

Single Stage Transpedicular Decompression, Fixation And Deformity Correction In Tuberculosis Of Dorsal And Lumbar Spine

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Abstract:

Study Design: Retrospective study.

Purpose: To evaluate neurological, functional and radiological outcome in patients with tuberculosis of thoracic and lumbar spine who underwent surgical transpedicular decompression, fixation and deformity correction simultaneously.

Methods: 20 patients with tuberculosis of the thoracic or lumbar regions undergone transpedicular surgical decompression between July 2013 to December 2014 who had progressive neurological deterioration or increasing pain despite ATT therapy and conservative measures. Neurological recovery (Frankel grading), functional improvement (VAS score) and radiological outcome were evaluated preoperatively, immediate postoperatively, and at 3 months, 6 months, 1 year and 1.5 years of follow up period.

Results:

Average VAS score was 8.3 preoperatively which had improved to 1.7 at 1 year of follow up. Frankel grade of approximately 75% of patients improved by 2 grade. Average improvement of kyphotic deformity was 10.35 degree; however loss of correction was 4.1 degree in follow up period at 1 year.

Conclusions:

Single stage transpedicular decompression, fixation and deformity correction is safe, effective and relatively less invasive procedure for the surgical management of tuberculosis affecting dorsal and lumbar spine as it improves neurological outcomes, reduces morbidities and complications, allows deformity correction and improves spinal stability simultaneously.

Keywords: Decompression, Dorsal, Lumbar, Tuberculosis, Spine

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I. Introduction

Spinal tuberculosis is the most common extra-pulmonary form of tuberculosis prevalent worldwide particularly in underdeveloped and developing countries^{1,2}. It has affected 1.7% of population worldwide and accounts for approximately 50% of all skeletal tuberculosis³. Thoracic region of spine is most commonly affected⁴. With the advancement of diagnostic tool like MRI, early diagnosis is possible. Early diagnosis and effective anti-tubercular treatment (ATT) has made cure in majorities of patients treated conservatively alone. Surgical intervention is indicated in patients with progressive neurological deterioration, progressive pain or kyphotic deformity in spite of anti-tubercular treatment; however resistance of mycobacteria and association of HIV infection posed many problems to the patients recently. Aim of surgical intervention in tuberculosis of spine is to achieve adequate decompression, solid fused, painless and stable spine without deformity. Anterior approach had become very popular as it had allowed direct exposure to the affected pathological area and adequate decompression; but at the same time fixation were poor and persistent residual deformities were known complications. Combined anterior and posterior approaches solved problems of poor fixation and deformity; but associated morbidities are significantly high. Recently lateral extra-cavitary approach (LECA) has become popular as it allows decompression and debridement anteriorly and pedicle screw fixation

posteriorly simultaneously through same incision; but handling of pleura and hence pulmonary complications occur significantly.

Transpedicular approach overcomes all these issues as it allows circumferential decompression of neural arch as well as provides stability through pedicle screw which provides three column fixations. Our aim is to evaluate neurological, functional and radiological outcome of patients of tuberculosis of dorsal and lumbar spine treated surgically through transpedicular approach.

II. Material And Methods

Material:

This is a retrospective type of study conducted in Central institute of Orthopaedics, VMMC and Safdarjung hospital, a tertiary care center in northern India. In this study, we have evaluated neurological, functional and radiological outcome in patients of tuberculosis of dorsal and lumbar spine who were treated surgically through transpedicular approach. Records of 20 patients who were surgically treated between July 2013 and December 2014 were reviewed. There were (11) male and (9) female. Level of involvement were n=16 in thoracic and n=4 in lumbar region (Table 1). Mean age of presentation was 37.4 years (20 to 56 years) and average duration of symptoms was 4.5 months (2 to 9 months).

Table 1: Patient's detail showing level of affected vertebrae and level of fixation

No of patients	Level of vertebrae affected	Level of pedicle screw fixation done
2	D1-D2	C5,C6,D3,D4
1	D2-D3	C7,D1,D4,D5
1	D7-D8	D5,D6,D9,D10
3	D8-D9	D6,D7,D10,D11
2	D9-D10	D7,D8,D11,D12
3	D10-D11	D8,D9,D12,L1
1	D10-D11-D12	D9,D10,L1,L2
3	D11-D12	D9,D10,L1,L2
2	L2-L3	D12,L1,L4,L5
1	L3-L4	L1,L2,L5,S1
1	L4-L5	L2,L3,L5,S1

Diagnosis was based on constitutional symptoms, laboratory findings, radiography (Fig.1A, 1B), MRI (Fig. 2A, 2B) and transpedicular biopsy. All 20 patients who underwent surgical transpedicular decompression and fixation were initially managed conservatively on ATT but developed progressive neurological deficit or worsening pain despite conservative treatment.

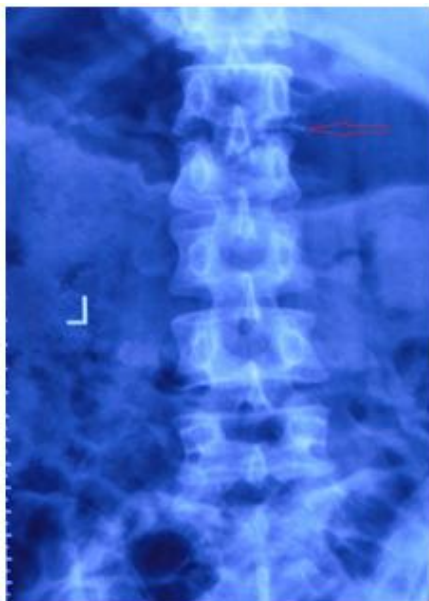


Fig. 1A: Preoperative antero-posterior view of lumbar spine showing reduction in inter-vertebral disc space between L1 and L2 vertebra with localized kyphotic deformity.



Fig. 1B: Preoperative lateral view of lumbar spine showing reduction in inter-vertebral disc space between L1 and L2 vertebra with localized kyphotic deformity.

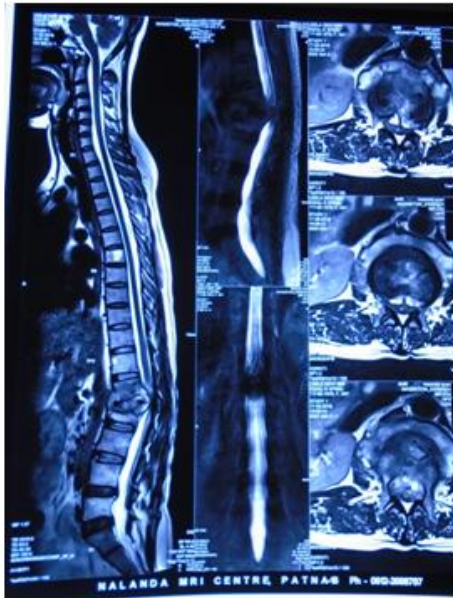


Fig. 2A: Magnetic resonance imaging (Sagittal section T2) showing collection of pus in pre-vertebral, paravertebral and epidural space at the level of L1 and L2 with Severe compromise of spinal cord and thecal sac

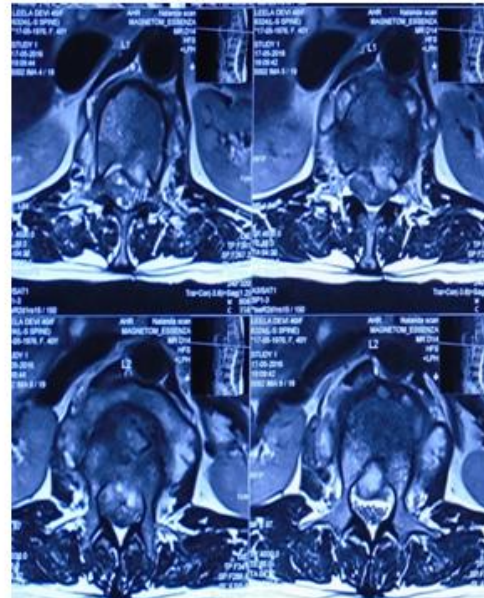


Fig.2B: Magnetic resonance imaging (Axial section T2) showing collection of pus in pre-vertebral, paravertebral and epidural space at the level of L1 and L2 with severe compromise of spinal cord and thecal sac.

Proper general examination and neurological examination including muscle tone, sensation, motor power, deep tendon reflexes, sacral sensation, and bulbocavernous reflexes were done. The neurological status was graded according to the Frankel classification. Routine hematological investigations including complete blood count (CBC), erythrocyte sedimentation rate (ESR), C reactive protein, mantoux test, radiography, computed tomography (CT), and magnetic resonance imaging (MRI) of the affected region of spine were performed in all patients.

Operative procedure:

Posterior midline incision given over affected spinal segment in supine position after confirmation with the help of C arm. Bilateral hemilaminotomy or laminectomy done and pedicle on both sides were identified and curetted to reach middle and anterior column. Proper decompression of neural arch done. Pedicle screw fixation done two levels above and two levels below affected segment along with inter-transverse fusion using bone graft (Fig. 3A, 3B).



Fig. 3A: Post-operative antero-posterior radiograph showing transpedicular decompression and fixation at two levels up and two levels below the affected segment.

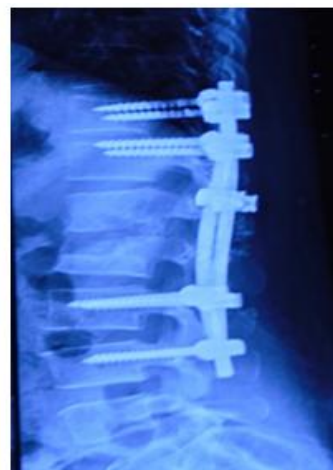


Fig. 3B: Post-operative lateral radiograph showing transpedicular decompression and fixation at two levels up and two levels below the affected segment with correction of kyphotic deformity

Postoperatively patients were gradually mobilized with the help of brace which were continued for next 12 weeks and gradually discarded as pain decreased and motor power improved. Physiotherapy of both lower limbs, care of bladder, bowel and back were taken. Anti-tubercular treatments (ATT) were continued for 18 months. Stitch removal done on 12th day postoperatively.

Follow up:

No major complications occurred post-operatively and in follow up periods. Only 1 patient developed localized infection who got cured after debridement and antibiotics. Follow up of patients were done at the interval of 3 months, 6 months, 1 year and 1.5 years postoperatively. General examination, neurological examination (Frankel grading), pain assessment (VAS), radiological evaluation (standard radiograph) and monitoring blood parameters (CBC, ESR, CRP, LFT, KFT) were done in follow up period. MRI was done at 6 monthly intervals post operatively to assess resolution of pus and radiological healing.

III. Result

Average duration of follow up was 18 months with a range of (12-22 months); ESR were raised in 12 (60%) of patients while CRP was positive (> 6 ng/dl) in 15 (75%) of patients preoperatively. Level of CRP returned to their normal limit in 14 (70%) patients in 3 month of anti-tubercular treatment; while ESR returns to their normal in 8 (40%) patients after 3 months of treatment. Mantoux test was positive in 11 (55 %) of patients and histopathology had confirmed tuberculosis with caseating granuloma in all 20 patients but culture for acid fast bacilli was positive in 8 (40%) patients only. Stain for AFB (acid fast bacilli) were positive in 18 (90%) of patients. Average VAS score improved from (8.3) preoperatively to (1.7) in 1 year of follow up period (Table 2). Frankel grading was B in (6) patients, C in (11) and, D in (3) patients pre-operatively; while Frankel grading was D in (7) patients, E in (13) patients (Table 3). Average correction of kyphotic deformity was 10.35° in immediate post-operative period; but loss of correction was 4.1° in follow up period at 1 year (Table 4).

Table 2: Mean VAS (visual analogue scale scores) of patients

Follow up of patients	Mean visual analogue score (VAS)
Preoperative	8.3
Immediate postoperative	3.2
Follow up at 3 months	2.6
Follow up at 6 months	2.2
Follow up at 12 months	1.7
Follow up at 18 months	1.4

Table 3: Frankel grading of patients (Preoperatively and in final follow up)

Frankel grading	No of patients Preoperatively	No of patients in final follow up
Grade A	0	0
Grade B	6 (30%)	0
Grade C	11 (55%)	0
Grade D	3 (15%)	7 (35%)
Grade E	0	13 (65%)
Total	20 (100%)	20 (100%)

Table 4: Data of the patient’s showing preoperative and post-operative kyphotic deformity

Patients	Preoperative Cobb’s angle	Postoperative Cobb’s angle	Immediate deformity correction	Cobb’s angle in final follow up	Loss of sagittal alignment
1	26	17	9	20	3
2	29	19	10	23	4
3	27	20	7	23	3
4	26	18	8	22	4
5	35	21	14	24	3
6	31	19	12	23	4
7	33	21	12	27	6
8	28	19	9	24	5
9	30	18	12	20	2
10	27	17	10	21	4
11	31	22	9	27	5
12	33	21	12	25	4
13	32	20	12	24	4
14	29	21	8	24	3
15	30	20	10	26	6

16	34	22	12	27	5
17	32	23	9	29	6
18	28	17	11	20	3
19	36	25	11	30	5
20	32	22	10	25	3
Mean value	30.45	20.1	10.35	24.2	4.1

Radiological healing was assessed on the basis of resolution of pus, reappearance of trabeculae, fatty marrow replacement, and bony fusion. All patients except 1 healed completely in 18 month of treatment while one had MDR (multi drugs resistant) who was taking treatment for MDR tuberculosis in follow up period.

IV. Discussion

Tuberculosis is known to mankind from ages. It remains prevalent in developing countries and affects all susceptible people. Spinal tuberculosis is the most common form of extra-pulmonary tuberculosis and accounts for 50% of all skeletal tuberculosis³. Mostly spinal tuberculosis is treated conservatively with availability of early diagnostic tool like MRI and effective anti-tubercular drugs. However surgical decompression is indicated in patient with progressive neurological deterioration, worsening pain and progressive kyphotic deformity in spite of anti-tubercular treatment^{3,5,6,7}.

Purpose of surgical intervention is to achieve adequate decompression, stability and fusion. Various methods of decompression and fixation had been described in the literature. Surgical approach in spinal tuberculosis has evolved from anterior to posterior. Anterior approach was popular previously as it allows direct visualization of pathological vertebral bodies and intervening disc spaces and obtaining wide adequate decompression. However fixations were not so strong and hence persistent deformities are known complications. Anterior fixation is not feasible in the lumbar and lumbosacral spine due to the presence of the common iliac vessels anterolaterally⁸. Combined anterior and posterior approaches solved the problems of stability but at the same time it increases operative time, blood loss, infection and morbidity^{9,10,11,12}. Campbell et al. has reported higher rates of complications with isolated anterior fixation and combined anterior and posterior spinal fusion in comparison to isolated posterior fusion¹³.

Recently lateral extracavitary approach (LECA) had been popularized as it allows decompression and debridement anteriorly as well as transpedicular fixation posteriorly through same incision but handling of pleura occurs and hence pulmonary complication increases in this approach. However with the development of effective anti-tubercular drugs, tuberculous lesions may be successfully treated and spontaneous fusion occurs, and hence complete debridement is not unduly emphasized^{14,15}. Only circumferential neural arch decompression is sufficient and usually there is no need for radical debridement. Transpedicular decompression and fixation is relatively less invasive approach which allows circumferential spinal cord decompression and three column fixation using pedicle screw simultaneously which can be extended proximally and distally away from the involved segment through uninvolved posterior column to provide strong fixation^{12,13,16}. Bezer et al. reported transpedicular drainage and posterior instrumentation as a less demanding single-stage procedure in patients with lumbosacral tuberculosis¹⁷.

It has major advantages over other surgical procedure (1) Less invasive, less blood loss and less morbid. (2) Minimal interference to the spinal stability (3) Satisfactory deformity correction (4) Allows bone conservation, protecting the spinal cord and prevents epidural adhesion following laminotomy. (5) Allows circumferential spinal cord decompression and inter-transverse fusion, reduce trauma for patients, and improve their quality of life (6) Effectively prevents post-operative spinal instability, subluxation and corrects kyphotic deformity. Majorities of patient were pain free in final follow up. There were neurological improvements in more than 75 % of cases by grade 2. Functional recovery was comparable to the result of saho¹⁸. Radiological healing were assessed by re-mineralization and reappearance of bony trabeculae, sharpening of articular and cortical margins, sclerosis of vertebral body and end plates, and fusion of vertebral bodies on plain X-rays as well in MRI as resolution of enhanced vertebral body and paravertebral collection and fatty replacement of marrow seen as enhanced intensity on sequential T1 and T2 images¹⁹.

V. Conclusion

Single stage transpedicular decompression, fixation and deformity correction is safe, effective and relatively less invasive procedure for the surgical management of tuberculosis affecting dorsal and lumbar spine as it improves neurological outcomes, reduces morbidities and complications, allows deformity correction and improves spinal stability simultaneously.

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