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ORIGINAL ARTICLE

The Diagnostic Accuracy of Magnetic Resonance Imaging (MRI) For Detection of Spinal Tuberculosis (TB)

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ABSTRACT

Background: Diagnosis of spinal tuberculosis is a major challenge. It is usually made using a blend of, laboratory , imaging investigations, clinical and none of these are 100% confirmatory. The objective of this study was to determine the diagnostic accuracy of magnetic resonance imaging (MRI) for detection of spinal tuberculosis (TB)

Methodology: This cross-sectional study was conducted in the department of Radiology, Lahore General Hospital, on 150 patients, with suspicion of spinal TB from January,2020 to August,2020. Patients having Backache for >6 months, loss of appetite, loss of weight >10% in previous one month, raised ESR >15 mm/hour, and positive sputum results for AFB were included. The patients underwent full spinal MRI scan. MRI was done using 1.5 Tesla MR for diagnosis of spinal TB. The diagnosis of spinal TB was then confirmed on histopathologic reporting.

Results: Mean age of study participants was 47.83±9.65 years. There was male predominance with 93 (62.0%) males and 57 (38.0%) female patients. The mean duration of spinal TB symptoms was 11.52±3.12 months. On accuracy of MRI, there were 83 (55.3%) true positive cases, 10 (6.67%) false positive, 08 (5.33%) false negative and 49 (32.67%) true negative. The sensitivity of MRI was 91.2%, specificity 83.1%, positive predictive value (PPV) 89.2% and negative predictive value (NPV) 86.0%.

Conclusion: Sensitivity of MRI was 91.2% and specificity 83.1%.MRI is an ideal non-invasive imaging modality for the diagnosis of spinal TB.

Keywords: Magnetic resonance imaging, Spinal, Tuberculosis.

Authors' Contribution:	Correspondence:	Article info:
[1]Conception; Literature research; manuscript design and drafting[1,2]Critical analysis and manuscript review;[3,4]Data analysis; Manuscript Editing.	*Maryam Ahsan Khokhar* *Email: shezamaryam67@gmail.com*	*Received: December 5, 2020* *Accepted: September 26, 2020*

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Introduction

Tuberculosis though being an ancient disease, is still a major health concern.[1,2] In 2018, 10 Million cases of TB were reported and deaths reported were1.5 million.[3] In the past two decades, progress was made in elimination of tuberculosis and as a response, a reduction of 0.2/100,000 cases has been reported in US and 7.3/100,000 cases in UK.[4,5] Spinal Tuberculosis has a total prevalence up to 35% among all cases of extra-pulmonary tuberculosis.[6] Diagnosis is still a major challenge. Diagnosis is usually made using a combination of clinical, laboratory and imaging investigations, and none of

these are 100% confirmatory. The clinical symptosms are axial malaise and axial pain, however these are non-specific. The specific symptoms appear at advanced disease stage and include; development of neurologic deficit, cold abscess and kyphotic deformity but at this stage the mortality is very high.[7, 8] The laboratory markers such as Ziehl Nielson stain, culture reporting have poor accuracy because of less bacterial load in spinal TB (<105 bacteria/mL).[9]

Magnetic resonance imaging (MRI) is now commonly used for evaluation of patients having suspicion of spinal tuberculosis. MRI has several benefits as it is non-invasive, can be performed to diagnose spinal TB at early stages, the whole spinal cord at a single time can be scanned and repeated scans can be performed, without any significant harm to the patient.[10]

The aim of the study is to determine the diagnostic accuracy of MRI for diagnosis of spinal tuberculosis taking histopathological findings as a gold standard test. As very little is published regarding accuracy of MRI for diagnosis of spinal tuberculosis, and that too with variable results, the study can be helpful in determining whether MRI can be reliably used for diagnosis of spinal tuberculosis.

Methodology

This cross-sectional study was conducted on 150 patients with suspicion of spinal TB. The study duration was 8 months, conducted from period of January 2020 to August 2020 in the department of Radiology, Lahore General Hospital, Lahore. Patients having Backache for >6 months, loss of appetite, loss of weight >10% in previous one month, raised ESR >15 mm/hour, and positive sputum results for AFB were included. Patients having contra-indication to MRI (those having permanent pacemaker, ocular implants or defibrillator or allergy to contrast media) were excluded. Informed consent from each patient was taken.

The sample size for this study was calculated by taking estimated prevalence of spinal tuberculosis 35%,[6] expected sensitivity of MRI 97.9% and specificity 81.1% for diagnosing spinal tuberculosis[11], taking desired precision level of 4.0% for sensitivity and 8.0% for specificity.

For all patients, detailed information regarding clinical symptoms, and laboratory findings was collected. The patients underwent full spinal MRI scan (as a routine protocol for evaluation of underlying pathology). MRI was done using 1.5 Tesla MR. The following criteria was used to diagnose spinal TB on MRI findings; on T2 images, increase in signal strength on on T1 images and vertebral bodies, decrease in signal intensity on both vertebral discs and bodies, existence of collections within the in adjacent paravertebral soft tissues or vertebra, vertebral body damage with reduction in body height of more than half, or irregularity of margins of vertebral body end plate. Biopsy specimens of the affected segments were taken either transpedicular or after surgical debridement and the diagnosis was confirmed using histopathological examination, presence of acid-fast bacilli on biopsy specimens, or presence of epithelioid cells.

Data analysis was done using SPSS v25. 2×2 table was formulated to calculate diagnostic accuracy of MRI against histopathologic examination.

Results

Mean age of the study participants was 47.83±9.65 years. There was male predominance with 93 (62.0%) males and 57 (38.0%) female patients. Mean body mass index (BMI) was 28.56±3.28 Kg/m^2. The mean duration of spinal TB symptoms was 11.52±3.12 months.

On accuracy of MRI, there were 83 (55.3%) true positive cases, 10 (6.67%) false positive, 08 (5.33%) false negative and 49 (32.67%) true negative. The accuracy of MRI was 91.2%, specificity 83.1%, PPV 89.2% and NPV 86.0%. (Table 2).

Table I: Baseline Characteristics.	
Mean Age	47.83±9.65
Gender	
Male	93 (62.0%)
Female	57 (38.0%)
BMI (Kg/m^2)	28.56±3.28
Disease Duration (Months)	11.52±3.12

Table II: Accuracy of MRI in Diagnosis of Spinal TB.			
Spinal TB on MRI	**Spinal TB on Histopathology**		**Total**
	Yes	**No**	
Yes	83	10	93
No	08	49	57
Total	91	59	150
Sensitivity: 91.2%			
Specificity: 83.1%			
Positive Predictive Value (PPV):89.2%			
Negative Predictive Value (NPV): 86.0%			

Discussion

Spinal TB is a common problem around the globe. It occurs in 1.0% patients infected by pulmonary tuberculosis. According to literature, 25% to 60% of all bone contaminations are caused by tuberculosis.[12,13] Incidence of pyogenic spondylitis (0.15% to 3.0%) is much lower as compared to the tuberculous disease. The accurate differential diagnosis of spinal TB is necessary as the treatment of TB spondylitis is entirely different from that of pyogenic spondylitis.[14]

MRI has made huge improvements in the evaluation of spinal infections. Because of its non-invasive nature, it provides rapid diagnosis of underlying pathologies.[15,16] The specific nature of MRI imaging can help to diagnose disease even at early stages of infection. However, some authors have reported that MRI findings in some cases may overlap the diagnosis of spinal TB in patients with other spinal disorders.[17,18] Therefore, determining the diagnostic accuracy of MRI for diagnosis of spinal TB is of prime importance.

In present study, we found that MRI is 91.2% sensitive and 83.1% specific for diagnosis of spinal TB. A similar study by Ahmad et al. on accuracy of MRI containing 147 patients with suspicion of spinal TB reported sensitivity of 92.13%, specificity 84.48%, PPV 90.11% and NPV 87.50%.[19]

Kanna et al. conducted a study on correlation of MRI findings with tissue studies. The authors used different individual clinical findings on MRI to determine the accuracy. Among these, sub-ligamentous spread, vertebral collapse and large abscess formation with thin wall were found to have highest accuracy, with sensitivity ranging from 91.14% to 69.62% and specificity ranging from 81.69% to 50.70%.[15]

While Sexena et al. reported much higher sensitivity and specificity of MRI. They reported that MRI is 97.9% sensitive, and 81.1% specific for diagnosis of spinal tuberculosis taking histopathology as gold standard.[11]

There are still limited number of studies that have determined the accuracy of MRI for evaluation of spinal TB. There is a still a need to conduct more studies with larger sample sizes to strengthen the evidence about the accuracy of MRI for spinal TB.

There are certain limitations of this study, we took histopathology as gold standard test but it can give false negative results in some cases, that may affect accuracy of MRI. The other highly sensitive test for diagnosis of spinal TB is PCR but this test also gives false positive results as it also detects dead bacteria, therefore cannot be used as gold standard test. However, on the basis of the study results and existing literature, it is recommended that early MRI scans should be done in patients having suspicion of spinal TB. Early diagnosis of disease can help to prevent mortality associated with spinal TB.

Conclusion

Sensitivity of MRI was 91.2% and specificity 83.1%. MRI is an ideal non-invasive imaging modality for the diagnosis of spinal TB.diagnosis of spinal TB.

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