intensity on T1W images and low signal on T2W images (Low signal on T2Wimages is due to caseous necrosis in the tuberculoma, which has

high protein content). Post contrast study shows ring /nodular enhancement.[9] The extent of spinal cord involvement, nerve root integrity and involvement of posterior elements and also response to therapy is best assessed by MRI.[10-12]

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.[13,14] MRI has been shown to be accurate in differentiating tuberculous spondylitis from pyogenic spondylitis. The presence of a well-defined paraspinal abnormal signal, a thin and smooth abscess wall, subligamentous spread to three or more vertebral levels, and multiple vertebral or entire body involvement are more suggestive of tuberculous spondylitis than pyogenic spondylitis.[14] Early recognition and prompt treatment are therefore necessary to minimize residual spinal deformity and/or permanent neurological deficit .Conservative treatment by ant tubercular drugs has shown favorable results in early diagnosed cases as anti-tuberculous drugs will be able to reach the tuberculous caseous material and cavities in spine.[15] However in patients with severe bone involvement along with cord or root compression, surgical treatment is the only benefitable measure.[16]

CONCLUSION

MRI is a very valuable tool in the evaluation of spinal TB. The MRI scan is highly sensitive in the detection of various pathological processes of spinal tuberculosis and their pattern of occurrence and also provides excellent depiction of soft tissue involvement, cord involvement and nerve root integrity. It is an accurate modality in differentiating spinal TB from pyogenic spondylitis and aids in diagnosing spinal TB in early stages and hence prompt treatment minimizes spinal deformity and permanent neurological deficits. Serial MRI scans can also be used to assess the disease response to treatment.

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