



CASE REPORT

Dual epidural catheters for labor analgesia in a spinal cord injury patient: a case report



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Abstract Impediment to local anesthetic solution in the epidural space results in unsatisfactory pain relief during labor epidural. Patients with a history of back trauma and spinal instrumentation have increased rates of epidural failure due to patchy spread of local anesthetic with obliterated epidural space. Dual Epidural Catheters (DEC) can be used in such clinical scenarios with complete labor analgesia and improved patient satisfaction. We present the successful management of a parturient with vertebral fracture at risk for epidural failure and neurologic injury due to bone fragments and inserted cranial and caudal to the fractured vertebra using ultrasound to avoid neurologic sequelae.

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Introduction

Spinal Cord Injury (SCI) is a rare but devastating outcome of traumatic injury that involves the spine. The National Spinal Cord Injury Statistical Center (NSCSC) estimates that the annual incidence of SCI is approximately 54 cases per million in the US.¹ The most common causes of SCI are motor vehicle crashes, followed by falls, acts of violence such as gunshot wounds, and sport/recreational activities. As of 2016, 80% of these new cases of SCI were in males and the average age at the time of injury was 42 years old. This makes obstetrical patients with spinal cord injury an uncommon occurrence.

While spinal cord injury is infrequently encountered in the obstetric population, its presence does have some

significant impacts on anesthetic management of pregnant patients. One significant concern that can manifest itself unpredictably is the potential for sympathetic hyperreflexia also known as autonomic dysreflexia, which is caused by damage to the thoracic sympathetic chain, most commonly, although not exclusively, with lesions above T6.² Although patients may be insensate below the level of the spinal lesion, noxious stimuli such as uterine contractions with labor can cause potentially life-threatening hypertension and bradycardia due to disruption of the sympathetic and parasympathetic balance.

Another consideration in obstetric patients with spinal cord injuries is the potential effects on neuraxial anesthesia because of anatomical barriers in the epidural space to allow free flow of the local anesthetic solution. Scar tissue and other changes resulting from the injury increase the risk of failed epidural due to either mal positioning of the tip of the

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epidural catheter or due to prevention of uniform spread of local anesthetic solution within the epidural space.³

During labor, pain progresses along the lower thoracolumbar region depending on the stage of labor. During the first stage of labor, painful uterine contractions are transmitted via the T10 to L1 spinal segments as visceral pain. As labor progresses to the second stage, stretching and pressure on the uterine cervix transitions the pain to the S2–S4 spinal segments combined with the T12 to L1 segments as somatic pain. Pain of second-stage labor is not only more intense but these thick nerve roots are further from the tip of the epidural catheter which may result in sacral sparing with inadequate analgesia during the second stage of labor.³

We report a case of a patient with a history of a fractured L3 vertebra for labor analgesia at risk for epidural failure with a single catheter, managed successfully with Dual Epidural Catheters (DEC). A written informed consent was taken from the patient for publication.

Case report

A 19-year-old primigravid female who presented at 39 weeks gestation for induction of labor. The patient was 154.9 cm tall (5'1") and weighed 79 kg (174 lb). She had a history of paraplegia from a self-inflicted abdominal gunshot wound at the L3 spinal level. At the time, the patient had been submitted to an exploratory laparotomy with splenectomy and bowel resection. The patient had a past medical history of depression and functionally used a wheelchair to move around, but stated that she did have some motor strength in her left lower extremity greater than right lower extremity. Due to her immobility, the patient was on prophylactic enoxaparin for the duration of her pregnancy. The patient also noted that she had urinary incontinence but did not require straight

catheterization. The patient was being treated for pyelonephritis during pregnancy with nitrofurantoin.

Upon examination of her outside medical records, the patient's most recent Computer Tomography (CT) scan had showed comminuted fracture of the L3 vertebra and noted a focal mild kyphotic curvature centered at L3. Mild retropulsion of osseous fragments as well as scattered discrete punctate densities, presumably osseous fragments, within the spinal canal were also noted with narrowing of the spinal canal at L3. On physical examination, the patient did have complete numbness at the L3 and L4 level on the right side, had 2/5 strength for dorsiflexion and plantar flexion on the right and 4/5 strength on the left. The patient said that she was not able to regularly ambulate and generally moved in a wheelchair. The patient desired labor analgesia and was counseled extensively regarding the potential increased risk of ineffective analgesia and increased risk of complications. The risk and benefits of alternative analgesic techniques, including dual epidural catheter placement, single or continuous spinal anesthesia, nitrous oxide, intravenous opioid administration, and pudendal block were discussed thoroughly with the patient and her family. To provide effective, safe analgesia throughout all stages of labor as well as to avoid any injured structures or anatomic barriers in the epidural space, a mutual decision was made to place two separate epidural catheters, one above and one below the level of the patient's spinal lesion. In order to accurately visualize and avoid the comminuted fractures present at the patient's L3 level, ultrasound was used to visualize the patient's spine (Fig. 1), and the patient's vertebral levels were marked with a surgical marker on onto the patient's back (Fig. 2).

Once the patient's anatomy was adequately visualized and marked, the epidural catheters were sequentially placed with standard technique. Upper epidural catheter

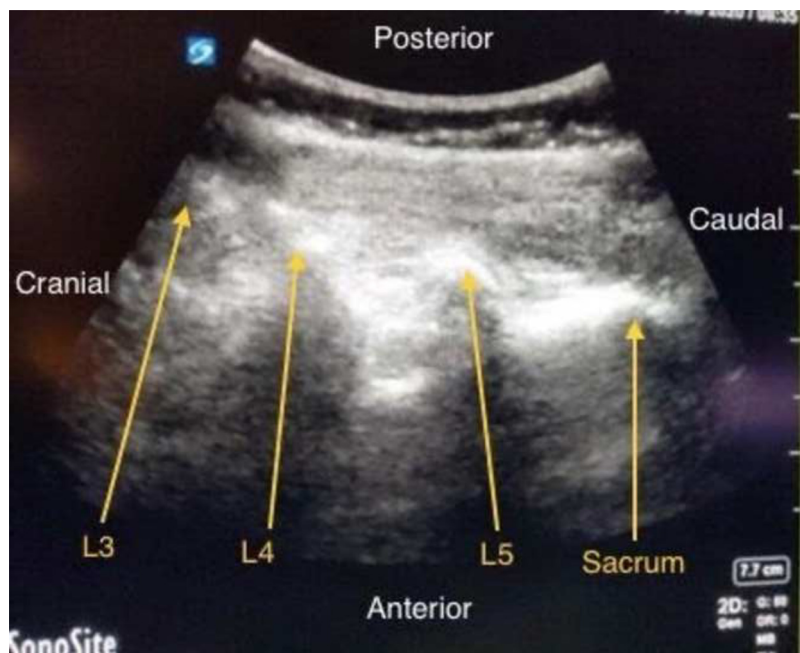


Figure 1 Ultrasound image of patient's vertebral column showing comminuted fracture at L3 spinal vertebra.



Figure 2 Image of dual epidural catheters in patient's back and relevant spinal levels marked after ultrasound imaging.

started at 6 mL/h infusion of 0.1% bupivacaine with 2 mcg/mL fentanyl to cover the first stage of labor, while the lower epidural catheter was started at 4 mL/h to adequately cover the sacral nerves, with the plan to titrate infusions through both catheters to provide optimal analgesia with labor progression.

The patient had excellent pain relief during the entire course of her labor and had an otherwise uneventful vaginal delivery of her baby. No adjustment of PCEA setting had been made throughout the entire course of labor. The patient's epidural catheters were removed intact in standard fashion.

Discussion

Lumbar epidural catheter placement is the gold standard for labor analgesia and is a common practice worldwide. However, failure of epidural anesthesia and analgesia is a frequent clinical problem which mostly relates to malposition of the epidural catheter or a patient's challenging neuraxial anatomy. Analgesic failure may even occur with a true epidural catheter and 5% to 8% blocks can either be unilateral or may be patchy in an otherwise complete block.⁴ The second stage labor analgesia may be inadequate in a prior working epidural due to sacral sparing as perineal nerves are thick and away from the epidural catheter tip which may not bathe these nerves with enough local anesthetic solution. Low epidural catheters inserted at the L4–L5 intervertebral level provide superior perineal analgesia compared to high epidural

catheters inserted at the L1–L2 intervertebral level.⁵ Patients with a history of chronic low back pain due to back trauma may have increased rate of failures due to scarring and epidural adhesions that either slow the diffusion of local anesthetic past the injured area or block it altogether. Our patient had a history of comminuted fracture at the L3 vertebral level and therefore was at risk for difficult epidural placement, malposition of epidural catheter and epidural failure, either due to sacral sparing or patchy block due to potential fibrosis and adhesions in the epidural space. Epidural placement without imaging would have been difficult and potentially unsafe with a risk of neurologic injury due to osseous fragment dislodgement. A pre-procedural ultrasonographic scan to identify relevant landmarks was done with subsequent needle insertion as increased precision was required due to abnormal spinal anatomy and the presence of unstable bony fragments. Dual Epidural Catheter (DEC) to manage her labor was planned, upper epidural catheter placed at the L1–L2 intervertebral level for first stage analgesia, and lower epidural catheter placed at the L4–L5 intervertebral level for the second stage to avoid sacral sparing. Initial infusions started at 6 mL/h for the upper epidural catheter and 4 mL/h for the lower epidural catheter with the plan to titrate infusions as labor progressed.

The DEC technique to alleviate labor pain was first described in 1949 and later in 1967. Yet, the current literature is sparse in the use of DEC therapy for labor analgesia. Contemporary literature about the use of DEC in scoliosis correction surgery and esophagectomies did not

show an increase in side effects associated with catheter placement as compared to single epidural catheter therapy. In a manuscript published in Chinese with an English abstract, labor analgesia provided by a dual catheter technique was compared to a single catheter. No serious anesthesia related complications were noted in either group with no effects on delivery outcomes.⁶

Despite the relative infrequency of obstetric patients with clinically significant spinal cord injuries, it is important to address their special physiologic and anatomic requirements while still providing them access to effective and safe labor analgesia. The widespread availability of ultrasound provides an excellent means of visualizing patient anatomy and allows for accurate determination of relevant anatomic levels and structures prior to placement of a labor epidural. While there is always concern for anatomic changes to the epidural space after spinal cord trauma, this does not consign the patient to having to endure labor and vaginal delivery without neuraxial analgesia nor does it require cesarean delivery. Here we demonstrate that using an epidural catheter on either side of the spinal cord lesion allows for specific titration of the neuraxial block as well as adjustment as the labor progresses to specifically target the areas responsible for pain during the specific stages of labor.

Conflicts of interest

The authors declare no conflicts of interest.

References

1. Jain NB, Ayers GD, Peterson EN, et al. Traumatic spinal cord injury in the United States, 1993-2012. *JAMA*. 2015;313:2236–43.
2. *Obstetric Management of Patients with Spinal Cord Injuries: ACOG. Committee Opinion, Number 808. Obstet Gynecol.* 2020;135:e230–6.
3. Arendt K, Segal S. Why epidurals do not always work. *Rev Obstet Gynecol.* 2008;1:49–55.
4. Pan PH, Bogard TD, Owen MD. Incidence and characteristics of failures in obstetric neuraxial analgesia and anesthesia: a retrospective analysis of 19,259 deliveries. *Int J Obstet Anesth.* 2004;13:227–33.
5. Moore A, Villeneuve V, Bravim B, et al. The labor analgesia requirements in nulliparous women randomized to epidural catheter placement in a high or low intervertebral space. *Anesth Analg.* 2017;125:1969–74.
6. Li JZ, Wang MS, Ji XH, et al. Efficacy and delivery outcomes of women underwent double-catheter epidural block during labor. *Zhonghua Fu Chan Ke Za Zhi.* 2010;45:819–24.