MRI Evaluation of Tuberculosis of Spine

Rashmi U. Turamari¹, Pradeep Kumar Chandandur Nagarajaiah², Chakenalli Puttaraju Nanjaraj³, N.L. Rajendra Kumar⁴, Sowmya Jagadish⁵, Pradeep Hagalahalli Nagajegowda⁶, Ashwin Raghavendra⁷

¹Resident, ²Assistant Professor, ³Professor, ⁴Professor and HOD, ⁵Resident, ⁶Associate Professor, ⁷Resident, Department of Radiodiagnosis, Mysore Medical College and Research Institute, Mysuru, India

Corresponding author: Pradeep Kumar Chandandur Nagarajaiah, #32, Chandrodaya, Behind Veerabadreshwara Flour Mill, Bogadi 2nd Stage, Mysuru, Karnataka, India-570009

DOI: 10.21276/ijcmsr.2018.3.3.10

ABSTRACT

Introduction: Tuberculosis of spine accounts for 50% of all musculoskeletal tuberculosis. Magnetic resonance imaging is an excellent imaging modality for the diagnosis of tuberculosis of the spine and can diagnose tuberculosis of the spine four to six months earlier than conventional methods offering the benefits of early detection and treatment. The aim of this study was to evaluate various MR imaging features along with demographic distribution and clinical presentation of spinal tuberculosis.

Material and methods: A descriptive study was carried out on 30 patients who presented with strong clinical suspicion of spinal tuberculosis over a period of 23 months. All subjects underwent plain and contrast-enhanced magnetic resonance imaging. The positive cases of spinal tuberculosis were evaluated on the basis of the signal intensities and morphological abnormalities seen on magnetic resonance imaging.

Result: In this study, male preponderance was noted with a backache being the most common symptom. Seventy percent (21) of cases had epidural involvement, 33.3% (10) of the patients had endplate irregularity, 26.6% (8) of patients had a collapse of the vertebral bodies and 10% (3) of patients had complete destruction of vertebral bodies. Ninety percent (27) patients had intervertebral disc involvement. Pre and paravertebral involvement were noted in 83.3% (25) of cases and 40% (12) of cases had psoas abscess.

Conclusion: MRI is a non-invasive investigation of choice in the diagnosis spinal tuberculosis and hence appropriate treatment can be started early

Key words: TB Spine, Epidural Abscess, Intradural Abscess, Gibbus, Vertebral Body Collapse, PSOAS Abscess, Paravertebral Abscess, Endplate Irregularity

INTRODUCTION

Approximately 10% of patients with extrapulmonary tuberculosis have skeletal involvement. The spine is the most common skeletal site affected, followed by the hip and knee.¹ Spinal involvement is usually a result of the hematogenous spread of Mycobacterium tuberculosis into the cancellous bone of the vertebral bodies. The primary infection is either a pulmonary lesion or the lymph node of the mediastinum, mesentry, cervical region, genitourinary system or other viscera. It can result in a collapse of vertebrae and fracture of bones leading to neurological damage. In advanced untreated cases, this can lead to compression of the spinal cord and complete paralysis.

Magnetic resonance imaging is an excellent imaging modality for the diagnosis of tuberculosis of the spine. It is more sensitive and specific because of multiplanar imaging which reveals better diagnostic details. The aim of this study was to evaluate role of Magnetic resonance imaging in diagnosis of spinal tuberculosis, various MR imaging features that help in differentiating between the various stages of disease progression along with demographic distribution and clinical presentation of spinal tuberculosis. Contrast enhancement is best seen on T1-weighted fat saturation sequences, where there is enhancement of only those tissues that takes up the Gadolinium. Contrast enhancement is helpful to define para spinal and epidural disease and is useful to assess the extent of soft tissue mass.³

MATERIAL AND METHODS

A descriptive study was carried out on 30 patients over a period of 23 months from November 2015 to September 2017 in Department of Radiodiagnosis, Mysore Medical College and Research Institute, Mysuru. Institute Ethics Committee Clearance was obtained before the start of the study.

Patient selection criteria

The study included patients from 2 to 80 years of age including both men and women with or without neurological
deficit at spinal level with strong clinical suspicion of spinal tuberculosis. Patients with a history of trauma were not a part of this study. Also, patients with a history of claustrophobia, the history of metallic implants, cardiac pacemakers and cochlear implant in-situ were excluded from this study.

Method
The MRI examination of the spine was performed using standard surface coils and body coils, of GE Optima MR360, 1.5 Tesla. Detailed clinical history, physical and systemic examination findings were noted in addition to the laboratory investigations. Patients fulfilling the inclusion and exclusion criteria underwent plain and contrast-enhanced Magnetic resonance imaging.

Scanning technique
MRI examination of the spine was performed in the sagittal, coronal and axial planes. T1, T2, STIR and post contrast T1 sequences were obtained. A slice thickness of 4 mm was used for both sagittal and axial images. A field of view of 350 mm and 200 mm was used for the sagittal and axial images, respectively. Omniscan (Gadodiamide) was intravenously injected in all cases of suspected tuberculosis.

STATISTICAL ANALYSIS
Descriptive statistics were presented using percentages and frequencies for nominal data while meaning, standard deviation, median, minimum and maximum for continuous/discrete variables. The results were presented in figures, tables, frequency graphs and pie charts.

RESULTS
Out of the 30 patients, the majority of patients belonged to the third and fourth decades, the percentage is 30% and the majority were male patients (57%). Backache was the main mode of presentation followed by combined symptoms including backache, weight loss, and fever. Neurological complaints were present in 8% (4) of cases, 16% (5) of cases had past history of tuberculosis, 13.3% (4) cases had concurrent pulmonary tuberculosis and 6.6% (2) patients had the retroviral infection.

The most common presentation was two vertebral involvements, seen in 20 patients (66.6%). Lumbar region is the most common region of involvement with 70% (21) cases having epidural involvement. Intradural and intramedullary involvements seen in only 6.6% (2) cases each (Table I).

All the patients had altered signal changes in the involved vertebra, 33.3% (10) of the patients had endplate irregularity, 26.6% (8) of patients had the collapse of the vertebral bodies and 10% (3) of patients had complete destruction of vertebral bodies. About 6.6% (2) of patients had already developed kyphotic deformities at the time of examination (Table II).

Case-1: Clinical history: History of back ache (Sagittal T2WI image shows altered signal intensities involving L4-L5 disco vertebral unit, with complete collapse of L4-L5 disc, with pre and para-vertebral collection indenting on the thecal sac posteriorly.) Case-2: Clinical history: History of back ache (Sagittal T2 image showing multiple level involvements. Altered signal intensity noted in D4, D5 and D6 vertebrae with partial destruction of D5-D6 disc with partial collapse of D5 vertebra. Peripherally enhancing pre-vertebral and epidural abscess with adjacent cord edema is also noted. Altered signal intensity and anterior wedge collapse of D12 vertebra is noted.)

<table>
<thead>
<tr>
<th>Imaging features</th>
<th>Number of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altered signal changes only</td>
<td>30</td>
<td>100%</td>
</tr>
<tr>
<td>End plate irregularity</td>
<td>10</td>
<td>33.3%</td>
</tr>
<tr>
<td>Vertebral body collapse/Compression fracture</td>
<td>8</td>
<td>26.6%</td>
</tr>
<tr>
<td>Complete destruction of the vertebral body</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>Spinal deformity (kyphosis)</td>
<td>2</td>
<td>6.6%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MRI features</th>
<th>Number of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevertebral abscess</td>
<td>25</td>
<td>83.3%</td>
</tr>
<tr>
<td>Paravertebral abscess</td>
<td>25</td>
<td>83.3%</td>
</tr>
<tr>
<td>Psoas abscess</td>
<td>12</td>
<td>40%</td>
</tr>
<tr>
<td>No pre and paravertebral abscess</td>
<td>5</td>
<td>16.6%</td>
</tr>
</tbody>
</table>

Chart-1: Chart showing the MR imaging features of intervertebral disc involvement
Turamari, et al. MRI Evaluation of Tuberculosis of Spine

9
5
shows involvement of
Back pain was the presenting symptom
11
showed decreased height of intervertebral disc
4
10
7
by Ferrer MF et al.
was between 20-30 years, which was similar to study done
In this study, the maximum number of patients belonged
involvement and the next common was 23.3% involving
involvement and all of the above findings.
Resonance Imaging is the most valuable investigation in the
psoas abscess
disc involvement, epidural abscess, paravertebral abscess,
causes bony destruction and collapse of the vertebrae, with
Tuberculosis is the most common infection worldwide
(11) of cases (case photographs 1-4).
Ninety percent (27) patients had intervertebral disc
involvement and all the patients showed altered signal
intensities. Reduced intervertebral disc space was observed
in 30% (9) patients, 33.3% (10) patients had partial
destruction and 26.6% (8) patients had complete destruction
of the intervertebral disc and 3 patients did not show disc
involvement (Chart I).
In this study, 83.3% (25) of cases had pre and paravertebral
involvement and 40% (12) cases had frank psoas abscess. In
16.6% (5) of cases pre and paravertebral involvement was not
seen (Table III). In this study, 83.33% patients had thecal
collapse and compression, Cord edema noted as the increasedT2 signal is
seen in 20% (6) cases and cord compression is seen in 36.6%
(11) of cases (case photographs 1-4).

**DISCUSSION**

Tuberculosis is the most common infection worldwide
and it can affect almost any part of the human body, most
commonly the lungs. The spine is affected in 50% of the cases
of skeletal tuberculosis. Tuberculous infection of the spine
causes bony destruction and collapse of the vertebrae, with
a gibbus or kyphotic deformity, skip lesions, intervertebral
disc involvement, epidural abscess, paravertebral abscess,
psoas abscesses and edema in the soft tissue planes. Magnetic
Resonance Imaging is the most valuable investigation in the
patients with spinal tuberculosis, as it can clearly demonstrate
all of the above findings.
In this study, 60% of patients were having lumbar spinal
involvement and the next common was 23.3% involving
thoracic vertebral bones, 10% patients had involvement of
thoracolumbar and only 3.33% patients had multiple level
involvement of the spine. Total of 72 vertebrae was affected
in 30 patients. An average number of vertebrae affected per
patient was 2.26.
In this study, the maximum number of patients belonged
to the age group 30-40 years and next common age group
was between 20-30 years, which was similar to study done
by Ferrer MF et al.1 Back pain was the presenting symptom
in 70% of the cases and other common complaints were
neurological symptoms, fever, and weight loss. Past history of
tuberculosis was present in 16.6% of the patients and 13.3%
of patients had active pulmonary tuberculosis. In the present
study, 6.6% of the patients were HIV affected patients.
Every patient had altered signal changes in the involved
vertebral bodies. Endplate irregularity was noted in 33.3%
of the patients, 13.3% of patients had the collapse of the
vertebral bodies, and 26.6% of patients had vertebral body
collapse and compression fracture and 10% of patients had
complete destruction of vertebral bodies. About 6.6% of
patients had already developed spinal deformities at the time
of examination. Similar studies done by Sajid Ansari et al.
shows that 26.7% of patients had spinal deformity and 6% of
patients had complete destruction of vertebral bodies.6
Ninety percent (27) of patients had intervertebral disc
involvement and all the patients showed altered signal
intensities, 30% (9) patients had reduced intervertebral disc
height, 33.3% (10) patients had partial destruction and 26.6%
(8) patients had complete destruction of the intervertebral
discs, 3 (10%) patients had no disc involvement.
A study conducted by Sinan et al.7 shows involvement of
intervertebral discs in 72% of cases and a study by Ledermann
et al (2003)8 showed decreased height of intervertebral disc
space in 50% of cases.
Due to lack of proteolytic enzymes subligamentous spread
along the anterior and posterior ligaments is common in
spinal tuberculosis. Posteriorly it can involve extradural or
intradural region or may involve spinal cord. The lesion is
called granulation tissue when it showed hypo to intermediate
signal intensity on T1W images, hyperintensity on T2W
images and homogenous enhancement on post gadolinium
images.9
Formation of cold abscess and involvement of pre and
paravertebral soft tissue favors the diagnosis of spinal
tuberculosis. If the infection is not controlled by early
intervention, adjacent muscle involvement occurs resulting in
psoas abscess. Calcification or bone fragments within the pre
/paravertebral soft tissue are called ‘rice bodies’, specific for a
tubercular abscess. They are identified as small areas of signal
void on T2W images. Presence of ‘rice bodies’ within the pre
and the paraspinal abscess was reported in the literature by
Huang et al.10
In all the cases of this study contrast enhancement
examination was done using Gadolinium (Omniscan)
and T1 sagittal and axial images were taken. Two types of
contrast enhancement were observed in the present study.
Heterogenous enhancement of involved vertebral bodies and
intervertebral discs.
Ring like peripheral enhancement of involved vertebral
bodies and intervertebral discs.
Epidural and pre and paravertebral collections show rim
enhancement with central hypointense areas of necrosis.
It has been reported that thick rim enhancement in these
abscesses is strongly suggestive of tuberculous infection and
is not seen in non-granulomatous spondylitis.11
Spinal cord involvement was very clearly seen on sagittal
and axial MR images. 83.33% (25/30) patients had thecal
compression. Out of which 36.67% (11/30) had actual cord
compression. Cord edema is seen as increased T2 signal intensity and was present in 20% (6/30) patients. Thus in decreasing order of frequency, the progression of compression was thecal compression, cord compression, and cord edema. The high signal on T2 W images within the cord could represent either cord edema or myelomalacia. It is important to differentiate these two entities because edema is reversible whereas myelomalacia is not. Unfortunately, based on imaging appearance alone it was not possible to differentiate between cord edema and myelomalacia and clinical history and duration of disease have to be taken into account.

Sharif et al. have reported a higher incidence of arachnoiditis in their study (33%). Sharma et al., however, reported that only 9% of tubercular spinal arachnoiditis in their study, which was caused by spinal tuberculosis. Dorsal region was the commonest site of involvement in both these studies. On T1W images arachnoiditis is seen as shaggy cord-CSF interface. On post- gadolinium images there was a meningeal enhancement. However, arachnoiditis, as a complication of spinal tuberculosis was not seen in any of the patients in this study.

Our study showed that MRI is an accurate modality in diagnosing and evaluating spinal tuberculosis in early stages and serial MRI scans can also be used to assess the disease response to treatment which is comparable to many studies. Limitation of our study was follow up of a few patients could not be done.

CONCLUSION

MRI imaging findings are helpful in diagnosing as well as evaluating the extent of spinal tuberculosis. MRI should be considered as the first line imaging modality for patients with suspected spinal tuberculosis, as it provides necessary information to the surgeon for proper management by providing accurate vertebral involvement, intra-osseous abscess, vertebral disc involvement, skip lesions, early soft tissue involvement, spinal cord affection, dural and intradural involvement.

MRI is an accurate modality in diagnosing and evaluating spinal tuberculosis in early stages and serial MRI scans can also be used to assess the disease response to treatment.

REFERENCES