Ulnar Artery Thrombosis Following Tranexamic Acid Administration for Craniosynostosis Repair

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INTRODUCTION

- Craniosynostosis is the premature fusion of one or more cranial sutures in an infant.
- If left untreated, craniosynostosis can lead to cranial growth restriction and increased intracranial pressure
- Pediatric craniosynostosis repair with cranial vault reconstructive surgery can be associated with significant blood loss.[1]
- Tranexamic acid (TXA), an antifibrinolytic, has been shown to decrease blood loss and transfusion in craniofacial surgery.[2]
- Data regarding the safety of TXA is limited.
- We describe a case of ulnar artery thrombosis following an ulnar arterial line placement in a patient who received TXA for cranial vault reconstructive surgery.

CASE REPORT

Pre-operative

- A four year old, 14 kilogram female with a history of chromosomal abnormalities, global developmental delay, and craniosynostosis presented for bifrontal craniectomy and frontal orbital advancement.
- Past surgical history was significant for a ventricular septal defect and atrial septal defect closure at 2 months of age, posterior cranial vault distraction at 7 months of age, and frontal orbital advancement at 30 months of age.
- Preoperative labs values were as follows: hemoglobin 13.7 g/dL, hematocrit 40.7%, platelets 379,000 per mcl, PT 13.4 sec, PTT 29.2 sec, INR 1.0 and fibrinogen 300 mg/dL.

Intra-operative

- The patient was brought to the operating room and inhalation induction and intubation were uneventful.
- Arterial line placement proved to be challenging.
- The right radial artery was difficult to palpate so was not attempted. The right posterior tibial and left radial artery attempts were unsuccessful.
- Ultimately, the left ulnar artery was cannulated on the second attempt with ultrasound guidance.
- The patient received a 10 mg/kg bolus of TXA followed by an infusion of 3 mg/kg/h.
- Surgery lasted for approximately 5 hours
- Estimated blood loss was around 580 milliliters. 455 milliliters of packed red blood cells and 280 milliliters of fresh frozen plasma were transfused.
- The arterial line had damping following lab draws, but normalized following flushing.
- The TXA infusion was discontinued intraoperatively due to clotted specimens.

Post-operative

- Following the case in the PACU, the left hand was noted to be cold and mottled.
- Radial and ulnar pulses were not palpable, and a pulse oximeter placed on that extremity showed no waveform.

IMAGES

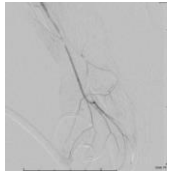

Image 1: Arteriogram with filling defect of ulnar artery

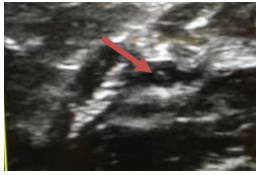

Image 2: US image of ulnar artery with echobright structure in center representing clot

Image 3: Left hand palmar aspect with mottling

Image 4: Left hand dorsal aspect with mottling

Image 5: Intraoperative exposure of left ulnar artery

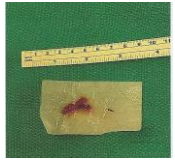

Image 6: Left ulnar artery clot

Image 7: Left hand, 3 weeks post op

Image 8: Left arm, 3 weeks post op

CASE REPORT continued

Post-operative, cont'd

- The arterial line was removed, and interventional radiology was consulted.
- By ultrasound exam there was an occlusive thrombus seen within the ulnar artery. The radial artery showed a high bifurcation and became distally progressively diminutive.
- The patient underwent two interventional radiology procedures which transiently improved ulnar artery patency, but the patient ultimately needed surgical ulnar artery thrombectomy and reconstruction with a saphenous vein graft.
- Ulnar pulse and good color returned to the left hand following surgery.

DISCUSSION

- Surgical intervention is the treatment of choice for craniosynostosis , however cranial vault reconstructive surgery can be associated with significant blood loss.
- Methods to address blood loss during surgery include early blood product transfusion, cell salvage and antifibrinolytics.
- TXA is an antifibrinolytic agent that blocks the lysine binding sites on plasminogen molecules, thereby preventing the conversion of plasminogen to plasmin.[3] TXA has been used to reduce blood loss in cardiac, orthopedic, and cranial vault reconstructive surgery.[4]
- A recent review revealed no difference in the incidence of adverse events in patients treated with or without antifibrinolytics including TXA in cranial vault reconstructive surgery.[5]
- Recent studies suggest the use of TXA is both safe and efficacious in cranial vault repair.[6]
- TXA use has been associated with both arterial and venous thrombosis in other types of surgeries.[7-8]
- Case reports of seizures and cerebral, pulmonary, mesenteric and retinal thrombosis have been reported in the literature.[4,5]
- This patient had an abnormal left radial artery, with more evident narrowing as the artery progressed distally. Due to absent collateral flow as a result of a thrombosed ulnar artery the left hand became critically ischemic.
- Our patient may have had several risk factors including early use of FFP and an aberrant radial artery which potentially placed the patient at higher risk for complications.
- To our knowledge, this is the first report of arterial thrombosis associated with the use of TXA in cranial vault reconstructive surgery.
- Although TXA has been used safely in the past for cranial vault reconstructive surgery, providers should be aware of the potential risk of thrombosis associated with TXA.

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