One-Stage Posterior Surgery for Treatment of Advanced Spinal Tuberculosis

**Background.** It is not uncommon that some patients in poor general condition and advanced spinal tuberculosis can not proceed with the staged anterior spinal surgery after posterior surgery. We demonstrated a group of patients with advanced spinal tuberculosis that were treated posterior procedure alone.

**Methods.** From January 1993 to January 2001, 12 patients in our hospital in poor general condition and advanced spinal tuberculosis with angular deformity more than 25° and/or spinal canal compression more than 30%, were treated in our hospital with posterior surgery and chemotherapy only. All patients were immobilized postoperatively with orthosis until solid fusion was noted on bony graft. The chemotherapy was continued for at least 12 months in all patients.

**Results.** Spontaneous bony fusion of vertebrae at 1-year follow-up averaged 75%. Solid union on posterior or posterolateral fusion was about 91.7%. Implant loosening and deep wound infection were noted in 2 of the patients respectively. We assessed the functional results with the postoperative activity condition, symptom relief and medication dependence in the 6th month after the spinal surgery. Seven cases of the 12 patients (58.3%) had good to excellent results in this series.

**Conclusions.** The one-stage posterior surgery with chemotherapy is a considerable and alternative treatment for patients with advanced spinal tuberculosis and in poor general condition.
METHODS

From January 1993 to January 2001, there were 53 patients of spinal tuberculosis treated surgically in our hospital. Forty-one patients were treated with staged operation: posterior instrumentation followed by anterior debridement and bone grafting. The remaining 12 patients had poor general condition and advanced spinal tuberculosis—marked abscess with angular deformity more than 25° and/or spinal canal compromise more than 30% (Fig. 1) or with multiple skip lesions (Fig. 2). They received only posterior instrumentation and fusion in addition to chemotherapy: 11 cases among them were in too poor general condition to tolerate another operation (preserving less than 70% of normal pulmonary or cardiac function preoperatively, presenting unstable vital signs during the initial posterior spinal surgery or dependent on endotracheal tube with ventilation more than 3 days postoperatively). The other one had multiple skip lesions in which T10 spinal canal compromise. Among them, 9 were male and 3 were female. The age averaged 63.8, ranging from 28 to 81. The duration between symptom onset and diagnosis was 5.5 months on average (range, 3 weeks to 20 months).

Fig. 1. Imaging studies obtained in a 78-year-old man, who suffered from severe back pain and kyphotic deformity over his back for more than one year. (A) Anteroposterior view showing the vertebral body collapse on L1. (B) Lateral view revealed the Cobb’s angle of kyphotic angulation was 45° preoperatively. (C) Main lesion over vertebral body of L1 developed a great abscess with marked bony destruction and disk preservation. (D) The abscess involved into the spinal canal with cord compromise. (E) The anteroposterior file of one year follow-up after posterior instrumentation and correction. (F) The Cobb’s angle improved to 20 with good outcome.
Preoperative workup for all patients included measurement of the erythrocyte sedimentation rate, C-reactive protein, sputum smear and culture to detect acid-fast bacilli, CT-guided biopsy and assessment of preoperative activity (Table 1). The pain grading was used according to the pain grading criteria designed by Anderson and Henley. Criteria of grade 0 included no back pain, full function and no medication; criteria of grade 1 included occasional back pain, full function and no medication; criteria of grade 2 included occasional back pain, interferes with work or recreation, and anti-inflammatory medication; criteria of grade 3 included frequent back pain, interferes with work and requirement of medication or physical therapy; criteria of grade 4 included constant

Fig. 2. Imaging studies obtained in a 59-year-old man. (A) Anteroposterior view and (B) lateral view of preoperative films revealed general osteoporotic change and mild vertebral body height decrease on T10 and T11. (C) MRI showed multiple lesions over T1, T5, T7, T10 and T11. (D) The canal compromise on T10 and T11 resulted in Frankel C neurologic deficit. (E) CT-guided biopsy was performed on the lesion. (F) Laminectomy on T10 and posterior instrumentation and fusion was performed. (G) Although the treatment outcome was poor, the acceptable alignment was maintained after posterior instrumentation. However, this patient got improvement of life quality from absolute bedridden to sitting on his bed occasionally.
back pain, disabling from work and requirement of narcotics. The polymeric chain reaction was implanted in 1993 but did not prevail because the insurance did not pay for that. Thus none of the specimens obtained in the series was examined using this technique. Chemotherapy began immediately when the diagnosis was made: with rifampicin 600 mg/day, isoniazid 300 mg/day and ethambutol 500 mg/day or pyrazinamide 1 g three times a day, which lasted for at least 12 months. All patients were evaluated by anteroposterior and lateral radiography for vertebral collapse or an angular deformity, by computerized tomography (CT) for bony destruction and canal compromise, or by magnetic resonance imaging (MRI) for detection of granulation tissue and its spread. Intraosseous abscesses were detected in all patients.

At admission, 2 patients had Frankel grade E, 5 were grade D, 4 were grade C and 1 was grade B; none was grade A. Ten patients were bed-ridden or wheelchair-dependent and 2 needed canes for ambulation. The general characteristics of the 12 patients were: paraspinal abscess with kyphotic deformity more than 25°, and/or canal compromise more than 30°. So they were indicated for thoracolumbar decompression more than 30°. In the thoracic region or thoracolumbar junction, where flexion moment or a tendency to kyphosis was not noted,

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Sex</th>
<th>Pain Gr. &amp; Activity</th>
<th>Pre-OP Grade</th>
<th>Frankel Gr.</th>
<th>Duration of S/S</th>
<th>Level &amp; (Skip lesion)</th>
<th>Angulation &amp; (Bone destruct)</th>
<th>Paraspinal abscess</th>
<th>Canal compress</th>
<th>S/S subside duration</th>
<th>Post-OP Frankel Gr.</th>
<th>Post-OP angulation fusion at 1 year</th>
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<td>D</td>
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<td>E</td>
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<td>(+)</td>
<td>35%</td>
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<td>(+)</td>
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<td>D</td>
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<td>(+)</td>
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<td>1M</td>
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<td>(+)</td>
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<td>(+)</td>
<td>50%</td>
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<td>(+)</td>
<td>30%</td>
<td>–</td>
<td>C</td>
<td>8° (-)</td>
<td>Poor</td>
<td>C</td>
<td>8° (−)</td>
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BedR = status of bed-ridden; Exc = excellent; M = month; W = week; WhC = wheelchair.
we preferred longer segmental fixation, at least two above and two below the lesion. In the lower lumbar region, we preferred fixation and fusion as short as possible. There were 8 cases with long segmental fixation: 5 cases used TSRH instrumentation, and 3 cases used CD instrumentation. Short segmental fixation was instrumented with FI in 2 cases and the other 2 patients with Trifix instrumentation. Close-system drain was inserted under and above fascia for hematoma drainage.

After all catheters were removed and protective orthosis worn, then patients were allowed to mobilize. A Milwaukee brace was applied for patients with lesion above T8; thoracolumbosacral orthosis (TLSO) or Taylor brace was used for those lesions over the thoracic and thoracolumbar junctions. Chair-back brace was used for lesions over the lower lumbar region. The braces were continuously used for an average of 7.8 months postoperatively, ranging from 6 to 14 months, until posterior fusion or vertebral body was seen with solid union on radiography.

The follow-up period ranged from 1 to 7 years (average value: 4.64 years). Regular postoperative radiographs were used to assess the condition of posterior fixation and fusion in the first month, the third month, the sixth month and then the annual follow-up. Bony fusion was defined as: presence of mineralization and condensation of the bony mass with no more progression in angular deformity. The assessment of functional results was based on the postoperative recovery of activity and symptom relief in the sixth postoperative month. The results were categorized with the grades of Anderson and Henley and modified with pain and activity: excellent, complete relief of symptoms with little or no more need of medication during daily activity and work; good, occasional back pain that needed medication or cane help for ambulation; fair, frequent back pain de pending on wheelchair for outdoor activity; and poor, constant back pain in bedridden status.

RESULTS

The treatment results are shown in Table 1. The granulation tissue was at tained from vertebral bodies or soft tissue mass through preoperative CT-guided biopsy in 10 cases and intra-operative transpedicular biopsy on the lesions in 2 patients. Histologic examination of granulation tissues invariably showed infiltration of lymphocytes and epithelioid cells with areas of the caseating necrosis and sporadic Langhan’s giant cells. Epidural or intradural abscesses were found and drained during surgery in all patients. Mycobacterium tuberculosis smear and culture appeared positive in 3 patients (cases 1, 5, 12). The erythrocyte sedimentation rate elevated on an average of 56 mm/hour, ranging from 34 to 90. The mean value of C-reactive protein was 2.87 mm/dL, ranging from 0.1 to 7.4. At the final follow-up, most of patients had improved in neurologic deficit (2 cases were Frankel grade E pre- and post-operatively, 1 improved from Frankel grade B to D, 5 cases from grade D to E and 2 cases from grade C to D), except 2 patients: one was an amphetamine abuser and the other had multiple-level in sence (cases 11 and 12, respectively). Both were Frankel grade C pre- and post-operatively. The functional assessment of operational outcome came with modified Anderson and Henley’s grades, showed excellent results in four patients of our series, good results in 3, fair results in 3 and poor outcomes in 2. Deep wound infection happened in the patient with drug abuse, he received wound debridement several times. Finally, the wound healed 5 months later with out implant removal, and vertebral body consolidation was noted after another 9 months. Radiographically, the partial or complete fusion at the vertebral destruction (spontaneous anterior fusion) was at an average of 75% at one-year follow-up and vertebral consolidation was found around the 13.5 th month. The union rate on posterior or posterolateral fusion was 91.7%, excluding the case with drug abuse and deep wound in fec tion. But in this series, the situation of postoperative abscess absorption was not checked routinely. The postoperative kyphotic angle was 22.5° in 8 pa tients, and remaining patients mainained in normal alignment. These 8 patients with kyphotic deformity had a mean age of 75 years old. The postoperative kyphotic angle was 22.5° in 8 patients, and remaining patients maintained in normal alignment. These 8 patients with kyphotic deformity had an average age of 7.07°, ranging from -13° to 25°. Pedicular screws loosening on the low end of fixation and back-out was noticed in one case (case 9) in the 5th month after surgery and the implant was re moved one
year later. The Taylor brace was worn in 15 months until the vertebral body and posterior fusion union. His final kyphotic angle was 45°, progressing from 35° preoperatively.

**DISCUSSION**

In general, there are several characteristics of spinal tuberculosis: first of all, the initial symptoms and signs of spinal tuberculosis are insidious and nonspecific, which make early diagnosis difficult. Third, the angular deformity can present before other symptoms because of the indolent nature of spinal tuberculosis. Third, it has higher incidence of cord compression in advanced patients. Recently, the improvement of diagnostic tools and techniques, such as MRI, CT-guided biopsy and polymerase chain reaction, has made earlier diagnosis possible. Hong-Kong procedure, the standard one for anterior debridement and bone grafting, is effective for cord decompression and abscess drainage. However, the correction of an angular deformity is more effective with posterior instrumentation and fusion, especially with transpedicular instrumentation, or anterior approach plus posterior fixation. The modern posterior spinal instrumentation provides rigid fixation and stability. In 1994, Osman Guven et al. reported that satisfactory function of stabilization and kyphosis prevention were provided by posterior rigid fixation in early-stage Pott’s disease. In 1999, Lee et al. reported transpedicular instrumentation providing rapid relief of instability and correction of vertebral and posterior stabilization in patients with limited spinal bone destruction. To our knowledge, no literature has reported posterior instrumentation and chemotherapy for treating advanced spinal tuberculosis with spinal instability and/or neurologic compromise. In this series, 12 cases with advanced spinal tuberculosis and in poor general condition were treated with only posterior instrumentation, fusion, and chemotherapy. The spontaneous fusion rate at the vertebral lesions was at an average age of 75% at one-year follow-up, and the average period at which final union was found was in an average age of 13.5 months. Union on posterior or postero-lateral fusion was 91.7%. The good to excellent functional result was 85.3%.

The outcome of treating patients of advanced spinal tuberculosis with posterior instrumentation was not as bad as we expected originally. The possible reasons were as follows: first, we confirmed the diagnosis from MRI and CT-guided biopsy to facilitate the planning for surgical procedure and chemotherapy as early as possible; second, rigid posterior instrumentation facilitated early mobilization and decreased the morbidity caused by their bed-ridden state; third, indirect decompression during debridement and posterior stabilization with posterior instrumentation improved the neurologic function; fourth, good preoperative effect and in flammary control or abscess resection were not timed on the antituberculous chemotherapy. All these factors facilitated an effective treatment of advanced Pott’s disease with posterior instrumentation and chemotherapy.

The negative factors affecting the results were the advanced vention of spinal tuberculosis, old age with osteoporosis, poor general condition or poor patient compliance. For example, case 9, an 81-year-old patient with marked osteoporosis, had his implant loosened 5 months after the surgery. The brace was worn for 15 months and the kyphotic deformity progressed until vertebral and posterior fusion was achieved. Case 10 of the series was a victim of advanced systemic tuberculosis, involving lung, spine and knees. Her activity did not improve until the chemotherapy was completed and total knee replacement was done one year after the spinal surgery. Although the posterior fusion was fair, the stability of her spine and lift quality improved. Case 12 was a patient with multiple lesions over different levels of thoracic spine. He received palliative decompression and stabilization for T10, T11 where the spinal canal was compromised. Although he expired one year after the spinal surgery due to respiratory failure and cachexia, the con 

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noticed during the survival follow-up period.

REFERENCES


