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Research Article

Pattern of Disease in Patients of Spinal Tuberculosis by Magnetic Resonance Imaging (MRI)

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Abstract: ***Introduction:*** Spinal tuberculosis is usually a secondary infection from a primary site in the lung or genitourinary system. 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. In the developing countries, the disease has an aggressive course, particularly in children and young adults resulting in abscess formation. ***Objectives:*** To study the disease pattern in patients of spinal tuberculosis by Magnetic Resonance Imaging. ***Methods:*** This cross-sectional study was carried out in the Department of Orthopedic Surgery, BSMMU, Dhaka, Bangladesh from October 2014 to September 2015. Total 40 patients who underwent MR imaging of Spine were randomly considered forth is study. The study type was cross sectional study. This study has been performed using a 1.5T PHILIPS ACHIEVA MRI scan machineusing spinal coil. Sequences used were T1axial and sagittal, T2 axial, sagittal and coronal, STIR in sagittal and coronal planes. T1+ contrast, DWI and ADC sequences will be used whenever possible. ***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. There were 26 males (65%) and 14 females (35%). The most common clinical presentation was backache (75%) with a localized kyphosis deformity followed by fever (62.5%), malaise (47.5%) and weight loss (22.5%). The Thoracic spine was the commonest site of the disease (35%) followed by the thoracolumbar region (30%). 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 also showed intramedullary and intradural involvement. ***Conclusion:*** MRI examination is highly sensitive in detecting the various pathological processes of spinal tuberculosis and their patterns of development. The extent of soft tissue involvement is best assessed by MRI, which not only helps guide surgical treatment but also monitors the response to treatment during follow-up.

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

INTRODUCTION

Spinal tuberculosis is usually a secondary infection from a primary site in the lung or genitourinary system. 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] Spread to the spine is thought to be hematogenous in most instances. Tuberculosis infection is characterized by a delayed hypersensitivity immune reaction. The first stage is a pre-pus inflammatory reaction with Langerhans' giant cells, epithelioid cells, and lymphocytes. The granulation tissue proliferates, producing thrombosis of vessels. Tissue necrosis and breakdown of inflammatory cells result in a paraspinal abscess. 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 kyphosis) 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.

MATERIAL AND METHODS

This cross-sectional study was carried out in the Department of Orthopedic Surgery, BSMMU, Dhaka, Bangladesh from October 2014 to September 2015. Total 40 patients who underwent MR imaging of Spine were randomly considered forth is study. This study has been performed using a 1.5T PHILIPS ACHIEVA MRI scan machine using spinal coil. Sequences used were T1axial and sagittal, T2 axial, sagittal and coronal, STIR in sagittal and coronal planes. T1+ contrast, DWI and ADC sequences will be used whenever possible.

Inclusion criteria:

- Patients of all ages and both sex with clinically suspected or proven spinal tuberculosis.

Exclusion criteria:

- Patient who are previously diagnosed with spinal tuberculosis and have taken surgical treatment.
- Follow up cases who are on ant tubercular treatment.
- Patients who have claustrophobia, freshly implanted MRI incompatible prosthesis. Patient with aneurysm clips, ferromagnetic implants, and pacemakers.
- Patients not willing to participate.

Patients were selected by non-probability convenience sampling. Patients were diagnosed on the basis of clinical examination, history and following investigations: Sputum cytology, CBC, and ESR. Chest X-ray also performed for the diagnosis of pulmonary tuberculosis. Gold standard of the diagnosis of inflammatory lesion of spine was histopathological biopsies. All features of MRI observed in biopsy proven cases were carefully evaluated.

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 seen in 35% (Table 2) of the cases followed by thoracolumbar (30%), and lumbar vertebra (20%). Various clinical presentations such as fever, backache, weight loss, malaise were noted with most common being backache (75%) in 30 cases (Table 3). Intervertebral disc involvement was seen in 85% of the cases with an epidural component occurring in 75% 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	2	10
31-40	14	6	50
41-50	6	4	25
51-60	4	2	15

Table-2: Regional distribution of TB spine

Region	No of cases	Percentage
Cervical	4	10
Thoracic	14	35
Thoracolumbar	12	30
Lumbar	8	20
Multiple levels	2	5

Table-3: Clinical profile of patients with spinal TB

	Fever	Backache	Malaise	Weight Loss
No of cases	24	30	18	12
Percentage	60	75	45	30

Table-4: Extent of tuberculosis spine in various compartment

Features	No of cases	Percentage
Intervertebral disc involvement	34	85
Wedge collapse of body	18	45
Complete destruction of vertebra	8	20
Sub ligamental extension	18	45
Epidural collection	30	75
Intraduralin volvement	4	10
Intramedullary involvement	2	5
Pre and paravertebral collections	24	60

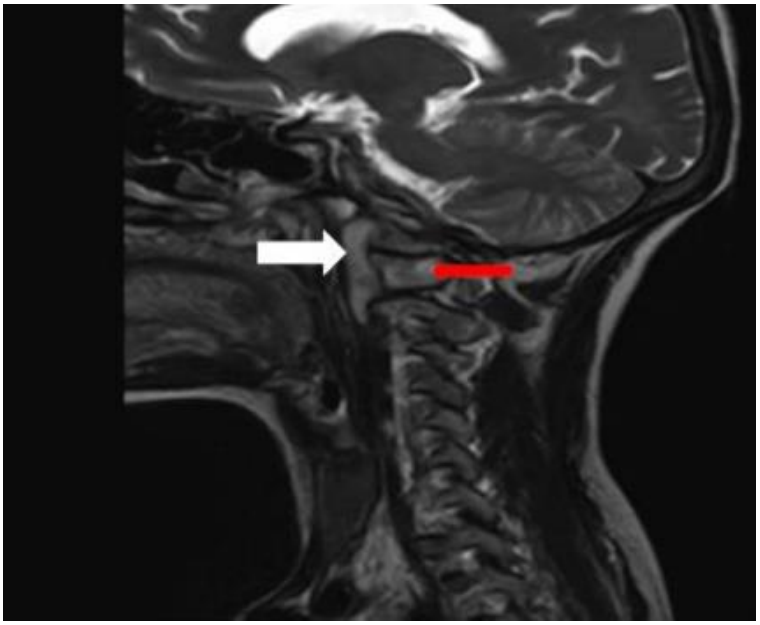

Figure 1: Sagittal T2 WI showing Prevertebral collection with subligamental extension is seen in the cervical region (white arrow). Note the hyper intensity of affected cervical vertebrae (Red arrow)

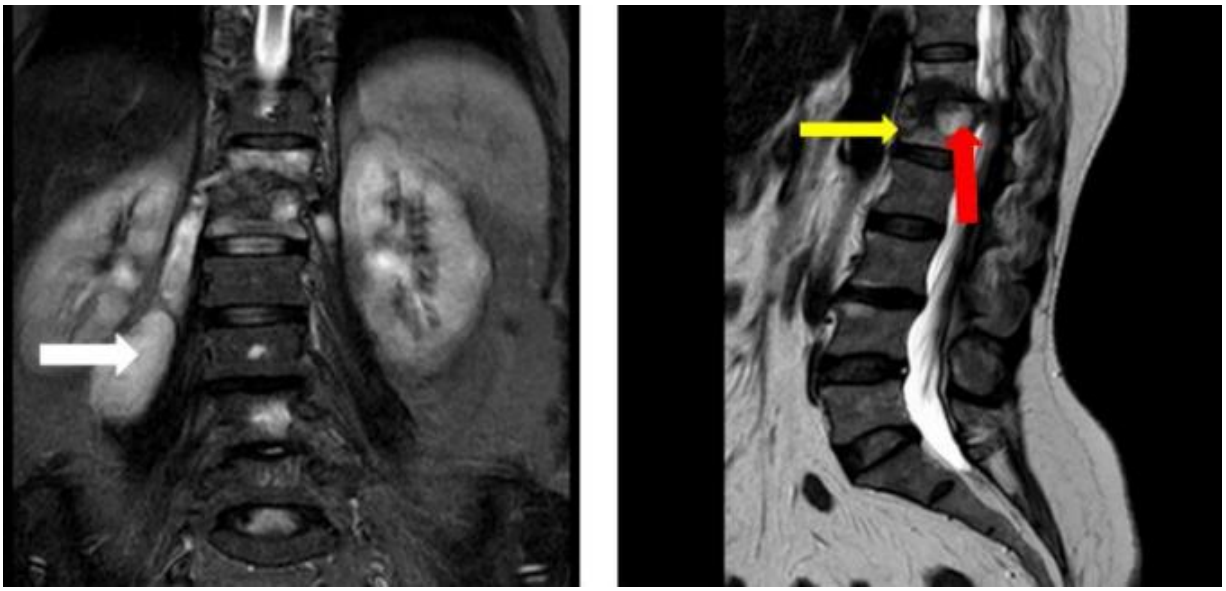

Figure 2A and 2B: Coronal STIR and Sagittal T2 WI showing erosion of T12 and L1 vertebra with marked wedging of L1 vertebra (Yellow arrow). Bilateral psoas abscess (White arrow) noted with anterior epidural collection (Red arrow) compressing over thecal sac

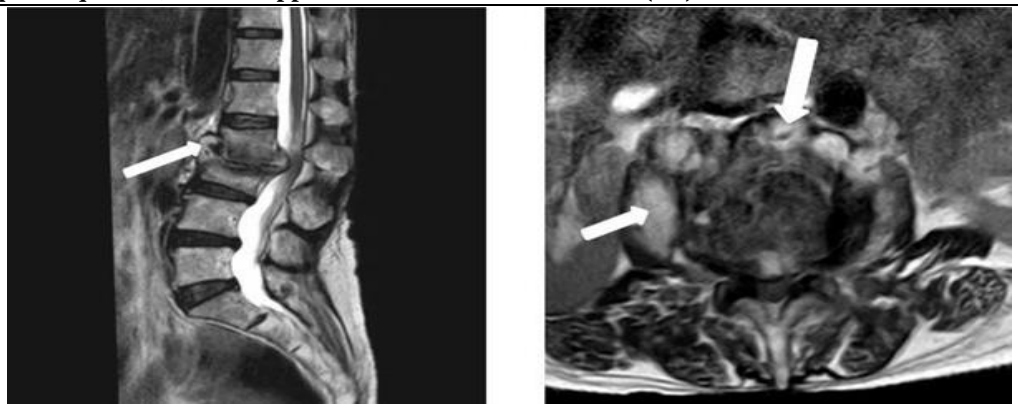

Figure 3A and 3B: Sagittal and axial T2 WI showing erosion of L2 and L3 vertebra. Multiple well defined pre vertebral and para vertebral collections are seen (White arrow)

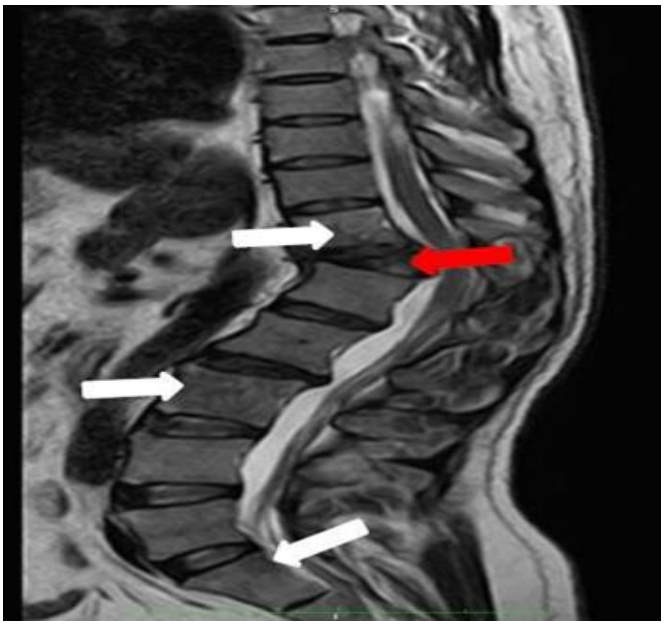

Figure 4: Sagittal T2 WI showing multiple level involvement. There is altered marrow signal intensity involving D11 and D12 vertebra. Similar altered marrow signal intensity noted involving L3 and poster superior corner of S1 vertebra (White arrow). There is severe wedging of D12 vertebra with kyphotic deformity (Red arrow)

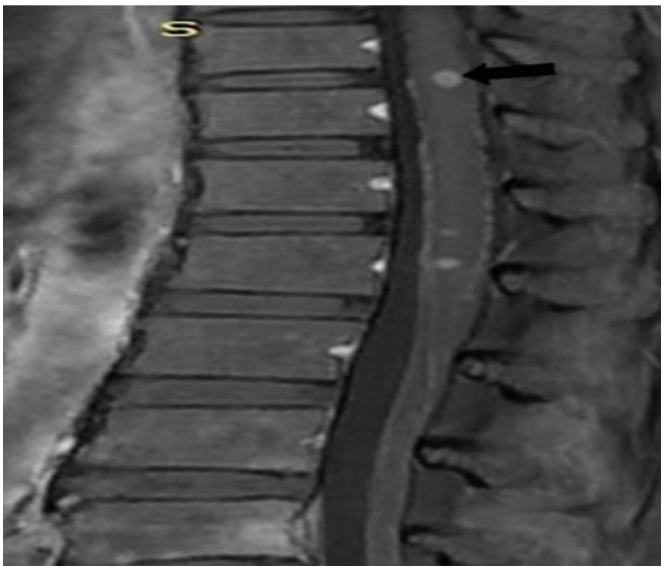

Figure 5: Sagittal T1W post contrast image showing nodular enhancement in thoracic cord suggestive of intramedullary involvement

DISCUSSION

The differential diagnosis of tuberculous spondylitis includes pyogenic and fungal infections, sarcoidosis, metastases, and lymphoma. There are no characteristic signs on imaging that can easily distinguish tuberculosis from other diseases. Usually, infectious spondylitis is characterized by the involvement of the intervertebral discs. A history of chronicity and slow progression indicate tuberculosis. In addition, inflammatory aggregates tend to be larger in tuberculosis than in pyogenic spondylitis. In central and posterior types of tuberculosis, only a biopsy can make a diagnosis [5, 6]. Tuberculosis is a major public health problem, especially in developing countries, where poverty, malnutrition, overpopulation, poor sanitation, and the presence of drug-resistant strains are predisposing factors that promote the spread of tuberculosis. Spinal tuberculosis is a clinically significant extrapulmonary form of tuberculosis and accounts for the majority of cases of musculoskeletal tuberculosis. The disease usually begins as a localized lesion with a combination of osteomyelitis and arthritis. Typically, multiple vertebrae are affected, usually the anterior aspect of the vertebral body adjacent to the subchondral plate, from which the disease spreads to the adjacent intervertebral discs. In children, the intervertebral disc may be the primary site, as the disc is well vascularized, whereas in adults, disc disease develops secondarily by the spread of infection from the vertebral body. In addition, when bone is affected, wedge-shaped collapse (Figure 1) or destruction of the vertebrae (Figure 4) occurs, resulting in kyphosis. When an epidural abscess (Figure 2) is formed, the diameter of the spinal canal narrows, resulting in spinal cord compression and neurological deficits. [5] In this study, we attempted to present the various manifestations of spinal tuberculosis with their clinical correlations. The regional distribution of vertebrae in our study was similar to the results of DJ Kotzke.[5] Shanley DJ6 evaluated the radiological manifestations of tuberculous spondylitis, such as intraosseous and paraspinal abscess formation, as shown in Figures 2 and 3 in our study. The paraspinal abscess in the lumbar region may progress along the lumbar sheath and extend to the thigh, causing erosion of the 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 sub ligamentous 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 was noted 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 5), On MRI tuberculomas appear as low or intermediate signal intensity on T1W images and low signal on T2W images (Low signal on T2W images 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 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. Well-defined paravertebral abnormal signals, thin and smooth abscess walls, subligamentous extension to three or more vertebral levels, and multiple vertebral or systemic involvement indicate tuberculous spondylitis rather than pyogenic spondylitis.[14] Early diagnosis and prompt treatment are therefore necessary to minimize residual spinal deformity and permanent neurological deficits. Conservative treatment with tuberculous drugs has proven successful when diagnosed early, as they can reach the tuberculous caseous material and the spinal cavity.[15] However, for patients with severe bone metastases with spinal cord or root compression, surgery is the only promising remedy.[16] MRI images provide important information about the vertebrae and disc space. Spinal canal and paraspinal anatomy.Knowledge of the spectrum of MR findings in tuberculous spondylitis, especially in high-risk patient populations, can prevent diagnostic delays and limit the morbidity that may be caused by this progressive but curable infection. The use of gadolinium holds promise for early detection of disease, as it always results in bone enhancement, and may aid in diagnosis if the marginal pattern of the soft tissue mass is visualized by enhancement.

CONCLUSION

MRI is an invaluable tool for evaluating spinal tuberculosis. MRI examination is highly sensitive in detecting the various pathological processes of spinal tuberculosis and their patterns of development, and also provides excellent visualization of soft tissue involvement, spinal cord involvement, and nerve root integrity. It is an accurate method to differentiate between spinal tuberculosis and pyogenic spondylitis and helps in diagnosing spinal tuberculosis at an early stage, allowing prompt treatment to minimize spinal deformity and permanent neurological deficits. Serial MRI scans can also be used to evaluate the response of the disease to treatment.

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