Analysis of Changing Paradigms of Management in 179 Patients with Spinal Tuberculosis Over a 12-Year Period and Proposal of a New Management Algorithm

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Key words
- Antitubercular chemotherapy
- Paraplegia
- Spinal deformity
- Spinal tuberculosis
- Surgery
- Tubercular spondylitis
- Vertebral collapse

Abbreviations and Acronyms
CT: Computed tomography
ESR: Erythrocyte sedimentation rate
MRI: Magnetic resonance imaging
TB: Tuberculosis

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OBJECTIVE: **To describe management and outcome in a large cohort of patients with spinal tuberculosis (TB).**

METHODS: **Of 212 patients with spinal TB treated between January 1999 and June 2011, 179 patients were included in the study (≥6 months follow-up; mean age, 34.8 years; age range, 10–75 years). The cohort was divided into two groups ($n = 89$ and $n = 90$); group I was treated from 1999–2003, and group II was treated from 2004–2011.**

RESULTS: **The study cohort comprised 93 male patients. Mean age was 34.8 years ± 7.2 (range, 10–75 years). Mean duration of symptoms was 2.4 months. Sensorimotor deficits were present in 167 patients (93.5%; 74 patients were paraplegic), pain was present in 156 patients (87%), bladder involvement was present in 127 patients (71.7%), and extraspinal TB was present in 36 patients (22.3%). Of patients, 92% were receiving prior chemotherapy; one fifth of these patients were on second-line chemotherapy. Thoracic spine involvement was most common ($n = 86$; 57%), followed by cervical spine ($n = 50$; 29%), craniovertebral junction ($n = 22$; 15%), and lumbosacral spine ($n = 20$; 10.5%). Surgery was performed in 146 patients (68% instrumented fusions and 16% circumferential fusions). Mean follow-up was 20.2 months (range, 6–60 months). Sensorimotor deficits improved in 89% of patients, pain improved in 71%, bladder symptoms improved in 88%, and paraplegia improved in 77%. Patients in group II had a higher incidence of cord compression ($P < 0.01$), severe vertebral body collapse ($P < 0.001$), and paraplegia ($P < 0.001$). Group II patients underwent more instrumented surgeries ($P < 0.01$), especially circumferential fusions ($P < 0.001$). The improvement in paraplegia was better after 2004 (group II). Bladder symptoms correlated with the timing of surgery ($P < 0.1$).**

CONCLUSIONS: **Medical treatment of spinal TB is the mainstay; however, radical, instrumented surgeries should be offered when indicated. The presence of paraplegia should not preclude surgery. A practical management paradigm is also suggested.**

INTRODUCTION

Today, one third of the world population is likely to be infected with *Mycobacterium tuberculosis* (8, 20, 25, 44). According to current World Health Organization estimates, tuberculosis (TB) kills 1.68 million people a year worldwide (8). With an increasing number of immunocompromised patients with human immunodeficiency virus, there may be a worldwide resurgence of TB. Of all patients with TB, nearly 5% have involvement of the skeletal system. Vertebral TB constitutes about 50% of all cases of skeletal TB (16, 25, 27, 30, 38, 40, 43).

With contemporary imaging techniques such as magnetic resonance imaging (MRI), spinal TB is being diagnosed much earlier (15, 38, 44), and patients may be treated with drugs effectively before they develop neurologic deficits, the most crippling complication of spinal TB. A significant number of patients still present late after disease onset with severe neurologic dysfunction (44) and spinal deformity, especially in developing countries such as India. These patients are more likely to become candidates for surgery.

TB is probably as old as human civilization (49). In 1779, Pott published the first modern description of spinal deformity and paraplegia resulting from spinal TB (24, 41). In contrast to historical times, effective management of spinal TB is now possible. The treatment of this disease has undergone a sea change since the advent of effective anti-TB drugs in the latter half of the twentieth century (42, 49). Although medical treatment is the mainstay of therapy, surgery is required in certain situations. In addition, with increasing sophistication of the instrumentation, indications of surgery have expanded to include not only correction or prevention of neurologic deficits but also correction of deformities (1-7, 26, 38).

We report a retrospective study of a large series of patients treated with medication or surgery or both (although the present series is biased toward surgery). With increased

safety profiles of spine surgeries as well as complexity of spine instrumentation, we wanted to evaluate the role of surgery in the current treatment of spinal TB. Analysis of this study has provided us with insights regarding optimization of treatment and creating management paradigms, which is of significance in managing this complex condition. We have further divided our cohort into two groups to compare the changes in clinical profile, management paradigms, and outcomes over time.

METHODS

We retrospectively reviewed the medical records of patients treated for spinal TB between January 1999 and June 2011. Of 212 patients, follow-up records with at least 6 months of follow-up of 179 patients were available for analysis (Table 1).

Diagnosis of spinal TB was made according to the criteria followed at our institute (Table 2). MRI and computed tomography scan (CT) of the spine were the primary modes of diagnosis. MRI can detect subtle changes (e.g., signal changes in the vertebral bodies, peridiscal signal changes) induced by TB. In addition, gross changes, such as epidural abscess, associated spinal cord tuberculomas, and destruction of vertebral body elements with abscess formation, clearly reveal the diagnosis. Other parameters, including increased erythrocyte sedimentation rate (ESR), increased blood leukocyte count, and the presence of low-grade fever (especially increased fever in the evenings), corroborated our diagnosis (1, 36, 48). MRI findings were characteristic enough to make a diagnosis of spinal TB in 171 patients. In five patients in whom MRI findings were equivocal, CT-guided biopsy was used to confirm the diagnosis. In addition, pus was sent routinely for smear examination and cultures for all cases after surgery.

To evaluate the shift of clinical, radiologic, and management paradigms, the patients were divided into two groups, one comprising patients treated from 1999 to August 2003 (group I; $n = 89$) and one comprising patients treated from 2004–2010 (group II; $n = 90$) (Table 3). A cutoff period of 2004 was chosen because it formed the median for the entire cohort of the study. This period also approximately represented a general shift of surgical strategies in our department as a result of a wider usage of complex instrumentation for spinal surgeries.

Table 1. Clinical and Radiologic Features of Patients with Spinal Tuberculosis

Clinical Presentation	Number of Patients ($n = 170$)
Age (years)	
Mean	34.8 ± 7.2
Range	10–75
Gender	
Male	88 (51%)
Female	82 (49%)
Clinical features	
Local pain and tenderness	128 (87%)
Radicular pain	42 (24%)
Fever	39 (22.9%)
Pulmonary Koch disease	34 (20%)
Tubercular lymphadenitis	2 (1.1%)
Sensorimotor deficits	167 (93.5%)
Bladder involvement	127 (71.7%)
Deformity	22 (22.9%)
Spinal region affected	Surgery ($n = 137$; 80%)/Conservative ($n = 33$; 20%)
Craniovertebral junction	15 (9%)/7 (3%)
Cervical spine	42 (23%)/8 (4%)
Thoracic spine	70 (40%)/16 (9%)
Lumbosacral spine	19 (11%)/2 (1%)
Imaging characteristics	
Vertebral body involvement	
Severe collapse (>50%)	37 (21%)
Mild to moderate collapse (<50%)	31 (18%)
Endplate collapse or disease	32 (19%)
Signal changes only	49 (28%)
Posterior element involvement	9 (5%)
Cord or thecal sac compression	144 (80%)
Paraspinal or epidural abscess	153 (85%)
Disk space involvement	131 (73%)

All patients received a standard chemotherapy regimen for 18 months. The drugs administered were isoniazid (5-10 mg/kg), rifampicin (10 mg/kg), pyrazinamide (15-30 mg/kg), and ethambutol (15-20 mg/kg) for 2 months in the intensive phase followed by isoniazid and rifampicin for the next 16 months in the continuation phase. In some cases, pyrazinamide was continued for the first 4 months at the surgeon's discretion. Patients already started on second-line therapy (ofloxacillin, ciprofloxacillin) were continued on the same medication until a complete remission was demonstrated. Patients underwent serial liver function tests to detect drug-induced hepatitis. Patients suspected to have drug-resistant TB but not requiring surgery were referred to the Department of Pulmonary Medicine for second line chemotherapy.

Management Protocol

We analyzed retrospectively the patients who underwent surgery or medical