Abdominal Arteriovenous Malformation in a Neonate: A Rare Cause of Pulmonary Hypertension
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Introduction
Umbilical arteriovenous malformations in the neonate are rare, and are typically managed with surgical excision. Endovascular coiling of these lesions can be technically challenging in newborns. Here we present a case where this was attempted.

Patient History
- An eight day old full term female presented with an abdominal AVM causing severe pulmonary hypertension.
- She had increasing severe tricuspid regurgitation and right heart failure, which progressed to respiratory failure. She was intubated and started on milrinone.
- The patient presented to the interventional radiology suite for embolization of the abdominal AVM, with a pediatric surgeon on standby.

Case History
- We anticipated hypotension due to a sudden drop in preload when the only source of venous outflow from the AVM, the umbilical vein, was occluded.
- We prepared volume resuscitation with fluid, as well as vasopressin to increase vascular tone, to be given as the umbilical vein was embolized.
- During the case, angiography demonstrated severe AV shunting with the bilateral epigastric arteries draining through the umbilical vein, to the ductus venosus, to the IVC and into the right heart.
- Coil embolization of the AVM nidus, including inferior epigastric arteries and umbilical vein, was performed, however we did not observe the hemodynamic instability due to a drop in preload that we expected.
- Repeat echocardiogram showed evidence of residual AVM, with AV shunting into the ductus venosus. We then realized that the umbilical arteries were likely still providing residual arterial inflow despite nidal embolization. This explained the lack of a sudden decrease in cardiac output that was expected.
- The umbilical arteries were then ligated surgically in order to terminate the residual AV shunt.
- She tolerated the laparoscopic procedure well without hemodynamic or respiratory instability.

Discussion
- Umbilical AVMs are rare and may be discovered incidentally during a workup for heart failure. Morbidity and mortality can be high if the condition is not diagnosed and treated rapidly. Embolization offers the unique ability to occlude the AVM nidus and venous outflow directly, which usually cannot be performed surgically, and theoretically can prevent the patient from having to return for subsequent surgeries to address residual AV shunting. During the case, there was some residual flow from the umbilical arteries after coiling, which drained into the ductus venosus and provided some preload. Since the venous outflow from the AVM was not occluded precipitously and completely in our case, we avoided hemodynamic instability due to sudden drop in preload. However this necessitated the patient to come back for a subsequent procedure due to the risk associated with embolizing umbilical arteries in neonates.

Anesthetic Details
- The patient had central and arterial access.
- Milrinone and alprostadil infusions were continued from NICU.
- Nitric oxide was on standby for pulmonary hypertensive crisis.
- Anesthesia was maintained with fentanyl, ketamine, and rocuronium.

Follow Up
- The patient's follow-up ECHO showed no residual shunt. Her pulmonary hypertension improved and she was able to eat and gain weight.
- At eight weeks old, she was evaluated by her cardiologist, and echocardiogram showed no pulmonary hypertension with normal heart chamber size and function.

Figure 1: Pre-operative angiogram of abdominal AVM
Figure 2: Post-coiling Angiogram of abdominal AVM