Catheter-induced brachial artery thrombosis in the neonate

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Acute arterial thrombosis is a rare complication of brachial artery cannulation that can threaten the viability of the affected limb. We present a case of a premature male neonate who suffered complete thrombosis of the brachial artery following multiple failed attempts at cannulation. He subsequently underwent emergent thrombectomy, resection of the involved vessel segment, and primary microanastomosis with good recovery. ***Ann Pediatr Surg*** **10:78–80 © 2014 Annals of Pediatric Surgery.**

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Introduction

With the increasing use of invasive therapeutic interventions such as direct arterial puncture, indwelling arterial monitoring devices, central venous catheters, and arterial and venous umbilical catheters, adverse iatrogenic thromboembolic events are becoming more common. Acute arterial thrombosis is a rare but serious and potentially limb-threatening complication of brachial artery cannulation. We present the case of a 2.4 kg premature neonate who required urgent operative exploration for an ischemic limb.

Case report

A male neonate, born at 32-week gestation, weighing 1730 g, was transferred to the Montreal Children's Hospital, neonatal intensive care unit (NICU) for suspected necrotizing enterocolitis. After consultation with pediatric surgery, the decision was made to treat the patient medically with antibiotics and bowel rest.

However, on day 35 of life (corrected gestational age of 37 weeks), the patient was discovered to have a perforation of the terminal ileum secondary to stricture and underwent resection of terminal ileum and cecum with mucous fistula and ileostomy.

Following the procedure, the anesthesia team attempted to place a right arm brachial artery catheter for blood pressure monitoring and blood procurement. Following multiple unsuccessful attempts at cannulation of the right brachial artery, the line was found to be occluded and the right hand was noted to be pale. The brachial artery line was subsequently removed. During the next 4 h, the right hand and forearm were noted to have increasingly sluggish capillary refill and worsening pallor. Purple discoloration of the fingertips also developed.

Plastic surgery was consulted following brachial artery insertion at which point a bedside Doppler ultrasound was performed and demonstrated suspicion of thrombus of the right brachial artery at the level just proximal to the antecubital fossa, with good proximal flow but no distal flow. An intravenous heparin drip as well as a hematology consult were suggested by the plastic surgery team. The patient was assessed by a hematologist who suggested thrombolysis; however, considering the patient's recent intra-abdominal surgery, thrombolytic therapy was contraindicated [1]. Upon re-examination of the hand, the pallor had worsened and pregangrenous changes of the fingertips were present; the decision was made by the plastic surgery team to take the patient to the operating room for exploration of the right brachial artery (Fig. 1).

Upon intraoperative exposure just proximal to the antecubital fossa, the brachial artery was identified and measured 1.9 mm in diameter (equivalent to the size of a digital artery in the adult). Multiple through and through puncture marks of the brachial artery were clearly visualized. A thrombus measuring 7 mm in length was seen at this precise location, completely occluding the vessel and blocking all distal flow.

Thrombectomy and resection of the involved 7 mm vessel segment were performed under full magnification. Following resection, an attempt was made to insert the smallest available Fogarty catheter (#2, 1 mm maximum deflated diameter) into the vessel; however, because of the extremely small diameter of the vessel, we were unable to insert the catheter distally or proximally to the site of thrombosis. A 27-G angiocatheter was then inserted into the proximal brachial artery to verify proximal flow; even under direct microscopic visualization, this was a difficult task as the angiocatheter was nearly the same diameter as the lumen of the artery.

A tension-free primary microanastomosis was performed using 10-0 nylon suture. The decision to carry out fasciotomies was considered; however, the hand and forearm were quite soft and because of the increased morbidity of conducting hand and forearm fasciotomies on a neonate, it was decided to abort fasciotomies and closely monitor postoperatively for the development of compartment syndrome.

The patient was immobilized with the elbow in slight flexion to minimize tension on the anastomosis, and he was returned to the NICU (Fig. 2). Following further

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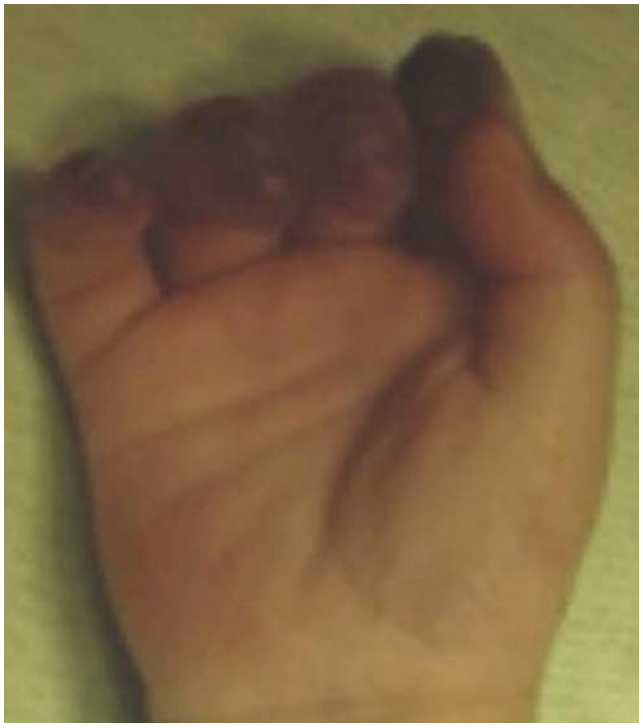
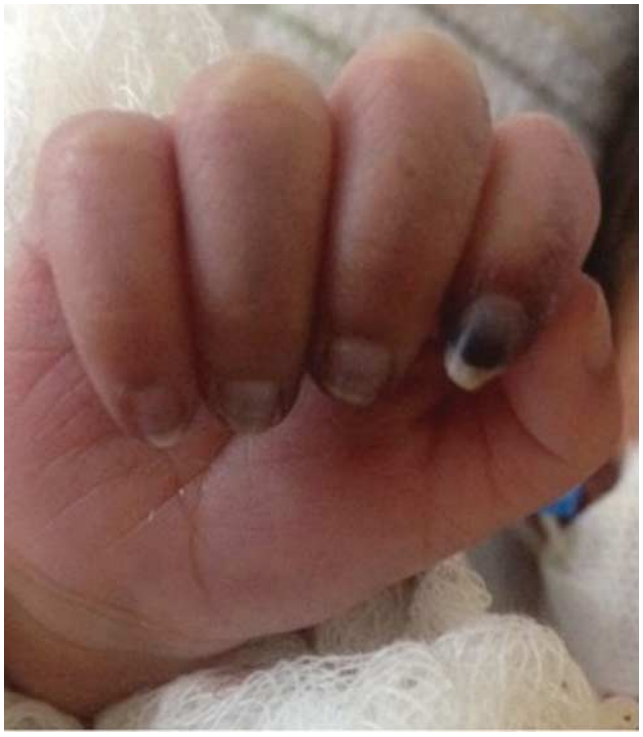
Fig. 1



Photograph of the hand at initial assessment.

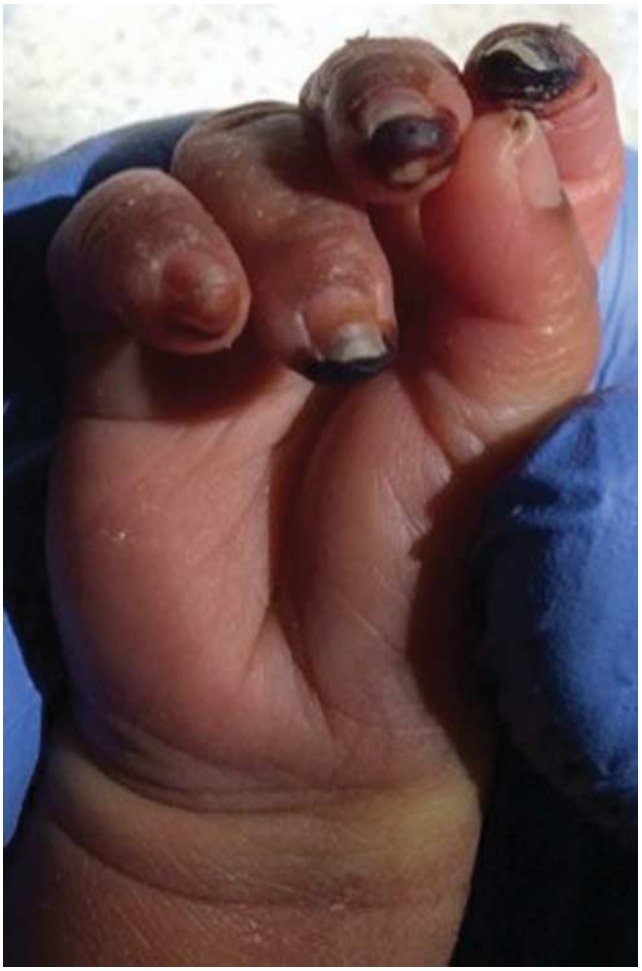
Fig. 2



Photograph of the hand immediately postoperative.

discussion with plastic surgery, pediatric surgery, and hematology teams, it was agreed that a continuous heparin infusion (10 IU/kg/h) would be initiated and continued for 7 days.

Fig. 3



Photograph of the hand at 3 weeks' postoperative.

The patient underwent an uneventful postoperative course with no development of compartment syndrome and with no further progression of the area of necrosis and with minimal persistent ischemic damage to the fingertips. Capillary refill normalized and he began moving his hand and fingers well postoperatively (Fig. 3). Postoperative Doppler ultrasound was performed and flow was confirmed in the brachial, radial, and ulnar arteries distal to the site of anastomosis. The patient was discharged home in stable condition 2 weeks following admission.

Discussion

Various authors have estimated the incidence of thromboembolic events in newborn to be 2.4/1000 among patients admitted to the NICU [2], with up to 90% being associated with an iatrogenic event [3]. Important risk factors for the development of thrombosis include inflammation, maternal diabetes, disseminated intravascular coagulation, congenital heart disease, decreased cardiac output, neonatal polycythemia, and sepsis [4,5]. Preterm infants are even more susceptible to developing thrombosis due to their lower cardiac output, relative

polycythemia, and greater propensity for vasospasm of vessels [6–8]. The risk for thromboembolic event is further increased with manipulation of the vessel and multiple puncture attempts [9].

Although we present a fairly unique and severe case of acute arterial occlusion requiring surgical intervention, it is important to be aware of other, less aggressive treatment options available for the management of neonatal thrombosis. Expectant management, topical vasodilators as well as thrombolytic and/or anticoagulant therapy should all be considered when evaluating the patient with a thromboembolic event before proceeding to surgery. In our case, because of the complete occlusion of the vessel threatening the upper limb and absolute contraindication to initiating thrombolytic therapy (invasive surgical procedure within the past 3 days), we opted to proceed directly to surgical intervention. Other absolute contraindications to commencing thrombolytic and/or anticoagulant therapy include central nervous system surgery or ischemia, active bleeding, and seizure activity within 48 h. Relative contraindications include thrombocytopenia, low fibrinogen concentration, international normalized ratio greater than 2, severe coagulation deficiency, and hypertension [1].

Although some authors consider brachial artery catheterization to be a safe procedure [10], we feel strongly that brachial artery cannulation should not be performed in neonates with extreme low birth weight. First, because of the extreme small size of the brachial artery, blindly attempting to cannulate such a vessel percutaneously is an extremely difficult task to perform requiring multiple puncture attempts and subsequent intimal damage. In addition, even the insertion of the smallest plastic catheter (27 G) into the neonate brachial artery intraoperatively demonstrated that the catheter diameter alone nearly occluded the entire lumen. Although early diagnosis and knowledge of the management of these adverse events are paramount to maximize the chances of limb salvage and normal limb growth, the main goal should remain the prevention of such complications by avoidance of cannulating sites with no collateral flow such as the brachial artery.

Conclusion

Neonatal limb ischemia is an uncommon but potentially devastating complication of arterial cannulation. Early diagnosis and treatment with intravenous heparin and/or surgical intervention are paramount to maximize the chances of limb salvage and normal limb growth.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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