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Case report

Oblique corpectomy for treatment of cervical spine epidural abscesses: Report on four cases☆

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ABSTRACT

Background: Spinal epidural abscesses (SEAs) in cervical locations are particularly life-threatening. Currently, SEAs are widely treated with bony decompression, followed by internal stabilization in purulent osteomyelitis. However, recently, a growing number of studies have reported minimally invasive approaches without internal fixation.

Purpose: We describe four patients with cervical SEAs that were evacuated by oblique corpectomy (OC) without fusion.

Methods: This study included two women and two men (aged 44–90) that received operations for removing ventral cervical SEAs. All patients presented with progressively increasing myelopathy, and 3 had severe comorbid conditions. In all cases, a multilevel OC without fusion was performed. The amount of bone resection was tailored to fit the needs of granulation removal, with an effort to retain as much of the vertebral bodies as possible. Then, pus was evacuated and debridement of granulation was performed, followed by rinsing and drainage.

Results: The neurological status of 3 patients improved significantly after surgery. At the last follow-up examination, one showed full recovery, and in two a minor residual deficit persisted. During mean follow-up of 5.5 years, no internal stabilization was necessary. The oldest patient was tetraplegic, and had several concomitant diseases. That patient died from sudden cardiac arrest on the third postoperative day. Oblique corpectomy did not affect the anterior or posterior column. Additionally, it provided a broad view of the ventral aspect of the spinal canal.

Conclusions: Oblique corpectomy allows appropriate spinal cord decompression and granulation removal in the case of cervical spine epidural abscess, without sacrificing spinal stability.

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1. Introduction

Although spinal epidural abscesses (SEAs) are rare, and the mortality rate has significantly declined in the last decades of the 20th century [1], they pose considerable risk of severe neurological deficit and death [2]. SEAs in a cervical location are particularly life-threatening, because they run the risk of sudden deterioration. Early diagnosis and aggressive surgical treatment are essential in symptomatic cases. Currently, SEAs are widely treated with bony decompression, followed by internal stabilization (usually anterior fusion) in purulent osteomyelitis [3–8]. However, the need for instrumental stabilization remains questionable when the predominant problem is the abscess, and osteomyelitis is not a major issue. In some cases, extensive procedures may be unreasonable, considering the high frequency of severe comorbidities. Over the past few years, a growing number of studies have described less invasive approaches without internal fixation [9–12]. Here, we describe four patients with ventral cervical SEAs that were evacuated via an oblique corpectomy without fusion.

Table 1 – Summary of patients, symptoms, examinations and treatments.

	Patient N° 1	Patient N° 3	Patient N° 3	Patient N° 4
Age	44	64	54	90
Sex	F	F	M	M
Comorbid conditions	Sclerosis multiplex	Diabetes, hypertension, atrial fibrillation, cholelithiasis	No	Diabetes, HT, AF, CAD, chronic heart failure, rheumatoid arthritis, chronic renal failure
Neurological deficit on admission	No neurological deficit	tetraparesis, Frankel Grade C, urinary retention	Rapid deterioration up to tetraplegia, Frankel Grade B	Rapid deterioration up to tetraplegia, Frankel Grade B
Other symptoms	Neck pain	Neck pain	Neck pain	/–/
Duration of symptoms	1 month	1 month	7 days	10 days
C-reactive Protein	Not done	75	150	58
White blood cells level	14,200	8000	14,400	11,800
Fever	/+/	/–/	/+/	/–/
Extension of the abscess	C5–C7 (3 levels)	C6–C7 (2 levels)	C4–C5 (2 levels)	C4–C5 (2 levels)
Location of the abscess	Anterior to the spinal cord	Anterior to the spinal cord	Anterior to the spinal cord	Anterior to the spinal cord
Coexisting: – osteomyelitis – discitis – paravertebral tissues inflammation	Osteomyelitis C6, discitis C5/C6	Osteomyelitis C6-Th1, discitis C6/C7, purulent inflammation of paravertebral tissues at C3-Th3	Osteomyelitis C4–C5, discitis C4/C5	Osteomyelitis C4–C5, discitis C4/C5
Surgery details	Oblique corpectomy C5–C7, pus evacuation	Oblique corpectomy C6–C7, debridement of granulation tissue	Oblique corpectomy C4–C5, pus evacuation + debridement of granulation tissue	oblique corpectomy C4–C5, pus evacuation
Additional procedures	Drainage of epidural space	Drainage of paravertebral tissues from the posterior approach	Drainage of epidural space	Drainage of epidural space
Blood cultures	Negative	Negative	Negative	Negative
Pus cultures	*Staphylococcus aureus*	Negative	*Staphylococcus aureus*	Negative
Drainage	Rinsing drainage with saline solution	Rinsing drainage with saline solution	Rinsing drainage with saline solution	Rinsing drainage with saline solution
Duration of drainage maintenance	1 day	4 days	4 days	3 days
Antibiotic therapy	/+/	/+/	/+/	/+/
Short-term outcome	Full recovery	Improvement, Frankel Grade D	Improvement, Frankel Grade C	No improvement The patient died on the 3rd postoperative day.
Long-term outcome[a]	Full recovery Frankel Grade E	Stable, Frankel Grade D	Improvement, Frankel Grade D	Not applicable
Follow-up duration	110 months	62 months	26 months	Not applicable
Secondary spinal instability or kyphosis	No	Nonsignificant kyphosis, no need for internal fixation	No	Not applicable

[a] Frankel grading system: A – complete paralysis, B – sensory function only below the injury level, C – incomplete motor function below injury level, D – fair to good motor function below injury level, E – normal function.

2. Case reports

Four patients with cervical SEAs were treated with oblique corpectomy in our department over the last 10 years. The patient ages ranged from 44 to 90 years. All patients presented with symptoms of progressively increasing myelopathy. Two patients had severe medical comorbidities, and the third showed coexisting sclerosis multiplex (Table 1). All patients had multilevel cervical SEAs that were diagnosed with contrast-enhanced magnetic resonance imaging (MRI). No patient had significant spinal deformity, spinal instability, or severe osteomyelitic destruction before surgery.

2.1. *Operation*

A multilevel oblique corpectomy was performed with a technique described previously by George [13]. The patient was placed in a supine position, with head slightly rotated to the contralateral side. The vertical point of approach was planned based on preoperative MRI, and the correct levels were confirmed under fluoroscopy performed after the spine was exposed. To reach the lateral surface of the cervical spine, the longus colli muscle was divided along the transverse processes. The intervertebral foramina were opened with a Kerrison punch. The vertebral artery was exposed and partially mobilized. The drilling started from the lateral surface of the vertebral body and progressed toward the spinal canal unilaterally. A corridor 5–8 mm wide was created to reach the posterior longitudinal ligament. The range of bone resection was subsequently expanded, when necessary, toward the contralateral side of the anterior wall of the spinal canal. The range of resection was tailored to fit the needs of granulation removal, with an effort to retain, as much as possible (at least half), the vertebral body. The posterior longitudinal ligament was excised, and pus was removed with the granulated material. Specimens were collected for culture. In each case, two catheters were implanted for rinsing and draining the procedural area.

2.2. *Postoperative course*

Intravenous antibiotic therapy was administered for 6 weeks; then, oral antibiotic therapy was given for the following 6 weeks. Spine immobilization for 6 weeks with a semi-rigid cervical collar was recommended to control pain and to prevent kyphotic deformity. The three patients that survived received follow-up MRI to confirm sufficient spinal cord decompression. Postoperative computed tomography (CT) studies were performed to assess the extent of bony resection (Fig. 1). Functional radiographs were obtained in long-term follow-ups to check the stability of the cervical spine (Fig. 2).

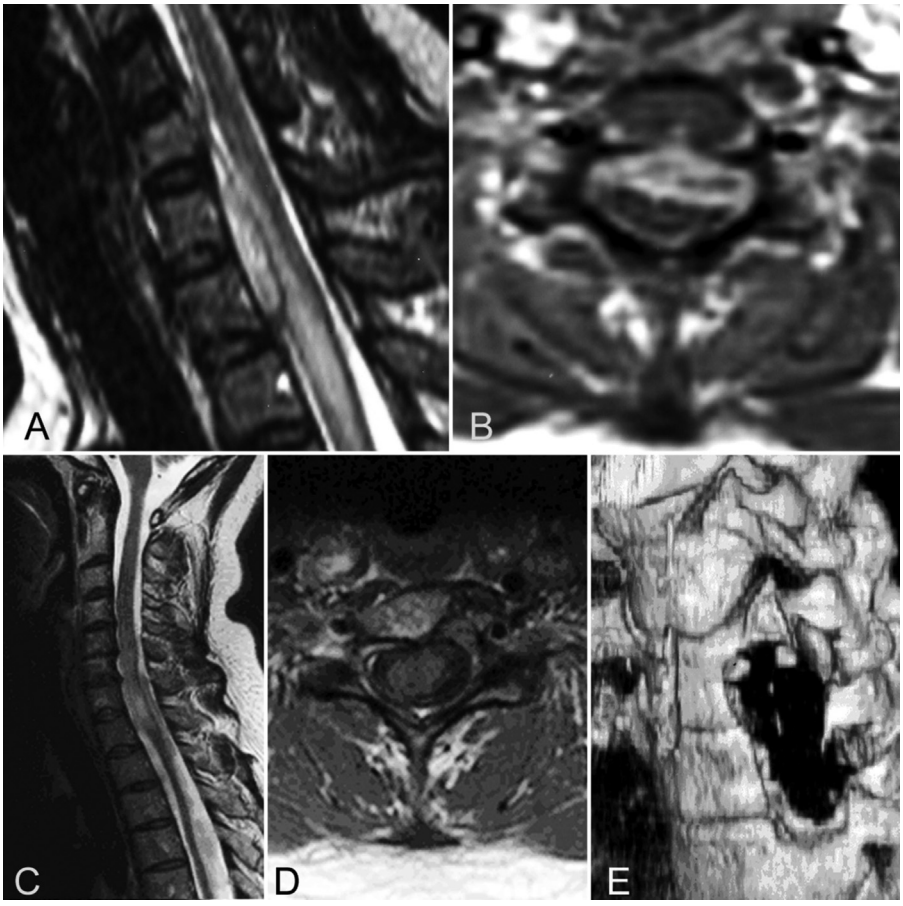

Fig. 1 – Case 1. (A and B) Preoperative MRI shows cervical spinal epidural abscess at the C5–C7 levels with significant spinal cord compression and myelopathy. (C and D) Follow-up MRI confirmed adequately decompressed dural sac and no kyphotic deformity. (E) The range of bony resection is visible in follow-up CT (anterolateral view from the left side).

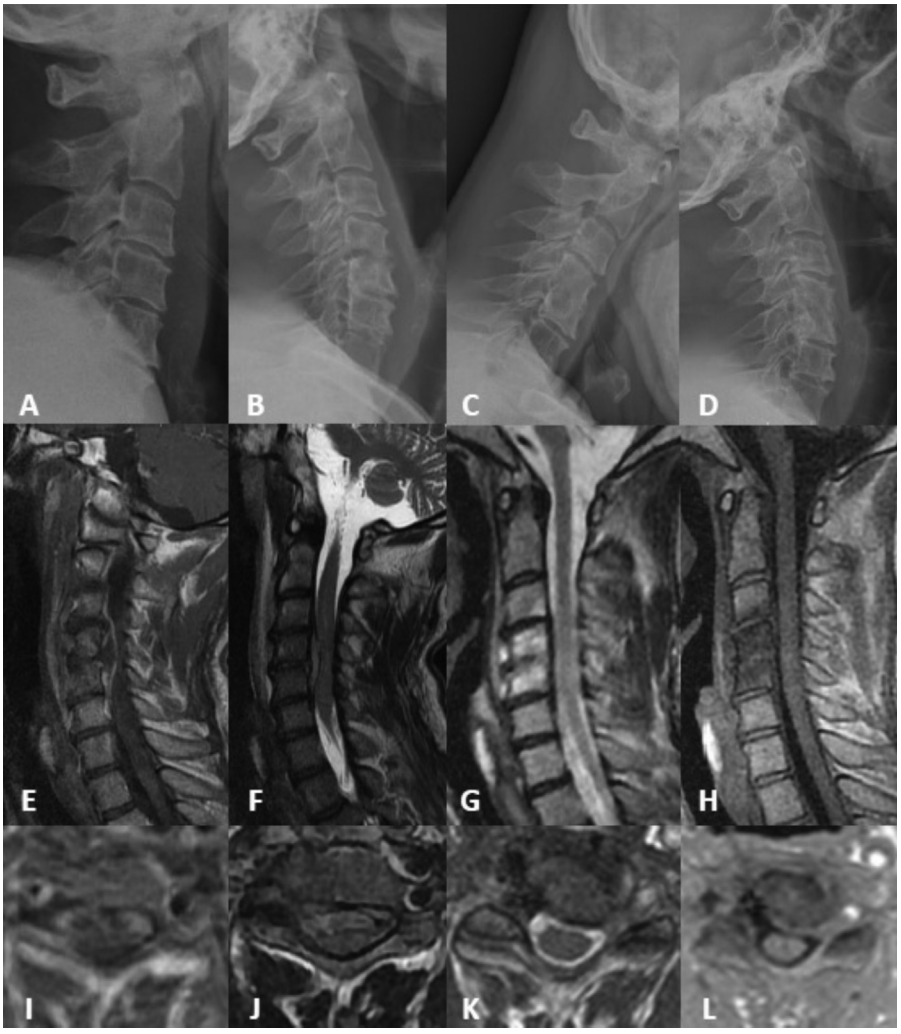

Fig. 2 – Case 3. Summary of imaging data. (A) Preoperative lateral radiograph. (B) 3 months follow-up extension radiograph. (C and D) 2 years follow-up flexion-extension radiographs. Note the spontaneous fusion at C4–C5 level. (E, F, I, J) Preoperative, contrast enhancement T1-weighted and T2-weighted MR imaging demonstrate SEA at C4–C5 levels with significant stenosis and myelopathy. (G, H, K, L) Follow-up MRI obtained 3 months post surgery. T1-weighted and T2-images show an effective spinal cord decompression and (K and L) narrow surgical corridor on the right side of the vertebral body.

Neurological status of the three surviving patients improved significantly and remained stable at the long-term follow-ups. Patient N° 1 fully recovered and was discharged to her home. Her follow-up exams (MRI and functional X-ray) were satisfactory. Patient N° 2 also improved and was referred for rehabilitation to the Neurology Department. Currently, she is self-reliant, with a minor residual deficit that does not influence daily life. A follow-up X-ray of the cervical spine revealed nonsignificant kyphosis; however, no clinical sequel has been noted during the 2-year follow-up period. Patient N° 3 was operated on after 21 h duration of tetraplegia but he significantly improved to the discharge (Frankel Grade C). At 2 years follow-up visit he was self-reliant with minimal right-sided weakness and could walk easily with one cane (Fig. 2).

One 90-year old patient with deep tetraparesis and many concomitant diseases died on the 3rd postoperative day due to cardiac arrest. The cause of death was not related to the surgery, but to a severe general condition.

Follow-ups ranged from 3 days to 9.2 years (mean 5.5 years). No recurrence of the abscesses was observed and no instrumental stabilization was necessary for any of the cases.

3. Discussion

Cervical SEAs located on the ventral surface of the spinal canal, particularly those with significant granulation, present a complex problem. In these cases, wide visualization of the ventral aspect of the spinal canal is necessary for adequate spinal cord decompression. However, extensive bone resection results in the need for internal stabilization. Spinal instrumentation following debridement and grafting (with autologous bone or allograft) is widely accepted for this condition [3–5,8]. However, it remains unclear whether asymptomatic bacterial colonization of implants poses a real risk of recurrent osteomyelitis or is a purely theoretical

problem [14–16]. In fact, this kind of complication has rarely been reported in clinical series [5]. Nevertheless, the complexity of the procedure should be considered in the context of the general condition of the patient, the feasibility of a less invasive treatment, and the risk posed by fusion procedures.

For these reasons, the use of less invasive approaches for treating spinal epidural abscesses has become more noticeable in recent years. In particular, they have been applied to abscesses located in the thoraco-lumbar spine and abscesses that required a posterior approach [9,17–19]. Other reports have described minimally invasive procedures for draining cervical SEAs [10–12,20].

Muzzi et al. described a drainage technique for a single-level anterior discectomy, where a silicone catheter was placed into the spinal canal for irrigation [12]. That procedure had the disadvantages of a very limited view into the spinal canal, a blind introduction of the catheter, and the inability to remove the solid part of the SEA. However, despite the absence of grafts, spontaneous vertebral fusion was noted, and spinal stability was maintained in all eight cases.

Deshmukh reported the use of a trough corpectomy for abscess evacuation form ventral cervical and upper thoracic spine [11]. The spinal canal was accessed via narrow midline corridor, through the vertebral bodies and discs. In the reported case, a SEA was resolved without compromising spinal stability. The author mentioned that the main drawbacks of that approach were the limited visualization of the spinal canal lumen and the limited ability to remove a granulomatous abscess.

The OC technique was developed by George Bernard more than 20 years ago [21]. This approach to the cervical spine did not compromise spinal stability, and it was most suitable for treating degenerative myeloradiculopathy. OC is indicated mainly for anterior spinal cord compression with a straight or kyphotic cervical spine. OC is contraindicated with the presence of spinal instability [13,22]. Therefore, we reasoned that oblique corpectomy would be appropriate for removing ventral cervical SEAs in selected cases. However, some additional points should be noted in regard to this particular entity. The OC should be also contraindicated with the presence of a kyphotic deformity due to osteomyelitic destruction or with extensive osteomyelitic involvement of vertebral bodies.

The advantages of the OC for SEA removal are that it does not require a very wide bony opening on the posterior end for drainage of the pus, and it can be tailored intraoperatively to any given situation. Furthermore, OC does not preclude the possibility of further instrumental fusion. For example, some authors advocated a two-staged procedure, where debridement with or without grafting is performed first; then, this may be followed by a delayed secondary instrumental fusion [6,23]. However, after the OC, secondary surgery may not be necessary. Thus, the OC provides the option of a ''wait-and-see'' approach after decompression.

A distinct advantage of OC over other minimally invasive approaches is the feasibility of granulation removal (Fig. 3.). Occasionally, the granulated component of an SEA is considerably large, consisting of two thick layers that cover the dural sac and posterior longitudinal ligament. Thus, it may be insufficient to simply lavage the liquid portion of a SEA. The pus can be easily distinguished from granulation in MRI scans. The pus is iso- or hypointense on T1-weighted images, and peripheral contrast enhancement indicates the extent of the granulation component.

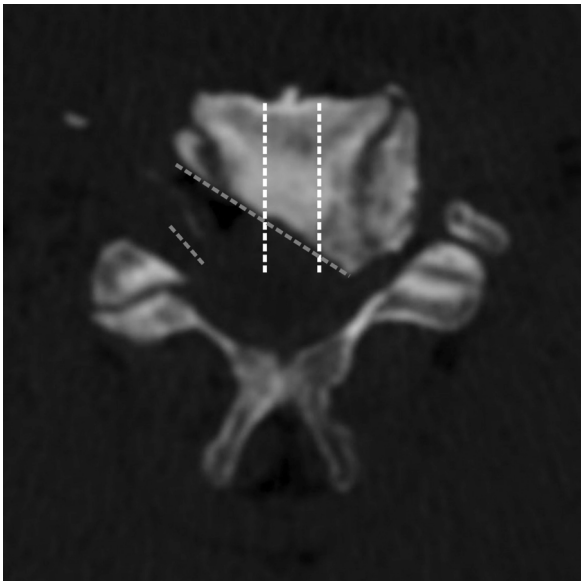

Fig. 3 – Schematic comparison of the two least invasive approaches for removing abscesses located on the frontal surface of the spinal canal. White lines – midline trough approach. Gray lines – oblique corpectomy. Note that the view into the spinal canal is much wider in the oblique corpectomy technique. It allows more accurate removal of the pus and the inflammatory granulation.

The two techniques mentioned above for SEA drainage without fusion can cause a slight secondary kyphosis [11,12]. In this study, one case developed a nonsignificant kyphosis following OC. However, to date, no clinical consequences were observed, and there has been no need for secondary stabilization.

In this study, the fourth, unsuccessful case should not be considered an argument against the OC procedure. This ninety year-old man exhibited severe neurological and poor general condition; he probably would have been disqualified from the surgery by many neurosurgeons. We decided to operate, because the less invasive OC approach was, compared to other options, the only chance for altering the predicted chain of events. Patients that present with paralysis have a very poor prognosis. In the series of Hlavin et al., five out of 7 patients with preoperative paralysis died, and no patient recovered neurological function [2]. Moreover, SEA is frequently associated with severe medical comorbidities [2,24]; this should be kept in mind when considering the best treatment option.

To our knowledge, this study was the first to describe the use of OC for SEA removal in a cervical location. Based on our findings, OC should be considered for patients with ventral cervical SEAs that cause neurological deficits, but no spinal instability or extensive osteomyelitic involvement. Our series was too limited to draw far-reaching conclusions, but this approach appeared to have some advantages; it did not affect

the anterior and posterior column, but it provided a broad view of the ventral aspect of the spinal canal. Therefore, adequate spinal cord decompression and granulation removal was possible without sacrificing spinal stability.

Conflict of interest

None declared.

Acknowledgement and financial support

None declared.

Ethics

The work described in this article has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans; Uniform Requirements for manuscripts submitted to Biomedical journals.

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