Embolization and Tranexamic Acid to Reduce Bleeding in Resection of Intracranial Juvenile Nasopharyngeal Angiofibroma

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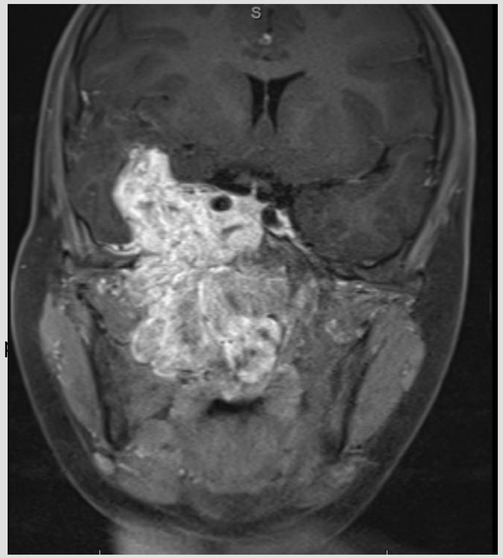
Learning Objectives

1. Recognize that blood loss during juvenile nasopharyngeal angiofibroma (JNA) resection is associated with increased morbidity and mortality.
2. Recognize that embolization of feeding vessels prior to resection can significantly reduce blood loss.
3. Formulate a multimodal approach to reduce blood loss in high grade (intracranial) JNA.
4. Demonstrate that tranexamic acid (TXA) can be utilized to reduce blood loss and transfusion volume in JNA resection

Preoperative Course

A 9-year-old, 43 kg, ASA III male with no past medical history for resection of a large JNA with intracranial extension. Presented six months prior with snoring, nasal obstruction, facial pain, swelling, and epistaxis. MRI showed a large mass with compression of the right nasopharynx and elevation of the temporal lobe. Biopsy was consistent with JNA and he was referred to oncology. He was started on sirolimus, an mTOR inhibitor that has recently shown promise in reducing tumor burden in prepubescent males with JNA. Although symptoms improved he continued to have epistaxis and sloughing of tumor via his nares and developed blurred vision and facial numbness. Repeat MRI showed the tumor had enlarged (9.2 × 5.2 × 5 cm) with increased invasion into the middle fossa and demonstrated compressive optic neuropathy. He was referred to otolaryngology, neurosurgery, and interventional radiology for resection with prior arterial embolization. He was continued on his chemotherapy and prophylactic antibiotics preoperatively. Preoperative anesthetic assessment showed no other concerns, including evidence of airway compromise. On the day prior to surgery he underwent successful embolization of the arterial blood supply from the external carotid while the internal carotid feeders could not be occluded due to size and concern for ischemic injury.

Case Description



On day of surgery:

- Radial arterial line
- Two 18 g PIVs
- Hemoglobin10.5 g/dL
- Crossmatched blood

Uneventful induction with fentanyl, propofol, and vecuronium. Anesthesia was maintained with isoflurane, nitrous, and sufentanil infusion. Additional 16 g IV and new arterial line (malfunction), and p Doppler due to risk of venous air embolism.

The following techniques were utilized to reduce blood loss:

- Hypotension with a MAP goal of 55-60
- Reverse Trendelenburg position
- TXA bolus of 20 mg/kg followed by 10 mg/kg/h infusion intraoperatively
- Of note, cell salvage was avoided at surgeon request.

The intracranial tumor was resected followed by the nasopharyngeal burden:

- Blood loss 950 mL
- Fluids: 3900 mL crystalloid, 885 mL pRBCs, 600 mL plasma.

The patient had no significant hemodynamic instability and extubated at the end of his 10.5 h procedure. Postoperative hemoglobin 9.8, pH normal, base deficit 2.8.

Postoperative Course

Patient had an uneventful course in PICU until discharge on postoperative day 7. At his postoperative clinic visit one month later, his only residual deficits were an improving optic neuropathy, sixth nerve palsy and loss of sensation in V2 territory. Repeat MRI showed a small area of residual tumor and he is being closely followed for tumor growth as he enters puberty.

Discussion

The potential for catastrophic blood loss is one of the most challenging aspects of JNA resection and is associated with increased morbidity and mortality.[1] Numerous techniques have been utilized to reduce blood loss including: reverse Trendelenburg position, induced hypotension, cell salvage, and preoperative embolization. Embolization is utilized by most centers and has been shown to reduce quantity transfused blood in high grade tumor resection, but not necessarily improve outcomes.[2] Also, embolization is often unable to be utilized on the internal carotid feeders associated with intracranial JNA due to size and risk of ischemia. Tranexamic acid, an antifibrinolytic has been widely utilized to reduce blood loss and transfusion in pediatric cardiac, orthopedic, trauma, and craniofacial surgeries.[3] Literature review showed anecdotal use of antifibrinolytics for resection, and one study comparing the use of aminocaproic acid versus TXA in low grade NPA resection.[4] Given that high grade tumors with intracranial extension tend to have more blood loss and increased morbidity, there appears to be a dearth of knowledge in the use of TXA to reduce blood loss. While we had good outcomes with our use of TXA in combination with embolization, further research needs to be conducted to determine if the benefits outweigh the risks.

References

1. Varun J, Kumar DS, Charu M, Hemanshu P. Juvenile nasopharyngeal angiofibroma with intracranial extension - A review of 29 cases. Journal of Neuroanaesthesiology and Critical Care 2014:1:40-45.
2. Moulin G, Chagnaud C, Gras R, Gueguen E, Dessi P, Gaubert JY, Bartoli JM, Zanaret M, Botti G, Cannoni M. Juvenile nasopharyngeal angiofibroma: comparison of blood loss during removal in embolized group versus nonembolized group. Cardiovasc Intervent Radiol. 1995;18:158-61.
3. Goobie SM, Meier PM, Pereira LM, McGowan FX, Prescilla RP, Scharp LA, Rogers GF, Proctor MR, Meara JG, Soriano SG, Zurakowski D, Sethna NF. Efficacy of tranexamic acid in pediatric craniosynostosis surgery: a double-blind, placebo-controlled trial. Anesthesiology 2011;114:862-71.
4. Dubey SP, Schick B. Juvenile Angiofibroma. Cham, Switzerland: Springer, 2017.