

# Management of a Retained Epidural Catheter in a Pregnant Patient: A Case Report and Review of Literature

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## Abstract

**Background:** Epidural anesthesia is an effective intervention to treat labor pain and provide analgesia for orthopedic procedures. A rare complication of this technique is epidural catheter retention. **Case Presentation:** In this case report, we present an otherwise healthy 21-year-old G2P0010 woman at 39 weeks and 3 days gestation whose anesthetic management was complicated by a symptomatic retained epidural catheter fragment. Computed tomography (CT) imaging of her spine showed the fractured catheter within her paraspinal muscles and neurosurgery recommended no surgical intervention at that time. The patient reported resolution of back pain while in the postpartum unit which she continues to endorse two weeks after discharge. **Conclusion:** Retained epidural catheter is a medical emergency that requires immediate imaging and neurological evaluation. While magnetic resonance imaging is typically regarded as the standard imaging modality for this complication, in epidural sets that contain metallic components, we suggest using CT to avoid the risk of thermal nerve damage. In cases where the patient does not report any acute complaints, nonsurgical management may be appropriate but close follow-up is required to monitor for catheter migration.

## Keywords

Epidural, Obstetric Anesthesia, Neuraxial Anesthesia, Retained Catheter, Computed Tomography

## 1. Introduction

Epidural analgesia is a common technique used to alleviate pain during labor and delivery [1]. Anesthetic agents, typically a combination of local anesthetics and

opioids, are injected into the epidural space of the lumbar spine, numbing the spinal nerves and preventing the transmission of pain signals from the lower body while maintaining the patient consciousness, allowing them to participate in the delivery process [2]. This procedure is provided to women who prefer significant and extended pain relief and are expected to experience prolonged labor. Similarly, combined-spinal and epidural analgesia are sometimes used in patients undergoing Caesarean section when the expected procedure duration exceeds the duration of spinal anesthesia. The use of a catheter that is secured within the epidural space allows for the continuous administration of anesthetic agents during long labor processes, providing pain relief as needed. In a prospective observational study of 294 pregnant women receiving patient-controlled epidural analgesia (PCEA) of 0.0625% bupivacaine and fentanyl by Clivatti *et al.*, 92% of women reported satisfaction with the quality of anesthesia and less than 10% reported incidence of complications [3]. Common complications of epidural anesthesia include hypotension, headache, back pain, while uncommon adverse effects include infection, nerve damage, and very rarely, retained epidural catheter fragments [4]. Over the past several years, the adoption of using lower concentrations of local anesthetics such as 0.0625% bupivacaine and lipophilic opioids (fentanyl and sufentanil) has reduced the incidence and severity of epidural associated adverse effect [5]. As such, due to its effectiveness and overall safety profile, approximately 80% of women in developed countries have elected to undergo epidural analgesia during labor [6] [7].

One of the rarer complications of epidural anesthesia is catheter retention. Retained epidural catheter occurs when the distal end of the catheter fragments within the epidural space or surrounding tissues after extraction. Symptoms may range from mild but temporary pain at the catheter insertion site to severe complications such as spinal cord compression and infection. Oftentimes, the condition is entirely asymptomatic. While there currently is no literature that reports the incidence of retained epidural catheter, several case reports have described incidents of epidural entrapment and their medical management. In cases when gentle catheter retraction does not extract an intact catheter, the decision to pursue surgical intervention is dependent on several key factors including patient symptomatology, location of the epidural fragment, and risk of future complications. Herein, we describe a unique case of an otherwise healthy pregnant patient who experienced complications with a retained epidural catheter fragment, which subsequently developed into back pain. We will present the course of events that led to this incident as well as the steps taken to make the diagnosis. Finally, we will discuss our treatment strategy and provide management recommendations using existing literature on this complication.

## 2. Case Presentation

Our patient was a 21-year-old G2P0010 woman at 39 weeks and 3 days gestation who was brought to the emergency department complaining of contractions

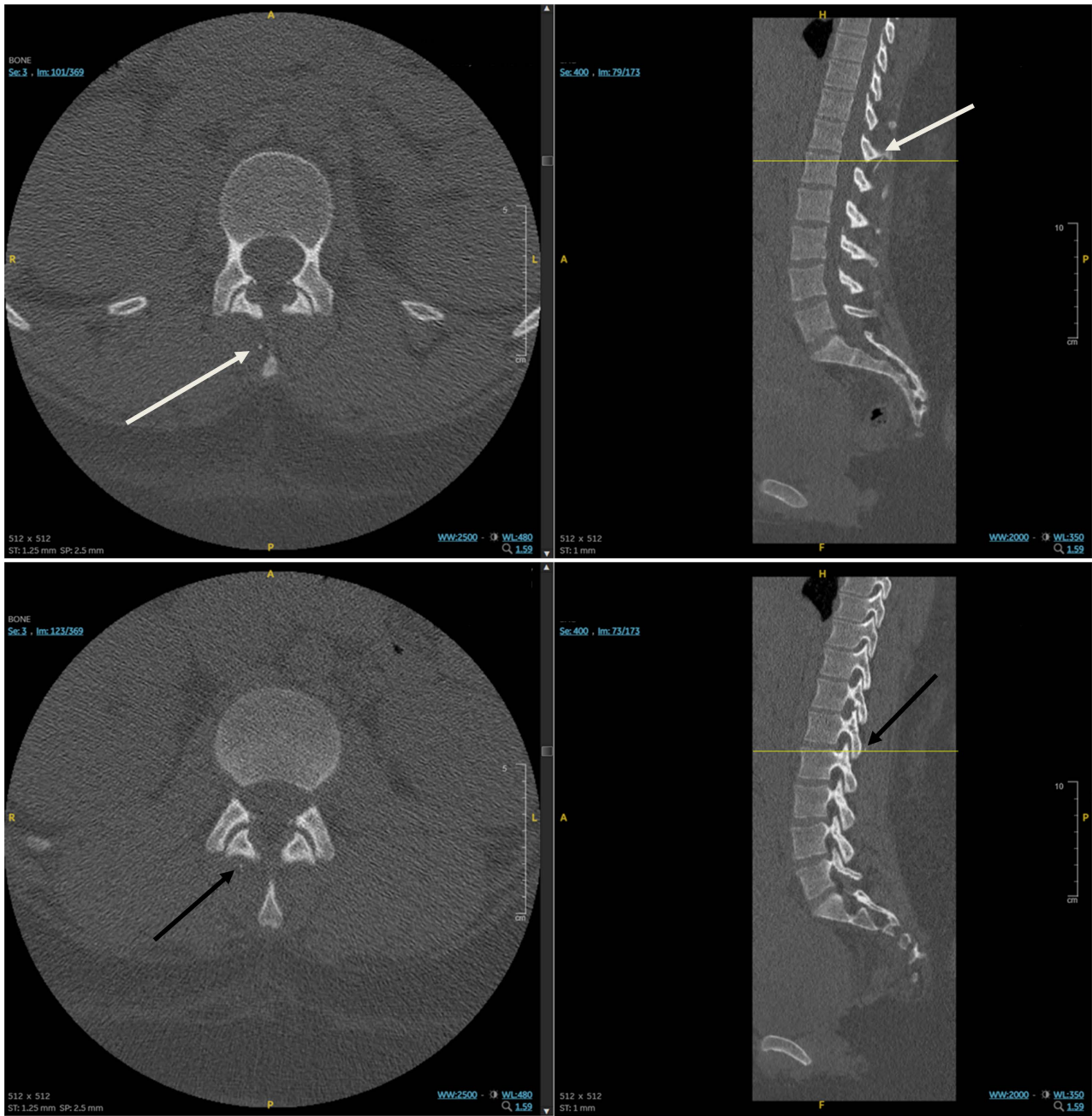
which started prior to arrival. Her past medical history was notable for class III obesity but otherwise healthy. The patient was admitted to the labor and delivery unit and continued to endorse moderate-to-severe abdominal pain every 10 - 20 minutes without any leakage of fluids or vaginal bleeding. Fetal examination showed heart rate of 135 beats per minutes, moderate variability, present accelerations, and absent decelerations. Tocodynamometer readings showed 1 contraction every 15 minutes. Prior to elective induction of labor with transcervical balloon and misoprostol, the patient requested epidural catheter placement. On physical examination, the patient was in mild distress and was able to communicate verbally. On airway examination, she was Mallampati Class II with thyromental distance greater than three finger breadths and full neck range of motion. Her cardiovascular, dental, pulmonary, and abdominal examinations were otherwise normal. She was classified as American Society of Anesthesiologists (ASA) Class 3 given her history of morbid obesity and the anesthetic plan was to place an epidural catheter for analgesia.

Shortly after admission to the labor and delivery unit, a 20-gauge multi-orifice soft tip epidural catheter was placed in the L4 - L5 epidural space at 13 cm skin depth under sterile conditions. The patient tolerated the procedure well and did not report any sensory, motor, or strength changes. Infusion of continuous fentanyl-bupivacaine (2 mcg per mL - 0.125%) in 250 mL normal saline via patient-controlled epidural analgesia was initiated which relieved her pain. Sixteen hours after placement of the epidural catheter, the patient reported inadequate labor analgesia. Two 5 cc boluses of 0.25% bupivacaine were given at 30-minute intervals without analgesia at any sensory levels which suggested nonfunctioning epidural. This prompted immediate replacement of the catheter.

With the patient in a sitting position, a plastic, flexible, metal spring tipped 19-gauge catheter was placed after two attempts in a sterile fashion. During the initial attempt, the epidural space was properly located using epidural space loss of resistance to air technique. However, when the catheter was threaded into the epidural space, the patient experienced labor contractions and continued epidural threading was met with resistance. A decision was made to remove the catheter at that time. Resistance was felt during extraction but was immediately lost. On visual examination of the catheter, the tip was noted to be absent, and the patient was notified of this incident. Immediate neurological exam showed no focal neurological deficits: lower extremity strength exam was 5/5 in bilateral hip flexion/extension, knee flexion/extension, plantarflexion, and dorsiflexion. Sensation was intact through dermatomes L1 - S2 bilaterally. Due to patient's labor pains, a second epidural catheter was placed afterwards with no issues.

Following removal of the catheter after vaginal delivery the next day, the patient reported mild aching pain near her second epidural placement site which prompted an urgent computed tomography (CT) scan of her lumbar spine without contrast. Magnetic resonance imaging (MRI) was initially ordered but was ultimately deferred given that the catheter used contained a metallic spring in the

tip. The results of the CT scan were notable for an approximately 3 cm long linear density in the right paraspinal soft tissues adjacent to the spinous process of T12 and L1 which could represent a retained catheter as shown in **Figure 1**. Neurosurgery was immediately consulted and advised no intervention at that time. The patient was discharged from the hospital two days later with no complaints of any back pain or any new onset of neurological symptoms. The patient was followed-up two weeks after discharge via telephone and she continued to report no back pain or new neurological complaints.



**Figure 1.** Transverse (left) and sagittal (right) CT scan of the lumbar spine showing retained catheter within the right paraspinal muscles. White arrow indicates most distal end of the fractured catheter tip while the black arrow indicates the most proximal end.

### 3. Discussion

Retained epidural catheter is a rare and potentially dangerous complication during pain management of pregnancy. We present a case of an otherwise healthy patient with image-verified epidural catheter retention who reported non-radicular back pain after catheter extraction. While most published cases of retained epidural fragment suggest that this complication is ultimately asymptomatic and do not require surgical intervention, a small subset of patients may require neurosurgical intervention due to potential cord or nerve root compression [8]-[10]. Mitra and Fleischmann reported that in patients with asymptomatic retained catheter, invasive surgical intervention is not indicated [11]. Renna and Vikram reported a similar case of an asymptomatic retained combined spinal-epidural catheter at the level of the L5 vertebral spine, which was confirmed with x-ray, that was treated with conservative management and close follow-up [12]. Tarukado *et al.* reported a case in which a patient with asymptomatic fragmented catheter experienced migration of the catheter tip into the epidural space four weeks after extraction. The patient ultimately elected for L2 - L3 laminectomy seven weeks after the catheter had broken and fibrosis was appreciated on the surface of the dura mater. As such, the authors recommended surgical removal of the catheter if it is retained within the spinal canal before adhesions advance [9]. Walia *et al.* reported that fibrosis within the epidural space occurs around three weeks, at that time the patient is at the greatest risk of nerve injury or impingement [13]. In cases where patients reported persistent back pain several weeks after epidural removal or new neurological deficits, current literature suggests timely surgical intervention via exploratory laminotomy or endoscopic extraction [14]-[19]. As such, early detection and continuous imaging is crucial to ascertain the risk of nerve injury and need for surgical intervention.

Upon detection of a fractured epidural catheter, immediate radiological imaging is required. It is important to note that while a patient may present with no focal neurological symptoms, fragmented epidural catheters have the risk of acutely migrating to the intrathecal space as described by Ugboma *et al.* [20]. While MRI is considered the best imaging technique to locate the radio-opaque fragment; CT, x-ray, and ultrasound have all been used in the past with varying degrees of success [16] [21]. In our case, we decided to pursue CT imaging due to the tip of our catheter being reinforced with a metallic spring. In a safety study conducted by Owens *et al.*, metal reinforced epidural catheters exposed to 3 Tesla MRI elicited heating of 4°C to 7°C at the entry points [22]. While the MRI-induced thermal dose typically does not exceed the maximum safe lead tip temperature of 43°C for neural tissues established by Coffey *et al.*, there currently is no consensus on the risk of thermal nerve injury from epidural catheters that are within proximity to the spinal cord dura [23]. Thus, it is imperative that extreme caution should be used when deciding if MRI is indicated.

Current literature suggests several techniques that can help prevent the incidence of retained epidural catheters. Blackshear *et al.* suggested that patients

should be placed in the lateral decubitus position with gentle retraction during difficult epidural removal [24]. Typically, this occurs when the epidural catheter tip is looped or kinked, as such, low tension is recommended during extraction to prevent catheter subluxation [25]. If the catheter remains impinged, hyperflexion of the lumbar spine, cessation of traction for three hours, and injection of normal saline to decrease catheter turgor have all been proposed to facilitate catheter removal [26]-[29]. We additionally suggest that short insertion of the catheter (less than 5 cm beyond the tip of the needle) may prevent knotting and looping.

In our case, we hypothesize that the catheter was fractured due to the multiple attempts needed for insertion complicated by increased traction required for removal of the catheter. We emphasize the importance of not only initiating early imaging to determine the position and severity of the retained catheter, but also to quickly identify which catheter model was used to guide the decision on whether CT or MRI is safely indicated. We hope that this case can serve as a reminder that despite improvements in epidural technique and equipment, providers should still be cognizant of the risk of epidural retention and understand the management of this complication as well as the importance of informing the patient and providing reassurance if it occurs.

Due to the rarity of this complication, there is currently no large-scale retrospective studies investigating the incidence and outcomes of retained epidural catheters. We recommend future researchers to investigate the causes of epidural catheter fracture and formulate a comprehensive management algorithm. Finally, we also suggest additional research into MRI compatibility for epidural and combined-spinal epidural catheter kits that contain metal spring reinforced tips. While our literature review suggests that metallic epidural tips may cause neural damage, there are no simulation or proof of concept trials that confirm this supposition.

## 4. Conclusion

Epidural catheter breakage and retention is a serious complication of epidural anesthesia that requires immediate medical management. We emphasize several key factors regarding epidural catheter management: 1) identifying a stuck epidural and implementing retraction techniques, 2) determining catheter type and assessing the risk and benefit of different imaging modalities, 3) visualizing the anatomical position of the catheter, 4) assessing the neurological status of the patient to determine if surgical intervention is indicated, and 5) providing long-term follow-up with repeat imaging in asymptomatic patients.

## Ethics

Ethical approval was exempted from our institution given that the report only has one patient, and no patient identifiers were provided.

## Consent for Publication

Written consent was obtained from the patient for publication of this case report

and accompanying images.

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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