Original Research Article

Role of Plain Radiography and MRI in Evaluation of Spinal Tuberculosis

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Abstract

Background and purpose: Tuberculosis is one of the oldest disease prevalent in India since ages caused by Mycobacterium tuberculosis. There are many forms of tuberculosis in which spinal tuberculosis accounts for 2% of all forms.The mode of infection is through hematogenous route. The clinical features ranges from simple back pain, tenderness, stiffness, deformities of spine.The plain radiography spine is the initial modality of choice in developing countries as it it easily available and cost effective, but can't diagnose the early changes in the disease.In the recent era CT, MRI and PET are frequently used modalities for diagnosing spinal tuberculosis. MRI can be used for early diagnosis due to its high soft tissue contrast resolution and multiplanar reconstruction can be done to identify spinal cord involvement and neural elements involvement. Early diagnosis is important to avoid bone deformities and spinal cord compression to the benefit of the patient.The aim is to study the sensitivity and specificity of radiograph and MRI in evaluating the disease manifestations of spinal tuberculosis.**Methods:** We studied plain radiographs and MRI spine of 60 patients who presented to radiology department with complaints of low backache.**Results:** Plain radiographs were used to detect bony abnormalities, paravertebral densities. MRI is used to detect soft tissue changes ,paravertebral abscesses .ADC and DWI were used to diagnose abscesses.**Conclusion:** MRI is superior to radiographs in identifying soft tissue changes, neural involvement, spinal cord involvement. MRI is more sensitive to detect the severity and extent of disease process. MRI is more superior for early diagnosis of Potts spine and in various stages of disease progression and follow up after treatment.

Keywords: Potts spine, MRI

Introduction

Tuberculosis is the oldest infection and still remains the leading cause of mortality in India.As per WHO ,one third of the population in the world are suffering from tuberculosis.

Yearly six million people become ill and two million people die from tuberculosis and this rise is due to joint and spine tuberculosis

Spinal tuberculosis is the most dangerous form of musculoskeletal tuberculosis.The infection spreads to spine via haematogenous route.

The most common involved areas are lower thorasic and lumbar vertebra .The order of spread is paradiscal ,anterior vertebral, subligamentous [1-5].Pathophysiology consist of caseous necrosis leading to vertebral body collapse and spinal damage .

Plain radiographs can be used in later stages of disease .MRI is sensitive in early detection and diagnosis of edema ,soft tissue changes and spinal cord involvement.

The management of the patient depends on the severity of infection levels of vertebral involvement,so early diagnosis leads to prevent bone deformities and spinal cord compression.

Aims and Objectives

To evaluate the sensitivity, specificity and efficiency of radiographs in correlation with MRI in suspected and proven cases of spinal tuberculosis.

Materials and Methods

- The present study was conducted in the department of Radio diagnosis, Konaseema Institute of Medical Sciences and Research Foundation, Amalapuram
- Study Design: Institution based prospective study.
- Source of Data: Patients presenting to the orthopedic department with symptoms related to low backache were referred to Radiodiagnosis Department.
- Sample Size: 60 patients
- Study Period: July 2021- October 2021.

Study Area: Konaseema Institute of Medical Sciences and Research Foundation, Amalapuram, Andhra Pradesh.

Selection criteria

Inclusion criteria

All patients with complaints of backpain who are clinically suspected /known cases of spinal tuberculosis .

Exclusion criteria

Patients with cardiac pacemakers and metallic implants

Claustrophobic patients

Trauma and postoperative patients.

Procedure

Data Collection

- All clinically suspected patients presenting to orthopedic Department with symptoms (clinical symptoms include backache, stiffness, tenderness) were referred to Department of Radiodiagnosis for MRI in Konaseema Institute of Medical Sciences, between September 2021 – December 2021.
- All patients were informed about the procedure of MRI scan and clinical history was taken from them and consent was taken prior to the procedure.
- The demographic data, clinical symptoms, past medical history all are entered in proformas.

Equipment used

X ray machine –Allengers Model -1000 MA

Kvp used – 80-90

Mas used-60-70

Philips Achieva -1.5 T MRI scanner.

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The suspected patients were subjected to plain radiographs initially and the radiological features are entered in the proformas and later subjected to MRI.

Method of evaluation

Radiographs – X-ray spine including cervical and dorsoloumbar are taken in both anteroposterior and lateral views .

MRI Spine

Scan was done on 1.5 T MRI scanner .Multiplanar reconstructed images can be taken, The pulse sequences acquired are Sagittal T1, T2, STIR, Axial T1, T2, Post contrast –T1Axial and Sagittal. ADC and DWI sequences are also taken.

Results

Distribution of patients according to sex and age-

In this study among 60 patients, 44(73.3%) were males and 16(26.6%) were females. The age group ranges between 10 -80 years. Table showing age and sex distribution

Table 1:Distribution of patients according to sex and age

Age	Males	Females	Total	Percentage
10-20	8	2	10	16.6
21-30	2	6	8	13.3
31-40	6	4	10	16.6
41-50	8	4	12	20.0
51-60	14	0	14	23.3
61-70	4	0	4	10.0
71-80	2	0	2	3.3
	44	16	60	100.0

Vertebra involved –

Potts spine most commonly involves thoracic vertebra (43.3%) followed by lumbar vertebra (26.6%).

Involvement of different vertebra in the spine as seen in the radiographs

Table 2: Distribution of patients according to vertebra involved

Vertebra involved	X ray distribution of patients	Percentage
Cervical	6	10.0
Cervical /thoracic/lumbar	2	3.3
Lumbar	16	26.6
Lumbar/sacral	6	10.0
Thoracic	26	43.3
Thoracic/lumbar	4	6.6
	60	100

Disc space involvement

Disc space was reduced in 56 cases (93.3%) and normal in 4 cases (6.6%).

Table 3:Distribution of patients according to condition

Condition	Disc space	Percentage
Normal	4	6.6%
Reduced	56	93.3%

Vertebral body height – Vertebral body height was reduced in 52 cases (86.6%) and normal in 8 cases (13.3%).

Table 4: Distribution of patients according to vertebral body height

Condition	Vertebral body height	Percentage
Decreased	52	86.6%
Normal	8	13.3%

Associated deformities

Table 5:Distribution of patients according to deformities

Condition	Deformities	Percentage
Absent	48	80%
Present	12	20%

Radiological Findings On MRI: The main sequences used are T1,T2 and FLAIR .The involved regions showed hypointensity on T1 in 54 cases and hyperintensity on T2 in of 54 cases. On FLAIR –the involved regions showed hyperintensity.

Table 6: Radiological Findings On MRI

	T1	T2	FLAIR
Hypointensity	54	4	0
Hyperintensity	4	54	58
No signal intensity changes	2	2	2

Collection/Abscess- This can be found on post contrast study as lesions having peripheral rim enhancement.In our study 90% of cases had collection/abscess while 10% showed no collection/abscess.

Table 7: Collection/Abscess

Condition	Collection/Abscess	Collection/Abscess
Present	54	90%
Absent	6	10%

T1 + contrast enhancement-On post contrast study 58 of cases (97%) showed enhancement .

Table 8: T1 + contrast enhancement

Condition	T1 + contrast enhancement	T1 + contrast enhancement
Absent	2	3.3%
Present	58	96.7%

Spinal cord and nerve root involvement- MRI is the best modality of choice to study the involvement of spinal cord and nerve roots .In this study 38 cases (63.3%) showed spinal cord and nerve root involvement and 22 cases (36.6%)showed no involvement.

Table 9: Spinal cord and nerve root involvement

	Spinal cord and nerve root involvement	Spinal cord and nerve root involvement
Present	38	63.3%
Absent	22	36.6%

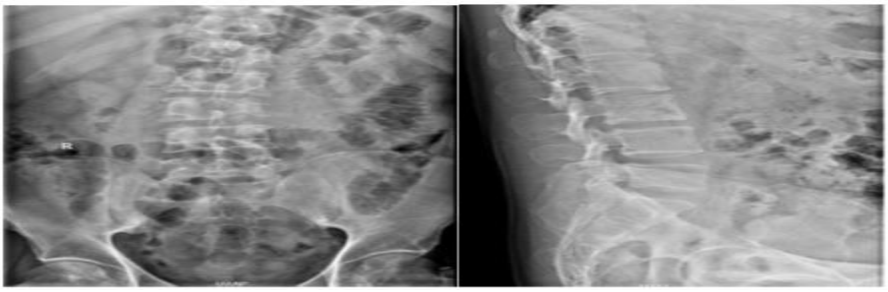

Fig 1: X-ray AP and Lateral view of lumbar spine shows decreased vertebral body height of L3 vertebral body and mild scoliotic deformity to right is noted with sclerosis involving the body of L3 vertebra

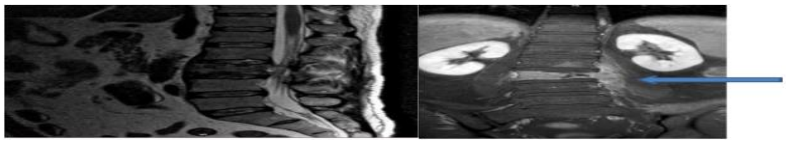

Fig 2: T2W hyperintensity is noted in the body & posterior elements of L2 & L3 vertebrae and in the intervertebral discs of L2-3 and L3-4 vertebra.

On postcontrast study, heterogeneous enhancement of L2 and L3 vertebrae is noted. As compared to X-ray images reveals decreased vertebral body height of L3 vertebral body with mild scoliotic deformity to right and sclerosis involving the body of L3 vertebra.

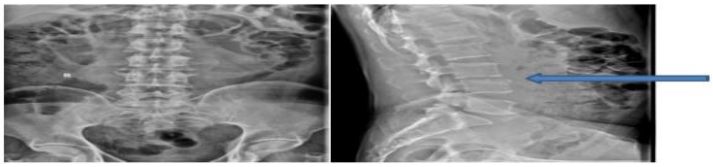

Fig 3: Shows reduced disc space at L3 - L4 vertebral level with osteophytes, bony erosions and surrounding sclerosis in the body of L3 vertebra and reduced disc space at L3 - L4 vertebral level.

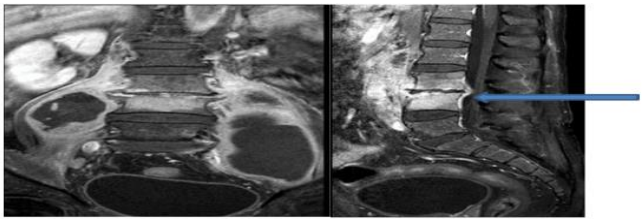

Fig 4: Spondylodiscitis involving the L3 -L4 vertebral bodies with erosion of inferior end plate of L3 and superior end plate of L4 and involvement of the intervening intervertebral disc spaces is noted. Bilateral psoas abscesses are seen extending from L3 to L5 lumbar vertebrae on the right and L3 to S3 vertebra on the left with subligamentous extension of collection along the anterior and posterior longitudinal ligaments from superior end plate of L3 to inferior end plate of L4 vertebral body causing thecal sac compression.

As compared to x-ray it shows reduced disc space at L3 - L4 vertebral level with osteophytes and bony erosions with surrounding sclerosis in the body of L3 vertebra and reduced disc space at L3- L4 vertebral level

Discussion

Tuberculosis is the most common infection of the spine until the last century but it showed decline during the period of 1960's-70's due to awareness of public health programmes and drugs available for treating pott's spine.Potts spine is the most common extrapulmonary form of tuberculosis[10]. Plain radiography is the initial investigative modality which gives the information regarding diagnosis of tuberculosis. Plain radiography helps in detecting most of the cases of TB spine but it cannot identify the early changes of bone involvement and the bone destruction may occur even before the diagnosis .In this study male dominance and clinical pattern of onset is in accordance with observation of other studies. The regional distribution of vertebra matches Bikha ram's research as well. The patterns of involvement of vertebra are detected in MRI which cannot be identified on plain radiographs.The main patterns are paradiscal,anterior,central and posterior elements .

In paradiscal type the infection starts at the metaphysis and extends into the vertebral disc space by eroding the cartilaginous end plates.In tubercccular spondylitis ,there will be sharp destructive margins with no sclerotic margins which differentiates from pyogenic spondylitis.

In the anterior pattern the vertebral body corner is involved ad spreads to adjacent vertebra along the anterior longitudinal ligament.Anterior vertebral body collapse leads to kyphosis .

In the central pattern ,infection starts in single vertebral body and it may spread to adjacent vertebra,but the disc is normal. The posterior pattern is very rare .In the assessment , treatment and follow up of TB spine ,MRI became the most valuable investigation.The complications like abscess formation , spinal cord involvement and extension into spinal canal causing arachnoiditis can be prevented by early diagnosis on MRI.The features which favours tuberculous spondylitis are sparing of intervertebral discs until later stages of disease,anterior vertebral body corner involvement,multiple contiguous vertebral body involvement,subligamentous spread ,paraspinal abscess formation with calcification and vertebral body destruction.In pyogenic infections there may be haematogenous or direct spread from adjacent structures.In pyogenic spondylitis there will be early involvement of intervertebral discs with loss of disc height and disc herniation.Early changes include bone marrow edema seen as hyperintense signals on T2 and STIR .Intervertebral disc involvement is also seen as hyperintense signals on T2 and STIR. Later there may be formation of phlegmon and abscess which can be differentiated on contrast studies and DWI .In this way MRI is useful to differentiate between pyogenic and tubercular spondylitis based on the imaging appearances .We obtain the following information through MRI

1. The site of involvement
2. Patterns of involvement of vertebra
3. Number of vertebrae involved-contiguous or not
4. Compression fractures
5. Vertebral canal size
6. Spinal cord compression
7. Kyphosis
8. Paravertebral soft tissue swelling or abscess

Though MRI is expensive than x-ray or CT, it gives better idea about the extent of disease and thus helps better in providing the treatment and also accessing the prognosis.

Chemotherapy gives better results in the early diagnosed cases. Anti-tubercular drugs reaches the cavities and caseous lesions in the spine, however if the bone involvement is severe, surgical procedure remains the main stay .Surgical treatment whether anterior or posterior approach is based on the MRI findings.

Conclusion

In patients suspected for TB spine or Pott's disease, MRI is much more accurate and superior diagnostic modality compared to x-ray. It is more sensitive than x-ray to find the status and severity of the disease and helps in detection and diagnosis of TB spine better. MRI also helps in detecting bone and soft tissue diseases, helps early detecting neurological involvement, helps for early treatment thus early prognosis and follow up. Several other studies help to understand that MRI is far more superior to conventional x-ray in detecting early spinal tuberculosis and spinal cord involvement.

Conflict of Interest: Nil
Source of support: Nil

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