



Original Article

## Skip hemilaminectomy for the treatment of holospinal epidural abscess: A single-center experience

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### ABSTRACT

**Background:** Holospinal epidural abscesses (HEAs) are rare with potentially devastating consequences. Urgent bony decompression and abscess evacuation with long-term antibiotic therapy are typically the treatment of choice.

**Methods:** We reviewed cases of holospinal HEAs operated on between 2009 and 2018. Variables studied included preoperative laboratories, CT/MR studies plus clinical and radiographic follow-up for between 34 and 60 postoperative months.

**Results:** We utilized skip hemilaminectomies to minimize the risks of segmental instability. Targeted antibiotic therapy was also started immediately and maintained for 6 postoperative weeks. MR/CT studies documented full radiographic and neurological recovery between 6 and 12-months later.

**Conclusion:** HEAs may be treated utilizing multilevel skip hemilaminectomies to help maintain spinal stability while offering adequate abscess decompression/resolution.

**Keywords:** Epidural abscess, Holospinal epidural abscess, Mini-invasive spine surgery, Skip hemilaminectomy

### INTRODUCTION

Holospinal epidural abscesses (HEAs) are rare with potentially devastating consequences. They typically occur in the sixth and seventh decades of life.<sup>[8,10]</sup> Their frequency ranges from 0.2 to 1.2 cases/10,000 hospital admissions, and their mortality rate is 15%.<sup>[8]</sup> Here, we successfully utilized skip laminectomies in four patients with HEAs and effectively provided abscess evacuation/decompression while preserving spinal stability.<sup>[9]</sup>

### MATERIALS AND METHODS

Four patients with HEAs had surgery between 2009 and 2018. The preoperative work-up included neurological evaluation and full laboratory studies (i.e., ESR, CRP, procalcitonin, and MR/CT assessment) [Table 1].

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**Table 1:** The baseline characteristics of patients.

ID	Sex	Age	Level of HEAs	comorbidities	Laboratory parameters	Etiology	Antibiotic therapy	Number of segments	Admission neurology	Number of hemilaminectomy	Postoperative neurology	Postoperative Frankel scale <sup>^</sup>	Operative time (minutes)
1	F	60	C-T-L	Diabetes pemphigus	CRP:125 mg/l ESR: 45 mm/h Pro-calc.: 15.7 ng/ml	<i>S. aureus</i> (MSSA)	Linezolid and meropenem	20	Quadripareisis/ bladder dysfunction	4 level left, 4 level right, 4 level left	Full recovery/24 h	E	200
2	F	56	C-T-L	Sepsis psoriatic arthritis	CRP: 203 mg/l ESR: 125 mm/h Pro-calc.: 43 ng/ml	<i>S. aureus</i> (MRSA)	Linezolid and meropenem	16	Quadripareisis/ bowel bladder dysfunction	4 level right, 4 level left, 4 level right, 4 level left	Full recovery/24 h	D	180
3	F	62	C-T-L	Diabetes	CRP: 143 mg/l ESR: 64 mm/h Pro-calc.: 57.3 ng/ml	<i>S. aureus</i> (MRSA)	Linezolid and meropenem	16	Quadripareisis/ bladder dysfunction	4 level left, 4 level right, 4 level left, 4 level right	Full recovery/36 h	E	140
4	M	77	C-T-L	Recurrent UTIs	CRP: 133 mg/l ESR: 73 mm/h Pro-calc.: 23.7 ng/ml	<i>E. coli</i> (ESBL)	Linezolid and rifampicin	15	Quadripareisis/ bowel bladder dysfunction	3 levels left, 4 levels right, 4 levels left, 4 levels right,	Full recovery/12 h	D	150

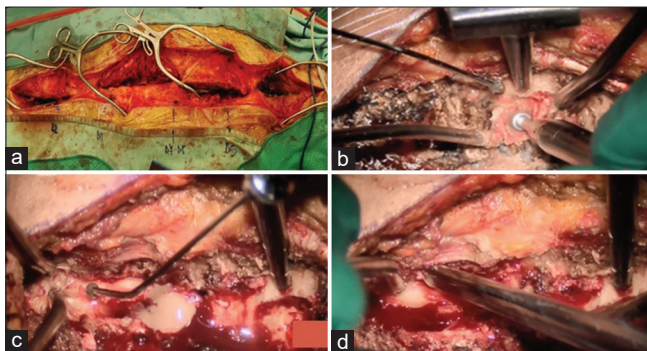
<sup>^</sup>Frankel scale: Grade A. Complete paralysis, Grade B: Sensory function only below the injury level, Grade C: Incomplete motor function below injury level, Grade D: Fair-to-good motor function below injury level, Grade E: Normal function. ESBL: Extended-spectrum beta-lactamase, MSSA: Methicillin-sensitive *Staphylococcus aureus*, MRSA: Methicillin-resistant *Staphylococcus aureus*, *S. aureus*; *Staphylococcus aureus*, *E. coli*: *Escherichia coli*

## Surgical technique

Surgery was performed, on average, within 6 h of admission. Although the incision spanned the entire abscess length, we utilized skip laminectomies to preserve spinal stability, avoiding performing full laminectomies at all levels. Four surgeons simultaneously operated at different levels; two initially started on the cervical region and then continued to the lower cervical/upper thoracic spine, while two other surgeons started on the contralateral side in the mid-lower thoracic region and proceeded to the lower lumbar levels [Figure 1a]. Hemilaminectomies never extended beyond four levels, leaving a residual bony bridge on each side of the transitional level; we preserved the inter- and supraspinous ligaments to maintain spinal stability<sup>[4]</sup> [Figure 1b]. All subjects underwent repeat holospine CT scan and MRI studies postoperatively, and all confirmed satisfactory abscess excision/drainage [Figures 1c and d]. Laboratory inflammatory indexes were reassessed 3 days after surgery and appropriately followed. In addition, all patients underwent 6 weeks of postoperative antibiotic therapy.

## Clinical data

Three females and one male averaged 62 years of age were included in the study. Their comorbidities consisted of diabetes mellitus (2), pemphigus under steroids treatment (1), recurrent UTIs (1), sepsis (1), and psoriatic arthritis (1) [Table 1]. Symptoms included diffuse nonlocalizing back pain of <24 h, bowel/bladder dysfunction, and acute rapidly progressive quadriparesis. Leukocyte counts were above 12,000 in two of four patients, while ESR, CRP, and procalcitonin levels were uniformly elevated [Table 1]. Preoperative MRI/CT scans showed diffuse cord compression



**Figure 1:** (a and b) Skin was incised along the midline and muscles were dissected subperiosteally and unilaterally. Hemilaminectomy never extended beyond four levels, leaving a residual bony bridge on each side. Care was taken to preserve the inter- and epi-spinous ligaments. (c) Collection removal was obtained by gentle suction of the fluid component and irrigation. (d) Sublaminar undercutting and contralateral flavectomy were added to allow contralateral abscess control.

in all patients; two had the most severe cervical cord compression while two others had maximal compression in the cervical/thoracic conus levels [Table 1] and [Figure 2].

## RESULTS

### Postoperative course

Following multilevel skip laminectomies, two patients experienced full symptoms regression within 48 h, and two others within 3 and 8 weeks postoperatively. MR imaging performed within 1 week after surgery uniformly confirmed complete evacuation of the collection [Figure 3].

### Organisms

Intraoperative cultures revealed methicillin-sensitive *Staphylococcus aureus* (one patient), extended-spectrum beta-lactamase-positive *Escherichia coli* (one patient), and methicillin-resistant *S. aureus* (two patients). Broad-spectrum antibiotics were started immediately after surgery and replaced by targeted therapy in two cases once microbiological sampling was received [Table 1].

### Follow-up and duration of antibiotic therapy

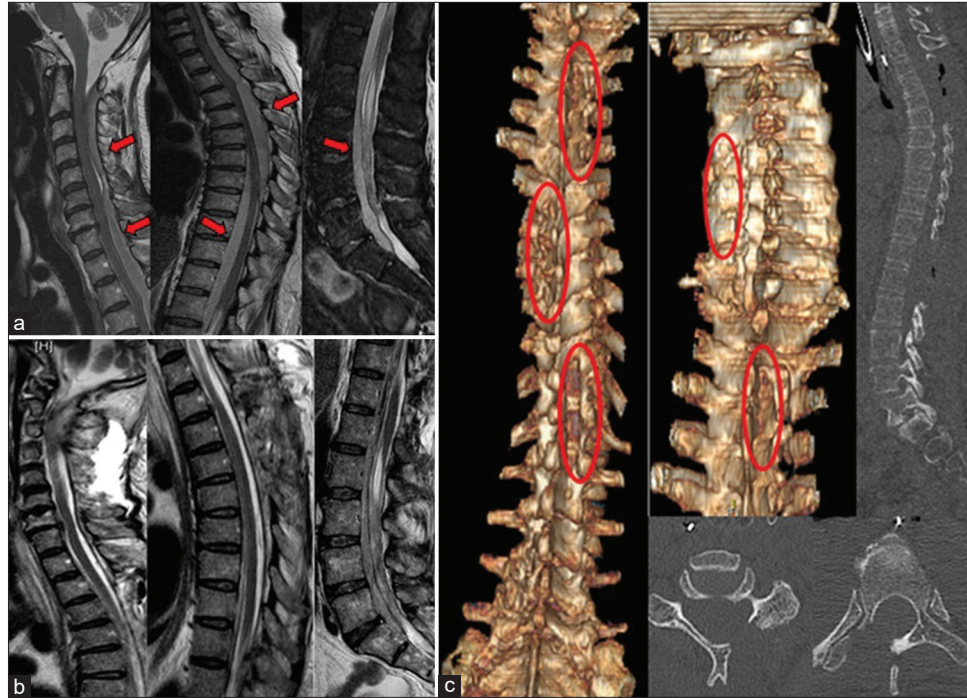
Patients underwent 6–12 months of standing postoperative holospinal X-rays plus an MRI and CT at 12 months, none developed instability [Figure 3]. Clinical follow-up was repeated every 3 months, and monitoring was stopped 36 months from surgery; none showed further clinical or radiographic evidence of abscess recurrence.

## DISCUSSION

HEAs are relatively rare, and early diagnosis and treatment are critical to achieve the best functional outcomes. Neurological deficits are typically due to direct mechanical compression and/or indirect vascular occlusion (i.e., septic thrombophlebitis).<sup>[3,6,7]</sup> Urgent surgical decompression in combination with long-term antibiotic therapy is the treatment of choice for extensive HEA, while conservative treatment rarely successful.

### Surgical options

Older reports described the use of extensive laminectomies or hemilaminectomies, but increased the risks of instability.<sup>[1,2,5,7]</sup> Alternatively, Proietti *et al.* effectively placed small catheters in the epidural space through multiple skip laminectomies and fenestrations, effectively managing HLAs.<sup>[8]</sup> In addition, multiple skip hemilaminectomies, as described by Börm *et al.*, effectively treated seven cases of epidural hematomas (i.e., unilateral removal of one lamina at every three levels for clot extension).<sup>[2]</sup>



**Figure 2:** (a) Contrast MRI T2 study documenting an extensive (C3-S1) purulent epidural collection, with severe cord components both at cervical and lumbar levels (red arrow). (b and c) A postoperative high-resolution computed tomography scan with coronal, sagittal, and 3D reconstructions (skip hemilaminectomy was marked by red circle) and a contrast MRI showed complete evacuation of HEA and spinal stability.



**Figure 3:** (a and b) CT and X-rays plus MRI study, performed 1 year later, confirmed no lesion relapse without evidence of instability.

### Skip hemilaminectomy (SH)

SH has the following advantage: preserving the entire spinous processes and posterior spinous ligaments while leaving the facet joints alone. They offer satisfactory exposure with safe removal of HSAs. They also minimize intraoperative blood loss and reduce the risk of spreading the infection to surrounding unaffected structures. Furthermore, as show in this case, they can be performed by

two teams of two spine surgeons/team addressing different contralateral levels.<sup>[4]</sup>

### CONCLUSION

HEAs are rare, and multilevel skip hemilaminectomies provide adequate decompression/abscess resection, while avoiding subsequent instability.

### Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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### Conflicts of interest

There are no conflicts of interest.

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