DIVERSITY OF SPINAL TUBERCULOSIS FINDINGS ON MAGNETIC RESONANCE IMAGING: A STUDY FROM A TERTIARY CARE HOSPITAL

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ABSTRACT

Objective: To determine the spectrum of findings on Magnetic Resonance Imaging (MRI) in patients with spinal tuberculosis (TB) in a tertiary care hospital.

Methodology: From January 2019 to December 2020, this retrospective study was carried out at the Hayatabad Medical Complex (HMC), Peshawar, Department of Diagnostic Radiology. In total, 120 TB patients were sampled for this research. A total of 45 samples were found to be TB cases and were further investigated in this study.

Results: Out of those 45 patients 19 (42.2%) were female and 26 (57%) were male. In 45 patients only 9 (20%) gave a history of previous tuberculosis. Spondylitis at a single level was observed in 3 (6.7%) patients, 37 (82.2%) patients had spondylitis at multiple levels, and 5 (11.1%) did not develop any spondylitis.

Conclusion: This study concluded that magnetic resonance imaging is costly but valuable for the investigation of spinal TB. It is a variety of presentations that can cause a diagnostic dilemma so by looking into the most repetitive and common findings we can achieve diagnostic accuracy for spinal TB.

Keywords: Spinal Tuberculosis; Magnetic Resonance Imaging (MRI); Spondylitis.

INTRODUCTION

Mycobacterium Tuberculosis is the common etiology of tuberculosis (TB). Spinal TB contributes to approximately 2% of all tuberculosis cases.[1] The most common regions are the lower thoracic and lumbar vertebrae, preceded by the mid-thoracic and cervical vertebrae[1]. If there is a clinical suspicion of spondylitis, then Magnetic Resonance Imaging (MRI) is advised as timely detection may prevent serious spinal or neurological implications.[2] It also permits for anatomical characterization of the infection in multiple planes, timely detection of the disc and bone degeneration, delineation of extension in bone and soft tissues, and identification of skip lesions in noncontiguous spinal TB.[2] On the foundation of MRI, the operational judgment involving anterior and posterior decompression would be made. A study conducted in Pakistan showed the prevalence of spinal TB on MRI among 61.90% of patients.[3]

The development of the spinal infection is paradisal. It originates in the vertebral metaphysis, eroding the cartilaginous endplate, and ultimately leads to the narrowing of the disc space caused by infection or disc herniation through into the endplate. With the loss of cortical bone, endplate demineralization takes place as a consequence of osseous resorption.[4] T1-weighted MRI sequences exhibit a low signal, whilst T2-weighted imaging indicates a greater signal. This is attributed to inflammatory exudates, cells, and hyperemia altering bone marrow. On MRI, this pattern spotlighted a variety of other inflammatory and infectious conditions.[5]

In contrast to the cerebrospinal fluid signal, abscess and collections have relatively high intensity on T1-weighted images and low signal intensity on T2-weighted sequences.[5] In patients with abscesses, the smooth wall contrast enhancement is minimal, meanwhile, the phlegmon contrast enhancement is consistent.[6]

In the anterior arrangement, the infection occurs in the side region of the vertebral body and progresses beneath the anterior longitudinal ligament to the neighboring vertebrae.[7] Subligamentous spreading uncovers the avascular vertebrae by detaching the periosteum and anterior longitudinal ligament from the surface of the vertebrae. This morphology is often confused with bone malignancy.[8] The existence of a subligamen-

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tous abscess with contrast enhancement, retention of the discs, and aberrant signal involving numerous vertebral regions with diverse signal intensity are amongst the MRI findings in the anterior pattern.[9]

In this phase, MRI reveals a single vertebra with a hypo-intense T1-weighted signal and vertebral instability with preservation of the disc.[10,11] Spinal TB is known for its fatal repercussion around the globe, it is known for its disastrous outcomes such as spreading across the vertebrae, resulting in the weakening of bones and destruction of the cushioning discs. MRI plays a vital role in the visualization of components related to soft tissue and bone.

METHODOLOGY

A retrospective study was carried out in the Diagnostic Radiology Department at Hayatabad Medical Complex, Peshawar from January 2019 to December 2020. The approach of non-probability sampling was used. For our study, samples from 120 tuberculosis patients were taken. Out of these samples, 45 were found to be TB cases and were further assessed for our study. The characteristic clinical appearance, systemic constitutional manifestation, prior TB exposure or concurrent visceral TB, and neuroimaging modalities were used to confirm the diagnosis of spinal TB.

In addition to performing skin tests, the diagnosis of spinal TB also included hematological investigations such as complete blood counts (CBC), erythrocyte sedimentation rates (ESR), Mantoux tests, and enzyme-linked immunosorbent assays (ELISA), and polymerase chain reactions (PCR). To identify acid-fast bacilli (AFB) and isolate organisms for culture, antibiotic sensitivity testing, and histopathology, bone tissue or abscess samples were collected.

All the patients were referred to the radiology department for an MRI spine for low-grade chronic fever with weight loss, back pain, tenderness, any spinal mass, or any previous history of tuberculosis while the Patients with non-TB spondylitis and with a history of any immediate fracture or spinal trauma were excluded from this study. Approval was obtained from the Ethical Committee of Hayatabad Medical Complex after which informed consent was taken from all the patients referred to the radiology department which explained the study's purpose. History was taken in each case.

On a 1.5 Tesla Philips MRI scanner, the spine was scanned using non-contrast T1 weighted (T1W), T2 weighted (T2W), and short tau inversion recovery (STIR) sequences in the axial, sagittal, and coronal planes. This was followed by contrast-enhanced T1W sequences following intravenous gadolinium contrast agent administration. The results were independently verified by a third radiologist to eliminate inter-observer bias. Anomalous signal intensities that appeared hypo-intense on T1W sequences and hyper-intense on T2W sequences, together with heterogeneous enhancement of the vertebral bodies and discs, were MRI characteristics of Pott's spine that were demonstrated in our investigation. In non-contrast sequences, STIR sequences can assist distinguish fluid from a fatty component. Additionally, the pre-and paravertebral muscles, soft tissues, and intraspinal extension are precisely revealed by these MR sequences.[8]

The data were analyzed statistically with the help of SPSS version 22.0. Mean and SD was calculated from numerical variables such as age. Frequencies and percentages were calculated for categorical variables such as gender and MR findings (including spondylitis, spondylodiscitis, vertebral collapse, any soft tissue component, psoas abscess, spinal canal extension, gibbus deformity, and post-TB sequelae).

RESULTS

A total of 45 patients were included in our study. Out of which 26 (57%) were male and 19 (42.2%) were female. In our study patients having age less than 21 years were 9 (20%), patients with an age range from 21 to 30 had 3 (6.7%), 31 to 40 had 5 (11.1%), 41 to 50 had 6 (13.3%), 51 to 60 had 14 (31.1%), 61 to 70 had 5 (11.1%) and greater than 70 had 3 (6.7%).

Out of the total of 45 patients, only 9 (20%) gave a history of previous TB. In our study 3 (6.7%) patients had spondylitis at a single level, 37 (82.2%) patients had spondylitis at multiple levels, and 5 (11.1%) did not develop any spondylitis.

Spondylodiscitis at a single level was developed in 22 (48.9%) patients, at multiple levels in 12 (26.7%) patients, and 11 (24.4%) patients did not develop any spondylodiscitis.

Spondylolisthesis at a single level devel-

Table 1: Details of the main variables (n=45)

Variables		Number (%)
Soft Tissue Component	Prevertebral Soft Tissue Component	7 (15.6%)
	Paravertebral Soft Tissue Component	2 (4.4%)
	Both Pre and Paravertebral Soft Tissue Component	25 (55.6%)
Psoas Abscess		13 (28.9%)
Spinal Canal Extension		27 (60.0%)
History of Tuberculosis		9 (20.0%)
Post Tuberculosis Sequelae	Fusion	3 (6.7%)
	Altered Signals	3 (6.7%)

oped in 2 (4.4%) patients, and 43 (95.5%) did not develop any spondylolisthesis. The compression collapse of single, and multiple-level vertebrae development was seen in 13 (28.9%) and 8 (17.8%) patients respectively. The detail of soft tissue components; development of psoas muscle abscess and extension of the infective process; and of Post TB sequelae are given in Table 1.

DISCUSSION

TB is a major health concern being more common in developing countries and poor socioeconomic sections. Spinal TB constitutes the most common site of skeletal TB and presents with various neurological symptoms. Spinal tuberculosis can present with a variety of MRI findings ranging from spondylitis, discitis, compression collapse, soft tissue component, and psoas abscess to grievous complications like intra-spinal extension and neurological deficit. As tuberculosis is a disease of the developing world, prevalent in our setup so several cases were presented to our department. As the neurosurgery department is in our hospital so the cases could be easily followed. But on the contrary, the study was limited to just one radiology department, so the sample size was small and the age of patients was between 51-60 years. TB can develop and progress at any age.[12]

In our study males were more affected than females which is similar to the study done by Sinan et al[14] and which is contradictory to the study done by Jain et al.[15] In our study, the most common level of vertebral involvement in the lumbar region was similar to the study done in Bangladesh.[13] Similar findings were also noted by Sinan et al.[14] Another study conducted by Bhatnagar et al[16] showed that the lumbar region was the second most common site involvement.

The multiplicity of vertebral level involvement is found in 83% of cases reported are identical to Bangladesh et al. findings.[13] In our study, 28.9% of patients developed psoas abscesses. Spondylitis is below the level of psoas abscesses. The presence of various imaging abnormalities, such as subligamentous spread, intraosseous, and paraspinal abscesses with thick rim enhancement, is diagnostic even if the little calcifications characteristic of TB are invisible on MRI. Common findings include the development of psoas abscesses, paraspinal extension, and subligamentous spread. These abscesses and their communications can be seen on enhanced coronal imaging.[12]

Although the disc looks to be thinning, discitis has a significant T2 signal (although a type 1 modic degenerative disc may also show an elevated T2 signal). On T2 weighted images, there is an abnormally elevated disc signal, and the endplates around the abnormal disc level are hyperintense.[12] The rate of erythrocyte sedimentation was reportedly high in patients with spinal TB.[17] Conservative treatment regimen yields beneficial outcomes in situations where malignancy is detected early. Anti-TB treatments can achieve TB caseous material and spine cavities. 20 Surgical management is the sole approach if there is severe bone contact as well as a cord or root compression.[18]

MRI is extremely helpful in evaluating the level of involvement and response to therapy of isolated TB of posterior elements. The deficiency of ionizing radiation and the multiplanar competency of MRI makes it advantageous for postoperative valuation of the spine and follow-up studies for monitoring the response to therapy. Tuberculous radiculomyelopathy is the most common complication (38.7%) associated with tuberculous meningitis. In our study, 60% of patients showed intraspinal extension of the disease process as epidural abscesses.

CONCLUSION

In our study, the most common findings in order of decreasing frequency, associated with spinal TB were spondylitis, spondylodiscitis, surrounding soft tissue infiltration, intraspinal extension, compression collapse, psoas abscess, post tuberculous sequelae, and spondylolisthesis. Because of the varied presentation of tuberculosis on MRI, it becomes a diagnostic dilemma. So by looking into the most repetitive and common findings we can achieve diagnostic accuracy for spinal TB on MRI.

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Author's Contribution

MA conceived the idea and contributed to the data collection. AS contributed in data collection and reviewed the manuscript. MS and RS helped in writing and reviewing the manuscript for final approval. GW helped in the overall review process for the manuscript. MR performed data analysis and reviewed the final manuscript. Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of Interest

Authors declared no conflict of interest

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None

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.