# Umbilical artery catheter, aortic dissection, carotid cannulation, and pseudoaneurysm in a neonate: A tale of propagating pathology

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## ABSTRACT

**Arterial dissections are uncommon in neonates. Complications include thrombosis, bleeding, dissection, aneurysm and pseudoaneurysm. We report an unusual case of multisite pathology (dissection and pseudoaneurysm) following common vascular interventions. A term neonate with antenatal diagnosis of congenital heart block secondary to maternal lupus deteriorated clinically at 5 days of life. He was found to have an abdominal aortic thrombus secondary to abdominal aortic dissection, following umbilical arterial catheter placement. Attempted percutaneous treatment was complicated by dissection of the left common carotid artery and formation of a large pseudoaneurysm. Neonatal lupus is associated with weakened vessel wall which may be vulnerable to injury from line placement and endovascular interventions. Various options are available to manage arterial dissection, thrombus, and pseudoaneurysm, but consequences of these options need to be carefully weighed to minimize further complications.**

**Keywords:** Aortic dissection, carotid artery pseudoaneurysm, neonatal lupus, umbilical arterial catheterization

## INTRODUCTION

Arterial dissections are rare in the neonatal period. We describe a case of carotid artery pseudoaneurysm in a newborn with neonatal lupus following percutaneous attempt at revascularization of the superior mesenteric artery (SMA), consequent of abdominal aortic dissection with false lumen thrombosis after removal of umbilical arterial catheter.

## CASE REPORT

A male baby weighing 2.6 kg was delivered by elective cesarean section at term for known congenital heart block and breech presentation. Maternal anti-Ro antibody was positive. He was intubated for increased work of breathing. Electrocardiography showed complete heart block. 5Fr umbilical arterial and venous catheters were inserted before transfer to our pediatric cardiac intensive care unit.

He was hemodynamically stable. Echocardiography revealed a structurally normal heart with good function. Chest radiograph and cranial ultrasound were unremarkable. He was extubated on day 5 of life, and umbilical lines were removed.

Six hours later, he became pale, mottled, and tachypneic and had temperature instability. Blood gas revealed severe metabolic acidosis (pH 6.78 and lactate 15 mmol/L). He was reintubated and resuscitated. Echocardiography

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DOI: 10.4103/apc.APC_67_19



**How to cite this article:** Wang J, Semple T, Bautista-Rodriguez C, Hoschtitzky A, Cheshire N, Chan-Dominy A. Umbilical artery catheter, aortic dissection, carotid cannulation, and pseudoaneurysm in a neonate: A tale of propagating pathology. Ann Pediatr Card 2020;13:87-90.

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**Received:** 10-05-2019 **Accepted:** 01-06-2019 **Published:** 19-07-2019

demonstrated impaired systolic function. Blood tests showed disseminated intravascular coagulopathy.

Abdominal distension and frank hematuria were noted. Ultrasound demonstrated a significant aortic thrombus [Figure 1], suspected to be secondary to aortic dissection. The thrombus extended into the SMA [Figure 2] leading to necrotizing enterocolitis (NEC) and right renal artery resulting in renal ischemia [Figure 3]. Repeat cranial ultrasound showed bilateral Grade I germinal matrix hemorrhage.

SMA revascularization was attempted in view of NEC and critical ischemia (lactate 17 mmol/L). Aortic dissection precluded femoral arterial access. The left common carotid artery (CCA) was punctured, and a 5Fr introducer was placed. The procedure was aborted due to CCA dissection noted in the first angiogram after introducer placement. Doppler ultrasound did not show flow compromise [Figure 4].

Heparin infusion was commenced with no improvement in SMA blood flow. Thrombolytic therapy (recombinant tissue plasminogen activator) was administered but was discontinued 4 hours later due to a new right thalamic hematoma [Figure 5]. On heparin, the aortic thrombus reduced in size with return of renal arterial flow, but a large left CCA pseudoaneurysm (17 mm × 22 mm × 22 mm) was demonstrated 9 days after CCA dissection [Videos 1, 2 and Figures 6, 7]. This was repaired a few days later by direct suture closure of the pseudoaneurysm neck [Figure 8]. Neonatal lupus was confirmed in the presence of anti-RNP/Sm and anti-Ro antibodies. A permanent dual-chamber pacemaker was inserted, and he was asymptomatic with normal renal profile at the time of discharge to home at 34 days of life.

## DISCUSSION

This case of neonatal lupus with arterial dissections that threatened multiorgan injury serves as caution for vigilance on vascular procedures. Our decision-making on management of the dissections and complications evolved on anticoagulation threshold, technical access for primary and rescue percutaneous and surgical interventions toward multiorgan flow preservation. We believe that this is the youngest and smallest patient reported in literature with both arterial dissection and pseudoaneurysm.

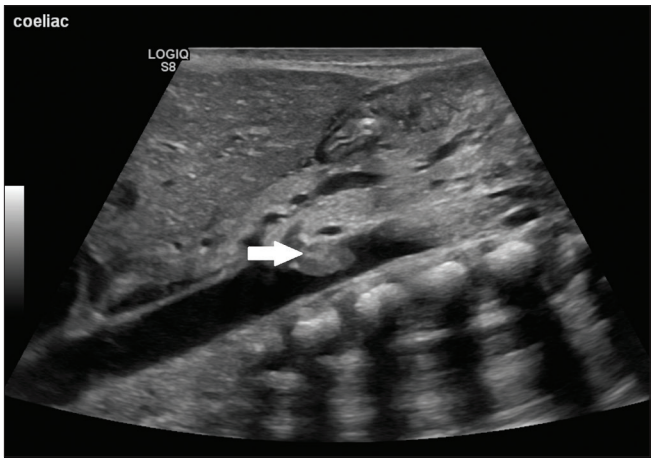


**Figure 1: Large aortic thrombus occluding coeliac axis (white arrow)**

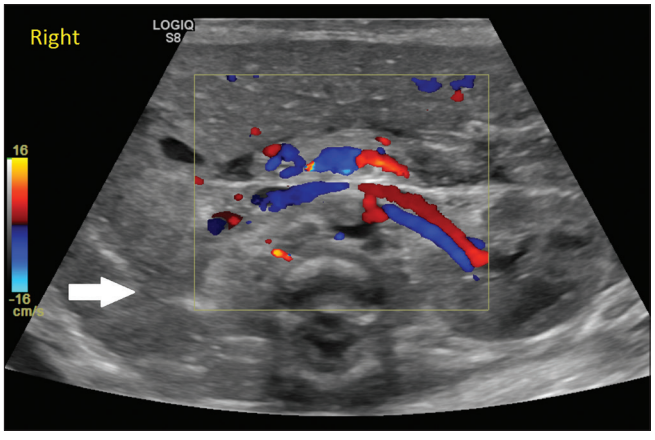


**Figure 3: Aortic thrombus causing reduced right renal blood flow and infarction (white arrow)**

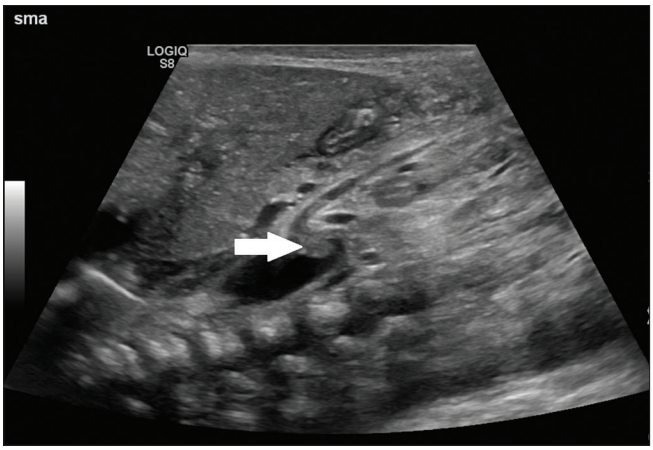


**Figure 2: Aortic thrombus compromising blood flow to superior mesenteric artery (white arrow)**

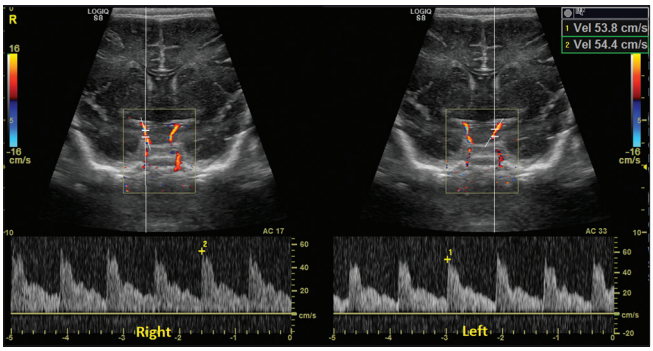


**Figure 4: Normal bilateral carotid blood flow Doppler**

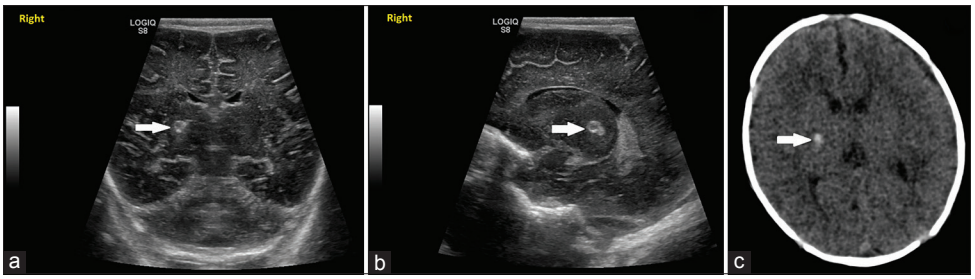


**Figure 5: Thalamic bleed (white arrow) in coronal view (a), sagittal view (b) and computed tomography of brain (c)**

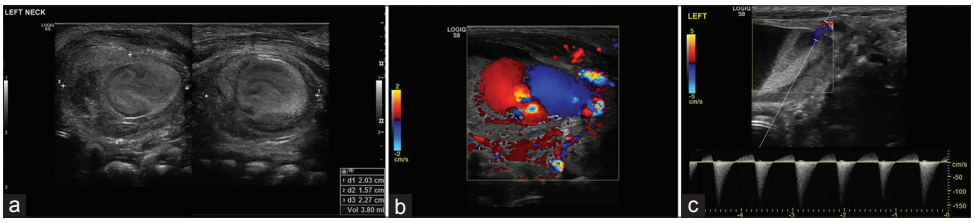


**Figure 6: Left common carotid artery pseudoaneurysm, "yin-yang sign" (a), blood flow pattern (b), neck (c)**

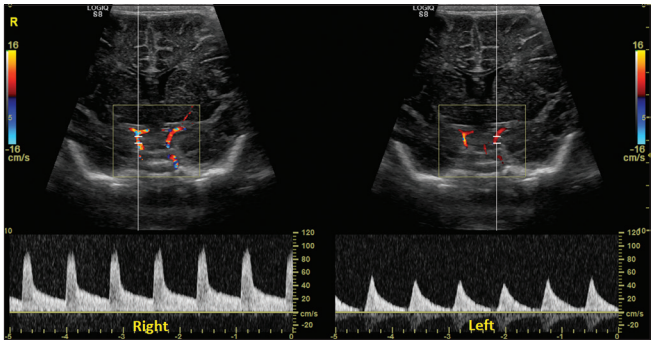


**Figure 7: Abnormal Doppler waveform in the left carotid artery**

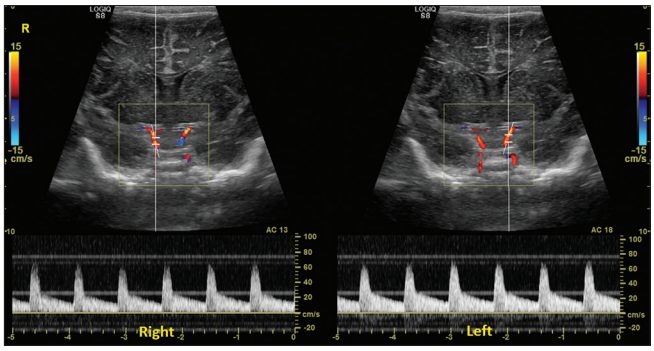


**Figure 8: Normalized left carotid artery Doppler waveform after suture closure of the pseudoaneurysm neck**

### Neonatal lupus and arteriopathy

Neonatal lupus has been associated with blood vessel wall compromise, possibly due to maternal autoantibodies causing wall inflammation, predisposing to aneurysm formation and dissection.[1] Interventions such as catheterization and use of guidewires are challenging as minor contact can cause dissection.

### Aortic dissection with occlusive thrombus

Umbilical arterial catheterization (UAC) is performed for continuous hemodynamic monitoring. Complications include thrombosis, infection, bleeding, dissection, aneurysm, and pseudoaneurysm.[2,3] Aortic thrombus can occur as a consequence of aortic dissection, like in our case.[3] Once an aortic thrombus forms, the aim is not only to prevent thrombus progression but also to remove the thrombus, if flow to vital organs is compromised. Unfractionated heparin infusion is commonly used for the former, targeting anti-Xa level between 0.3 and 0.7 IU/ml.[4] Available options to improve blood flow include systemic or localized thrombolysis, thrombectomy, and angioplasty/stenting.

In a case series involving nine premature infants with aorto-iliac thrombosis related to UAC, the outcome of three treatment options was analyzed: unfractionated heparin only infusion, unfractionated heparin infusion followed by intravenous streptokinase, and low-dose intravenous streptokinase only infused through the UAC directly into the thrombus. The third option was most favorable.[5] Thrombectomy has been shown to be technically challenging with poor outcome in infants.[5] As with unfractionated heparin infusion, we considered systemic thrombolysis very carefully in light of the intracranial bleeds. Although evidence in the neonatal population is scarce, localized thrombolysis and/or angioplasty/stenting may be possible if appropriate access was amenable.

### Pseudoaneurysm management

In contrast to a true aneurysm which consists of focal dilatation involving all three layers of the arterial wall, pseudoaneurysm occurs when there is an interruption

in the continuity of the arterial wall due to trauma or inflammation causing partial tear or localized disruption of the vessel wall.[6] The sustained arterial pressure leads to blood leaking into the surrounding tissues, forming a sac. If left untreated, the pseudoaneurysm can rupture, become infected, or compress the upper airway and adjacent neurovascular bundles.[7] Various radiological modalities can be used to look for thrombus; however, ultrasonography provided sufficient information to guide management in our case. For detection of postcatheterization pseudoaneurysms of superficial blood vessels, ultrasound has a sensitivity of 94% and a specificity of 97%.[6]

To treat pseudoaneurysms, confounding factors such as morphology, areas involved, existence of intracranial collateral circulation, and age of the patient will determine the choice for management to be conservative, endovascular, or surgical. The former is suitable for very small pseudoaneurysms and requires surveillance and anticoagulation. The endovascular approach (stenting/coiling) is considered when there is intact circle of Willis. The technique was safe and effective (technical success rate of 98.2%) in 23 children (2–15 years old), with lower mortality rate compared to surgical repair. Internal carotid artery ligation for pseudoaneurysm has been associated with 5%–25% risk of stroke even in patients with sufficient collateral circulation.[7]

## CONCLUSIONS

Vascular procedures need to be carried out with considerable vigilance, especially in neonates with antenatal pointers toward the diagnosis of neonatal lupus. Localized aortic thrombolysis seems to be favorable provided access is possible. The management of pseudoaneurysms is controversial when comparing endovascular and surgical options, particularly in newborns.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

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