International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182 Print ISSN: 2349-5979
www.allsubjectjournal.com
Volume 2; Issue 11; November 2015; Page No. 110-113

Surgical Outcome of one stage (anterior and posterior) surgical treatment of primary pyogenic spinal infection in the thoracic spine using minimally invasive techniques

[1, 2] Hamdan Abdelrahman, [2] Mohamed Gamal Hassan, [2] Mohamed El-meshtawy, [2] Khalid Mohamed Hassan, [1] Mootaz Shousha, [1] Heinrich Boehm

[1] Zentralklinik Bad Berka –Germany

[2] Asiut University Hospitals- Asiut- Egypt

Abstract
Study design: a prospective observational study
Objective: was to evaluate the clinical outcomes of one stage video- assisted thoracoscopic debridement and reconstruction combined with posterior percutaneous transpedicular fixation in prone position in the treatment of pyogenic spinal infections in the thoracic spine.
Methods: between 2010 and 2013, 54 patients with primary pyogenic spinal infection at the thoracic spine underwent anterior thoracoscopically assisted debridement and fusion combined with Posterior Transpediculr Fixation (PTPF) in prone position. The clinical outcomes were evaluated before and after the surgery in terms of hematologic examination, pain level, and neurologic status. Bone fusion and changes in sagittal alignment were examined radiographically.
Results: Fifty four patients were included (35 males and 19 females) with mean age of 67.6 years. More than 80% of the patients had associated comorbidities. The mean operative time was 195.46 ± 46.629 minutes, for thoracoscopic anterior surgery was 100.37±30.045 min; and for posterior 95.093±29.308 minutes. The average blood loss was 533±279.413 ml. Twenty nine patients (53%) had preoperative neurological deficits ranging from Frankel A to D. One patient (Frankel A) did not show any neurological improvement at the final follow-up. The mean VAS at final follow-up was 1.03/10 (preoperative 7.89). The mean preoperative kyphosis angle was 17.11°, improved to 6.51° postoperatively and reached 8.48° at the final follow-up. First year mortality rate was 5.5% (3 patients).
Conclusion: Minimal invasive spinal techniques including thoracoscopic debridement and fusion and posterior percutaneous instrumentation showed good clinical and radiological outcomes and can be considered as alternative to open procedures with decreased rates of morbidities in managing thoracic spinal infections in elderly patients.

Keywords: pyogenic spinal infection, surgical treatment, VATS, thoracoscopic, percutaneous instrumentation

Introduction

Vertebral osteomyelitis is reported to range between 2-7% of all cases of bone infection, but it keeps rising because of increased life expectancy among over the last decades [1]. The pyogenic spondylosiscitis occurs frequently in elderly and debilitated patients who have significant medical comorbidities and predisposing factors for spinal infection [2].

The aim of surgery in is to relieve pain by eradication of the infection, reconstruction of the defects and restabilization of the spine. Since 1960 when Hodgson *et al* [3]. reported anterior arthrodesis as a treatment option for spinal tuberculosis, anterior radical debridement and spinal fusion is advocated as an effective treatment of these infections [4]

However, loss of correction and failure of the graft resulting from slippage, fracture, and absorption, especially when more than 2 vertebrae have been excised, have been reported as serious complications associated with this method. These disadvantages of single anterior surgery have led to the use of instrumentation for surgical treatment of spinal infection [5, 6].

Video assisted thoracoscopic surgery (VATS), in cases of thoracic and thoracolumbar spinal infection, is a good alternative to conventional thoracotomy with minimal morbidity, although surgically demanding [7].

In this study, we analyzed the clinical outcome of single stage surgical treatment on pyogenic spondylitis.

Methods

Patients

For those whose infections were resistant to conservative therapy and who have major bone destruction, neurologic deficits, abscess formation, sepsis manifestation, and intractable back pain, surgical treatment was indicated.

We performed a prospective study of 54 consecutive patients of primary pyogenic spinal infection treated with one stage surgical method (anterior debridement and fusion VATS combined with posterior instrumentation (PTPF) between January 2010 and January 2013, at Zentralklinik Bad Berka, Germany.

All patients were assessed preoperative (preop) clinically and neurologically as per Frankel grading. X-rays of the affected spinal region and whole spine MRI were obtained in all the cases. Routine laboratory investigations included inflammatory parameters ESR, CRP, leucocytes.

Perioperative (periop) measurements included operative time, blood loss, chest tube drainage, postoperative (postop) pain using visual analogue scale (VAS), length of hospital stay and

complications. The clinical data were assessed postoperative and at the last follow up using subjective clinical results.
The study population consisted of 35 males and 19 females; average age was 67.6 years (range 43-85). The mean follow-up was 37.4 months (range 6 to 66.2).

Operative Procedure
After general anesthesia the patient is turned in the prone position. For graft harvesting, the iliac crest should be accessible. Iliac bone graft is taken percutaneously in cases of interbody fusion or open technique in patients with large defects.

- ***Thoracoscopic procedure***

The technique included two incisions: the first is about 2.5 cm mini-thoracotomy done in the mid-axillary line and the second is about 1 cm in the posterior axillary line for the 30° thoracoscope.
The aimed level is determined and checked radiographically. The prevertebral parietal pleura is incised and pealed using a blunt ball-tipped hooked dissector. Usually for lesions cranial to T9, the right side was approached and left side for levels below. For optimal placement of the retractor minimal disinsertion of the spinal attachment of diaphragm can be done to expose the segment L1/2 [8, 9]. The segmental vessels can be identified, ligated and cut if necessary. A thorough debridement was performed to remove necrotic disc, sequestra, infected granulation tissue as well as abscess drainage if present under direct vision through the thoracoscope. Spinal canal decompression was done in 35 patients (65%). Interbody fusion cage sufficed in 46 patients (85%) and expandable one to bridge corpectomy defect was necessary in 8 patients. At the end of the operation, the pre-vertebral pleura is closed, the thoracic cavity is inspected and an intercostal tube is inserted. The percutaneous posterior instrumentation is then started after closure of the anterior approach under sterile conditions.

- **Posterior percutaneous instrumentation**

Pedicle screws were placed under 2 image intensifiers. At the target pedicle, the skin is incised and the fascia is opened. Under image intensifier, a cannulated pedicle finder is inserted through the pedicle. Once the tip of the cannulated finder has been advanced into the vertebral body, the stylet of the finder is removed and replaced by a guide wire. The cannulated polyaxial screw is then inserted along the guide wire after removal of the pedicle finder. After insertion of all screws using the same technique, the position of them is checked using the C-arm in both anteroposterior and lateral views.
The extent of posterior instrumentation depends on bone quality of the patient, degree of preop deformity and the technique done anteriorly.
Then the rods are applied percutaneously through the incision for the uppermost screw of the instrumentation and tightened via the screw-extensions in corrective compression when needed. The incisions are then closed and adhesive strips are then applied.

Results
More than 77 % of the patients (37 patients) had comorbidities, cardiac diseases in 28 and Diabetes Mellitus in 19 patients (35%). According to the American Society of Anesthesia (ASA) scoring system, 37 % of the patients had (ASA) score of III and IV. The mean presurgical interval of symptoms was 48.7 days (range 7 -120).

Invasiveness of the Procedures
The mean total operative time was 195.46 ± 46.629 min; for anterior surgery was 100.37±30.045 min; and for posterior 95.093±29.308 min. The mean total blood loss was 533±279.413 ml. There was significant time difference in cases with and those without spinal canal decompression (*p*-value of 0.011*) and between blood loss in both group (*p*-value of 0.000*).
According to Huang classification of complications in thoracoscopic surgeries [10], periop complications occurred in 3 patients (5.5%). Grade III and IV complication not reported in any of our patients (Table 1)

Table 1: *Periop. Complications according to Huang classification and their management*

Complication	Grade	Number of patients	Management
Recurrent Effusion	IIa	1	Chest tube
Subcutaneous hematoma	I	1	Drainage
Sphincter dysfunction	I	1	Conservative (improved within 2 weeks)

- The mean IMC-stay was 5.65±3.470 days. The chest tube was removed on average 4 days (range 3–6 days) after surgery.
- One patient was re-operated within the first three months (extension of percutaneous fixation) due to increased kyphosis due to adjacent osteoporotic fracture. Another patient had to be operated (the same technique from the other side) due to spondylodiscitis in adjacent segment within 13 months.

Laboratory Assessment
- Significant decrease in the level of inflammatory parameters (p- value 0.000*) (Table 2).
-

Table 2: *Means of the prep. and postop. Inflammatory parameters*

Inflammatory parameter	Preop.	2 weeks postop.	Last FU
CRP *(mg/dl)*	100.9	38.4	14.2
ESR *(mm/hr)*	82.6	66	35.8
Leucocyte count *($x10^3$/mm)*	9.8	8.9	7.4

Staph. aureus was the most common isolated organism in 24 patients (44%) and in 37% no organism could be isolated. The mean postop hospital stay was 17±5.525 days. The antibiotic therapy ranged between 1.5 and 3 months according to the course of inflammatory parameters.

Clinical outcomes
Mortality rate in the first year was 5.5% (3 patients); 2 during the hospital stay (one due to sepsis and one due to cardiac infarct), one died after 6 months after discharge due to renal failure.
For subjective patient reported outcomes at the last follow up for 51 patients 94% of patients had satisfactory results i.e. good

or excellent result, excellent results were obtained in 29 patients, good in 19, fair in two patients. The mean VAS improved from 7.89 preop to 1.03 at the last follow up. Based on the Frankel grading, of patients who had neurological deficit (29), 86% (25 patients) improved at least one level.

Radiological outcomes

Mean preop Kyphotic angle was 17.11° improved to 6.51° postop and reached 8.48° at the last follow up (p-value 0.002*). According to modified Brantigan– Steffee classification, no cases of instrumentation failure till the last follow up reached. Full bony fusion in the x-ray reached in the last follow up in 48 of 51 patients (94%).

Discussion

With the advent of new diagnostic techniques, multiple-drug antimicrobial chemotherapy, and improvements in surgical techniques, the prognosis has improved dramatically in recent years [11]. The most widely accepted approach for surgical management of vertebral osteomyelitis combines an anterior debridement and autologenous bone grafting with posterior instrumentation stabilization performed in a single- or two-stage procedure [12]. The primary goals of minimally invasive techniques focus on reducing the operative morbidity associated with classic open surgical techniques.

This prospective study was performed in 54 consecutive patients with primary pyogenic spinal infections at the thoracic level to determine the efficacy of previously reported surgical technique (VATS and PTPF). One of the most important observations of this study was that pain level decreased significantly after the first operation. This result reconfirmed one of the several principles of this procedure that the use of posterior instrumentation in the same procedure provides sufficient stability at unstable infected sites, and thus immediately helps to decrease pain and to secure bony fusion [13].

In addition, the neurologic deficits (25 of 29) were improved 86% in the patients of this study. Importantly, the unimproved 4 patients had incomplete neurological deficit except one with Frankel A who stayed unimproved till the last follow-up. The combination of pain relief and amelioration of neurologic deficits may have improved the daily activities of the patients described here.

The effects of surgical treatment for spinal infection and the amelioration seen on blood examination, including CRP, ESR and white blood count were reported elsewhere to be positively correlated [14]. In this study, significant improvement of the pain level was observed after each operation, the CRP level changed significantly after the operation. Although the immobilization effect achieved through application of posterior instrumentation in the first procedure was useful in suppressing infection at the anterior site in a preliminary study, [12] this effect was observed in this study where only pyogenic spinal infections were treated. A possible explanation for significant changes in the blood examination data is the intraoperative drainage of abscesses and radical debridement as well as the antibiotic treatment according to culture and sensitivity.

The amount of blood loss during each surgery was relatively low in comparison with previous reports using conventional combined anterior and posterior one-stage operation for tuberculous spondylitis [15] and anterior instrumentation [16] Lin *et al* compared open versus percutaneous pedicle screew fixation in treating pyogenic spondylodiscitis [17]. They proved that percutaneous posterior instrumentation was asociated with significantly less intraop. blood loss, shorter operative time, and reduced postop. pain with no adverse effect on infection control [17]. These findings agree well with those obtained in this work, where the mean operative time for posterior instrumentation was 95 minutes and the amount of blood loss during instrumentation was negligeable.

In this work, two minimally invasive techniques; namely VATS for anterior debridement and reconstruction together with percutaneous instrumentaion for posterior stabilisation, were applied in order to offer the immunocompromised patients suffering from spondylodiscitis the advantages of both methods. Kaiser *et al* mentioned four prerequisits to accept a minimally invasive technique [18]. First, there should be no compromising of the surgical procedure if one wishes to proceed with less invasive approach; the indications for operation should be the same, and what is accomplished by the less invasive procedure should be equivalent to that achieved by the open procedure. Likewise, the incidence of complications should not differ significantly from that which result from from the analogous open procedure. These four criteria were fulfilled in the current study and in no case a shift for open surgery was necessary. Postop. VATS-related complications occurred in four patients. These were simply alterations from the ideal postoperative course resulting in no lasting disability and were classified as grade I and IIa according to Huang *et al*. Grade III and IV complications were not reported in any of the patients.

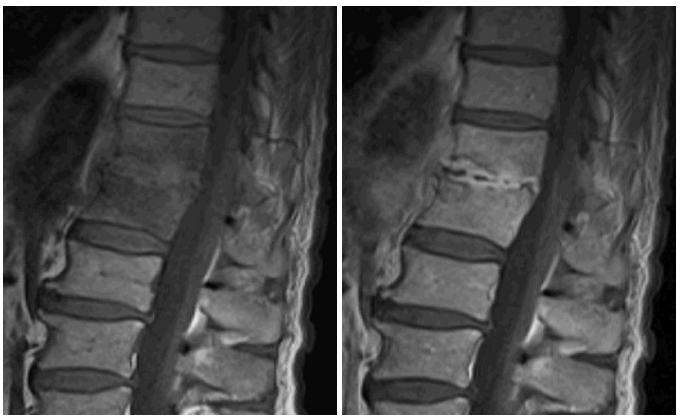

Fig 1: MRI sagittal Images of Spondylodiscitis Th11/12 a. T1 sequence b.T1 with contrast

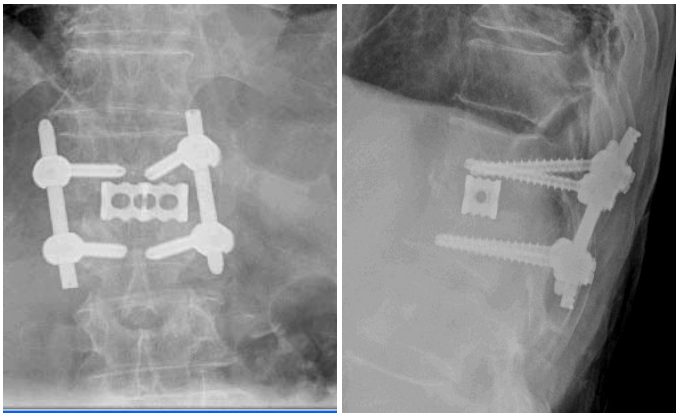

Fig 2: AP and lateral radiographs one year postoperative

References

1. Tyrell PNM, Cassar-Pollucino VN, McCall IW. Spinal infection. Eur Radiol 1999; 9:1066-77.
2. Gasbarrini AL, Bertoldi E, Mazzetti M. Clinical features, diagnostic and therapeutic approaches to haematogenous vertebral osteomyelitis. Eur Rev Med Pharmacol Sci 2005; 9:53-66.
3. Hodgson AR, Stock FE, Fang HS. Anterior spinal fusion. The operative approach and pathological findings in 412 patients with Pott's disease of the spine. Br J Surg.1960; 48:172-178.
4. Upadhyay SS, Sell P, Saji MJ. Surgical management of spinal tuberculosis in adults. Hong Kong operation compared with debridement surgery for short and long term outcome of deformity. Clin Orthop Relat Res 1994; 302:173-82.
5. Lee EY, Hahn MS. A study of influences of the anterior intervertebral fusion upon the correctability of kyphosis in tuberculous spondylitis. J Korean Orthop Assoc. 1968; 3:31-40.
6. Rajasekaran S, Soundarapandian S. Progression of kyphosis in tuberculosis of the spine treated by anterior arthrodesis. J Bone Joint Surg. 1989; 71:1314-1323.
7. Newton PO, Marks M, Faro F. Use of video assisted thoracoscopic surgery to reduce perioperative morbidity in scoliosis surgery. Spine 2003; 28:249-54.
8. Boehm H. Ein neues minimal invasives Konzept zurkomplexen Restabilisierung der Wirbelsäule. Habilitation thesis, Justus-Liebig-University, Giessen, Germany 2013, 81.
9. Shawky A, Al-Sabrout A, El-Meshtawy M. Thoracoscopically assisted corpectomy and percutaneous transpedicular instrumentation in management of burst thoracic and thoracolumbar fractures. Eur Spine J 2013; 22:2211-18.
10. Huang TJ, Hsu RW, Sum CW. Complications in thoracoscopic spinal surgery: a study of 90 consecutive patients. Surgical endoscopy 1999; 13:346-50.
11. Herkowitz HN, Garfin SR, Eismont FJ. Infections of the Spine In: Rothman-Simeone The Spine. Elsevier Philadelphia, 2006.
12. Lowery GL, KulkarniSS. Posterior percutaneous spine instrumentation. Eur Spine J 2000; 9(Suppl 1):S126-S130.
13. Fukuta S, Miyamoto K, Masuda T. Two-stage (posterior and anterior) surgical treatment using posterior spinal instrumentation for pyogenic and tuberculotic spondylitis. Spine 2003; 28:E302-E308.
14. Azzam NI, Tammawy M. Tuberculous spondylitis in adults: diagnosis and treatment. Br J Neurosurg. 1988; 2:85-91.
15. Sundararaj GD, Behera S, Ravi V. Role of posterior stabilization in the management of tuberculosis of the dorsal and lumbar spine. J Bone Joint Surg Br. 2003; 85:100-106.
16. Govender S. The outcome of allografts and anterior instrumentation in spinal tuberculosis. Clin Orthop Relat Res. 2002; 398:60-66.
17. Lin TY, Tsai TT, Lu ML. Comparison of two-stage open versus percutaneous pedicle screw fixation in treating pyogenic spondylodiscitis. Musculoskeletal Disorders 2014; 15:443.
18. Kaiser LR, Shrager JB. Video-assisted thoracic surgery: the current state of the art. AJR Am J Roentgenol. 1995; 165:1111-7.