Bilateral lower extremity ischemia due to a retained umbilical artery catheter in a preterm neonate

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Abstract

The use of umbilical artery catheters is common in Neonatal Intensive Care Units, especially in low and very low birth weight neonates. Rarely, these can break or fracture, leading to a retained fragment, which can embolize or cause thrombosis. We present a case of a very low birth weight, premature neonate, 940 grams, with a retained umbilical artery catheter that led to bilateral lower extremity ischemia. A laparotomy with aortotomy was performed for retrieval of the catheter. Chronic occlusion of the aorta with collateralization is a long-term complication associated with this case.

Keywords

Umbilical artery catheter; Catheter fracture; Ischemia

1. Introduction

Umbilical artery catheterization has become the standard of care in the Neonatal Intensive Care Unit (NICU) for continuous hemodynamic monitoring and arterial blood sampling. Complications from umbilical artery catheters (UAC) can include infection, thrombosis, arterial vasospasm, and aneurysm formation [1,2]. Infrequently, these catheters can fracture or break resulting in retained fragments, leading to thrombosis, distal embolization, and ischemia [3,4]. Over the past 50 years, only 15 cases of broken UACs have been reported in the literature [2,5–17], with bilateral lower extremity ischemia presented in only one prior case. Here we describe the removal of a retained UAC fragment in a very low birth weight (VLBW) neonate, including post-discharge follow-up for three years.
2. Case report

A 27-week preterm, twin, male, neonate, was admitted to the NICU after delivery, via Cesarean section, due to respiratory distress syndrome requiring intubation. Umbilical artery and vein catheters were placed shortly after birth, with the venous catheter removed without incident after two days. On day of life four, the UAC was no longer needed. During removal, the catheter was accidently transected while cutting the sutures and bleeding at the umbilical cord was noted. A hemostat was placed over the umbilical stalk, resulting in the cessation of bleeding. Pediatric surgery was consulted for removal. A plain abdominal x-ray (AXR) was obtained showing a 6.5cm UAC fragment overlying the abdomen, appearing to still be within the umbilical artery (Image 1). Removal at the bedside was attempted with sedation and full relaxation. An infraumbilical incision was made, both umbilical arteries were dissected free and controlled with ties, however, neither contained the retained fragment. Exploration was extended into the abdomen where the UAC was palpated. An AXR was obtained showing the retained fragment had migrated deeper within the abdominal aorta (Image 2). Loss of bilateral femoral pulses and poor perfusion below the umbilicus resulting in significant ischemia was then noted.

The 940-g neonate was taken code one to the operating room (OR) for an exploratory laparotomy and removal of retained catheter. An endovascular approach was considered, but rejected, due to the size of the neonate and the severe ischemia present. The UAC fragment was palpable from the aortic bifurcation proximally. After proximal and distal control was obtained with vessel loops, the catheter was removed via an infrarenal aortotomy, which was then closed transversely with interrupted 7–0 polyprophylene sutures. Intraoperative dopplers revealed good flow proximal to the aortotomy closure and improved flow within the bilateral distal arteries, however, significant vasospasm was present. Before leaving the OR, doppler signals were obtained in the bilateral femoral arteries. As reperfusion was achieved within two hours of the onset of acute ischemia, observation was chosen over bilateral lower extremity fasciotomies. The post-operative x-rays confirmed complete removal of the catheter fragment.

Post-operatively, the patient had slow capillary refill of the bilateral lower extremities, with dusky coloration and mottling. An arterial duplex was obtained showing obstructive pathology within the aorta. Anticoagulation was unable to be started due to the patient’s high risk of intracranial hemorrhage. Perfusion to the lower extremities continued to improve, with return of normal skin coloration and palpable pulses. He was discharged from the NICU three months later in good condition.

Repeat arterial duplexes one month and one year after discharge showed no evidence of arterial occlusion. The patient was seen in the Pediatric surgery clinic last year for continued follow up. Ankle-brachial indexes (ABIs) obtained were 0.81 on the right and 0.84 on the left. Though aortoiliac duplexes were normal, a CT angiography (CTA) of the abdomen and pelvis was obtained to evaluate for long term vascular injury. The CTA showed short segment chronic occlusion of the distal abdominal aorta with reconstitution of the common iliac arteries via several collateral vessels (Image 3). His most recent ABIs have improved to 0.9 bilaterally. He is currently the same height as his twin with normal limb development.
3. Discussion and conclusion

Broken or fractured umbilical artery catheters resulting in thrombosis or embolization are rare occurrences. This usually occurs during removal or repositioning of the catheter, especially when cutting the attached suture, but has also been reported during catheter insertion [14]. A literature review discovered only 15 cases reported since 1972 [2, 5–17]. As in our patient, most fractured UACs were found in VLBW premature neonates. This is likely due to the increased need for invasive monitoring in these neonates, generally through access of the umbilical artery, as obtaining peripheral arterial access can be difficult [18].

Early recognition of a broken catheter is paramount and can help determine the route of retrieval of the retained fragment, as well as decrease the potential associated complications. Local exploration of the umbilical stump at the bedside is an accepted first approach for retrieval in the majority of cases. Unfortunately, as in our case, this is rarely successful due to further migration of the catheter into the abdominal aorta. Both endovascular and open surgical approaches have been described as the next option for retrieval. In cases reported in the literature, about half utilized an open approach with aortotomy and half an endovascular approach.

The chosen technique often depends on infant size, location and associated complications of the retained fragment, severity of the patient’s overall clinical status, and availability of equipment and comfort level of the surgeon with advanced endovascular techniques. Per the current literature, there does not appear to be a difference in clinical outcome between the two approaches. Arterial spasm and occlusion have been reported as post-operative complications of both approaches. It is important, however, to note that one must constantly monitor the patient for signs of ischemia or decompensation, as these can develop rapidly in VLBW neonates. In our patient, signs of bilateral lower extremity ischemia developed in under one hour after initial attempted removal of the catheter. The development of this severe complication guided surgical decision making, as expedited removal was essential to give our patient the best chance of recovery without severe deficits or loss of limb. Wagner et al. [8] reported a similar case of an absent femoral pulse pre-operatively, with long term sequelae of right leg muscle atrophy and a limb length discrepancy.

Retained fragments from broken UACs are a rare occurrence but can present with serious complications. Prompt recognition and retrieval are essential, as the risk of developing unilateral or bilateral limb ischemia is high. Stenosis or occlusion can result in long term ischemic complications, including growth inhibition, and aneurysmal disease is a risk following vascular repair. Long term follow-up of these patients is crucial to evaluate for vascular injury. Vascular duplex can be used; however, it may not be adequate for intraabdominal disease, particularly for short segment damage. ABIs are a good tool to follow lower extremity ischemia, especially in children, as they are inexpensive and utilize a noninvasive method.

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Image 1.
Cross-table lateral view of the abdomen showing an umbilical artery catheter fragment (arrow).
Image 2.
Cross-table lateral view of the abdomen showing retained UAC with migration further into the abdominal aorta (arrow).
Image 3.
CTA abdomen and pelvis with 3-D reconstruction showing chronic occlusion of the distal abdominal aorta with reconstitution of common iliac arteries via collateral vessels (arrowhead-infrarenal aorta; star-aortic bifurcation; arrow-left iliac stenosis).