Extensive spinal epidural abscess treated with “apical laminectomies” and irrigation of the epidural space: report of 2 cases

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Spinal epidural abscess (SEA) is a rare but often devastating infection of the epidural space around the spinal cord. When an SEA is widespread, extensive decompression with laminectomy is often impossible, as it may subject the patient to very long operative times, extensive blood loss, and mechanical instability. A technique called “skip laminectomy” has been described in the literature, in which laminectomies are performed at the rostral and caudal ends of an abscess that spans 3–5 levels and a Fogarty catheter is used to mechanically drain the abscess, much like in an embolectomy.

In this report of 2 patients, the authors present a modification of this technique, which they call “apical laminectomies” to allow for irrigation and drainage of an extensive SEA spanning the entire length of the vertebral column (C1–2 to L5–S1).

Two patients presented with cervico-thoraco-lumbar SEA. Laminectomies were performed at the natural apices of the spine, namely, at the midcervical, midthoracic, and midlumbar spine levels. Next, a pediatric feeding tube was inserted in the epidural space from the thoracic laminectomies up toward the cervical laminectomy site and down toward the lumbar laminectomy site, and saline antibiotics were used to irrigate the SEA. Both patients underwent this procedure with no adverse effects. Their SEAs resolved both clinically and radiologically. Neither patient suffered from mechanical instability at 1 year after treatment.

For patients who present with extensive SEAs, apical laminectomies seem to allow for surgical cure of the infectious burden and do not subject the patient to extended operating room time, an increased risk of blood loss, and the risk of mechanical instability.

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Historically, the prognosis for SEA has been extremely bleak with high morbidity and mortality rates.10 Pioneering neurosurgeons such as Dandy introduced the surgical treatment of SEA via the use of laminectomies for direct drainage.4 However, the advent of antibiotics and sulfonamides have had the greatest impact on decreasing the mortality rate of this devastating disorder. Combining surgical drainage with targeted antibiotic therapy has become the preferred treatment for symptomatic SEAs, especially those causing cord compression and progressive neurological symptoms.6,8

The most common location for SEA is the thoracic spine (35%), whereas the lumbar or lumbosacral spine ac-
Surgical treatment of holocord spinal epidural abscess

counts for approximately 30% of cases. An SEA limited to one region of the spine is amenable to drainage through simple 1- to 2-level laminectomy or laminotomy without significant risk of iatrogenic instability, but cases with more extensive involvement may necessitate more extensive decompression. Holospinal epidural abscesses involving the cervical, thoracic, lumbar, and even sacral regions are extremely rare, but when encountered, they represent a particularly challenging treatment dilemma. In patients with extensive involvement of the spinal epidural space, extensive multilevel laminectomies may not be possible for a number of reasons, including the risk of mechanical instability, long surgical times, and high operative blood loss.

In this report, we describe 2 cases of cervico-thoraco-lumbar holospinal epidural abscess treated via “apical” skip laminectomy and epidural irrigation using a small-bore pediatric feeding tube, with immediate improvement in neurological function and long-term infection control.

Surgical Technique

Three separate midline incisions are made over the midcervical, midthoracic, and midlumbar areas (Fig. 1). We then perform laminectomies centered at the apices of the natural spinal lordosis and kyphosis in the cervical spine at C-4, C-5, or C-6, in the thoracic spine at T-6, T-7, or T-8, and in the lumbar spine at L-3 or L-4.

Upon performing the laminectomies, swabs are sent for culture. A 5-Fr pediatric feeding tube is then advanced from the thoracic level down toward the lumbar area as well as up toward the cervical area, and saline and vancomycin are sent through the pediatric feeding tube, resulting in further irrigation of the epidural abscess in portions not exposed via the laminectomies (Fig. 2). In the cervical and lumbar areas, the feeding tube is advanced rostrally and caudally, respectively, with further irrigation of the proximal and distal extent of the epidural abscess. During irrigation, the opposite end is carefully observed for egress of irrigation fluid and pus. The catheter can sometimes be passed completely through to the opposite end, and irrigation can be started as the catheter is slowly pulled back. Gentle depression of the dura with a Penfield 3 or Woodson elevator at the opposite end will help in the egress of fluid so as not to trap the irrigation fluid (Fig. 2C). If no egress of fluid is observed, the catheter should be repositioned or the attempt should be aborted.

After the irrigation fluid begins to clear of turbid material, normal hemostasis is performed. A surgical drain is left subfascially at each surgical site, and each surgical incision is closed in layers using 0 Vicryl for fascia, 3-0 Vicryl for subdermal and subcutaneous layers, 3-0 Vicryl for subdermal layers, and Steri-Strips for skin.

Case Reports

Case 1

History and Examination

This 51-year-old morbidly obese man with a medical history significant for Type 2 diabetes mellitus presented with worsening lower-extremity weakness and urinary retention in the setting of known Staphylococcus aureus bacteremia and urosepsis. He was treated with oral antibiotics. Six days later, he presented to another outside hospital with worsening right flank pain as well as left hip pain, and after falling, the weakness in his bilateral lower extremities was worse. Blood cultures grew out methicillin-sensitive S. aureus, and he was started on intravenous daptomycin. On physical examination, the patient’s upper-extremity motor strength was graded 4 to 4-5 bilaterally. His lower-extremity strength was graded 4-5/5 in bilateral iliopsoas, 4/5 in the remaining lower extremities on the left, and 5/5 on the right. Magnetic resonance imaging of the entire spine revealed an extensive posterior rim-enhancing epidural lesion from C-2 to at least S-2 (Fig. 3 left).

Operation

The patient underwent the surgical procedure with no complications. The entire procedure took less than 2 hours, and estimated blood loss was less than 100 ml.

Postoperative Course

Postoperatively, the patient reported improved strength in his bilateral upper and lower extremities. At the 1-year
follow-up, he had totally regained his lower-extremity strength, his incisions were well healed (Figs. 3 right and 4), and MRI revealed excellent evacuation of the abscess.

**Case 2**

**History and Examination**

This 46-year-old man with a remote history of intravenous drug use presented after experiencing progressive pain and weakness from his lower back to his legs and a decreasing ability to control his bowel and bladder. Ten days after the symptoms commenced, he suffered a fall and was taken to an outside hospital where he was noted to be paraplegic at the L-1 level. Physical examination confirmed lower-extremity paraplegia and slightly decreased motor strength (4/5) in the bilateral upper extremities. Magnetic resonance imaging revealed diffuse, mild T2 signal throughout the cord suggestive of a presyrinx along with the presence of an SEA extending from the cranio-cervical junction to the lumbar spine from C-1 to L-4 (Fig. 5 left).

**Operation**

The patient underwent the surgical procedure with no complications. The operative time was less than 3 hours, and blood loss was less than 100 ml.

**Postoperative Course**

At 1-year postoperatively, the patient had regained his upper- and lower-extremity strength, and MRI showed excellent evacuation of the SEA (Fig. 5 right).

**Discussion**

Holospinal epidural abscess is a complicated problem. On one hand, there is a pressing need to decompress the spinal elements and reduce the infectious burden. Although there may be some case reports on the resolution of extensive SEAs following medical treatment, the general consensus is that with progressive neurological deterioration, surgical intervention is warranted. On the other hand, multilevel laminectomies may subject the patient to complications, such as increased operative time, blood loss, and recovery time, as well as mechanical instability. Since many patients have multiple comorbidities and extensive infections, instrumented fixation is often not a desirable option.

There have been only a few case reports on extensive SEAs covering more than 5 vertebral levels. The first report of selective laminectomies involved performing laminectomies at the rostral and caudal ends of the abscess and using Fogarty catheters to mechanically drain the abscess much like an embolectomy. Though this technique may prove beneficial, we believe that it may involve very high hydraulic pressures on the spinal cord. By way of comparison, the feeding tube that we use is much more flexible than the Fogarty catheter used by Schultz et al. and is much smaller at its largest inflation diameter (Fig. 6). Others have made changes to this technique, including the use of laminotomies and even laminoplasties. There have also been reports of transoral odontoidecctomy, removal of the anterior arch of C-1, and partial corpectomy of C-2 for a ventrally located cervical epidural abscess.
We have found some advantages in the technique that we espouse in this report. First, using 3 discrete incisions allows access to all 3 major regions of the spine but with preservation of the soft tissue attachments at the junctional spinal levels (C-2, C-7, T-1, T-12, and L-1). Second, by choosing to include the midcervical, midthoracic, and midlumbar spine levels in our laminectomies, we have in fact chosen the maximally elevated aspect of the spine and the 2 troughs when a patient is prone, or the “apices” of the spinal curvature. This allows for a degree of “gravity-assisted” drainage of pus from the cervical and lumbar laminectomy sites, which can reach from C-1 all the way down to S-1. Finally, the use of a semi-rigid but flexible small-bore pediatric feeding tube (5-Fr) allows for relatively high-flow irrigation through a catheter that can be easily passed through the epidural space without coiling (Fig. 6). Because the opening of the tube is positioned on the side of the tubing as opposed to its end, irrigation can be directed to the left or right to maximize abscess drainage. Any resistance to catheter insertion should be avoided given the absence of direct visualization of the catheter tip. Some authors have suggested that certain MRI characteristics may help to distinguish “liquid” pus from tougher granulation-type pus, and this should be used to decide whether extensive open techniques or a more limited technique should be applied.9,14 Our technique is recommended when liquid pus is encountered rather than for cases with solid granulation tissue. The small-diameter
pediatric tube was selected for its ability to give tactile feedback but with relative flexibility. Another adjunct to this technique to help limit damage to the spinal cord is the use of intraoperative monitoring, such as the use of somatosensory evoked potentials or motor evoked potentials, when possible. Fluoroscopy can also be used, but visualizing such a small catheter is difficult.

For large paraspinal abscesses, pre- or postoperative interventional radiology drainage is often used. Direct intraoperative irrigation and drainage of paraspinal abscesses via a transmuscular approach is also an option and often occurs during exposure of the spine.

Though laminectomies at the apex of the thoracic kyphosis are generally avoided in spine surgery, in these complex infections, we have found benefit with a 2- to 3-level laminectomy at the thoracic apex and have not experienced postlaminectomy hyperkyphosis in our 2 patients.

**Conclusions**

Extensive SEA is a complicated surgical problem. We present a variation of the standard surgical techniques that allows for irrigation and drainage of an extensive holospinal epidural abscess yet allows one to minimize complications such as increased bleeding, longer operating times, and the risk of mechanical instability.
References


Author Contributions
Conception and design: all authors. Acquisition of data: Abd-El-Barr, Bi, Bahluyen, Rodriguez. Analysis and interpretation of data: Chi, Abd-El-Barr. Drafting the article: Chi, Abd-El-Barr, Groff. Critically revising the article: Chi, Abd-El-Barr, Groff. Reviewed submitted version of manuscript: Abd-El-Barr, Bi, Bahluyen, Rodriguez, Groff. Administrative/technical/material support: Rodriguez.

Supplemental Information
Previous Presentation
Portions of this work were presented in abstract form at the New England Neurosurgical Society (NENS) meeting, June 27–29, 2013, held in Brewster, MA.

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