RESEARCH PAPER

Role Of Mri In Evaluation Of Spinal Tuberculosis (Potts Spine)

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ABSTRACT

Background:Spinal tuberculosis (Pott's spine) is the most common form of skeletal tuberculosis and a major cause of morbidity due to delayed diagnosis and neurological complications. Early and accurate imaging is essential for timely management.

Aim:To assess the role of Magnetic Resonance Imaging (MRI) in the evaluation of spinal tuberculosis.

Materials and Methods:This cross-sectional study included 100 patients with clinically suspected spinal tuberculosis referred from outpatient and inpatient departments. MRI was performed using a 1.5 Tesla scanner with standard sequences including T1, T2, STIR, and contrast-enhanced imaging. Clinical, demographic, and imaging findings were analysed using statistical software, with significance set at $p < 0.05$.

Results:The mean age of patients was 42.0 ± 9.67 years, with male predominance (59%). Backache (72%) was the most common presenting symptom. Lumbar spine involvement (63%) and affection of two contiguous vertebrae (67%) were most frequent. MRI revealed vertebral signal changes in 100% of cases and disc involvement in 93%. Paravertebral abscess (83%), prevertebral abscess (85%), and epidural abscess (71%) were commonly observed. Neural involvement included thecal compression (85%) and cord compression (37%). Most findings were statistically significant ($p < 0.05$).

Conclusion:MRI is a highly sensitive and reliable modality for early diagnosis, assessment of disease extent, and detection of complications in spinal tuberculosis. It plays a crucial role in guiding management and improving patient outcomes.

Keywords: Spinal tuberculosis, Pott's spine, Magnetic Resonance Imaging, MRI, vertebral involvement, paravertebral abscess, spinal cord compression..

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INTRODUCTION

Spinal tuberculosis, commonly referred to as Pott's spine, remains one of the most serious forms of extrapulmonary tuberculosis and continues to be a significant health concern in developing countries, including India. It accounts for nearly 50% of all skeletal tuberculosis cases and predominantly affects the thoracolumbar region of the spine. The disease is characterized by a gradual onset, often presenting with nonspecific symptoms such as back pain, low-grade fever, weight loss, and neurological deficits in advanced stages. Delay in diagnosis can result in severe complications including vertebral collapse, kyphotic deformity, spinal instability, and irreversible paraplegia, making early and accurate detection crucial for optimal patient outcomes [1,2].

Magnetic Resonance Imaging (MRI) has emerged as the imaging modality of choice in the evaluation of spinal tuberculosis due to its superior soft tissue contrast resolution and multiplanar imaging capabilities. Unlike conventional radiography, which detects only late-stage bony destruction, MRI allows for early identification of marrow edema, intervertebral disc involvement, and subtle paraspinal soft tissue changes. This early detection plays a pivotal role in initiating timely antitubercular therapy and preventing disease progression [3,4]. Furthermore, MRI provides excellent visualization of epidural extension and spinal cord compression, which are critical determinants in assessing neurological involvement and planning surgical intervention if required.

One of the hallmark features of spinal tuberculosis on MRI is the involvement of contiguous vertebral bodies with relative preservation of the intervertebral disc in early stages, distinguishing it from pyogenic spondylitis. The presence of paravertebral abscesses, subligamentous spread, and skip lesions are also better appreciated on MRI. T1-weighted images typically demonstrate hypointense signals in affected vertebrae, whereas T2-weighted and STIR sequences show hyperintensity due to inflammatory edema and abscess formation. Post-contrast sequences further aid in delineating abscess walls and granulation tissue, enhancing diagnostic confidence [5–7].

In addition to diagnosis, MRI is invaluable in monitoring therapeutic response and detecting complications. Reduction in abscess size, resolution of marrow edema, and improvement in spinal cord compression can be effectively assessed during follow-up imaging. MRI also helps differentiate active disease from healed lesions, which is often challenging on other imaging modalities. This is particularly important in guiding the duration of antitubercular therapy and avoiding overtreatment [8,9].

Despite its advantages, MRI findings should always be interpreted in conjunction with clinical and laboratory data, as certain features may overlap with malignancy or other infectious conditions. Nevertheless, the high sensitivity and specificity of MRI make it an indispensable tool in the comprehensive evaluation of spinal tuberculosis. With increasing availability and advancements in imaging techniques, MRI continues to play a central role in improving diagnostic accuracy, guiding management strategies, and ultimately reducing morbidity associated with Pott's spine [10].

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The present study aims to assess the role of Magnetic Resonance Imaging (MRI) in the evaluation of spinal tuberculosis (Pott's spine), with a focus on its diagnostic and prognostic utility. The objectives of the study are to analyze the characteristic MR imaging features of spinal tuberculosis, to identify imaging findings that aid in differentiating various stages of disease progression, and to evaluate the spectrum of MRI manifestations associated with this condition. Additionally, the study seeks to examine the demographic distribution and clinical presentation of patients with spinal tuberculosis, thereby correlating radiological findings with clinical parameters to enhance early diagnosis, guide management, and improve patient outcomes.

MATERIALS AND METHODS

Study Design:A hospital-based cross-sectional study was conducted to evaluate the role of MRI in patients with suspected spinal tuberculosis.

Study Population: The study included patients presenting with clinical features suggestive of spinal tuberculosis who were referred from outpatient (OPD) and inpatient (IPD) departments, primarily from Medicine, Chest and TB, and Orthopaedics.

Sample Size:A total of 100 patients were included in the study.

Study Duration: The study was carried out over a period of 1.5 years, from December 2022 to July 2024, after obtaining approval from the institutional ethical committee.

Study Place: Department of Radio-Diagnosis, Maharishi Markandeshwar (Deemed to be) University.

Inclusion Criteria:

Individuals with clinically suspected or confirmed spinal tuberculosis, irrespective of age and gender.

Exclusion Criteria:

Patients who had undergone surgery following a prior diagnosis of spinal tuberculosis.

Individuals with contraindications to MRI such as pacemakers, ferromagnetic implants, aneurysm clips, or MRI-incompatible prostheses.

Patients with severe claustrophobia precluding MRI examination.

Patients already on antitubercular therapy (on follow-up).

Individuals unwilling to participate in the study.

Study Procedure:

Patients with clinical suspicion of spinal tuberculosis referred from OPD/IPD were enrolled.

Written informed consent was obtained from all participants prior to imaging.

Detailed clinical history and findings from systemic examination were recorded as per a predefined proforma.

MRI was performed using a 1.5 Tesla scanner (Achieva, Philips Medical Systems, The Netherlands).

Imaging sequences included T1-weighted axial and sagittal, T2-weighted axial, sagittal and coronal, and STIR sequences in sagittal and coronal planes.

Additional sequences such as post-contrast T1-weighted imaging, diffusion-weighted imaging (DWI), and apparent diffusion coefficient (ADC) mapping were performed whenever feasible.

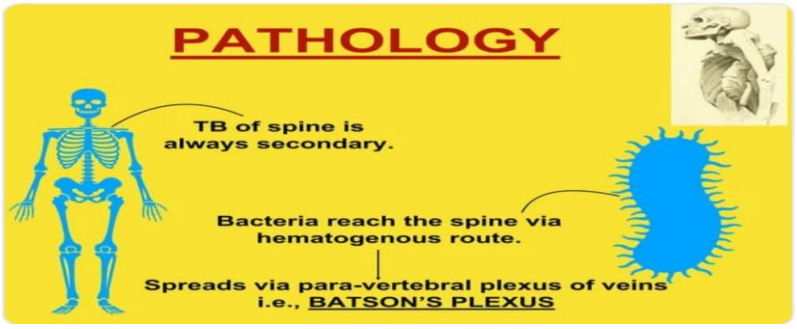


Figure: 1. Pathogenesis of TB

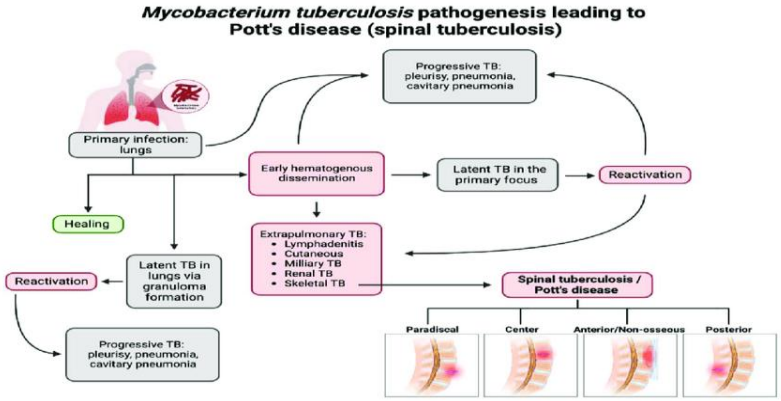


Figure: 2.Pathophysiology of Pott's Spine

Figure: 3. Anterior Lesion

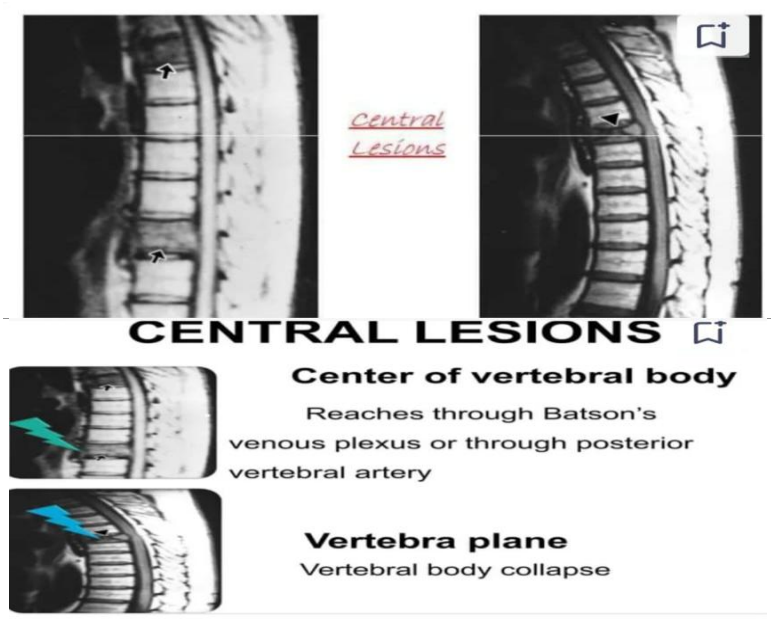


Figure: 4. Central Lesions

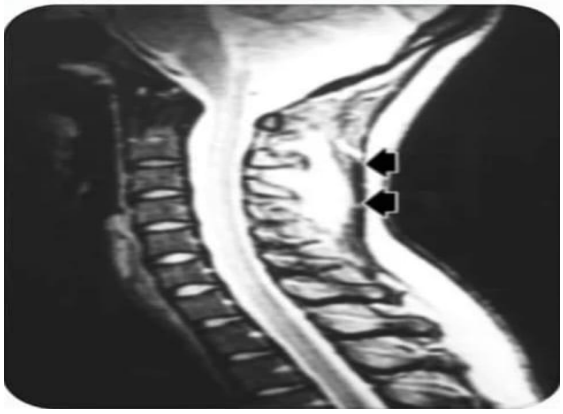


Figure: 5. Skipped Lesions

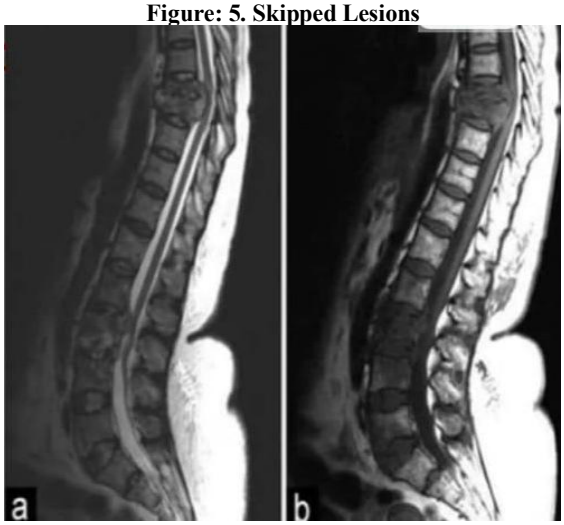


Figure: 6. Skipped Lesions with More Than Tb Lesion in Vertebral Column with One Or More Healthy Vertebrae In Between The 2 Lesion.

Statistical Analysis

Data were entered into Microsoft Excel and subsequently analysed using IBM SPSS Statistics (SPSS Inc., Chicago, IL, USA) and GraphPad Prism. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The unpaired t-test was applied to compare continuous variables between independent groups, whereas the paired t-test was used for comparisons within the same group. Categorical variables were analysed using the Chi-square test or Fisher's exact test, as appropriate. A p-value of <0.05 was considered statistically significant.

RESULT

Table 1: Demographic Profile

Variable	Category	Number	%	P-value
Age Group (years)	21–30	23	23	**0.021**
	31–40	29	29	
	41–50	15	15	
	51–60	22	22	
	61–70	11	11	
	Total	**100**	**100**	
Gender	Male	59	59	**0.048**
	Female	41	41	
	Total	**100**	**100**	
Mean age:		42.0 ± 9.67 years		

Table 1: Demographic Profile

In the present study of 100 patients, the majority belonged to the 31–40 years age group (29%), followed by 21–30 years (23%) and 51–60 years (22%). Patients aged 41–50 years constituted 15%, while those in the 61–70 years group accounted for 11%. The association between age distribution and spinal tuberculosis was statistically significant ($p = 0.021$). The mean age of the study population was 42.0 ± 9.67 years. With respect to gender distribution, males constituted 59% and females 41% of the study population, demonstrating a male predominance. This difference was also statistically significant ($p = 0.048$).

Table 2: Clinical Presentation & Risk Factors

Variable	Category	Number	%	P-value
Clinical Features	Backache	72	72	**<0.001**
	Fever	7	7	
	Neurological deficit	6	6	
	Weight loss	4	4	
	Combined symptoms	11	11	
	Total	**100**	**100**	
Risk Factors / History	Past TB	17	17	**0.032**
	Pulmonary TB	14	14	
	HIV/immunocompromised	6	6	
	Family history TB	3	3	
	Total	**100**	**100**	

Table 2: Clinical Presentation & Risk Factors

Backache was the most common presenting symptom, observed in 72% of patients, followed by combined symptoms in 11%. Fever was present in 7% of cases, neurological deficits in 6%, and weight loss in 4%. The distribution of clinical features was statistically significant ($p < 0.001$). Among risk factors, a past history of tuberculosis was seen in 17% of patients, pulmonary tuberculosis in 14%, HIV/immunocompromised status in 6%, and family history of tuberculosis in 3%. These associations were statistically significant ($p = 0.032$).

Table 3: Vertebral Involvement Pattern

Variable	Category	Number	%	P-value
No. of Vertebrae Involved	1	6	6	**<0.001**
	2	67	67	
	3	17	17	
	4	7	7	
	>4	3	3	
	Total	**100**	**100**	
Region Involved	Lumbar	63	63	**<0.001**
	Thoracic	20	20	
	Thoracolumbar	10	10	
	Cervico-dorsal	3	3	
	Lumbosacral	3	3	
	Multiple levels	3	3	
	Total	**100**	**100**	

Table 3: Vertebral Involvement Pattern

The majority of patients (67%) had involvement of two vertebrae, followed by three vertebrae in 17% of cases. Single vertebral involvement was noted in 6% of patients, while 7% had involvement of four vertebrae and 3% had involvement of more than four vertebrae. This distribution was highly significant ($p < 0.001$). Regarding the region involved, the lumbar spine was the most commonly affected (63%), followed by the thoracic region (20%) and thoracolumbar junction (10%). Cervico-dorsal, lumbosacral, and multiple-level involvement were each observed in 3% of patients. The regional distribution was statistically significant ($p < 0.001$).

Table 4: MRI Structural Changes

Variable	Feature	Number	%	P-value
Vertebral Body Changes	Altered signal	100	100	**<0.001**
	Endplate irregularity	31	31	

	Collapse	15	15	
	Complete destruction	8	8	
	Kyphosis	6	6	
Disc Involvement	Altered signal	93	93	
	Reduced height	31	31	
	Partial destruction	33	33	
	Complete destruction	9	9	
	No involvement	7	7	
	Overall significance			

Table 4: MRI Structural Changes

All patients (100%) demonstrated altered signal intensity in the vertebral bodies on MRI. Endplate irregularity was observed in 31% of cases, vertebral collapse in 15%, complete destruction in 8%, and kyphotic deformity in 6%. Disc involvement was present in the majority of patients, with altered signal intensity seen in 93%, reduced disc height in 31%, partial destruction in 33%, and complete destruction in 9%. Only 7% of patients showed no disc involvement. These findings were statistically highly significant ($p < 0.001$).

Table 5: Soft Tissue & Neural Involvement

Variable	Feature	Number	%	P-value
Paravertebral Involvement	Prevertebral abscess	85	85	
	Paravertebral abscess	83	83	
	Psoas abscess	43	43	
	No abscess	15	15	
Neural Involvement	Epidural abscess	71	71	**<0.001**
	Intradural	7	7	
	Intramedullary	9	9	
	Thecal compression	85	85	
	Cord edema	23	23	
	Cord compression	37	37	
	Overall significance			

Table 5: Soft Tissue & Neural Involvement

Paravertebral involvement was common, with prevertebral abscess seen in 85% and paravertebral abscess in 83% of patients. Psoas abscess was noted in 43% of cases, while 15% of patients had no abscess formation. Neural involvement showed epidural abscess in 71% of patients, intradural involvement in 7%, and intramedullary involvement in 9%. Thecal sac compression was present in 85% of cases, spinal cord edema in 23%, and cord compression in 37%. These findings were statistically highly significant ($p < 0.001$).

Figure: 7.Clinical Presentation & Risk Factors

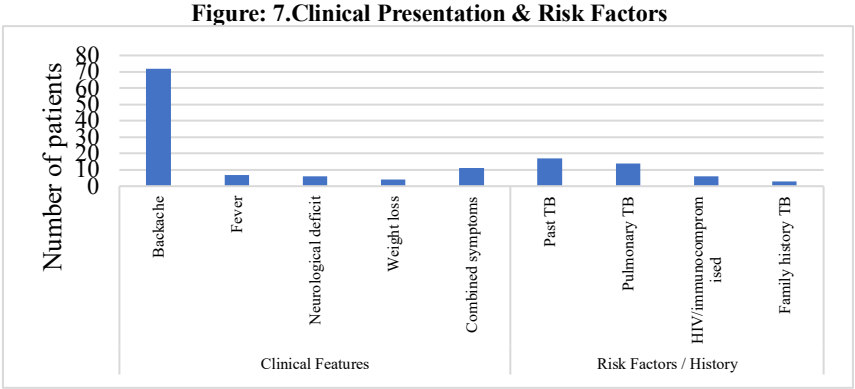
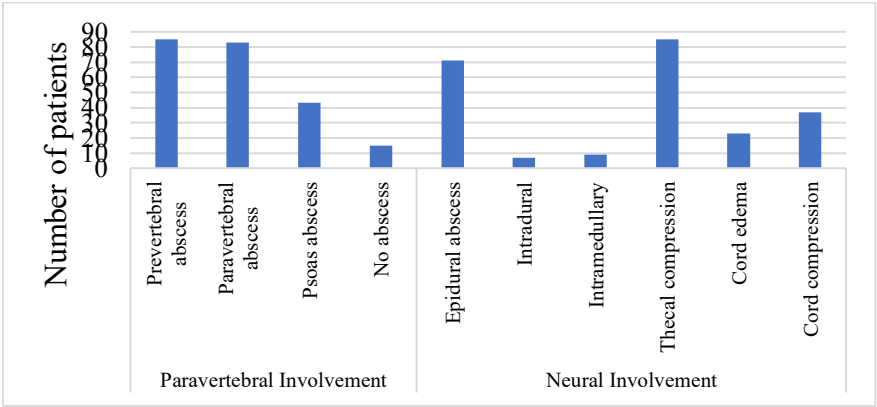


Figure: 8.Soft Tissue & Neural Involvement



DISCUSSION

The present study demonstrated that spinal tuberculosis predominantly affected individuals in the economically productive age group, with the highest incidence seen in the 31–40 years category (29%) and a mean age of 42.0 ± 9.67 years. A similar age distribution has been reported by Jain AK et al., who observed peak incidence in the third and fourth decades, attributing it to higher exposure risk and active disease transmission in this age group [11]. Likewise, Rasouli MR et al. reported a mean age ranging between 35–45 years in patients with spinal tuberculosis, closely aligning with the present findings [12]. Male predominance (59%) observed in this study is consistent with earlier studies, where males were more commonly affected, possibly due to greater occupational exposure and healthcare-seeking patterns [13].

Clinically, backache was the most common presenting complaint (72%), followed by constitutional and neurological symptoms. This observation is in agreement with the findings of Tuli SM, who emphasized back pain as the earliest and most consistent symptom of Pott's spine [14]. The relatively lower incidence of neurological deficits (6%) in the present study may be due to earlier diagnosis facilitated by MRI. In contrast, Moon MS et al. reported higher neurological involvement, likely reflecting delayed presentation in their cohort [15]. Among risk factors, past tuberculosis (17%) and pulmonary TB (14%) were notable, correlating with findings by Burrill J et al., who highlighted prior TB exposure as a significant contributor to spinal involvement [16].

In terms of vertebral involvement, the present study showed that two contiguous vertebrae were most commonly affected (67%), followed by multilevel involvement. This pattern is characteristic of spinal tuberculosis and has been similarly reported by Polley P et al., who described contiguous vertebral involvement as a hallmark feature due to subligamentous spread of infection [17]. The lumbar spine was the most frequently involved region (63%), followed by the thoracic spine, which is comparable to findings by Desai SS, who also reported lumbar predominance in their series [18].

MRI findings in the present study revealed universal vertebral body signal alteration (100%), with frequent disc involvement (93%), endplate irregularity, and varying degrees of vertebral destruction. These findings are consistent with the observations of Moorthy S et al., who reported that altered marrow signal intensity and disc involvement are key MRI features of spinal tuberculosis [19]. The presence of kyphosis (6%) and vertebral collapse (15%) in this study further supports the progressive nature of the disease when not detected early.

Soft tissue and neural involvement were prominent in the current study, with high incidence of paravertebral (83%) and prevertebral abscesses (85%), as well as epidural abscess (71%) and thecal compression (85%). These findings are in concordance with Sharif HS, who emphasized the role of MRI in detecting epidural extension and spinal cord compression with high sensitivity [20]. The occurrence of cord edema (23%) and cord compression (37%) highlights the importance of early MRI evaluation to prevent irreversible neurological deficits.

Overall, the findings of the present study are consistent with previously published literature, reinforcing the pivotal role of MRI in early diagnosis, characterization of disease extent, and detection of complications in spinal tuberculosis. MRI not only facilitates accurate staging of the disease but also aids in guiding appropriate therapeutic interventions, thereby improving clinical outcomes.

CONCLUSION

Magnetic Resonance Imaging (MRI) plays a pivotal role in the comprehensive evaluation of spinal tuberculosis (Pott's spine), offering high sensitivity for early detection and detailed characterization of disease extent. The present study highlights that spinal tuberculosis commonly affects individuals in the middle age group with a male predominance, most frequently involving the lumbar spine and typically affecting two contiguous vertebrae. MRI effectively demonstrates key features such as vertebral marrow changes, disc involvement, paravertebral and epidural abscess formation, and neural compression. Its ability to detect soft tissue involvement and spinal cord changes makes it indispensable for early diagnosis and prevention of complications such as deformity and neurological deficits. Furthermore, MRI aids in disease staging and treatment planning. Thus, MRI should be considered the imaging modality of choice in suspected cases of spinal tuberculosis to facilitate prompt management and improve clinical outcomes.

REFERENCE

1. Tuli SM. Tuberculosis of the skeletal system. 4th ed. New Delhi: Jaypee Brothers; 2010.
2. Jain AK. Tuberculosis of the spine: a fresh look at an old disease. J Bone Joint Surg Br. 2010;92(7):905–913.
3. Moorthy S, Prabhu NK. Spectrum of MR imaging findings in spinal tuberculosis. AJR Am J Roentgenol. 2002;179(4):979–983.
4. Burrill J, Williams CJ, Bain G, Conder G, Hine AL, Misra RR. Tuberculosis: a radiologic review. Radiographics. 2007;27(5):1255–1273.
5. Smith AS, Weinstein MA, Mizushima A, Coughlin B, Hayden SP, Lakin MM. MR imaging characteristics of tuberculous spondylitis vs vertebral osteomyelitis. AJR Am J Roentgenol. 1989;153(2):399–405.
6. Sharif HS. Role of MR imaging in the management of spinal infections. AJR Am J Roentgenol. 1992;158(6):1333–1345.
7. Desai SS. Early diagnosis of spinal tuberculosis by MRI. J Bone Joint Surg Br. 1994;76(6):863–869.
8. Gupta RK, Agarwal P, Rastogi H, Kumar S, Phadke RV. Problems in distinguishing spinal tuberculosis from neoplasm using MRI. Neuroradiology. 1996;38(Suppl 1):S97–S104.
9. Rasouli MR, Mirkoohi M, Vaccaro AR, Yarandi KK, Rahimi-Movaghar V. Spinal tuberculosis: diagnosis and management. Asian Spine J. 2012;6(4):294–308.
10. Polley P, Dunn R. Noncontiguous spinal tuberculosis: incidence and management. Eur Spine J. 2009;18(8):1096–1101.
11. Jain AK. Tuberculosis of the spine: a fresh look at an old disease. J Bone Joint Surg Br. 2010;92(7):905–913.
12. Rasouli MR, Mirkoohi M, Vaccaro AR, Yarandi KK, Rahimi-Movaghar V. Spinal tuberculosis: diagnosis and management. Asian Spine J. 2012;6(4):294–308.
13. Garg RK, Somvanshi DS. Spinal tuberculosis: a review. J Spinal Cord Med. 2011;34(5):440–454.
14. Tuli SM. Tuberculosis of the skeletal system. 4th ed. New Delhi: Jaypee Brothers; 2010.
15. Moon MS. Tuberculosis of the spine: current views in diagnosis and management. Asian Spine J. 2014;8(1):97–111.
16. Burrill J, Williams CJ, Bain G, Conder G, Hine AL, Misra RR. Tuberculosis: a radiologic review. Radiographics. 2007;27(5):1255–1273.
17. Polley P, Dunn R. Noncontiguous spinal tuberculosis: incidence and management. Eur Spine J. 2009;18(8):1096–1101.
18. Desai SS. Early diagnosis of spinal tuberculosis by MRI. J Bone Joint Surg Br. 1994;76(6):863–869.
19. Moorthy S, Prabhu NK. Spectrum of MR imaging findings in spinal tuberculosis. AJR Am J Roentgenol. 2002;179(4):979–983.
20. Sharif HS. Role of MR imaging in the management of spinal infections. AJR Am J Roentgenol. 1992;158(6):1333–1345.