EVALUATION OUTCOME OF POSTERIOR DECOMPRESSION WITH INSTRUMENTED FUSION IN THORACIC AND THORACOLUMBAR TUBERCULOSIS

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ABSTRACT Aims: This research aims to evaluate the functional, neurological, and radiological outcomes of patients treated with posterior decompression with instrumented fusion in thoracic and thoracolumbar tuberculosis. **Method:** Records of 8 men and ten women aged 22 to 58 years who underwent posterior decompression with instrumented fusion were followed up for a minimum one year were reviewed. Comparative analytic design with a prospective approach using the Oswestry Disability Index (ODI), Frankel grading, and Local Kyphus angle were evaluated preoperatively, three months, six months, and 12 months postoperatively. The data were then collected and analysed with Mann-Whitney U-test, Wilcoxon Signed Ranks test, and Spearman's Correlation test. **Results:** The mean ODI score improved from 72.35 to 28.2 at one-year follow-up ($p<0.01$). Frankel grading was grade B in 2, grade C in 4, grade D in 7, and grade E in 5, which improved to grade C in 1, grade D in 3, and grade E in 14 at one-year follow-up. The mean preoperative kyphus angle in the thoracal was lesser than thoracolumbar (14.0 vs 30.9) ($p<0,001$). The mean surgical correction was 18.50. **Conclusions:** Posterior decompression with instrumentation is an effective procedure for surgical treatment of thoracal and thoracolumbar tuberculosis in better functional outcome, patient satisfaction, and neurological improvement from preoperative to one-year follow-up.

KEYWORDS Thoracic; Thoracolumbar; Posterior decompression with instrumented fusion; Oswestry Disability Index [ODI] score; Frankel grading; Local Kyphus Angle

Introduction

The spine is the most common site of skeletal tuberculosis (TB) and accounts for 50 per cent of all musculoskeletal TB. According to the World Health Organization's Global tuberculosis report 2015, TB causes of death worldwide with 1.4 million deaths in 2014. [1-4]

The infection is caused by a highly aerobic, alcohol-acid-resistant, non-proteolytic enzyme-producing bacillus, the Mycobacterium tuberculosis, also known as Koch 's bacillus (BK).[7] The infection of the vertebral body is associated with the intraosseous venous plexus derived from the Batson paravertebral venous plexus. The most common type of spinal tuberculosis is the paradisical that occurs in about 90 to 95% of cases.[7-10]

In the Hong Kong procedure, the spine is approached anteriorly so that the affected area may be dealt with most directly. The angular deformity is corrected by insertion of a strut graft. A graft may not provide stable fixation, especially in cases in which the graft spans more than two disc spaces. A combined approach overcomes stability issues but increases morbidity because of two surgeries (single event or staged).[3-6]

The aim of surgery in spinal tuberculosis is adequate decom-

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pression and stability along with correction of de¬formity and its maintenance. Posterior approach allows circumferential decompression of neural elements along with three-column fixation attained via pedicle screws by the same approach.[5],[11-12]

The present study aims to evaluate the results (functional, neurological, and radiological) of the posterior approach in operat¬ed patients with thoracic and thoracolumbar tuberculosis.

Materials and Methods

This prospective study of 8 men and 10 women aged 22 to 58 (mean, 35.4) years were diagnosed with thoracic (n=8) and thoracolumbar (n=10) tuberculosis based upon radiological findings (MRI) and confirmed by histopathology reports postoperatively, operated for posterior decompression with instrumented fusion by two trained spine surgeon between January 2017 and July 2017 and were followed up for a minimum of one year were reviewed. (Table I)

An indication of surgical procedure was intolerable back pain and progressive neurological deficit despite ongoing conservative means. Skeletally immature patients ($\leq$ 13 years old), non-contagious spinal lesion, cervical or lumbar lesion, or previous spinal surgery were excluded. The diagnosis was made based on the erythrocyte sedimentation rate, plain radiography of thoracal and thoracolumbar spine (anteroposterior and lateral views), and magnetic resonance imaging was carried out in all patients.

The patient was placed prone under general anaesthesia. A midline incision was made. The paraspinal muscle was retracted up to the level of transverse processes. Pedicle screws of adequate length were placed a minimum of 2 levels above and below the affected vertebrae. The titanium rod was fixed on one side to allow distraction if needed — posterior decompression of neural elements by laminectomy and removal necrotic caseous materials and curdy purulent exudates. Extensive anterior debridement was avoided. Under adequate distraction, transpedicular or transforaminal debridement was done using currettes. Posterolateral fusion was done in all cases. Infected material was sent to histopathological examination and culture sensitivity.

Postoperatively, the patient was discharged after one week. Antituberculosis chemotherapy was continued for at least one years (pyrazinamide, ethambutol, isoniazid, and rifampicin for the first three months and the last two drugs for further six months) or until the lesion healed. The brace support was continued for three months. The instrument was not removed.

Functional status was assessed using the Oswestry Disability Index (ODI). Neurological status was evaluated using the Frankel grading. Patients were followed up at three months, six months, and one year. Kyphus angle preoperation and immediate after the operation was measured on radiographs to determine kyphosis correction of the deformity. 13 (Figure I)

Data were then analyzed using SPSS for windows version 22. The comparison was made using Chi-square test, Mann-Whitney U-test, Wilcoxon Signed Ranks test, and Spearman's Correlation test as appropriate. A p-value < 0.05 was considered statistically significant.

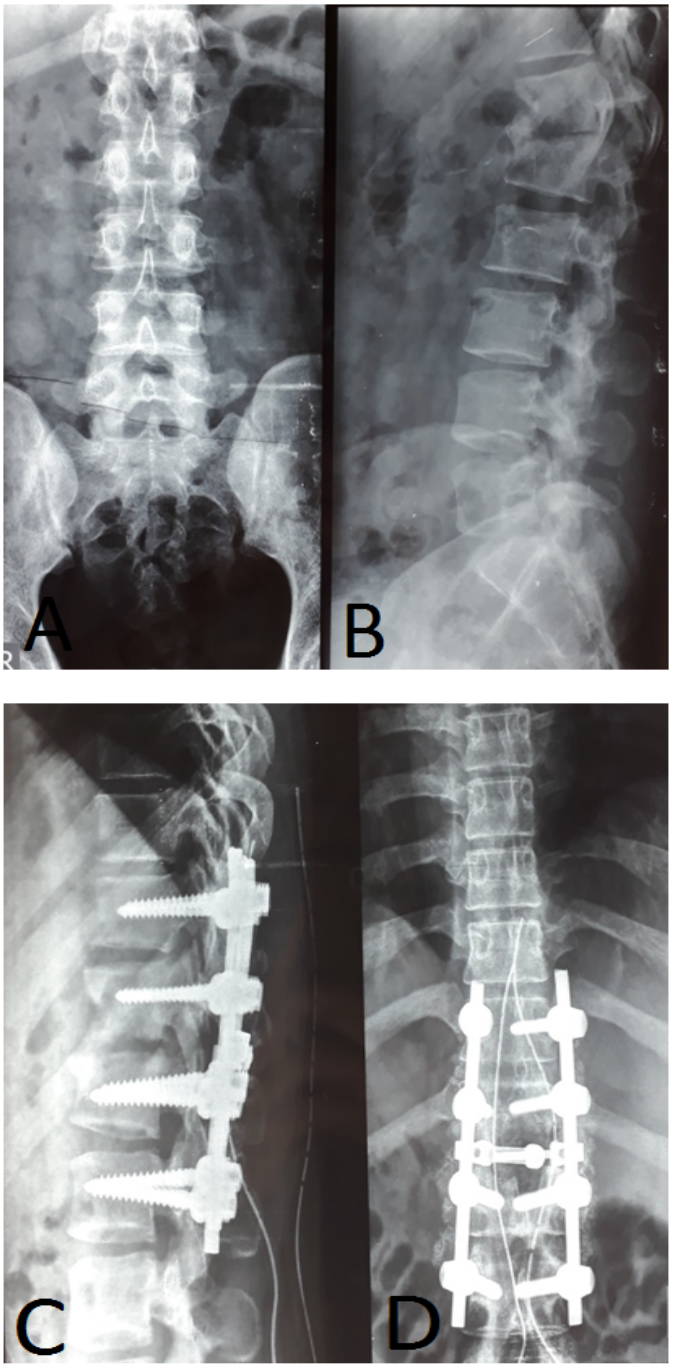

Fig.1.A.B.C.D. Tuberculosis spondylitis Th XII – L 1, with destruction in a 25-year-old male. Preoperative X-rays. (A) Anterior-posterior view and (B) lateral view. Pedicle screw – rod system fixation followed by decompression and fusion. Postoperative X-rays. (C) Anteroposterior view and (D) lateral view.

Table 1 Details of the Patients in Both Groups

Variable	Category	Group		Total
		Thoracal	Thoracolumbar	
Gender	Male	3	5	8
	Female	5	5	10
Age (in years)	Mean age (range)	38.6 (24 to 58)	32.8 (22 to 46)	35.4
Regional distribution	Th III - Th IV	1	0	1
	Th IV- Th V	2	0	2
	Th V- Th VI	1	0	1
	Th VIII - Th IX	1	0	1
	Th IX - Th X	3	0	3
	Th XI- Th XII	0	2	2
	Th XII - L I	0	5	5
	L I- L II	0	3	3
Frankel Grading	A	0	0	0
	B	2	0	2
	C	2	2	4
	D	3	4	7
	E	1	4	5
Kyphus angle pre operation	<10 degree	1	0	1
	10- 20 degree	7	0	7
	21- 30 degree	0	5	5
	>30 degree	0	5	5

Results

Respectively for 8 and 10 patients with thoracic and thoracolumbar involvement, at one year follow-up the mean ODI percentage improved from 74.7 to 31.7 ($p<0.05$) and from 70.4 to 25.1 ($p<0.01$) , whereas the mean pain intensity improved from 3.1 to 1.4 ($p<0.01$) and from 3.3 to 1.1 ($p<0.01$). There were significantly decreased of ODI percentage and pain intensity score after 3, 6 and 12 months postoperatively than before surgery either in the thoracal or thoracolumbar group ($p <0.01$). (Table II and III)

With the duration of one-year follow-up, all patients were classified as Frankle grade B in 2, grade C in 4, grade D in 7, and grade E in 5 preoperatively, which improved to grade C in 1, grade D in 3, and grade E in 14 at one-year follow-up. No neurological deterioration was noted in any patients postoperatively. Thirteen cases suffered neurological insults before surgery, most recovered after surgery. (Table IV)

The mean kyphus angle at preoperation in thoracic and thoracolumbar was 140 and 30.90, respectively. The mean correction of kyphus angle in the thoracic group was lesser than thoracolumbar group (6.3 vs 18.5). ($P<0.01$) (Table V)

Discussion

Surgical approach in spinal tuberculosis has evolved from anterior to posterior.[5-6] Isolated anterior approach can achieve adequate spinal decompression, but the extent of deformity correction and maintenance with an anterior implant is less. Moreover, they have a higher rate of complications.[15-16] When deformity due to bone destruction and neurological deficit co-exist, a circumferential procedure often provides a comprehensive solution. Excessive blood loss, delayed recovery, and increased operative time may increase morbidity and mortality.[15-18]

Recently, the posterior approach has gained popularity because less invasive, allows circumferential cord decompression, can be extended proximally and distally to the involved segment, and provides stronger three-column fixation through uninvolved posterior elements via pedicle screw.[6],[19] The posterior approach for spinal tuberculosis is associated with a low rate of complications. Avoidance of the anterior or combined anteroposterior approach prevents the risk of lung deflation–related complications.[20-26] Decompression of spinal cord enhances neurological recovery thorough debridement of the caseous tissue, debris, and sequesters from vertebral body and disc. Recovery is faster and more compete in patients with early surgery in active disease than in those with chronic disease.[14],[24]

Table 2 Comparison of Oswestry Disability Index before the operation, three months, six months and one year after the operation

Group	Variables	N	Mean	SD	P
Thoracal	Preoperation	8	74,7	6,0	
	3 months post op	8	46,1	6,5	0,011
	6 months post op	8	33,3	8,6	0,012
	12 months post op	8	31,7	8,9	0,012
Thoraco Lumbal	Preoperation	10	70,4	7,9	
	3 months post op	10	40,9	10,5	0,005
	6 months post op	10	28,0	11,0	0,005
	12 months post op	10	25,1	12,4	0,005
*Wilcoxon Signed Ranks test SD: Standard Deviation					

Table 3 Comparison of Pain Intensity before the operation, three months, six months and one year after the operation

Group	Variables	N	Mean	SD	P
Thoracal	Preoperation	8	3,1	0,8	
	3 months post op	8	1,8	0,9	0,009
	6 months post op	8	1,4	0,5	0,008
	12 months post op	8	1,4	0,5	0,008
Thoraco Lumbal	Preoperation	10	3,3	0,7	
	3 months post op	10	1,7	0,8	0,004
	6 months post op	10	1,2	0,4	0,004
	12 months post op	10	1,1	0,3	0,004
*Wilcoxon Signed Ranks test SD: Standard Deviation					

In our study, the highest incidence of disease was seen in thoracolumbar spine (55.56 %), rather than the thoracal spine reported by Sundararaj et al. and Hodgson et al.[20-21] Our patients had rapidly decreased of pain intensity about 50% within three months post-operatively either in the thoracal spine or thoracolumbar. Overall, pain improvement at one-year follow-up in the thoracic and thoracolumbar spine was about 55% and 67% respectively, which is slightly higher than that obtained by Ahsan et al. (49%, 60%).[14]

The mean surgical correction in entire study was 13.50 with 6.30 in the thoracic spine and 18.50 in thoracolumbar spine, which is similar with Sundararaj et al20 (13.70), but less than that obtained by Moon et al. (210) and Rajasekaran et al. (230).[22-23] Similarly, with Acar et al., we found a strong correlation between ODI percentage and Frankel grading, but no correlation between the correction of ODI percentage and correction of Kyphus angle.[27] (Figure 2)

Neurological lesions were observed in 13 patients (72%), of whom nine patients (69%) recovered to normal. One graded as Frankel C were unchanged after surgery. All neurologically intact patients were allowed to walk immediately after the operation, and those with a neurological deficit started mobilization within a week. All were independent at the time of discharge, in contrast to those who had anterior surgery alone. Those who were mobilized early showed less morbidity and a notable improvement in pain relief and patient satisfaction.

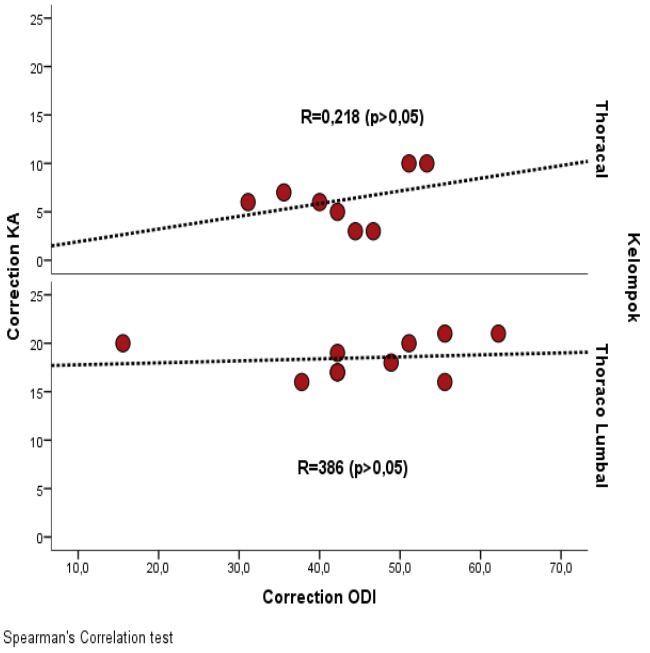

Fig.2. Correlation between of Correction of Kyphus Angle with ODI Improvement

Table 4 The neurological Frankel grading before the operation and at one-year follow-up

Score	Pre-op	One year follow up
A	0	0
B	2	0
C	4	1
D	7	3
E	5	14

Table 5 Comparison of Local kyphus angle before and after the operation

Variables	Group	N	Mean	SD	P
Pre Op	Thoracal	8	14,0	3,7	0,000
	Thoraco Lumbal	10	30,9	2,5	
Post Op	Thoracal	8	7,8	1,4	0,000
	Thoraco Lumbal	10	12,4	1,1	
Correction	Thoracal	8	6,3	2,7	0,000
	Thoraco Lumbal	10	18,5	2,0	
*Mann-Whitney test SD: Standard Deviation					

Conclusion

Posterior decompression with instrumentation is an effective procedure for surgical treatment of thoracal and thoracolumbar tuberculosis in better functional outcome, patient satisfaction, and neurological improvement. Further studies with a large number of patients and loss of kyphus angle correction will be necessary.

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Authors statements

Competing Interests

The authors declare no conflict of interest.

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