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## Umbilical catheter rupture: A serious complication in neonatal intensive care units

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## ABSTRACT

Umbilical catheterization is commonly used as a route to provide medications and fluids to the neonates as well as for blood sampling and continuous monitoring. Although the rupture of umbilical catheters is considered as a rare, preventable complication, it has been reported several times in the literature. Healthcare providers need to be cautious with catheter placement, maintenance, and removal to prevent such a complication.

Hereby, we review the literature about this complication after presenting two incidents of umbilical venous catheter rupture in two separate patients in our neonatal ICU. One was removed easily through the umbilical stump, whereas the other required surgical exploration.

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## 1. Introduction

With the advancement of neonatal care, many interventions are performed to help the sick neonates survive their illness. Providing intravenous fluids and medications is one of the crucial steps in the management of critically ill neonates [1]. One of the most common and reliable methods used for vascular access is the umbilical venous and arterial catheterization, which is also used to withdraw blood samples and for continuous monitoring [2].

Umbilical venous and arterial catheterization is usually considered as easy to apply and most importantly safe. However, many unwanted complications might develop such as sepsis, arrhythmias, ischemia, and rupture [3,4].

Although the rupture of the catheter is considered as a rare, preventable complication, it has been reported several times in literature [5]. Avoiding the rupture or retention of the catheter segment should be among the goals of healthcare providers while caring for these fragile patients.

*Abbreviations:* UAC, Umbilical arterial catheter; UVC, Umbilical venous catheter; NICU, Neonatal Intensive Care Unit.

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## 2. Case presentation

## 2.1. Case no. 1

A 36-week 3200-g late preterm newborn was admitted as a case of respiratory distress syndrome and persistent pulmonary hypertension. He was intubated, given surfactant, and received magnesium sulfate. Umbilical venous and arterial catheters (UVC and UAC) were inserted on the second day of life and documented to be in good central positions as confirmed by an x-ray. On the seventh day, the patient's clinical status improved, and the catheters were electively removed with some difficulties in removing the retaining sutures. Few hours later, a small segment of the umbilical catheter was noticed protruding externally through the umbilical stump, an abdominal X-ray was obtained, and 1.8 cm of the UAC was found to be retained along the umbilical artery pathway. It was removed through the umbilicus by using forceps according to the aseptic technique. Complete removal was confirmed by an abdominal x-ray after the procedure. The infant had no reported complications.

## 2.2. Case no. 2

A 36-week 3700-g late preterm newborn was admitted as a case of meconium aspiration syndrome. The UVC was inserted on the second day of life for medications and fluid administration. Three days later and after the stabilization of his clinical condition, the

removal of the UVC was attempted, and while trying to remove the tight sutures around the catheter using a blade, it was inadvertently cut by the blade.

An attempt was made to retrieve the retained fragment at bedside through the umbilicus using forceps, but it failed and the tip of the line was not visible. The abdominal X-ray showed the line to be along the umbilical vein pathway, which was about 2 cm away from the skin (Fig. 1).

Immediately, the patient was transferred to the operating room. Under general anesthesia, a supraumbilical transverse incision was made, and the umbilical vein was identified and opened. An X-ray was taken during the operation, which showed the retained segment to be at the level of the diaphragm and it was retrieved under fluoroscopy guidance using forceps.

In subsequent days, the patient did not develop any complications, and he was discharged home from the NICU in a stable condition.

Per our hospital policy, an incident report was completed for each case and submitted to the hospital administration. Simultaneously, the parents of both infants were informed about the complications and a consent for surgical exploration was obtained for the second case.

### 3. Discussion

Umbilical catheterization is considered as a life-saving procedure in the neonatal ICU. In general, it is safe, but it is not without serious complications if not used and managed cautiously and properly. Reported complications include infection, thrombosis, arrhythmia, and rupture [3,4].

Rupture of the catheters during removal is a serious complication, and if this is missed, the retained fragment can be trapped as a foreign body anywhere along the venous pathway or even as an embolus into the heart causing severe complications including mortality [6]. Ruptured umbilical catheters have been reported in few case reports [5]. Methods described in literature about retrieving a retained fragment include a surgical approach or through a less invasive transcutaneous technique.

In 2013, Dhua et al. reported a case of UVC rupture that required surgical exploration to retrieve the broken segment. In their report, they also did a literature review and found 13 articles published between 1972 and 2013, approximately 20 cases of umbilical catheter rupture with nearly half of the broken segments removed by a surgical approach [5].

The transluminal approach is considered less invasive and probably a safer approach if feasible [7–9]. We used this approach in our first reported case. However, blind attempts at removing the broken segment through the transluminal approach might result in pushing the fragment closer to the heart and therefore, a surgical exploration will be deemed as an emergency to avoid more serious complications as happened in our second reported case. A similar approach was reported by Dhua 2013.

The mechanism of catheter rupture can be explained by using sharp scissors or blades during the fixation process or most likely during removal. Suture overtightening might also cause weakness in the catheter wall and contribute to easier rupture while in use or during removal [10].

As a universal practice, healthcare providers should be cautious with the insertion and removal of catheters; well-trained personnel should be responsible for conducting this procedure in the neonatal ICU, and local hospital policies and guidelines should be implemented. Central line bundles have been applied in many centers and have overall contributed to less side effects mainly infection [11]. Fine tip scissors should be used during the process of removal instead of sharp blades. Surgical clamps and hemostats should be readily available in the removal kit and providers should be vigilant to use them immediately in case of an accidental break, before the view is obscured, if massive bleeding happens.

Having seen two cases within a very short period in our unit emphasizes the seriousness of the problem and strictly insists on using the appropriate instruments. In addition, we need to establish and implement a local policy regarding the process of insertion and removal of umbilical catheters, including a clear role assignment of two experienced providers and to avoid the use of sharp blades. Checking the whole catheter length immediately after

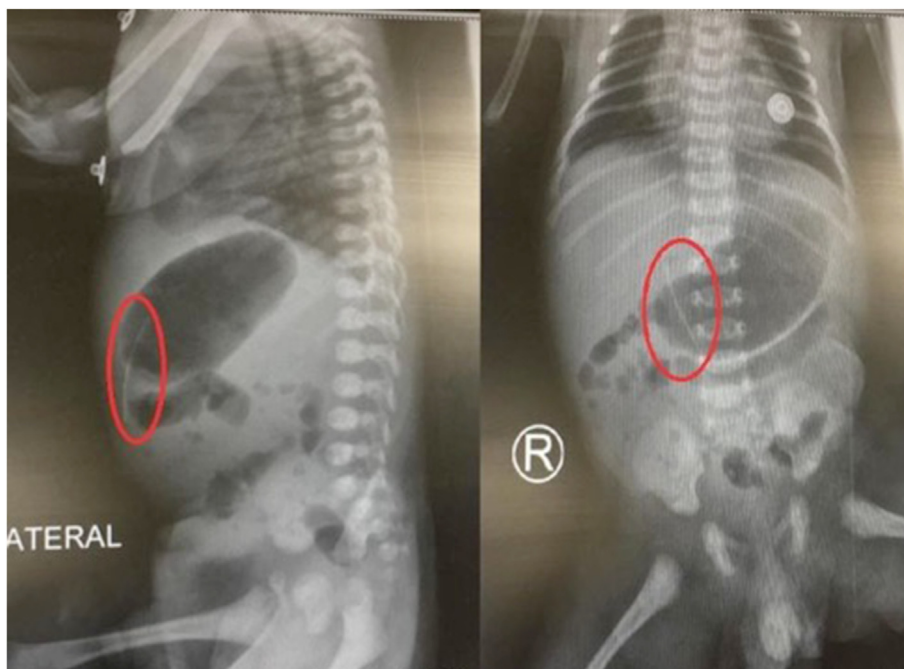


Fig. 1. Lateral and AP X ray of the abdomen, showing the retained UVC fragment.

removal is very important, and doing a radiograph if any suspicion exists about a catheter rupture should always be considered.

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### Declaration of competing interest

All authors declare no conflict of interest.

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