Thoraco lumbar spinal tuberculosis-assessment of functional outcome following posterior decompression and posterior instrumentation

Shanmuga Sundaram Pooswamy, Niranjanan Raghavn Muralidharaogpalan*

ABSTRACT

Background: Spinal tuberculosis is the most common form of extra pulmonary tuberculosis. Complications of untreated spinal tuberculosis include neurological deficit and gibbus deformity. Treatment of spinal TB can be surgical or conservative. Surgical treatment is the mainstay in spinal tuberculosis with neurological deficit. Various approaches to surgical management are anterior only, combined anterior & posterior and posterior only. Posterior only approach is less traumatic and more familiar to orthopaedicians.

Methods: 23 patients diagnosed of spinal tuberculosis with neurological involvement who underwent single stage posterior decompression and posterior stabilization were analyzed with ASIA grading and VAS score.

Results: The mean age of the study population was 48.86. There were 12 females and 11 males. The mean operative time and blood loss were 152.19 minutes and 265 ml. Increasing age correlated with blood loss and operating time. The mean follow up period was 36.21 months. There were significant differences in the ASIA and the VAS scores when pre-operative, immediate post-op and final follow up where compared.

Conclusions: Single stage posterior decompression and instrumentation is a safe and effective procedure in the treatment of tuberculous spondylodiscitis with neurological deficit and a kyphotic angle <60°. The long-term results are better because of posterior instrumentation, which provide stability and the healing anteriorly following antituberculous treatment.

Keywords: Spinal tuberculosis, Posterior only approach, Posterior stabilization, Posterior decompression

INTRODUCTION

Tuberculosis caused by Mycobacterium tuberculosis is a disease that has been present since antiquity. The bacillus affects pulmonary and extra-pulmonary structures. The bone and joint tuberculosis is the most common type of extra-pulmonary tuberculosis and spinal TB is the most common location of extra pulmonary tuberculosis.1

The Revised national tuberculosis control programme has done a stellar job of identifying and treating TB. However due to the high disease burden some case of tb spine go on and develop complications such as neurological deficit including paraparesis and paraplegia, severe kyphosis and gibbus formation and cold abscess formation.

The presence of neurological deficit is one of the indications for surgical intervention in TB spine.2

Various modalities of intervention such as anterior only, combined anterior plus posterior and posterior only approaches have been advocated each with its own benefits and complications.3,4
The posterior only approaches have been gaining popularity because of the increased morbidity in using an anterior approach and the frequent need for the use of another specialist surgeon.\(^5\)

This paper is intended to study the effects of single stage posterior stabilization and decompression without bone grafting in Tb spine presenting with a neurological deficit in patients where kyphotic angle is less than 60°.\(^6\)

**Aim and objectives**

- To study the effects of single stage posterior stabilization and decompression on patients with tuberculosis spondylodiscitis of the spine presenting with a neurological involvement with kyphotic angle less than 60°.\(^7\)

**METHODS**

All patients were treated at Saveetha Medical College Hospital between May 2010 to August 2014 were included in the study. This is a retrospective study and all patients fulfilling the inclusion and exclusion criteria were included in the study.

**Inclusion criteria**

Inclusion criteria were all patients with people of either sex who are 18 (Eighteen) – 70 (Seventy) years of age; x-ray and MRI proven Tuberculosis of the spine with neurological involvement; who appeared for periodic follow-up; people who consented to include themselves in the study.

**Exclusion criteria**

Exclusion criteria were tuberculosis of posterior elements alone; tuberculosis with no neurological involvement; pregnant women; kyphosis angle >60°; patients with an unsound mind (who cannot fill up the questionnaires); patients not willing to consent to the study; previous back surgery; previous fractures of the spine; posterior elements involved in the disease process.

**Sample size**

The prevalence in India is about 40% (which includes latent and active tuberculosis).\(^6\) Out of this 40%, 80% is considered to be latent and 20% active.\(^7\) So active disease is 8% of the total. 40% of active tuberculosis is extra pulmonary.\(^8\) 10% of the extra-pulmonary patients have skeletal involvement. (Total: 0.32%). Out of this about 50% have spinal involvement (Total: 0.16 %).\(^9\)

Applying this to formula for calculation of sample size.\(^10\)

\[
\text{Sample size} = \frac{Z_{1-\alpha/2}^2 p (1-p)}{d^2}
\]

Where \(Z_{1-\alpha/2}\) is standard normal variate. 5 (five) % error value is 1.96

\[p = \text{proportion in population: here } p=0.0016\]

\[d = \text{absolute error/precision: } d=0.02\]

Hence sample size \(= \frac{1.96^2 \times 0.0016 \times 0.9984}{0.02^2} = 15.34\)

Hence the report of this study may be considered significant

**Questionnaires**

Questionnaire’s used in the study were Visual Analog Scale – Numerical rating scale and ASIA grading system.

**Visual analogue scale**

Numerical rating scale: Visual analogue scale is a patient filled up questionnaire to identify the level of pain in an individual. This is a 10 cm scale, which has no pain or 0 at one end and 10 or the worst pain of my life at the other end. There are whole numbers such as 1, 2, 3 as intermediate points.\(^11\)–\(^14\)

The validity, reliability, generalizability and internal consistency have been proven by multiple studies, as is the effectiveness of the scale as a measure of analgesic treatment.\(^15\)–\(^20\)

This scale has also been proven in multiple studies to be effective for rural illiterate patients as well.\(^21\)

**ASIA grading system**\(^22,23\)

The American Spinal injuries association scale (for spinal cord problems) was developed by the American Spinal injuries association. This scale consists of five grades A – E (with A being complete Spinal cord injury to E being normal spinal cord function). This grading system has been validated and found to be reliable in assessing spinal cord function in Tb spine.\(^24,25\)

The testing is done for ten muscles on each side of the body and 28 sensory locations on each side of the body.

**Sensory examination:** The following scores are given to each sensory point

0 – The sensation is absent
1 – The sensation is present but impaired
2 – The sensation is normal
NT – Not testable

Scores are individually tested for both light touch and pin prick sensation. The maximum score possible is 112.
Motor examination: The scores used are 0 – 5 following the MRC Grading System and in addition NT is not testable.  

For the twenty muscles (or ten in the lower limb) a score of 100 (50) is obtained.

Then the neurological level is identified.

This is then used to classify and grade A – E

Pre-operative:

All patients with a diagnosis of Spinal tuberculosis involving the anterior elements and the spinal cord are admitted. Basic investigations such as blood counts, ESR, Mantoux were performed. Co-morbidities were identified and treated appropriately. Necessary opinions taken and patients worked up towards surgical fitness. Antituberculosis treatment begun.

Preoperative VAS and ASIA (AIS) scales obtained.

Figure – 1a Pre-operative X ray

Figure – 1b Pre-operative MRI

All patients were started on pre operative antituberculous treatment as soon as the diagnosis was made. The drugs used were a daily regimen of isoniazid 5 mg/kg, rifampicin 10 mg/kg, ethambutol 15 mg/kg, and pyrazinamide 25 mg/kg.

Intra-operative

Patients operated under General Anaesthesia in prone position under sterile aseptic precautions. Levels confirmed under c-arm guidance. Pedicle screw inserted two levels above and below the diseased segment(s).

Posterior decompression: In the diseased segment, either laminectomy, partial laminectomy done to decompress the neural structures.

The process is repeated for each level under c-arm guidance.

If a paravertebral abscess is present it is identified and drained.

Figure – 2a and b Intraoperative Picture

Once this is achieved we complete posterior instrumentation using rods and screws. Appropriate rod contouring is performed to restore thoracic kyphosis and lumbar lordosis. Wounds closed in layers over a drain.

Blood loss and operative time calculated.

The pus and the granulation tissue were sent for culture sensitivity to rule out MDR tuberculosis.

Post-operative

Patients mobilized as tolerated. Aggressive physiotherapy and mobilization performed as needed. DVT prophylaxis instituted. VAS and AIS Scores calculated. Drain removal done on POD 2. Suture removal done on POD 12 if no wound complications were present.

Antitubercular treatment continued as Category I with a total intensive phase of 2 HRZE plus 8 HR for a total period of 10 months. Post-operative ESR measured to identify the status of the disease

Follow-up

Patients followed up at 1,3,6,12,24 months. X –ray studies done ESR measured. VAS and AIS scores recorded.

Figure 3: Immediate post-operative x-ray.

Figure 4: Follow up X ray showing healed lesion and no implant failure.

All statistical analyses were performed Microsoft Excel 2011 (Microsoft Inc., USA)

RESULTS

A total of 23 patients were evaluated in the study. The mean age of the study population was 48.86 (31-65). 11 were males and 12 were females. There is no association between sex and operative time and blood loss (p=0.13 and 0.16 respectively.

Increasing age showed a positive correlation with the blood loss and operating time (0.20 and 0.33 respectively) and strong correlation between blood loss and operating time (0.58).

Three patients had type 2 diabetes mellitus, 3 patients had hypertension, 1 patient suffered from Ischaemic heart disease, 1 patient suffered from clinical depression and 2 patients suffered from diabetes and hypertension.

All cases were operated by a single fellowship trained orthopaedic spine surgeon.
The follow-up period was 28-42 months (mean: 36.21 months).

The VAS obtained was tabulated for pre op, immediate post op and final follow up.

The pre-op, immediate post-op and final follow up and final follow up VAS scores were significant when the 3 groups were compared individually and together (p<0.00001).

| Table 1: VAS. |
|----------|----------|----------|----------|
|          | Mean     | Std dev  | Min      | Max      |
| Preoperative | 6.13     | 1.08     | 4        | 8        |
| Immediate post op | 3.21     | 1.38     | 1        | 6        |
| Final follow up  | 1.21     | 1.17     | 0        | 5        |

The ASIA score was tabulated for pre op, immediate post op and final follow up.

The pre-op, immediate post-op and final follow up and final follow up ASIA scales were significant when the 3 groups were compared individually and together (p<0.0001).

| Table 2: Asia grade. |
|----------------------|----------|----------|----------|----------|
|                      | A        | B        | C        | D        | E        |
| Preoperative         | 1        | 8        | 9        | 5        | 0        |
| Immediate post op    | 0        | 1        | 5        | 8        | 9        |
| Final follow up      | 0        | 0        | 1        | 5        | 17       |

The average operative time was 152.19 minutes (120-220 minutes). When operating time to complications is compared the operative time of >180 minutes is associated with more complications (p=0.01).

| Table 3: Operating time. |
|--------------------------|----------|----------|
| Mean                     | 152.1    | Std dev  | 23.85    |
| Min                      | 120      | Max      | 220      |

The average blood loss was 265.43 ml (160-460 ml). When blood loss is compared to complications there is no significant relationship (p=0.34).

| Table 4: Blood loss (ml). |
|---------------------------|----------|----------|
| Mean                      | 265.43   | Std dev  | 89.33    |
| Min                       | 160      | Max      | 460      |
a large kyphotic angle is present or a severe gibbus has developed. These cases have been excluded from our study.

The popularity of the posterior approaches has increased following the development of pedicle screw instrumentation. Many studies proved that the posterior instrumentation provided better results than anterior instrumentation.

The type of decompression achieved in the posterior approach is usually indirect. Secondly, although the disease predominantly spares the posterior elements, the laminae are usually removed to achieve decompression. This leads to an iatrogenic instability, which necessitates placing of grafts posterolaterally or a mesh cage with grafts anteriorly to achieve fusion. Transpedicular decompression has been performed in a few studies, although primarily as an adjunct or as a limited procedure in elderly patients.

Our series was designed with this problem in mind. The type of cases, which were included in the series, had neurological deficit and the kyphosis angle was <60°.

We hypothesized that

a) The major source of the neurological deficit was the pus and the granulation tissue, which was present anteriorly. Once adequate decompression was achieved leading to decreased pressure, the neural structures would start to function normally.

b) The posterior stabilization was done and the kyphotic angle was corrected, further collapse was prevented and the chemotherapy took care of the infection resulting fusion. This prevented further kyphotic collapse without the need for additional bone grafting.

When the results of this study are analyzed, all 23 patients noticed an improvement in the neurological status, which was statistically significant. 17 of the 23 patients had complete neurological recovery. No one the patients worsened after the surgery. This validates our approach that decompression through posterior approach is sufficient to cause a good neurological recovery and additional posterior decompression may not be required.

Secondly none of the cases in our study group reported loss of fixation or implant failure. This proves that the chemotherapy heals the disease and additional anterior/posterior/posterolateral grafting may not be needed in the included subset of patients.

Thirdly there have been no serious complications or death in our study population. We believe this is in part to the lesser operating time and blood loss when compared to the more radical surgeries.

CONCLUSION

Single stage posterior decompression and posterior instrumentation is a safe and effective procedure in the treatment of tuberculous spondylodiscitis with neurological deficit and a kyphotic angle <60°. The long-term results are better because of posterior instrumentation, which provide stability and the healing of anterior structures following antituberculous treatment.

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