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Posterior surgical treatment of ankylosing spondylitis with spinal tuberculosis

A case series and long-term follow-up

Xin Hua Yin, MD, Shi Chang Liu, MD, Ming Yang, MD, Bao Rong He, MD, Zhong Kai Liu, MD, Ding Jun Hao, MD*

Abstract

This retrospective cohort study aimed to evaluate the clinical outcomes of posterior surgical treatment of ankylosing spondylitis (AS) with spinal tuberculosis (STB). This was a retrospective study including 12 patients treated between January 2004 and April 2014 for AS with STB at our department. All patients underwent 1-stage posterior internal fixation, debridement, and bone fusion. The patients were evaluated based on the American Spinal Injury Association (ASIA), kyphotic Cobb angle, and the visual analog score (VAS). All patients were followed up for an average of 42.7 ± 13.2 months after surgery and bone fusion was achieved 6.8 ± 1.3 months. According to ASIA, 2 cases were rated as Grade D, 10 cases were Grade E at last follow-up. The average preoperative Cobb angle was 26.7 ± 7.6° (range 15–36) and the average postoperative Cobb angle was 7.8 ± 1.2° (range 6–9). The mean latest follow-up Cobb angle was 9.1 ± 1.0° (range 6–10). Compared with the average preoperative Cobb angle, there were significant differences regarding the kyphotic Cobb angle measured postoperatively and at final follow-up ($P < .05$). The VAS significantly was considerably improved between the preoperative and the last clinical visits. These positive results demonstrate that 1-stage surgical treatment for AS with STB by posterior debridement, fusion, and instrumentation can be an effective and feasible treatment method for this specific condition. It should be noted that it is necessary to carry out antiosteoporosis treatment and perform long-segmental instrumentation in order to obtain spinal stabilization.

Abbreviations: AS = ankylosing spondylitis, ASIA = American Spinal Injury Association, BMD = Bone mineral density, E = ethambutol, H = isoniazid, R = rifampicin, STB = spinal tuberculosis, TB = tuberculosis, VAS = visual analog score, Z = pyrazinamide.

Keywords: ankylosing spondylitis, bone fusion, posterior debridement, posterior instrumentation, spinal tuberculosis

1. Introduction

Recently, the incidence of spinal tuberculosis (STB) has dramatically increased in both developing and developed countries due to population migration, HIV infection, emergence of antibiotic resistant strains, among other reasons.[1] Ankylosing spondylitis (AS) is a common inflammatory rheumatic disease predominantly affecting the sacroiliac joints and spine.[2,3] Additionally, AS causes suppression of the immune system especially in the acute phase. The advent of anti-TNF-alpha therapy has brought hope as a successful treatment for patients with AS, but at the same time it is an immunosuppressive drug that can allow latent tuberculosis to reactivate.[4] There is a minority of papers referring to the surgical treatment such a situation (AS patients with STB). The aim of this study was to evaluate the clinical efficacy and feasibility of surgical treatment of AS with STB via 1-stage posterior instrumentation, debridement, and bone graft.

2. Methods

This study was approved by the Hong Hui Hospital Ethics Committee and written informed consent was obtained from all patients. We performed a retrospective review of clinical and radiographic data prospectively collected from 12 consecutive AS patients with STB treated between January 2004 and April 2014. All the patients presented with constitutional symptoms such as back pain, weakness, malaise, and intermittent fever. Five patients received long-term anti-TNF-alpha therapy to treat these symptoms. American Spinal Injury Association (ASIA) classification was used to assess the neurological compromise function and all 12 patients demonstrated neurological deficits (ASIA Grades B–D). Clinical outcomes were assessed preoperatively and at the last follow-up visit using the visual analog score (VAS). Kyphotic Cobb angle was measured by drawing 2 lines—one was along the top surface of the immediate upper normal vertebral body, and the other away from the diseased segment. The diagnosis of AS in patients with STB was based on clinical symptoms, radiographic evidence (e.g., plain radiograph, computed tomography, or magnetic resonance imaging), and both hematologic as well as pathological examination. The indications for surgery were progressive neurological deficit;

Editor: Johannes Mayr.

This work was financially supported by the Postdoctoral Science Foundation in Shanxi Province, China (No. 2016BSHYDZZ41).

The authors have no conflicts of interest to disclose.

Department of Spine Surgery, Hong Hui Hospital, Xi'an Jiaotong University College of Medicine, Xi'an, China.

* Correspondence: Ding Jun Hao, Department of Spine Surgery, Hong Hui Hospital, Xi'an Jiaotong University College of Medicine, Xi'an, Shanxi 710054, China (e-mail: hhyyspine@163.com).

Medicine (2018) 97:34(e11925)

Received: 16 January 2018 / Accepted: 22 July 2018

http://dx.doi.org/10.1097/MD.0000000000011925

persistent pain due to instability; severe kyphosis or kyphosis likely to progress; and poor outcomes following conservative treatment. All patients received posterior debridement, interbody fusion, and instrumentation surgery. Bone mineral density (BMD, g/cm^2) of the femoral neck was measured using dual-energy X-ray absorptiometry. A diagnosis of osteoporosis was based on the BMD more than 2.5 standard deviations (SD) below the young adult mean value. Using this definition osteoporosis was seen in all 12 patients.

2.1. Preoperative preparation

All patients were treated with HREZ chemotherapy (isoniazid 300 mg/d, rifampicin 450 mg/d, ethambutol 750 mg/d, and pyrazinamide 750 mg/d) for 2 to 4 weeks prior to surgery. All patients received antiosteoporosis treatment before and after surgery. When tuberculosis toxicity symptoms as well as nutritional state improved, the erythrocyte sedimentation rate and C-reactive protein had significant decrease, surgery was carried out.

2.2. Operative technique

Patients were placed in a prone position under general anesthesia with somatosensory-evoked potential monitoring. Afterward, the posterior spinal elements underwent unilateral facet joint resection with excision of the upper or lower costotransverse joint with a small fragment of ribs via a midline incision. According to preoperative symptoms and imaging, transpedicular screws were implanted in the side of the vertebral lamina. If the upper part of the vertebrae was not destroyed by infection, screws were also implanted in the destroyed vertebrae. A unilateral facetectomy and a laminectomy up to the medial pedicle edge were performed. A rod was temporarily placed on the offside of the nidus was used to stabilize the spine to avoid nerve injury during decompression and nidus debridement. Then, the superior and inferior articular processes of the vertebrae were partially resected on the same side to expose the intervertebral space. Next, we used a flush tube to drain any prevertebral abscesses. Collapsed vertebras, necrotic disc, and cold abscesses were completely removed by curettes through healthy bleeding bone. Correction of the deformity was performed by installing contoured rods and exerting compression at middle anchoring point with cantilever bending maneuver. Collateral anterior spinal cord decompression was then obtained. After thorough debridement, a titanium mesh was formed in accordance with bone defects, and an autogenous or allograft bone was filled into the titanium mesh. Afterward, the titanium mesh was implanted into the bone defect. Next, autologous or allograft bone particles were implanted into the lateral facet joints of diseased vertebrae and between the transverse processes. The surgical site was treated locally with 1.0 g streptomycin and 0.2 g isoniazid; drainage and incision sutures were performed postoperatively. The debrided material was collected and sent for culturing as well as pathological diagnosis (Fig. 1).

2.3. Postoperative procedure

The drainage tube was removed when drainage flow was clear and <30 mL/24 h. Patients then remained in bed for 5 to 7 days. Subsequently, patients received oral HREZ chemotherapy for at least 9 months postoperatively, and isoniazid, rifampicin, and ethambutol treatment for another 3 to 6 months.

Average operation time, amount of bleeding, hospitalization, and operative complications were recorded for all patients. Clinical outcomes were assessed preoperatively at the last follow-up visit using the VAS. The preoperative and postoperative kyphosis angle was recorded on lateral plain-film radiographs, and neurological status was recorded according to the ASIA classification. Bone graft fusion was assessed using the radiologic criteria of Bridwell et al[5] and X-ray examination was performed every 3 months. All statistical analyses were conducted by using the SPSS 20.0 software. A P value of $<.05$ was considered statistically significant.

3. Results

Our cohort was comprised of 8 males and 4 females, with an average age of 45.3 ± 10.7 years (range, 24–65), and each received a minimum of 2-year follow-up. All patients were had considerably improved constitutional symptoms and back pain after surgery. Tuberculosis was assessed by bacterial culture or pathological diagnosis and no recurrence was noted for all patients. All graft fusions were thoroughly fused, with an average fusion time of 6.8 ± 1.3 months and the postoperative Cobb angle at final follow-up was $9.1 \pm 1.0°$. The mean VAS was also observed to significantly improve between the preoperative stage and last follow-up visit. In 12 patients with neurological deficits, 10 showed complete neurological recovery. All but 2 patients had chronic donor site pain after surgery, but treated with physical therapy and acupuncture the symptom at final follow-up. Relevant outcomes are shown in Tables 1 and 2.

4. Discussion

China has one of the highest burdens of tuberculosis in the world.[6] The STB accounts for about 50% osteoarticular tuberculosis with a high morbidity and difficult treatment.[7] The STB in the AS is uncommon and we were able to find very few reviews in the literature about this specific condition. As we know, AS is a chronic, inflammatory disease commonly affects spine and hip, leading to kyphosis. This deformity is functionally and psychologically disabling.[8] Tuberculosis presentation can be atypical in AS patients, as they may report nonspecific symptoms and are treated initially for AS for such complaints as inflammatory back pain due to sacroiliitis and spondylitis. Therefore, diagnosis of TB in AS patient may be difficult, especially in the earliest stage of TB infection.

The main symptoms of AS with STB are dorsalgia, restricted spine movement, low-grade fever, progressive kyphosis, weight loss, and incomplete paraplegia. Dorsalgia was the cardinal symptom in almost all patients in this study. AS patients have an increased risk of spine fracture because the spine cannot withstand the normal loads endured by a healthy spine and osteoporosis in patients with AS.[9] An AS patient who develops STB is considered to have catastrophic disease because of the probability of spinal cord compression and paraplegia. AS and tuberculosis almost always affect the anterior column of the spine and thus spinal fractures can occur from relatively minor trauma.[10,11] This finding emphasizes the importance of early diagnosis in the management of AS with STB.

Although plain X-rays are often normal in the early stage of disease,[12,13] plain X-rays continue to be the initial screening procedure when infectious spondylitis is suspected. This is because plain X-ray changes are often present at the time of the initial examination.[14–16] Furthermore, preliminary exclusion of

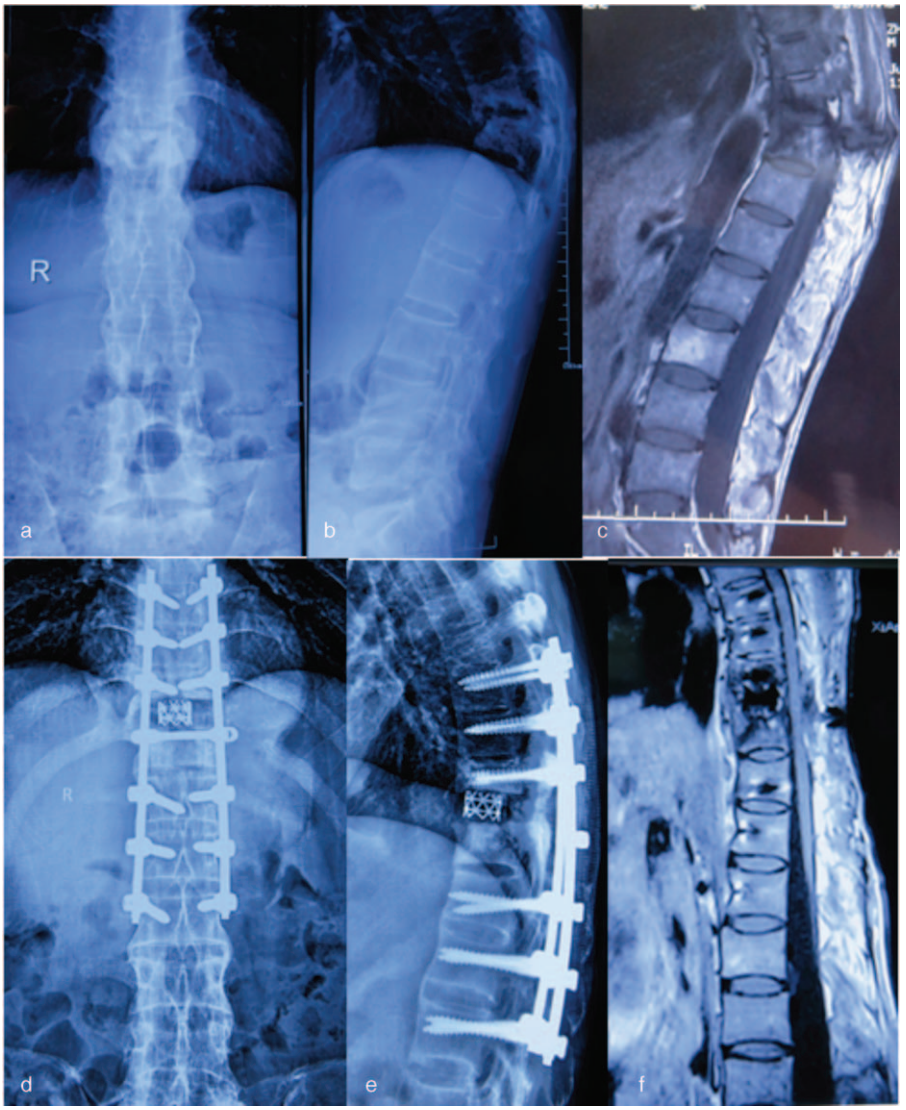

Figure 1. A 50-year-old man with ankylosing spondylitis admitted to our hospital. He complain of back pain persisting for 3 months. Two weeks ago, the patient presented with low-grade fever and progressing paraplegia. (A and B) X-ray showed the destruction of vertebral bodies of T10 and T11. (C) MRI shows high-signal intensity in the T10 and T11, the lesion spreading to the epidural space with severe spinal cord compression can be observed. (F) Postoperative MRI showed that spinal cord compression was relieved. (D–E) The patient underwent debridement, bone grafting and internal fixation, and received good clinical results at last follow-up. MRI = magnetic resonance imaging.

Table 1

Clinical data on the patients.

Gender	
Male	8
Female	4
Age, y	45.3±10.7
Operation time, min	300.4±121.3
Amount of bleeding, mL	1280.2±312.4
Duration of follow-up, mo	42.7±13.2
Fusion time, mo	6.8±1.3
ASIA scale (preoperation)	
B	2
C	4
D	6
E	0

ASIA = American Spinal Injury Association.

Table 2

Clinical outcomes of surgical treatments for ankylosing spondylitis patients with tuberculosis.

Cobb angle, °	
Preoperative	26.7±7.6
Postoperative	7.8±1.2
Final follow-up	9.1±1.0
ASIA classification	
D	2
E	10
VAS	
Preoperative	7.2±3.4
Final follow-up	1.2±0.8
Complications	
Pain of graft harvesting site	2

ASIA = American Spinal Injury Association, VAS = visual analog scale.

other disease by X-rays. We recommend that X-ray examination be included to preliminary diagnose tuberculosis. In previous series, the most common X-ray appearance consists of vertebral body destruction and disc narrowing. However, the height of disk space can be preserved until the later stages of the infection.[12] The magnetic resonance imaging scans are considered the method of choice in spinal infection because it combines high sensitivity with satisfactory specificity. The advantages of computed tomography over magnetic resonance imaging are a more reliable detection of calcified foci and provide a guide to interventional procedures.

Currently there is a paucity of information describing therapeutic strategies able to treat AS with STB. AS patients have a high frequency of spinal instability due to either increased rigidity or osteoporosis. Spinal instability, when it occurs, can lead to a greater risk of spinal fracture or dislocation with, in turn, a higher risk of severe neurological damage.[17–20] Considering these risks, surgical stabilization of the spine is absolutely necessary. Usually, this requires longer posterior instrumentation than is commonly needed for a similar fracture in spines of normal anatomy. Three or more levels above and below the fractured level need to be included in the instrumentation. While surgical procedures still play an important role in treating STB, antituberculous chemotherapy has been proven to be effective in most cases and thus has become the mainstay of the treatment.[21–23] Various methods of the surgical management in patients with tuberculosis spondylitis have been reported. Anterior procedures have problems of anesthetic complications, higher morbidities, vascular injury, graft failure, and poor fixations in osteopenic bone.[24–27] The combined posterior and anterior procedures lead to increased operating time, prolonged anesthesia, greater blood loss, and increased mortality, morbidity, and complications.[28]

With additional research on STB, a posterior surgical approach is becoming progressively more accepted by surgeons. The surgeon confirmed that the procedure has the advantage of minor surgical invasion, effective kyphosis correction, and fewer complications.[29,30] In our cohort, all patients underwent posterior surgery, and graft fusion was achieved in 12 patients at a mean period of 6.8 ± 1.3 months. The average postoperative Cobb angle was $7.8 \pm 1.2°$. The mean latest postoperative Cobb angle was $9.1 \pm 1.0\,°$ (range 6–10) with a small loss of correction at last follow-up. These results are similar to that of previous reports in which posterior underbody fusion for non-AS patients with STB was performed.

From our experience, in the treatment of STB in AS patients the following points should be emphasized. First, patients have a high frequency of spinal instability which can bring about the greater risk of spinal fracture or dislocation with, in turn, a higher risk of nerve damage and paralysis in the early stage. Therefore, the early diagnosis of AS patients with STB is very important. The early diagnosis may depend on computed tomography or magnetic resonance imaging but plain radiographic changes of bone erosion appears in only 50% of patients in whom the vertebra has been destroyed.[31] Furthermore, constitutional symptoms were shown not contribute to the diagnosis of TB in AS patient in our series. Second, other studies[32,33] have confirmed that thoracic-lumbar screw instrument and BMD have a strong negative correlation. Perioperative and intraoperative fixation is difficult for patients due to the frequent occurrence of osteoporosis in such patients. Therefore, patients with osteoporosis should receive regular antiosteoporosis treatment for increasing the bone density, enhancing pedicle screw fixation by bone cement is essential for spinal stabilization. It is necessary to perform posterior long-segmental instrumentation to obtain spinal stabilization. Therefore, surgeons should monitor patient BMD and recommend drugs to help prevent bone loss and improve clinical efficacy. Third, nutritional support should be emphasized as TB patients suffer from malnutrition, anemia, and hypoalbuminemia due to long-term poor appetite and insufficient sleep, caused by persistent back pain. Preoperative immobilization, nutrition support, multiple low dose albumin, and blood transfusions in the perioperative period were useful in treatment of our patients. Moreover, patients with AS should receive anti-TNF-alpha therapy, because it is an immunosuppressive drug that can activate latent tuberculosis. Finally, but not insignificantly, despite advances in surgical techniques, chemotherapy remains the cornerstone of TB treatment.

There are some limitations in this study that should be noted. For example, small simple size, a lack of long-term observation, and without control. Therefore, the long-term effectiveness requires further follow-up. Research using a larger sample size and long-term follow-up should be performed in the future.

5. Conclusion

One-stage surgical treatment for AS with STB by posterior debridement, fusion, and instrumentation can be an effective and feasible treatment method. Antiosteoporosis and long-segmental instrumentation is necessary to obtain spinal stabilization.

Author contributions

Conceptualization: Xin Hua Yin.
Data curation: Xin Hua Yin.
Formal analysis: Zhong Kai Liu.
Funding acquisition: Zhong Kai Liu.
Investigation: Zhong Kai Liu.
Methodology: Shi Chang Liu.
Project administration: Shi Chang Liu.
Supervision: Ming Yang.
Validation: Ming Yang.
Visualization: Bao Rong He.
Writing – original draft: Ding Jun Hao.
Writing – review and editing: Ding Jun Hao.

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