A broken catheter in the epidural space

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ABSTRACT

القسطرة المقطوعة في منطقة فوق الجافية في الظهر نوع من أنواع القسطرة الظهرية للمنطقة فوق الجافية التي تحتوي على سلك مقوى داخل القسطرة والذي يُسهل دخول (Arrow FlexTip) القسطرة ويقلل إحتمالية اختراقه إلى الأوعية الدموية ، ومع ذلك مقارنة بالقسطرة التي لا تحتوي على معدن، وجد أن التي تحتوي على سلك مقوى بداخلها أكثر عرضه لأن تنقطع. هذه أول حالة تُرصد في المملكة العربية السعودية عن بقاء قطعة من القسطرة الظهرية في المريض. فإن الطرق لمنع حدوث مثل هذه الحالات وعلاجها تم شرحها ومناقشتها.

The Arrow FlexTip™ epidural catheter has reinforced coiled stainless steel wire, which facilitates its insertion and is less likely to puncture the blood vessels. However, as compared with non-reinforced, reinforced epidural catheters are more vulnerable to break. We report a case from Saudi Arabia on a retained fragment of a broken epidural catheter. Measures to prevent this mishap and its management are discussed.

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The epidural catheter has permitted the efficacy of an epidural block to extend from a few hours to many hours and even days. Nevertheless, like any other medical intervention in the body, insertion of a catheter in the epidural space has risks and complications of its own. Some of these complications are relatively common, such as cannulation of an epidural vein; and some are rare such as breakage of epidural catheter. Our objective in presenting this particular case is to increase awareness of this rare complication.

Case Report. We report a case of broken epidural catheter in a young healthy woman (American Society of Anesthesiologists Class I). She was admitted to the hospital at 33 weeks of pregnancy and diagnosed with intra uterine fetal death (IUFD). Her medical and obstetric history was otherwise, normal. She was transferred to the labor ward for the induction of labor and delivery of IUFD. During labor, when the cervix was 4 cm dilated, she requested epidural analgesia. The night on-call resident anesthetist was called and took verbal consent from the mother. The procedure was carried out aseptically, in the sitting position, using loss of resistance to air technique, through the lumbar one and 2 inter-laminar space. At the distance of 6 cm from the skin, the epidural space was found and there was no wet tap. An Arrow FlexTipplus™ reinforced epidural catheter (19.G) was inserted through the Tuohy needle (17.G) with little resistance. There was no attempt to withdraw the catheter while it was in the needle, however after removal of the needle, one cm of it was withdrawn and a length of 6 cm was left in the epidural space. The catheter was then aspirated to rule out the possibility of its sub-arachnoid or intra-vascular placement. The mother received the epidural test dose (3 ml of Xylocaine 1.5% with adrenaline 1:200,000), which was uneventful, followed by bolus dose of 6 ml bupivacaine 0.25% with fentanyl 60 µg. She was observed in the semi lateral position for the next 20 minutes for analgesia, blood pressure, heart rate, and uterine contractions. During this time, she received intravenous fluid of a liter of NaCl 0.9% and maintained her physiological parameters at the acceptable levels. The uterine contractions were almost painless and the upper level of epidural block, checked with ice, was up to the T10 level. Following this, an epidural infusion (bupivacaine 0.125% with fentanyl 2 ug/ml) at the rate of 10 ml/hour was commenced. Six hours later, she vaginally delivered the baby. Following

this, the midwife stopped the epidural infusion and then attempted to remove the epidural catheter. The catheter did not move. She then called the day on-call anesthetist who pulled the catheter with moderate traction but failed. The woman was placed in various positions (sitting, left and right lateral) with varying degrees of spinal flexion, a few more traction attempts were made, but all failed. Then, the senior anesthetist was called who also applied moderate traction, which resulted in breakage of the catheter from the 7 cms mark, but the coiled wire inside the catheter came out intact and straight. During all these attempts, she did not complain of any radicular pain or paresthesia. The skin puncture site was cleaned with alcohol swab, and the broken end of the catheter was looked for, but was not visible. Following this incident, a spinal surgeon was contacted who examined the woman and found her neurologically normal. He reassured the woman and requested plain x-ray and MRI of her lumbar spine. The x-ray image, but not the MRI showed evidence of a broken catheter. Also, subsequent CT scans of the lumbar spine revealed the detailed course of the broken catheter in the epidural space (**Figures 1 & 2**). The broken catheter appeared to enter the epidural space through the left lower corner of the inter-laminar window between the first and second lumbar vertebra, and after making a circular loop, ascend upwards on the left lateral side of the epidural space and the tip appeared to have positioned itself at the level of the upper end of the left neural exit foramina between L1 and L2. The woman was counseled regarding this mishap, which was documented in her notes. She was discharged with plans for follow-up in the spinal clinic. She was told that most likely the retained catheter would not cause any symptoms for many years, or for the rest of her life, but if any back pain or radicular symptoms related to the retained catheter occurred, surgical removal would then be required.

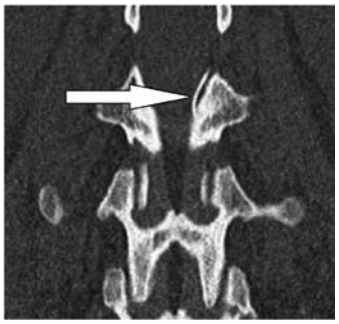

Figure 1 - A CT scan of the lumbar spine (coronal view). Arrow pointing toward the epidural catheter.

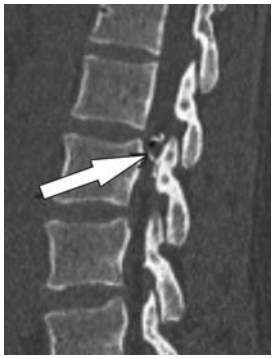

Figure 2 - A CT scan of the lumbar spine (sagittal view). Arrow pointing toward the epidural catheter.

Discussion. A fragment of broken epidural catheter left in a patient is a rare event. Bonica et al in 1957,[1] audited 3637 cases of epidurals anesthesia/analgesia and found only 2 incidents of epidural catheter breakage. This was probably the first report of epidural catheter breakage. Since then until 2008, only 30 cases of retained broken epidural catheter have been reported.[2] Under reporting of epidural catheter breakage is well established.[3] Surgical removal of entangled intact and broken catheters have been reported from the Middle-East.[4] There is a lack of reports of this kind from Saudi Arabia. The ArrowFlexTip™ epidural catheter has reinforced coiled stainless steel wire that facilitates its insertion making it less likely to puncture the blood vessels.[5] However, reinforced epidural catheters are more vulnerable to breakage. In a study assessing the tensile strength of epidural catheters,[6] the Arrow's catheter was found to be weaker than catheters manufactured by other (B Braun™, Becton Dickinson™, and Portex™) companies.

Technically, in our case there appears to be no obvious flaw in performing the epidural analgesia procedure except that the length of the catheter inserted was slightly more than the recommended limit. This probably caused the catheter to take a circuitous route. The removal of catheter was attempted successively by 3 individuals, all claiming to have used moderate force, which is a subjective expression. Undoubtedly, the repeated attempts stretched and weakened the catheter. After the failure of the first few attempts to pull out the epidural catheter, it would have been wiser to temporarily abandon the procedure, roll and tape the rest of the catheter to the woman's back and re attempt removal after a few hours.[7] The last attempt, although with only "moderate" traction force, resulted in snipping of the catheter. While attempting to remove the entangled catheter, we did employ some but not all

the recommended measures (**Appendix 1**). Moreover, we were unaware of some these recommendations, such as flushing the epidural catheter with ice-cold saline or administering general anesthesia (with a muscle relaxant) to the patient. Retrospectively, it can be said that any measures, which we did not use might have avoided this complication. However, following the incident, we counseled the patient and involved the spinal surgeon. She was shown her lumbar CT scan with the broken catheter. She understood our explanation and accepted our suggestions. She is hopeful to become pregnant next year and intends to receive labor epidural analgesia again!

Images of her lumbar spine are essential not only to confirm the retained catheter, but also to identify its location, length, and course. The image can be shown to the patient and kept as a record for her future management and medico-legal purposes. All the imaging techniques, MRI, CT, ultra-sound and plain x-ray of the spine were used. The MRI is an excellent imaging technique to visualize soft tissues; however, it is not good to visualize a foreign body. Moreover, it is contra-indicated if the metallic wire is also retained with the catheter.[8] The MRI, in our case did not show the broken catheter. However, the lateral view of the plane x-ray showed the circuitous course of the radio-opaque catheter. Nevertheless, even the radio-opaque catheter may not be visible, if it is over lapped by bone (such as lamina). However, the CT scan usually delineates the course, and provided the required information about the retained fragment. We believe when a foreign body (such as a fragmented catheter) is in question, investigation using a CT scan is the best method.

Ethical and legal issues could also emerge with a broken catheter incident. Though we obtained informed consent and did talk to the patient about the rare possibilities of serious neurological complications, we did not explicitly mention the possibility of catheter breakage and retention. However, following this incident, we believe that we fulfilled our ethical responsibility by consulting the spinal team with radiological investigations, counseling the patient, documenting all details in the patient file, and finally arranging patient follow-up. Retrospectively, we believe the overall management was satisfactory and there was no malpractice.[9]

Epidural catheter breakage is annoying both to the patient and care provider. To avoid this rare complication, the simple measures outlined in **Appendix 1** should be routinely adopted during both insertion and removal of an epidural catheter. Due to the technical advantages, we have been using the reinforced Arrow™ epidural for more than 2 decades. This is the first case of broken retained epidural catheter in our institution, and it has increased our awareness of this rare complication. We have also reported this to our hospital incident reporting system and through publishing this case report, would like to share our experience with others.

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Appendix 1 - Causes of epidural catheter breakage and recommendations for prevention.

Causes of epidural catheter breakage
A. Excessive pulling force. This may be unintentionally applied when a tangled catheter offers resistance during its extraction. This can happen when the catheter is kinked, knotted, entrapped or took a tortuous or circuitous course in the patient's spine.
B. Damaged catheter. Tuohy epidural can damage the catheter when it is advanced over the catheter, or when the catheter is withdrawn through the needle, or when excessive force is used to advance the catheter, or when excessive length is pushed through the needle. Pinching by the vertebral bone can also damage the catheter.
Recommendations to prevent epidural catheter breakage.[2]
(While inserting) A. Avoid damaging the catheter during insertion. B. Avoid excessive length beyond the tip of Tuohy needle.
(While removing) C. Avoid more than moderate traction* D. Try different patient's position with varying degree of flexion. E. Leave the catheter there (covered & tapped) and try again after few hours. F. Fill the catheter with cold preservative free sterile saline 0.9% and try again. G. Patient may require complete relaxation with general anesthesia. H. Patient may require surgical removal.
*Moderate traction is defined as the force applied to pull the scalp hair to cause moderated discomfort

ETHICAL CONSENT

All manuscripts reporting the results of experimental investigations involving human subjects should include a statement confirming that informed consent was obtained from each subject or subject's guardian, after receiving approval of the experimental protocol by a local human ethics committee, or institutional review board. When reporting experiments on animals, authors should indicate whether the institutional and national guide for the care and use of laboratory animals was followed. Research papers not involving human or animal studies should also include a statement that approval/no objection for the study protocol was obtained from the institutional review board, or research ethics committee.