Management of Tracheo-Innominate Fistulas

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Case presentation

• SM - 52 year old male
• PMH: HTN, DM, Afib, no PSH
• 11/2012 – transferred to KCHC from Woodhull for evaluation of right temporal mass
• 11/20/12 – biopsy c/w high grade glioma
• 12/5/12 – right temporal craniotomy with debulking, pathology c/w glioblastoma multiforme
Case presentation

• 12/24/12 – acute decline in mental status requiring intubation, imaging c/w tumor recurrence, mass effect with midline shift
• Per discussion with family – no radiation or chemotherapy; steroid therapy initiated
• Persistent poor neurological status, malnutrition, pneumonia with respiratory failure requiring vent dependence
• 1/4/13 – Percutaneous tracheostomy and PEG placement
• 3/31/13 - transferred back to SICU for presumed sepsis, started on IV antibiotics for total of 7 day course
Case presentation

• 4/11/13 7:10 PM – Code called after patient found pulseless with massive bleeding from oropharynx and tracheostomy
• Cuff was hyperinflated
• ACLS protocol initiated
• Anesthesia unable to orally intubate patient secondary to poor visualization; % O2 saturation remained in 70s
• Despite several rounds of ACLS, the patient expired
History

- **1897** - Korte reported a fatal TIF in 5-year old child with diphtheria after tracheostomy
- **1924** - Schlaeptert reviewed 115 cases of fatal hemorrhage after tracheostomy and documented that the innominate artery was involved in most cases
- **1964** - Silen reported the first short-term survivor
- **1968** - Reich reported the first long-term survivor of TIF
Introduction

• Pressure necrosis of anterior tracheal wall from cuff or tip causing erosion of trachea and innominate artery
• Rare complication of tracheostomy
• Incidence 0.7%
• Survival rate 14.3%
• Mortality rate 100% without operative intervention
• ~75% of TIF develop within first 3 weeks after tracheostomy
Anatomy

- Trachea is 11.8 cm long with 18-22 cartilaginous rings
- Innominate artery traverses trachea at level 9th tracheal ring
- Ranges between 6-13th tracheal rings
- Anatomical variants
Contributing factors

- Low tracheostomy tube placement
- Overinflation of tracheostomy cuff >20 mmHg
- Malpositioned tracheostomy tube tip
- Anatomical variations
- Local infection of tracheostomy wound
- Excessive manipulation of tracheostomy tube
- Long-term ventilation
- Radiation therapy
- Steroids
- Malnutrition
- Diabetes
Diagnosis

- Early diagnosis is key
- **Warning signs:**
  - Sentinel bleed
  - Pulsating tracheostomy tube
- Bronchoscopy
- CT Angiogram
- Angiogram
- Low sensitivities, delay in treatment
Principles of Management

- Secure airway
- Control bleeding
- Resuscitation

OR
Initial management

• Cuff overinflation
• Oral endotracheal tube placement distal to site
• Digital compression of artery via pretracheal space OR in trachea against sternum
• Compression via rigid bronchoscope
• Take to OR
Surgical management

- Median sternotomy
- Extension into right third or fourth intercostal space
- Innominate artery exposure by division of thymus and superior retraction of innominate vein
- Proximal and distal control
- Preservation of anomalous left common carotid artery
Surgical management

• Interruption of flow
  - Simple ligation and resection
• Maintenance of flow
  - Direct repair of defect
  - Interposition grafting
- Resection of involved innominate artery segment

Figure 13-1, Chapter 13 Tracheal fistula to brachiocephalic artery

Greenfield Chapter 80 Figure 80.33C
• Segment of damaged trachea excised with primary end-to-end anastomosis
• Strap muscle interposition
• Primary repair with buttress
• Relocation of tracheostomy
• Aorto-to-axillary artery bypass graft

Ann Thorac Surg 2004;77:1424-1426
• Interposition graft between ascending aorta and division of innominate artery
Studies

1994 Gelman et al
• 71 survivors of TIF from 1962 to 1994
• 40 survived long-term (>2 months)
• Maintenance of flow 15.8% LT survival
• Interruption of flow 71.2% LT survival
• Recurrent bleeding and death:
  Maintenance of flow 60% and 86% vs.
  Interruption of flow 7% and 29%
• Minimal neurologic sequelae

1988 Yang et al
• 24 survivors from 1875 to 1984
• Similar results
Prevention

• Reserve tracheostomy for patients requiring prolonged ventilation

• Avoid:
  - Tight wound closure
  - Excessive neck hyperextension
  - Tube manipulation (use long flexible tube connection)

• Monitor cuff pressures to < 20 mmHg frequently

• Expose anterior trachea by isthmus division to count rings from cricoid

• Selection of site at 2nd or 3rd tracheal rings

• Bronchoscopy if questionable positioning
Summary

• Tracheoinnominate artery fistula is a rare but devastating complication of tracheostomy
• Outcomes highly dependent on rapid diagnosis and immediate management
• Resuscitation, airway protection, control of bleeding
• Simple ligation and resection recommended
References

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Farewell!