

The role of minimally invasive spine surgery in the management of pyogenic spinal discitis

ABSTRACT

Background: Diagnostic yields for spondylodiscitis from CT guided biopsy is low. In the recent years, minimally invasive surgery (MIS) has shown to have a low morbidity and faster recovery. For spinal infections, MIS surgery may offer an opportunity for early pain control while obtaining a higher diagnostic yield than CT-guided biopsies. The aim of this study was to review our patients who underwent MIS surgery for spinal infection and report outcomes.

Methods: A retrospective review of seven patients who underwent MIS decompression and/or discectomy in the setting of discitis, osteomyelitis, spondylodiscitis, and/or an epidural abscess was identified. Patient data including symptoms, visual analog score (VAS), surgical approach, antibiotic regimen, and postoperative outcomes were obtained.

Results: Of the 7 patients, 5 patients had lumbar infections and two had thoracic infections. All seven patients improved in VAS immediately after surgery and at discharge. The average VAS improved by 4.4 ± 1.9 points. An organism was obtained in 6 of the 7 (85%) patients by the operative cultures. All patients made an excellent clinical recovery without the need for further spine surgery. All patients who received postoperative imaging on follow-up showed complete resolution or dramatically improved magnetic resonance imaging changes. The follow-up ranged from 2 to 9 months.

Conclusions: MIS surgery provides an opportunity for early pain relief in patients with discitis, osteomyelitis, spondylodiscitis, and/or epidural abscess by directly addressing the primary cause of pain. MIS surgery for discitis provides a higher diagnostic yield to direct antibiotic treatment. MIS surgery results in good long-term recovery.

Key words: Discitis; minimally invasive spine surgery; osteomyelitis; spinal infection; spondylodiscitis.

Introduction

Pyogenic spinal infections encompass the spectrum of but are not limited to spondylitis, discitis, spondylodiscitis, and epidural abscess.^[1] The incidence of pyogenic spine infections is increasing due to a greater number of patients with immunosuppression and bacteremia. In our experience, pyogenic spine infections are also prevalent in the end-stage renal disease population. While an epidural abscess with a neurological deficit is a clear indication for surgery, there is no consensus on the type of intervention that best manages spondylodiscitis. There have been some attempts to suggest an algorithm or guidelines for the management of these cases.^[2] Treatment either involves a computed tomography (CT)-guided biopsy with antibiotics or extensive

surgery with spinal reconstruction and instrumentation.^[3] Traditionally, a laminectomy was ineffective because removal of the posterior elements destabilized the spine in the setting of disc destruction, and access to the actual disk was limited.

Minimally invasive spine surgery (MIS) allows for reduction in blood loss, length of stay, recovery time, and complications.

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The benefits of MIS are all highly desirable features when treating patients with a suspected infection, especially since these patients are often sick or immunocompromised with multiple comorbidities.^[4-7] This paper reports a series of patients with spinal infection in whom MIS techniques were employed to obtain a quick diagnosis to enable appropriate antibiotic therapy and faster recovery from pain, reduce the disease burden, and avoid a potentially bigger operation.

Methods

A retrospective chart review of all patients who underwent MIS surgery for discitis, spondylodiscitis, or epidural abscess by the senior surgeon (HD) was collected from January 2014 to September 2015. Preoperative data collected included prior history of infection, preoperative visual analog score (VAS) scores, symptoms at the time of presentation, and any neurologic deficit. The surgical procedure performed was detailed including estimated blood loss (EBL), operative time, and the bacterial organism cultured. Treatment duration, follow-up VAS scores, and postoperative imaging were reviewed.

Surgery

The surgery was done using an 18–20 mm diameter tubular retractor.^[8] The patients were placed prone, and fluoroscopy was used to localize the correct level. A 2 cm incision was made 3–5 cm laterally. A lateral to medial angulation of the tubular retractor allowed for exposure of the disk space without retraction of the dura. The midline structures were preserved, and a lateral laminectomy and partial facetectomy were done using a high-speed drill. Culture swabs were used to obtain cultures, and pathology specimen was sent. Up biting pituitary rongeurs and curettes were used to debride necrotic disc material, and the disk was irrigated with antibiotic irrigation. The wound was closed in a standard fashion with vicryl sutures and dermabond for the skin [Figures 1-3].

Results

A total of 7 patients were identified as having undergone MIS procedures for the treatment of spinal infection. The mean age was 60.1 years (median 60 years, range 55–69) and there were five males and two females.

The average preoperative VAS was 8.9 ± 1.2 . Four patients had symptoms of only back pain, two had back pain and bilateral leg pain, and one had back pain with left leg pain. Six of the 7 patients were neurologically intact and one patient had a foot drop.



Figure 1: Sagittal magnetic resonance imaging showing T7–T8 spondylodiscitis with an epidural abscess

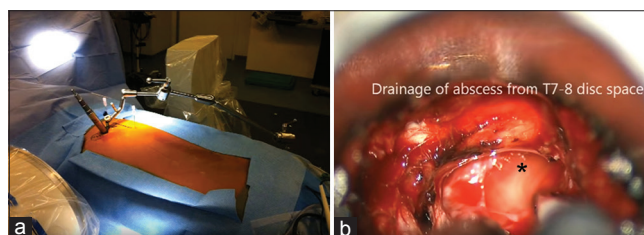


Figure 2: (a) Operative room setup for minimally invasive surgery and (b) transpedicular discectomy using tubular retractors and removal of pus (*) from the disc space

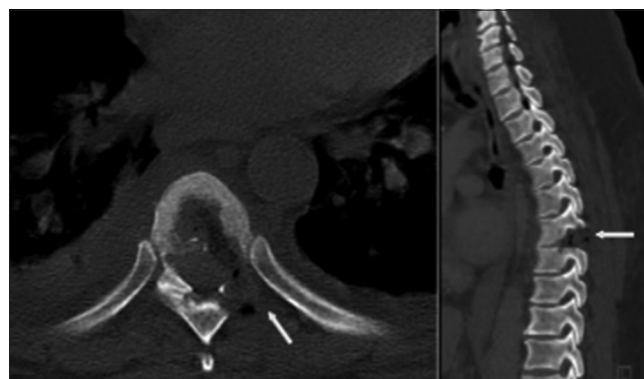


Figure 3: Postoperative computed tomography scan showing the minimally invasive approach and trajectory of surgery (arrows) with excellent outcome

Three patients had known bacteremia at the time of surgery, two patients had pneumonia, and one patient had a urinary tract infection and had lower extremity cellulitis. Of the seven patients, three had positive cultures (blood/urine) before surgical intervention. One patient had a prior interventional radiology-guided biopsy of the infectious disc space at an outside institution, but no positive cultures were identified. Six of the 7 patients were started on antibiotics before neurosurgical consultation.

Five patients had infections of the lumbar spine and 2 patients in the thoracic spine. The average number of levels operated on in every surgery was 1.1 ± 0.4 levels. Surgical details including the operation performed, EBL, and operative time are shown in Table 1. The average EBL was 38 ± 35 ml, average operative time was 77.6 ± 39.2 min. In 6 of the 7 cases, we were able to obtain positive cultures. Details of preoperative sedimentation rate, C-reactive protein, white blood cell count, organism identified, antibiotic, and treatment duration are shown in Table 2. The mean postoperative and discharge VAS scores were 5.4 and 4.4, respectively.

Five patients had follow-up 2–9 months after surgery. Four of the seven patients had postoperative magnetic resonance

imaging. One patient showed complete resolution of the infection. However, all patients showed improvement on imaging findings after surgery. The mean follow-up VAS score was 1 ± 1.67 . Details of preoperative and postoperative symptoms and VAS scores are shown in Table 3.

Discussion

High yield of cultures

The diagnosis of a spinal infection is made based on clinicoradiological evidence and obtaining appropriate cultures. However, the pathogen identification rate varies among studies.^[8-10] Hematogenous spondylodiscitis is caused predominantly by *Staphylococcus aureus*. Up to half of these infections can be caused by methicillin-resistant *S. aureus*. This

Table 1: Patient demographics and surgical procedure, estimated blood loss (EBL), and operative time

Patient	Age	Gender	Surgery	EBL	Operative Time (min)
1	57	M	L4/5 MIS laminectomy	5	37
2	60	M	T7/8 MIS transpedicular discectomy and decompression	50	71
3	68	M	T7/8 MIS hemi-laminectomy, discectomy	50	84
4	51	M	L1/2 MIS laminectomy, discectomy	50	86
5	61	M	L3/4 MIS laminectomy	8	79
6	69	F	L5/S1 discectomy	5	34
7	55	F	Left L2/3, Right L5/S1 MIS discectomy, paraspinous abscess evacuation	100	152

Table 2: Patient preoperative and postoperative laboratory findings and antibiotic regimen

Patient	Preop ESR	Preop CRP	Preop WBC	Positive Culture Prior to surgery	Antibiotics given prior to surgery	Bacteria	Antibiotic	Antibiotic duration	Infection cleared on MRI	Most recent ESR	Most recent CRP	Most recent WBC
1	>140	43	10.5	Blood and urine	Yes	Proteus Mirabilis	Ceftriaxone, PO levaquin	6 weeks each	Yes	1	<5	8
2	78	<5	12.2	No	Yes	Staph epidermis	Vancomycin, Cefipime	8 weeks	Improved	26	<5	8.8
3	42	<5	5.6	Urine	No	Ecoli, ESBL	Ertapenem	6 weeks	Improved	14	<5	6.5
4	N/A	N/A	13.5	No	Yes	Negative (Hx of MSSA)	Cefazolin	8 weeks	Improved	37	<5	5.6
5	71	54	14	No	Yes	Strep pneumoniae	Ceftriaxone	6 weeks	N/A	36	10	8
6	85	107	20.5	No	Yes	Group B Strep	Ceftriaxone	6 weeks	N/A	28	<5	5.4
7	N/A	N/A	18.4	Blood	Yes	Strep milliri	Ceftriaxone	8 weeks	N/A	N/A	N/A	4.8

Preop - Preoperative; ESR - Erythrocyte sedimentation Rate; CRP - C - reactive protein; WBC - White blood cell count

Table 3: Patient Demographics and Preoperative/Postoperative Visual analogue scale (VAS) scores

Patient	Neurologic deficit	Symptoms	Preoperative VAS pain	Postoperative VAS	Discharge VAS	Follow-up VAS
1	No	Back pain	7	3	3	4
2	No	Back pain	8	0	0	0
3	No	Back pain	10	8	6	0
4	No	Back pain, bilateral leg pain	10	7	5	N/A
5	No	Back and leg pain	8	6	6	0
6	No	Back pain	9	6	6	2
7	Yes	Back and bilateral leg pain, foot drop	10	8	5	0

VAS - Visual Analog Scale

is followed by aerobic and anaerobic *Streptococcus*, *Escherichia coli*, *Pseudomona aeruginosa*, *Streptococcus pneumonia*, and *Enterobacter*.

CT-guided cultures are often negative, especially when patients have been on empirical preprocedural antibiotics for a suspected infection. A negative culture result may call into doubt the presence of infection and may require treatment with broad spectrum antibiotics not optimized to the actual pathogen. The literature suggests that MIS techniques yield higher diagnostic efficacy. Yang *et al.*^[10] showed that 90% of their patients obtained cultures when this was done with a percutaneous endoscopic technique as opposed to the causative bacteria being identified in <50% of their cases where a CT-guided biopsy was performed. Heyer *et al.*^[8] showed that CT-guided biopsy's bacteriological yield was only 32%. We were able to obtain a positive culture in all but one of our patients, despite almost all of them being on antibiotics before surgery.

Adequate tissue for histopathology and cultures not only determines the correct bacteria but also helps rule out tuberculosis, sterile discitis, and fungal or parasitic spinal infections. One of our patients (not included) suspected of having pyogenic discitis was eventually diagnosed to have gout of the disk based on pathology specimen, which not only provided the correct diagnosis and pain relief after starting her on appropriate medication but also avoided long-term antibiotics.

Local pain control

Localized back pain is the most common presentation of pyogenic spine infections. Some studies report up to 98% of patients presented with local spine pain of longer than 6 weeks' duration, and 50% with fever at presentation.^[11] Others have suggested that spine surgery may improve pain in patients with discitis. Nasto *et al.* documented in patients with single-level noncomplicated spondylodiscitis, surgical stabilization with percutaneous screw, and rod stabilization was associated with faster recovery, lower pain scores, and improved quality of life compared with thoracolumbar bracing.^[12]

Chen *et al.*^[4] reported quick pain relief from a VAS of 9.2–2.3 after MIS endoscopic surgery and antibiotic treatment for spondylodiscitis in a cohort of immunocompromised patients. Similarly, another group too reported that all patients showed immediate back pain reduction after surgery for discitis.^[13] Apart from allowing for bacteriological and histological testing, MIS techniques enable drainage of infected material, prompt relief of pain and suffering, and

early patient mobilization. Reduction of pain allows for early patient mobilization and earlier hospital discharge.^[14]

Minimally invasive surgery

Surgery is indicated in patients with pyogenic infection with an epidural abscess.^[15] Our cases illustrate that even in the presence of discitis without an epidural abscess, it is possible to use MIS techniques to drain infected material and result in immediate improved functional recovery.^[16] MIS techniques allow for a less invasive approach that may be appropriate for patients with extensive other comorbidities that exclude a larger surgical approach.^[5,17] MIS techniques further reduce blood loss, pain resulting in early postoperative mobilization, and shorter hospital stay and recovery time. Other minimally invasive options such as percutaneous endoscopic lavage and drainage have been reported to be successful in obtaining a bacteriologic diagnosis, relieving the patient's symptoms, and assisting in the eradication of spondylitis.^[6,18] While percutaneous endoscopic techniques are not widely used by all surgeons, we do believe that MIS techniques and surgery through a tubular retractor is a familiar technique to many spine surgeons. The same MIS techniques can be applied to drain and obtain tissue for lumbar and thoracic discitis patients.

Some authors have described an alternative technique for the surgical treatment of lumbar discitis and osteomyelitis using a direct lateral retroperitoneal approach, which allows for thorough debridement and anterior column reconstruction while avoiding the need to mobilize the great vessels.^[7,19,20] Madhavan *et al.*^[19] state that surgeons who are comfortable with the direct lateral retroperitoneal approach for degenerative pathology should exercise caution when adapting this approach to infectious cases. Local anatomy is often distorted by the infection, and the disc space may not be readily identifiable because it is necrotic and inadequate. The distorted anatomy makes it easier to stray from the disc space and encounter bleeding from a segmental vessel or the great vessels. Nonetheless, the technique allows for effective eradication of infection, with reasonable blood loss and minimal approach-related morbidity.^[21]

In cases of discitis, which are often managed with a biopsy and antibiotics, early debridement of these infections by percutaneous discectomy can accelerate the natural process of healing and prevent progression to bone destruction and epidural abscess and delayed treatment may result in serious neurologic complications.^[22] This series demonstrates that MIS techniques do not result in an increased rate of secondary surgery and in fact arresting the infectious process early may prevent further bone destruction and the need for subsequent surgery.

Conclusions

This series shows that MIS surgery techniques are safe and efficacious, reduce pain dramatically, and provide a high yield culture to guide appropriate antibiotic therapy in patients with thoracic and lumbar spondylodiscitis.

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Conflicts of interest

There are no conflicts of interest.

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