Primary Posterior Fixation For Tuberculosis Of The Spine

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Citation

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Abstract

Tuberculosis of the spine is a very frequent case in the practice of spine surgeons in the developing world, and is set to pose a challenge to the developed world in near future. Only anterior surgery seems to be falling short in potential for correction of the kyphotic deformity as well as of preventing gradual collapse later on. Posterior fixation has shown an excellent potential for correction of deformity and prevention of secondary collapse when combined with anterior reconstruction and fusion in cases of trauma and deformity, and its potential is now being tested worldwide for tuberculous spine.

We treated 100 patients with tuberculosis of various spinal levels with different levels of neurological impairments with primary posterior corrective fixation and second stage anterior debridement, decompression and reconstruction and followed them up for an average of 41 months. We didn't face any graft related problems, could mobilize the patient immediate after the surgery and achieved solid fusion in all cases. We faced only 4 un-acceptable adverse events in these cases in form of infection (2), neurological injury (1) and non-fusion (1). The mean preoperative kyphotic angle was 36.6 degrees and correction of a mean of 10.375 degrees (36.6%) was maintained at final follow up of 41 months.

We find that for cases of exudative stage tuberculosis of spine, primary posterior fixation and second stage anterior debridement and reconstruction provides good neurological decompression, early bony fusion and correction and/or prevention of deformity, allows early and better rehabilitation and is a recommendable strategy of surgical treatment for carefully selected patients.

INTRODUCTION

Mycobacterium Tuberculosis is the most common causative organism for infective spondylitis in developing countries. ([1]) While all forms of tuberculosis are rare in the developed countries, its resurgence has been seen in these times of immunodeficiency states and syndromes as well as due to the global migrant population groups from the underdeveloped nations. ([2]) Time to diagnosis, early or gradually developed deformities and neurological consequences of the deformity as well as of the disease are the major factors that determine the ultimate outcome for the patient. ([2], [3])

Neurological recovery and eradication of tuberculous infection with stabilisation of the spine are the goals of the treatment of the spinal tuberculosis. ([2]) Delayed diagnosis is a common problem in developing countries due to lack of access to health care system and in developed countries due to rarity of suspicion. On an average, a patient with spinal tuberculosis is diagnosed at 16th to 19th month of the disease process, ([3]) by which time the typical kyphotic deformity is usually evident. While the anterior radical debridement surgery and modern chemotherapy have been accepted as ideal treatment for eliminating the infection and healing the bone with fusion ([4,5]), it often leaves behind the kyphotic deformity only partially addressed if at all.

This study was aimed at identifying the role and efficacy of treating spinal tuberculosis patients in destructive stage of disease with primary posterior corrective fixation and then anterior debridement and reconstruction. The recently increasing interest into published literature ([2,6,7,8]) about posterior fixation in tuberculosis of spine inspired us to share our own experiences with the fraternity.

METHODS

A total of 100 patients were included in the study with mean age 35.9 years- 52 males and 48 females with tuberculosis of spine with different levels of involvements and neurological status. The patients had been treated from 1997 till December 2006 and data collection was both retrospective as well as prospective. The diagnosis was based on suggestive clinical history; imaging modalities such as plain x-rays, ultrasound of psoas and paravertebral spaces, CT scan of involved levels and/or MRI of involved level with scanning of spine for skip lesions. Diagnosis was confirmed through histopathology of the tissue obtained during anterior surgery.

All patients included in this study were treated at the active stage of the tuberculous spondylitis.

Figure 1

Table 1: Spinal levels involved and neurological status

Level involved	Neurological status				
	A	B	C	D	E
Dorsal (D1-D11)	6	5	12	12	4
Dorsolumbar (D12-L1)	4	1	4	12	13
Lumbar (L2-L4)	1	0	4	5	15
Lumbosacral (L5-S1)	0	0	0	1	1

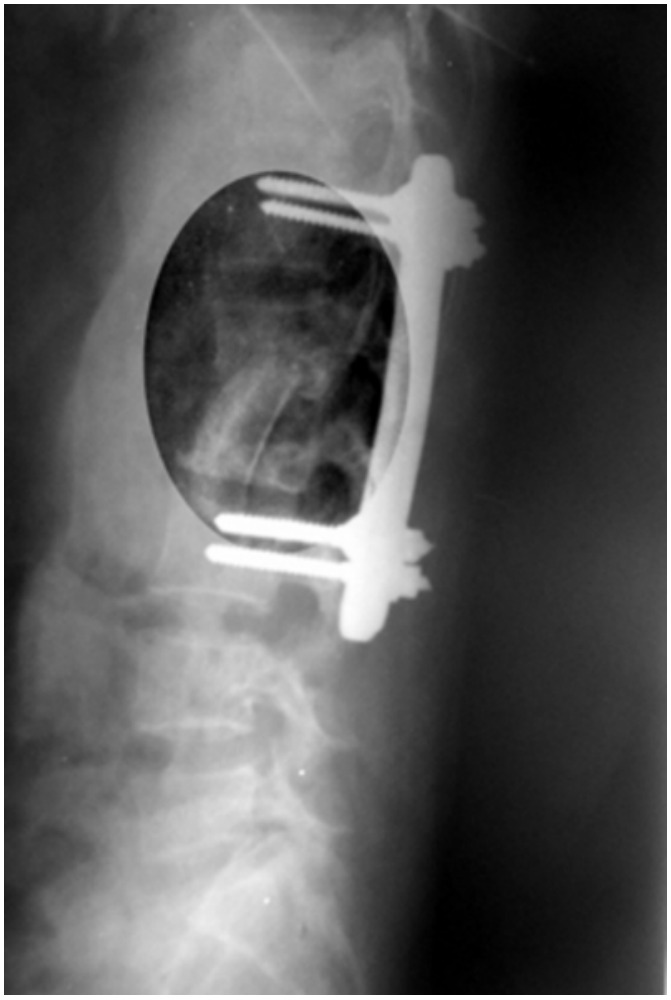
The patients received 2-3 weeks of preoperative chemotherapy after being admitted in the special spine unit. Medical and anaesthetic evaluation regarding cardio-pulmonary functional status and fitness for surgery and pre-operative physiotherapy program including respiratory physiotherapy in view of anterior abdominal, transthoracic or transdiaphragmatic surgery.

Figure 2

Picture 1: Radiograph showing L1-2 tuberculosis with Kyphosis and anterior destruction of both vertebral bodies

Figure 3

Picture 2: Postoperative radiograph showing Steffee instrumentation with good correction of kyphotic deformity and tricortical iliac bone graft in place.



The patients were operated in routine operative list with 1st stage posterior fixation in form of sublaminar wiring and Hartshill rectangle fixation or transpedicular screw, thoracic hook and rod systems extending up to 2 levels on both sides of the lesion. Absence of disease in the adjacent vertebral bodies was confirmed with MRI when pedicle screws fixation was planned in order to avoid putting screws in infected body part; and in turn to avoid risk of providing an innate surface for the infection as well as to avoid unsound fixation in diseased body. No posterior complex decompression or fusion was attempted, neither was a biopsy tried through posterior surgery.

Figure 4

Picture 3: A case of L2-3 tuberculosis treated with primary corrective posterior fixation and second stage anterior debridement and fusion at 6 months follow up showing healing of the infection and developing fusion

2nd stage anterior debridement, neurological decompression and anterior columns reconstruction was carried out at 1- 2 weeks after the first surgery. The major factors dictating the time between the two surgeries were anaesthetist's opinion for fitness for second surgery, availability of crossmatched blood and room on operative schedule. The anterior surgery was carried out with thoracotomy in the levels D2-D11, transdiaphragmatic for D12- L1 and lumbar retroperitoneal for lumbar levels. The paraspinal abscess was drained; debridement of infected bony and soft tissue was done. Neurological decompression was carried out under vision. Bony debridement was carried out till healthy bleeding bone margin was reached and reconstruction was performed with autogenous bone graft from iliac crest or ribs. Iliac crest grafts were used alone or filled into titanium mesh cages, while rib grafts were never used as only graft material; ribs were morsellized and filled into titanium mesh cages. In one case with more than 3 bodies involved, we used a fibula graft. Bone graft substitutes or BMP were not used in any of

the cases.

Figure 5

Table 2: Method of fixation and graft used

Graft material	Method of fixation	
	Sublaminar wires with Hartshill	Pedicle screw and/or hooks
Cage	39	6
Tricortical Iliac	24	10
Rib	19	1
Fibula	1	0

The patients received local segment nerve blocks for immediate postoperative pain relief and respiratory and bedside physiotherapy were encouraged. The patients were referred for mobilisation and physiotherapy as soon as they were free of the operative pain and received occupational evaluation and therapy according to their neurological status.

Figure 6

Picture 4: Another case of L1-2 tuberculosis with minimum Kyphosis

Figure 7

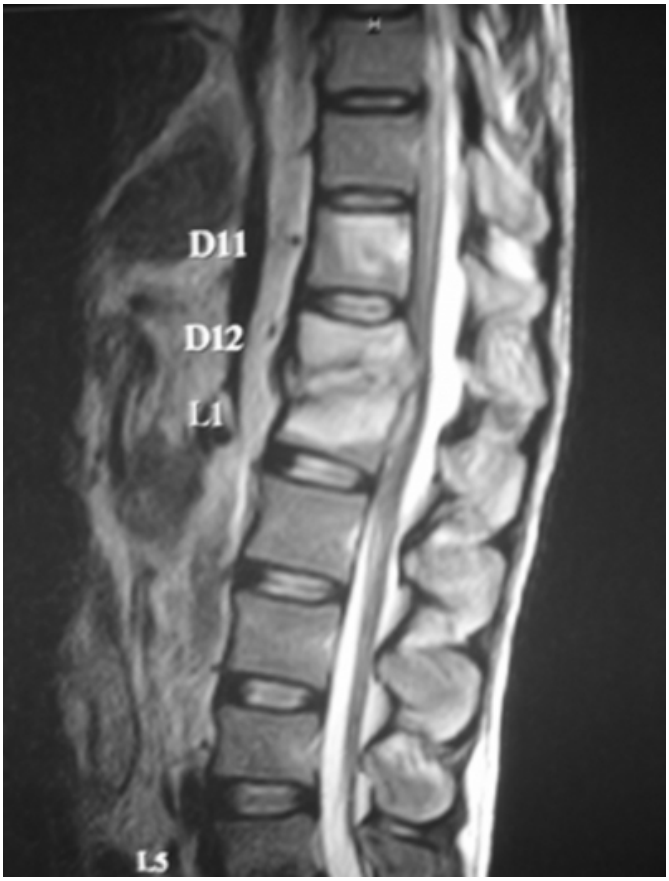
Picture 5: MRI of the patient 3 showing 2 bodies involved and debris compressing on the neural tissue. The cephalad body also showing some lytic focus, which prevents us from using pedicle screws for fixation.

Figure 8

Picture 6: Stabilization of the same patient 3 with sublaminar wires and Hartshill rectangle showing good correction of the Kyphosis. The patient later had anterior reconstruction with titanium mesh cage filled with bonegraft

Figure 9

Picture 7: Another example of D12-L1 tuberculosis, which shows involvement of D 11 on the MRI that excludes the possibility of using pedicle screw in the D 11 level



The patients were followed up at 2 weeks after discharge, and then monthly for 6 months, six monthly or as required later on. The outcome was assessed in the form of mechanical correction achieved by measuring kyphotic angles, neurological recovery in the measure of ASIA (American Spinal Injury Association) scoring system ($_{12}$) and fusion status that was suggested by presence or absence of local pain on movement anteroposterior and lateral radiographs and maintenance of correction.

RESULTS

Mean duration of follow-up 41.75 months after surgery (range 9-114 months). 4 patients were lost to follow-up on a long term. Operative blood loss was 300 mls per procedure per patient. Mean angle correction at the last follow-up of all patients 10.375 degrees (max. 20 degrees)

There were no peroperative complications noticed. 2 patients had posterior surgery wound infection at 4th postoperative day, which was treated with routine wound debridement and antibiotics and healed uneventfully later. Another patient

with ASIA A neurology at presentation had severe posterior surgery wound infection that required implant removal in the 4th week after surgery. The patient showed 6 degrees loss of correction after implant removal, and didn't improve in neurological status.

60 patients showed upto 2 ASIA grades improvement in neurology. 6 patients who presented with ASIA A neurology primarily didn't improve at all. One patient had neurological deterioration immediate postoperative after sublaminar wiring and hartshill fixation from ASIA grade B to A. The implants were removed immediately but the patient never had any neurological recovery in next 26 months follow-up.

Figure 10

Table 3: Complications encountered

Complications	
Infection	2
Neurological worsening	1
Non-fusion	1
Delayed fusion	2
Total	6

Most (81) patients were completely pain free and all had improved pain scores as compared to preoperative status. All but 1 patient had radiological signs of fusion at 12 months post operatively. The patient that didn't show radiological signs of fusion also had significant relief from pain as compared to pre-operative pain scores. The radiological signs of fusion started to appear at 3rd month post anterior surgery follow-up in most patients.

2 patients had signs of lucency around the graft at 3 months, they were sent for ultrasound scans and recurrent abscess was found. The abscess was drained under ultrasound guidance and sent for culture, and both were found to be having tuberculous infection resistant to routine anti-tuberculosis chemotherapy. Revised chemotherapy schedule was arranged in consultation with medical specialists in conjunction with the therapeutic aspiration of abscess. Both patients showed fusion at 8-9 months post surgery.

The one patient who had posterior surgical site infection requiring implant removal had lost kyphotic correction, but went on to fuse in kyphotic position anteriorly. The patient was ASIA A at presentation and never improved neurologically, but had healed infection and significant pain relief at 15 months follow-up.

The one patient who had worsened after the posterior corrective fixation also had a signal intensity change of the spinal cord matter on the MRI scan. The patient didn't show any improvement in neurology after implant removal. It was assumed that the neurological injury developed due to the mechanical or vascular trauma due to stretching on the neurological tissue which was already involved in tuberculous inflammatory process.

9 patients had decubitus ulcers from the time of presentation, which were of superficial nature and healed with split skin grafting in 3 patients and dressing and rehabilitation in the rest. There were no late neurological deteriorations in any patient. 3 patients died within 12 months of surgery due to unrelated causes. There were no graft related problems like graft displacement, slippage, fracture or subsidence.

DISCUSSION

Due to the usual late presentation, most TB spine patients present with some degree of kyphosis. Anterior debridement and fusion with structural graft support has been established as recommended surgical treatment for spinal TB, ([4,9,11]) but it has not been successful in preventing subsequent progressive kyphosis from developing. Only anterior surgery with grafting also has very limited potential for correction of deformity due to adjacent segment bones being too osteoporotic for a good purchase and dispensable forces of correction with anterior instrumentation. Anterior fixation devices bring in the fear of providing innate surface for residual infection and also are not as efficient in correcting and preventing kyphosis as the posterior fixation devices. The residual and progressive kyphosis creates physical and psychological difficulties for the patient including chronic backache and so prevention and correction of kyphotic deformity is an important clinical goal for patients with dorsolumbar tuberculous spines ([15]).

The patients in this series were all in the active exudative stage of the disease- as established by active destruction and instability of vertebral column with expression of active granulomatous tissue, tuberculous sequestra and pus at the time of anterior surgery. At this stage the correction of kyphotic deformity is mechanically easy to achieve as the kyphosis is not yet rigid enough to require primary anterior release for correction.([10]) Posterior correction is partially achieved by positioning the patient in prone position on the Relton-Hall frame, and then using the posterior implant facilities for correction. There are series reported of cases operated with posterior fixation being done after first doing anterior debridement and reconstruction, but we believe that trying to achieve correction after having grafted anteriorly would result in probable destabilization of the graft or loss of compressive forces on graft. Thus the correction would have

to be dependant on the amount of correction achievable with only anterior surgery, which might not be as much as that attainable with posterior surgery. Having the spine fixed posteriorly gives the advantages of giving the subsequent anterior graft primary stability and allowing immediate mobilization and rehabilitation of the patient.

It may be of concern that with primary fixation in situ the anterior graft material may not have the advantage of compression forces that would hasten fusion, but as most (83) of our patients had fixation with sublaminar wires and Hartshill rectangle system, which allowed some vertical freedom of movement to the spinal column, it provides compression without allowing progressive kyphotic angular deformity. Again as the sublaminar wires are placed in the caudal and cephalad bodies from the apex of the kyphus in the patients, there is no real danger of occupying the already endeared spinal canal. We didn't experience any neurological injury directly attributed to the implant placements.

The attained correction at the final follow-up at a mean of 41 months in our series was an average of 36.6% of the original deformity. (Maximum 58.5%) which is significantly more than the correction reported at the final follow up by Kim et al ([13]) who reported 55.1% average initial correction but could maintain only 7.5% correction at the final follow up at average 24 month. We didn't face any graft problems like graft fracture, slippage, resorption, or collapse unlike the series by Lifeso et al ([14]) who reported these complications in their patients treated with only anterior debridement and fusion.

The first stage posterior fixation gave a great mechanical pain relief to the patients early post-operatively which allowed the patients to be mobilized to different extents very soon after the posterior surgery. With this the complications like decubitus ulcers were avoided to a great extent. Again the posterior fixation rendered the anterior reconstruction immediate stability, which allowed important advantage avoiding bed-ridden condition to avoid decubitus ulcers and post-operative pneumonia and other complications of recumbency in the patients. Deep venous thrombosis is anyways uncommon in Indian population and we didn't need to use thromboprophylaxis in any patient. With regular chemotherapy (and 2 patients with modified chemotherapy regime) all patients had their tuberculous infection healed.

CONCLUSION

Primary posterior corrective fixation with appropriately selected instrumentation and second stage anterior debridement and reconstruction with appropriate chemotherapy gives a good correction and long term maintenance of the deformity with good neurological decompression and early bony healing and allows early and faster rehabilitation when performed for patients with exudative stage of tuberculosis of spine.

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