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Spinal tuberculosis: a ten-year prospective study in a referral hospital, Eastern part of India

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Abstract

Spinal tuberculosis is a significant reason for neurologic deficits in overpopulated places in developing countries. It is the most common form of skeletal tuberculosis; it can involve any part of the vertebral column. the vertebral lesions may be congruous and may also be non-congruous at different levels. Early diagnosis and prompt treatment are the mainstay of management. Contrast-enhanced MRI, tissue diagnosis, and multidrug chemotherapy are the most commonly required treatments, and surgery is necessary in selected cases to improve the outcome. Debridement and decompression with or without fusion, in the form of pedicular screw rod fixation, as an easy and quick procedure, helps to improve neurologic outcome in some cases. Surgery helps patients to be ambulatory early, and it also reduces pain early. Surgery can help patients return to their normal daily life and to work early. Radiological screening of the whole spine reduces the chance of missing the non-congruous lesions.

Keywords: Vertebrae, Pott's disease, Myelopathy, Surgery

Introduction:

Spinal Tuberculosis is the most common type of skeletal Tuberculosis. It is one of the most ancient diseases found in history, as early as 3400 BC, as was detected in Egyptian mummies (1). Incidence of tuberculosis is not common in Western countries, but it is as high as 36% prevent on India (2). As per a report of 2019, more than ten million people suffered from tuberculosis, and India contributed the maximum share (26%) of total cases worldwide (3). Most of the tuberculosis cases are pulmonary. The prevalence of extrapulmonary skeletal tuberculosis is 10%. Approximately 50% of skeletal tuberculosis cases involve the spine (4). As this communicable disease has high prevalence and causes long-term morbidity, early diagnosis and prompt treatment are necessary for the prevention of spinal deformity and neurological deficit (5).

Spinal tuberculosis is also known as Pott's disease. The term came after the classic description of involvement of paradiscal vertebrae and other vertebral elements leading to kyphosis and deformity by Sir Percival Pott in 1979 (6).

Spinal tuberculosis is always secondary, due to hematogenous spread. Caseous necrosis and exudative reaction are common in spinal tuberculosis. A neglected case may suffer from a cold abscess formed by serum, leukocytes, caseous material, bone debris, and bacilli. Cold abscess may

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occur far from the site of infection by penetrating through fascial planes (7). Clinically spinal tuberculosis may present as (i) Paradiscal lesion, where the infection starts at the vertebral metaphyses and then destroying disc by eroding cartilage plate, followed by involvement of adjacent vertebrae, (ii) Central lesion, where it starts in the centre of vertebral body and spreads centrifugally, (iii) Anterior lesion, where bone destruction stars beneath the anterior longitudinal ligament that leads to vertebral collapse and (iv) Appendiceal type, where the pedicle, lamina, articular process and spinous process are affected primarily (8). Tubercular spondylitis usually occurs in dorsal vertebrae, followed by Lumbar and Cervical vertebrae (9). In Contiguous spinal tuberculosis, there is involvement and destruction of multiple adjacent vertebral bodies and intervertebral discs. Multiple-level non-contiguous infection is atypical and involves two different levels of vertebral involvement without destroying the vertebral bodies in between the two levels. However, in some studies, the incidence of multiple-level non-contiguous infection is as high as 71% (10).

Malnutrition, alcoholism, overcrowding, drug abuse, diabetes mellitus, immunosuppressive treatment, and HIV infection are common predisposing factors for spinal tuberculosis. Genetic susceptibility to spinal tuberculosis has recently been demonstrated. Association of FokI polymorphism in the Vitamin-D receptor gene and spinal tuberculosis has been demonstrated in a Chinese population, and this gene was stated to be associated with susceptibility to spinal tuberculosis (11). The most serious complication of spinal tuberculosis is neurological involvement, and its incidence varies from 10 to 40% (12). The reason for paraparesis or paraplegia is due to spinal cord compression caused by abscess, granulation tissue, sequestrated bone, and disc or pathological subluxation in active disease, and in healed cases it may be due to fibrosis of dura, spinal deformity, or by transverse ridge of bone formed anterior to the spinal cord. Other uncommon causes are Tuberculous myelitis, Spinal artery thrombosis, Infective thrombosis of an anterior spinal artery, Tuberculous arachnoiditis, and Meningeal inflammation and fibrosis (12,13). The Grading of neurological deficit may be assessed by ASIA impairment Score or by Tuli's grading system, but neither of these systems can effectively grade the neurological deficit in spinal tuberculosis (14).

ASIA Impairment Scale (AIS)

A Complete: No sensory or motor function is preserved in sacral segments S4-S5, no sacral sparing

B Sensory Incomplete: Sensory but not motor function is preserved below the neurological level and includes sacral segments S4-S5, and

No motor function is preserved more than three levels below the motor level on either side of the body

C Motor Incomplete: Motor function is preserved below the neurological level, and more than half of the key muscle functions below the neurological level of injury have a muscle grade of less than 3 (Grades 0-2)

D Motor Incomplete: Motor function is preserved below the neurological level, and at least half (half or more) of the key muscle functions below the neurological level of injury have a muscle grade ≥ 3

E Normal: Sensation and motor function are graded as normal in all segments

Tuli's Grading System

Grade I: Negligible: Patient unaware of neurological deficit. The clinician detects the deficit.

Grade II: Mild: Patient aware but manages to walk without support

Grade III: Moderate: Non-ambulatory because of paralysis (in extension) with sensory deficit less than 50%

Grade IV: Severe: Grade III+ flexor spasm/paralysis in flexion/flaccidity, sensory involvement more than 50%, with sphincter involvement.

MRI is the diagnostic tool of choice for spinal tuberculosis. Involvement of the vertebral bodies, disk destruction, cold abscess, vertebral collapse, and spinal deformities can be demonstrated in MR images. Abscess formation and collection, and expansion of granulation tissue adjacent to the vertebral body are almost diagnostic of spinal tuberculosis. It also detects intramedullary or extramedullary tuberculoma, spinal cord cavitation, and spinal cord edema. Screening of the whole spine easily detects non-contiguous lesions (15,16). Destruction of vertebral bodies and disc spaces, marked enhancement of the lesion, epidural abscess,

Low signal intensity on T1-weighted images, hypersignal on T2-weighted images, and heterogeneous enhancement occur in MR images. The pedicle and the posterior element involvement are generally not characteristic of spinal tuberculosis. It is occasionally difficult to differentiate spinal tuberculosis from a metastatic disease on MRI. In elderly patients with vertebral damage, metastatic disease of the spine should be considered (16).

Active Pulmonary tuberculosis must be ruled out in patients with spinal tuberculosis. 50 and 75% of patients with osteoarticular tuberculosis and up to 67% of patients with spinal tuberculosis have an associated primary lung focus or have a past history of pulmonary tuberculosis (17). CT-guided aspiration cytology is very useful for the histological diagnosis of spinal tuberculosis.

The common cytological findings are epithelioid cell granulomas (90%), granular necrotic cells (83%), and lymphocytic infiltration (76%), scattered multinucleated and Langhans' giant cells (56%) (18). Clinical and radiological diagnosis should be more stressed, as false-negative results of biopsy are common, and bacteriology tests are negative (19).

Back pain, local tenderness, muscle stiffness, a cold abscess, gibbus, and a prominent spinal deformity are the main clinical features of spinal tuberculosis.

As the progression of spinal tuberculosis is slow and insidious (average duration is 4 to 11 months), patients only visit doctors when there is increased pain, spinal deformity, or neurological symptoms. Classical constitutional symptoms, like malaise, weight loss, and evening rise of temperature, are present in approximately 20–30% of cases of osteoarticular tuberculosis.

Anti-tubercular treatment should be started as early as possible after diagnosis. The category-1 antituberculosis treatment regimen, as per the World Health Organisation, is divided into two phases: an intensive (initial) phase and a continuation phase. In the 2-month intensive phase, a combination of four first-line drugs: isoniazid, rifampicin, streptomycin, and pyrazinamide, is given. In the continuation phase, two drugs (isoniazid and rifampicin) are given for 4 months. WHO recommends nine months of treatment for tuberculosis of bones or joints (20). Surgery is only indicated in patients with progressive bone destruction despite adequate ATT, failure of conservative treatment, rapid onset paraparesis or paraplegia, enlarging paravertebral abscess despite anti-tubercular treatment, spinal instability due to collapse, destruction of two or more adjacent vertebrae, Kyphosis, painful paraplegia in elderly, spinal tumour syndrome(epidural tuberculoma) and uncertain diagnosis for biopsy. Generally, debridement with or without stabilization is done in the surgical treatment of spinal tuberculosis.

Materials and Methods

We collected data on all patients of vertebral tuberculosis (both ambulatory and with neurological deficits) attending our OPD and IPD since January

2014 to December 2023. Patients admitted to other departments, such as orthopaedic surgery and the tropical medicine department, and referred to our department (Neurosurgery) were also included in this study. Contrast MRI of the clinically proposed segment of a vertebra, with screening of the entire spine and CT-guided FNAC from the involved vertebra, was performed in all patients. Understandably, patients who came with features of Pott's spine but were later diagnosed as different, like metastatic lesion or plasma cell disorder, were not included in this study. Most of the admitted patients with different grades of neurological deficits underwent surgical treatment in the form of debridement with or without pedicular fixation, except those who refused to give consent for it. Neurological deficits were assessed by Tuli's grading system in the pre-surgical visit, and the power of the limbs was recorded as per the Medical Research Council Scale of muscle strength. After surgery, all patients were followed up at 4, 8, and 12 weeks and then on an as-needed basis. Anti-tubercular medicines were given to patients in the pre-surgery and post-surgical period as per the Revised National Tuberculosis Control Program from their specified clinic. X-ray of the affected part was done in all cases, and contrast-enhanced MRI was done in selected cases in post-operative follow-up.

Aims and Objectives

This study aimed to estimate the burden of this disabling disease in our society, especially in this City and the surrounding suburbs, and to follow up the treated patients to detect neurological improvement, if any, in the neurosurgery department of a referral hospital. Another aim of this study was to detect the possibility of missing non-contiguous vertebral tubercular lesions if contrast MRI is used only for a localised area. Apart from the epidemiology and prognostic significance, we got some idea of the association of this disease with other comorbidities like diabetes and other immunodeficiency status.

Result and Discussion

The total number of patients in this study is 468. There were 340 (72.65%) male patients and 128 (27.35%) female patients. 48 diagnosed patients were admitted to other departments and were referred to us later on, and the rest were attended to in our OPDs. The mean age of patients was 34.5 years.

Table 1: Tuli's grading of the patients at the very first visit.

Tuli's grade	Male(n=340)	Female (n=128)	Total (n=468)
Grade I	76(22.35)	24(18.75%)	100(21.37%)
Grade II	136(40.0%)	58(43.31%)	194(41.45%)
Grade III	125(36.76)	42(32.81%)	167(35.68%)
Grade IV	3(0.88%)	4(3.12%)	7(1.49%)

Table 2: Motor power of limbs of patients at first visit, as per Medical Research Council scale, and sensory deficit and sphincteric disturbances are as follows:

Power N=468	5/5	4+/5	4-/5	3/5	2/5	1/5	0/5	Sensory deficit	Sph. deficit
M	65	38	98	85	47	3	4	46	15
%	19.1	11.2	28.8	25	13.8	0.8	1.8	13.5	4.4
F	20	29	32	22	17	3	5	28	17
%	15.6	22.6	25	17.2	13.3	0.23	3.9	21.8	13.3

According to CEMRI, the number of congruous lesions is 438(93.6%), and non-congruous lesions at two or more levels were found in only 30(6.4%) patients. Among the non-congruous lesions, there was female preponderance (22:8), and all cases were being treated for type II diabetes mellitus.

Table 3: Levels of lesion as per MRI:

Level	Male n=340	Female n=128	Total n=468
Cervical	2(0.58%)	2(1.5%)	4(0.8%)
Cervico-dorsal	5(1.47%)	4(3.1%)	9(1.9%)
Dorsal	178(52.3%)	54(42.2%)	232(49.6%)
Dorso-lumbar	88(25.8%)	22(17.2%)	100(21.4%)
Lumbar	42(12.3%)	15(11.7%)	57(12.2%)
Lumbo-sacral	17((5.0%)	9(7.0%)	26(5.5%)
Non-congruous	8(2.3%)	22(17.2%)	30(6.4%)

The total number of type 2 diabetes patients was 93(19.8%), and 16 patients were diagnosed while they were under treatment for spinal tuberculosis. Type 2 diabetes patients were confirmed by laboratory diagnosis (21). A total of 9(1.9%) patients were immunocompromised.

Initial CT-guided FNAC was negative in 13(2.7%) patients, and those patients needed a second attempt at FNAC. Anti-tubercular chemotherapy was started from local Government tuberculosis clinics near the patient's residence, as soon as the diagnosis was confirmed. A baseline liver function test was done in every case.

There is controversy about the requirement of surgery in the treatment of spinal tuberculosis. Konstam and colleagues strongly opined for

conservative treatment in the form of rest, anti-tubercular medicines, and traction (22). Tuli opined for a middle path concept of conservative treatment and surgery in selected cases in 1975 (23). Benefits of surgery were correction of kyphosis, immediate neural decompression, early relief of pain, early bony fusion, and the possibility of early ambulation and early return to normal life (24).

Surgery, in the form of laminectomy in dorsal and cervical vertebrae (with few exceptions) and laminectomy with fusion in dorso-lumbar and lumbar/lumbo-sacral segments, was done in patients with Tuli's grades II, III, and IV. The total number of surgeries performed on patients with spinal tuberculosis was 343(73.3%). Among the patients treated with surgery, 107(31.2%) patients were treated only with laminectomy and decompression, and the rest with fusion with decompression. All cases of craniovertebral tuberculosis were treated conservatively. The time of surgery was within one to three weeks after diagnosis, and the mean was 18th day. Titanium alloy made pedicular screws and rods were used for posterior fusion. The mean period of post-surgery hospital stay was 12 days. Ceftriaxone at a dose of one gram intravenously twice daily for five days was administered in all post-operative cases. Apart from surgical site pain, there was no significant complication in our study group. A routine anteroposterior and lateral view of the X-ray of the respective vertebral segment was done in all cases before discharge. Continuation of anti-tubercular treatment, gradual ambulation with physiotherapy, and encouraging walking with a brace or collar was sufficient to observe significant neurological improvement in follow-up. Except for one female patient who had flaccid paraplegia at admission and underwent surgical debridement, all paraparetic (not paraplegic) patients were found improved neurologically at the 12th week follow-up visit. In our study, among the surgically treated patients, 114 were non-ambulatory at the time of admission. We found 96 (84.2%) patients ambulatory with or without help at the end of the 12th week post-surgery.

Though in some studies, there is significant improvement of neurologic deficit on only conservative treatment, and only 8 patients needed delayed surgery (25), some other study Favors surgical treatment. In a study performed in Korea among 37 patients, 94% of patients had a favourable outcome, and radical surgery was significantly related to their outcome (26).

It can be concluded that there is a significant role of surgical decompression with or without fusion in reducing pain and early neurologic improvement in cases of spinal tuberculosis, and a contrast screening of the whole vertebral column is necessary for diagnosing non-congruous lesions.

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