



Clinical Study

Minimally invasive surgery through the interlaminar approach in the treatment of spinal tuberculosis: A retrospective study of 31 patients

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ABSTRACT

The aim of this study was to evaluate the efficacy of minimally invasive spinal decompression combined with local chemotherapy in treating patients with thoracic/lumbar tuberculosis (TB) and abscess compression of the spinal canal. Clinical data of 31 patients with thoracic/lumbar TB and spinal epidural abscess, admitted to our hospital between December 2005 and June 2014 were retrospectively analyzed. All patients received initial conservative treatment but achieved unsatisfactory results and then underwent minimally invasive spinal canal decompression, focus debridement and catheter drainage through a posterior interlaminar approach. Postoperatively, a short-course (1–2 months) of local chemotherapy was given. The patients were followed up on a regular basis. The neurologic status was graded according to the American Spinal Injury Association (ASIA) score system. Kyphotic deformity was evaluated using Cobb angle measurement. Patients were followed up for an average of 37 months (range: 12–96 months). At the last follow-up, ASIA scores were improved in all patients, and there was a mild increase in the Cobb angle, but satisfactory spinal stabilization was achieved. Hepatorenal function, erythrocyte sedimentation rate and C-reactive protein levels all returned to normal. One complication was observed, where the patient had worsened deficit postoperatively but achieved a satisfactory recovery (from Grade C to Grade E) one year after a second surgery. Minimally invasive spinal canal decompression combined with local chemotherapy appears to be an effective treatment for patients with thoracic/lumbar TB and abscess compression in the spinal canal.

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1. Introduction

Spinal tuberculosis (TB) is a paucibacillary disease characterized by formation of cold abscess, destruction of the intervertebral disc and the adjacent vertebral bodies, and collapse of the spinal elements and anterior wedging leading to kyphosis. As the most common extrapulmonary form of TB, spinal TB is a major public-health problem in developing countries [1,2]. As the most serious complication of spinal TB, paraplegia, with an occurrence of 10–20%, usually results in death [3]. Among spinal TB, thoracic TB is the most common sub-type due to the anatomical structure of the thorax. Nerve compression syndrome is rare in lumbar or lumbosacral vertebrae because of the large volume of the lumbar spinal canal.

The goals of the management of spinal TB are to eradicate infection, prevent or treat neurologic deficits, and correct and avoid spinal deformity progression. Current surgical methods include

anterior debridement, decompression, fusion followed by ventral or posterior decompression with fixation [4–7]. Conventional surgical approaches to the ventral aspect include thoracotomy with extrapleural or transpleural access, lateral extracavitary and costotransversectomy approaches for the thoracic spine, and retroperitoneal approaches for the lumbar spine [6,8,9]. However, these are extensive approaches with associated morbidity [6].

Despite increased treatment concepts and surgical methods, the management of TB remains challenging [2,10,11]. This study aimed to evaluate the efficacy of minimally invasive spinal decompression through an interlaminar approach combined with local chemotherapy in patients with thoracic or lumbar TB and spinal epidural abscess.

2. Methods

2.1. Patient characteristics and selection

This study was approved by the Ethics Committee of the hospital and signed informed consent was obtained from all patients.

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Clinical and radiographic data of 31 spinal TB patients who were admitted consecutively to our hospital between December 2005 and June 2014 were reviewed (Table 1). The inclusion criteria were: thoracic/lumbar TB diagnosed according to symptoms, physical signs, imaging examination and etiological assessment results; anti-TB drug therapy alone with proven unsatisfactory outcome; lack of serious toxic symptoms of TB; obvious pus compression in spinal canal confirmed by CT scan/MRI; Cobb angle $<25^\circ$; lack of serious bone damage; body temperature $<38^\circ\text{C}$, and erythrocyte sedimentation rate (ESR) <50 mm/h. The exclusion criteria were unresponsiveness to anti-TB drugs, canal compression caused by granulation tissue, calcification or osseous lesions, abscess and sinus formation, serious bone destruction in anterior/middle column, young patients, other vertebrae-associated co-morbidities, psychogeny and evident contraindications to surgery [12,13].

As for clinical symptoms, back pain or lower back pain of unknown cause occurred in all patients, sensorimotor dysfunction in lower limbs in 23 patients, and bladder and bowel dysfunction in two patients. X-ray findings suggested intervertebral disc space narrowing or loss occurred in all patients and mild kyphosis (Cobb $<5^\circ$) in six patients. CT scans suggested vertebral body and intervertebral damage resulting in intervertebral disc stenosis and dural sac compression in all patients. MRI results revealed spreading of TB infection to the spinal canal epidural space and abscess formation beside the spine or in the intermuscular space between the psoas major and the neighbouring tissues.

2.2. Treatment method

Patients were initially treated with isoniazid (INH) (300 mg), rifampicin (450 mg), ethambutol (750 mg) and pyrazinamide (1500 mg) per day. The surgery was performed when ESR decreased and subnormal levels of C-reactive protein (CRP) were observed.

Preoperatively, the infection and abscess sites were determined by C-arm fluoroscopy. For the intervertebral focus debridement surgery, patients were placed in the prone position under anaesthesia (general anaesthesia in 19 patients and regional anaesthesia in 12 patients). A posterior median incision of 5.0 cm was made (Fig. 1a). Then the paravertebral muscle of the affected side was dissected along the spinous process to expose the posterior vertebral plate (Fig. 1b). With C-arm fluoroscopy, an opening (2.0 cm \times 1.5 cm) was made on the laminae to expose the dural sac. Through this opening, decompression was performed (Fig. 1c, d), interior to the root of the spinous process, laterally to the outer edge of the small joint, proximally to the nerve root, and distally to the pedicle. The spinal canal and intervertebral space were identified and located with a nerve root retractor, where debridement was performed using normal saline as shown in Figure 2a, b and necrotic tissue and pus-containing liquid samples were collected for pathologic and laboratory assessments respectively.

2.3. Postoperative care and follow-up

Postoperatively, antibiotics (INH, rifampicin, ethambutol and pyrazinamide) were administered for 3–5 days, with intravenous nutrition therapy according to the nutritional condition of the patients. The spinal cavity was flushed with 2,000 ml normal saline (containing 1.2 g INH injection) per day for 0.5–2 months until the flushing fluid was clear. INH (0.1 g) was injected to the epidural tube 1–2 times/day for 1–2 months. Patients were encouraged to start walking under the protection of back support 3–5 days after the surgery. The general chemotherapy was administered orally with INH (300 mg), rifampicin (450 mg), ethambutol (750 mg)

Table 1

Demographics and clinical characteristics of patients of patients with thoracic/lumbar tuberculosis

Characteristic	Value (N = 31)
Male/female	19/12
Age (years)	53.3 (range 33–78)
Medical history (months)	8.2 (range 2–16)
Thoracic tuberculosis	27/31 (87.1%)
Lumbar tuberculosis	4/31 (12.9%)
Kyphosis	6/31 (19.4%)

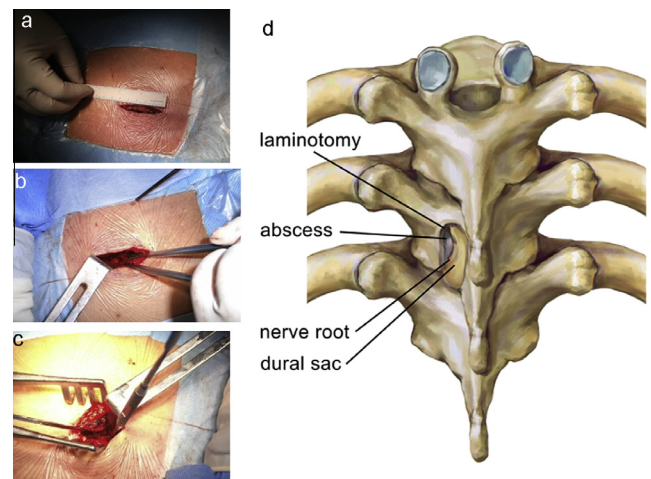


Fig. 1. The interlaminar approach for intervertebral focus debridement surgery in thoracic/lumbar tuberculosis. (a) A posterior median incision of 5.0 cm was made. (b) The lamina was partially removed to expose the dural sac and nerve root. (c) The dural sac was protected with a retractor and local decompression and debridement was performed in the canal and intervertebral space. (d) A diagram of the exposure.

and pyrazinamide (1,500 mg) for 12–18 months according to the disease condition.

The patients were followed up 0.5, 1, 2, 3, 6, 12 and 18 months postoperatively and once a year thereafter. Hepatorenal function, ESR, CRP and imaging assessment were evaluated. Postoperative complications, visual analogue scale (VAS) scores indicative of back pain, and American Spinal Injury Association (ASIA) scores of neurological functions were all recorded. Kyphotic deformity was also evaluated through Cobb angle measurement as previously described [14].

2.4. Statistical analysis

The data were expressed as mean \pm standard deviation (SD) and the statistical analysis was performed using SPSS 13.0 (Chicago, IL, USA). The data of normal distribution were analyzed by t-test with $p < 0.05$ considered statistically significant.

3. Results

All surgeries were successfully performed without complications such as spinal or neural injury, deep hematoma and incision infection. The average operation time was 80 minutes (range: 60–130 minutes) and intraoperative blood loss was 90 ml (range: 30–150 ml). All incisions healed completely without sinus formation. Two weeks postoperatively, X-ray examinations showed there were no changes in vertebral sequence and Cobb angle. The duration of anti-TB treatment before regression of symptoms, and hematologic and radiological abnormalities ranged from 12 to 18 months (average: 14.5 months). After an average follow-up of

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