e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2022; 14(8); 927-934

Original Research Article

A Retrospective Observational Assessment of the Surgical Management of Spinal Tuberculosis

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Received: 07-06-2022 / Revised: 25-06-2022 / Accepted: 23-07-2022

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Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to evaluate the surgical management of spinal TB.

Methods: The present study was conducted in the Department of Orthopaedics, Fort U Mediemergency Hospital, Patna, Bihar, India. We studied all the patients with spinal TB who presented with or without motor deficits due to spinal TB admitted and surgically treated in the hospital for 1 year.

Results: A total of 100 patients were included in the study. Out of which, 60 were males and 40 were females. The average age group is 45.5 years, the youngest being 18 years and the oldest 60 years. No gender-related difference was seen in our study. The most common site of involvement was thoracic followed by lumbar, cervical, and thoracolumbar. Pain was the most common symptom, and weakness was seen in 40 patients, 25 of whom had epidural compression.

Conclusion: Surgical treatment is a safe and effective approach to treat spinal tuberculosis infection. Although in less severe cases image-guided percutaneous aspiration and posterior percutaneous fixation can be an excellent therapeutic choice, in severe cases with large abscesses and extensive vertebral column involvement, aggressive treatment with direct aspiration and debridement, anterior reconstruction and posterior instrumentation can result in a rapid recovery and acceptable rate of complications.

Keywords: Diagnosis; Spinal Tuberculosis; early surgical management;

Introduction

Spinal tuberculosis (TB) accounts for 1–2% of all cases of TB and is a common extra pulmonary form. Musculoskeletal TB comprises ten percent of all TB cases, 50% of which are spinal. [1,2] Although it is primarily a skeletal disease, secondary involvement of the nervous system may lead to diverse neurological disabilities. The incidence of neurological complications in spinal TB ranges

variously from 10 to 41%. [3] Paraplegia is the most dreaded complication of this disease. It affects the intervertebral disc space and adjacent vertebral bodies, leading to skeletal deformities. Considering the potentially devastating nature of the disease, antitubercular regimens for treatment of spinal TB have characteristically been longer duration, usually ranging between 9 and 24 months or more. Although various international guidelines deem 6 months to be sufficient, they do provide provisions for extended therapy beyond the guidelines, based on the clinical scenarios.

Tubercular involvement of the dorsal vertebral column poses a potential threat as the spinal canal in this region is narrow. Additionally, the physiological kyphosis at the thoracic level pushes tubercular tissue into the spinal canal causing compressive myelopathy. A tubercular abscess may enter the spinal canal also via the intervertebral foramen. In the lumbar region, the abscess tends to enter the psoas muscle. [4] Another uncommon issue is of multilevel non-contiguous involvement of the vertebrae by TB without the involvement of adjoining intervertebral discs or vertebral bodies. [5]

Spinal TB occurs in fewer than 1% of patients with TB. [6-8] However, spinal TB accounts for 40%–50% of all spinal infection. [7,8] Spine TB accounts for 50% of the cases of extra pulmonary musculoskeletal TB. [6,7] Spinal TB continues to be a burden in developing countries, contributing to deformity and neurological deficit. Surgery is reserved for patients with mechanical instability or neurological deficits. [6]

Diagnosis in the initial phase of the disease can be challenging. The cardinal symptoms of spinal tuberculosis are pain, mild fevers, chills, kyphotic deformity, paravertebral abscess or even progressive neurological impairment. The presence of paravertebral abscess is an important cause of morbidity and is usually associated with more severe deformity, instability and neurological impairment, particularly when epidural abscess is also present. Clinical exam, laboratory and imaging studies are helpful; however definitive diagnosis is made only via identification of Mycobacterium tuberculosis. [9]

Antitubercular drugs are the gold standard for the treatment of TB in cases without spinal deformity or neurological impairment and are the first choice of treatment often resulting in fusion in 80% of cases. [10] The indication for surgery in patients with tuberculosis of the spine are severe spinal deformity, spinal instability, neurological deficits, presence of large tubercular abscess either para spinal or epidural and failure of response to anti-tubercular drugs. [11-13] The approach for the surgery can be anterior, posterior, combined, or posterolateral with promising results with posterior or combined approaches.

The aim of the present study was to evaluate the surgical management of spinal TB.

Materials and Methods

The present study was conducted in the Department of orthopaedics, Fort U Mediemergency Hospital, Patna, Bihar, India. We studied all the patients with spinal TB who presented with or without motor deficits due to spinal TB admitted and surgically treated in the hospital for 1 year.

The medical records and the clinical presentation, any family history or history of exposure, clinical examination notes, imaging, histopathological report, and follow-up data (Only those data of patients who had completed 1 year follow up were included in this study and analysed) were analyzed. Cases in which the follow-up period was shorter than 12 months were considered as lost to follow-up and excluded. Out of total 140 patients, 100 patients were included in the final analysis. We considered early presentation for those

patients presenting within 4 weeks of onset of symptoms. The study was approved by the local institutional ethical review board.

A written informed consent was obtained from all the patients for publication of data for academic purposes.

Preoperative evaluation

All patients underwent neurological impairment grading according to the American Spinal Association Impairment Scale (ASIA) of motor and sensory impairments ranging from A to E,[11] ranging from no motor and sensory function to normal function: Grade A – complete loss of motor and sensory function, Grade B – sensory incomplete, Grade C – motor incomplete with less than half of key muscle functions below the single neurological level having a Muscle grade > or = 3 (greater than or equal to 3), Grade D – motor incomplete with at least half (half or more) of key muscle functions below the single neurological level having a muscle grade g3, and Grade – E normal motor and sensory function. ASIA Grades A, B, and C were considered severe.

All the patients in the study had undergone following investigations: MRI spine with gadolinium (to identify involved spinal level, presence of para spinal or epidural abscess and to assess the extent of spinal cord compression and to also assess the posterior elements, facet joint involvement). X ray spine (lateral view, anterior-posterior view and dynamic flexion-extention view)-to assess for mobility to rule out spondylolisthesis of the involved level. Routine pre-operative blood investigation including ESR.

Surgical procedure

All surgical procedures were performed by a single team of neurosurgeons (2 per team), who were consistently involved in patient selection and surgical intervention. This ensured uniformity of inclusion of patients and the procedures followed. The patients underwent surgical procedures based on the presence of epidural abscess/granulation tissue with cord compression, neurological impairment, vertebral body destruction, facet destruction, and spine instability.

All the patients with thoracic or lumbar TB in the current study underwent surgery by posterior approach with fusion using the titanium implants (Jayon Implants Private Limited, India) for spinal instability. Thirty patients underwent emergency laminectomy and decompression for the epidural collection. In the thoracic and lumbar group, 40 out of 50 patients underwent open procedure, midline incision, subperiosteal paraspinal muscle dissection at the involved level and two levels above and below, laminectomy at the involved level with abscess drainage, and/or debridement of granulation tissue and pedicle screw fixation. 10 out of 50 patients, with no significant thecal compression, but involvement of facets requiring stabilization, underwent minimally invasive pedicle screw fixation and transpedicular decompression/ biopsy, and in those patients where extensive vertebral body involvement was seen, initially minimally invasive pedicle screw insertion in two levels above and below the involved vertebra was done. In patients with involvement of a single level with paradiscal and posterior element involvement with significant epidural collection, the surgical option is laminectomy and decompression of epidural abscess with pedicle screw stabilisation two levels above and two level below the involved segment.

Among 20 cervical Tb patients, 10 patients underwent only anterior approach with median cervical corpectomy of the involved cervical vertebral body, decompression of epidural abscess and fusion with expandable cage and anterior cervical plate (Jayon Implants, Titanium). The remaining 10 patients underwent both anterior and posterior cervical fusion (360 degree), Anterior- corpectomy with cage

and plate fixation and posterior lateral mass fixation, due to the presence of kyphosis. All patients' abscess/granulation samples were sent for Ziehl–Neelsen staining and TB culture and histopathology to identify mycobacterium. In the latter half of the study, samples were also sent for cartridge-based nucleic acid amplification test (CBNAAT).

Postoperative management

All the patients were started on antitubercular treatment (ATT), 2 months intensive phase (4 drugs, H – isoniazid [5 mg/kg], R – rifampicin [10 mg/kg], Z – pyrazinamide [35 mg/kg], and E – ethambutol [20 mg/kg]), followed by 3 drugs (H-Isoniazid, R-Rifampicin, Z-ethambutol) for 4 months followed by continuation phase (2 drugs, H- Isoniazid R-Rifampicin) for 12 months according to RNTCP guidelines. Postoperatively, patients were followed up at 6, 12, and 18 months. At the 6th and 18th months, X-ray spine was done to assess the fusion and MRI scan with gadolinium was repeated after 12 months to assess the eradication of disease.

Statistical analysis

Data were analyzed using SPSS software version 18.0 (SPSS Inc. Released in 2009. PASW Statistics for Windows, version 18.0. Chicago, IL, USA: SPSS Inc.). The continuous variables were analyzed using descriptive statistics using mean and standard deviation (SD). The categorical variables were analyzed using frequency and percentage. The frequency distribution of the number of cases, as per their ASIA grade (ordinal data), was compared before and after surgery using Wilcoxon signed-rank test. Further, the A to E score was converted into Likert scale 1–5, respectively, for statistical analysis of the mean scores. Baseline comparisons were carried out using Students' t-test for continuous variables and Chi-square test for categorical variables. Paired t-test was employed for analysis of presurgery to post surgery scores. $P \leq 0.05$ was considered statistically significant.

Table 1: Indications of surgery (note that medical therapy should always be started as well)

Indications of surgery
Neurological deficit Emergent surgical intervention should be performed if neurologic deficit exists, unless the deficit is minimal and non-progressive or the patient has medical co-morbidities such as sepsis or coagulopathy. If the deficit is minimal the patient should be carefully monitored to detect any progression in the symptoms.
Failed medical therapy and progression of disease despite best medical therapy
Chronic pain after medical management
Prominent deformity
Significant instability

Results

A total of 100 patients were included in the study. Out of which, 60 were males and 40 were females. The average age group is 45.5 years, the youngest being 18 years and the oldest 60 years. No gender-related difference was seen in our study. The most common site of involvement was thoracic followed by lumbar, cervical, and thoracolumbar. Pain was the most common symptom, and weakness was seen in 40 patients, 25 of whom had epidural compression [Table 2].

Table 2: Frequency distribution of location and clinical presentation of spinal tuberculosis

Location of TB spine	**N %**
Cervical	20 (20%)
Thoracic	40 (40%)
Lumbar	25 (25%)
Thoracolumbar	15 (15%)
Total	**100 (100%)**
Clinical presentation	
Back Pain	90 (90%)
Fever	75 (75%)
Cough	20 (20%)
Weight loss	35 (35%)
Weakness	40 (40%)
Numbness	20 (20%)

On Analyzing, all the patients who presented before 4 weeks and underwent surgery with or without epidural abscess (either percutaneous pedicle screw fixation and transpedicular biopsy followed by anti-tubercular treatment or underwent laminectomy and abscess draining), all patients undergoing early surgery showed improvement in their ASIA grade significantly. On Analysing, only those patients presenting with epidural abscess with neurological deficits, significant improvement in ASIA grade was seen in patients who underwent surgical decompression of abscess within 4 weeks as compared to those patients who presented later. This shows early decompression is beneficial in patients with epidural abscess. [Table 3]

Table 3: Change in ASIA grade (score) after surgical intervention among patients with and without epidural abscess/collection based on time of presentation

Patients	**Pre**	**Post**	**P**
Time of presentation and treatment (weeks)			
≤4	4.6 (0.60)	5 (0)	<0.001
≥4	3.30 (2.10)	3.80 (1.80)	0.140
Patients with epidural abscess/collection			
Time of presentation and treatment (weeks)			
≤4	4.0 (0.55)	5 (0)	<0.001
≥4	3.10 (2.75)	3 (2.80)	

Discussion

The success rate of surgical TB management is high and effective according to a study based on data collected from 582 patients throughout 11 years. [14]

Tuberculosis continues to have a worldwide impact with an estimated nine million new cases each year and a mortality rate of two million deaths each year. [15,16] Spinal tuberculosis accounts for over 40% of all spine infections and is the most prevalent spine infection globally. [17] The most difficult cases to treat are those with extensive spine involvement, vertebral body collapse, severe deformity, neurological injury and large abscesses, which in turn can spread towards the spinal canal and invade the epidural space.

The antitubercular drug is the mainstay of treatment for TB resulting in spontaneous fusion in about 80% of cases. Conventional medical treatment for spinal TB is for 18–24 months, [10] however, some prefer to treat for 6–12 months. [18,19] In our hospital, we followed RNTCP protocol of intensive phase for 6 months followed by continuation phase for 12 months which showed complete resolution on MRI images. The diagnosis of the disease is made by histopathological examination and CBNAAT report.

Combined treatment is more effective in the management of TB spine, [20] which enables for abscess drainage/debridement of granulation tissue, specimen for histopathology, and spinal fusion and deformity correction. Surgical management has resulted in early neurological improvement and enabling the early return of patients to routine activity. However, surgical management of spinal TB has always been controversial, with a few advocating surgical management, versus others claiming no additional benefits with surgical management. [21] Several benefits of surgical management of spinal TB do exist. These are immediate relief from symptoms (pain), and compression of neural tissue, reduced kyphosis (early and late), faster and higher bone fusion, and less bone loss. [22]

Approaches for surgery can be either anterior, posterior, or combined approaches. We have also observed good surgical outcome with the posterior approach in all the thoracic and lumbar TB cases, as was seen in previous studies. [23-26] Posterior approach surgery not only reduces bleeding but also shortens operation time and length of stay. [24] Posterior approach can directly relieve spinal stenosis and nerve root compression; both spinal decompression and internal fixation can be done at the same time, so patient compliance is better. [23-25] Posterior fusion combined with rigid instrumentation has shown to reduce intraoperative anesthetic and surgical complexity and morbidity that can be associated with the anterior approach. Even without debridement of the affected vertebral bodies, up to 98% cure rate with posterior fusion alone and chemotherapy is seen. [27,28]

Conclusion

Surgical treatment is a safe and effective approach to treat spinal tuberculosis infection. Although in less severe cases image-guided percutaneous aspiration and posterior percutaneous fixation can be an excellent therapeutic choice, in severe cases with large abscesses and extensive vertebral column involvement, aggressive treatment with direct aspiration and debridement, anterior reconstruction and posterior instrumentation can result in a rapid recovery and acceptable rate of complications. Minimally invasive pedicle screw fixation is an advanced surgical technique with less muscle dissection and blood loss and especially found effective in long-segment fusions wherein midline open single-level laminectomy and decompression could be added at the level of epidural abscess.

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