

Original Article

One-stage anterior radical debridement and reconstruction with titanium mesh combined with anti-tuberculosis for cervical spinal tuberculosis: 5-13 years follow up

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Abstract: Objective: To investigate the efficacy of anterior reconstruction with titanium mesh filled with autogenous bone following radical debridement in patients with cervical spinal tuberculosis at 5-13 years follow up in a single institution. The tuberculosis is a serious infection disease and it is also increased rapidly around the world in recent years, especially in the undeveloped and developing countries. Anterior radical debridement and reconstruction have been advocated and it was superior to drug treatment or simple anterior debridement. Materials and methods: In our prospective study, there were a total of 24 patients (13 male and 11 female; average age, 55.6 years) diagnosed as cervical spinal tuberculosis, who underwent one-stage anterior radical debridement, reconstruction with titanium mesh. All patients received standard anti-tuberculosis chemotherapy for 2-4 weeks preoperative. This anti-tuberculosis chemotherapy was kept 12 to 18 months after surgery. All patients were follow-up at 1, 3, 6, 9, 12 and 18 months after surgery. Plain radiographic were used to determine the fusion status and instrumentation failure. Neurologic outcome was evaluated with ASIA grade and ESR value; CRP was used to determine the infection activity, and clinical outcome was analyzed with Odom's criteria. Results: All cases have got a solid fusion; there were none cases of draining fistula formation. Of all 19 patients with preoperative slight kyphosis, the deformity was totally corrected after surgery. Recurrence was not found and there was no other recurrence of the tuberculous infection in our 24 cases. No significant loss of deformity correction was found in our study. No subsidence or migration of implants and instability of cervical spine was found on the radiographs. Conclusions: The one-stage anterior radical debridement and reconstruction with titanium mesh filled with autogenous bone combined with anti-tuberculosis is a safe and effective method in the surgical management of cervical spinal tuberculosis.

Keywords: Cervical spine, spinal tuberculosis, spinal surgery

Introduction

The tuberculosis is a serious infection disease and it is also has increased rapidly around the world in recent years, especially in the undeveloped and developing countries [1]. And then, it is causing more widespread concern than ever before [2]. Spinal tuberculosis is the most common osseous manifestation of Mycobacterium tuberculosis infection and has an aggressive behavior of profound vertebral destruction and severe complications. However, the treatment failure is always because unresponsiveness or noncompliance with anti-tuberculosis chemo-

therapy. Surgery is sometimes because of the patients with severe pain and neurologic deterioration from spinal cord compression, progressive kyphotic deformity and instability. The goal of surgery is to eradicate the infection and prevent neurologic deficit or spinal deformity [3]. Anterior radical debridement and reconstruction have been advocated [4]. The Medical Research Council of the United Kingdom carried out a series of controlled clinical trials in multiple centers and the results indicated that radical debridement plus anterior spinal fusion was superior to drug treatment or simple anterior debridement [5]. We presently report a

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Table 1. Summary of Patient demographics

	NO. Patients (%)
Age	55.6 years (range, 43-75 yrs)
Weight	66.8 Kg (range, 44.1-88.9 Kg)
Sex	
Male	13
Female	11
Involved segment	NO. vertebrae bodies
C3	22
C4	24
C5	2



Figure 1. A 53-year-old man, he had severe neck pain and limbs weakness owe to the compression of their cervical spinal cord on MRIs (left). The other 57-year-old man, the MRIs revealed the spinal cord was compressed also (right).

Table 2. Neurologic grades (ASIA)

Neurologic status (Frankel)	NO. Patients (%)	
	Pre-op	Post-op
A	0	0
B	0	0
C	8	1
D	16	2
E	0	21

group of 24 cases with the exudative stage of cervical spinal tuberculosis treated by the one-stage anterior radical debridement and reconstruction with titanium mesh. The purpose of the research was to determine the efficacy of anterior instrumentation combining with anti-tuberculosis after radical debridement and reconstruction in patients with cervical spinal tuberculosis over a 5-year period at a single department.

Methods and materials

Patients

A total of 24 consecutive patients (11 women and 13 men) with histologically and clinically were diagnosed cervical spinal tuberculosis at our department between January 2000 and December 2008. All of them underwent the anterior debridement and reconstruction with titanium mesh combining with anti-tuberculosis in this study. Their records, radiographs and demographic data (**Table 1**) were reviewed again. All of them previously had been not treated for pulmonary tuberculosis, and ten patients had a positive family history of pulmonary tuberculosis. Average age was 55.6 years (range 43-75 years). The symptoms of tuberculosis, such as weight loss, low grade fever, and fatigue was found in all patients medical records. The duration of the disease was from 1 to 5 months (average, 3 months). They all had slight or moderate neck pain and limbs weakness owe to the compression of their cervical spinal cord that was revealed on MRIs (**Figure 1**). The paravertebral abscess and the severe Kyphotic deformity were not found in all of them. The neurologic examination according to the American Spinal Injury Association (ASIA) classification showed that the grade C in 8, D in 16 patients (**Table 2**).

Surgical procedures

All patients with cervical spinal tuberculosis were treated with the one-stage anterior debridement and reconstruction with titanium mesh. They were operated on under general anesthesia with endotracheal intubation. Normally, the patients were placed on supine positions. After routine exposure, the destructive vertebral bodies were identified and resected with curettes, rongeurs and a high-speed air drill. This excision extended cranially and caudally until healthy bleeding cancellous bone was exposed. After radical resection of the involved vertebrae bodies, the spinal defect was measured. The resultant gap was repaired with titanium mesh filled with harvested iliac bone and local bone. None of them had undergone supplementary posterior instrumentation surgery. After careful hemostasis, 3 to 4 g of gentamicin was put in the wound, and a closed drainage should be placed.

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Table 3. Summary of clinical results (Odom's criteria) and postoperative findings

Findings	No. Patients (%)
Clinical results	
Excellent	19 of 24 (79.1)
Good	4 of 24 (16.7)
Satisfactory	1 of 24 (4.2)
Poor	0 of 24 (0)
Fusion rate	24 of 24 (100)
Cage subsidence	0 of 24 (0)

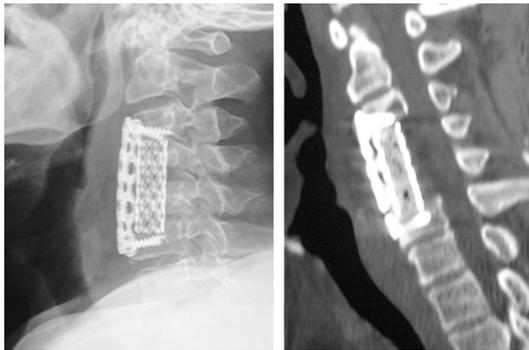


Figure 2. The solid fusion was confirmed by the lateral radiograph and CT scan at final follow-up.

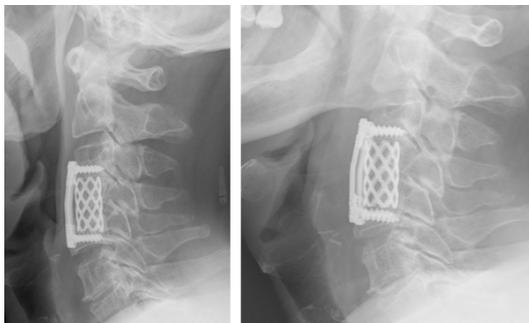


Figure 3. A 62-year-old man, no subsidence or migration of implants and instability of cervical spine was found at 3 months (left) and final follow-up (right) lateral radiograph postoperative.

Anti-tuberculosis chemotherapy

All patients received routine chest X-rays and sputum examinations for the tubercle bacillus, but all were found to be without open tuberculosis or acute pulmonary tuberculosis. All patients received standard anti-tuberculosis chemotherapy by oral administration of isoniazid (300 mg/d), rifampicin (450 mg/d), and/or ethambutol (1200 mg/d), and streptomycin

(750 mg/d) for 2-4 weeks preoperative. When the patients had not low fever or anemia, operation was carried out. Of course, this anti-tuberculosis chemotherapy was kept 12 to 18 months after surgery.

Follow-up

Immediately, routine radiographs were got to assess the alignment of cervical spine and placement of implants. All patients were follow-up at 1, 3, 6, 9, 12 and 18 months after surgery. At 1, 6, 12 and 18 months, plain radiographic were used to determine the fusion status and instrumentation failure. Computerized tomography scans were made when the solid fusion was not confirmed on the X-ray plain. Neurologic outcome was used ASIA grade, the ESR value and CRP was determined the infection activity, and clinical outcome Odom's criteria.

Results

All cases were followed up from 5 to 13 years. Recurrence was not found in our 24 cases. The preoperative symptoms of all patients had an immediate improvement after surgery. Three months later, 18 patients (75%) got good to excellent postoperative clinical outcomes, and 6 patients (35%) had satisfactory results. The main complaints of patients with satisfactory results were the upper extremities pain. However, all cases got the perfect recovered at final follow-up except one patient got persistent left arm numbness (**Table 3**). At one year follow-up, there were 11 patient stopped to anti-tuberculosis chemotherapy, and the other patients were stopped at 18 months because the CRP and ESR were normal and the involved segment got a solid fusion. The solid fusion was confirmed by the X-ray and CT scan (**Figure 2**) in all cases and the draining fistula were not found in the all cases. No subsidence or migration of implants and instability of cervical spine was found on the radiographs (**Figure 3**). There was no other recurrence of the tuberculous infection. At final follow-up, the neurologic grade (ASIA) was grade C in 1, D in 2 and E in 21 patients (**Table 2**).

Discussion

Although the treatment of spinal tuberculosis remains controversial, the radical debridement

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surgery produces got the best results compared with other treatment methods [6] because the surgery may provide quicker pain relief much earlier healing, and a better chance of neurologic recovery than other treatment methods [7]. However, radical debridement and decompression has become the standard procedures for the surgical treatment of cervical spinal tuberculosis (TB) in indicated, [8, 9] but the large intervertebral gap always cause instability of the cervical spine. So reconstruction of the anterior spinal column is necessary. Surgical treatment of spinal TB, autograft strut bone graft alone without fixation because of concerns of instrumentation affecting the ability to eradicate infection in the early days [10]. In recently, reports have revealed that the ability of mycobacterium to adhere to metal instrumentation is lower than staphylococcus [11, 12]. Some reports [13-15], however, have shown a high percentage of fracture and migration only using autograft iliac crest and autograft fibula strut with concomitant disadvantages including more blood loss, extra surgical time for harvest and potential disability from fibular harvest. Multiple studies [16-18] have demonstrated the effectiveness of using titanium mesh filled with harvested iliac bone for interbody fusion.

Many kinds of the structural grafting techniques have been used in order to recover the stability of the cervical spine, such as autogenous iliac graft or rib graft and femoral or fibular alloallograft [19]. However, these procedures are not successful maintaining the alignment of the cervical spine. The supplementary posterior instrumentation and fusion has got a perfect clinical outcome. Al-Sebai et al. [20] used one- or two-stage posterior fusion and fixation to treat 14 patients with progressive deformity owing to cervical spinal tuberculosis following the anterior debridement and grafting. All patients got satisfactory fusion within a period of 4 to 9 months. The results of Chen et al. [21] reported 32 patients showed that 97% patients achieved solid fusion and improvement of symptoms at final follow-up. However, the combined procedures will extra operating time, blood loss, and perioperative complications. Anterior reconstruction with titanium mesh has a safe and effective in the prevention of graft collapse and the maintenance of the deformity correction.

Many authors [22-24] reported the patients with spinal TB accepted the anterior instrumentation and there were no instances of resorption or failure of the graft, and no recurrence of the disease in their studies. Hassan [25] reported that the single-stage anterior autogenous iliac bone grafting and instrumentation in 16 patients with lower cervical spine tuberculosis got satisfactory results. Fourteen patients had neurologic deficits, 12 complete recovery and 2 marked improvements at an average of 38 months.

In the current study, 24 patients with cervical spinal TB were well treated with one-stage anterior debridement and reconstruction with titanium mesh filled with autogenous iliac bone and instrumentation combining with the anti-tuberculosis preoperative and postoperative. All patients got relief in pain and improvement in neurologic deficits except one whose neurologic status did not marked improve following surgery. Remarkably, the use of anterior debridement and reconstruction with titanium mesh combining with the anti-tuberculosis provides an effective, stable alignment, and solid fusion on the basis of proper decompression without increasing recurrence of cervical spinal tuberculosis infection.

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Disclosure of conflict of interest

None.

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