Section: Radiodiagnosis

Original Research Article

TO DETERMINE THE USE OF MRI IN THE ASSESSMENT OF SPINAL TB

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Abstract

Background: Tuberculosis, caused by Mycobacterium tuberculosis, is a long-standing illness that has been common in India for centuries. Spinal TB constitutes 2% of all kinds of tuberculosis. The method of infection occurs via the hematogenous pathway. The clinical presentation encompasses a spectrum of symptoms including uncomplicated back pain, soreness, stiffness, and spinal abnormalities. The plain radiography spine is the preferred first imaging method in poor nations because to its easy accessibility and cost-effectiveness. However, it is unable to detect early disease changes. CT, MRI, and PET are often used modalities in the contemporary period for the diagnosis of spinal TB. MRI is valuable for early detection because of its exceptional ability to distinguish soft tissues and its capability to do multiplanar reconstruction, which aids in identifying spinal cord and neural element involvement. Prompt detection is crucial in order to prevent skeletal abnormalities and compression of the spinal cord, hence benefiting the patient. The aim is to determine the use of MRI in the assessment of spinal TB. **Materials and Methods:** The MRI case records of 60 patients diagnosed with TB were examined retrospectively, and pertinent clinical history was also documented. The diagnosis was established using a combination of patient history, clinical examination, and medical studies. The investigations conducted included complete blood count (CBC), erythrocyte sedimentation rate (ESR), examination of sputum cells, and histological analysis to detect acid-fast bacilli in the affected area. The MRI scan was conducted using a 1.5 Tesla GE MRI machine. The following magnetic resonance imaging (MRI) sequences were examined: The imaging protocol includes sagittal and axial T1 weighted (T1 FRFSE) sequences, sagittal and axial T2 weighted (T2 FRFSE) sequences, coronal and sagittal STIR sequences, and post-contrast T1 weighted sequences in axial, coronal, and sagittal planes. Intravenous injection of gadodiamide (GdDTPA-BMA) at a dosage of 0.1 mmol/kg was used to acquire post-contrast T1-weighted sequences. **Result:** The research had a total of 60 patients, ranging in age from 20 to 60 years, with the majority falling between the 30-40 year age bracket. There were 42 men, accounting for 70% of the total, and 18 girls, accounting for 30%. The MRI scan revealed that the thoracic spine was the most afflicted level, with the thoracic vertebrae being the most often impacted vertebrae, seen in 38.34% of the cases [Table 2]. This was followed by the thoracolumbar vertebrae in 25% of the cases, and the lumbar vertebrae in 20% of the instances. The study observed many clinical manifestations including fever, backache, weight loss, and malaise. The most prevalent symptom was backache, reported in 75% of the 45 patients [Table 3]. 85% of the patients had intervertebral disc involvement, whereas an epidural component was seen in 78.33% of the cases [Table 4]. Cord edema was seen in 12% of the patients. **Conclusion:** Magnetic Resonance Imaging (MRI) is an invaluable technique for assessing spinal Tuberculosis (TB). The MRI scan is quite accurate in identifying different disease stages of spinal TB and their occurrence patterns. It is a reliable method for distinguishing between spinal TB and pyogenic spondylitis. Additionally, it helps in the early diagnosis of spinal TB, allowing for rapid treatment that reduces spine deformity and prevents long-term neurological damage.

INTRODUCTION

Tuberculosis (TB) is a disease that is brought about by the bacteria Mycobacterium tuberculosis. Tuberculosis (TB) is increasingly prevalent, especially in poorer nations. The spine is the most frequent site of extrapulmonary tuberculosis, representing over 50% of cases with musculoskeletal tuberculosis.[1] In poor nations, the illness progresses rapidly, especially in children and young people, leading to the development of abscesses. As a result, it is common to see neurologic problems and spinal deformities.[2] It is mostly prevalent in the Eastern hemisphere of the planet. India is expected to have one-fifth of the global population of patients with tuberculosis.[2] Tuberculosis primarily targets the pulmonary system, however it may also impact several other bodily regions.[3] Approximately 1-2% of TB patients have skeletal system involvement, with spinal tuberculosis being the most prevalent variant, accounting for almost 50% of all cases.[2] Spinal tuberculosis is considered one of the most ancient illnesses known to humans, since it has been recorded in ancient Egyptian mummies.[4-6] Sir Percival Pott was the first to describe spinal TB in 1779, and the condition is widely known as "Pott's Spine". Spinal tuberculosis often originates by the spread of tuberculosis bacteria in the bloodstream, often originating from the lungs. However, it may also originate from other sites beyond the lungs. The condition often affects the thoracic and lumbar regions of the spine, with the thoracolumbar junction being the most commonly affected area. Less frequent places include the cervical area and sacrum. There are four different forms of spinal involvement that have been identified by radiological examination: paradiscal, anterior, central, and neural arch or appendiceal.[7-11] The paradiscal kind is the most prevalent among these options. Diagnosing spinal TB might be difficult because of the vague constitutional symptoms. Imaging is crucial for promptly diagnosing and making therapy choices. Plain film radiography (PFR) is a widely utilized and often used imaging method in clinical settings to confirm the diagnosis of spine TB. It has been shown to have a high diagnostic effectiveness ranging from 91% to 99% as determined by radiologists.[12]

Magnetic resonance imaging (MRI) is now the favored method of imaging for individuals who are suspected to have spinal tuberculosis (TB). MRI is the most effective way for identifying early illness and is the recommended technology for determining the activity and scope of infection. The image displays not only the presence of bone involvement, but also the presence of edema and swelling in the soft tissues.[13] Tuberculosis (TB) of the spine is largely caused by the spread of infection from the lungs into the bloodstream. The infection usually originates from the front section of the vertebral body, then progresses to the disc, resulting in bone deterioration and the development of an abscess. The abscess extends under the anterior longitudinal ligament and the intervertebral disc, resulting in a subsequent decrease in disc height. As the vertebral bodies compress, a pronounced angulation, known as kyphos, occurs. Caseation and the development of cold abscesses may spread to the next vertebra or infiltrate the surrounding paravertebral soft tissue. The presence of cord compression and edema may be attributed to either the pressure exerted by the abscess or the displacement of bone, or to the involvement of the spinal artery, leading to neurological impairments.[13] It is crucial to distinguish between TB and pyogenic spondylitis. Disc involvement manifests early in cases of pyogenic infection and later in cases of TB. Tuberculosis is often associated with calcification.[13] The objective of this research is to provide a detailed description of different radiological characteristics of spinal TB and examine the effectiveness of MRI in determining the severity of the illness.

MATERIALS AND METHODS

The MRI case records of 60 patients diagnosed with TB were examined retrospectively, and pertinent clinical history was also documented. The diagnosis was established using a combination of patient history, clinical examination, and medical studies. The investigations conducted included complete blood count (CBC), erythrocyte sedimentation rate (ESR), examination of sputum cells, and histological analysis to detect acid-fast bacilli in the affected area. Additionally, the growth of mycobacterium was observed through tissue or ascitic fluid cultures. Furthermore, patients with clinical, radiological, and operative evidence of spinal tuberculosis were assessed for a satisfactory therapeutic response to drug treatment.

The MRI scan was conducted using a 1.5 Tesla GE MRI machine. The following magnetic resonance imaging (MRI) sequences were examined: The imaging protocol includes sagittal and axial T1 weighted (T1 FRFSE) sequences, sagittal and axial T2 weighted (T2 FRFSE) sequences, coronal and sagittal STIR sequences, and post-contrast T1 weighted sequences in axial, coronal, and sagittal planes. Intravenous injection of gadodiamide (GdDTPA-BMA) at a dosage of 0.1 mmol/kg was used to acquire post-contrast T1-weighted sequences.

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.

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- Intradural/ intramedullary: Nature and enhancement of the lesions.

The scans underwent independent evaluation by two radiologists, with any discrepancies in results being handled by consensus.

RESULTS

The research had a total of 60 patients, ranging in age from 20 to 60 years, with the majority falling between the 30-40 year age bracket [Table 1]. [Table 1] shows that there were 42 men, accounting for 70% of the total, and 18 girls, accounting for 30%. The MRI scan revealed that the thoracic spine was the most afflicted level, with the thoracic vertebrae being the most often impacted vertebrae, seen in 38.34% of the cases [Table 2]. This was followed by the thoracolumbar vertebrae in 25% of the cases, and the lumbar vertebrae in 20% of the instances. The study observed many clinical manifestations including fever, backache, weight loss, and malaise. The most prevalent symptom was backache, reported in 75% of the 45 patients [Table 3]. 85% of the patients had intervertebral disc involvement, whereas an epidural component was seen in 78.33% of the cases [Table 4]. Cord edema was seen in 12% of the patients.

Table 1: Age and sex distribution

Gender	Number	Percentage	P value
Male	42	70	0.53
Female	18	30	
Age group			0.33
Below 30	8	13.33	
30-40	27	45.00	
40-50	15	25.00	
50-60	10	16.67	
Mean Age	42.26±3.36		

Table 2: Regional distribution of TB spine.

Region	No of cases	Percentage (%)
Cervical	5	8.33
Thoracic	23	38.34
Thoracolumbar	15	25.00
Lumbar	12	20.00
Multiple levels	5	8.33

Table 3: Clinical profile of patients with spinal TB.

Symptoms	Number =60	Percentage (%)
Fever	38	63.33
Backache	45	75.00
Malaise	27	45.00
Weight loss	13	21.67

Table 4: Extent of tuberculosis spine in various compartments.

Features	No of cases =60	Percentage (%)
Intervertebral disc involvement	51	85.00
Wedge collapse of body	28	46.67
Complete destruction of vertebra	11	18.33
Subligamental extension	29	48.33
Epidural collection	47	78.33
Intradural involvement	5	8.33
Intramedullary involvement	3	5.00
Pre and paravertebral collections	35	58.33

DISCUSSION

Tuberculosis is a significant public health concern, particularly in developing nations where poverty, hunger, overcrowding, unsanitary conditions, and the development of drug-resistant strains contribute to the spread of the illness. TB of the spine is a significant manifestation of extrapulmonary TB, representing the majority of musculoskeletal tuberculosis cases. The illness often begins as a localized lesion that encompasses both osteomyelitis and arthritis. Usually, many vertebrae are affected, primarily targeting the front part of the vertebral body next to the subchondral plate. From there, the condition expands to impact the neighboring intervertebral discs. In infants, the disc might serve as a major location for vascularization, but in adults, disc illness is often a result of infection spreading from the vertebral body. Additionally, when the bone is affected, there is a collapse of the wedge shape and destruction of the vertebrae, leading to the development of kyphosis. Epidural abscess development leads to the narrowing of the diameter of the spinal canal, which in turn causes compression of the spinal cord and resulting in neurological deficits.[14]

In this work, we have aimed to illustrate the diverse range of manifestations of spinal tuberculosis,

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together with their clinical association. The geographic allocation of vertebrae in our investigation exhibited resemblance to the discoveries made by DJ Kotzke.[14] In our study, we examined the radiographic features of tubercular spondylitis, specifically focusing on the formation of abscesses within the bone and in the paraspinal area. We found that paraspinal abscesses in the lumbar region tend to move along the psoas sheath, potentially extending into the femoral region and leading to erosion of the skin above it.[14,15]

MRI is considered the most reliable and accurate imaging technique for diagnosing TB Spondylitis because it provides exceptional clarity in seeing soft tissues and the ability to view the affected area from several angles. The conventional pattern of dissemination, which begins at the front and progresses to affect adjacent vertebrae by subligamentous extension, is readily seen on MRI. Our investigation found that T1-weighted images often show a decrease in signal intensity inside the afflicted vertebral marrow. T2-weighted images show a higher intensity in the affected tissues compared to normal tissues.[16] The presence of meningeal involvement, which suggests ongoing inflammation, and the presence of rim enhancement surrounding abscesses in the bone and soft tissues near the spine, which is uncommon in non-tubercular abscesses, may be most effectively seen with contrast-enhanced MRI.[17]

Our investigation included three instances that had intramedullary tuberculomas. Tuberculomas are seen on MRI as areas with low or intermediate signal intensity on T1-weighted images and low signal intensity on T2-weighted imaging. The low signal intensity on T2-weighted images is attributed to the presence of caseous necrosis in the tuberculoma, which contains a large amount of protein. The post-contrast investigation reveals the presence of ring-like nodular enhancement.[18] Magnetic resonance imaging (MRI) is the most effective method for evaluating the level of spinal cord involvement, assessing the integrity of nerve roots, determining the involvement of posterior components, and evaluating the response to therapy.[19-21]

Distinguishing between tuberculous spondylitis and pyogenic spondylitis is crucial as it allows for appropriate therapy, which may decrease the occurrence of disability and functional impairment.[22,23] MRI has shown accuracy in distinguishing between tuberculous spondylitis and pyogenic spondylitis. Features such as a clearly identifiable aberrant signal in the paraspinal area, a thin and smooth abscess wall, spread under the ligament to three or more levels of the spine, and involvement of numerous vertebrae or the whole body are more indicative of tuberculous spondylitis rather than pyogenic spondylitis.[23] Early identification and immediate intervention are essential in order to reduce any lasting spine deformity and/or severe neurological impairment. Treatment with antitubercular medications has shown effective in early identified cases, since these treatments are able to penetrate the tuberculous caseous material and cavities in the spine.[24] However, for individuals with extensive bone involvement and cord or root compression, surgical therapy is the only beneficial option.[25]

CONCLUSION

Magnetic Resonance Imaging (MRI) is an invaluable technique for assessing spinal Tuberculosis (TB). The MRI scan is quite accurate in identifying different disease stages of spinal TB and their occurrence patterns. It also enables detailed visualization of soft tissue involvement, cord involvement, and nerve root integrity. It is a reliable method for distinguishing between spinal TB and pyogenic spondylitis. Additionally, it helps in the early diagnosis of spinal TB, allowing for rapid treatment that reduces spine deformity and prevents long-term neurological damage. Serial MRI scans may be used to evaluate the disease's response to therapy.

REFERENCES

1. Bansal A, Kaur I, Kaur Mohi J, Garg Y. Comparison of MRI with x-ray in the evaluation of tuberculosis of spine. Int J Med Res Rev [Internet]. 2019Oct.31 [cited 2024Apr.20];7(5):380-8..
2. Sharma G, Ghode R. Tubercular Spondylitis: Prospective Comparative Imaging Analysis on Conventional Radiograph and MRI. Int J Anat, Radiol Surg.2016;5(3):41-46..
3. Konstantinos A. Testing for tuberculosis. Australian Prescriber 2010; 33: 12–18.
4. Kumar, Y., Gupta, N., Chhabra, A. et al. Magnetic resonance imaging of bacterial and tuberculous spondylodiscitis with associated complications and non-infectious spinal pathology mimicking infections: a pictorial review. BMC Musculoskelet Disord.2017;18, 244.
5. Singh, K. S., Robindro, P., Devi, O. P., & Lilavati, N. MRI Evaluation of Spinal TB: A Cross-Sectional Study. European Journal of Molecular and Clinical Medicine.2022; 9(1), 354+.
6. Bynum H. Spitting blood. The history of tuberculosis. Oxford: Oxford University Press; 2012. 6-10.
7. Sai Kiran NA, Vaishya S, Kale SS, Sharma BS, Mahapatra AK. Surgical results in patients with tuberculosis of the spine and severe lower-extremity motor deficits: a retrospective study of 48 patients. J Neurosurg Spine. 2007;6:320–326.
8. Pott P. The chirurgical works of Percivall Pott, F.R.S., surgeon to St. Bartholomew's Hospital, a new edition, with his last corrections. 1808. Clin Orthop Relat Res. 2002; 398: 4-10.
9. Boachie-Adjei O, Squillante RG. Tuberculosis of the spine. Orthop Clin North Am. 1996;27:95–103.
10. chirmer P, Renault CA, Holodniy M. Is spinal tuberculosis contagious? Int J Infect Dis. 2010;14:e659– 66.
11. Moorthy S, Prabhu NK. Spectrum of MR imaging findings in spinal tuberculosis. AJR Am J Roentgenol.2002;179:979–983
12. Boruah DK, Gogoi BB, Prakash A, Lal NR, Hazarika K, Borah KK. Magnetic resonance imaging evaluation of posterior spinal tuberculosis: a cross-sectional study. Acta Radiologica. 2021;62(8):1035-1044.
13. Bajwa GR. Evaluation of the role of MRI in spinal Tuberculosis: A study of 60 cases. Pak J Med Sci. 2009;25(6):944-7.
14. Kotzé DJ, Erasmus LJ. MRI findings in proven Mycobacterium tuberculosis (TB) spondylitis.
15. Shanley DJ. Tuberculosis of the spine:imaging features.AJR. Am J Roentgenol. 1995;164:659-64.

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16. Sharif HS, Clark DC, Aabed MY, Haddad MC, Al Deeb SM, et al. Granulomatous Spinal Infections: MR Imaging. Radiology. 1990;177:101-7.
17. Sharma A, Goyal M, Mishra NK, Gupta V, Gaiwak SB. MR Imaging of Tubercular Spinal Arachnoiditis. AJR. 1997;168:807-12.
18. Prakash ML, Sarwagi R, Ramkumar, Srilatha K, et al. Spinal intramedullary tuberculoma: typical, atypical presentation on magnetic resonance imaging. Journal of Case Reports. 2013;3(2):404-9.
19. Sinan TH, Al Ismail M, et al. Spinal tuberculosis: CT and MRI features. Ann Saudi Med. 2004;24(6):437-41.
20. Ansari S, Rauniyar RK, Dhungel K, et al. MR evaluation of spinal tuberculosisAl Ameen J Med Sci. 2013;6(3):219-25.
21. Narlawar RS, Shah JR, Pimple MK, Patkar DP, Patankar T, Castillo M. Isolated tuberculosis of posterior elements of spine: magnetic resonance imaging findings in 33 patients. Spine. 2002;27:275- 81.
22. Arizono T, Oga M, Shiota E, Honda K, Sugioka Y. Differentiation of vertebral osteomyelitis and tuberculous spondylitis by magnetic resonance imaging. Int Orthop. 1995;19:319–22.
23. Jung NY , Jee WH , Ha KY et al Discrimination of Tuberculous Spondylitis from Pyogenic Spondylitis on MRI. AJR. 2004;182:1405–10.
24. TB infection Apley's system of Orthopedic and fracture, 8th edition, Arnold, Oxford University Press Inc, New York 2001.
25. Sinha S, Singh A, Gupta V. Surgical management and outcome of tuberculosis at lantoaxial dislocation: A 15 years experience. Neurosurgery. 2003;52(2): 331-9.

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