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CLINICAL AND RADIOLOGICAL EVALUATION OF SPINAL TUBERCULOSIS

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Abstract

Introduction: The tubercular spine is an extrapulmonary variant of tuberculosis and is frequently associated with severe disabling paraparesis, quadriplegia, and spinal deformities due to vertebral destruction. Hence, early diagnosis and management plays a deciding factor in improving the prognosis.

Objectives: To compare and contrast the clinical and radiological presentation of spinal tuberculosis, to compare and test diagnostic techniques and approaches to treatment of this condition.

Materials and Methods: The present study is a cross-sectional descriptive study that included 150 spinal tuberculosis patients who attended PIMS Islamabad, Pakistan and Hayatabad Medical Complex Peshawar, Pakistan. Information was obtained from a review of clinical charts and reports, symptoms, topographical abnormalities identified by X-ray and MRI scans, and outcomes. The study is done over 12 months.

Results: More than half of the patients were male (58%), with an average age of 43.2 years. Some of the symptoms the patients presented were back pain = 90%, fever = 78% and neurological deficits = 47%. MRI was the most helpful modality in diagnosing the affliction, and 20 percent needed surgery for complicated cases.

Conclusion: Tuberculosis of the spine is still a considerable concern to the public health. It is very crucial to diagnose the case early and treat it as soon as possible to enhance both medical and neurological outcomes.

Keywords: Spinal tuberculosis, diagnosis, MRI, anti-tubercular therapy, surgical intervention.

INTRODUCTION

Spinal tuberculosis (TB) is still a global medical concern, especially in endemic countries such as Pakistan. It is one of the types of extrapulmonary tuberculosis that mainly infects the spine region and may lead to severe consequences if not diagnosed early. The disease targets primarily the vertebral bodies, intervertebral discs, and neighbouring tissues. Consequently, the clinical manifestations are

initially nonspecific in most patients, and the true nature of the pathology may only become apparent several months after the onset of the disease. The presenting complaints include back pain, fever, weight loss and neurological impairment, and since these symptoms overlap with other spinal conditions, diagnosis becomes difficult (1). The management of the condition should be timely to obtain accurate diagnoses in order to avoid potentially severe consequences of the spine's irreversible destruction and such complications as spinal deformity, paraplegia, and even death (2). Spinal tuberculosis is generally an extension of pulmonary tuberculosis or hematogenous dissemination of the M. tuberculosis bacilli from the primary focus in the lungs. After gaining access to the spine, the bacteria are home mainly in the anterior part of the vertebrae and give rise to granulomatous lesions. These lesions can lead to structural disruption of the vertebral body and eventual deformation due to its collapse. Eventually, the infection may spread to include the intervertebral disc lesion with abscess formation, which may extend into the paraspinal soft tissues or even the spinal canal and produce neurological complications (3).

The diagnosis of spinal tuberculosis is difficult because the symptoms are similar to those of many diseases that affect the vertebral column, such as pyogenic spondylodiscitis, malignancy, and degenerative disorders of the spine (4). Spinal TB can be suspected clinically, but Confirmation is mostly based on radiographic examinations, including plain X-rays, MRI and CT. Characteristic features on X-rays include vertebral body destruction, disc space narrowing and abscess formation. However, MRI is said to be more specific and sensible and gives a view of soft tissues, the amount of abscess formation, and the degree of spinal cord compression. Moreover, the application of certain molecular procedures as GeneXpert MTB/RIF was useful for determining both the time and the severity of Mycobacterium tuberculosis in spinal lesions, thus improving a timely detection (6).

Spinal tuberculosis requires the use of anti-tubercular drugs and sometimes surgery to address the situation. The conventional short-course anti-tubercular therapy includes isoniazid, rifampicin, pyrazinamide, and ethambutol, which are prescribed for a course of 6-12 months. In patients with severe disease, spinal deformities or neurological deficits, surgical management is usually required to undertake the decortication of the spinal cord and spinal stabilization, as well as the removal of the infected tissues (7). The surgical options include anterior, posterior and combined anterior-posterior approaches based on the severity and location of the disease (8). Radiological imaging is useful in the visualization of the status of the disease and in pre-operative planning. MRI is especially advantageous in defining the spinal cord and other soft tissues around it, making it easier to determine the level of abscess formation and the involvement of neural tissues (9). Furthermore, MRI can distinguish between infectious spondylodiscitis and other inflammatory or degenerative diseases of the spine, which can be almost indistinguishable radiologically (10).

Spinal tuberculosis is still a leading cause of morbidity in the regions where the disease is endemic, such countries as Pakistan. The earlier the diagnosis, the better medical and surgical care management, and the better results are expected, with fewer instances of patients becoming permanently disabled. Clinical and radiographic manifestations of spinal tuberculosis are usually rather vague, so suspicion and high-resolution imaging must be used to diagnose and treat this pathology (11). Additionally, in endemic regions, it becomes imperative to diagnose the disease early starting intervention to avoid developing other types of spinal TB (12). Thus, in recent years, integrated diagnostic imaging techniques such as high-resolution MRI and CT, along with molecular diagnostics including GeneXpert MTB/RIF, have improved the potential of substantially increasing the diagnostic accuracy of spinal tuberculosis. These tools have helped to improve the diagnostic time and more specialized planning of the treatment (13). However, some concerns exist in the diagnosis and management of spinal tuberculosis, especially in developing country settings, due to the limited availability of advanced diagnostic tests for ear, ly treatment and other related factors (14).

In addition, vitamin D deficiency has also been identified with an increased risk for tuberculosis disease development. The current literature has also pointed to a possible link between an insufficient level of vitamin D in the blood and the development of both pulmonary and extra-pulmonary forms of tuberculosis, which include spinal TB. Therefore, vitamin D supplementation might be a complementary treatment to conventional TB treatment, but more research is necessary to determine

the effectiveness of this treatment (15). The important finding is that the challenge of spinal tuberculosis falls more squarely on the public health practice, even in countries and regions with high TB incidence. Actually, further progress in diagnostic testing for proper diagnosis of this disorder, in the development of optimal therapy, and in increasing the availability of medical and surgical management options are required to reduce the burden of this disabling disease among affected people.

Objective: The objective of this study is to evaluate the clinical and radiological features of spinal tuberculosis, assess diagnostic methods, and determine the effectiveness of treatment approaches in managing this condition.

MATERIALS AND METHODS

Study Design: This is a descriptive cross sectional study focused on assessing clinic and imaging profile of spinal tuberculosis. The research also evaluates the diagnostic and treatment techniques in relation to the given case of spinal TB patients.

Study setting: The current study was carried out on patients attending PIMS Islamabad, Pakistan and Hayatabad Medical Complex Peshawar, Pakistan which is a tertiary care hospital, routinely managing large number of TB patients.

Duration of the study: The study was conducted over a period of 12 months, from July, 2023 to June, 2024.

Inclusion Criteria

The study involved patients with histologically proven spinal tuberculosis based on clinical and investigation findings, radiographic imaging, and microbiological tests. Patients selected for the study were those aged 18 years and above and on anti-tubercular treatment for at least six months. This included patients who were previously imaged by MRI or CT scan and showed features suggestive of spinal tuberculosis, such as destruction of the vertebral body and intravesicular abscess.

Exclusion Criteria

Previous spinal surgery was considered as a contraindication together with other soft tissue or osteolytic spinal infections, including pyogenic spondylodiscitis, malignancy, and those patients who could not have complete medical records. Also, patients with other chronic diseases that may influence the state of the spine, for example, congenital spinal deformities or a past history of ankylosing spondylitis, were eliminated during the study.

Methods

One hundred and fifty patients of spinal tuberculosis identified at PIMS Islamabad, Pakistan and Hayatabad Medical Complex Peshawar, Pakistan were reviewed retrospectively. Demographic data and other clinical information, such as symptoms and illness duration, were obtained from patients' charts. Radiological imaging, including X-ray P Cricket, MRI, and CT scan studies, was explicitly evaluated for the degree of vertebral involvement, abscess formation and presence of spinal cord compression. Besides clinical and imaging evaluation, microbiological evidence was secured by GeneXpert MTB/RIF tests and cultures derived from biopsies or aspirates of involved regions. All clients received standard anti-tubercular treatment, and individuals who had neurological problems or severe spinal contractures were taken through surgery. Their results were assessed on the basis of clinical responses, radiographic findings, and outcomes following surgery. The quantitative data was analyzed with descriptive statistics to fill in the demographic and clinical data. From the analysis of the results, the effectiveness of various treatment methods used in the management of spinal tuberculosis was established.

RESULTS

One hundred and fifty documented spinal TB patients were recruited for this study. The patient cohort was 43.2 ± 12.4 years old, with 58% male prevalence. Most of the patients were from a low-income

population, and the duration of the complaints ranged from moderate to several years of back pain, fever, and unexplained weight loss. The period of time that patients spent with the symptoms before they paid a visit to a doctor hovered between 2 months to 6 months, a mean of 4.1 months.

Table 1: Demographic Distribution of Patients

Characteristic	Number of Patients (%)
Male	87 (58%)
Female	63 (42%)
Mean Age (Years)	43.2 ± 12.4
Socioeconomic Status (Lower)	120 (80%)

Clinical Presentation

The clinical manifestation which was most frequently reported was localized back pain in 90% of the patients, and fever was the next least systemic manifestation seen with (78%), weight loss (65%) and neurological deficit (47%). They are neurological manifestations experienced mainly in the later stages of the patient, where the patient develops features of spinal cord compression or abscess.

Table 2: Clinical Symptoms of Spinal Tuberculosis

Symptom	Number of Patients (%)
Back Pain	135 (90%)
Fever	117 (78%)
Weight Loss	98 (65%)
Neurological Deficits	71 (47%)

Radiological Findings

An analysis of the X-ray results showed that vertebral body changes were seen in 85% of the patients, while intervertebral disc space narrowing was seen in 62%. Neck MRIs documented soft tissue abscesses in 55% of patients, and 35% demonstrated spinal cord compression. X-ray imaging was helpful in determining the extent of bony involvement in relation to the tumour but was relatively less informative than MRI in detecting soft tissue infiltration.

Table 3: Radiological Findings in Spinal Tuberculosis

Radiological Finding	Number of Patients (%)
Vertebral Body Involvement	128 (85%)
Disc Space Narrowing	93 (62%)
Soft Tissue Abscess	82 (55%)
Spinal Cord Compression	52 (35%)

Treatment and Outcomes

A total of 85% of the patients were treated with anti-tubercular therapy and observation. Operative management was necessary for 20% of the patients mainly in cases with neurological impairment or severe spinal curvature. The medical operations performed comprised debridement, spinal fusion, and abscess drainage. In this paper, the treatment outcome revealed better signs of recovery on the clinical symptoms and radiology after six months of treatment. In 60% of those patients who had initial spinal cord compression, there was neurological deterioration. The follow-up was done at the end of the instances mentioned above and according to it, 90% of the patients had shown clinical and radiological change for better while in 10% of patients deformities or neurological sequelae were evident.

DISCUSSION

Spinal TB is still a significant disease that affects the world's population, especially in developing countries, such as Pakistan, where the TB rate is relatively high. The purpose of this study was to assess clinical features, imaging, treatment, and patient management of spinal TB in a university teaching hospital. The findings also portray a high impact of illness burden with more males affected and notably delayed presentation to the healthcare facility. These findings are in agreement with other authors who have observed that spinal tuberculosis frequently presents late, thus making diagnosis and management challenging (1). That is why early diagnosis and intervention play the most important role in the optimization of the patient's prognosis and positivity of giving a permanent disability status. Among the study revelations, the patient demographics revealed that the most significant number of patients were within the age range of 30-50 years. This age group appears most affected by spinal tuberculosis because of the growing awareness of active TB and its EPT manifestations in adults. Moreover, spinal TB was observed to affect low-income earners, and this concurs with other writers who have categorized poverty as a risk factor towards TB. These may be attributed to pandemic factors such as high population density in homes, poor nutrition, and restricted healthcare access—all of which fuel the development of TB.

The clinical symptoms identified in this study are similar, consistent with prior studies reporting back pain, fever, and weight loss as the most common manifestations in patients (4). This is evident because 90% of the patients studied complained of backache, therefore showing that spinal tuberculosis should be considered when evaluating patients who present with persisting backache in areas of high prevalence. Fever and weight loss were also reported, with these symptoms being very gambles, which can be associated with many infections or inflammation. Because these symptoms are quite vague, spinal TB is frequently diagnosed late, with patients having initially been diagnosed with musculoskeletal disorders or even malignancy (5). In this study, neurological deficits were noted in 47 per cent of the patients despite the fact that spinal tuberculosis occurs at the anterior vertebral body and intervertebral disc. Neurological deficits occur because a compressed spinal cord is partly due to abscess formation or vertebral structure collapse (6). This is an unusual presentation because neurologic involvement in spinal tuberculosis entails the risk of becoming paralyzed permanently if treatment is not administered effectively and early enough. In such circumstances, many individuals often need a delicate procedure that involves surgery to open up the spinal cord and correct the damaged bones. The evaluation showed that 20% of the patients required surgical intervention, findings that tally with other studies that estimated the need for surgery in spinal TB to be about 15-30% (7).

An understanding of the radiographic appearance of the spine was essential to the diagnosis and management of spinal tuberculosis in this study. MRI was reported to be superior to X-ray imaging in identifying affection of soft tissues, including abscesses and cord compression. MRI has a better resolution and is better in distinguishing the degree of infection and the possible complications, such as epidural abscesses and neurocompression (8). In this study, 55% of the patients had MRI findings indicating soft tissue abscesses, and this is in agreement with studies done in advanced countries (9). It is only viable to determine the kind of treatment that is necessary when these complications are identified on time. In addition, MRI proves to be helpful in the differentiation of spinal tuberculosis from other diseases with similar manifestations, including pyogenic infections, tumours or spinal degenerative diseases (10). X-ray examination has not lost its relevancy in diagnosing bony involvement, including vertebral body destruction and disc space narrowing. However, MRI is superior to X-ray in detecting soft tissue changes that may result in underdiagnosis in settings with extensive paraspinal abscess formation (11). In this group, vertebral body involvement was noted in 85 % of subjects, and disc space narrowing in 62 %. These radiological features are typical of spinal tuberculosis and are quite often seen in the initial presentation of the disease. However, it is noteworthy that X-ray findings can be atypical, and the results cannot provide sufficient evidence of disease progression, which is why MRI is used in clinical practice more often (12).

Spinal tuberculosis requires administration of anti-tubercular drugs such as isoniazid, rifampicin, pyrazinamide and ethambutol for half a year to one year in most cases. The majority of the patients,

85%, underwent treatment with anti-tubercular therapy, and good improvement was demonstrated in the clinical state of the majority of the patients after six months of the treatment. This is in concordance with other studies which have postulated that a longer duration of anti-tubercular therapy is required to eliminate the infection and preclude relapse (13). However, it was also determined that 20% of patients needed surgery because of neurological deficits or significant spinal deformities. Surgery was considered only for those cases with a history of spinal cord compromise or deformity and in those patients who failed to respond optimally to medical treatment. Surgery involved the removal of infected tissues by debridement, enhancing the space for the spinal cord through spinal fusion, and abscess drainage was also done (14).

Another striking observation in the present work was the enhancement of neurological status that was apparent in 60% of the patients in whom spinal cord compression was present initially. This suggests that the condition can undergo healing when evaluated for timely surgical management together with anti-tubercular drugs. However, it is also necessary to state that some patients had residual deformities or persistent neurological deficits even after treatment. These findings stress the importance of early detection and prompt treatment, as the delay in the treatment will lead to the deterioration of the spinal column and the spinal cord (15). Finally, TB spine continues to be a major problem in morbidity and mortality, especially in areas of high TB burden. The treatment includes early diagnosis of TB disease, the early commencement of ATT and the correct appropriate surgery in managing thoracic TB-related complications for better outcomes in the patients. MRI is the most useful investigation in diagnosing spinal TB and evaluating the complications of the disease. Nowadays, spinal tuberculosis remains a major problem, and there is still a lack of sufficient data on how to manage the patients in the most effective way.

CONCLUSION

In conclusion, spinal tuberculosis still poses a significant health problem globally, particularly in TB-endemic countries like Pakistan. This work will also illustrate that in the management of the disease, much emphasis should be put on early diagnosis, clinical alertness and prompt intervention. The presenting clinical signs and symptoms include back pain, fever, and neurological abnormalities. These signs are vague, which results in delayed diagnosis. Radiological imaging, especially MRI, is helpful in the assessment of the disease Burrow, including the soft tissue abscesses and spinal cord compression. Antituberculosis drugs continue to hold the role of therapy, and surgery is used only if there is neurological compromise or spinal curvature. The study also acknowledges early management since it has benefits in overall clinical management and neurological recovery. Nevertheless, many improvements have been observed in diagnosing spinal tuberculosis and the treatment regimens leading to better treatment outcomes, though more work is needed in order to enhance the best approaches to managing spinal tuberculosis.

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