Laryngeal Trauma

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Grand Rounds Presentation
September 3, 2003
Introduction

- Incidence: 1:30,000 ER VISITS
- Airway
- Voice
- Outcome determined by initial management
Anatomy and Physiology of Larynx

- Well protected (mandible, sternum, neck flex)
- Functions: Airway, tracheobronchial protection, voice
- Support: Hyoid, thyroid, cricoid
- Innervation: RLN, SLN
- Supraglottis: soft tissue
- Glottis: relies on external support, crico-arytenoid mobility and neuromuscular input
- Subglottis: cricoid, narrowest in infants
Anatomy and Physiology of Larynx
Mechanism of Injury

- **Blunt** –
  - MVA, strangulation, clothesline, sports related
  - Significant internal damage, minimal external signs
- **Penetrating**
  - GSW: damage related to velocity
  - Knife: easy to underestimate damage
Blunt Trauma: Mechanisms of Injury

- Compression over spine
- Static lateral force
- L-T separation
Compression Over Spine
Static Lateral Force
Initial Evaluation

- ATLS principles
- Secure airway – local tracheotomy
- Intubation can worsen airway
- Avoid cricothyroidotomy
- Pediatric: tracheotomy over bronchoscope
- Clear C-spine
History

- Change in voice – most reliable
- Dysphagia
- Odynophagia
- Difficulty breathing - more severe injury
- Anterior neck pain
- Inability to tolerate supine position – probable airway compromise imminent
Physical exam

- Stridor
- Hoarseness
- Subcutaneous emphysema
- Hemoptysis
- Laryngeal tenderness, ecchymosis, edema
- Loss of thyroid cartilage prominence
- Associated injuries - vascular, cervical spine, esophageal
Physical Exam
Flexible Fiberoptic Laryngoscopy

• Perform in emergency room
• Findings dictate next step
  – CT scan
  – Tracheotomy
  – Endoscopic
  – Surgical Exploration
  – Other studies
Laryngoscopic Exam
Radiographic Imaging

• C-spine
• CT if airway stable and mild abnormality on flexible exam.
  – Good for intermediate cases with scope limited by edema
• Angiography and contrast esophagrams considered
CT Scan

Indications:

- Significant mechanism of injury
- Rule out occult fracture/dislocation
- Confirmation of suspected fracture
- Determine extent of fracture(s)
CT Scan
Laryngotracheal Injury Classification

- Group I: Minor hematoma, no fracture
- Group II: Edema/hematoma, minor mucosal injury, no exposed cartilage, non-displaced fracture
  - Group III: Massive edema, mucosal tears, exposed cartilage, cord immobility
  - Group IV: See group III, more than 2 fracture lines, massive trauma laryngeal mucosa
  - Group V: Complete laryngotracheal separation  
    \cite{Schaefer1982}
Laryngeal Trauma

Asymptomatic or minimal symptoms

F/L

CT scan

Mild Edema
Small hematoma
Non-displaced linear fracture
Intact mucosa
Small lacerations

Displaced fracture
(by CT or exam)
Loss of mucosa or extensive laceration
Bleeding
Exposed cartilage

Bed rest
Cool mist
Antibiotics
Steroids
Anti-reflux

Tracheotomy

Panendoscopy

Explore
Laryngeal Trauma

Respiratory distress, open wounds, bleeding

Tracheotomv

Panendoscopy

Explore
Acute Management of Laryngeal Trauma

- History of Neck Trauma, Examine for Physical Signs of Trauma
  - Airway Stable
    - Flexible Fiberoptic Laryngoscopy
      - Mucosa or Cartilage Disrupted
        - Computed Tomographic Scan
          - Abnormal
          - Normal
      - Normal Endolarynx
    - Impending Airway Obstruction
      - Tracheotomy
        - Direct Laryngoscopy and Esophagoscopy
          - Hematoma, Small Laceration, but Endolarynx Intact
            - Medical Management
          - Isolated Fracture, Displaced Thyroid, but Endolarynx Intact
            - Open Exploration of Neck With Open Reduction and Internal Fixation of Fracture
          - Mucosa or Cartilage Disrupted
            - Open Reduction and Internal Fixation of Fractures, Repair Mucosal Lacerations + Endolaryngeal Stent
      - Mucosal or Cartilage Disrupted
        - Tracheotomy or Intubation
          - Direct Laryngoscopy and Esophagoscopy
            - Laryngeal Thyrotomy
              - Laryngeal Cartilage Unstable, Anterior Commissure Disrupted, Massive Mucosal Injuries
                - Open Reduction and Internal Fixation of Fractures, Repair
Indications for Repair

- Comminuted fractures
- Displaced fractures
- All fractures involving the median and paramedian thyroid ala
- Cricoid fracture
- LT separation
- Large mucosal lacerations
- Laceration of AC and free edge VC
- Disruption CA joint
- VC immobility
- Exposed cartilage
Laryngeal exploration and repair

232-1. Incisions for repair of laryngeal fracture

Optional incision
Laryngeal exploration and repair
Laryngeal exploration and repair
Laryngeal exploration and repair

Closure (figure-of-eight sutures) and secured stent
Goals of Laryngeal exploration

- Cover all cartilage to prevent granulation tissue and fibrosis
- Primary closure ideal, can undermine mucosa or use advancement flaps from epiglottis or pyriforms
- Palpate arytenoids and reposition if necessary
- Resuspend anterior commissure, ORIF of fractures
Laryngeal Framework Repair
Laryngeal Framework Repair
Endolaryngeal stenting

- Necessary for disrupted A.C., multiple displaced fractures, and/or multiple and severe mucosal lacerations
- Provides support and prevents stenosis but can cause iatrogenic injury (remove between 2 to 3 weeks)
- 4 point fixation allows safe recovery
Endolaryngeal stenting

FIG. 68-6. Fixation of Portex endolaryngeal stent using nonabsorbable sutures.
Treatment Goals

- Preservation of airway
- Prevention of aspiration
- Restoration of normal voice
Outcomes

• Airway
  – Poor – trach dependent
  – Fair – mild aspiration or exercise intolerance
  – Good – preinjury status
Outcomes

• Voice
  – Poor: aphonia or whisper
  – Fair: changed or hoarse
  – Good – normal voice
Outcomes

• Swallowing
  – Normal
  – Abnormal
  – Subjective patient report
Outcomes

• Medical better than surgical
• Voice results worse with use of stents (airway the same), less time in better
• Vocal cord paralysis – poorer outcome
• Improved results with repair <48 hours
Conclusions

• Rare injury
• Assess airway first and follow systematic management
• Timely evaluation with high index of suspicion for classic signs and symptoms
• Don’t forget about associated vascular or esophageal injuries
• Treatment based on site/extent of injury