CASE PRESENTATION

3 week old ex-32 week old twin preemie born via cesarean section presented for a coarctation repair.

Past medical history:

- Brief period of intubation immediately after birth.
- Echo cardiogram: juxtagradial coarctation of the aorta, mild LVH & LV systolic function with normal limits.
- Idiopathic thrombocytopenia which resolved after a platelet transfusion.

Preoperatively:

- 40 mmHg gradient between the patient’s upper and lower extremity blood pressure readings.

Intraoperatively:

- Fentanyl and rocuronium were used to induce anestesia
- Nasal endotracheal tube was placedatraumatically.
- Peripheral IV access on the left upper extremity and a right radial arterial line were obtained

Patient was hemodynamically stable until the aortic clamp was applied, at which time the arterial line tracing dampered. It became evident that the right subclavian take off from the aorta was anomalous.

Without a reliable method to monitor end-organ perfusion pressure, we decided to institute cerebral oximetry to monitor cerebral oxygenation. During the 15 minutes of clamp time, we extrapolated from that data to see if cerebral perfusion was adequate.

Postoperatively:

- Patient was admitted to the CICU, intubated without any vasoactive infusions.
- Twenty-four hours after the repair, the patient remained intubated without a blood pressure gradient between the upper and lower extremities.

CASE CHALLENGES

1. The presence of an aberrant subclavian artery and possible vertebral artery takeoff was unknown prior to incision.
2. During cross-clamp, arterial pressure monitoring became unreliable, making assessment of perfusion to vital organs difficult.

DISCUSSION: ABERRANT ANATOMY

Similar unexpected anatomy has been previously documented in the literature. While this aberrancy can produce intraoperative complications, as did in our case, it can conversely provide beneficial circulatory support.

In a unique case report in a patient with an interrupted aortic arch and aortic atresia, which is usually a fatal combination, the patient was able to perfuse his basilic arteries via retrograde blood flow to the Circle of Willis [6]. Monitoring for adequacy of organ perfusion proved challenging and this case was completed under deep hypothermic circulatory arrest [6].

Other case reports state that left thoracotomy for surgical correction of aberrant subclavian is well tolerated in the pediatric population, whereas adults can suffer from extreme ischemia and decreased posterior cerebral circulation. In these cases, vascular surgeons can reattach the subclavian to the right common carotid, although, this can be technically challenging [7].

When anomalous subclavian arteries arise, which happens (on the right side) in about 0.5% to 1% of the population, it develops as the last branch of the descending aorta [4, 5]. It is unusual that this anomalous takeoff causes clinical dyspnea or dysphagia, as the right subclavian typically travels posterior to the esophagus [5], making its presence difficult to identify clinically.

DISCUSSION: MONITORING

Non-invasive approaches:

Cerebral oximetry allows for continuous non-invasive monitoring of oxygen delivery to the brain using a venous-weight ratio of oxygenated and deoxygenated hemoglobin as monitored by the absorption of near infrared light wavelengths in tissue [1]. Best used as a trending tool.

ASL pMRI uses electromagnetically labeled arterial blood water, instead of intravenous contrast of radioactive tracers. Labeled blood is allowed to flow into the area of interest and images taken before and after labeled blood flow introduction are compared to assess cerebral blood flow [2]. Application intraoperatively is extremely limited as an MRI machine is necessary to attain this important information.

DCS examines the properties of deep tissues using near-infrared light to monitor relative blood flow, rather than oxygen saturation. This is accomplished by examining the scatter of near-infrared light thousands of times before it reaches the sensor; a “spickel pattern” is created at the sensor from the various light fields interactions. Variation in the spickel pattern reveals information about the objects creating the scatter, most commonly red blood cells. Ultimately, examining changes in spickel patterns over time reveals data about blood flow [3]. DCS is very new technology, and while it is non-invasive, more studies are required before its clinical application becomes commonplace.

Alternatives:

Deep hypothermic circulatory arrest remains a plausible option [8]. Regional antegrade cerebral perfusion has been used by some centers [8].

REFERENCES: