Bleeding during airway surgery

• Unlikely, but possibly devastating, early or late complication of tracheal surgery
• Potential trauma during thermal control to important adjacent structures (i.e., recurrent laryngeal nerve)
• Medical morbidities:
  • potential for added morbidity due to airway obstruction when bleeding into the airway
  • hypoxia
  • transfusion of blood products
Bleeding during open airway repair

• Early (first 48 hours)
  – Anterior jugular vessels
  – Thyroid vessels

• Late (2-3 weeks)
  – Inominate artery injury (0.1-0.5%)
Common respiratory and airway lesions in which hemostasis is vital during surgical Rx

• Laryngotracheal stenosis
• Airway Hemangiomas
• Recurrent respiratory papillomas
Surgery for Airway Stenosis

• What are the goals of surgical treatment for laryngotracheal stenosis?
  • Avoid or remove tracheotomy tube
  • Minimize morbidity
  • Preserve voice and function
Endoscopic Treatment of Airway Stenosis

- Better suited for acquired stenoses, than for congenital
- CO2 is workhorse in airway due to low tissue penetration, however hemostasis is modest at best
- A cycle of multiple, serial endoscopic treatments such generally be avoided
- The KTP and YAG lasers maintain better vessel coagulation properties than the CO2 laser
- A rare anatomical variant of the superior laryngeal artery, with it piercing the thyroid cartilage through an aberrant thyroid foramen, may be associated with bleeding risk during endoscopic airway procedures
Anterior Cricoid Split

- Alternative to tracheotomy in the failing to extubate neonate when
- Subglottic stenosis/edema is primary source of extubation failure
- Pt factors:
  - weight at least 1.5 kg
  - no assisted ventilatory support for 10 days
  - requirement of less than an FiO2 of 35%
  - no congestive heart failure
Laryngotrachoplasty

- Aims to expand a narrowed glottic/subglottic airway with grafting (typically autologous cartilage)
- In single stage procedures, tracheotomy is avoided post-op
- In double stage surgery, a tracheotomy is left post-op
- Great care should be taken when grafting near the innominate artery. In a rare but devastating complication, infection around the graft could contribute to innominate artery fistula in the recovery period.
Figure 1. Intraoperative photo demonstrating course of inominate artery over the distal third of the cervicothoracic trachea
Cricotracheal Resection

• Involves laryngotracheal resection of involved stenotic segment, with thyrotracheal anastamosis
• Well suited for severe grade 3 or grade 4 stenoses
• Ideally, there should be a 3 mm margin between the membranous vocal cord margin and the stenotic site
• Chin-to-chest sutures are mandatory in the early post-operative stage
Slide Tracheoplasty

• Workhorse technique for congenital tracheal stenosis
• Shortens the trachea in half, but increase the luminal diameter 2-fold
• Surgery is typically carried out under cardiopulmonary bypass with requisite anticoagulation
• Careful, bloodless dissection is critical
Tracheoinominate fistula

- Presents as delayed bleeding, either luminally or in neck
- Reported to occur in 0.1-0.5% of open tracheal surgery cases
- Survival rate is only 10-30%
- Risk factors include: infection, excessive cuff pressures, revision tracheal surgery, excessive movement of tracheotomy tube, and poor nutritional state
Airway Hemangiomas

• Are benign congenital vascular malformations
• May present in the airway as subglottic hemangiomas,
• Proliferative phase: presents in the first 6 months of life with inspiratory or biphasic stridor.
• Undergoes an involution phase at 12-18 months of life
• Associated skin congenital hemangiomas are present in 50% of patients especially in a “beard” facial distribution.
Figure 2. Typical endoscopic photograph of a subglottic airway hemangioma
Subglottic Cysts

• Subglottic cysts often mimic the presentation of subglottic hemangiomas.
• These are comprised by obstructed submucosal glands which expand and form fluid filled cysts.
• Subglottic cysts most frequently occur in infants with a history of prematurity and intubation, and as such frequently co-exist with subglottic stenosis.
• Endoscopic techniques are used to excise subglottic cysts, but these have a high tendency to recur.
Recurrent Respiratory Papillomas

- Recurrent respiratory papillomatosis (RRP) is the most common benign neoplasm of the larynx in children.
- RRP occurs due to the human papilloma virus (HPV), most frequently subtypes 6 and 11 and tend to initiate in zones of epithelial transition such as the laryngeal glottis.
- Children usually present in the second to third year of life with dysphonia.
- Younger presentation is typically associated with more severe and aggressive RRP where children often may also present with stridor and airway obstruction.
Conclusions

• Surgical bleeding is an unlikely, but potentially devastating, event during the surgical management of pediatric and adult laryngotracheal disorders
• An intimate knowledge of the anatomy of the large vessels coursing in the vicinity of the airway is imperative
• Anatomical variants in the position of the inominate artery or the superior thyroid artery can place confer increased risk
• Delayed bleeding from an inominate artery fistula is a particularly devastating complication from open airway surgery