The Efficiency of a Posterior Approach Technique for the Management of Pyogenic Spondylitis

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*Abstract***:** Pyogenic spondylitis is a severe infection of the spine which can be associated with debilitating neurologic deficits due to massive bone destruction and secondary collapse of the involved vertebral segments. If the symptoms are not severe, conservative management can be considered. When there is massive bone loss, neurologic deficits or severe pain, surgery is required. Although the most effective technique was considered to be anterior debridement associated with posterior stabilization, recent studies have shown good results with posterior only techniques. The objective of our study was to evaluate the efficiency of a posterior approach technique for the treatment of pyogenic spondylitis. We analyzed a group of 12 patients with confirmed pyogenic infection of the spine, which were operated through a posterior approach, with debridement, abscess evacuation and stabilization of the involved spine segments. There were 8 males and 4 females with a mean age of 60 (45-74) years. The most frequent involved pathogen was Methicillin-Sensitive Staphylococcus Aureus (MSSA), identified in 6 cases. Four patients had lumbar involvement and 8 had thoracic involvement. Two patients had neurologic deficit. All patients received post-operative antibiotic treatment in an infectious-disease hospital. The mean number of fused vertebrae was 4 (2-7). The mean operating time was 145 minutes (80-270) and the mean blood loss was 516 ml (250-1500). The minimum follow-up was 12 months. There were 2 reoperations: one for surgical site infection and one for instability of the involved segment which required anterior column reconstruction with a mesh cage, through an extended extracavitary posterior approach. A posterior approach technique for the treatment of pyogenic spondylitis is an effective technique for infection control and stabilization of the spine, without the extended operating times and risks associated with anterior surgery.

Key-words: pyogenic spondylitis, posterior approach, stabilization, neurologic deficit, abscess, decompression, fusion

1 Introduction

Pyogenic spondylitis represents a severe infection of the spine often associated with high risk of debilitating effects due to bone destruction and secondary neurological complications. Most often, if there is no neurological deficit, the mainstay of treatment consists of antibiotic treatment after the involved pathogen is identified using methods such as vertebral biopsy or blood cultures. In certain cases, due to severe bone lesions leading to vertebral instability or to neurological symptoms, surgical treatment is necessary. Usually the most effective method for infection control and stabilization of the spine was considered to be anterior debridement and reconstruction of the affected vertebral bodies using a bone graft or reconstruction cage associated with posterior fixation using instrumentation [1], [2], [3]. Most recent studies have shown that the use of posterior instrumentation alone provides a good chance for fusion and allows for faster mobilization and rehabilitation of the patient without significant risk for subsequent infection of the implants[4], [5]. Prolonged operating times, increased bleeding and difficulty with the use of anterior approaches have made surgeons try to avoid this type of management. In the past years there have been a few studies documenting the efficiency of a single

posterior approach for management of spine infections[4], [5], [6], [7], [8]. The results were promising, with high rates of infection eradication and bony fusion. This paper presents the outcome of 12 patients diagnosed with pyogenic spondylitis treated with a posterior approach technique and instrumented fusion.

2 Materials and methods

We included in our study all patients with pyogenic spondylitis operated in Foișor Orthopaedic Hospital between 01.01.2011 and 31.12.2015. There were 12 patients, 8 males and 4 females with a mean age of 60 years (45-74). The diagnosis was confirmed by clinical evaluation, imaging techniques (CT, MRI, X-rays) and identification of the pathogen by vertebral biopsy prior to surgery, intraoperative cultures, or positive blood cultures. All patients had elevated inflammatory markers (C-reactive protein, ESR and fibrinogen) while only 6 had elevated white blood cell count.

Patients either didn't receive antibiotic treatment before surgery or they had, but it was not effective. Our indications for surgical treatment through a posterior approach were poor general condition (1 patient), minor bone destruction (2 patients), multiple level involvement (1 patient), severe pain secondary to spine instability (6 patients) and presence of neurological deficit (2 patients).

Six patients had lumbar spine infection and 8 had thoracic involvement. One patient had multiple levels affected by infection. Two patients had a confirmed associated infectious process (septic arthritis and urinary tract infection) and five had significant associated comorbidities: 3 had type 2 diabetes, 1 had chronic kidney failure, 1 had Hodgkin's Disease. In the other 5 patients' history, we could not identify any significant predisposing condition (Table 1).

The causative pathogen was identified by blood cultures in 4 cases, by intraoperative cultures from epidural or disk abscesses in 6 cases and by pre-operative biopsy in 2 cases. Methicillin-Sensitive Staphylococcus Aureus (MSSA) was identified in 6 cases, Methicillin-Resistant Staphylococcus Aureus (MRSA) was found in 1 case, Pseudomonas Aeruginosa in 2 cases, Salmonella in 1 case, Group B Streptococcus (Gr.B Strep) in 1 case and one patient had E. Coli associated with the presence of acid fast bacilli (Table 1).

Our surgical technique consisted of a posterior midline approach and fixation with pedicle screws and titanium rods only. Depending on the degree of bone destruction, the number of involved levels and the presence of instability, the mean number of fused vertebrae was 4 (2-7). Pedicle screws were also inserted in affected vertebrae where there was no major bone destruction in order to achieve better stability of the construct and to avoid unnecessary fusion. Decompression was performed in case of neurologic deficit or the presence of an epidural abscess. The intervertebral disk was approached in a transpedicular fashion, with evacuation of the abscess, debridement and gathering of tissue and fluid for microbiology and pathology analysis.

All patients followed the same rehabilitation protocol with early mobilization two days after surgery, without an orthosis or brace.

Patients were given post-operatively intravenous antibiotics according to pathogen susceptibility which were continued in an infectious disease treatment centre for up to 8 weeks until the inflammatory markers returned to normal values.

The duration of each surgery and the intraoperative blood loss were evaluated. We have used a modified Robinson's classification to grade pre-operative and post-operative pain [9], [10]. Pain was considered as mild if the patient didn't have any limitation of activities, moderate if patients occasionally used anti-inflammatory and pain relief drugs and had minimal limitation of activities and severe pain was considered if patients had severe activity limitation requiring frequent use of pain and anti-inflammatory medication. Frankel's grading was used to evaluate neurological status [11] (Table 1).

X-rays, MRI and CT-scans were analysed by the radiologist from our institution pre-operatively and post-operatively to assess the degree of bone and soft tissue involvement as well as the presence of bony fusion.

The statistical analysis was performed using Microsoft Excel and patient data was collected from hospital archives and the Romanian Arthroplasty Register.

3 Results

The mean operating time in our group of patients was 145 minutes (80-270). The mean blood loss was 516 ml (300-1500). The mean follow-up was 26 months (12-48). Two patients presented pre-operative neurologic deficit due to compression of the spinal cord by a large abscess. One patient had Frankel B paraplegia secondary to compression at T10-T11 level (Table 1). Immediately after surgery, the deficit did not improve significantly, but after intense neurologic rehabilitation the patient is able to walk with support. Another patient presented with Frankel D paraplegia with a compressive abscess at

L1-L2 level. Patient recovered full function after surgery with decompression of the area and evacuation of the abscess.

There were no significant intraoperative complications. However, two patients required a second intervention. One patient presented with deep surgical site infection which required an irrigation and debridement procedure. Another patient required a reconstruction procedure of the spine at the involved level because of instability causing severe pain at mobilization in post-operative period. A posterior extended extracavitary approach was carried out and the anterior column of the spine was reconstructed using a mesh cage. The patient had a favourable outcome without any neurologic deficit or need for subsequent surgery.

Post-operative pain levels were significantly reduced, with 7 patients being pain-free, 4 patients having mild pain and 1 patient accusing moderate pain, which could be explained by the underlying severe degenerative disc disease.

The mean duration of antibiotic treatment was 6.7 weeks (6-8). All patients returned to normal WBC and inflammatory marker values at the end of the medical treatment.

Rigid bony fusion was achieved for all patients at 6.3 months (5-8) with the exception of one who only had partial union. We consider that the reason for the partial union was the presence of significant bone destruction associated with important patient comorbidities (uncontrolled type 2 diabetes and extended atherosclerotic disease).

4 Discussion

Spinal infections comprise between 2% and 7% of all musculoskeletal infections [12] with up to 4% mortality [12] and usually accompanied by a challenging diagnostic and treatment course.

In pyogenic spondylitis culture positive rates for tissue or blood vary from 30% to 70% and up to a third of suspected patients may present culture-negative pyogenic spondylitis [18] therefore it is more often than expected that the diagnosis must rely on other items such as past history of epidural procedures, fever, pain in the vertebral area, neurological signs or symptoms in the vertebrae or extremities [18], progressive kyphosis or spinal instability often with progressive respiratory insufficiency[4], coupled with extraspinal concomitant infection [19], elevated white blood cell count, Erythrocyte sedimentation rate and C-reactive protein level. CT scanning, MRI are also of use both in diagnosis and surgical planning as are plain or digital X-Rays if disease progression has had time to develop [5].

The surgical treatment may be provided using one of many techniques such as radical anterior debridement with vertebral column reconstruction, anterior debridement only or with adjunct instrumentation and bone grafting, combined antero-posterior debridement and fixation or posterior instrumentation coupled with transpedicular or transforaminal debridement and bone grafting [5]. However, patient status may not permit anterior surgery because of medical comorbidities, difficulty in using the anterior approach or multilevel involvement [5].

Posterior only approaches have only recently gotten into the spotlight regarding the management of spondylitis or spondylodiscitis (whether tuberculous or pyogenic in respect to the origin of the infective organism). Posterior instrumentation alone omits anterior debridement and needs to be combined with effective antibiotic therapy thus it should be mandatory to identify the microorganism in question [5]. It's indication wanes in the presence of large anterior column destruction (more than two vertebrae), as this compromises overall spinal stability, in which case, a combined anterior-posterior technique for stabilization and subsequent fusion may be more appropriate.

Most surgeons use an anterior approach for debridement, evacuation, decompression and vertebral body reconstruction. There are several disadvantages of this technique that should be taken into account: longer bracing period, longer bed-rest after surgery, potential vertebral column collapse, impaired respiratory function during a thoracotomy, potential vascular complications during anterior lumbar surgery [14], [15], [16].

Several advantages of the posterior approach comprise maintenance of spinal stability and kyphotic angle during healing, promot earlier mobilization while also permitting to some amount transforaminal abscess drainage and debridement through the decompressive laminectomy performed [16], [17].

Although there are authors that cite antibiotic regimens of more than 5 months [19], infection control is achieved at around 8.2 weeks [5] while inflammatory markers usually return within normal values around 3 months after surgery [19].

All patients included in this paper have been mobilized without bracing. Although postoperative bracing is advocated [4], [5], [19], [20] and continued for weeks [20] or even months [4], [19], this approach may be linked to tradition rather than scientific proof.

The mean improvement of the Frankel score and the mean blood-loss and operative time were consistent with other declared values within the literature [5], [20].

For providing infection control, spinal stability and neurological decompression, posterior segmental instrumentation seems to be safe and effective as shown by the low complication rate and the positive trend of clinical, radiological and blood work values.

5 Conclusion

A posterior approach technique with debridement of the disk space, evacuation of the abscess and stabilization with transpedicular screws and rods is an effective and safe procedure for the management of pyogenic spondylitis. Operating times are reduced and the risks associated with anterior approaches are avoided. It is important that the involved pathogen is identified and antibiotic therapy continued for a minimum of 6 weeks, as this type of technique does not allow an extensive debridement to be carried out. In case of massive bone destruction involving the anterior column, reconstruction may be necessary and this can be achieved through an extended extracavitary posterior approach. However, it is clear that this technique may not be suited for all cases and a double approach (anterior and posterior) should be considered in case of massive bone loss and large abscesses, where extensive debridement with reconstruction is necessary.

Table 1 – Patients' clinical and surgical data

Case	Gender	Age	Pathogen	Comorbidity	Affected level	Frankel	Fused levels	Op time (mins)	Blood loss (ml)
1	M	60	E.coli + BK	Type 2 Diabetes	L3-L4	E	2	170	300
2	F	66	MRSA	Septic arthritis, Type 2 Diabetes	T11-T12	E	5	120	500
3	M	45	MSSA	N/A	T9-T10	E	3	120	500
4	M	64	Gr.B Strep	Type 2 Diabetes	L1-L2	D	3	120	500
5	M	62	MSSA	N/A	T10-T11	B	7	270	750
6	F	65	Pseudomonas	N/A	T9-T10	E	2	100	300
7	M	46	MSSA	N/A	T11-T12	E	4	80	300
8	M	53	Pseudomonas	Hodgkin Disease	L5-S1	E	2	180	400
9	M	66	Salmonella	Renal failure	T12-L1	E	5	160	500
10	F	74	MSSA	N/A	T5-T6	E	4	100	250
11	F	63	MSSA	UTI	L1-L2, L4-L5-S1	E	7	180	1500
12	M	64	MSSA	N/A	T11-T12	E	4	140	400
Mean		60.6					4	145	516.6

6 Example cases

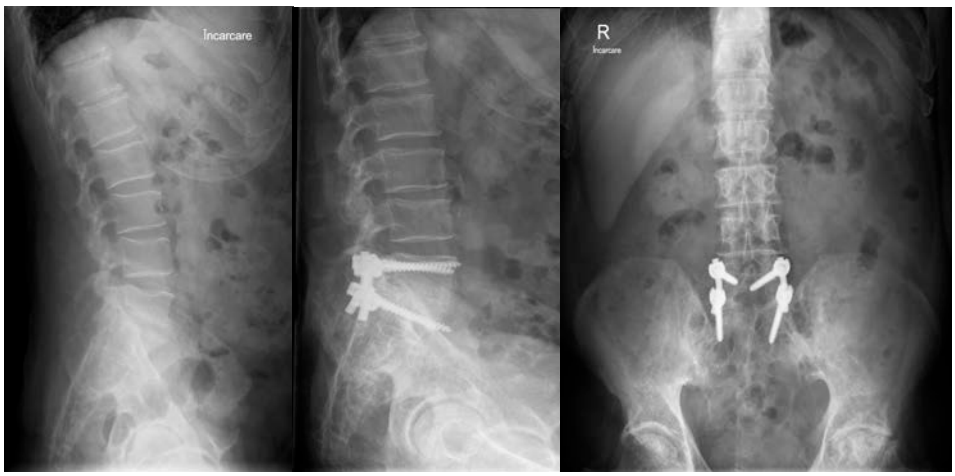

Fig 1A Fig 1B Fig 1C

Case 8: 53 year old male with L5-S1 Pseudomonas Aeruginosa infection. Fig 1A pre-op x-ray; Fig 1B and 1C post-op X-rays with complete fusion at affected level

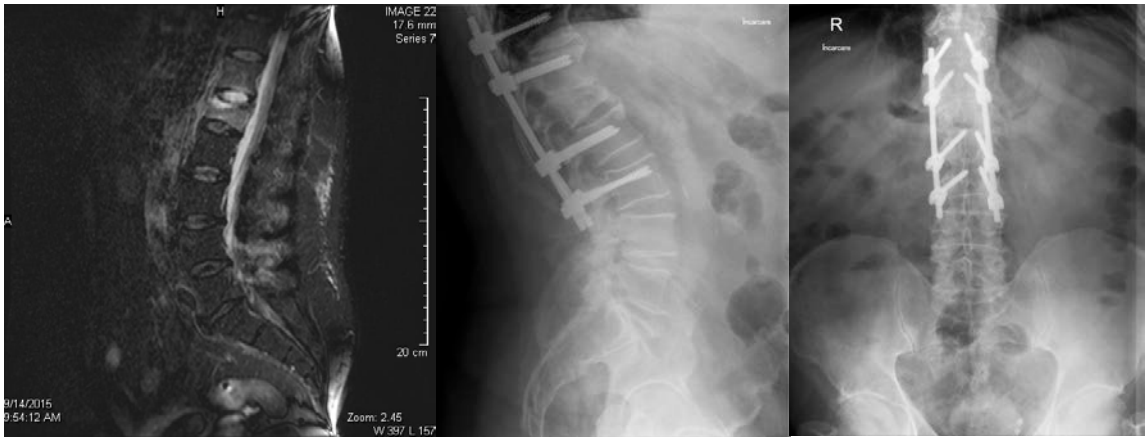

Fig. 2A Fig. 2B Fig. 2C

Case 9: 66 year old male with T12-L1 Salmonella infection. Fig 1A pre-op MRI showing disc abscess, Fig 2B and 2C post-op x-rays with partial fusion at affected level

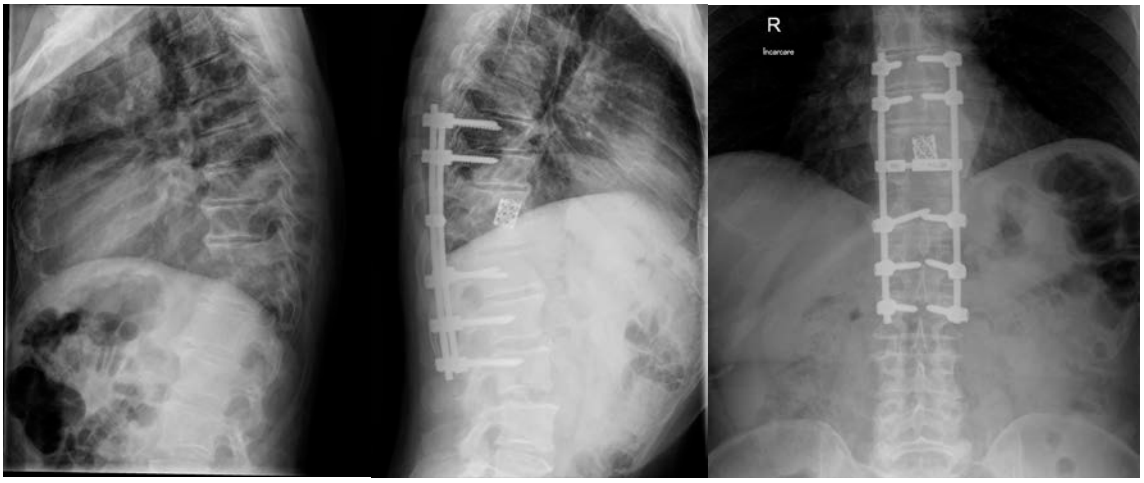

Fig. 3A Fig. 3B Fig. 3C

Case 5: 62 year old male with MSSA infection. Fig. 3A pre-op x-ray showing important bone destruction at T10-T11 level, Fig 3B and 3C post-op x-rays with multilevel fixation and anterior reconstruction using mesh cage

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