

Laryngo-Tracheal Injuries

Emergency situation with potential for partial or full airway obstruction requiring immediate attention and securing of the airway

ANESTHETIC CONSIDERATIONS:

- Emergency → full stomach, remote location
- Trauma patient with associated injuries:
 - C-spine
 - Closed head injury and increased ICP
 - Major vascular
 - Thoracic (PTX, pneumomediastinum)
 - Esophageal
- Potential for airway obstruction:
 - Evolution of underlying process
 - Manipulation of tenuous airway
 - Avoid PPV and neuromuscular blockade until distal to lesion
 - Avoid cricoid pressure
 - Complications of airway obstruction:
 - Hypoxemia
 - Hypercapnia and respiratory acidosis
 - Negative pressure pulmonary edema (post obstructive pulmonary edema)

ANESTHETIC GOALS:

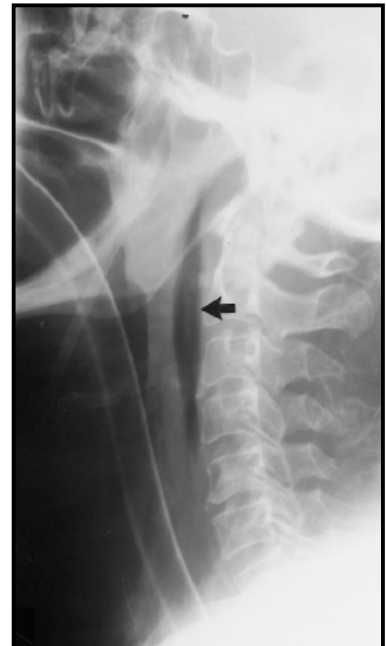
- Identify the injury and evaluate extent
- Maintain spontaneous respirations
- If intubation required, ensure you have secured airway distal to injury
- Identify associated injuries

HISTORY

- Recognize that these injuries may be cryptic and that significant internal injury may be present even when no external signs of trauma are evident
- Injuries may also be missed if patient has been intubated
- Importance to diagnose as delay may lead to progressive airway obstruction and lack of recognition of associated injuries with high mortality (e.g. esophageal perforation)
- Maintain a high level of suspicion
 - Penetrating neck injuries and incidence of larynx / trachea injuries
 - GSW 4.6 – 7.2%
 - Stab wound 2.8 – 3.4%
 - Blunt neck trauma has a lower incidence of injury (0.34%)
- High incidence of associated injuries
 - Closed head injury
 - Maxillofacial injuries
 - Associated neck injuries
 - Cervical spine injury (50%)
 - Esophageal injury (25%)
 - Vascular injury

PHYSICAL

- Up to 25% of patients may have no external evidence of injury
- However, if no clinical findings suspicious for laryngeal / tracheal injuries, it is highly unlikely that there is a significant injury
- Presentation may also be delayed
- **HEENT**
 - External neck trauma
 - Air leaking through neck wound → only hard sign
 - Subcutaneous emphysema (39%)
- **RESP**
 - Dyspnea & respiratory distress (33%)
 - Hemoptysis (5%)
 - Hoarseness (4%)
 - Stridor
 - Pneumothorax
 - Beware the persistent airleak
- **CVS**
 - Volume status, amount of resuscitation



INVESTIGATIONS

- Unfortunately, majority of investigations are neither sensitive or specific
- **Labs:**
- **Imaging:**
 - CXR: pneumothorax / pneumomediastinum / subcutaneous air
 - Neck X-ray: prevertebral air

- CT Neck
 - Can quantify disruption
 - Associated injuries
 - CTA
- Laryngoscopy / Bronchoscopy
 - Essential to delineate injury once suspected
- Esophagoscopy
 - Also essential once laryngeal or tracheal injury identified as missed esophageal injury carries a high mortality
- **Special:**
 - Angiography looking at carotid involvement

OPTIMIZATION

- Consider antisialagogue to decrease secretions
- ATLS resuscitation if necessary

ANESTHETIC OPTIONS

- Retrospective review of 104 patients with tracheobronchial injuries up to 80% died in the pre-hospital setting; therefore, you might expect a patient to arrive in extremis to the ER
- Non-Emergent Laryngotracheal injury
 - Examine for other injuries
 - Awake FOI or rigid bronchoscopy to secure A/W distal to injury
 - Inhalational induction
 - Consider awake tracheostomy
- Emergent Airway Required
 - Awake FOI
 - Awake Spontaneously breathing intubation with topicalization
 - RSI without cricoid pressure – not first option!!
 - Tube through open injury in the trachea
 - Awake Tracheostomy or cricothyroidotomy
- Note: awake FOI...probably impractical if no equipment available, or massive hemoptysis

ANESTHETIC SETUP

- **Drugs**
 - Emergency drugs
- **Equipment**
 - If at all possible, transfer patients to operating room
 - Ensure tubes of varying sizes available
 - Prior to proceeding, equipment and personnel required to perform rigid bronchoscopy and immediate tracheostomy must be present prior to any airway manipulation

MANAGEMENT OF ANESTHESIA

- **Induction**
 - **Airway Management**
 - Despite the following concerns, many patients can be managed with conventional techniques
 - Airway management approach will depend on clinical circumstance and surgical plans
 - **Principles of Management**
 - Avoid PPV and neuromuscular blockade until distal to lesion
 - No cricoid pressure
 - Intubate distal to injury
 - **Difficulties with Airway Management**
 - Patients have co-existing neck injuries which can make any technique more difficult
 - PPV can exacerbate airleaks, pneumothorax, pneumomediastinum and can result in airway disruption and life-threatening obstruction
 - Induction of anesthesia with neuromuscular blockade can result in airway obstruction
 - Often direct laryngoscopy or fiberoptic bronchoscopy difficult due to distortion of airway structures or bleeding within the airways
 - **Blind insertion of ETT, even under direct vision, can result in airway disruption or creation of blind passage**
 - Fiberoptic bronchoscopy may itself occlude narrowed airway and lead to trauma
 - Cricoid pressure may exacerbate injury and result in complete airway obstruction
 - **Non-Emergent Laryngotracheal injury**
 - May have time to delineate injuries prior to proceeding with securing airway (if required)
 - Consider awake FOI or rigid bronchoscopy and securing airway distal to injury
 - If need to induce GA, consider inhalational induction
 - Always consider awake tracheostomy
 - **Massive Hemoptysis**
 - May require rigid bronchoscopy to assess and treat hemorrhage
 - Can then intubate over rigid bronchoscope
 - Consider inhalational induction with maintenance of spontaneous respiration
 - Contra-indication to jet ventilation
 - **Emergent Airway Required**
 - Approach will depend on degree of injury suspected
 - Options:

- Awake FOI (if time permits)
 - Spontaneously breathing intubation with topicalization
 - Conventional RSI without cricoid pressure may be tried with intubation distal to injury
 - Awake tracheostomy or cricothyroidotomy may be first choice if significant trauma suspected, failed intubation, or immediate need for airway
 - Once intubated, need to confirm that you are in the trachea (and not a false lumen)
 - ETCO₂ monitor
 - CXR
 - Consider fiberoptic bronchoscopy to confirm placement and ensure you are distal to the fracture
- **Maintenance**
 - Anything
- **Emergency**
 - Delayed extubation

DISPOSITION & MONITORING

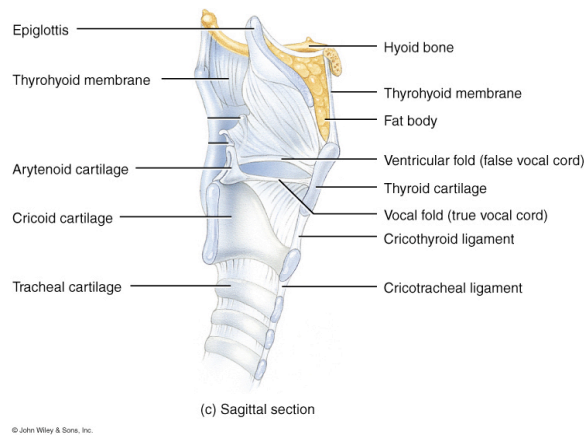
- Postoperative transfer to ICU for ongoing care
- Likely requires days of mechanical ventilation (depending on level of injury and repair) to allow airway edema, emphysema or hematoma to settle

COMPLICATIONS

- Hemoptysis
- Pneumothorax
- Tension pneumothorax
- Broncho-pleural fistula
- Open Airway
- Creation of false passage

PATHOPHYSIOLOGY

- **Larynx anatomy**



- **Larynx innervation**
 - Superior laryngeal nerve (branch off vagus nerve)
 - External branch – motor to cricothyroid
 - Internal branch – generalized sensation above level of vocal cords
 - Recurrent laryngeal nerve (branch off vagus nerve)
 - All intrinsic muscles of larynx (except cricothyroid)
 - Generalized sensation below the level of vocal cords

Muscles of Larynx	Innervation	Action
Cricothyroid	External branch of SLN	Tenses VC
Posterior cricoarytenoid	RLN	AB ductor of VC
Lateral cricoarytenoid	RLN	AD ductor of VC
Thyroarytenoid	RLN	Relaxes VC
Transverse arytenoids	RLN	AD ducts VC

- Total mortality associated with all forms of airway injury is 15-30%
- In penetrating neck trauma:
 - Mortality is 2-6% (usually from vascular injury)
 - 5-15% penetrating neck trauma involves airway
 - 1/3 are laryngeal, 2/3 are cervical trachea injuries
- In blunt trauma:
 - Injury to larynx or cervical trachea is uncommon (<1%)
 - Pattern of airway injury: larynx 35%, cricoid 15%, cervical trachea 45%
 - Thyroid cartilage fracture most common in direct blow
 - Tracheal tear or disruption most common in flexion / extension injury

- Tracheal disruption most common at cricoid / tracheal junction
- 10-50% have associated C-spine injury
- 25% of patients have no signs, or symptoms
- In iatrogenic trauma:
 - Intubation injury occurs in 0.1% of all intubations (injuries include tracheal stenosis, VC distraction, arytenoid dislocation)
 - Decreased incidence with low pressure, high volume cuffs
- Evolution of upper airway injury is includes: airway edema, subcutaneous emphysema and hematoma formation (all usually within 6 hours of injury) making endotracheal intubation more difficult as time passes

REFERENCES

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