Anterior spinal surgery alone in the surgical treatment of thoracolumbar spinal tuberculosis: a prospective study

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Abstract

Background: One of the important sites for extrapulmonary TB involvement is the skeleton. Tuberculous spondylitis (Pott’s disease) comprises 50-70% of the skeletal tuberculosis.

Methods: In this case series study, we prospectively investigated the result of anterior surgery alone (anterior debridement, fusion and instrumentation) in the patients with spinal tuberculosis. The patients with immature skeleton, long segment disease or kyphosis more than 50° were excluded. All the cases were followed for at least 2 years (mean 31.4+/−6.4 months).

Results: This study comprised of 23 (13 male and 10 female) cases with a mean age of 35.8 (SD=7.8) years old. Segmental kyphosis was corrected from +11.9° (SD=13.8°) preoperatively to -3.8° (SD=8.9°) after surgery that was mainly maintained at the last follow up visit. Bony union was achieved in all cases but one.

Conclusions: Our results showed that in selected cases of tuberculous spondylitis, anterior surgery alone could be encouraging.

Keywords: Tuberculosis, Spine, Instrumentation, Fusion.

Introduction

Tuberculosis (TB) is a disease of enormous dimensions worldwide. World Health Organization estimates that approximately one third of the world’s population is infected with Mycobacterium Tuberculosis and the disease is thought to cause at least 3 million deaths each year, and the annual number of new cases is now nearly 8 million [1].

About 16% of newly reported cases of tuberculosis involve extrapulmonary sites [2]. One of the important sites for extrapulmonary TB involvement is the skeleton. The incidence of this type of TB has been raised with increasing age and is equally frequent among men and women. Any bone in the body may be involved [3, 4] even though, tuberculous spondylitis (Pott’s disease) occurs most commonly and comprises 50-70% of the skeletal tuberculosis. The most commonly involved vertebrae in adults are the lower thoracic and upper lumbar whereas in children the upper thoracic spine is the most frequent site [5].

Standard chemotherapy is highly successful in skeletal TB, but surgery is occasionally a necessary adjunct [6]. There is no well-defined surgical procedure of choice, although an “all-or-none” approach has been advocated by several surgeons [7]. However nearly most of the authors agree that surgery is indicated in early neurologic findings especially in the cases with progressive neural
deficit [8]. In this case series study, we pro-
spectively investigated the result of anterior
surgery alone in our patient with spinal TB.

Methods
In this case series research, we prospec-
tively studied 23 patients with active tho-
columbar spinal TB who surgically treated
with one stage anterior operation. All of
these patients were treated by one surgeon
and by one surgical technique. Our inclusion
criteria for surgery were spinal instability
(figure 1), involvement of the thoracolumbar
spinal region, a failure of medical treatment,
neurological compromise especially in the
form of progressive neurologic dysfunction,
and a large soft tissue mass including a huge
cold abscess. We excluded the patients with
vertebral involvement of equal or more than
3 levels (long segment disease) [9,10], ky-
photic deformity more than 50 degrees,
those cases with less than 2-year follow-up,
and the cases whose pre- or postoperative
diagnosis was not compatible with TB. In
patients with equal or more than 3 vertebral
involvements, severe kyphosis, or in imma-
ture children, two stage surgeries (anterior
debridement and fusion, and then posterior
fusion and instrumentation) were performed.
These patients were also not included in this
study. All the participants had assigned the
informed consents.

Chest x-ray was performed in all cases to
reveal any concomitant pulmonary infection.
Due to the endemic state, we relied on clini-
cal and non-invasive paraclinical (blood tests
and imaging) characteristics for confirma-
tion of TB diagnosis. In no case preliminary
aspiration or biopsy was performed.

Surgical technique
All the patients were operated on in right
lateral decubitus position, with left thoraco-
tomy, thoracoabdominal or anterior
retroperitoneal approaches, depending on
infected level. After thorough debridement
and drainage, vertebral body was recon-
structed either with tricortical iliac crest
bone graft or mesh cage compacted inside
with autogenous or allogeneous bone graft.

Finally the construct was rigidly immobi-
lized with anterior spinal instrumentation
(via (“Xia anterior” is a brand name of this
system) anterior spinal implant; Stryker, fig-
ure 2). Postoperatively, the patient was mo-
bilized on the 2nd or 3rd day after surgery
while a rigid orthosis was applied. Medical
treatment with anti-tuberculous drugs was
continued according to standard regional
protocol.

Neurologic deficit in our patients was
graded according to the Impairment Scale
defined by American Spinal Injury Associa-
tion (ASIA), ranging from A through D for
spinal cord injuries [11, 12]. Regional sco-
liosis or kyphosis was measured as the angle
formed by intact upper and lower endplates
of the infected vertebrae on standing pos-
teroanterior and lateral views. Sagittal angles
were recorded with negative or positive
measures if they were applied to lordotic or
kyphotic angles, respectively. At the last fol-
low up visit, crossed bony trabeculation, ab-
sence of implant failure, loosening, and sig-
ificant correction loss or pain imply to the
solid fusion.

The patients were followed at 2 weeks,
2months, and 6months and then annually
after the operation.

Statistical Methods
The preoperative and most recent postop-
erative scales were compared with use of the
paired T test. The level of significance was
set at p< 0.05. All analyses were performed
with use of Statistical Package Science
Software (SPSS v. 10).

Results
After inclusion and exclusion criteria
came into account, we studied 23 (13 male
and 10 female) cases in this research. The
mean age of the patients was 35.8 (SD=7.8,
ranged 23 to 50 years old). Vertebral levels
involvement was depicted in Fig. 3.

16 cases (70% of the patients) were first
treated by at least 2 to 3 weeks medical ther-
apy with anti-tuberculous drugs. In re-
mind, due to urgent situations like acute or
progressive neurologic deficit, neoadjuvant
Fig. 1. An adult woman with tuberculous spondylitis. A 34 years old woman presented with a history of low back pain for about 6 months followed by inability to walk, and wheelchair bound. In imaging vertebral bodies of L3 and most of the L4 was destroyed.

Summary of pre- and postoperative findings in our patients was shown in Tables 1 and 2. Mean preoperative segmental kyphosis and scoliosis were $+11.9^\circ$ (SD=$13.8^\circ$, range $+35^\circ$ to $-28^\circ$) and $4.8^\circ$ (SD=$4.1^\circ$, range 0 to $-10^\circ$), respectively. Immediate postoperative segmental kyphosis was corrected to a mean of $-3.8^\circ$ (SD=$8.9^\circ$). This difference between pre- and post-operative kyphosis was significant statistically ($p<0.05$). The correction was mainly maintained during the healing process (with a minimal mean correction loss of about $1.8^\circ$ (SD=$1.3^\circ$) at the latest following up visits that was trivial; $p=0.12$).

Chest x-ray revealed that 7 out of 23 patients (30%) had some evidences of pulmonary involvement but active pulmonary tuberculosis was only present in 3 cases (13%). Prevalence of HIV infection in our patients was 17.3% (4 cases). The mean follow up period was 31.4 months (range; 24-52, SD=6.4).

Fig. 2. Postoperative radiographs. Plain anteroposterior and lateral view of the lumbar spine, postoperatively taken in the same patient depicted on figure 1. The patient was operated anteriorly by radical debridement, anterior reconstruction with mesh cage and bone graft, and rigid anterior instrumentation.
We had 3 patients with significant preoperative neurologic deficit. Complete neural recovery was observed in two, and an improvement from ASIA scale B to D in the rest of them.

Bony union was achieved in all cases but one (case #8). In this patient, implant failure (screw breakage without significant displacement) was associated with refractory pain. So he was treated with posterior spinal fusion and instrumentation. The pain was finally disappeared and bony union was occurred.

We did not have any deep wound infection but superficial infection occurred in 2 cases that responded satisfactorily to the nonoperative measures. In one case, intraoperative ureteral tearing occurred that was
Table 2. Summary of postoperative findings.

<table>
<thead>
<tr>
<th>Case No</th>
<th>Kyphosis/Scoliosis Early</th>
<th>Kyphosis/Scoliosis Final</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.BA</td>
<td>+5/2</td>
<td>+5/2</td>
<td>Death 3 years after operation (septicemia due to severe IV drug abusing)</td>
</tr>
<tr>
<td>2.MM</td>
<td>-7/0</td>
<td>-6/0</td>
<td>Superficial wound infection</td>
</tr>
<tr>
<td>3.MA</td>
<td>-30/0</td>
<td>-28/0</td>
<td>Complete neurologic recovery</td>
</tr>
<tr>
<td>4.RS</td>
<td>0/4</td>
<td>+4/4</td>
<td>Complete neurologic recovery</td>
</tr>
<tr>
<td>5.ZY</td>
<td>-10/2</td>
<td>-10/2</td>
<td>-</td>
</tr>
<tr>
<td>6.AAG</td>
<td>-8/4</td>
<td>-8/6</td>
<td>-</td>
</tr>
<tr>
<td>7.MS</td>
<td>+4/0</td>
<td>+5/0</td>
<td>Neurologic state D</td>
</tr>
<tr>
<td>8.ZC</td>
<td>0/0</td>
<td>+20/10</td>
<td>Implant failure and pain (treated by PSFI)</td>
</tr>
<tr>
<td>9.MH</td>
<td>-10/2</td>
<td>-10/0</td>
<td>-</td>
</tr>
<tr>
<td>10.AF</td>
<td>0/2</td>
<td>0/2</td>
<td>-</td>
</tr>
<tr>
<td>11.MA</td>
<td>-12/0</td>
<td>-12/2</td>
<td>Intraoperative ureteral tearing (Intraoperatively was repaired)</td>
</tr>
<tr>
<td>12.AR</td>
<td>-6/0</td>
<td>-6/0</td>
<td>-</td>
</tr>
<tr>
<td>13.AG</td>
<td>-15/4</td>
<td>-13/6</td>
<td>-</td>
</tr>
<tr>
<td>14.HT</td>
<td>+4/0</td>
<td>+6/2</td>
<td>-</td>
</tr>
<tr>
<td>15.NF</td>
<td>-4/4</td>
<td>-4/6</td>
<td>-</td>
</tr>
<tr>
<td>16.SG</td>
<td>+4/0</td>
<td>+4/0</td>
<td>-</td>
</tr>
<tr>
<td>17.SR</td>
<td>-2/0</td>
<td>-2/0</td>
<td>-</td>
</tr>
<tr>
<td>18.KY</td>
<td>+4/0</td>
<td>+4/4</td>
<td>Superficial wound infection</td>
</tr>
<tr>
<td>19.BH</td>
<td>+4/4</td>
<td>+4/6</td>
<td>Complete neurologic recovery</td>
</tr>
<tr>
<td>20.VA</td>
<td>-16/2</td>
<td>-14/2</td>
<td>-</td>
</tr>
<tr>
<td>21.FK</td>
<td>-2/0</td>
<td>0/0</td>
<td>-</td>
</tr>
<tr>
<td>22.ZH</td>
<td>+10/2</td>
<td>+12/4</td>
<td>-</td>
</tr>
<tr>
<td>23.AR</td>
<td>0/4</td>
<td>2/4</td>
<td>-</td>
</tr>
</tbody>
</table>

*PSFI=Posterior Spinal Fusion and Instrumentation*

repaired on that session with double J stent. The stent was removed 3 months later with no additional complication. We did not notice any adverse reaction like miliary tuberculosis even in the cases who did not receive neoadjuvant medications before surgery.

**Discussion**

Extrapulmonary tuberculosis presents more of a diagnostic and therapeutic challenge than pulmonary tuberculosis. This partly relates to its being less common and therefore less familiar to most clinicians. In addition, extrapulmonary tuberculosis usually involves relatively inaccessible sites [5].

In Pott’s disease, the destructive changes usually involve two adjacent vertebrae but rarely and lately the intervertebral discs. A usual presentation of the disease is pain. Systemic symptoms of infection are not common. The imaging abnormalities are not specific for tuberculosis but may be seen with any chronic osteomyelitis [13]. Confirmation of the diagnosis is obtained by aspiration or biopsy. Evidence of granulomatous inflammation even in the absence of bacteriologic proof of the diagnosis is sufficient to begin anti-tuberculosis therapy unless another cause is found [14].

In a clinical review of 40 cases with tuberculous spondylitis, Tasova et al retrospectively studied the clinical presentation, laboratory, and radiologic findings in adult cases [15]. 30% of their patients had a history of contact with a patient having active pulmonary TB and 85% of them required surgery in addition to standard medical treatment. The most frequent symptom and site were low back pain and lumbar spine, respectively.

Anterior debridement and fusion through anterior approach has been the most common standard surgical treatment of spinal tuberculosis. Prolonged external immobilization or more recently posterior fusion and instrumentation via posterior approach are also proposed [16]. Recently, a variety of new approaches were introduced to facilitate and simplify the surgery. Posterior lumbar interbody fusion and posterior instrumenta-
tion is one of this approaches described by Lee for the lumbar tuberculous spondylitis [17].

In the past, most surgeons had some concerns about anterior instrumentation in the presence of tuberculous infection partly because of introducing foreign material into infected tissue. In one of the first reports related to applying anterior instrumentation in the patients with tuberculous spondylitis in 1999, Yilmaz et al [18] observed no recurrence of the disease. Average correction of the deformity which they reported was 64% and 81% in the cases with one or two levels of involvement and the patients with more than two levels, respectively. They propose that anterior is more effective than posterior instrumentation for reducing the deformity and stabilizing the vertebral column in patients who have kyphosis due to spinal tuberculosis.

In 2003, Benli reported their surgical results of 63 patients with Pott’s disease who underwent anterior radical debridement, fusion and instrumentation [19]. The mean age of the patients was 46.8 years. They observed that the addition of anterior instrumentation increased correction rate of the deformity and maintaining it. Out of 25 patients with neurologic deficit, 20 and 4 had full and partial recoveries, respectively. They reported very few intra and postoperative complications. They employed an aggressive neoadjuvant chemotherapy prior to surgery (except in urgent cases with recently developed or progressive neurologic deficit) and reported no disease reactivation at all. Finally, they concluded that anterior instrumentation is a safe and effective method in the treatment of tuberculosis.

Similarly Jin [20] reported the surgical results of one stage anterior interbody autografting and instrumentation in thoracolumbar spinal tuberculosis in 23 cases with spinal tuberculosis; while 14 out of 15 patients with neurological deficit showed obvious improvement. A mean of 18° kyphosis correction was achieved after surgery but a moderate progressive kyphosis occurred after 2½ years in a 9-yr child. Ultimately, they recommended one-stage anterior interbody autografting and instrumentation in the surgical management of spinal tuberculosis in selected cases and suggested supplementary posterior fusion in children.

Conclusions
Our results showed that in selected cases of tuberculous spondylitis, anterior surgery alone that comprises thorough debridement, arthrodesis and rigid instrumentation could be encouraging. It is obvious that this approach for the cases with long segment involvement or severe kyphosis may be more challenging and even not applicable.

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Conflicts of interest
No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References