Clinical efficacy of CT-guided percutaneous huge ilio-psoas abscesses drainage combined with posterior approach surgery for the management of dorsal and lumbar spinal tuberculosis in adults


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A B S T R A C T
Purpose: To evaluate the clinical efficacy of CT-guided percutaneous huge ilio-psoas abscesses drainage combined with posterior approach surgery for the management of dorsal and lumbar spinal tuberculosis in 16 adult cases.
Methods: Between January 2006 and June 2013, a total of 16 dorsal and lumbar spinal tuberculosis patients with huge ilio-psoas abscesses underwent two-stage CT-guided percutaneous abscesses drainage and posterior debridement, decompression, intervertebral fusion and instrumentation. Standard quadruple antituberculous chemotherapy was performed both before and after surgery.
Result: The average follow-up period was 26.7 months (range: 18–38 months). There is no severe complication and relapse of spinal tuberculosis. The blood loss was 921.0 ± 141.3 mL, operation time was 174.8 ± 15.7 minutes. Kyphotic angle improved from 36.6 ± 10.0° preoperatively to 8.1 ± 1.8° postoperatively with 2.2 ± 1.5° loss of correction at final follow-up. The solid bone fusion was achieved in all cases at average 6.6 ± 2.2 months after surgery. Neurologic deficits were recovered in varying degrees except 4 cases remained the same. The postoperative quality of life significantly improved. The Oswestry Disability Index (ODI) decreased from 32.8 ± 10.6 preoperatively to 14.4 ± 7.9 at the final follow-up.
Conclusion: CT-guided percutaneous drainage combined with posterior approach surgery was proved to be safe and effective for the management of dorsal and lumbar spinal tuberculosis with huge ilio-psoas abscesses in adults.

Level of study: Level IV, retrospective.

1. Introduction

Despite the remarkable achievements since the advent of antituberculous drugs, tuberculosis (TB) remains a global public health problem, especially in the undeveloped and developing countries [1,2]. Spinal TB, also called Pott disease, is the most common form of the extrapulmonary TB, accounting for almost 50% of cases of osteoarticular TB [2–5]. Spinal TB abscesses is more common compared with other spondylitis. Once the abscesses penetrate the periosteum, the pus will spread along the anatomic spaces under the action of gravity [6]. In terms of dorsal and lumbar spine, abscesses usually spread to the ilio-psoas muscle. Although there is still controversial about surgical indications, it is widely accepted that patients with spinal cord compression, considerable bony sequestra, progressive deformity and instability need surgical intervention [7,8]. So far, anterior, posterior and combined anterior-posterior approaches have been described for treating dorsal and lumbar TB combined with huge ilio-psoas abscesses, there is still no optimal surgical approach because of the respective drawbacks. In recent years, Computed tomography (CT)-guided percutaneous abscesses drainage has been introduced as a new approach in the management of spinal TB abscesses [9,10]. But for some severe patients, only drainage of abscesses is not enough. In this paper, we retrospectively studied 16 adult dorsal and
lumbar spinal TB patients associated with huge ilio-psoas abscesses. The purpose was to assess the clinical efficacy of CT-guided percutaneous abscesses drainage combined with posterior approach surgery.

2. Materials and methods

2.1. Patient information

Written informed consent was obtained from each patient and this study was approved by Ethics Committee of Yan Taishan Hospital.

A total of 16 consecutive adult dorsal and lumbar spinal TB patients associated with huge ilio-psoas abscesses were included in this study. All patients were treated with two-stage CT-guided percutaneous ilio-psoas abscesses drainage and posterior approach surgery between January 2006 and June 2013. There were 9 males and 7 females. Their ages ranged from 20 to 57 years, with an average age of 37.6 ± 10.4 years. Of the 16 patients, 10 had bilateral ilio-psoas abscesses, and the remaining 6 had unilateral ilio-psoas abscesses. The involving spinal segments ranged from T12 to L5. Neurological deficits were assessed according to the Frankel grading. Grade B in 1, C in 5, D in 7, and E in 3 patients. The preliminary diagnosis of spinal TB was made based on clinical presentation, laboratory examinations and imaging findings including X-ray film, computed tomography (CT) scan, and magnetic resonance imaging (MRI). Preoperative kyphotic angle was 36.6 ± 10.0° (range: 10–54°). The Oswestry Disability Index (ODI) score, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) of patients were 32.6 ± 10.6, 68.3 ± 19.4 mm/h, 19.0 ± 8.6 mg/L, respectively (Table 1). The patients with multilevel (>2 adjacent vertebrae) involvements, active lung TB and positive HIV were excluded from this study.

2.2. Preoperative preparation

The standard quadruple antituberculous chemotherapy was initiated (isoniazid 300 mg daily, rifampicin 600 mg daily, ethambutol 20 mg/kg daily and pyrazinamide 25 mg/kg daily) for 2–4 weeks before the surgery. When the constitutional symptoms improved, and ESR and CRP significantly decreased, the surgery could be performed.

2.3. Surgical strategy

2.3.1. First stage: CT-guided percutaneous ilio-psoas abscesses drainage

The patient was placed in the prone position on the examination table, then CT scan was done to measure the depth, angle and distance from the skin to each abscesses. The catheters were inserted using the Seldinger technique under local anesthesia. According to the catheter size, proper dilatation was performed, and 8.5 F drainage catheter was inserted into abscesses cavity, then the abscesses was drained and were sent for culture. The other abscesses were drained using the same method. In this study, it is only rough estimated under CT scan that single abscesses volume was more than 100 mL, the drainage catheter was considered to be placed. All patients went on the systemic antituberculous chemotherapy, meanwhile the abscesses were aspirated and irrigated with saline solution (5–10 mL) and isoniazid (200 mg) twice a day. The duration of draining ranged from 5 to 12 days (mean 7 days). When the single drainage volume was under 10 mL/24 hours, catheters could be removed. But before doing that, a follow-up CT scan was performed to make sure there were no huge abscesses remaining.

2.3.2. Second stage: posterior approach surgery

The surgery was performed 1 week later after the last drainage catheter was removed. The patients were placed in the prone position and operated on under general anesthesia. The pedicle screws were inserted into the vertebrae (1 or 2 levels above and below the lesion). Then the unilateral lamina, zygopophysial joint and transverse process were removed on the severe side of the infected vertebrae. This approach could provide the vision exposure up to 270°, the necrotic disc, sequestra, abscesses, caseous granulation tissue were removed until to healthy bleeding bone with various curettes. Subsequently the kyphosis was slowly and carefully corrected with the help of internal fixation instrument. A strut autograft iliac bone was inserted to bridge the gap and offer support after debridement. For most patients, unilateral exposure was enough, if necessary, other side was treated in the same way. The local antibiotics therapy with 1.0 g of streptomycin was administrated and a local drainage tube was inserted. Specimens obtained during the operation were sent to histopathologic examination (Fig. 1).

<table>
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<td>General data of the patients.</td>
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M: male; F: female; y: year; min: minute; ESR: erythrocyte sedimentation rate; CRP: C-reactive protein; KA: kyphotic angle; FG: Frankle grade; ODI: Oswestry Disability Index; FU: follow-up; F: fusion; m: month; BT: before treatment; FFU: final follow-up; Pre: preoperative.
Intravenous antibiotics were administered to prevent infection within the postoperative 48 hours. The drainage tube was pulled out when the volume of the drainage was less than 20 mL a day. All of the patients were treated with standard quadruple antituberculous chemotherapy above mentioned for 12–18 months. Gradual ambulation was started after 1 week under the protection of a brace. Patients were followed at 1-month intervals for the first 6 months, every 2-month intervals for the next 6 months. One year later, regular follow-up at 3-month intervals was performed. Activity of the tuberculosis was monitored by ESR and CRP. Examinations of hepatic and renal function determined whether it is necessary to adjust the antituberculous drugs. Position of the instruments, angle of kyphosis and bone fusion status were monitored by X-ray films. CT and MRI were not routine unless recovery of the patient don’t achieve the expected effect. Neurologic outcome was assessed by Frankle grading and postoperative quality of life was assessed by ODI score. The fusion was assessed by X-rays. If we observed the presence of bridging trabecular bone between intervertebral space and motion was less than 4° on flexion-extension radiographs, then intervertebral fusion was defined according to Suk grade [11].

All statistical analyses were performed with SPSS19.0 (SPSS, Inc., Chicago, IL, USA). Paired t test was used in this study. Statistical significance of all tests was set a p value of less than 5%.

3. Results

No patients were lost to follow-up. All the patients had a successful recovery from the diseases and no relapse of spinal TB until the final follow-up. The mean follow-up duration was 26.6 ± 5.5 months, blood loss was 921.0 ± 141.3 mL, operation time was 174.8 ± 15.7 minutes, ESR and CRP returned to normal at the final follow-up. Statistical analysis revealed that there were significant differences between pre-operation and the final follow-up (P < 0.05), Only 4 patients’ culture of the pus yielded Mycobacterium TB, but postoperative pathologic examination gave the definite diagnosis of TB in all patients. There was significant relief of pain with ODI scores from 32.8 ± 10.6 preoperatively to 14.4 ± 7.9 at the final follow-up (Table 2).

According to the Frankle grading, neurologic deficits were improved at the final follow-up. Among the 13 patients with preoperative neurologic deficit, 2 with grade C recovered to D, 3 with grade C recovered to E, 1 with grade D didn’t change, 6 with grade
D recovered to E. The average kyphotic angle was significantly improved from 36.6° ± 10.0° preoperatively to 8.1 ± 1.8° postoperatively and was 10.3 ± 2.6° at final follow-up. The loss of correction was 2.2 ± 1.5°. Statistical analysis revealed that there were significant differences between pre-operation and the final follow-up (P < 0.05). Solid fusion was obtained in all patients according to Suk grade. The average intervertebral bone fusion was 6.6 ± 2.2 months (range 4 to 12 months).

There was superficial incision infection in case 5, which was managed successfully with antibiotics and regular dressing. There was no internal fixation failures before achieving solid fusion, but looseness and extraction was observed in two patients (cases 4 and 12) during the subsequent follow-up. The internal fixations were removed after the spinal TB was completely cured.

4. Discussion

With the advent and clinical application of the antituberculous drugs in the last century, the remarkable progress has made in the spinal TB treatment. Most patients of spinal TB can be cured with antituberculous chemotherapy alone if early diagnosis is made. However, surgery should be considered for patients with spinal deformation or instability, neurological deficits, failure of medical treatment [6,12,13].

The small iliopsoas abscesses of dorsal and lumbar spinal TB can be spontaneously absorbed under the standard antituberculous chemotherapy. However for the huge abscesses, medical treatment usually is not enough. According to the literature [9,10], some scholars attempted to treat diseases with CT-guided percutaneous abscesses drainage and achieved good clinical outcomes. Based on our experience, it is easy to relapse for huge iliopsoas abscesses if adequate debridement isn’t performed. Anterior approach can offer direct vision exposure for tuberculous lesion of the spine, so it’s convenient for radical adequate decompensation, radical debridement of lesion and abscesses, strut graft and correction of deformity. It was once regarded as the optimal surgical approach for the treatment of dorsal and lumbar tuberculosis. Chen et al. [14] performed anterior surgical treatment for dorsal and lumbar tuberculosis with huge abscesses with debridement, bone grafting and internal fixation in 9 patients, all patients were clinically cured. However, because of the complex anatomic relationship, there may be more complications with this approach [15], such as neurovascular injury, abdominal visceral injury or pneumothorax, etc. Moreover, although application of anterior instruments were proved safe and effective due to the specific behavioral characteristics of mycobacterium tuberculosis which differ from pyogenic bacteria [16,17]. Some scholars [18] hold a different opinion. They insist that it is clearly against the principle to make instruments direct contact with infected lesion and abscesses. In 1995, Güven [19] reported that posterior instruments and anterior interbody fusion for tuberculous kyphosis of dorsal and lumbar spines were helpful in providing early fusion, preventing progression of kyphosis, and correcting the kyphosis. From then on, combined anterior-posterior approach was widely adopted. Kuen et al. [20] performed operations on 14 patients of tuberculosis spondylitis with psosas abscesses. All the patients underwent anterior debridement with an interbody bone graft and posterior fusion with using pedicle screws. Kyphotic deformity and neurological function were significantly improved. However, the patients need to re-sanitize the operation field and drape, so surgical procedures increased the operative time, the amount of bleeding, difficulty and complications. It is inapplicable to the elderly patients with poor cardiopulmonary function [6]. In recent years, posterior approach alone was reported [6,12]. Compared with the above mentioned approaches, this approach is indeed a good choice for debridement, decompression and internal fixation with one incision. Li et al. [6] prospectively studied 41 patients treated with single posterior surgery and pointed that psosas abscesses could be effectively drained through the lateral vertebral body. We hold different opinions on this point. First of all, this surgery is only suit to particular patients whose paravertebral abscesses or iliopsoas abscesses next to infected lesion. If the abscesses locate far from the spinal lesion, it is very difficult to deal with it just depending on posterior approach. Second, even if the posterior approach can reach and drain the abscesses during the operation, it is impossible to determine whether the abscesses are cleaned away as much as possible.

In this study, we performed CT-guided percutaneous iliopsoas abscesses drainage in the first stage. Advantage of this minimally invasive technology is embodied in the following aspects:

- the surgery is performed under local anesthesia with short operative time and less blood loss;
- before removing the drainage catheter, residual abscesses are assessed by CT reexamination. If necessary, the catheter can be readjusted or repositioned with the help of CT scan. Based on our experience, it is difficult to drain the abscesses thoroughly. Abscesses can be absorbed gradually under standard antituberculous chemotherapy if volume of isolated abscesses is less than 30 mL;
- the pus obtained is sent for laboratory examination and culture, it is helpful for the early diagnosis of tuberculosis.

In the second stage, posterior approach alone was performed including debridement, bone graft and internal fixation. Tuberculous granuloma, caseous necrosis tissue, sequestrum need to be completely debrided. Compared to other approaches, this approach has more advantages in reducing operation time and blood loss, decreasing risk of postoperative complications. In this paper, all 16 patients were inserted adequate autogenous iliac bone into the anterior column of the spine. It played an important role in providing structural support, dispersing stress, avoiding the loss of correction and promoting bone fusion. The average kyphotic angle was significantly decreased from 32.7° preoperatively to 8.1° postoperatively with 2.2° loss of correction at final follow-up, which was similar to the previous other studies on posterior-only surgery [6,12], but better than anterior-only surgery [14]. Loss of correction is inevitable in both approaches but posterior pedicle screw fixation seems more solid in the long run thanks to the three-dimensional fixation, which is much stronger than anterior instrumentation. Solid fusion was observed in all 16 patients and average fusion was 6.6 months. There were no significant difference with other studies.
[12,21], but Sahoo et al. [22] found that fusion rate was only 55.5% in all 12 patients. He attributed the possible reasons to early surgical intervention and neutralization of the internal fixation. However, we found that there was no bone graft between vertebral bodies in his study. That may be the more important reason for low fusion rate.

No matter which surgical approach we choose, it must be kept in mind that any surgery for the treatment of spinal TB will fail without antituberculous chemotherapy. In our study, all of the patients were treated with standard quadruple antituberculous chemotherapy for at least 12 months. We think it is essential to maintain adequate chemotherapy duration in order to prevent relapse and emergence of drug-resistance strains. During average 27-month of follow-up, there is no relapse in our study.

Some limitations of this study should be considered. Firstly, this is a retrospective study, so there may be a subjective selection bias during involving the patients. Secondly, the number of cases was relatively small. In spite of the satisfactory clinical outcomes in this study, the clinical trial of large scale and multi-center should be considered to verify its efficacy. Moreover, The patients need to undergo frequent radiation exposure during CT-guided percutaneous abscesses drainage and follow-up. At present, it is impossible to determine whether radiation hazard will be harmful to the human health in the future.

5. Conclusion

Coupled with standard quadruple antituberculous chemotherapy, CT-guided percutaneous abscesses drainage combined with posterior approach surgery was proved to be safe and effective for the management of dorsal and lumbar spinal tuberculosis in adults. This combined application of minimally invasive and open surgery not only reduces the operation time, blood loss and postoperative complications, but also achieves radical debridement, interbody fusion, good correction of deformity and rigid internal fixation.

Ethics and consent

Written informed consent was obtained from each patient and this study was approved by Ethics Committee of Yantaishan Hospital.

Author's contributions

J.L.Z. conceived of the study, drafted and revised the manuscript critically, gave the final approval of the version to be published. D.X.Z. participated in the collection and analysis of data, helped to draft the manuscript. X.B.Z., X.B.J. helped to draft the manuscript and ensured the accuracy and integrity of the data. All authors read and approved the final manuscript.

Availability of data and materials: detailed data in our study can be found in Table 1 in the main paper.

Disclosure of interest

The authors declare that they have no competing interest.

Acknowledgment

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References