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Clinical Case Studies

Anterior transcorporeal full-endoscopic drainage of a long-span ventral cervical epidural abscess: A novel surgical technique



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A B S T R A C T

Background: A long-span ventral cervical epidural abscess is a rare and devastating condition. Typically, extensive procedures are chosen to deal with this condition and usually end up with limited cervical motion. Here, we describe a novel minimally invasive anterior full-endoscopic transcorporeal approach for drainage of large ventral cervical epidural abscess.

Case description: A 33-year-old man presented with seizures and acute weakness in all extremities persistent for 2 hours. His motor power of the upper and lower extremities was rapidly declined from grade III to grade 0 within 12 hours. Magnetic resonance imaging (MRI) showed a long-span ventral epidural abscess extending from C2 to T1, cervical spinal cord, and a retropharyngeal abscess. A typical anterior cervical approach to the prevertebral space was performed to evacuate pus from the retropharyngeal abscess, after which anterior transcorporeal full-endoscopic drainage of the large ventral cervical epidural abscess was successfully performed.

Outcome: The patient's motor power recovered to grade IV within 2 weeks post-operation. He had no neck pain or instability following the operation. Postoperative MRI and computed tomography revealed diminished epidural abscess.

Conclusions: For managing cases with a ventral-type cervical epidural abscess, anterior transcorporeal full-endoscopic drainage is an alternative minimally invasive method that yields sufficient debridement and drainage.

Background

Spinal epidural abscess is a bacterial infection characterized by the accumulation of purulent fluid and suppuration in the spinal epidural space [1]. The incidence has been reported as 0.2–2.8 cases per 10,000 hospital admissions per year [2,3]. Hematogenous spread is reported as the most common mechanism of infection (more than half of cases) [4,5]. However, the infectious source was reported to be identified in only up to 50% of cases despite complete investigation [6].

Infected individuals may present with fever, back pain, neck pain and stiffness, muscle weakness, radiculopathy, or bowel and bladder dysfunction with different durations of symptoms. Spinal epidural abscess remains a challenging condition as the various clinical manifestations make early diagnosis and planning of appropriate treatment to prevent further morbidity and mortality difficult.

Abscesses in the cervical spine are less common compared to those in the lumbar and thoracic regions but have a high risk of causing major neurological deficits, morbidity, and death [5,7]. Thus, prompt detection, diagnosis, and management of cervical spinal epidural abscess are

the most important prognostic factors that lead to successful resolution and prevention of complications from delayed treatment [8].

When patients present with sepsis, significant or progressive neurological deficits, instability, or failure of medical treatment, surgical intervention is indicated [4,9,10]. The goals of surgical treatment for cervical epidural abscess are infectious source eradication, adequate drainage of abscesses, debridement of necrotic tissue, spinal cord decompression, and stabilization in cases of instability [2,11,12,13].

Cervical epidural abscesses are more common in the dorsal than in the ventral areas, as they are likely to accumulate in larger epidural spaces that contain infection-prone fat [8,14]. Additionally, it is not uncommon for an epidural abscess to extend to multiple levels [15,16,17]. The conventional open surgical drainage for this condition is challenging, often invasive, has high rates of morbidity and mortality, and may lead to spinal instability. Ventrally located abscesses are particularly challenging and may necessitate an extensive multilevel anterior approach for decompression. Therefore, any minimally invasive techniques that are capable of adequately draining the pus and preserving cervical stability are highly beneficial for patients who suffer from this condition.

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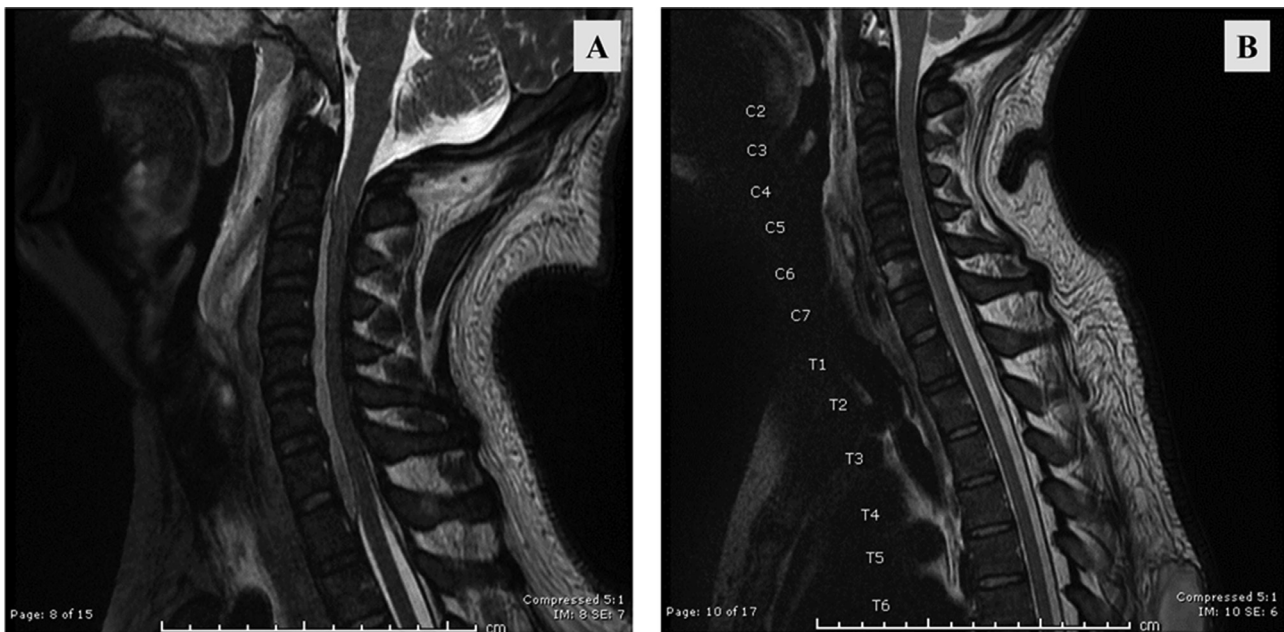


Fig. 1. Preoperative T2W-MRI showing a profound retropharyngeal abscess with long-span ventral cervical epidural abscess from C2-T1 (A). An immediate postoperative T2W-MRI showing significant reduction of pus collection at the anterior epidural space (B)
MRI: magnetic resonance imaging.

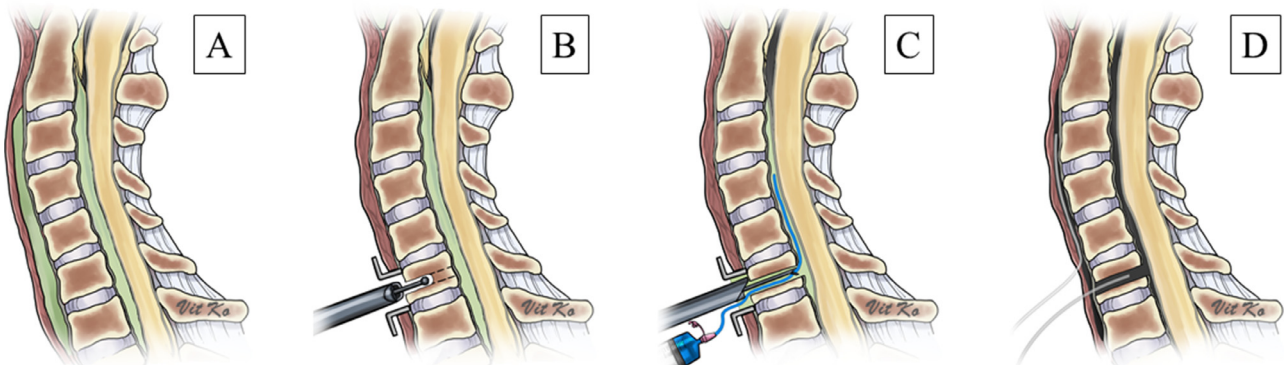


Fig. 2. Depicting the retropharyngeal abscess and long-span ventral cervical epidural abscess (A). Drilling of the C6 vertebral body (transcorporeal approach) after anterior debridement and drainage of the retropharyngeal abscess (B). Inserting the feeding tube in the ventral epidural space and irrigation (C). Placing drains after abscess drainage (D).

We report the case of a long-span ventral cervical epidural abscess that was successfully, safely, and effectively treated with anterior transcorporeal full-endoscopic drainage, a novel minimally invasive alternative method.

Case description

A 33-year-old man was brought to the hospital with acute seizures and weakness in all extremities experienced for 2 hours. He had type 1 diabetes mellitus and hypertension, which were poorly controlled.

Upon admission, neurological examination revealed grade III muscle power of the upper and lower extremities, hyperreflexia of the lower extremities, and the presence of abnormal upper motor neuron reflexes. After intracranial pathology was ruled out, emergent magnetic resonance imaging (MRI) showed a long-span ventral cervical epidural abscess from C2 to T1, compressing the central area of the cervical spinal cord. A retropharyngeal abscess was also noted (Fig 1A., Fig 2A).

The muscle power rapidly declined to grade I and he had sensory loss from C3 downwards within 6 h. At this point, emergent surgical intervention was warranted. After discussion with the patient and the

otolaryngologist, drainage via a typical anterior cervical approach to the prevertebral space was performed to evacuate pus from the retropharyngeal abscess. Subsequently, full-endoscopic drainage via the anterior transcorporeal approach was successfully performed.

Written informed consent was obtained from the patient prior to the operation. The procedure performed in study involving human participants was in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The Ethical Committee (EC) of the institution approved the study (EC number 33/2020).

Surgical technique

After general anesthesia was administered, the patient was placed in the supine position. A bolster pillow was placed under the cervical spine to achieve a normal lordotic curvature. Skin marking under fluoroscopic guidance was performed to identify the C5-6 intervertebral disc level where the highest amount of prevertebral abscess was noted.

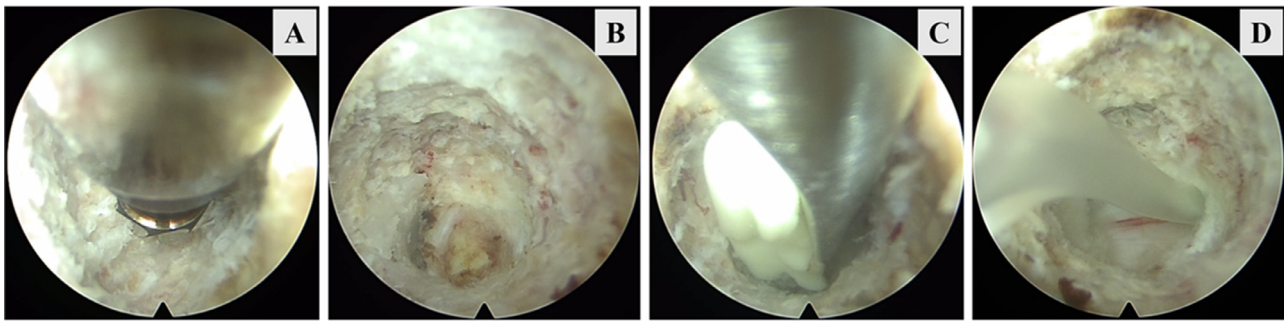


Fig. 3. Endoscopic view. Drilling via cervical vertebral body (A). Reaching the PLL (B). Pus breakout after entering the ventral epidural space (C). Irrigation via the passing NG tube (D)

PLL: posterior longitudinal ligament; NG: nasogastric.

A standard Smith-Robinson approach from the left side was used. In brief, a 4-cm skin incision was made, the platysma muscle was divided vertically, and the deep cervical fascia was incised to locate the plane between the strap muscles and the anterior border of the sternocleidomastoid muscle (SCM). Deep dissection was performed by dividing the pretracheal fascia medial to the carotid sheath. The medial structures (trachea, esophagus, thyroid, and strap muscles) were retracted medially, while the carotid sheath and SCM were retracted laterally using Army-Navy retractors.

The anterior cervical body plane was approached by exposing the swollen and inflamed tissue. A careful blunt dissection was performed, and the pocket of pus (approximately 20 mL) was thoroughly debrided after collected for gram staining, culture and sensitivity test.

The center of the C6 vertebral body was marked. Then, a full endoscopic system was assembled (RIWOSpine GmbH, Germany). Under fluoroscopic and endoscopic guidance, anterior drilling was performed using a 2.5 mm cutting tip and a diamond tip burr (Fig. 2B, 3A). During the tunneling process, intraosseous bleeding was managed with bipolar radiofrequency cautery, bone wax, and physical compression. The tunnel was enlarged to allow for endoscope insertion.

The posterior edge of the C6 body was reached before the posterior longitudinal (PLL) ligament was encountered (Fig. 3B). A dissector and hook were used to penetrate the PLL, exposing the stream of flowing exudative fluid in the tunnel (Video 1, Fig. 3C). Further resection of the PLL tissue was performed until adequate space was observed. An 8F nasogastric (NG) tube was inserted outside the endoscope working cannula through the tunnel. Using a pituitary rongeur, the tip of the NG tube was carefully passed between the PLL and the spinal cord (Fig. 2C, Fig. 3D). Normal saline was used as the irrigation fluid, pushing via the NG tube, while endoscopic fluid irrigation was temporally clamped (Video 2).

Advancement of the NG tube was performed gradually (Video 3) until the tip of the NG tube reached the most cranial or caudal part, where the length of the NG tube inserted was in concordance with the extent of pus measured from the preoperative MRI. The endpoint of irrigation was determined by the irrigation fluid characteristics, which showed no turbid appearance. A drain was placed, and the skin was closed in a subcutaneous fashion (Fig 2D).

Outcome

With a multidisciplinary team approach, proper blood glucose control, intravenous antibiotic therapy (adjusted to the culture and sensitivity test), dental and oral hygiene management, rehabilitation, and family counseling and support, the patient's muscle power had recovered to grade IV and sensory returned to near normal within 2 weeks after the operation. The patient had no neck pain or instability following the procedure.

The early postoperative computed tomography (CT) and MRI scans (Fig 1 B) revealed no remaining collection in the epidural space, increasing the space available for the spinal cord, thus correlating with the clinical improvement of the patient.

Discussion

To the best of our knowledge, this is the first published report with a detailed surgical technique description and demonstration of a full endoscopic method to drain a ventral cervical epidural abscess via a transcorporeal approach. However, there are few reports of the endoscopic technique having been used to drain ventral epidural abscess in the cervical, thoracic, and lumbar segments [11,18,19]. Owing to the fact that the patient had a retropharyngeal abscess, which needed to be drained from the anterior approach, and the collection was located at the ventral side of cervical spinal cord, an anterior approach was the preferred surgical option in this instance.

Spinal epidural abscess is a spinal emergency condition due to serious, life-threatening consequences from delayed diagnosis and treatment, such as irreversible neurological damage, sepsis, or death. Infection of the cervical spine is less frequently involved but is more devastating due to major neurological deficits; therefore, prompt early surgical drainage of a cervical epidural abscess followed by antibiotic therapy is generally recommended to avoid serious complications.

However, multilevel cervical epidural abscesses are not uncommon, especially in immunocompromised patients. In these patients, conventional extensive surgical drainage has a high risk of complications such as bleeding, long operative time, development of cervical instability, postoperative neurological deterioration, or other systemic problems [18]. Therefore, a number of various minimally invasive techniques for epidural abscess drainage have been described in the literature.

Percutaneous CT-guided needle aspiration was demonstrated by Lyu et al [20]. A patient with multilevel epidural abscess extending from the lower cervical to lumbar spine was successfully treated with CT-guided posterior needle aspiration. This technique is not suitable for ventrally located epidural abscesses, and intraoperative CT is suggested to avoid dural puncture and subsequent development of meningitis. A limited laminectomy combined with the use of small-diameter silicon epidural catheter irrigation was proposed to limit the need for extensive procedures [6]. However, possible limitations of this strategy include chronic infection with thick pus and adhesions, patients with extensive spinal stenosis, or abscesses located anterior to the spinal cord.

In cases of ventral cervical epidural abscess, anterior debridement is generally preferred to directly access the pathology [19]. Many different approaches have been demonstrated, such as anterior corpectomy, partial corpectomy, discectomy, posterior approach, or other minimally invasive methods [19,21,22,23,24]. The transpedicular approach was proposed [3] to gain access to the ventral epidural space posteriorly. This approach was completed by burring the medial aspect of the pedi-

cle to expose the ventral epidural space without any dural retraction. However, this technique is extensive and inevitably followed by cervical instability, which warrants instrumentation.

Microscopic and endoscopic techniques for cervical epidural abscesses have also been proposed. Recently, Chang et al. [11] demonstrated the full endoscopic removal of a dorsal cervical spinal epidural abscess extending from C4–7. The endoscope was inserted through the posterior cervical muscles to expose the C5–6 interlaminar space. With the advantages of the full endoscopic method, rapid recovery was observed; however, this technique is suitable only for dorsally located cervical epidural abscesses. Muzii et al. [7] performed a single-level anterior microsurgical discectomy to drain a ventral cervical epidural abscess using a silicone catheter. After incising the PLL, a 1.5 mm silicone catheter was inserted through the disc space, caudally and cranially, into the anterior epidural space to continuously lavage and remove the pus. The authors did not perform arthrodesis after abscess drainage. The proposed technique is simple, practical, and effective. However, there may be long-term consequences of cervical discectomy without fusion, such as early cervical disc degeneration or cervical instability.

Typical corpectomy or discectomy may cause postoperative instability requiring fusion and instrumentation, leading to a decrease in cervical motion. However, the presented novel technique resulted in minimal blood loss, less operative time, and early postoperative ambulation, without warranting the need for cervical fusion or instrumentation, thus preserving cervical motion. In addition, the endoscopic transcorporeal approach has proven to result in defect hole remodeling after operations [24]. The adequacy of the drainage should also be considered. Although the long-span abscess was approached by only a small hole via the vertebral body, we were able to pass a small NG tube to flush and debride the pus along its extent, which was monitored and confirmed by the subsidence of the abscess on postoperative CT scan and MRI.

Using the endoscope for surgical drainage of the cervical epidural abscess has other advantages. Infected individuals are typically elderly with multiple comorbidities or are immunocompromised. These patients cannot tolerate extensive procedures, such as corpectomy, multilevel laminectomy, and instrumentation. However, certain limitations are worth mentioned, such as, availability of the endoscopic system, long and steep learning curve, and adequacy of drainage.

Conclusions

The presented novel technique of anterior transcorporeal full-endoscopic drainage of a ventral cervical epidural abscess is feasible and yields satisfactory results and outcomes while sparing cervical motion after surgery.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author Declaration Statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed patient consent

The authors declare that informed patient consent was taken from the patient or family member.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.nxnsj.2021.100052.

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