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# TRAUMA LECTURES



*SOCIETY OF TRAUMA NURSES*



# Neck Trauma



# Objectives

**At the conclusion of this presentation the participant will be able to:**

- Examine the spectrum of neck trauma, the mechanisms of injury and associated injury patterns
- Define the three zones of the neck used as classifications of injury
- Identify the appropriate diagnostic modalities used to evaluate patients with neck trauma
- Explain the therapeutic interventions in the management of neck trauma
- Identify nursing interventions important in caring for patients with neck trauma

# Epidemiology

- 3500 deaths per year
- Mortality rate 2-6%
- Blunt mechanism accounts for 5%
- Penetrating trauma accounts for most
- Zone I injuries are the most lethal

# Epidemiology



- Commonly injured vessels
  - Internal jugular vein
  - Internal carotid artery
- Laryngeal and tracheal more common than pharyngeal and esophageal injuries

# Blunt Mechanism of Injury

- Steering wheel
- Assault
- Strangulation/Hanging
- “Clothes line” injuries
- Other (sports, industrial, etc.)



# Penetrating Mechanism of Injury

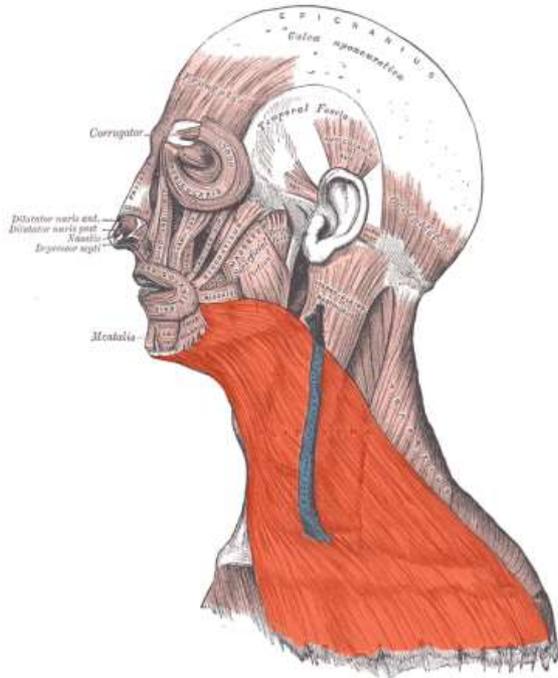
- Missile injury (bullet, knife, or other)
- Stabbing or lacerations
- Impalement
- Animal bites



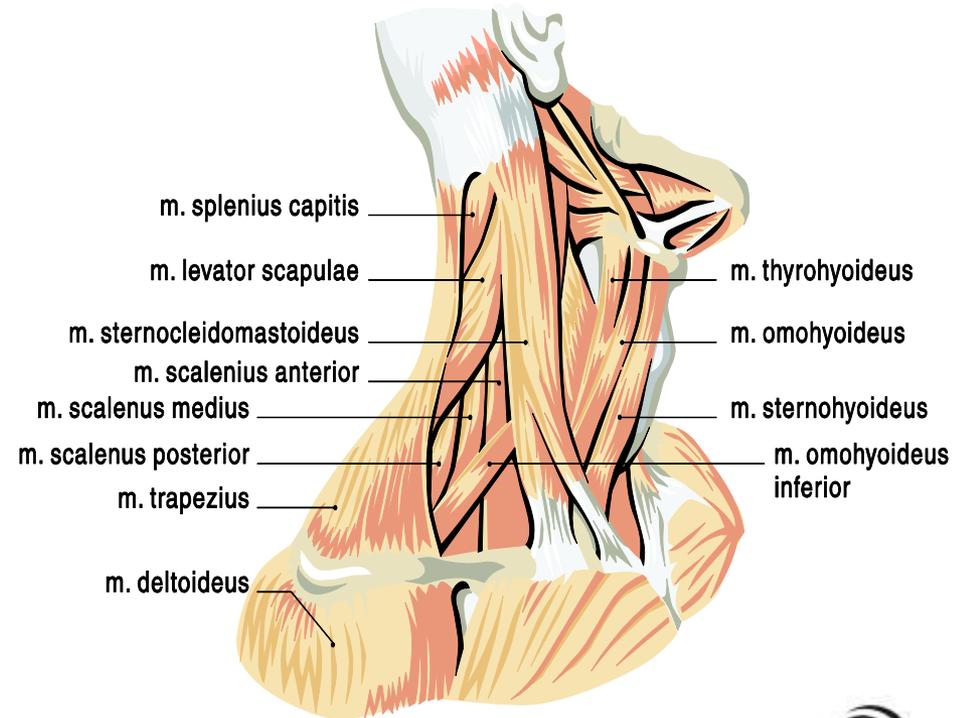
# Anatomical Review

## Fascia

### Superficial fascia



### Deep cervical fascia



# Structures at Risk



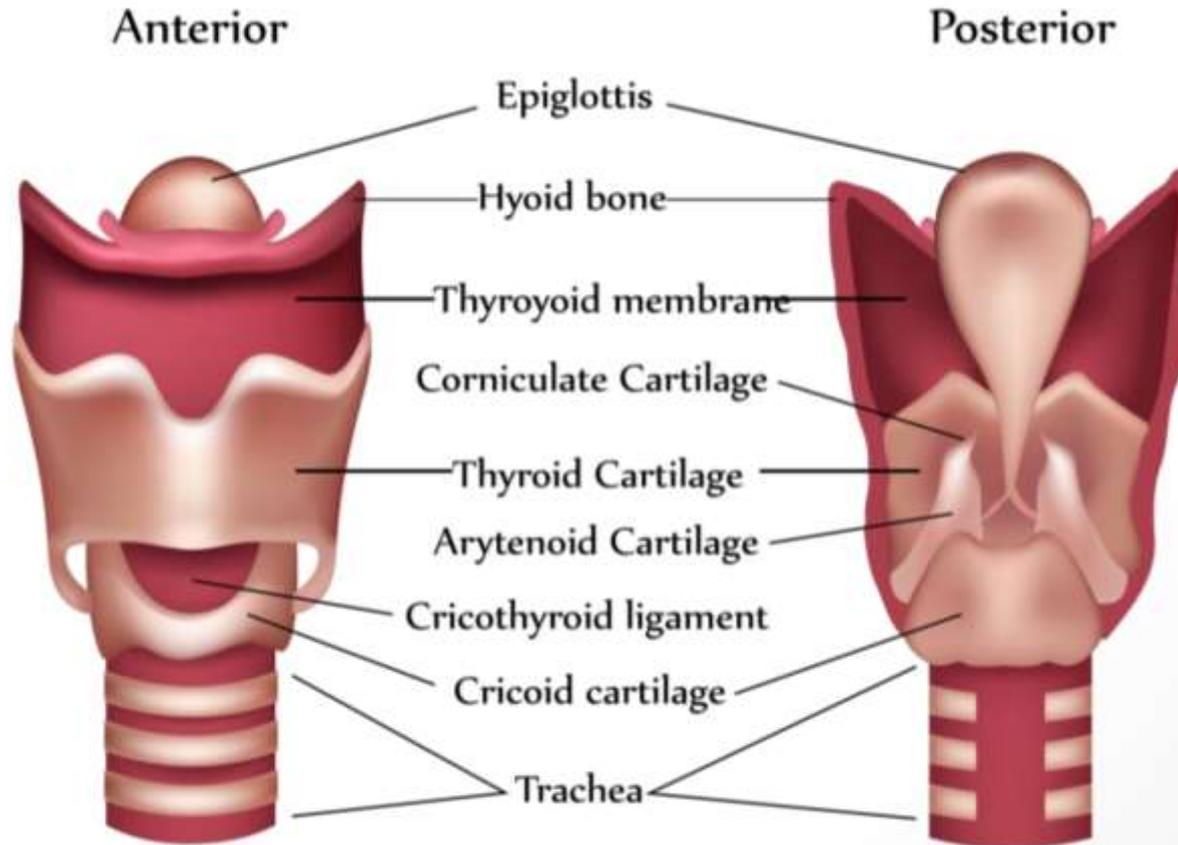
## Musculoskeletal

- Vertebral bodies
- Cervical muscles and tendons
- Clavicles, 1<sup>st</sup> and 2<sup>nd</sup> ribs
- Hyoid bone

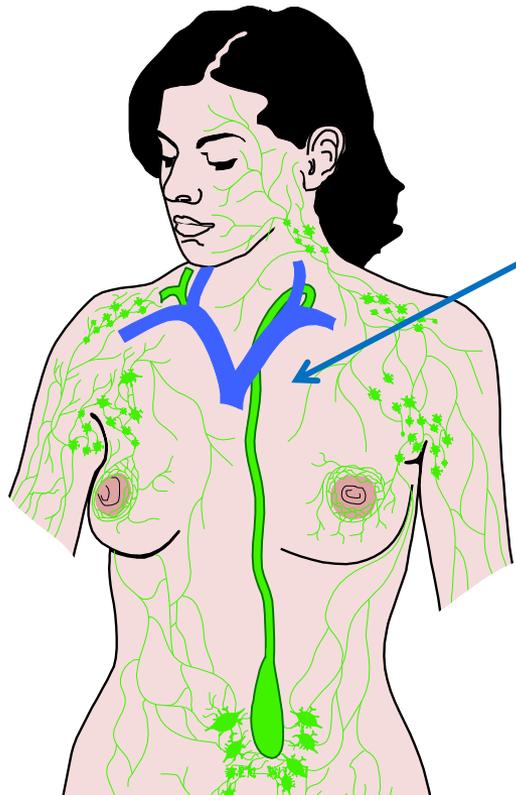
## Glandular

- Thyroid
- Parathyroid
- Submandibular
- Parotid glands

# Anatomical Review



# Structures at Risk

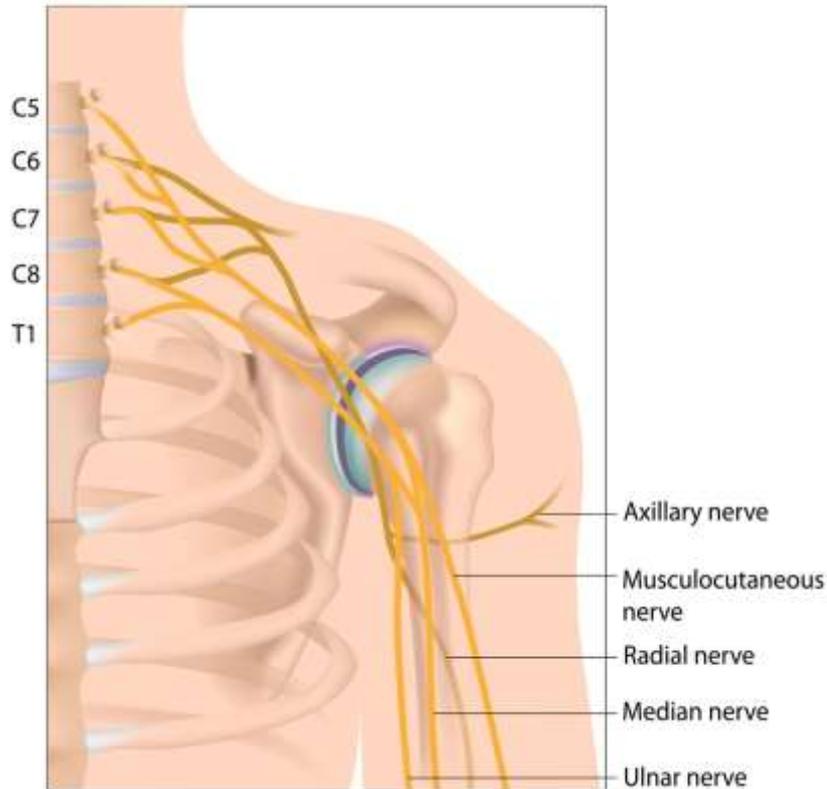


## Visceral structures

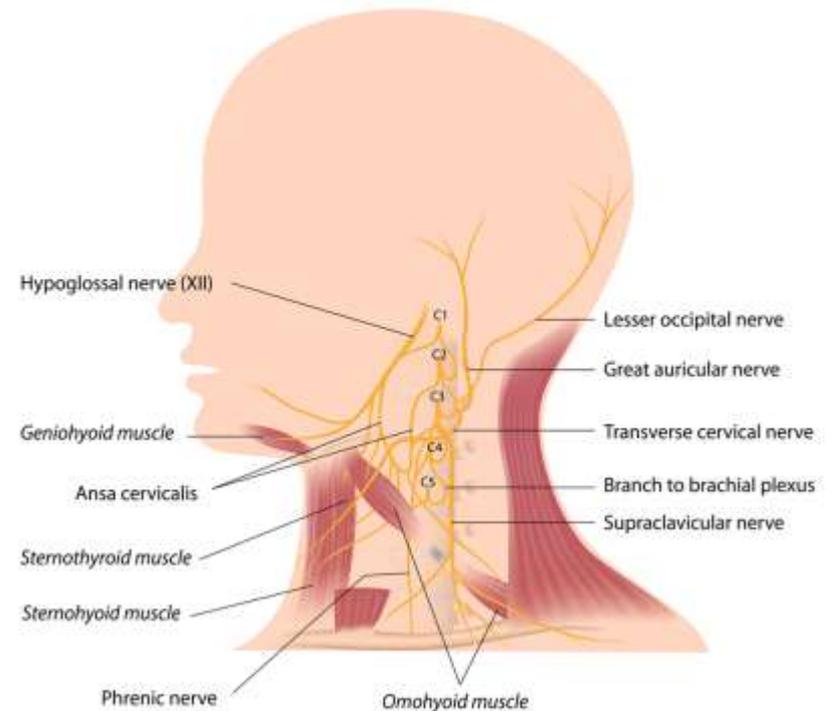
- Thoracic duct
- Esophagus
- Pharynx
- Larynx
- Trachea

# Structures at Risk

## The Brachial Plexus

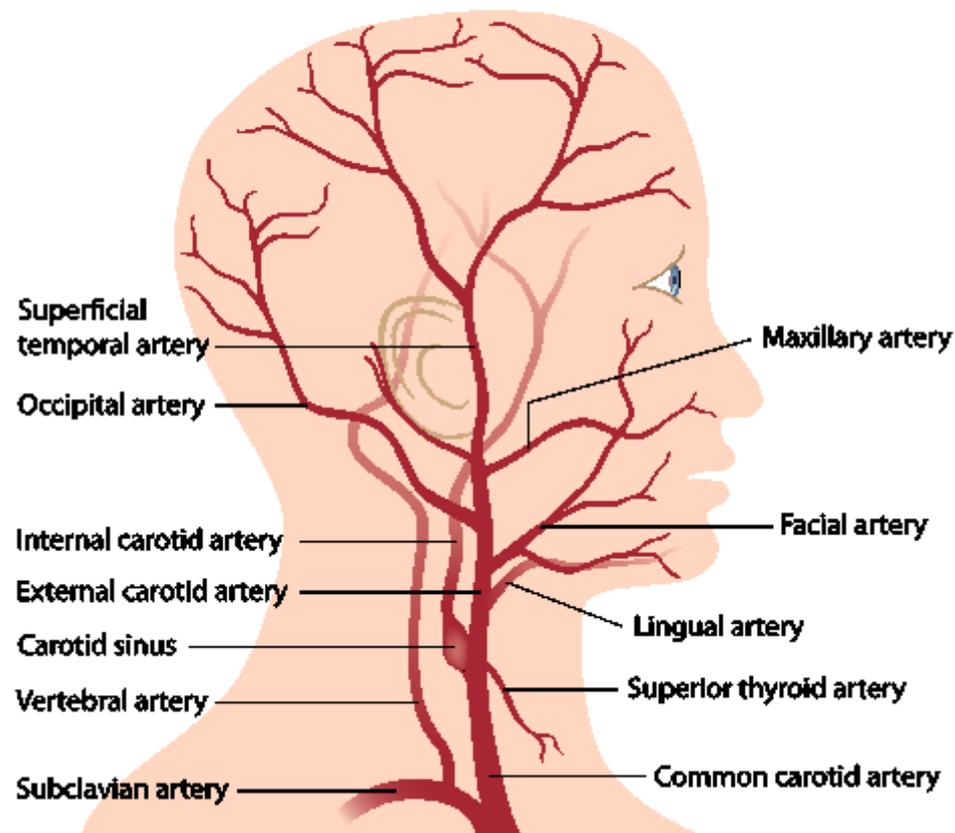


## The Cervical Plexus



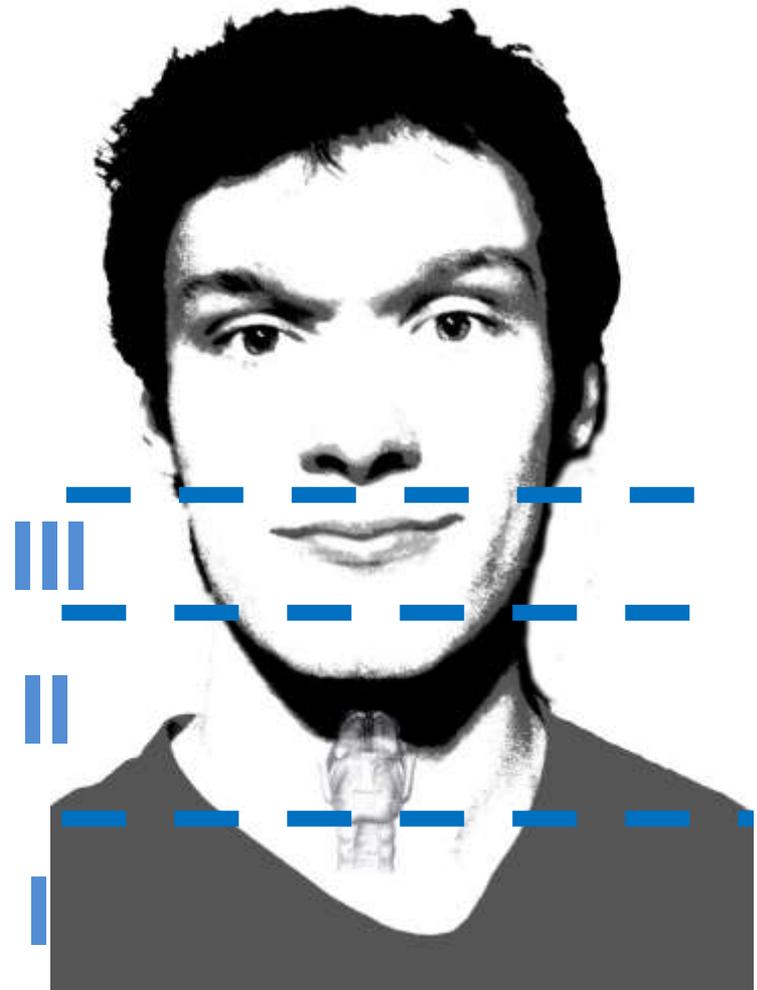
# Structures at Risk

## Blood Supply of the Head and Neck

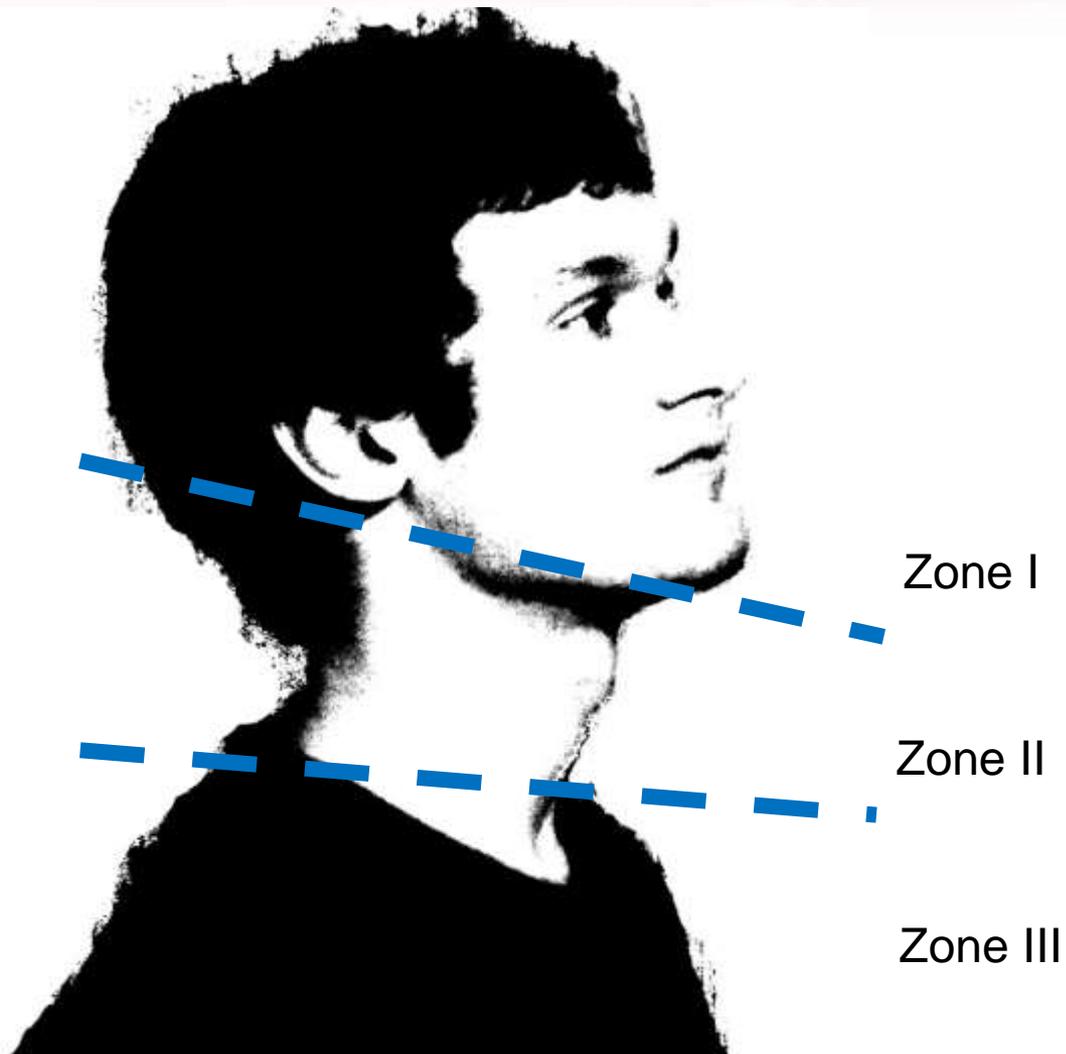


# Zones of the Neck

- **Zone III** - Clavicles and sternal notch to cricoid cartilage
- **Zone II** – Cricoid cartilage to the angle of mandible
- **Zone I** – Angle of mandible to base of skull



# Zones of the Neck



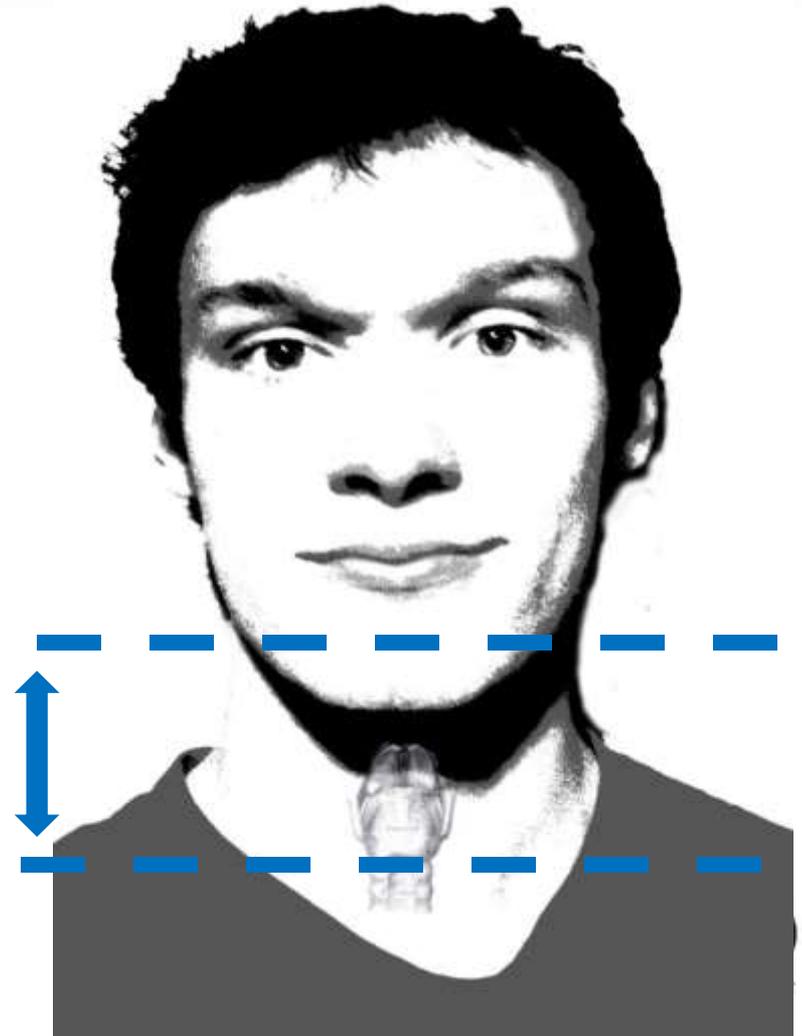
# Zone I

- Subclavian vessels
- Brachiocephalic veins
- Common carotid arteries
- Aortic arch
- Jugular veins
- Esophagus
- Lung apices
- C- spine/cord
- Cranial nerve roots



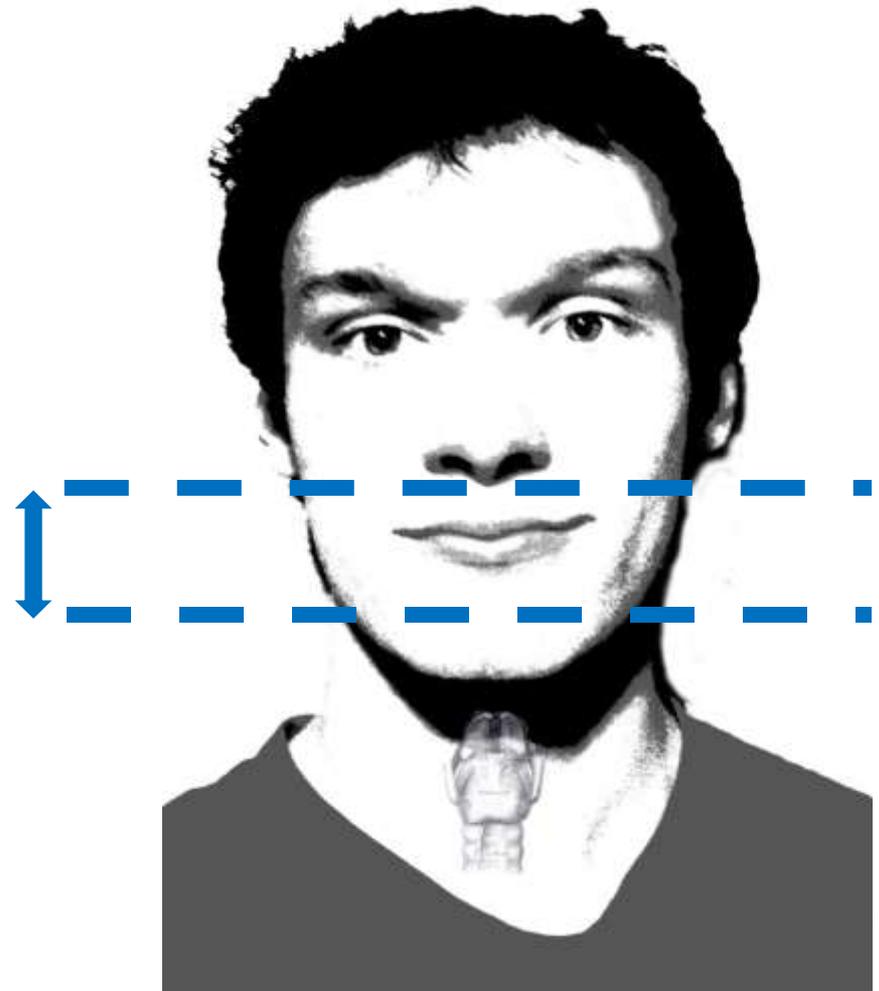
# Zone II

- Carotid and vertebral arteries
- Jugular veins
- Pharynx
- Larynx
- Trachea
- Esophagus
- C-spine/cord

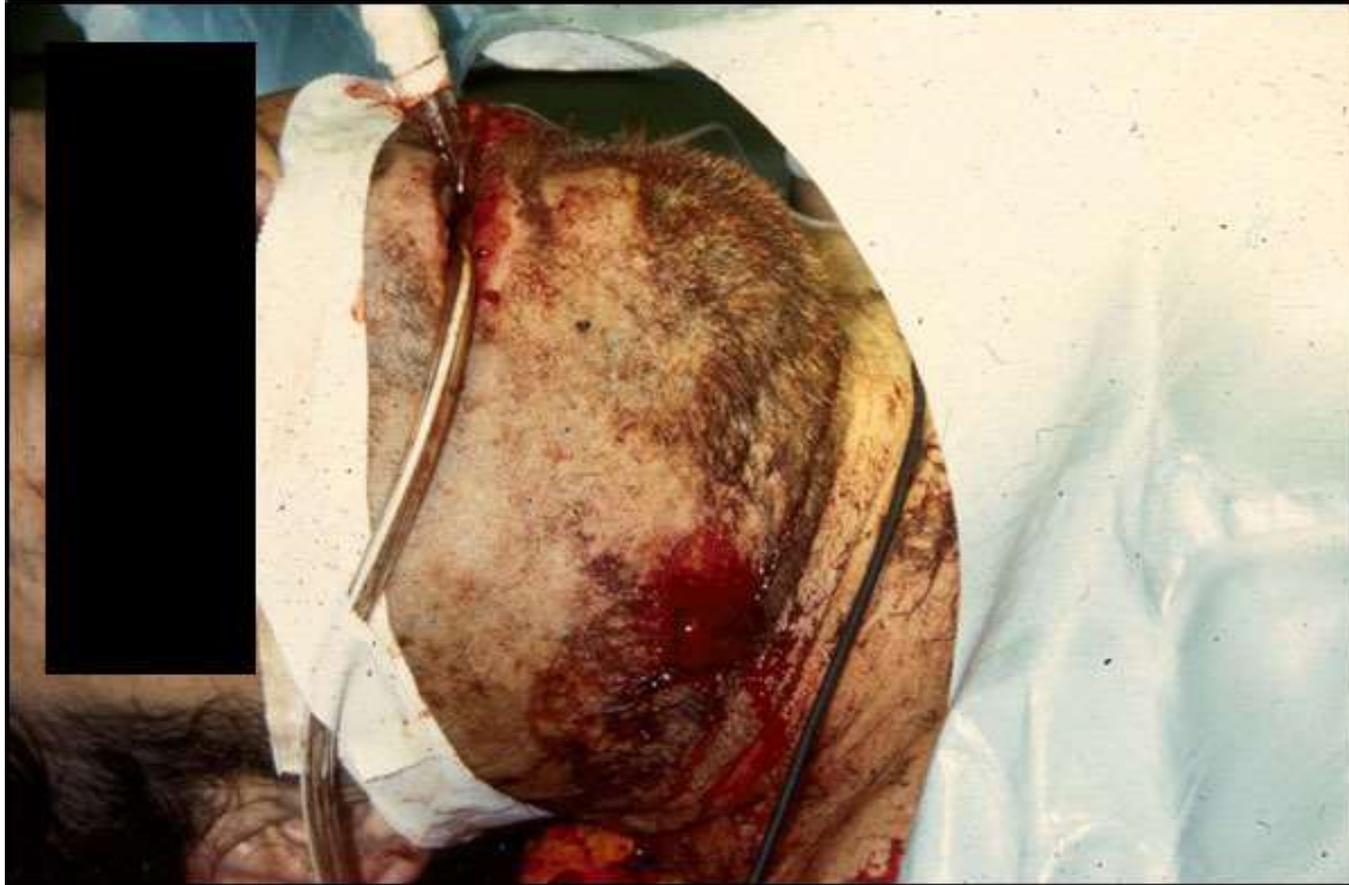


# Zone III

- Salivary and parotid glands
- Esophagus
- Trachea
- Vertebral bodies
- Carotid arteries
- Jugular veins
- Cranial Nerves IX-XII



# History and Physical



# History and Physical

- Gun
  - Caliper, distance
- Knife
  - Length, angle
- Amount of blood loss
- Baseline mental status
- Baseline motor status
- Drug or alcohol use



# Key Findings



## Hard signs

- Airway obstruction
- Pulsatile bleeding
- Expanding hematoma
- Unresponsive to resuscitation
- Extensive subcutaneous emphysema

## Soft signs

- Voice change
- Wide mediastinum
- Hemoptysis
- Hematemesis
- Dysphonia/dysphagia

# Management - Primary Survey

- ABCs
- Ensure airway is patent
- Ensure patient is adequately oxygenating
- Control any obvious hemorrhaging
- IV access

# Airway Considerations

Who requires immediate intubation?

- Apneic
- Comatose
- Respiratory compromise
- Expanding neck hematoma
- Massive subcutaneous emphysema
- Massive bleeding in airway

# Airway Considerations

- “Wait and See”
- Avoid excessive bag-valve-mask
- Exercise caution with paralytics and sedation
- Surgical airway last resort
- Cricothyrotomy vs. tracheostomy

# Control Bleeding

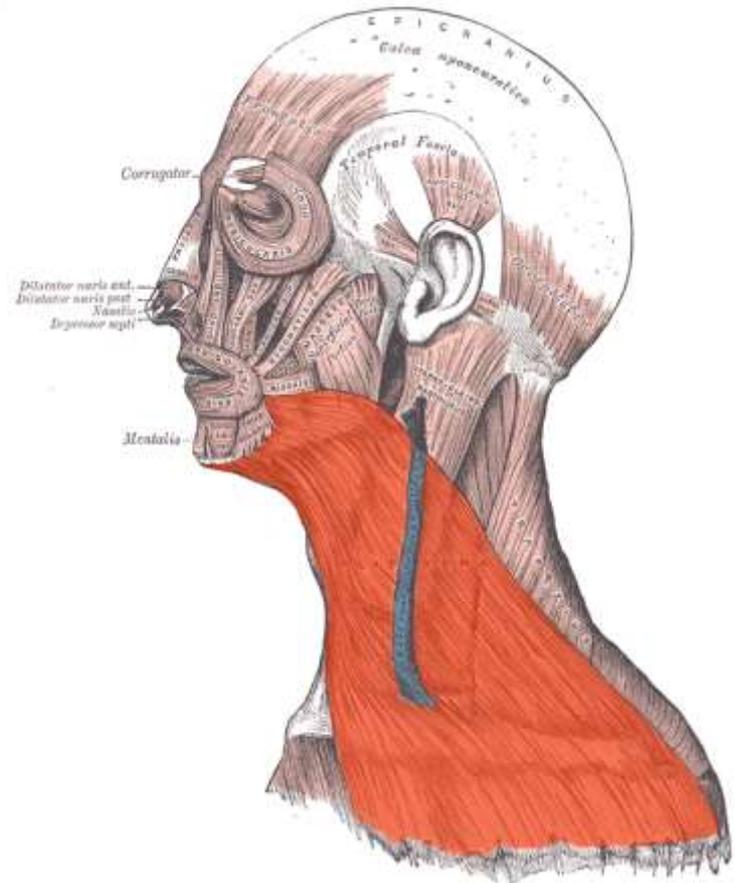


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- Local pressure only
- **No** tourniquets
- **No** pressure dressings
- **No** probing or blind clamp placement

# Physical Exam

- Violation of the platysma muscle
- CNS exam
- Obvious hematoma, bleeding



# Physical exam

- Contusions, lacerations, abrasions to the neck, etc.
- Expanding hematomas, obvious bleeding
- Hoarseness, stridor,
- Subcutaneous emphysema
- Hemoptysis, drooling
- Dyspnea
- Distortion of the normal anatomic landmarks
- Mandibular/midface instability



# Diagnostic Studies

- Chest radiograph
- CT and CT angiogram
  - Laryngeal injury
  - Tracheal injury
  - Vessels
  - Blunt esophageal injury



# Diagnostic Studies

## CT Scan

- Can aid in identifying weapon trajectory and structures at risk
- Should only be used in stable patients
- Gracias *et al* (2001) found that use of CT scan in stable patients
  - Saved patients from arteriogram indicated by older protocols 50% of the time
  - Avoided esophagoscopy in 90% of patients who might otherwise have undergone it

# Diagnostic Studies

- Laryngoscopy
- Bronchoscopy
- Esophagoscopy;  
esophagram
- Rigid vs. flexible  
esophagoscopy
- Color flow doppler,  
duplex ultrasonography
- MRA



# Diagnostic Studies

## Arteriogram

- Gold standard
- Invasive
- Complications
- Availability varies
- Expensive
- Contrast load
- Simultaneous intervention



# Specific Injuries



- Vascular
- Aerodigestive
- Cranial nerves
- Thoracic duct



# Vascular Injuries in the Neck

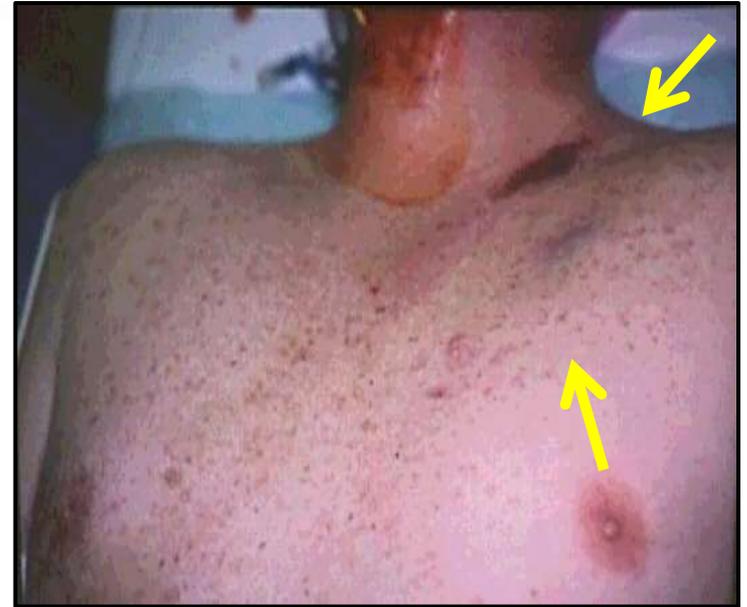
## Physical Exam

- External marks
- Decreased LOC
- Hemiparesis
- Hematoma
- Hypotension
- Dyspnea
- Thrill, bruit, pulse not present



# Associated Injuries

- Le Fort II or III fractures
- Basilar skull fracture involving the carotid canal
- Diffuse Axonal Injury with GCS < 6
- Cervical vertebral body fracture
- Near hanging with anoxic brain injury
- Seatbelt abrasion of anterior neck with significant swelling/altered mental status



# Primary Diagnostics

- CT angiogram of the neck
- Chest x-ray indicated in Zone I injuries because of their proximity to the chest
- Complete blood count, basic metabolic panel, toxicology and blood alcohol content



# Primary Diagnostics



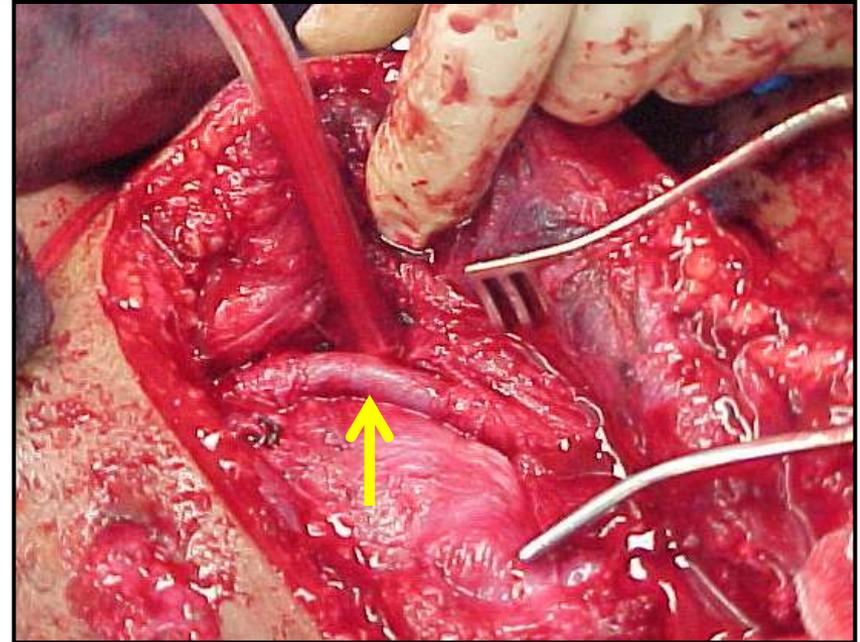
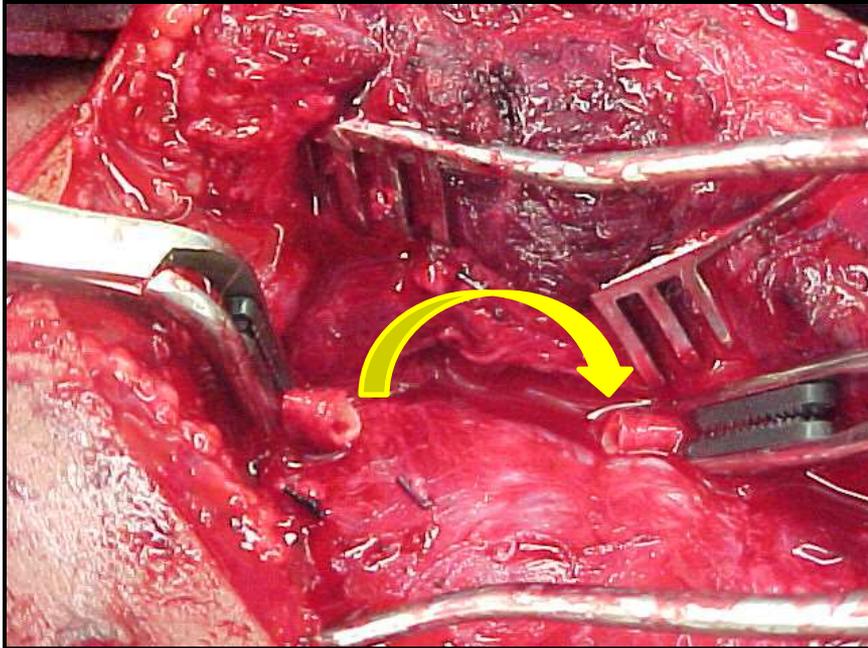
# Vascular Injury Management

- Common carotid: repair preferred over ligation in almost all cases
- Internal carotid: Shunting is usually necessary
- Vertebral: Angiographic embolization or proximal ligation can be used if the contralateral vertebral artery is intact
- Internal Jugular: Repair vs. ligation

# Carotid Intimal Flap



# Carotid Artery Interposition Repair



# Management Summary

## Vascular Injury

- Surgical exploration unstable and stable Zone II
- Angiography for Zone I and III
- Selective, nonoperative management stable Zone II
- Embolization high carotid or vertebral artery
- Endovascular stent (pseudoaneurysms)
- Anticoagulation blunt carotid/vertebral artery

# Aerodigestive Injuries

- Airway structures
  - Trachea
  - Larynx
  - Thyroid cartilage
- Esophagus
  - If diagnosis < 24 hours
  - Poor outcome if diagnosed > 24 hours
- Pharyngeal

# Tracheal and Laryngeal Injuries

## Signs of injury

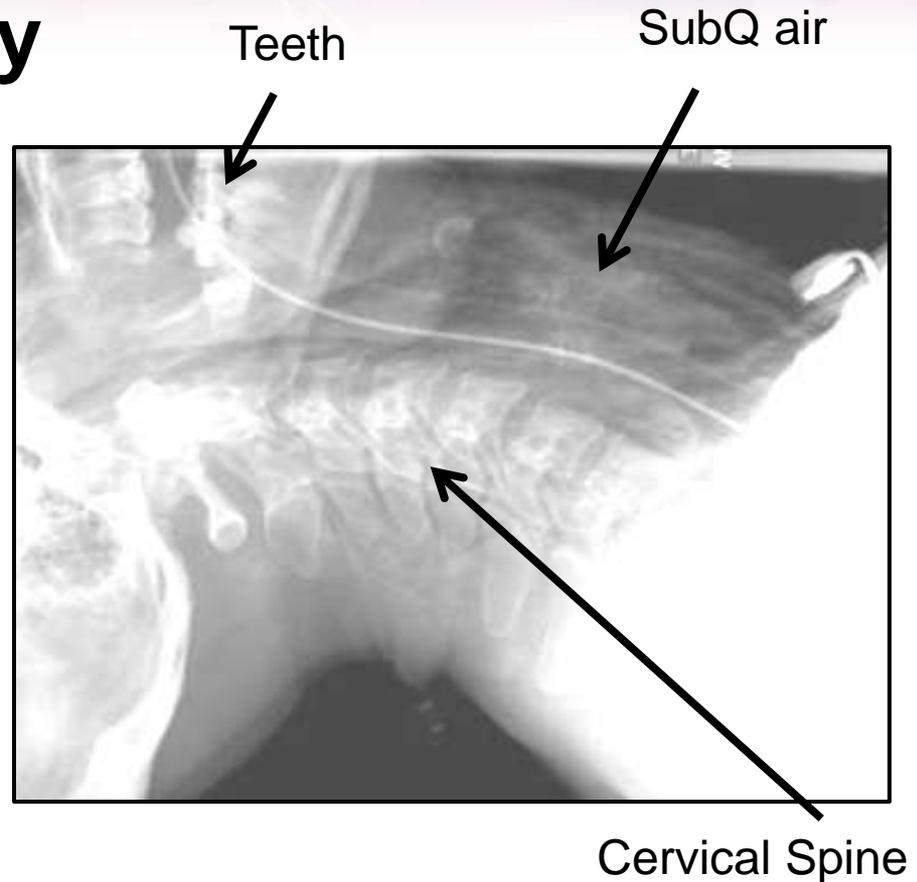
- Hoarseness and dysphonia
- Hemoptysis
- Subcutaneous emphysema in the neck and trunk
- Tenderness over the trachea



# Primary Diagnostics

## Laryngotracheal Injury

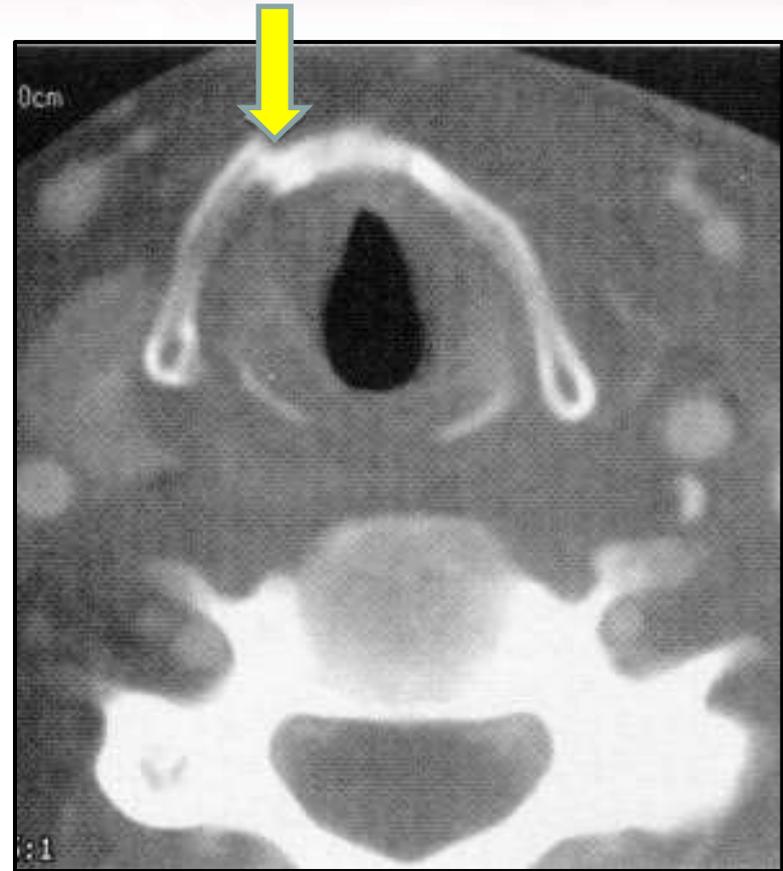
- Plain x-rays
  - Soft tissue emphysema
  - Airway compression
  - Fracture of laryngeal cartilages
- CT scan
  - 3D reconstruction
- Endoscopy
  - Flexible vs. rigid
  - Bronchoscopy/laryngoscopy



# Management

## Laryngotracheal Injury

- Secure the airway
- Early repair
- Laryngeal fractures
  - Thyroid fracture most common
  - Delay of reduction makes it more difficult and return of normal function unlikely



# Esophageal Injury

## Penetrating

- Sharp weapon (knife)
- High speed projectile (bullet)
- Iatrogenic laceration
- Lumen outward injury



# Esophageal Injury



## Blunt

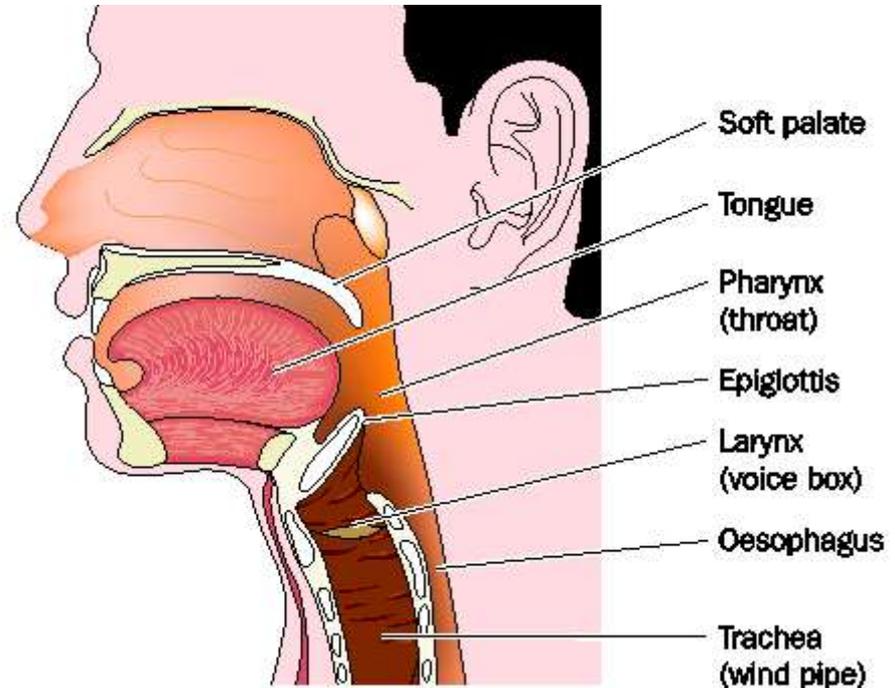
- Barotrauma
- Blast injuries
- Crush injuries
- Blow to the neck



# Esophageal Injury

## Signs of Injury

- Hematemesis
- Odynophagia
- Dysphagia
- Drooling, hypersalivatio
- Tracheal deviation
- Sucking neck wound
- Subcutaneous emphysema
- Pain with turning neck



# Esophageal Injury Diagnostics

## Radiographic Findings

- Plain films
  - Air in soft tissue planes
  - Pneumomediastinum
  - Leakage of fluid into right pleural space
- Contrast swallow
  - Extravasation is diagnostic
- CT scan

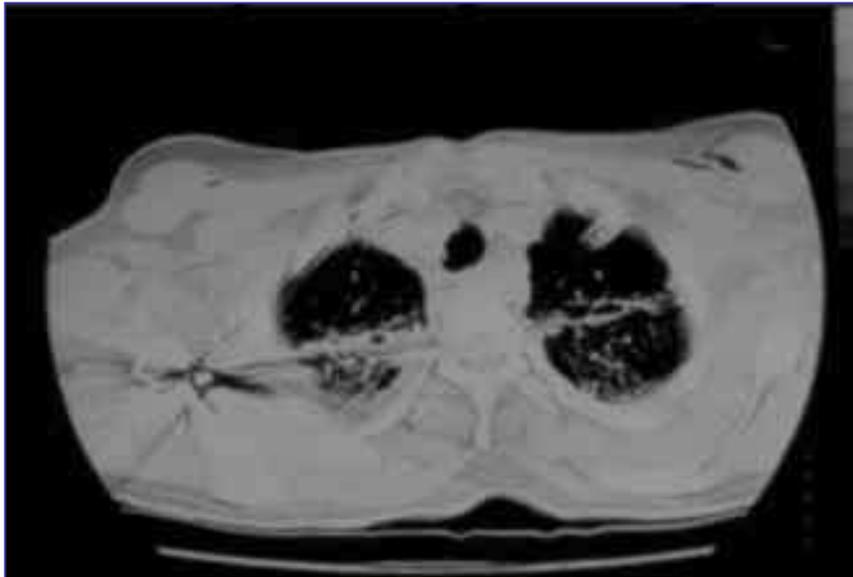
## Laboratory Findings

- Markers of inflammatory response
  - Leukocytosis with left shift
  - Low oxygen saturations
  - Acidosis on ABG

# Esophageal Injury Diagnostics

## Helical CT

- Expedites diagnosis
- Trajectory of missile
- Associated injuries



# Diagnosics Esophageal Injuries

**Normal**



**Thoracic Leak**



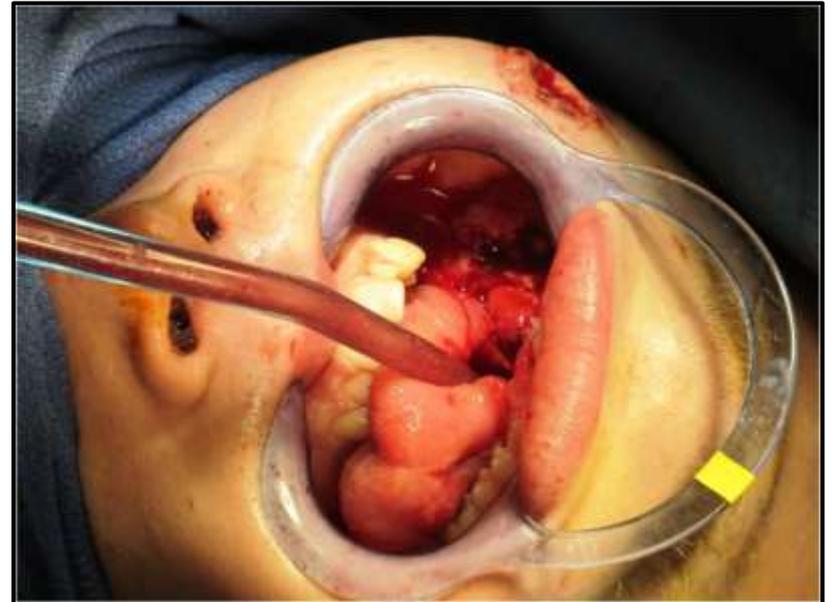
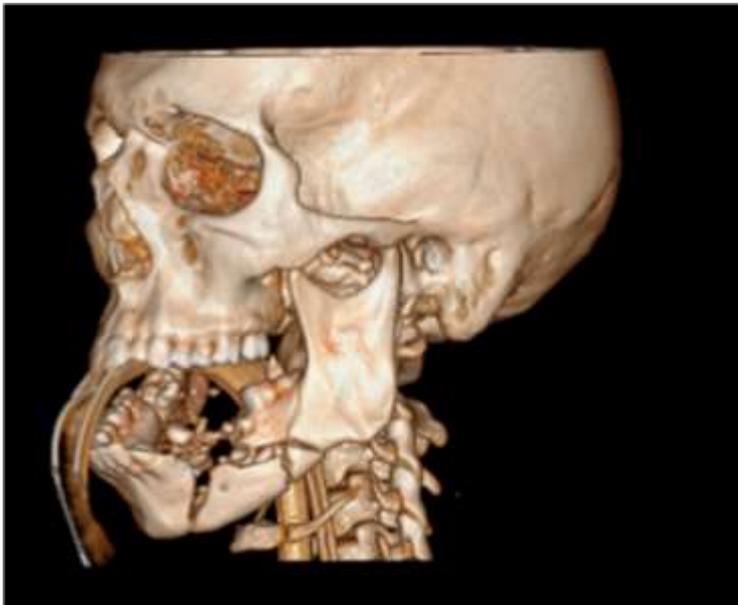
# Esophageal Injury

## Management Summary

- Initial assessment complex
- Goal is to minimize the bacterial contamination and enzyme erosion
- Gastric decompression
- Antibiotic coverage
- Drainage of wound
- Surgical repair

# Pharyngeal/Oral Injury

Similar presentation as esophageal injury



# Practice Guidelines

- Few published practice guidelines for the management of neck injuries
- Eastern Association for the Surgery of Trauma (EAST)
  - Penetrating neck injuries only
  - Blunt cerebrovascular injury

# EAST Guidelines Key Points

- Selective operative management vs. mandatory exploration
- CT Angiography and duplex ultrasound can be used to identify Zone II arterial injuries
- Plain CT of the neck can be used to rule out a significant vascular injury
- Contrast esophagography or esophagoscopy can be used to evaluate for perforation.
- Serial physical examination is 95% sensitive for detecting arterial and aerodigestive tract injuries that need repair

# EAST Guidelines Summarized

- Selective management is common now in asymptomatic patients;
- CT angiography is a very good tool to rule out vascular injuries
- The role of physical exam, esophagography, and esophogoscopy remains controversial

# Do all patients have to lay flat?

- Position patient in manner that is most comfortable
- Patients with anterior neck trauma may want to lean forward or sit upright
- Patients with copious secretions can be rolled on their side



# Possible Complications

- Loss of airway
- Swallowing problems with aspiration
- Stroke in unrecognized vascular injuries
- Soft tissue necrotizing infections, including mediastinitis due to delayed diagnosis of esophageal injuries
- Air embolism
- Pneumothorax, tension pneumothorax

# Nursing Considerations



Be alert for:

- Mental status changes and motor deficits
- Changes in airway patency
- Onset of stridor, drooling
- Difficulty laying supine
- Other injuries that are highly associated with cerebral vascular injuries

# Nursing Assessment

- Frequent neurologic and motor checks
- Frequent assessment for expanding hematomas in the neck
- Careful history documentation
- Reassurance
- Adequate pain assessment
- Anxiety reduction

# Summary

- Penetrating and blunt neck trauma occurs in 5-10% of patients with serious injuries
- Maintenance of an adequate airway is paramount to survival
- Maintain a healthy respect for initially benign appearing injuries
- Unrecognized vascular or aerodigestive injuries have a high mortality