

Breakage of Epidural Catheters: Case Report and Brief Review

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Abstract: Difficulties in removing the epidural catheter are rare. In this report, we describe two cases breakage of epidural catheter. Both cases involve the use of a catheter with innovative tip design and leading edge technology extrusion of the catheter body. The article discusses the causes of difficulties in removing the catheter, the tactics of the anesthesiologist in the event of such situations, the indications for surgical extraction, the remaining fragment of an epidural catheter.

Keywords: epidural catheter, catheter breakage, catheter knotting.

INTRODUCTION

A flexible catheter with an extended cone-shaped tip is a relatively new tool. Its use is associated with a higher knotting risk.¹ A knotted epidural catheter is a rare case: the frequency of this complication is one in 65,140 catheterizations, with an average of 0.0015%.² Most of the cases (88%) involved obstetric patients.³ Usually catheters broke during their removal. As Tsui and Finucane⁴ found out, at 37°C, the force required to fracture the catheter was 1.99 kg.

Almost all cases described in the literature report that the catheter broke during its removal from the lumbar extramural space (L₂-L₅). In cases when the epidural catheter was pulled out of the level Th_{8,9}, there was no significant difference registered with regard to the position of the patients: prone 1.61 N, supine 1.62 N, or lateral 1.36 N.⁵

CLINICAL CASE 1

A 28-year old healthy Caucasian parturient ASA II was admitted to hospital diagnosed with a 40/41 weeks' gestation and preeclampsia. Given the uterine inertia and preeclampsia, it was decided to initiate epidural analgesia and start labour induction. The anesthesiologist was called for. A puncture was performed at the L3-L4 level with a 18 G Tuohy epidural needle via the median approach with the patient in the sitting position. A catheter with innovative tip design and leading edge technology extrusion of the catheter body was inserted into the epidural space to a depth of 5 cm. The anesthesiologist decided to pull the catheter back to 1-1.5 cm "so that the administration of a standard dose of ropivacaine did not cause a high sensitive block, which may be harmful in case of the Caesarean". During its pulling, the catheter broke (approximately 4 cm were missing). As the result, the Caesarean section was performed under general anesthesia.

A multi-slice computed tomography of the thoraco-lumbar department showed a 18 mm fragment of the epidural catheter located in the L₂₋₃ vertebral segment on the L₃ upper body level between the vertebral arc plates to the right and medial to the right intervertebral joint in the projection of the yellow ligament; the inner end of the catheter was in the epidural space near the inner surface of the L₃ right arc leg. During the operation, a knotted epidural catheter was found in the epidural space (Fig. 1). The length of the unfolded fragment was 43 mm (Fig. 2).



Fig. 1. *Knotted epidural catheter fragment*



Fig. 2. *Unfolded epidural catheter fragment*

CLINICAL CASE 2

A 76-year old man ASA III was admitted to hospital diagnosed with third-stage dysplastic arthrosis of the left hip. Total hip replacement was performed under combine spinal-epidural anesthesia applied to the patient in the sitting position with the help of a midline approach to the L3-L4 interspace. The epidural space was identified by loss of resistance to saline on the first attempt with an 18G Tuohy needle. A subarachnoid block was done by 27G Whitacre needle by needle through needle technique. A catheter with innovative tip design and leading edge technology extrusion of the catheter body was inserted into the epidural space to a depth of 4 cm. After surgery, the patient was placed in a recovery room. In the morning next day, before transferring the patient to the orthopedic department, the anesthesiologist removed the epidural catheter, which required application of force due to a notable resistance of the catheter to pulling. The examination of the removed catheter showed its breakage. The estimated length of the catheter fragment left in the epidural space was 5cm. The patient consulted the neurosurgeon. It was decided to surgically remove the fragment. The operation was performed on the catheterization area. The catheter fragment was detected protruding from the interspinous ligament by 4 mm. The fragment was extracted (Fig. 3). Its length was 13 cm.

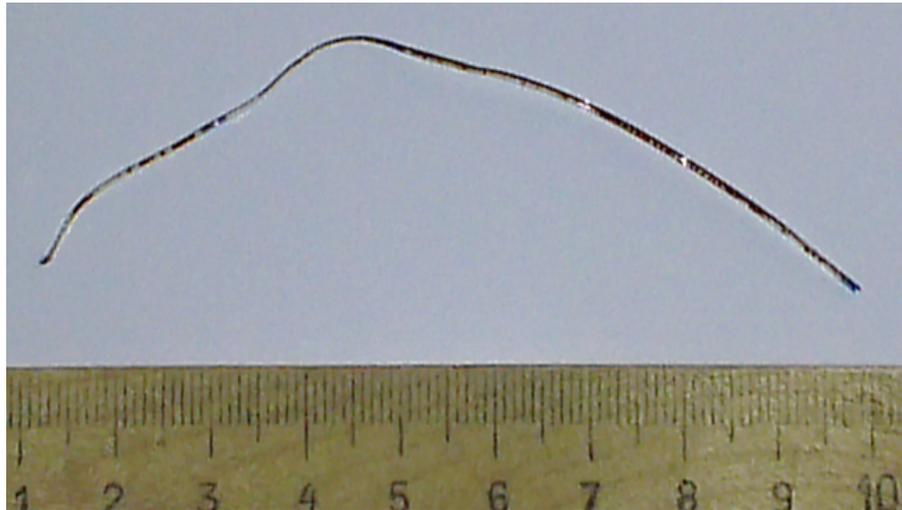


Fig. 3. *Surgically extracted epidural catheter fragment*

The problem may be related to inherent weakness of the catheter, which makes it subject to kinking during insertion. The removal difficulties may result from catheter knotting and fixation in the tissues of the spine as well as entwining around of nerve structures.⁶ Epidural catheter knotting can occur due to the increase of the flexibility of the distal tip at 37°C, when the catheter rests on the anatomical obstacles: fascia, vertebral arches, nerve roots, or blood vessels.

It is believed that the probability of knotting depends on the depth of insertion of the epidural catheter.⁷ The optimum is to introduce the catheter into the epidural space by 3–4 cm. However, knotting was registered even when the depth of the catheter introduction was less than 3 cm.⁸ The introduction of the catheter by 5 cm, or more, significantly increases the risk of knotting.⁹ In a reported case of breakage of the catheter inserted by 15 cm, even laminectomy could not help to extract the torn piece.¹⁰

After administration of the catheter into the epidural needle, it is strictly prohibited to remove it back, as it significantly increases the risk of the catheter cutting. If necessary, the catheter shall be extracted together with the needle as an entire block.

There are two described cases when a catheter breakage occurred when the removal was performed by someone other than the anesthesiologist. The first case involves an orthopedic surgeon who used a thermostatic clamp; the second, an untrained person, who did not quite realize what happened, and that led to a 4-day delay in breakage diagnostics.¹¹

In our experience we observed a patient who had his epidural catheter left “forgotten”. When the patient was back home taking bath, the catheter was detected and cut with scissors by the patient’s wife. Five days later, the patient visited a general practitioner and was directed to the hospital. The catheter that protruded off the skin by 3 mm was extracted. Further on no signs of neurological deficit were reported.

Epidural catheter removal shall be executed carefully and manually only. No instruments shall be used. The force applied to the catheter shall range within 0.17–0.32 kg.

The position of the patient during removal of the catheter is an important factor: the patient should be placed in the lateral position with flexed spine. Morris et al.¹² revealed that the catheter extraction force applied to the patients in the prone position is 2.5 times less compared to the sitting position.

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Before the removal, it is recommended to administer saline solution in the catheter.¹³ We have successfully used this technique in our practice several times.

Asai et al.¹⁴ recommend that in case second attempt of the extraction of the catheter is required, a 30–60 minute pause should be taken in order to ensure relaxation of the patient's muscles. Although this statement is arguable, some successful cases are described. In case the catheter removal causes pains in the patient, the procedure shall be stopped immediately, as it is likely that the catheter is twisted around spinal roots. This is an indication for a surgical catheter extraction.

The introduction of a conductor can increase the stiffness of the catheter and, thus, to allow to unfold the knotted sector. However, the conductor should be administered with caution, as the forced administration may lead to rupture of the catheter or damage to the spinal cord.¹⁵

We know one described case when the epidural needle was introduced into the catheter and then the catheter along with the epidural needle was pulled out gently in one mass without any difficulty.¹⁶ Despite of the successful outcome, this method is associated with a high probability of catheter rupture and cannot be totally approved for the practical use.

There is no necessity to remove a catheter fragment from the epidural space if there are no neurological symptoms, because catheter fragments fibrose without harm to the patient¹⁷; however, such patients shall be kept under the observation. We have been observing two patients with catheter fragments left in the epidural space. The monitoring periods are 1.5 and 4 years. Indications for surgical extracting occur only in case a fragment is located close to the surface (subcutaneous fat), or when there are clinical symptoms: functional disorders and pain syndrome in the area of the puncture of the epidural space.

To conclude with, we want to highlight that the use of the catheter catheter with innovative tip design and leading edge technology extrusion of the catheter body is associated with potential problems.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

Authors' Contribution

All authors contributed in paper preparation.

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