International Medical Case Reports Journal

Dovepress
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CASE REPORT

Retrograde Surgical Placement of a Thoracic Epidural Catheter in a Patient Undergoing Combined Thoracic and Spinal Surgery

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Abstract: Epidural anesthetic techniques for postoperative analgesia are rarely considered in spinal surgery, and high thoracic epidural analgesia (TEA) is considered medically risky. We present a successful case of surgical retrograde placement of a thoracic (T6-T7) epidural catheter under direct surgical visualization via T2 laminectomy in a patient who underwent combined thoracotomy and spinal surgery. TEA was confirmed by epidurogram, provided adequate postoperative pain relief, and the patient was discharged home three days post-surgery.

Keywords: thoracic epidural analgesia, retrograde, laminectomy, thoracotomy

Introduction

Midthoracic epidural analgesia (TEA) is a standard regional technique used for postoperative pain management in patients undergoing thoracotomy. However, high thoracic analgesia at T1-T2 is considered medically risky because of the increased risk of cardiovascular and respiratory complications.[1] Epidural analgesia has been controversial for postoperative pain management in patients undergoing major spinal surgery due to concerns of postoperative seroma formation, wound infection near the surgical incision, and potential interference with postoperative neurological monitoring. Despite these concerns, some advocate for epidural catheter placement under direct visualization by the surgeon at the end of open complex spine surgery, using a low concentration of local anesthetics to minimize the influence on the early postoperative neurological exam.[2–4] This has been reported to provide excellent pain control, reducing opioid consumption, and improving patient satisfaction.[5] In patients undergoing combined thoracic and spinal surgery, TEA technique is rarely considered. However, excellent analgesia is necessary to facilitate pulmonary rehabilitation and to promote postoperative physical therapy. Herein, we present a successful case of surgical retrograde placement of a T6-T7 thoracic epidural catheter (TEC) under direct surgical visualization via T2 laminectomy in a patient undergoing combined thoracic and spinal surgery.

Case Report

Introduction

The patient was a 52-year-old man with a left apical lung schwannoma measuring 9.5 cm x 9.6 cm x 13.5 cm. The mass was thought to arise from the T2 nerve root with erosion of the left second rib, complicated by compressive atelectasis of the left lung and chronic left-sided pleural effusion (Figure 1). This type of spinal tumor, known as a "dumbbell shaped tumor", comprises 6–14% of all spinal tumors; however, the majority of these tumors do not require a combined thoracic and spinal approach.[6] The patient underwent a left extended posterolateral thoracotomy with attempted tumor dissection and T2 laminectomy with transection of the left T2 nerve root. Preoperatively, the patient was opioid naïve and

Received: 3 April 2025
Accepted: 28 June 2025
Published: 3 July 2025

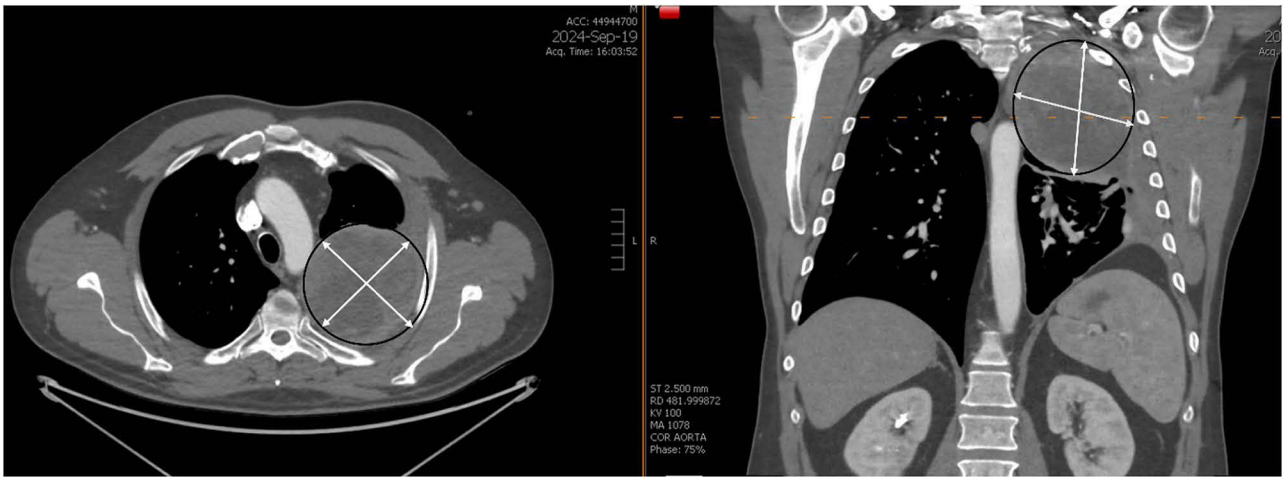

Figure 1 The location and size of left apical lung schwannoma. Black circle outlines the approximate border of the tumor with white arrows showing dimensions of the tumor (9.5cm x 9.6cm x 13.5cm).

minimally affected by pain related to his lung mass. His primary complaint that prompted further workup was exertional dyspnea. Other medical history was notable for obesity (115 kg, BMI 32) and thyroid cancer status post total thyroidectomy several years prior.

Surgical Details

On the day of surgery, a preoperative thoracic epidural was proposed for postoperative pain management given the anticipated surgical pain associated with thoracotomy. However, because the surgery would also involve the spine, it was deferred to avoid interrupting the surgical field. Instead, the surgical and anesthesia teams discussed the placement of a thoracic epidural intraoperatively with the patient. The benefits, risks, and alternatives were discussed with the patient and written informed consent was obtained from the patient. Intraoperatively, the patient received general anesthesia with an endotracheal airway. Left posterolateral thoracotomy was performed at the T4-T5 intercostal space, with chest tube placement at T5-T6. A separate posterior incision was made to expose the spinous processes of C7-T2 and to perform a left-sided muscle takedown, hemilaminectomy that exposed a mass visible at the T2 foramen, and transection of the T2 nerve root distal to the dorsal root ganglion. (Figure 2; markers A–C). Extensive tumor invasion and fibrosis prevented safe resection of the mass; therefore, tumor dissection was aborted. Prior to closure, the neurosurgeon (a senior resident, under supervision of attending neurosurgeon) placed a TEC directly into the epidural space via T2 laminectomy and then threaded the catheter caudally approximately 10 cm to the level of T6-T7, using sterile technique. The TEC was tunneled away from the incision and secured with sterile dressing to the skin at 18 cm (Figure 2, marker D).

Pain Management

Table 1 illustrates the total consumption of pain medications (including TEA) during the perioperative period. The patient received fentanyl and ketamine intraoperatively. The thoracic epidural infusion of bupivacaine 1/16% was initiated at a rate of 6 mL/hr after placement at the end of surgery. The patient was extubated uneventfully at the end of the surgery and recovered in the post-anesthesia care unit (PACU).

During the immediate postoperative period in the PACU, the patient received intravenous hydromorphone and oral oxycodone. The epidural sensory levels were tested with sharp and cold stimuli and demonstrated sensory block at the levels of T4-T7, predominately left-sided. The bupivacaine 1/16% infusion rate was increased to 8 mL/hr. Shortly after arriving to the acute care floor, the patient developed symptomatic orthostatic hypotension (MAP < 65) that improved with a reduction in the epidural infusion rate to 6 mL/hr and IV fluid administration. The multimodal postoperative pain regimen, in addition to the epidural, included scheduled acetaminophen, as-needed oxycodone, and as-needed methocarbamol.

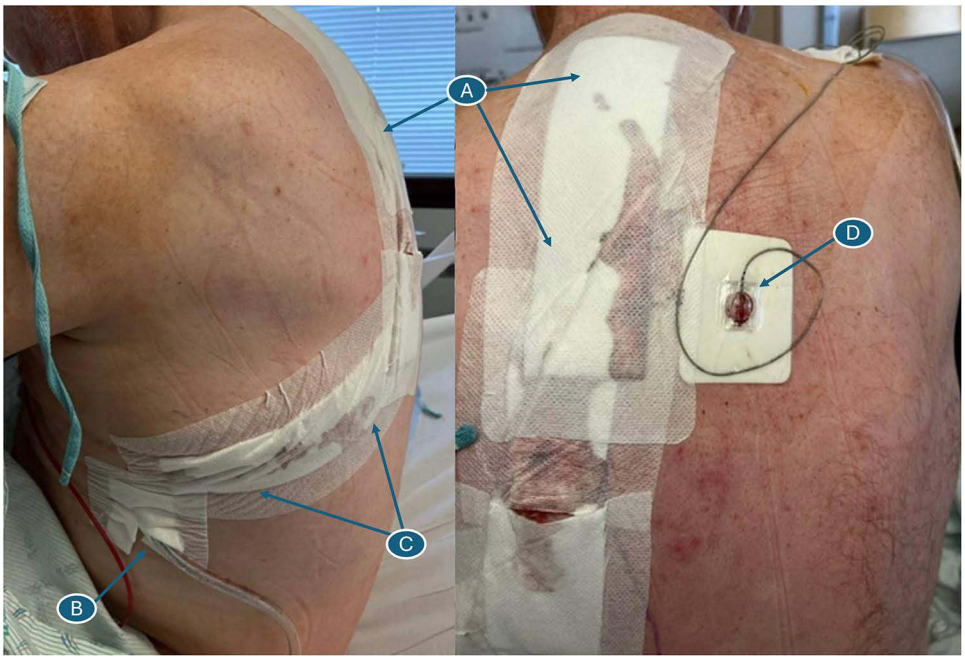

Figure 2 The surgical incisions of combined thoracic and spine surgery, and the exit site of thoracic epidural with sterile dressing. (**A**) Spine incision. (**B**) Chest tube placement. (**C**) Thoracotomy incision. (**D**) Epidural exit site.

On postoperative day (POD) 1, an epidurogram was completed to verify the position of the epidural catheter, which confirmed that the epidural tip retrogradely ending at T6-T7 (Figure 3, markers A and B), with appropriate contrast spread between T3-T9 (Figure 3, markers C and D). A sensory examination revealed a predominant left-sided sensory block at the levels of T4-T7 when tested with sharp and cold stimuli. Notably, the patient also had decreased sensation at the left T1-T2 levels, as expected status post left T2 nerve root transection. The patient primarily reported pain surrounding the thoracotomy surgical site near chest tube insertion. The pain was tolerable and did not interfere with functional progression. He was able to demonstrate a tidal volume of 2500mL on incentive spirometry. Symptomatic

Table 1 This Table Illustrates the Total Amount of Pain Medications the Patient Received in the Perioperative Period Including TEA, IV Hydromorphone, Other IV and PO Opioids, Acetaminophen (APAP), Ketamine and Other Adjuncts

	TEA	IV Opioids	PO Opioids	APAP	Ketamine	Adjuncts
Pre-op	–	–	–	–	–	–
Intra-op	Bupivacaine 1/16% at 6mL/hr	Fentanyl 200mcg	–	1gm IV	0.1mg/kg/hr	–
Immediate post-op in PACU	Bupivacaine 1/16% at 6–8mL/hr	Hydromorphone 1mg	Oxycodone 10mg	1gm PO	–	–
POD #1	Bupivacaine 1/16% at 8mL/hr	–	Oxycodone 40mg	4gm PO	–	Methocarbamol 1000mg
POD #2	Bupivacaine 1/16% at 12mL/hr	–	Oxycodone 20mg	4gm PO	–	Methocarbamol 500mg
POD #3	Discontinued in morning	–	–	4gm PO	–	–
Discharge medications	–	–	–	–	–	–

Abbreviations: TEA, thoracic epidural analgesia; IV, intravenous; PO, per os; APAP, acetaminophen; PACU, post-anesthesia care unit; POD, postoperative day.

https://doi.org/10.2147/IMCRJ.S532166

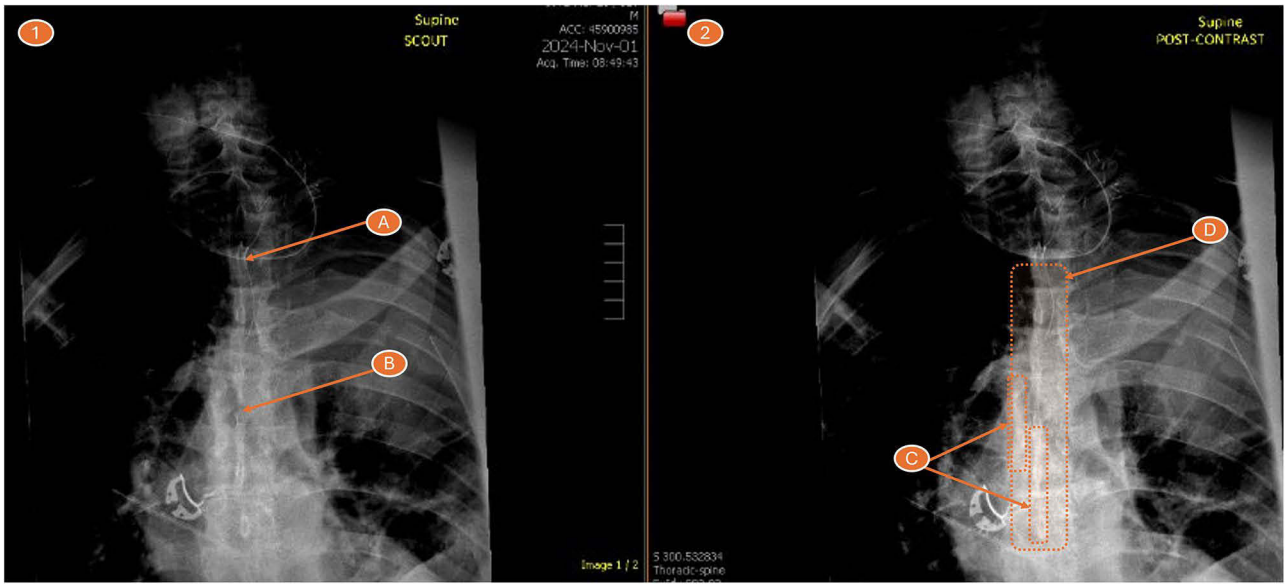

Figure 3 The postoperative epidurogram demonstrating pre- (1) and post- (2) contrast T-spine X-ray. (**A**) Epidural catheter insertion site (T1-T2). (**B**) Epidural catheter end site (T6-T7). (**C**) Concentrated areas of contrast. (**D**) Contour of contrast spread within spinal canal between T3-T9.

orthostatic hypotension initially limited the increase in epidural rate; however, this improved with oral intake. Therefore, the infusion rate was gradually increased over POD 1–2. The patient reported satisfaction with pain control with minimal supplemental opioid use.

Outcome

The epidural infusion was discontinued in the morning on POD 3, the TEC subsequently removed, and the patient was discharged home that day. The patient was discharged with 25 tablets of 5 mg oxycodone, along with acetaminophen and methocarbamol; however, upon outpatient follow-up both one day post-discharge and two weeks post-discharge, the patient reported tolerable residual postoperative pain and was not amenable to take any pain medication due to opioid sensitivity (constipation and drowsiness). The patient was able to take full breaths and walk with little or no pain. Furthermore, there were no late-onset complications reported at eight months post-surgery.

Discussion

Thoracotomy is considered to be one of the most painful surgical procedures. Incisional pain after posterolateral thoracotomy is severe, primarily due to the division of the latissimus dorsi and serratus anterior.[6] Patients undergoing thoracotomy are known to have a high incidence of postoperative complications, such as atelectasis and pneumonia from pain inhibiting coughing, longer length of hospital stay, and slower functional recovery.[7,8] Therefore, TEA is considered the gold standard for managing thoracotomy-related pain.[9,10] However, high thoracic analgesia at T1-T2 is considered medically risky due to potential ventilatory depression from the cephalic spread of local anesthetic blocking the phrenic nerves; therefore, it is not recommended.

The effectiveness of epidural analgesia was also demonstrated as the primary component of multimodal analgesia after major spinal surgery. Surgical anterograde placement of the epidural under direct visualization was utilized by the surgeon at the end of surgery.[2] However, this approach is not favored by many neurosurgeons because of concerns about sensory impairment and motor weakness that interfere with the postoperative neurological examination.[4] There is also a higher risk of postoperative seroma formation or wound infection near the surgical incision.

Other regional anesthetic techniques gaining interest for postoperative pain control after spine surgery include thoracic paraspinal blocks, such as the erector spinae plane block (ESPB). The pre-operative single bolus ESPB was not considered for this case as it has shown to only provide effective postoperative analgesia for 24 hours, compared to

no block, in patients undergoing lumbar surgery, with low-grade quality of evidence compromising the findings.[11] A continuous infusion ESPB via fascial plane catheter would also not be appropriate given its proximity and abutment with the surgical field when placed perioperatively. In addition, the disruption of the fascial plane during surgery would limit the extent of local anesthetic distribution along this space for effective postoperative pain control. Furthermore, the thoracic paraspinal block has unreliable analgesic coverage of the thoracotomy incision. Therefore, in this patient undergoing combined thoracic and spine surgery, where high postoperative pain management is anticipated for greater than 24 hours, epidural analgesia remains the gold standard for postoperative pain management.[9,10,12]

There is a paucity of literature regarding epidural analgesia for combined thoracic and spinal surgery and there are no reports on the use of retrograde surgical epidural placement of a TEC for postoperative analgesia. Here, we present a unique case of T6-T7 TEC successfully placed retrograde via a high thoracic entry point (T1-T2), under direct visualization by the surgeon after T2 laminectomy, and excellent TEA as the primary opioid-sparing pain regimen in a combined thoracic and spine surgery. Given the novelty of this technique, the patient selection for this unique approach should be judicious. For instance, this approach requires direct access to the epidural space, which is only applicable to patients undergoing surgeries that would expose the epidural space, such as laminectomy. In addition, retrograde placement of the catheter requires an experienced surgeon to perform the procedure in the epidural space, with minimal disruption. In patients undergoing extensive spinal surgery with multiple levels of laminectomy, posterior fusion with hardware, known intraoperative dural tears, and/or the need for intensive postoperative neurological monitoring, this approach may not be ideal. Furthermore, this approach requires thorough interdisciplinary discussion and planning, surgical competence in the retrograde placement of TEC, epidurogram confirmation, and close monitoring of both neurological deficits and analgesic benefits to ensure patient safety.

Conclusion

An epidural catheter can be safely placed retrograde via direct visualization by the surgeon from an upper thoracic (T1-T2) starting point to a middle thoracic (T6-T7) site to provide targeted analgesia in a small subset of surgical patients undergoing combined thoracic and spinal surgery, with minimal epidural disruption. This report demonstrates the feasibility of retrograde TEC technique in select patients, thereby solving the analgesic conflict for combined thoracic and spinal surgery by avoiding high thoracic TEA risks and offering an opioid sparing approach for sensitive patients.

Ethics Statement

Health Insurance Portability and Accountability Act (HIPAA) authorization for this case report was obtained from the patient and uploaded to the patient's online medical records. In addition, written informed consent for the publication of patient details, including images, was obtained from the patient and is available upon request. No institutional approval was required to publish the case details.

Disclosure

The authors report no conflicts of interest in this work.

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