

A prospective study on clinical, radiological, and pathological features in early diagnosis of spinal tuberculosis



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ABSTRACT

Background: Spinal tuberculosis (TB) is the most common of musculoskeletal TB. The diagnosis of spinal TB is difficult due to the non-specific symptoms. Clinical assessment, along with radiological features and biopsy, plays an important role in early diagnosis of spinal TB. **Aims and Objectives:** The aims of this study were to analyze clinical, radiological, and pathological features for early diagnosis of spinal TB and to identify other pathological conditions mimicking spinal TB. **Materials and Methods:** The present prospective study includes 110 patients. All patients were clinically and radiologically examined. The patients underwent percutaneous biopsy of the involved region and tissue samples were subjected to histopathological examination (HPE) and cartridge-based nucleic acid amplification test (CBNAAT) for definitive diagnosis of spinal TB. **Results:** Out of 110 cases, male preponderance (65.5%) was seen in comparison to females (34.5%). Dorsal spine (53.7%) and lumbar spine (41.3%) were the most common site of involvement. One hundred patients were confirmed as spinal TB by histopathology and molecular diagnosis. Histopathology alone could make diagnosis in 40 cases while molecular diagnosis in 100 cases and 10 cases were non-tuberculous in etiology (metastatic deposits of carcinoma in five cases, pyogenic spondylodiscitis in three cases and primary neoplastic lesion in two cases, one case of giant cell tumor, and one case of hemangioma each). **Conclusion:** Spinal TB is a deep-seated and paucibacillary condition difficult to diagnose due to inadequate sample. Therefore, multipronged approach by direct smear examination, HPE, and molecular diagnosis is required for early diagnosis. Culture is the gold standard for diagnosis while CBNAAT is highly sensitive and specific that enables rapid detection of tubercular bacilli and should be considered as first-line test.

Key words: Cartridge-based nucleic acid amplification test; Histopathology; Percutaneous biopsy

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INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by various strains of mycobacteria usually *Mycobacterium TB*. India alone has 1/5 of the total world population of tubercular patients.^{1,2} Among 8.6 million people who developed TB about 3% were estimated to have spinal TB in 2012.³ Of all the patients suffering from TB, nearly 1–2% have involvement of the musculoskeletal system. Spinal TB is the most common form of skeletal TB, constituting about 50% of all cases, described firstly by Sir Percival Pott after

whom the disease is commonly known as Pott's spine.^{4,5} The diagnosis of spinal TB is difficult due to the non-specific symptoms. Radiology plays an important role in early diagnosis of spinal TB but cannot confirm diagnosis. Biopsy of the involved region helps in increasing the yield of definitive diagnosis in case of suspected spinal TB. Culture is the gold standard method for the diagnosis of TB but can be negative in partially treated cases having slow replication rate of 6–8 weeks period, and it requires 10–100 bacilli/mL (live bacilli) in clinical specimens to become culture positive. Cartridge-based nucleic acid amplification

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test (CBNAAT) is a fast and accurate alternative diagnostic test to culture in spinal TB.

Aims and objectives

The aims of this study were to analyze clinical, radiological, and pathological features in establishing early diagnosis of spinal TB and to identify other pathological conditions mimicking spinal TB.

MATERIALS AND METHODS

The present prospective study was conducted in the Department of Orthopedic Surgery, Rohilkhand Medical College and Hospital, Bareilly, from November 2019 to November 2020 with the objective to study the clinic-radiological and pathological correlation in spinal TB. A total of 110 patients were included in the study. Inclusion criteria included patients of all age group, patient willing to give informed consent, patients of both sexes, the patients with clinical and/or radiological features suggesting of spinal TB, any patient not responding to ATT, and any patient who was suspected for any other pathology, but biopsy came out to be TB. Exclusion criteria included patient not giving consent, patient not willing for biopsy, any contraindication for biopsy or surgery, and biopsy not obtainable (inaccessible sites). Initially, X-ray of the involved region and further evaluation with magnetic resonance imaging (MRI), computed tomography (CT), or ultrasound is done. After clinical and radiological examinations, percutaneous biopsy of the involved region was done and sent for CBNAAT, culture, and histopathological examination (HPE).

Percutaneous biopsy procedure

Transpedicular approach – The patient is placed in the prone position under local anesthesia and the needle is introduced along the course of the pedicle to penetrate the vertebra at the groove between the lateral aspect of the superior articular facet (mammillary process) and the transverse process. In this area, the cortex is typically thin and the biopsy needle is perpendicular to the bone, decreasing the incidence of slippage. More than 50% of the cancellous bone, the vertebral body is accessible through this approach. The potential risk of this procedure is violation of the inferior and medial wall of the pedicle, which may lead to hematoma formation or infection into the spinal canal, which can compromise spinal cord. Consideration of the external diameter of the trephine and the internal width of the pedicle is always mandatory in this approach. The needle should always be toward the lateral and superior wall of the pedicle. The needle is placed in caudal to cranial angulation than a traditional vertebroplasty approach in an attempt to access intervertebral disc and endplate (Figure 1).

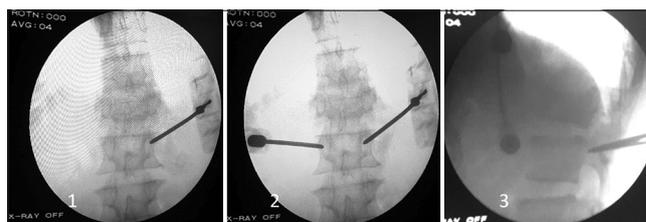


Figure 1: Transpedicle biopsy

Transforminodiscal – The superior concave surface of the vertebra is the entry point of the needle. The superomedial part of the vertebra is not accessible by this approach.

Direct lateral approach – For lumbar spine: The patient is placed in lateral position. Level confirmed under C-arm, local anesthesia given, and needle placed retroperitoneal and trans-psoas (Figure 2). Since the biopsy trocar and needle are thin, peritoneal breach does not occur and lumbar plexus is not damaged.

RESULTS

This study includes 110 cases, male preponderance (65.5%) was seen in comparison to females (34.5%). In our study, laborer showed the higher incidence (37.5%) of involvement. Pain in mid-back was the most common symptom among the patients (35.1%) while pain in low back was the second most common symptom (27.9%). Evening rise of temperature was among 69.1% of patients, weight loss was among 67.3% of patients, and loss of appetite was among 68.2% of patients. Deformity was present among 21.8% of patients. Involvement of dorsal spine and lumbar spine was among 35.5% and 28.2% of patients. Chronic tubercular granulomatous infection containing langhans giant cell formation and epithelioid cell formation histological finding was seen among 83.6% of patients. Chronic non-specific granulomatous histological finding was seen in 8.2% of patients (Figure 3). Acid-fast bacteria (AFB) stain and CBNAAT were positive among 21.8% and 90.9% of patients, respectively (Figure 4). Tubercular spondylodiscitis diagnosis was among more than half of patients (58.1%) while the percentage of non-tuberculous lesion was 9%.

DISCUSSION

TB is the most common infection worldwide. The spine is affected in almost 50% of cases of skeletal TB. TB of spine causes bony destruction and collapse of the vertebrae, kyphotic deformity, paravertebral abscess, psoas abscess, intervertebral disc involvement, epidural abscess, and edema in the soft-tissue planes.⁶ In this study, pain in mid-back was the most common presenting symptom among the patients (35.1%). Pain in low back was the second

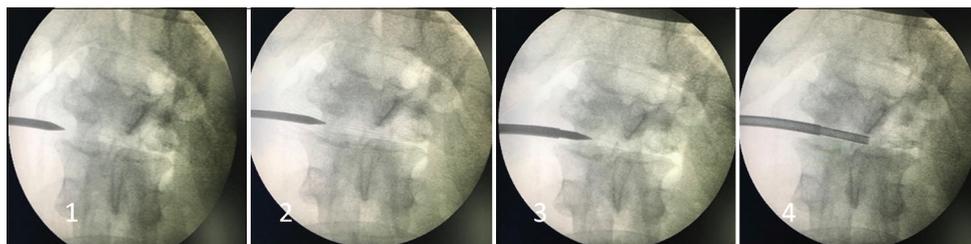


Figure 2: Transdiscal biopsy through direct lateral approach

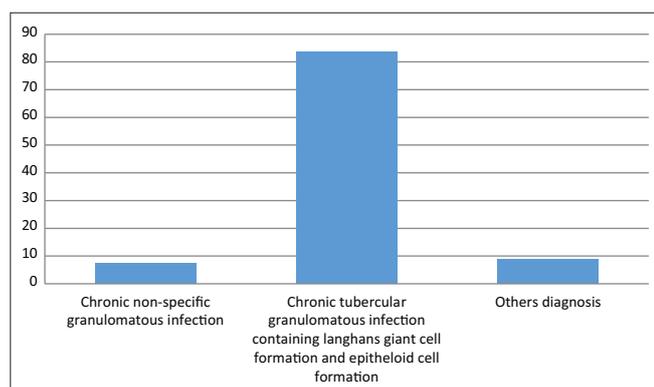


Figure 3: Graph showing distribution of patients according to histological finding

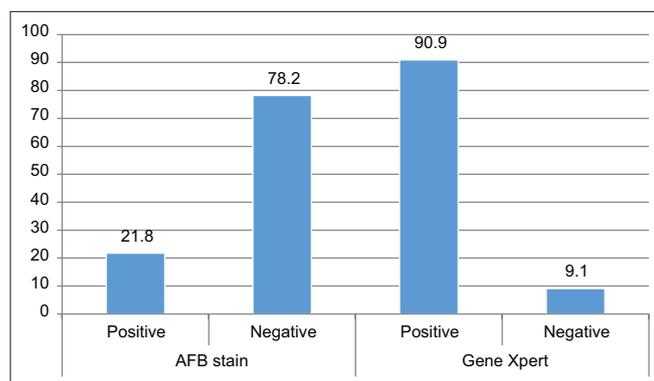


Figure 4: Graph showing distribution of patients according to microbiological finding

most common symptom among the patients (27.9%) and Singh et al., (2018)⁷ found that 45 patients (90.4%) presented with pain and difficulty while walking followed by backache in 29 patients (55.8%) and discharge from joints in 25 patients (48.1%). In the present study, constitutional symptoms such as evening rise of temperature were among 69.1% of patients and weight loss was among 67.3% of patients. Loss of appetite was among 68.2% of patients. Singh et al., (2018)⁷ found that constitutional symptoms of TB such as fever and weight loss were in 24 (46.2%) and 22 patients (42.3%), respectively. Sandher et al., (2007)⁸ (39%) and Sharma et al., (2016)⁹ (45%) reported almost similar findings in their study. In this study, deformity was present among 21.8% of patients, with the most common kyphotic deformity among 45.8% of

patients. The radiological findings of this study showed that dorsal spine and lumbar spine were involved in 35.5% and 28.2% of patients, respectively. Sharma et al., (2016)⁹ founded that the spine was the most commonly affected (50.77%). Kandal et al. (2017),¹⁰ in her study, founded that thoracolumbar region was involved in 30 cases (42.85%), lumbar region in 20 cases, cervical in 15 cases (21.42%), and cervicothoracic in 5 cases (7.14%). In the present study, AFB stain and CBNAAT were positive among 21.8% and 90.9% of patients, respectively. Held et al.,¹¹ in his study, evaluated 206 biopsies from 201 patients and founded that the sensitivity and specificity of CBNAAT MTB/RIF were 92.3% (84/91) and 99.1% (114/115), respectively. Jain et al., (2008)¹² showed that histology was positive for TB in all the cases. Tubercular spondylodiscitis diagnosis was among more than half of patients (58.1%) and non-tuberculous lesion was 9%, including metastasis (4.5%), pyogenic spondylodiscitis (2.7%), and primary neoplastic lesion (1.8%), Shaikh et al., (2013)¹³ found that 166 cases were histologically proved as TB and 74 proved to be non-TB lesions. Rafiqi et al., (2013)¹⁴ reported that diagnosis was confirmed on histology in 92% of cases. Prasad et al., (2017)¹⁵ reported that 70 cases out of which 60 cases were confirmed as spinal TB by histopathology and CBNAAT. HPE alone made diagnosis in 59 cases (98.33%) and CBNAAT in all the 60 cases (100%). In our study, out of 110 cases, 74 cases were clinically suspected of spinal TB undergone radiological investigation which revealed 60 cases of spinal TB which were confirmed by biopsy (HPE 58 cases and CBNAAT 60 cases) and 14 cases as non-TB underwent biopsy which revealed 11 cases of spinal TB (HPE 10 and CBNAAT 11) and three cases of non-TB. Thirty-six cases out of 110 cases which were suspected non-tubercular undergone radiological investigation revealed 24 cases as spinal TB underwent biopsy and 19 were spinal TB and five were non-TB and 12 cases which were radiological non-TB underwent biopsy which revealed ten cases as spinal TB and two cases as non-TB. Finally, out of 110 total cases, 100 were diagnosed as spinal TB and 10 were diagnosed as non-tubercular disease (Figure 5).

Limitations of the study

The limitations of this study were small sample size and shorter duration of study period. The studies having large

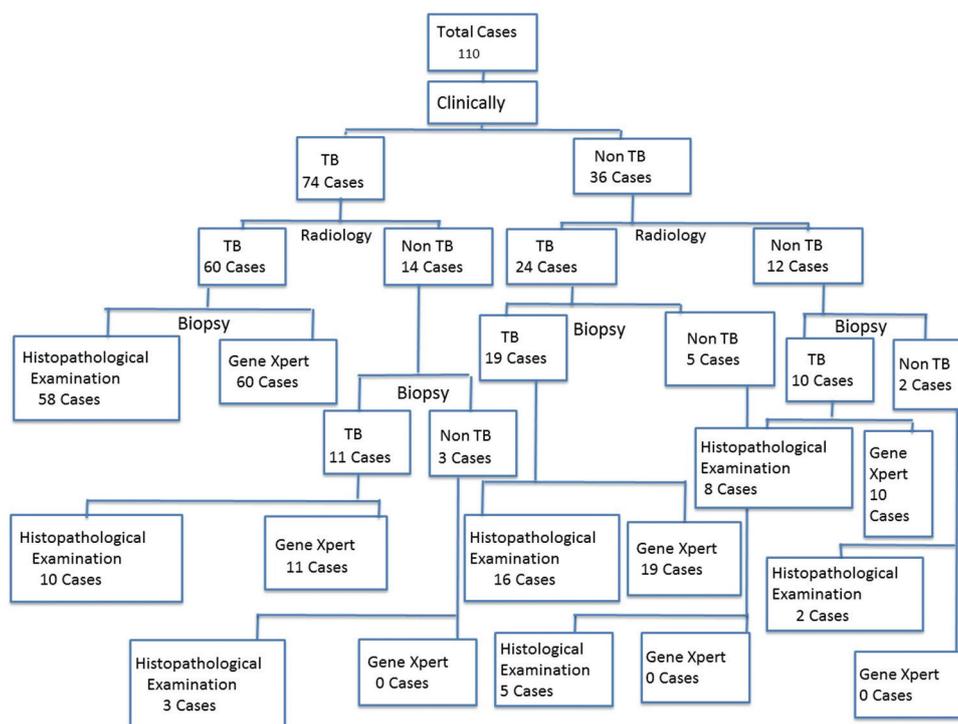


Figure 5: Flowchart showing different investigation modalities for early diagnosis of spinal tuberculosis

sample size with longer duration are required to have robust findings.

CONCLUSION

Spinal tubercular lesion and other non-tubercular lesion may have similar clinical and radiological features; also, there is high susceptibility to false-positive and false-negative result in clinico-radiological diagnosis of spinal TB. Therefore, biopsy (HPE, CBNAAT, and culture) in all cases of suspected spinal TB is must to get the accurate diagnosis. Furthermore, multipronged approach by direct smear examination, HPE, and molecular diagnosis is required for early diagnosis while culture is the gold standard for diagnosis but can be negative in partially treated cases. CBNAAT is highly sensitive and specific that enables rapid detection of tubercular bacilli but can give false positive results in non-viable bacilli but cost-effectiveness is of the restraints for widespread use of CBNAAT. HPE and CBNAAT are complementary to each other but not a substitute for culture. The results with CBNAAT have been more consistent in our study and it is our opinion that it should be considered as a first-line test rather than culture or histopathology. Therefore, the findings of this study can act as a bridge between early diagnosis of spinal TB at community or primary health-care center and prevention and treatment of deformity at the earliest possible as by conventional methods, it is difficult.

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Authors' Contributions:

PG- Concept and design of the study, prepared first draft of manuscript; **SB-** Interpreted the results, reviewed the literature, and manuscript preparation; **VG-** Concept, coordination, and statistical analysis and revision of manuscript.

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