Surgical Treatment of Thoracic and Lumbar Tuberculosis by Anterior Interbody Fusion and Posterior Instrumentation

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\textbf{Key Words}
Tuberculosis of the spine \textbullet{} Kyphosis \textbullet{} Anterior spinal fusion \textbullet{} Posterior spinal instrumentation

\textbf{Abstract}
\textbf{Objective:} To evaluate the efficacy and clinical outcome of simultaneous or sequential anterior and posterior surgical approaches in the management of spinal tuberculosis in the form of anterior extirpation of the tuberculous lesion, strut bone grafting of the defect produced and posterior instrumentation for spinal fixation.

\textbf{Subjects and Methods:} Twenty-two patients who had tuberculosis of the thoracic and lumbar spine with moderate to severe localized kyphosis and variable degrees of neurological deficits were treated at Al Razi Hospital (Kuwait) in the period from 1998 to 2000 by anterior debridement and autogenous strut bone grafting with simultaneous or staged posterior spinal fixation using either USS or SOCON spinal instrumentation. Appropriate antituberculosis treatment was given to all patients for 9–12 months. The postoperative follow-up period was 18 months.

\textbf{Results:} Of the 22 cases the average of preoperative kyphosis was 42°. The average of immediate postoperative correction was 27°. At the last follow-up the average correction was 24° and the loss of correction did not exceed 3°. Average fusion times were 5 months for one-segment fusions and 8 months for two-segment fusions. There was no recurrence of the disease in any of the cases. \textbf{Conclusion:} Posterior instrumental stabilization and anterior interbody fusion were found to be effective in arresting the disease, correcting kyphotic deformity and maintaining correction until solid spinal fusion.

\textbf{Introduction}

The most frequent site for extrapulmonary localization of tuberculous infection is the vertebral column. Tuberculosis of the vertebral column was described by Percival Pott in 1877 as a kyphotic deformity of the spine associated with paraplegia [1]. Spinal tuberculosis primarily affects the anterior column of the spine, and the resulting kyphosis remains the major residual problem after eradication of the microorganism by the appropriate medications [2, 3]. Since the report of Hodgson et al. [4] in 1960, anterior spinal arthrodesis has been advocated as the treatment of choice for tuberculosis of the spine after drainage and debridement of the cold abscess and the use of strut graft to fill the defect created and to reconstruct the anterior column. The high rate of graft failure or resorption and loss of correction [5–7] has led to the concept of internal fixation of the spine using metallic hardware, either posteriorly or anteriorly, to increase the success rate of correction and fusion procedures [2, 3, 8–10].
In our study, we assessed the efficacy of posterior spinal fixation combined with anterior extirpation of the tuberculous focus and grafting of the defect as a treatment for tuberculous spondylitis with kyphosis.

**Subjects and Methods**

Twenty-two patients with thoracic and lumbar tuberculosis were treated by anterior debridement and grafting and posterior fixation at Al Razi Orthopedic Hospital between 1998 and 2000. Cases reviewed in this study had active spinal tuberculosis from the 7th thoracic to the 3rd lumbar vertebrae and none of them had draining sinus. In this group of 22 patients, 12 were males and 10 females. The range of ages was from 16 to 39 years. Nine patients had variable degrees of neurological deficits.

Using Frankel scoring [11] the cases were divided as follows: Frankel B, loss of motor power with only intact sensation (1 case); Frankel C, motor power present but not useful (2 cases); Frankel D, motor power present and useful (6 cases). None of the cases in this study were assessed as Frankel A (complete spinal cord injury) and 13 patients had intact neurological function (Frankel E). Six patients had more than one vertebra involved, 14 cases had involvement of the thoracic spine (T7–T12) and 8 had involvement of the lumbar spine (L1–L3). The range of preoperative kyphosis of all cases was 16–70° with an average of 42°. The range of kyphosis of the thoracic spine (T12–L1) was 35–70° with an average of 53°. The range of kyphosis of the lumbar spine (L1–L3) was 16–28° with an average of 19.5°. Preoperative bacteriological investigation of the lesion was performed in 5 cases by CT-guided needle biopsy. This was not undertaken in other cases because of the presence of either neurological deficit or a marked spinal instability where surgery had to be undertaken without delay.

Histopathological and bacteriological examinations performed postoperatively confirmed the diagnosis in all cases. Primary posterior instrumentation was done in 13 cases followed by secondary anterior surgery. In 9 cases where neural compromise was evident, anterior or spinal decompression was done first followed by posterior instrumentation. In 12 cases simultaneous (same day) double approach was used, 10 cases had sequential (staged) approaches with a 1-week interval. In 14 cases the thoracic spine was approached anteriorly through left thoracotomy, while in 6 cases the lumbar spine was approached through a left retroperitoneal approach. For 2 patients a left thoracoabdominal approach was undertaken for thoracolumbar junction (T12–L1). In 16 cases the strut graft was obtained from the ribs and in 6 cases an autogenous tricortical iliac graft was used. Posterior grafting was performed for all cases with long posterior fixation whenever the number of the posteriorly fixed segments exceeded the number of anteriorly fused segments. In these cases grafting involved all the instrumented segments. All patients received antituberculosis chemotherapy once diagnosis of tuberculosis was established and this therapy continued for 9–12 months. All patients were followed up for a minimum of 18 months and in some cases an additional follow-up period exceeded 30 months. All patients were examined by AP and lateral radiographs of the spine performed immediately following surgery, at 3 and 6 weeks and at 3 months, then every 3 months up to 18 months. Erythrocyte sedimentation rate was checked at the same intervals (up to 18 months). Neurological assessment was performed at each follow-up using Frankel scoring. Patients without neurological deficits were allowed to walk in a molded thoracolumbar orthosis 1 week postoperatively. The brace was worn for 3–6 months.

**Results**

The erythrocyte sedimentation rate returned to normal within 6 months in 18 patients, and in all cases at 9 months. At 3 months, only 3 patients had moderate back pain. One patient had persistent mild back pain up to 6 months. By 6 months, 15 cases had bony fusion. After 12 months all cases showed evidence of solid spinal fusion with no graft resorption. The average fusion time was 5 months for one-segment fusions and 8 months for two-segment fusions. The range of immediate postoperative kyphosis of the thoracic cases was 18–35° with an average of 23° and that of the lumbar cases was –3 to 10° with an average of 2°. The overall range of immediate postoperative kyphosis for all cases was –3 to 35° with an average of 15° compared to 42° preoperatively, giving an average of 27° correction of kyphosis (64.3% correction of the original deformity). The average correction measured on the last follow-up radiographs 18 months after surgery was 24°. Therefore the average loss of correction did not exceed 3°. A gradual neurological improvement was noticed in the 9 patients with initial neurological deficit (table 1). Postoperative difficulties were noted as follows: 2 patients suffered a urinary tract infection and were treated with appropriate antibiotics. One patient had lung atelectasis and a chest tube was left in place until the atelectasis resolved. One male patient had deep venous thrombosis and was treated with anticoagulants. Two patients developed an adverse drug reaction to chemotherapy so the offending drug was stopped and different therapeutic combinations were used. Two patients showed elevation of liver enzymes so chemotherapy was stopped and the dosages readjusted prior to resumption of treatment.
Discussion

Kyphosis is a common complication of the tuberculous spine in patients treated by chemotherapy alone. Anterior arthrodesis has been advocated as treatment of choice by extirpation of the tuberculous focus and filling the gap with a bone graft [4]. Loss of correction and graft resorption, especially if more than one level is involved, have been reported by many authors [3, 5–7]. Posterior spinal instrumentation was found effective in correction of kyphosis and in the prevention of loss of the correction obtained. It provides stability to the graft, prevents graft collapse and hastens graft incorporation [2, 8]. Some investigators [2, 8] have stressed that posterior spinal instrumentation should be performed as a first-stage procedure to correct kyphosis followed by anterior drainage and grafting to reconstruct the anterior column. Anterior instrumentation was advocated as an alternative method for treatment of spinal tuberculosis [3, 9, 10]. This has the advantage of avoiding a second posterior surgery, but there is still controversy about inserting metal at the site of infection and it is difficult to eradicate the fear that infection will persist beneath the metal if it is placed in the area of infection [3, 10, 12]. Also, this technique is not effective when there is involvement of posterior spinal elements with posterior destruction [3], and in cases with osteoporosis or long multiregional anterior involvement where it is impossible to achieve stability by anterior fixation [9]. In our series we obtained good results in terms of correction of deformity with restoration of sagittal alignment, maintenance of correction until solid fusion and

Fig. 1. a Lateral X-ray of spine showing destruction of L3 body by tuberculous lesion. b After posterior fixation and anterior grafting. c 12 months later showing spinal fusion between L2 and L3.

Fig. 2. a MRI showing destruction of L1 and L2 bodies by tuberculous lesion with kyphosis and cord compression. b After posterior fixation and reduction of kyphosis, a big defect is seen between L1 and L2 before anterior grafting. c 12 months after anterior grafting showing solid fusion and filling of the defect.

Fig. 3. a Tuberculous lesion of T7 with paravertebral abscess and collapse of T7. b After posterior fixation and anterior grafting using the excised rib (arrows). c Lateral tomogram after 12 months showing crept calus around the rib graft.
neurological improvement in all cases with neurological deficit. In addition, we had no local recurrence in any of the patients. The average correction of kyphosis was 27° (64.3% of the initial deformity). These results are better than those reported by Moon et al. [2], who had 54% correction using posterior instrumentation and similar to those of Yilmaz et al. [3], who had 64% correction using anterior instrumentation. The average loss of the initial correction did not exceed 3°, which is similar to the results of Moon et al. [2] and Yilmaz et al. [3]. We did not adopt certain arrangements regarding surgical approaches reported by Moon et al. [2, 8], who stressed primary posterior or fixation followed by a secondary anterior approach. In many cases we started with an anterior approach where there was anterior cord compression and neurological deficits. In such cases, urgent anterior decompression was a necessity. In other cases we started with a posterior approach. We did not find difficulty in spinal correction with either protocol.

Conclusion

Treatment of active spinal tuberculosis by combined surgical approaches (posterior instrumentation/anterior extirpation of tuberculous lesion) is efficient in eradicating the disease, correcting the deformity with establishment of physiological sagittal contours and maintaining correction till solid fusion occurs. We found that posterior segmental instrumentation offers a rigid and reliable fixation of the spine and is efficient in effecting correction of the deformity.

References