

Surgical Management of Tuberculosis Spine

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Abstract

Background: Tuberculosis is a common disease across the world and India alone accounts for 24% of global burden of the disease. Tuberculosis involving vertebral column is one of the commonest presentations in the extra-pulmonary tuberculosis. It is associated with significant morbidity. Therefore, social burden of the spinal tuberculosis is high, especially in the developing countries. The condition needs medical management and surgical intervention to achieve relief of cord compression, correction of deformities and stabilisation when necessary.

Aim: Present study aimed to analyse both short and long term follow up of the spinal tuberculosis patients who underwent surgical stabilisation using implants.

Methods: All the patients with spinal tuberculosis treated in the Department of Neurosurgery, Gandhi Hospital, Secunderabad between January 2009 and December 2014 who underwent surgical stabilization using implant were included in the study. The study was taken up on both prospective and retrospective basis. Total 52 patients were included in the study. Preoperative and post operative status was analyzed in reference to the clinical symptoms and radiological evaluation. Their kyphotic angle regressions are specifically recorded during follow-up imaging. Parameters like time for mobilisation, duration of hospital stay, persistence of lesions and ESR trends and return to previous activity of the patient were followed.

Results: The risk of neurological deterioration was reported following surgical intervention which is minimised with sound techniques of surgery and advent of better imaging and instrumentation.

Duration and severity of neurological involvement prior to surgery is an important factor determining the final outcome.

The patients undergoing surgery involving implant stabilisation were mobilised as early as second postoperative day and could be discharged very early. Total hospital stay has been reduced significantly. Rapid neurological improvement helps in early rehabilitation. Patients could go back to their previous work earlier compared to the medical management group as reported in the past.

Follow up clinical evaluation and imaging was encouraging without problems like recrudescence or morbidity or need for prolongation of chemotherapy instead there was good union rate with normal ESR trends by end of three months.

Conclusion: This study aimed to assess the outcome and benefits of surgical stabilisation using implants for TB spine patients with neurological deficits and instability. There was significant advantage for the patients allowing reduction of hospitalisation, early mobilisation and recovery such that they are able to attend their previous work.

Keywords: Tuberculosis of Spine; Surgical Management; Spinal Implants.

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Introduction

Tuberculosis is a common disease across the world and India alone accounts for 24% of global burden of the disease [1].

Tuberculosis involving vertebral column is one of the commonest presentations in the extra-pulmonary

tuberculosis. It is associated with significant morbidity. Therefore, social burden of the spinal tuberculosis is high, especially in the developing countries.

The condition needs medical management and surgical intervention to achieve relief of cord compression, correction of deformities and stabilisation when necessary.

Surgical interventions mainly aim at decompression of cord, debridement and removal of pathological tissue so as to achieve good drug penetration, to help bony union and to have a stable spine. To achieve a stable spine, spinal fusion with bone grafting has been practiced.

Implant stabilisation was later introduced to enhance bony union in spinal stabilisation and aimed at early mobilisation. Use of implants in the presence of active disease has its own challenges and reservations.

Surgical stabilisation with implants is aimed at correction of spinal deformity and also to hold the correction till a sound bony union is achieved. It helps in early recovery and return to work. Use of foreign material in presence of infection may lead to persistence of infections. Hence implants were used cautiously in earlier days but now the perception is changing.

Aims and Objectives of the Study

Present study aimed to analyse both short and long term follow up of the spinal tuberculosis patients who underwent surgical stabilisation using implants.

When TB spine with need for surgical intervention patient presented to us, we opted for surgical decompression, bone grafting with implant stabilisation. Their kyphotic angle regressions are specifically recorded during follow-up imaging. Other parameters like time for mobilisation, duration of hospital stay, persistence of lesions and ESR trends and return to previous activity of the patient were followed.

Patients and Methods

All the patients with spinal tuberculosis treated in the Department of Neurosurgery, Gandhi Hospital, Secunderabad between January 2009 and December 2014 who underwent surgical stabilization using implant were included in the study. The study was taken up on both prospective and retrospective basis.

Inclusion Criteria

1. Patients of known tuberculous conditions presenting with spinal compression symptoms.
2. Patients with spinal compressive features suggestive of Koch's etiology.
3. Patients with spinal tuberculosis with instability.

Exclusion Criteria

1. Those patients where no implants were used for surgical stabilization.
2. Biopsy not confirmative of tuberculous etiology.

The detailed case records of such patients looking into the clinical parameters and imaging were maintained. Patients who underwent surgical stabilisation using implants were followed up on long term anti tuberculous treatment regimes.

Surgical interventions aimed at debridement, bone fusion using allograft, implant stabilization and additional synthetic bone graft material used. Surgical approaches were modified according need for clearance of pathology i.e., granulation or abscess and to allow proper fusion and stabilization so that good correction of alignment could be achieved.

Patients with CVJ involvement underwent posterior stabilisation by occipitocervical fusion (Figure 1). Subaxial spine surgeries were approach anteriorly and stabilized using locking plates. Patients with cervicodorsal involvement underwent transclavicular [anterior] approach and fusion was done.

Patients with thoracic spine involvement underwent anterolateral intrapleural decompression and fusion with screw and rod systems. Some patients were operated by posterolateral approach i.e., costotransversectomy and stabilized using pedicle screws (Figure 2).

Thoracolumbar spine was stabilized by pedicle screws applied on anterolateral surface of the vertebral body instead of Z plates. Lumbar spine was also stabilized using pedicle screws. Some patients needed retroperitoneal approach.

Kyphotic angles were measured pre operatively, post operatively and at follow up visits specifically at end of six month after surgery. Few patients were followed using CT scan to note the bony fusion.

ESR readings were noted at follow up visits at 3 weeks interval 3 months and at 6 months. Further ESR repetitions were done in patients who had persistent raised readings.

ATT was given for long term i.e., 12-24 months. In intensive phase Streptomycin was added to the standard regime. In continuation phase, 4 drugs were given upto 3 months and then 3 drugs were prolonged upto 18-24 months as necessary in some cases.



Fig. 1: Pre op MRI Cervical spine showing C2 Potts spine and post operative X-ray showing occipito cervical fusion with contour rods



Fig. 2: Thoracic spine Potts spine MRI (pre op) and post op X-ray with pedicle screw fixation

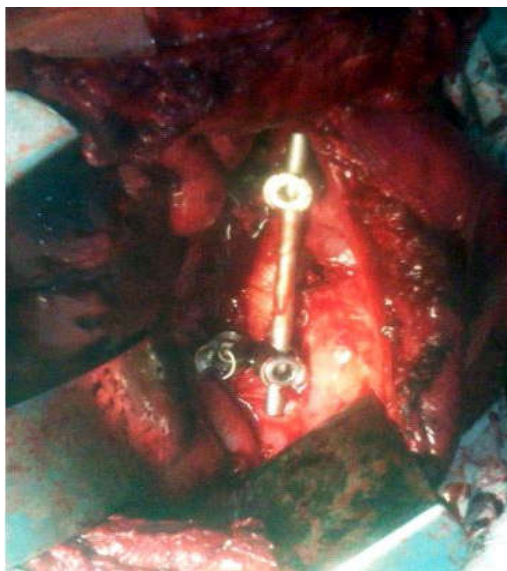


Fig. 3: Intra operative picture showing screws and rod over anterolateral aspect of vertebral bodies following debridement

A detailed list of all the clinical, pathophysiological and radiological parameters was analysed for outcomes.

Observations

A total of 52 patients, who completed minimum of six months follow up were analysed for the outcomes. The following observations were drawn.

A total of 962 patients underwent spinal stabilisation using implants at Gandhi Hospital during 2009 to 2014 out of which, 52 [5.41%] were of tuberculosis etiology, 94 were spondylolisthesis and the remaining 816, traumatic spine injuries. Six patients of TB spine underwent fusion without implant stabilisation.

There were total 1192 spacing occupying lesions of brain which were treated surgically out of which 104 [8.72%] turned out to be tuberculomas.

There were 7024 neurosurgical procedures from 2009 to 2014 at our hospital from which 162 [2.31%] were with tuberculosis etiology.

Age and Sex Incidence

Among 52 patients, 29 were male and 23 were female patients. There was increase in incidence among males at a higher age compared to female patients who were effected at younger and middle age.

Average age in the group was 38 years. Youngest was 11 years and the oldest, 72 years. Mean age of male patients was 42.12 years and female patients was 33.35 years.

There was one patient with HIV positive status. One patient had H/O trauma previously and one patient who had delivery recently. There were 3 patients who diagnosed as TB spine and on ATT at presentation with new onset motor deficits.

Clinical Features

Pain was the most prominent feature present invariably. Only one patient had no back pain. Weakness of limbs was present among 48 patients. Only four patients had no weakness of limbs. Half of the patients had numbness as complaint on presentation. Thirteen patients [25%] had bladder and/or bowel complaints at presentation. Rest of the 39 patients did not have such problems. There was fever in 12 patients [23.08%].

Swelling and Deformities: Swelling and spinal deformities were present in 10 of the patients whereas the rest of the 42 patient did not complain of any swelling. Gibbus deformity was seen in 24 [46.15%] patients. Tenderness was seen as invariable feature in all the patients. Cold abscess was seen in 16 [30.77%] patients. It was mostly seen among those with dorsolumbar region involvement. Regional involvement associated with cold abscess: Cervical – 2; Dorsal – 7; Lumbar – 5 and Dorsolumbar – 2.

Motor Deficits

Four patients had no motor involvement. About 10 more patients had minimal weakness of limbs. Quadripareisis was seen in 4 patients and lower limb weakness was noted in 44 patients of which 7 were paraplegic.

Patients with sensory deficits were 27 out of 52 while rest of 25 patients did not have any sensory involvement.

X ray findings: Out of 52 patients, 10 of them showed destruction, wedging or collapse of the vertebral body. 16 patients had evidence of cold abscess visualised in skiagrams.

CT & MRI: Few patients had undergone CT scan to demonstrate bony fusion on long term follow up.

MRI was done for all patients to delineate cord compression and epidural collection. Destruction and cord compression was noted in 49 patients while paraspinal collections were detected in 16 patients.

Regional and segment involvement of spine: Among the 52 patients, cervical spine involvement was seen in 6 [11.54%] patients. Dorsal involvement was most common with 31 [59.62%] patients being involved. 13 [25%] had lumbar spine involvement while other 2 had dorsolumbar involvement.

There was involvement of single vertebra in 18 [34.62%] patients, 2 vertebrae in 30 [57.69%] and 2 each had 3 or 4 vertebral involvement. Mean number of vertebrae involved was 1.77.

Surgical procedures: All patients underwent stabilisation using implants. Approach was variable based on the need. Bone graft has been used for all the patients along with G-bone supplementation.

One patient had odontoid destruction and cold abscess. He underwent occipito-cervical fusion with contour rods and bone grafting along with anterior drainage of the retropharyngeal abscess with debridement and onlay grafting done.

There were 5 individuals with sub axial spinal TB and all underwent debridement and autologous bone

graft fusion with locking plate stabilisation through anterior cervical approach.

Dorsal spine lesions were most common and 12 patients needed surgical debridement by costotransversectomy as there was posterolateral extension of soft tissue mass. Bone graft fusion using rib when possible and pedicle screw fixation was done. Thoracotomy was done for 15 patients who also had bone graft fusion and fixation using Screws and Rods instead of Z plate. One patient who underwent pedicle screw fixation elsewhere presented with late deficits, he had implant breakage and soft tissue mass and needed fusion procedure by anterior approach. Debridement and strut graft was done and implantation was abandoned on table due to large pulsating aorta abutting the screws placed.

Pedicle screw fixation with posterior decompression and debridement along with posterolateral fusion using bone grafts and G-bone supplementation was done in 14 patients comprising lumbar and dorsal spine lesions.

Antero lateral fusion was done for 5 patients with lumbar spine involvement by retroperitoneal approach (Figure 3). They were given bone grafts. One girl was given fibular graft who had implant break after 4 years and needed stabilisation.

Post-Operative Complications: Wound leak was noted in 2 [3.85%] patients and resolved spontaneously. One patient had implant breakage. No patient had deterioration of neurological status.

Hospital Stay: Duration of hospital stay ranged from 8 to 29 days with average stay of 16 days. Post-operative stay varied from 7 to 25 days with an average of 12 days.

Time for Ambulation: Most of the patients were made to stand in 3-5 days using walkers with braces on. During second week they were mobilized with braces and supports as necessary. Four patients with long pre-operative paraplegia needed upto 3 weeks for ambulation.

Anti-Tuberculous Treatment: Most of the patients were given ATT for 18 months. 4 patients were given extended treatment upto 24 months.

ESR

Pre-operative ESR was average 51 mm @ 1 hour and followed up at reviews. At six week follow-up, mean ESR was 32 mm @ 1hour with average drop of 19 mm. At three month follow-up, mean ESR was 18 mm @ 1hour with average drop of 32 mm showing downward trend.

Kyphotic Angles

Average pre-operative kyphotic angle was 18° ranging from 8° to 28°. Immediate correction achieved was 6.22 on an average and follow up showed final correction of average 5.04°. There was about 1.2° regression of correction noted during follow up.

Neurological outcome

Most of the patients showed good improvement in neurological status. Motor improvement with ability to walk with or without support was noted by 3 months in all patients except one patient who presented with long standing paraplegia of more than 3 months. Another patient who improved and was ambulant with support fell at home after 4 months. She became paraplegic and did not make improvement. 5 patients out of 7 paraplegics had complete recovery of motor strength at end of six months.

Discussion

The world has nearly 30 million people suffering from tuberculosis. Of all the patients with tuberculosis, nearly 1-3% has involvement of the skeletal system. Vertebral tuberculosis is the commonest form of skeletal tuberculosis, most series reporting an incidence of up to 50% of osteoarticular tuberculosis [1-2].

Spinal tuberculosis can occur at any age and affects both sexes equally. Spinal tuberculosis was found to be most common in the first three decades of life [2].

In our series also the average age group was 38 years, youngest being 11 years and the oldest was 72 years. The sex distribution in present study was 55.78% male and 44.22% were female patients. Akinyoola stated male to female incidence as 49% and 51% [3].

The spinal disease is always secondary to a primary lesion, usually from a visceral focus, and occurs due to haematogenous spread. Infection may reach the spine due to a bacillaemia or through the Batson's plexus of veins. The primary focus may be active or quiescent and may be in the lungs, mediastinal lymph nodes, kidneys or other viscera [2].

Classically, four types of involvement of the spinal column have been described in spinal tuberculosis [2]:

i. A paradiscal lesion which arises from arterial

spread of the infection

ii. The central type of vertebral body involvement of one or more distant or adjacent vertebrae (this is often associated with tuberculous meningitis as the spread of the infection is via the Batson's plexus of veins)

iii. The anterior type with cortical bone destruction and

iv. Appendiceal type.

Neurological involvement is the most serious of the complications of spinal tuberculosis. The overall incidence of neurological complications varies between 10% and 40% [2,4].

The most common presentation is back pain depending on the site of involvement of tuberculosis [3,5]. The most common sign is weakness of limbs either paraparesis or quadriparesis depending on the level of involvement of tuberculosis [3,6,7]. In the present study, pain was present in 98.08% patients. Weakness was seen in 92.31% of patients in present study. In present study, paraplegia was seen in 13.46% and various authors reported from 6% to 12% [5,8]. Bowel and bladder involvement was seen in 25% in present study. Sadik I Shaik 2013 reported bladder involvement in 9.6% of TB spine [5].

Cold abscess/ paraspinal collection was also seen in these patients [2,5,7]. In our study cold abscess was seen 30.77% of patients. Spinal deformity is also reported with various series [2,6]. Gibbus was seen in 46.15% patients in the present study.

The risk of paraplegia is highest in lesions of the cervico-dorsal region, although Tuli reported a higher incidence amongst those with mid thoracic lesions. He found that 139 out of 200 patients with neural involvement, the lesion was in the mid-dorsal region [2].

Spinal involvement is common at dorsal region [2, 9]. Among the 52 patients in our study dorsal spine is commonly involved (59.62%) followed by lumbar spine (25%), cervical spine (11.54%) and dorsolumbar spine.

There was involvement of single vertebra in 18 [34.62%] patients, 2 vertebrae in 30 [57.69%] and 2 each had 3 or 4 vertebral involvement. Mean number of vertebrae involved was 1.77. On an average involvement of 3.8 vertebrae was reported by Mukopadhaya and Mishra (1957) and V Agrawal (2010) reported as 2.5 [10,11].

Involvement of the cauda equina in the lumbar and lumbosacral regions is seen less frequently.

The spinal cord may be involved during any phase

of the disease, in the active phase within the first 2 years or in later years after the disease has become quiescent. In a given case more than one factor may contribute to the pathogenesis.

The degree and extent of the neurological deficit depends on the site of the disease, the direction of spread and the pathological changes produced. While usually the onset of symptoms is slow and progressive, in a small percentage of cases the paraplegia may be of sudden onset and nearly complete from the beginning.

Tandon and Pathak have divided the clinical picture of Pott's disease into four groups [12]:

1. Paraplegia arising in a known case of spinal tuberculosis
2. Paraplegia as the presenting symptom of spinal tuberculosis
3. Spinal tumour syndrome
4. Paraplegia due to tuberculosis of the posterior neural arch.

Plain X-ray is useful modality for screening the lesions and follow-up imaging helps ascertain response to the treatment.

Cobb Angle: The angle formed between a line drawn parallel to the superior endplate of 1 vertebra above the fracture and a line drawn parallel to the inferior endplate of the vertebra 1 level below the fracture [5,13].

CT scan can be useful in assessing the destructive lesions in the vertebral column helpful in planning surgery

Jain et al. classified the findings on CT scan into [14]

1. Fragmentary,
2. Osteolytic,
3. Subperiosteal, and
4. Localised and sclerotic types.

MRI with high resolution, direct multiplanar imaging, detection of marrow infiltration and the early detection of intradural infection can be done. The technique used should be modified, depending on the site and extent of the infection, using spin echo and T1-weighted imaging for localisation.

MR is also helpful in revealing associated lesions like intraosseous abscesses, paraspinous abscess, vertebral body and disc collapse, spinal deformity, skip lesions, epidural and intraspinal extension, involvement and compression of the cord or nerve roots and appendicular lesions. The use of

gadolinium enhanced imaging is advantageous.

Treatment

The aim of treatment is to confirm diagnosis, achieve bacteriological cure, prevent and/or treat deformity and neural compression. With technological advancements in the field of spinal imaging, early diagnosis of spinal tuberculosis is possible. With better chemotherapeutic drugs available that reach pus, granulation, caseous material and bone, non-operative management has become more effective, especially in cases diagnosed early.

Medical management is suggested in case of TB spine where there are no features of destruction, instability or neurological deficits. Present practice for TB spine patients where there is no surgical indication, chemotherapy and bed rest without immobilization for 4-6 weeks. The chemotherapy is continued for 9-12 months in most of the hospitals. Some patients may need prolonged ATT upto 18-24 months. Screening of ESR and radiological resolution are noted before terminating ATT.

Criteria for Deciding on Surgical Therapy

Neurological signs not improving or worsening within 4 weeks of adequate conservative and drug therapy
Development of neurological signs with progression while on adequate therapy
Recurrence of neurological signs after improvement
Rapid onset paraplegia
Paraplegia with flexor or painful spasms

Posterior spinal disease with spinal tumour syndrome

Prevertebral cervical abscess with difficulty in deglutition
When the diagnosis is in doubt

Late onset paraplegia
Correction of kyphosis

Unstable spine with persistent pain

Various surgical methods were used to treat the spinal tuberculosis like excision of abscess, granulation tissue, debridement, excision and bone grafting and excision, bone grafting and instrumentation to stabilize the spine and to correct the deformity.

Instrumentation helps to produce rigid fixation of the involved segments of the spine to allow uninterrupted healing, as movement in and around the spinal cord is still possible after anterior strut grafting. The instrumentation procedures also prevent any increase in spinal deformity that may occur in the course of healing.

Instrumentation also helps in early mobilization and in turn reduces the hospital stay, as in our study the duration of hospital stay ranged from 8 to 29 days with average stay of 16 days. Post-operative stay varied from 7 to 25 days with an average of 12 days. Sawan et al. 2014 reported average hospital stay of 12 days ranging 8-61 days [15].

Most of the patients were made to stand in 3-5 days using walkers with braces on. During second week they were mobilized with braces and supports as necessary. Four patients with long pre-operative paraplegia needed upto 3 weeks for ambulation.

Average pre-operative kyphotic angle was 18° ranging from 8° to 28°. Immediate correction achieved was 6.22 on an average and follow up showed final correction of average 5.04°. There was about 1.2° regression of correction noted during follow up.

The problem associated with instrumentation in the presence of infection is the possibility of persistence of a focus of infection. Biomaterial-centred infections are related to the preferential adhesive bacterial colonisation on inert surfaces. Mycobacteria produce much less biofilm than other bacteria [16,17].

MRC 14th report of 5 year study in ambulatory patients of spinal tuberculosis suggested INH and Rifampicin therapy on daily basis for 9 months to be effective with radical surgical decompression. In present study, the patients had variable vertebral and neurological involvement with surgical indications and all of them were stabilized with implants. All the patients were given ATT for 18 months following surgery: 5 drugs for 3 months followed by 4 drugs for 6 months and continued with 3 drugs for next 9 months. Four patients were known TB patients on ATT at presentation and were given ATT till 18 months following surgery in addition to their preoperative ATT course of 5 months in 2 patients and 2 months in 2 patients. Their ESR readings were noted to be normalised by 3-6 month duration and no patient needed prolongation of chemotherapy.

Neurological complication is the most dreaded and crippling complication of spinal tuberculosis. Tuli (1965-74) found neurological complication in 20 percent of the cases [2].

In present study, neurological complications were not seen except deterioration in one patient who improved neurologically, had a fall after 4 months during mobilisation (unrelated to the primary intervention) and she became paraplegic and did not improve subsequently.

In present study, motor improvement with ability to walk with or without support was noted by 3 months

in all patients except one patient who presented with long standing paraplegia of more than 2 months.

Conclusion

Tuberculosis being a common disease across the world, involving vertebral column, is associated with significant morbidity.

This study aimed to assess the outcome and benefits of surgical stabilisation using implants for TB spine patients with neurological deficits and instability. There was significant advantage for the patients allowing reduction of hospitalisation, early mobilisation and recovery such that they are able to attend their previous work.

The goal of surgical intervention in patients of TB spine is to achieve good debridement to reduce the infection load, to facilitate drug penetration, to decompress the spinal cord and provide stability to the unstable spinal segment in the immediate post-operative period and help to achieve good bone graft incorporation and bony union subsequently. Approach of surgical intervention needs to be planned as per the need of each case so that both the purposes of surgery are achieved.

For bony fusion to occur, minimum of 6 weeks during which the patient needs immobilisation i.e., bed rest. Use of Implants can achieve immediate stability of the spine and allow early mobilisation of the patient. At the same time, good bony union can occur at the lesion because of stable spinal segment. It is well established that the bony union following bone grafting with implant stabilisation in spine is more compared to the fusion without implant stabilisation. Use of implants in the presence of tuberculous infection can be done as biofilm formation and persistence of bacilli is not seen as with other pathogens.

Correction of kyphotic angle could be achieved significantly by timely intervention using implant stabilisation. It aids maintaining the anatomical balance till bony union is achieved so that there will be minimal regression of the angle.

The risk of neurological deterioration was reported following surgical intervention which is minimised with sound techniques of surgery and advent of better imaging and instrumentation.

Duration and severity of neurological involvement prior to surgery is an important factor determining the final outcome.

The patients undergoing surgery involving

implant stabilisation were mobilised as early as second postoperative day and could be discharged very early. Total hospital stay has been reduced significantly. Rapid neurological improvement helps in early rehabilitation. Patients could go back to their previous work earlier compared to the medical management group as reported in the past.

Follow up clinical evaluation and imaging was encouraging without problems like recrudescence or morbidity or need for prolongation of chemotherapy instead there was good union rate with normal ESR trends by end of three months.

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