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ROLE OF POSTERIOR TRANSPEDICULAR SCREW FIXATION SURGERY IN SPINAL TUBERCULOSIS: CLINICAL ANALYSIS AND SURGICAL OUTCOMES

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Abstract

Background; Spinal tuberculosis is a very serious kind of skeletal tuberculosis which occurs very frequently in adults. The basic objective of the study is to trace out the chances of safety and efficacy by treating the monosegmental lumbar tuberculosis in adults through one-stage posterior debridement and transpedicular screw fixation. **Material and Methods;** About 41 patients were observed retrospectively during this study. The imagery data, numerical data for mean surgery time, loss of blood during surgery, VAS Score, preoperative complications, bony fusion time and preoperative & postoperative neurological function was gathered. **Results;** Mean follow up period was observed about 13.6 ±2.7 months. The rate of cure after surgery was maximum in patients and no chances of recurrence were observed. Neurological outcome did not change in one case with grade A and increased by 1 to 3 grades in other patients with nerve deficit. The mean preoperative VAS score was 9.2 ± 2.13 and mean postoperative VAS score was 2.5 ± 1.32, respectively; and the difference was also significant ($P < 0.05$).There were three perioperative complications (7.31 %, 3/41) observed in this study. **Conclusion;** In conclusion, one stage posterior fixation procedure with pedicle screw is very safe and effective and in the treatment of adults lumbar spinal tuberculosis.

Introduction:

The reception of the evidences for the tuberculosis is at the rising trend through out the world, especially in developing countries. Spinal tuberculosis (ST) is a very serious kind of skeletal tuberculosis which occurs very frequently in adults [1, 2]. Spinal Tuberculosis often leads to kyphotic deformity as it causes gross destruction of the vertebral bodies and disc [1, 2]. Though many patients can be cured by chemotherapy, surgery is frequently imperative for spinal decompression and deformity correction [3].

The thoracolumbar spine is the most commonly affected, with less frequent involvement of the sacral and spinal cervical [4]. When the anterior and lateral portions of the vertebral body are affected, vertebral collapse occurs, resulting in kyphosis and gibbus deformity [5].Involvement of the posterior vertebral body results in cavitations and an extradural mass. The disc space is eventually destroyed, but at a slower rate than pyogenic infection [5]. Tuberculous spondylitis is diagnosed in the second, third, or fourth decade of life having male-to-female ratio as 1.3 : 1 to 1.7 : 1 [2,4,6–8]. Neurologic deficits with or without kyphotic deformities are frequent sequelae of disease [9].

Advancement of computed tomography (CT) scanning and MRI has enabled early diagnosis of spinal tuberculosis [10–16].Moreover; such effective chemotherapy regimes for anti tuberculosis are available which are very effective. So for this disease the strategies of treatment have been revised [17, 18]. Therefore, the treatment strategy for this disease entity has been revised and has become more conservative in recent years [12,17–21]. Isoniazid and rifampin given for 9 months (with streptomycin added for the first 3 months for resistant strains) is now the standard medical treatment [4].

Surgical treatment is recommended for failure to respond to antibiotics after 3–6 months, no improvement, or deterioration, in neurological function after a trial of antibiotics, posterior spinal involvement, spinal instability, recurrent disease, or recurrent neurological deficit [22]. The advantages of radical excision and fusion include a shortened recovery time and a smaller degree of deformity, including improved vertebral body height [2,6,22].

Latest instrumentation for transpedicular proves that it can provide effective stabilization to the lumbar spine and thoracolumbar [23–28]. Despite the fact that the majority of published papers favor the anterior approach combined with radical debridement and anterior fusion as it was observed that this infection usually placed in the anterior column, so the posterior approach reported by other authors has in recent times gained popularity with remarkable clinical success [13–16].

Previous studies [4, 5] showed that surgical treatment is an important strategy for the treatment of spinal TB. In 1934, Ito et al. firstly described anterior approach for spinal TB. But, anterior debridement can cause reduction in the spinal biomechanical stability and residual kyphosis is found at the end of treatment [6]. Thus posterior fusion and fixation combined with, anterior debridement was developed, which helped to cure the disease early .It also provide early bone fusion, prevent kyphosis progression and also make it correct [7–10].But, past studies has proved that these combined procedures took longer surgery time, more loss of blood, greater postoperative complications, and hospital stay for longer period of time [11, 12].

Objective:

Basic objective behind this study was to find out that in the spinal tuberculosis what is the role of posterior pedicle Screw Fixation procedure and what its clinical and surgical outcomes are after twelve to fourteen months of surgery.

Method and Material

Neurosurgery department of Shalamar Hospital was chosen for this descriptive case series study. The time period for this study was from November 2016 - September 2017. After registering the patients, under the supervision of an expert neurosurgeon results of all the clinical examinations, and medical history were recorded. The clinical data of 41 consecutive patients with monosegmental lumbar spinal tuberculosis, treated with one-stage posterior debridement, transpedicular fixation.

It was decided that those patients would be consider who exhibit following indications:

(1) unresponsive to chemotherapy and persistent back pain for last two months

(2) Appearance of gradual angular deformity (≥30°) or instability and neurological deficit appeared.

(3)Involvement of multilevel vertebrae where only single center was debrided and short bone fusion less than two levels had performed.

(4) Patients with poor health conditions who couldn't bear so much trauma

(5) patients whose anterior procedure surgery had performed and their anatomical structure was not clear.

Those patients were excluded who exhibited the following conditions. (1) absence of neurological deficits; (2) multi focus centers or in which anterior long-segment bone fusion is required and which cause deep muscle abscesses

3)patients having severe kyphosis deformity which requires combined posterior and anterior surgery.

The diagnosis of spinal TB was done by observing symptoms, by laboratory test results such as anemia, ESR, hypoproteinemia, CRP, CT scan, spinal X-ray and MRI. Same symptoms including backpain, night sweats, lower fever, weight loss and local tenderness were observed in all the patients.

CT scan and MRI examinations before surgery revealed the presence of smaller intervertebral space, monosegment vertebral bone destruction, uneven bone signals, paravertebral abscess, and Para spinal abscess formation.

Also, the patients were identified as spinal TB by histopatho logical evaluation. The patients whose spinal lesions were confined to mono-segment with/without neurology and/or deformity formation were involved in this study.

Preoperative Management. When clinical diagnosis of spinal TB was made and active pulmonary tuberculosis was excluded, patients were treated with four first-line antitubercular drugs (rifampicin, isoniazid, streptomycin, and pyrazinamide) for at-least two weeks before surgery. The surgery was done when it was noticed that ESR and CRP was decreased significantly. Moreover symptoms of TB toxicity has improved, and patients had better nutritional state.

Operative Procedure. After general anesthesia administration patients were placed in prone position. Back skin incision from midline linear was performed. For stabilization and correction of kyphosis pedicle screw system was installed in all patients, at least two levels above and below the decompression level. In the scenario where upper part of vertebral body remained safe by Tuberculosis, then such vertebrae could be treated by the pedicle screws. In that scenario a temporary rod was inserted on the mild side of the focus in order to avoid spinal cord injury. The drainage and incision sutures were applied. The debridement pathological tissues were sent for culture and histopathologic examination. The operative time, during surgery loss of blood, and perioperative complications were recorded.

Postoperative Management. Drainage tubes were removed after 48–72 hours .The patients were allowed to get up and walk with a brace two weeks after the surgery. Antituberculous chemotherapy regimen treatment was done to patients for 9-12 months.

Follow-Up. Postoperative follow-up visits were done at 1 and 3 months. After first thee months next follow-ups were after six months. At each follow-up evaluation, ESR and CRP were checked. Plain radiographs were obtained in standing positions in order to determine the development or progression of spinal deformity after surgery and instrumentation failure. MRI was carried out to observe the absorption of psoas muscle abscess at

first follow-up visit and each six-month interval, until the psoas muscle abscesses were completely absorbed. The nerve function and back pain were evaluated by Frankel Scale and Visual Analogue Score (VAS) score, respectively. Those patients meeting the following criteria were considered to be cured: (1) disappearance of clinical symptoms with the ability to return to normal activities; (2) improvement in kyphotic correction (3) ESR and CRP decrease to normal levels; and (4) no recurrence of spinal tuberculosis appearing one year after surgery.

Results All measurement data were expressed as X ± S.D. The statistical significance of kyphotic Cobb's angle before and after surgery and at the last follow-up were assessed using one-way ANOVA test. The statistical analysis was performed by applying Chi-square test and results were recorded. P value less than 0.05 was considered as baseline. All analysis were done by the utilization of SPSS Version 20.0. All patients were treated with the surgical procedure of pedicle screw fixation using posterior instrumentation, rods, hooks and pedicle screws.

Age and Gender distribution:

41patients were observed for this procedure 25 of the patients were males and 16 were females. When the average age of the admitted and under observation patients was recorded at the time of operation it was figured out about 29.58 years ±2 years. Distribution of patients w.r.t. age and gender is shown below.

Age groups (In years)	Gender		P-value
	Male (n=25)	Female (n=16)	
22 – 30	9	7	0.002
31 - 40	7	5	
41 – 50	5	3	
51 – 70	4	1	
Total	41		

Table1 Cross-tabulation of age group with respect to Gender

The recorded mean operative time was 193.24 ± 26 min (range 149–255 min) and mean loss of blood was 779.26 ± 394mL (range 400–1800 mL). The average postoperative recumbence period was 2.9±1.6 days. The average period for follow-up was noted and it was about 13.6 ±2.7 months.

Laboratory Data:

A proper follow up of the patients was performed for at least 12 months, with an average of 22.5 ± 2.5 months (range 11.5–27months).The average preoperative CRP values and ESR were 45 ± 15 mm/h (range 25–115 mm/h) and 29 ± 15mg/L (15–145mg/L), respectively. They decreased gradually one to two months after the surgery and came to the normal condition after three months of the surgery. Spinal TB was cured at the last follow-up, and traces of recurrence was about 0 % in all patients.

Kyphosis angle correction:

Kyphosis was observed in these cases. The kyphotic angles were measured by Cobb's method [17]. In these patients operated through the posterior approach, the kyphotic angle preoperatively ranged between 11.95°-26.4° with an average of 15.7°± 2.5° and improved in the immediate postoperative period to 9.54 ± 2.84°. It is

noteworthy that after 6 months from surgery little loss of correction angle was observed at the final follow-up (7.5° ±3.84°).

Three perioperative complications (7.31 %, 3/41) were observed in the present study. Two of them suffered from intercostal neuralgia, which was relieved by nonsteroidal anti-inflammatory and neurotrophic drugs. One suffered from the superficial infection around the incision but responded well to early debridement and antibiotics.

The rate of hardware failure was 4.87 % as it was observed in just two cases.

Hardware Failure	Gender		P-value
	Male (n=25)	Female (n=16)	
Yes	1	1	
No	24	15	0.74

Table2 Cross-tabulation of Hardware Failure with respect to Gender

The rate of infection was observed in 03 cases thus making the rate as 7.31 %.

Infection caused	Gender		P-value
	Male (n=25)	Female (n=16)	
Yes	02	01	
No	23	15	0.478

Table3Cross-tabulation of infection with respect to Gender

Neurological outcomes were evaluated by Frankel scale. Frankel scale was calibrated in grades as A to E which is defined as follows.

Frankle Grade	Description
Frankle A	Complete Power and sensation Loss
Frankle B	Only sensation Present
Frankle C	Some Power but cannot walk
Frankle D	Decrease pain but can walk
Frankle E	Normal Movement

Clear improvement in the clinical neurological status was observed postoperatively as-compared to preoperative status. There were no newly recorded permanent neurological deficits. Table 5 shows the improvement in preoperative clinical status compared with the postoperative clinical status according to the Frankel scale.

Frankel grade	A	B	C	D	E
Preoperative	0	4	4	24	9
Postoperative	0	2	3	19	17
$\chi 2$ value	29.2				
P value	0.000				

Table4: The preoperative and postoperative follow-up of neurological function was evaluated by Frankel scale.

Back pain was present in 41 cases preoperatively. The average pain score preoperatively was 9.2 ± 2.13 on the VAS scale and postoperatively was 2.5 ± 1.32. This decrease in back pain was statistically significant (0.05142, $P > 0.05$). The cases operated upon by means of the anterior approach evidenced more reduction in the VAS scale compared with those operated upon by the posterior approach, but the difference was statistically insignificant.

Discussion

Spinal TB still exist in underdeveloped countries. The goals of surgical treatment are focal clearance of TB, relief of spinal nerve compression, and correction of the serious spinal deformity. Since Ito et al. firstly introduced anterior approach for spinal-TB, anterior debridement combined with posterior fusion which was popular for the cure of disease. Recent trends in surgical treatment of spinal TB have been smaller incisions, static internal fixation, and only one approach during surgery [13, 14]. And hence becomes an alternative treatment for spinal TB.

Zhang et al. [15] indicated that one-stage posterior approach generate more satisfactory outcome than posterior.

In the present study, we performed the procedure of one-stage posterior debridement, fixation with pedicle screw, with monosegmental thoracic and lumbar spinal TB patients. The mean operation time was 192 min with an average blood loss of 775 mL. The operation time and blood loss were shorter than those reported by Pu et al. [16]. In his study, the mean duration was 390.2min and average blood loss was 834.1 mL. Three patients (8.1%) presented slight perioperative complications in this study and all recovered within three months, which did not affect the bony fusion of the spine.

Ma et al. [17] reported that excellent neurological result was observed after single stage posterior debridement, and internal fixation in patients, which was similar to those obtained via anterior decompression. For the correction of deformity most of the studies has declare posterior approach as a superior one than the anterior procedure. In the present study, the Frankel scores were significantly higher at the final follow-up visit than those before surgery ($P < 0.05$). The results were consistent with Zhang et al.'s study [18]. The VAS score of the patients was decreased to 2.5 at final follow-up visit while it was at 9.2 before the surgery. The ESR and CRP significantly decreased within three months postoperatively. The preoperative and postoperative mean kyphotic Cobb's angle were 15.7°± 2.5° and 7.5 ± 3.84° in the present study, and the difference was significant ($P < 0.05$). No significant loss of deformity correction was observed at the final follow-up (P =0.542).The result was similar to Zhang et al.'s study [19]. It was concluded from study that the final outcome of one-stage posterior approach was satisfying.

There are still some limits for this technique due to the authors' experience and insufficient sample of patients. Firstly, posterior debridement bears the potential risk of TB spreading to the posterior healthy regions, resulting in infection diffusion and fistulas. Fortunately, these complications have not been observed in the present study. Secondly, the normal posterior column of spine was destroyed to achieve complete debridement and decompression in this procedure, which could affect the spinal stability.

Conclusion: The procedure of one-stage posterior debridement, transpedicular screw fixation is safe and effective procedure for the surgical treatment of the monosegmental lumbar spinal Tuberculosis in adults. Although results from this study exhibited the correction and maintenance of kyphosis at t final follow-up, but it was the case of short-term follow up only. There is much room for further study considering the sample of large number of patients with longer follow-up.

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