

Outcome of anterior decompression and stabilization with cage in spinal tuberculosis not responding to anti-tuberculous chemotherapy for 4–6 weeks

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Abstract

Introduction: Spinal tuberculosis is a destructive form of tuberculosis. It accounts for approximately half of all cases of musculoskeletal tuberculosis. Tuberculosis of spine is one of the major causes of spinal deformity and paraplegia. Treatment of tuberculosis infection of spine is crucial. Surgical decompression and stabilization is considered in patients to prevent/treat complications arising as a result of the disease or where conservative treatment fails such as chemotherapy.

Objective: The objective of this study was to determine the outcome of anterior decompression and stabilization with cage in spinal tuberculosis patients not responding to anti-tuberculosis chemotherapy for 4–6 weeks

Material and methods: This descriptive case series on 105 patients were done at Department of Orthopedics, Ghurki Hospital Lahore from 1st Jan. to 31st Dec. 2016. All the patients fulfilling the inclusion criteria underwent neural decompression with subtotal or complete corpectomy of the involved vertebrae by same team of surgeons. All patients were followed for at least 6 months after surgery to determine their kyphotic angle, neurological deficit and functional outcome. All collected data was analyzed using SPSS version 20.

Results: The mean age of patients in this study was 38.16 ± 9.58 years. There were 44 (41.9%) male and 61 (58.1%) female patients in our study. The average value for Kyphotic angle pre-operation was 59.38 ± 8.28 and mean value post-operation was 22.89 ± 15.44 . Out of total subjects, 99 (94.4%) patients achieved correction in Kyphotic angle, improvement in neurological deficit was seen in 96 (91.4%) patients while there were 8 (7.6%) patients who restored normal function, 57 (54.3%) restored functional outcome to grade-I, 9 (27.6%) to grade-II and 11 (10.5%) to grade-III.

Conclusion: We conclude that spinal tuberculosis can be managed with cage along with anterior decompression and stabilization. As we found good outcome (in terms of kyphotic angle correction, improvement in neurological deficit and good functional outcome) in our patients.

Keywords: Spine, Pott's spine, tuberculosis, Anterior approach, Cage, posterior approach

Introduction:

Spinal tuberculosis is a destructive form of tuberculosis¹ and accounts for approximately half of all cases of musculo-skeletal tuberculosis.^{1,2} Spinal tuberculosis (TB) is more common in children and young adults. The incidence of spinal tuberculosis is increasing in developed nations. Genetic susceptibility to spinal tuberculosis has recently been demonstrated.¹ TB spine is a slowly developing disease and it takes 3-4

months in pathogenesis before kyphosis starts appearing. During these three-four months these patients present repeatedly with persistent low back pain with or without constitutional symptoms.³

In the initial stages, X-rays of these patients, may not have any radiological finding.^{3,4} Such patients with back pain should be kept under observation in an endemic region for Tubercu-

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losis and if sequential X-rays, with a gap of four to six weeks, show reduction of disc height they should be subjected to MRI.³ Moreover this is a medical disease which is not primarily treated surgically, but operation is required to prevent and treat the complications.^{5,6} Anterior instrumentation attain good results for correction of the deformity and maintaining correction, foci clearance, spinal-cord decompression and pain relief in the treatment of thoracic and lumbar spinal TB provided that the operative indication is accurately identified.⁷

Para-vertebral lesions, therapeutically refractory disease, severe kyphosis, a progressive neurological deficit, lack of improvement or deterioration are indications for surgery. Patients who present with a kyphosis of 60° or more, or one which is likely to progress, require anterior decompression, posterior shortening, posterior instrumented stabilization and anterior and posterior bone grafting in the active stage of the disease.⁶ Neurological deficit and deformity are the worst complications of spinal tuberculosis.^{6,8}

A study reported correction of kyphosis angle between approximately 2° and 10° was achieved in the immediate post-operative period with an average of 6.88±2.7.⁹ Moreover they reported 11 patients presented with paraparesis of the lower limbs in which seven (63.63%) had improved neurological deficit following surgery.⁹ Moreover another study 100% improvement in neurological deficit with anterior debridement.¹⁰ One more study reported the percentage of immediate correction in kyphosis was 52.27% when treated with anterior debridement, decompression and instrumentation. Using PRO-LO scale good functional outcome was seen in 30 patients (88.3%), 3 patients (8.8%) had a fair outcome and 1 patient (2.9%) had a poor outcome.¹¹ International literature gives a wide range in improvement of neurological deficit i.e. 63.63% (9) – 100%.¹⁰

No local study is available using cage along with anterior decompression and stabilization. The aim of this study is to confirm the role of anterior decompression and stabilization with cage in

spinal tuberculosis in our patients

Material and methods:

This descriptive case series was conducted at department of Orthopedics, Ghurki Hospital Lahore from 1st Jan. 2016 to 31st Dec. 2016 on 105 patients. The sample size was calculated using expected fair functional outcome in 8.8%¹¹ (least among all) outcome variables using WHO software at 95% confidence level, 5% margin of error and 10% absolute precision. Patients not responding to antituberculous chemotherapy [clinically no improvement and referred by a TB specialist for surgery] for 4–6 weeks of either gender from 18-50 years of age, confirmed spinal tuberculosis (Disco-vertebral osteomyelitis on MRI), Significant kyphosis (>40° of segmental kyphosis) [was calculated using Cob's method] and patients having grade A-D neurological deficit according to Frankel grading system were included in the study while the patients with previous surgery of spine, having liver and renal disease (was assessed through their medical record), refused to give consent or lost in follow up were excluded from the study. Patients' initial information like demographic data (name, age), contact details were taken from attendants and all patients were operated under general anesthesia with endotracheal intubation. Surgeries were performed by same team of spine surgeons. Pus and necrotic tissue were removed as much as possible until normal bleeding bone is reached. Neural decompression was carried out with subtotal or complete corpectomy of the involved vertebrae and the titanium or Polyether ether ketone (PEEK) cages packed with autogenous rib or iliac crest grafts was used for reconstruction. Immediately post-surgery, routine lateral and anteroposterior radiographs were obtained to assess the extent of decompression and placement of graft and instrumentation. All patients were followed for at least 6 months to determine their kyphotic angle, neurological deficit and functional outcome.

All data were collected on structured proforma initially and later on data were analyzed using SPSS version 20. Quantitative data like age

Table 1: Descriptive Statistics of Kyphotic angle before and after 6 months of surgery

	Kyphotic Angle Pre-op	Kyphotic Angle Post-op
Mean	59.38	22.88
Std. Deviation	8.28	15.44
Minimum	45	5
Maximum	78	65

Table 2: Frequency distribution of correction of Kyphotic angle

		Frequency	Percent	
Correction in Kyphotic angle	Yes 99(94.3%)	Male	39	88.6%
		Female	60	98.4%
	No 6(5.7%)	Male	5	11.4%
		Female	1	1.6%
			Total	105
Chi-square test = 4.48 .p-value = 0.034				

Table 3: Frequency distribution of improvement in neurological deficit

		Frequency	Percent	
Improvement in Neurological Deficit	Yes 96(91.4%)	Male	35	79.5%
		Female	61	100%
	No 9(8.6%)	Male	9	20.5%
		Female	0	0%
			Total	105
Chi-square test = 313.64 p-value < 0.001				

Table 4: Frequency distribution of improvement in neurological deficit

		Sex		Total	
		Male	Female		
Functional Outcome	Normal function 8(7.6%)	8	0	8	
		18.2%	0%	7.6%	
	Grade-1 57(54.3%)	20	37	57	
		45.5%	60.7%	54.3%	
	Grade-2 29(27.6%)	6	23	29	
		13.6%	37.7%	27.6%	
	Grade-3 11(10.5%)	10	1	11	
		22.7%	1.6%	10.5%	
	Total		44	61	105
			100.0%	100.0%	100.0%
Chi-square test = 28.39, p-value < 0.001					

and kyphotic angle was presented in the form of mean±S.D. Frequency and percentage was calculated for qualitative data like gender, correction of kyphotic angle, improvement in neurological deficit and functional outcome (good or fair). Data was stratified for age and gender to control the effect modifier. Post stratification chi-square test was applied and p-value ≤ 0.05 was considered as significant.

Results:

The mean age of patients in this study was 38.16±9.58 years ranges from 20-50 years. There were 25 (23.8%) patients in age group of 18-30 years and 80 (76.2%) were in age group of 31-50 years. There were 44 (41.9%) male patients and 61 (58.1%) female patients in our study with male to female ratio of 0.72:1.

The average value for Kyphotic angle pre-operation was 59.38±8.28 and mean value post-operation was 22.89±15.44. The minimum and maximum values of Kyphotic angle pre-operation were 45 and 78 and post-operation were 50 and 65. (table 1) Out of total subjects, 99 (94.4%) patients reported correction in Kyphotic angle and 6 (5.6%) did not have correction. Out of 44 male patients, 39 (88.60%) reported correction in Kyphotic angle whereas out of 61 female patients, 60 (98.4%) reported correction in Kyphotic angle, which was not statistically significant. (table 2)

Improvement in neurological deficit was reported in 96 (91.4%) patients while in rest of 8.6% patients no improvement was seen. Out of 44 male patients, 35 (79.5%) reported improvement in neurological deficit whilst out of 61 female patients, all 61 (100%) reported improvement in neurological deficit. Female gender was highly significantly associated with improvement in neurological deficit. (p-value<0.001). (table 3)

There were 8 (7.6%) patients who restored normal function, 57 (54.3%) restored functional outcome to grade-I, 9 (27.6%) to grade-II and 11 (10.5%) to grade-III. The female gender was highly significantly associated with functional outcomes. (p-value<0.00)(table 4)

Discussion:

Although the first documented spinal tuberculosis (TB) cases date back to 5,000-year-old Egyptian mummies, the first modern case of spinal TB was described in 1779 by Percival Pott.¹² Spinal tuberculosis is one of the oldest diseases known to mankind and has been found in Egyptian mummies dating back to 3400 BC.¹³ The

disease is popularly known as Pott's spine. The name traces back its origin from the description of tuberculous infection of the spine by Sir Percival Pott in his monograph in 1779.¹⁴

The majority of his patients were infants and young children. The classic destruction of the disk space and the adjacent vertebral bodies, destruction of other spinal elements, severe and progressive kyphosis subsequently became known as Pott's disease. Currently, the term 'Pott's disease/Pott's spine' describes tuberculous infection of the spine and the term 'Pott's paraplegia' describes paraplegia resulting from tuberculosis of the spine.¹⁵

Spinal tuberculosis is a destructive form of tuberculosis. It accounts for approximately half of all cases of musculoskeletal tuberculosis. The spinal column is involved in less than 1% of all cases of tuberculosis (TB). Spinal TB is a very dangerous type of skeletal TB as it can be associated with neurologic deficit due to compression of adjacent neural structures and significant spinal deformity. Therefore, early diagnosis and management of spinal TB has special importance in preventing these serious complications.¹²

Historically, spinal TB was managed by rest and decreased weight bearing on the diseased vertebrae by application of an immobilizing bandage, and by promoting the natural processes of healing by general hygienic measures.¹⁶ Simple aspiration or drainage of the abscesses¹⁷ and removing the lesion through the confined posterior route¹⁶ were the first surgical approaches introduced for this disease although the results were not promising enough. In 1895, Menard used an anterolateral extrapleural approach which had been developed and modified by other authors for the debridement of diseased tissues, mechanical decompression of the cord, and bone grafting for anterior spinal fusion.¹⁸ This was the first approach to provide adequate exposure for the treatment of dorsal lesions. Posterior spinal fusion had been advocated and used extensively in the management of spinal TB. Furthermore, in 1946, Alexander performed a lateral decom-

pression with preservation of the spinal stability by avoiding the laminae and posterior intervertebral joints.¹⁹

Approach for surgical treatment of thoracolumbar tuberculosis is always controversial. The goals of surgery in Pott's spine are adequate decompression, adequate debridement, maintenance and reinforcement of stability and correction and prevention of deformity. Traditionally, the anterior approach has been preferred throughout the spine to achieve these goals because the pathology of tuberculosis mainly affects the vertebral bodies and disc spaces, and the anterior approach allows direct access to the infected focus and is convenient for debriding infection and reconstructing the defect.²⁰ In the thoracic and lumbar region, anterior instrumentation to provide bone stability may be tenuous because the concomitant osteoporosis associated with infection renders the vertebrae structurally weak and may prevent adequate fixation.^{21,22}

A study investigated the effectiveness and safety of anterior instrumentation for different sites of involvement, number of involved levels, and different age groups in 100 consecutive patients (mean age, 44.3±12.4).²⁰ In this study the mean age of patients in this study was 38.16±9.58 years with minimum and maximum ages of 20.00 years and 50.00 years respectively. There were 44 (41.9%) male patients and 61 (58.1%) female patients in our study. The mean age was almost similar to above study.

According to our results the average value for Kyphotic angle pre-operation was 59.38±8.28 and mean value post-operation was 22.89±15.44. The minimum and maximum values of Kyphotic angle pre-operation were 45.00 and 78.00 and post-operation were 5.00 and 65.00. Out of total subjects, 99 (94.4%) patients achieved correction in Kyphotic angle. Dai L-Y et al used the anterior approach and single stage surgery and found that the deformity was corrected from an average of 13.5° on admission to an average of 1.9° after surgery.²³ The study of Garg et al did a comparative analysis of posterior and anterior approach. They found the posterior

approach having good Functional outcome (Prolo scale) i.e 94.4% patients compared to 88.23% patients in anterior approach.²⁴ On the other hand Erturer E et al in their comparative analysis of posterior and anterior approaches found that there was no statistically significant difference between groups in terms of the operation duration, intraoperative blood loss, bony fusion, intra-operative and post-operative complications, neurological status and the angle of kyphosis ($p > 0.05$). Good clinical outcomes were achieved in both groups.²⁵ Similarly Zhang H-q et al concluded that Surgical management by one-stage posterior debridement, TLIF and instrumentation for lumbar tuberculosis is feasible and effective. This approach obtained better clinical outcomes than combined posterior and anterior surgeries.²⁶ Xu Z, Wang X used the single-stage posterior debridement, compact bone grafting and posterior single-segment fixation. They found that the average Cobb angle decreased to $5.3 \pm 3.0^\circ$ post-operatively from $22.1 \pm 6.1^\circ$ pre-operatively. Meanwhile, average $1.8 \pm 1.0^\circ$ loss was observed at last visit.²⁷ Liu J-M did a retrospective study, the procedure of one-stage posterior debridement, nonstructural autogenous bone grafting, and instrumentation has a significant shorter operative duration, lower blood loss and perioperative transfusion, shorter hospital stay, and less hospitalization cost compared with the one of anterior debridement, strut bone grafting combined with posterior instrumentation for treating lumbar spinal tuberculosis.²⁸ Omid-Kashani F did anterior decompression and instrumentation and found that the Segmental kyphosis was corrected from $+11.9^\circ$ (SD=13.8°) preoperatively to -3.8° (SD=8.9°) after surgery that was mainly maintained at the last follow up visit²⁹ Similarly Li M et al found that one-stage surgical management for thoracic tuberculosis by anterior debridement, decompression and autogenous rib grafts, and instrumentation having excellent results. The deformity was corrected from an average of 19.8° on admission to an average of 3.7° after surgery and to an average of 4.6° at the final visit. No significant loss of deformity correction was noted in these patients. There was no other re-

currence of the tuberculous infection.³⁰ Jain AK et al did simultaneously anterior decompression and posterior instrumentation by extrapleural retroperitoneal approach in thoracolumbar lesions and found that the mean preoperative kyphosis was corrected from 55° to 23° .³¹ Lü G did anterior debridement and reconstruction via thoracoscopy-assisted mini-open approach for the treatment of thoracic spinal tuberculosis. According to them Thoracoscopy-assisted mini-open approach can provide a simple, safe, and practical treatment option with minimal invasiveness in cases of thoracic spinal tuberculosis.³² Different new scoring system has been available to assess the neurological and functional outcome. In our study the improvement in neurological deficit was seen in 96 (91.4%) patients while there were 8 (7.6%) patients who restored normal function, 57 (54.3%) restored functional outcome to grade-I, 9 (27.6%) to grade-II and 11 (10.5%) to grade-III according to PROLO Scale. Dunn R et al used other systems for better outcome. The Nurick average score improved from 5.5 to 1.9 and the mJOA lower limb score 1.8–5.5.³³ Similarly He M et al used another system of outcome. Their study findings were three patients with Frankel grade B, five with grade C, 12 with grade D, and five with grade E before surgery. During the last follow-up examination, in 20 patients with neurological deficit, 11 patients improved one grade, six patients improved two grades, one patient improved three grades, and the neurologic status remained unchanged in two patients.³⁴ Zhang HQ et al used both anterior and posterior approaches. According to them, the average preoperative local deformity angle was -13.8° , correcting to 3.4° post-operatively and 1.5° at the final follow-up. With the exception of one patient who received a D at the final follow-up, all cases obtained complete neurological recovery.³⁵

The aim of any approach is the improvement in kyphotic deformity, good functional and neurological outcome. We prefer anterior decompression and standalong cage in the developing countries where most of the people are poor and can't afford expensive instrumentation. There are certain limitations in our study. We didn't

describe other variables like bony union, demographic characteristics of the patients and a long follow up. So, further studies needed for better results in our population.

Conclusion:

Spinal tuberculosis can be managed with cage along with anterior decompression and stabilization. As we found good outcome (in terms of kyphotic angle correction, improvement in neurological deficit and good functional outcome) in our patients. It is cost effective in terms of instrumentation and having similar outcomes as compared to other approaches.

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Role and contribution of authors:

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