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Neck Trauma



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Objectives

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

- Recognize the mechanism of injury and associated injury patterns across the spectrum of neck trauma.
- Assess for the soft and hard symptoms of neck trauma.
- Identify the diagnostic modalities used to evaluate patients with neck trauma.
- Discuss the medical and nursing interventions appropriate for the management of the patient with neck trauma.

Epidemiology

- Mechanism of Injury
- Penetrating neck injury makes up 0.55-5% of all traumatic injuries.
- Blunt trauma is even more uncommon.
- Mortality ranges from 3-6%.
- Delayed and missed diagnosis can be fatal.

Penetrating Mechanism of Injury



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

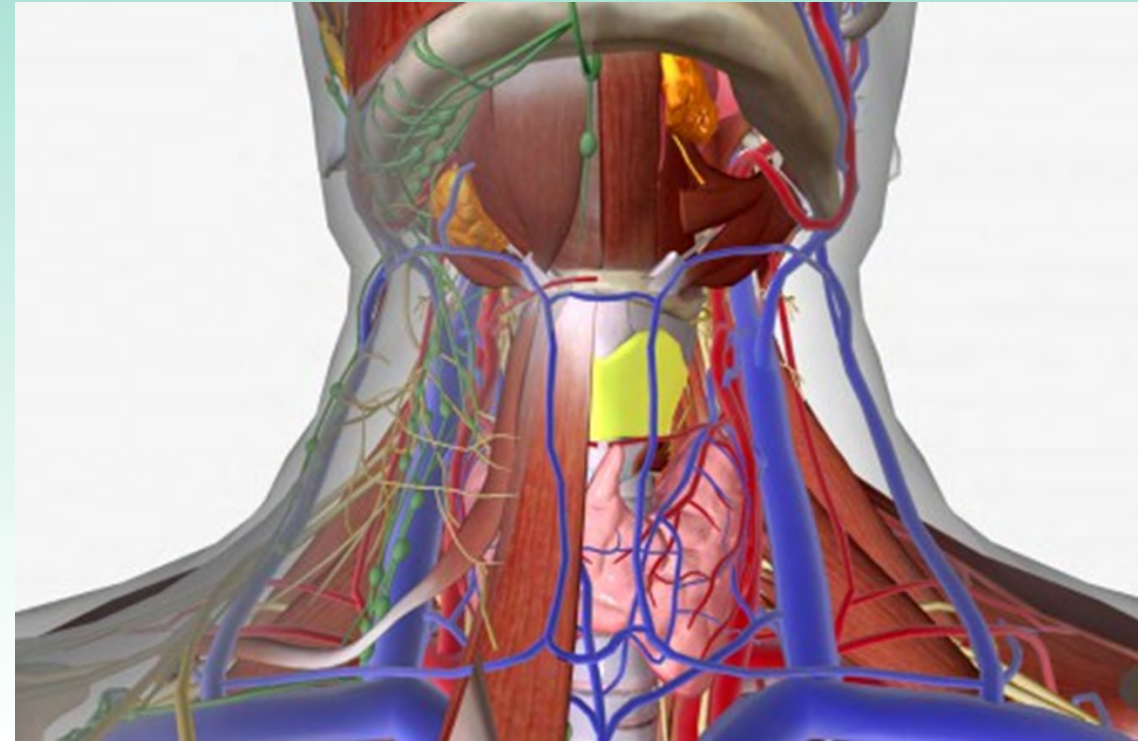
Blunt Mechanism of Injury

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



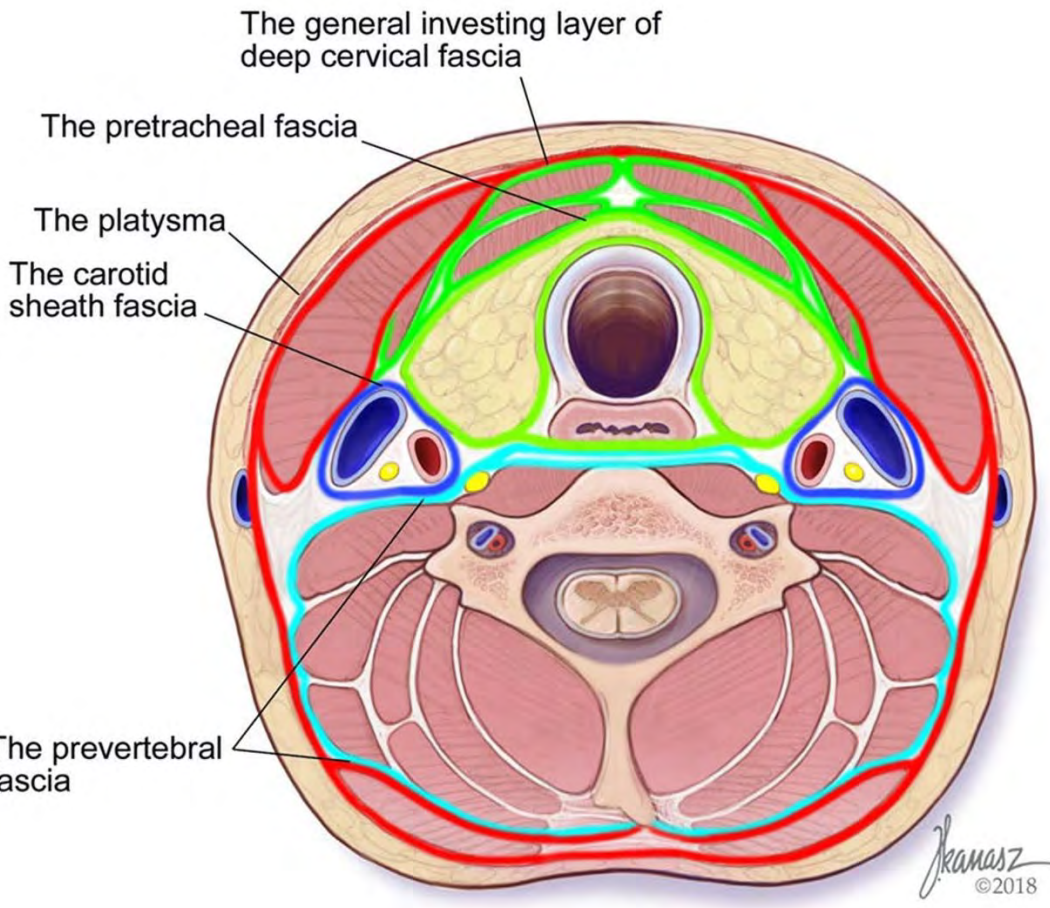
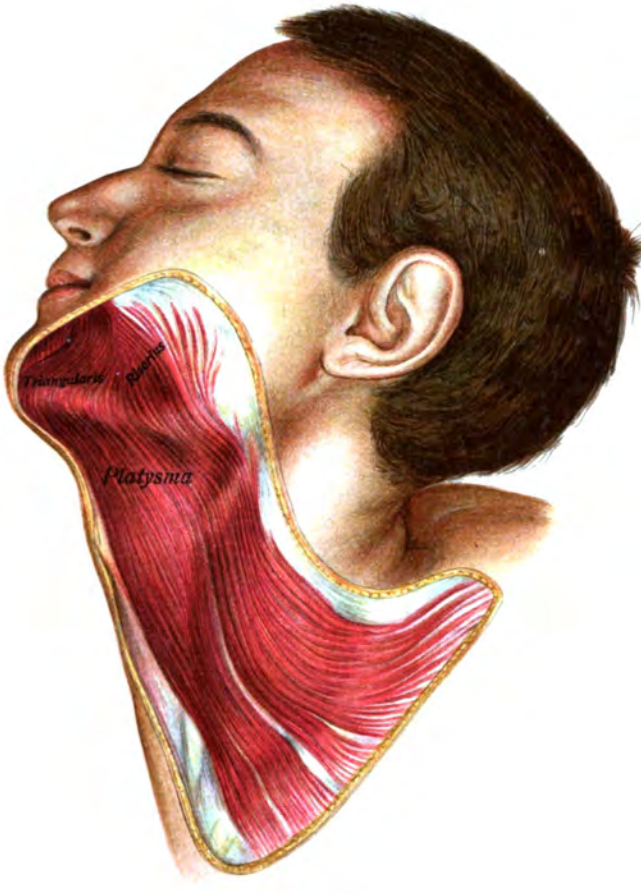
Epidemiology

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

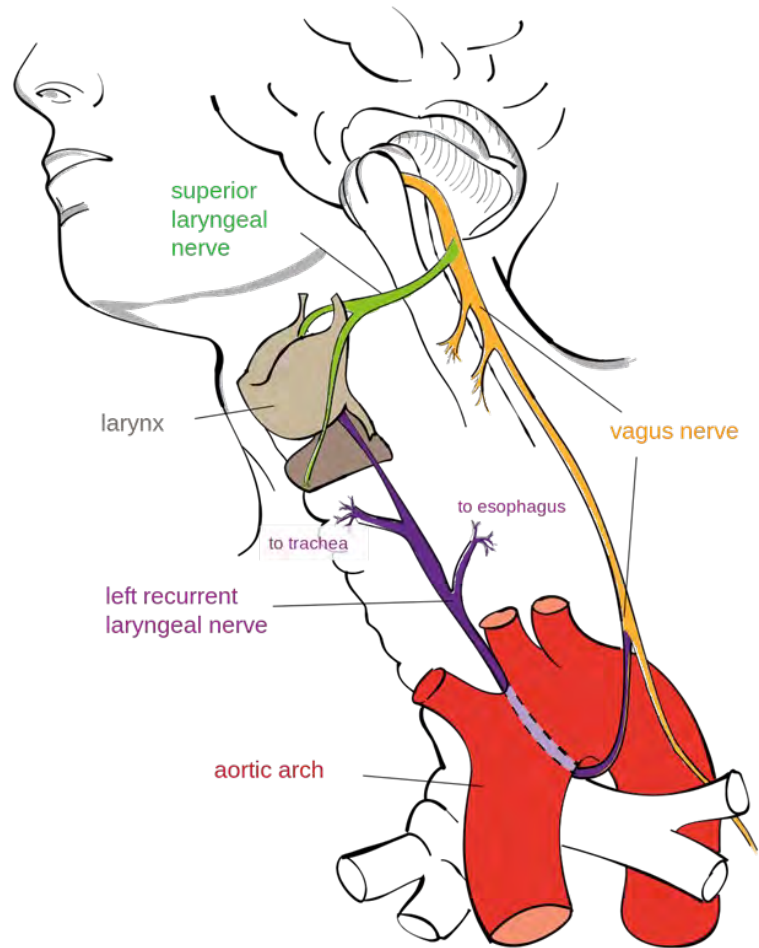


Platysma

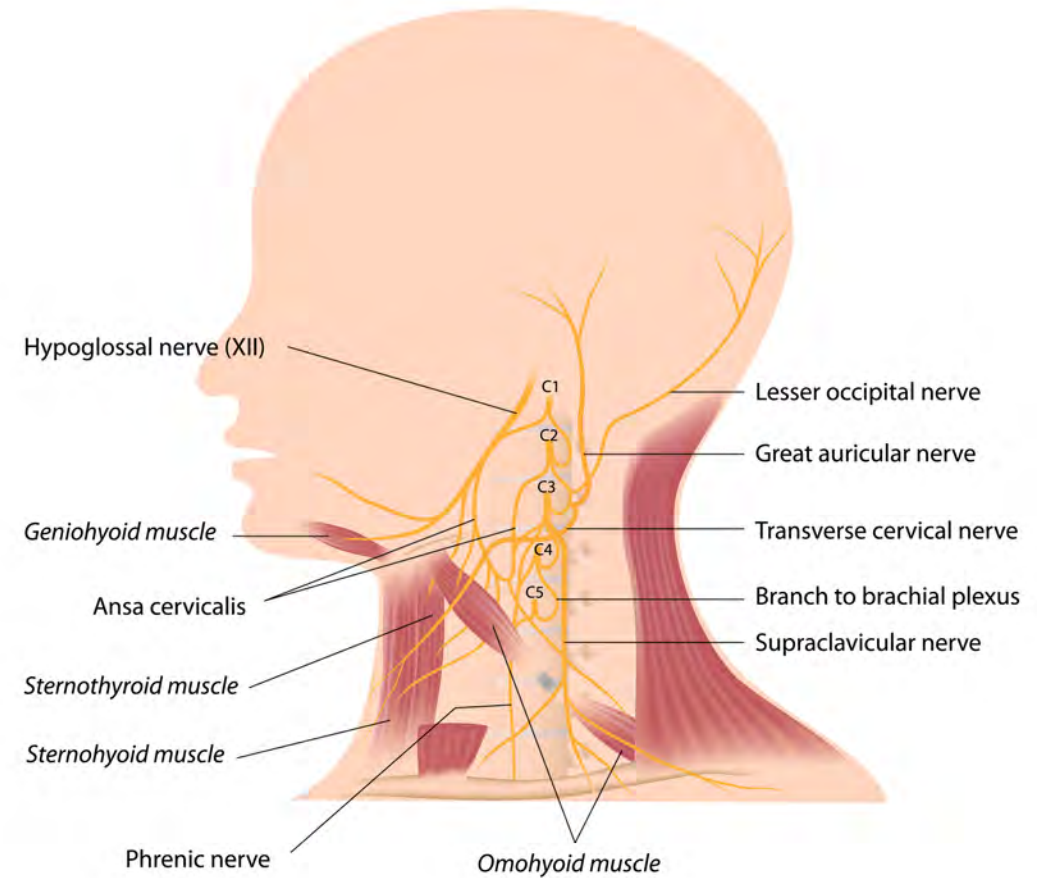
Platysma



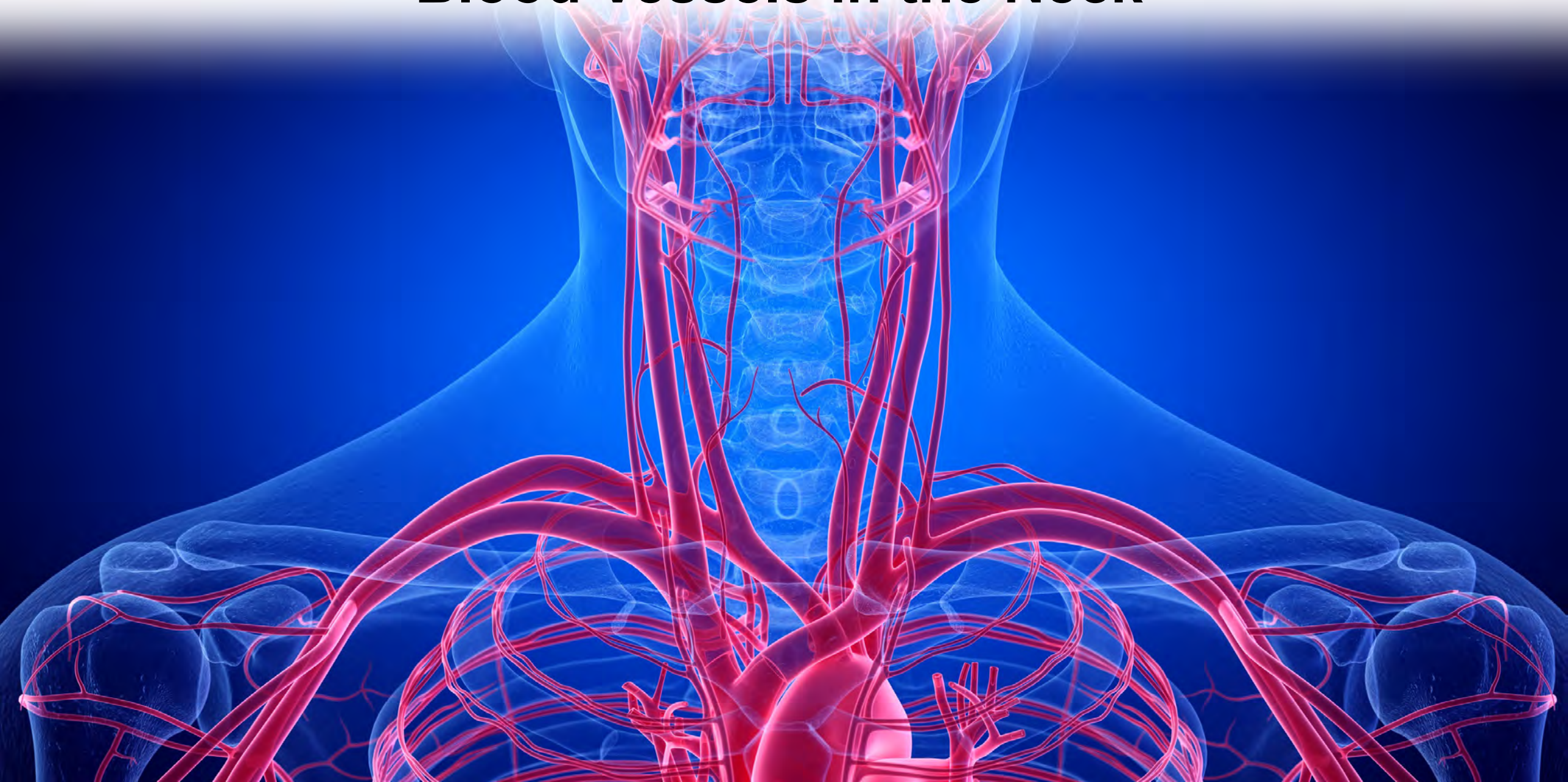
Nerves in the Neck



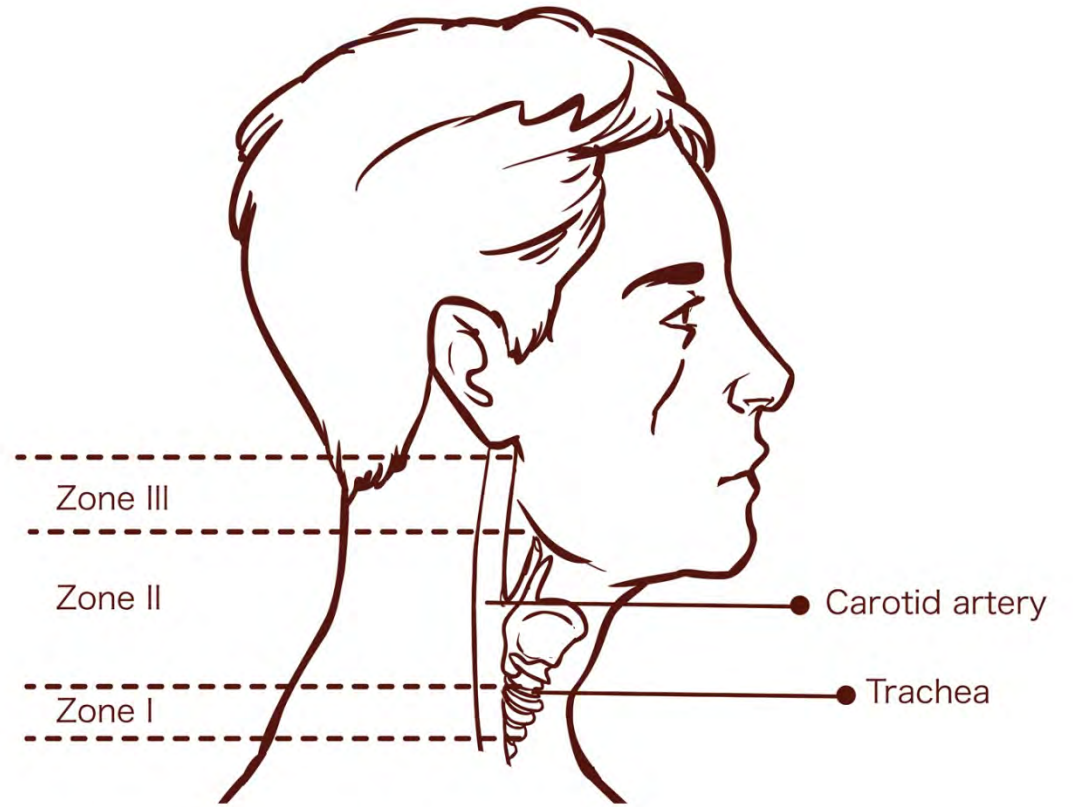
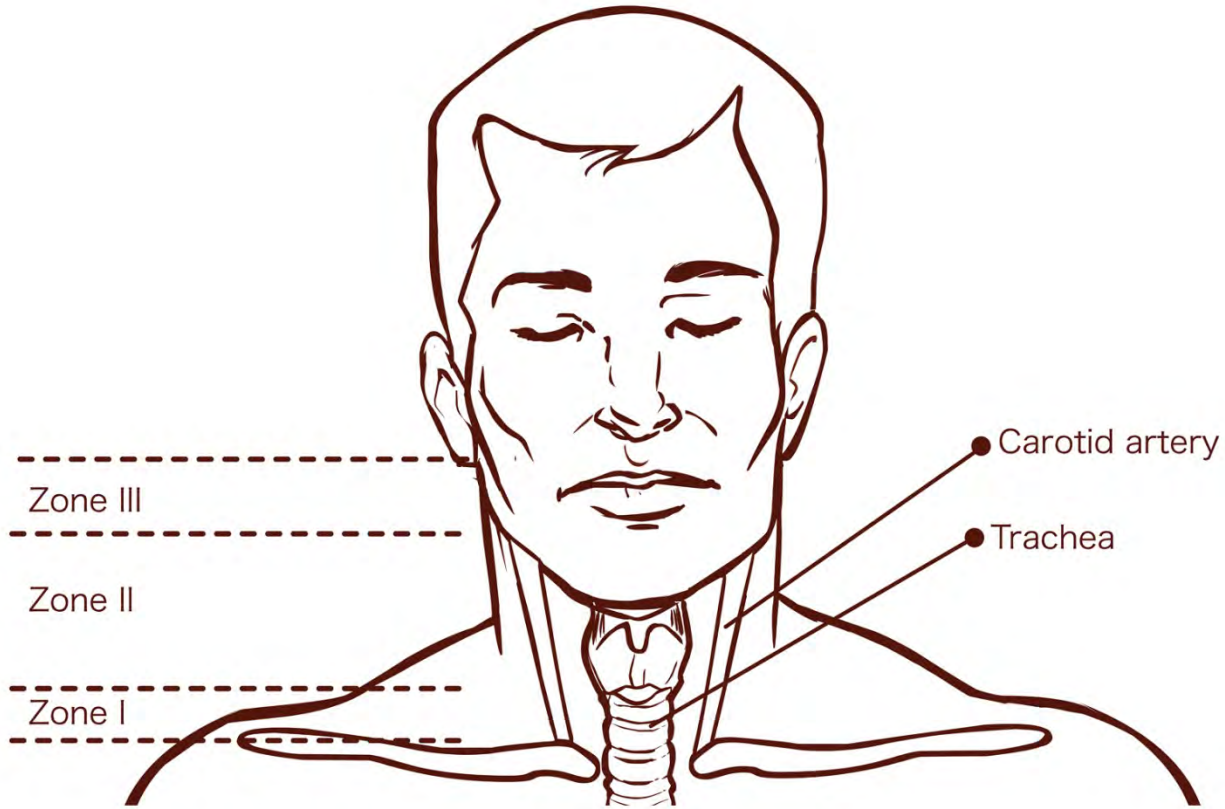
The Cervical Plexus



Blood Vessels in the Neck

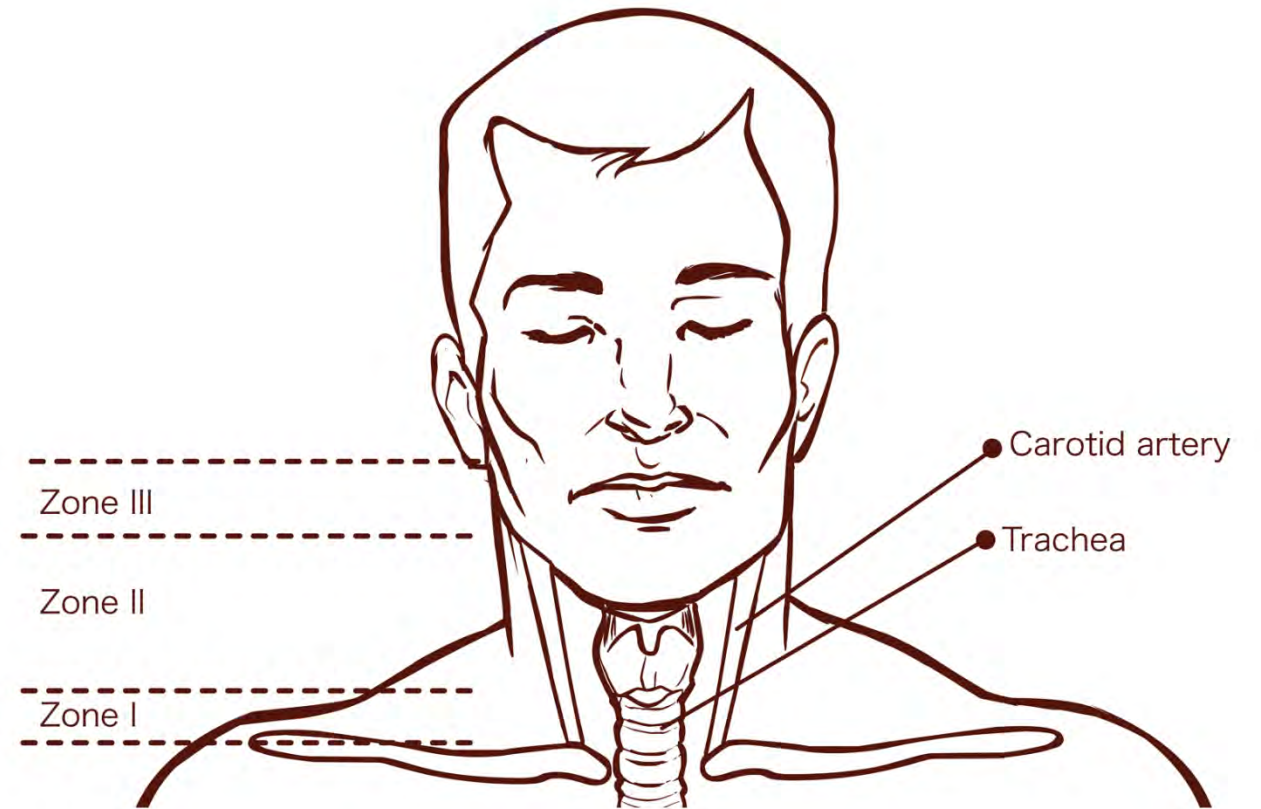


Zones of the Neck



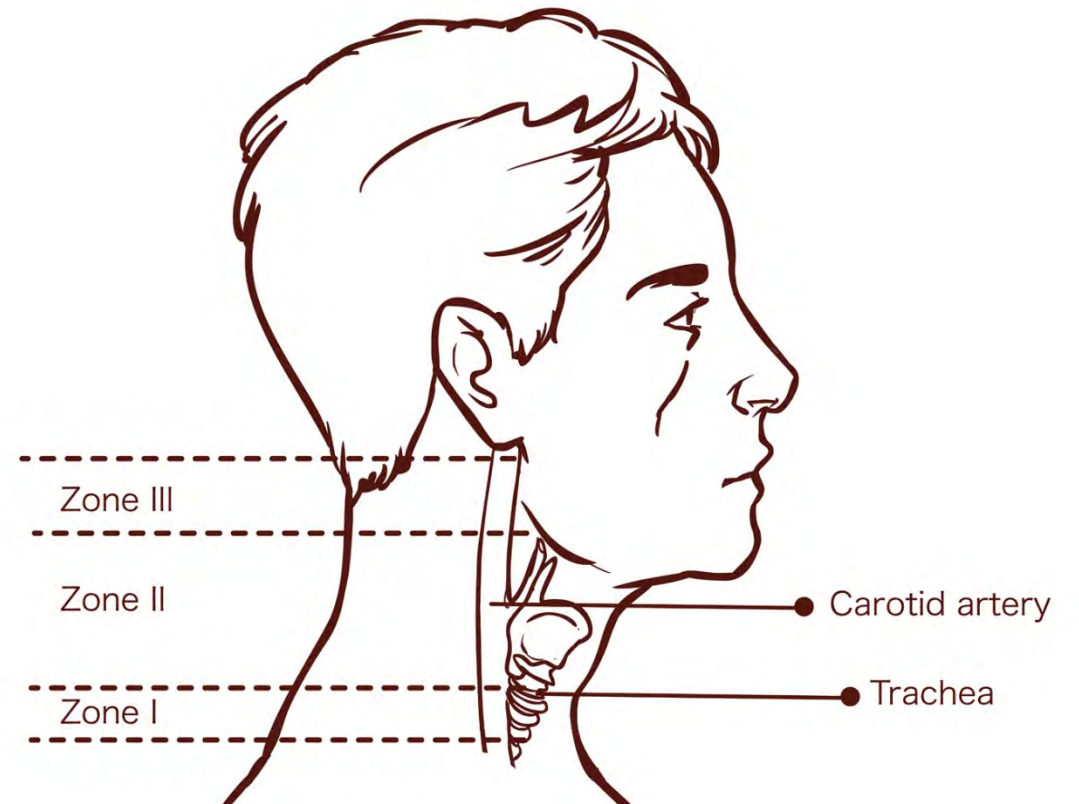
Zone 1

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



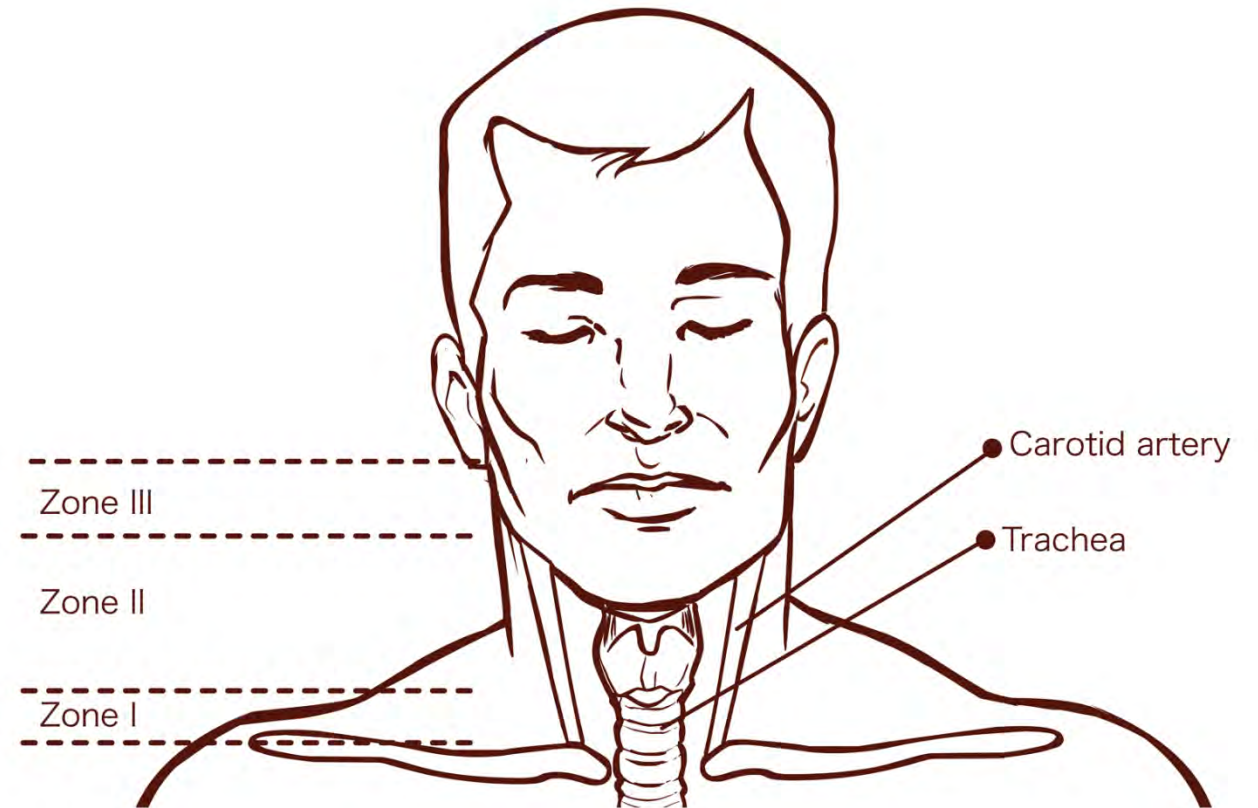
Zone 2

- Common carotid and vertebral arteries
- Jugular veins
- Pharynx
- Larynx
- Trachea
- Esophagus
- C-spine/cord
- Vagus/recurrent laryngeal nerves



Zone 3

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



History and Physical



History and Physical

- Gun
- Knife
- Amount of blood loss
- Baseline mental status
- Baseline motor status
- Drug or alcohol ingestion
- Self-inflicted or inflicted by other



Evidence of Significant Injury

Soft Signs

- Dysphagia
- Hoarseness
- Oro nasopharyngeal bleeding
- Neurologic deficit
- Hypotension

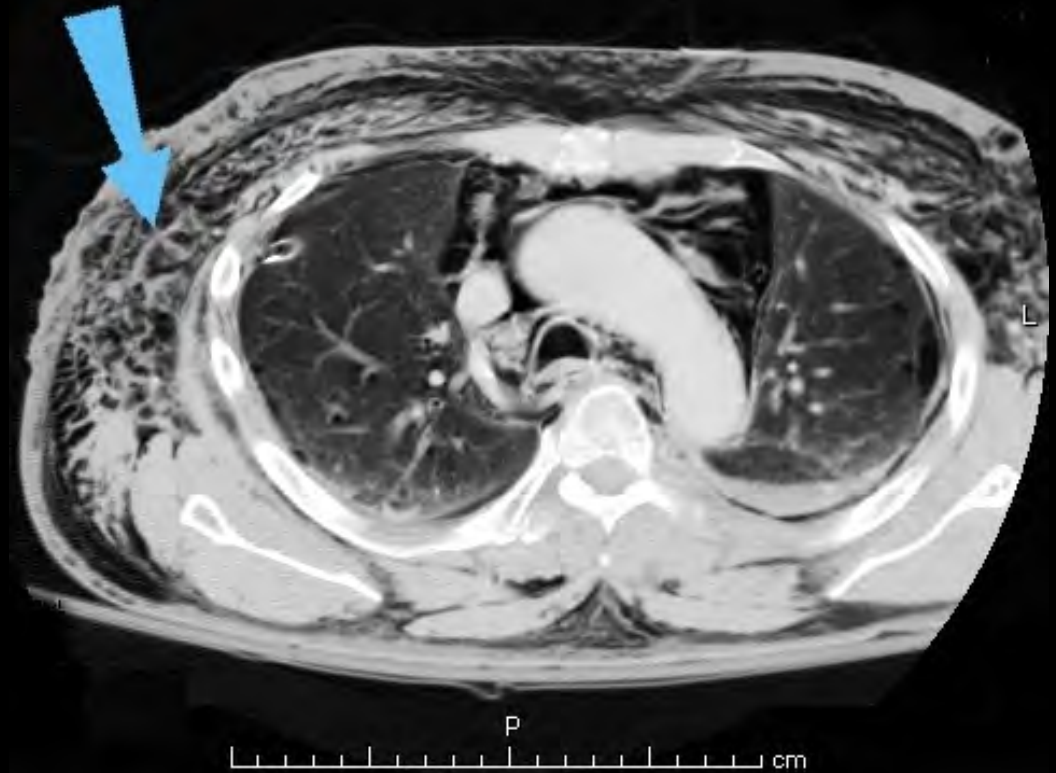
Hard Signs

- Subcutaneous emphysema
- Air bubbling through the wound
- Stridor or respiratory distress
- Hematoma (expanding)
- Active external hemorrhage
- Bruit/thrill Pulselessness/pulse deficit
- Distal ischemia



Primary Survey

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



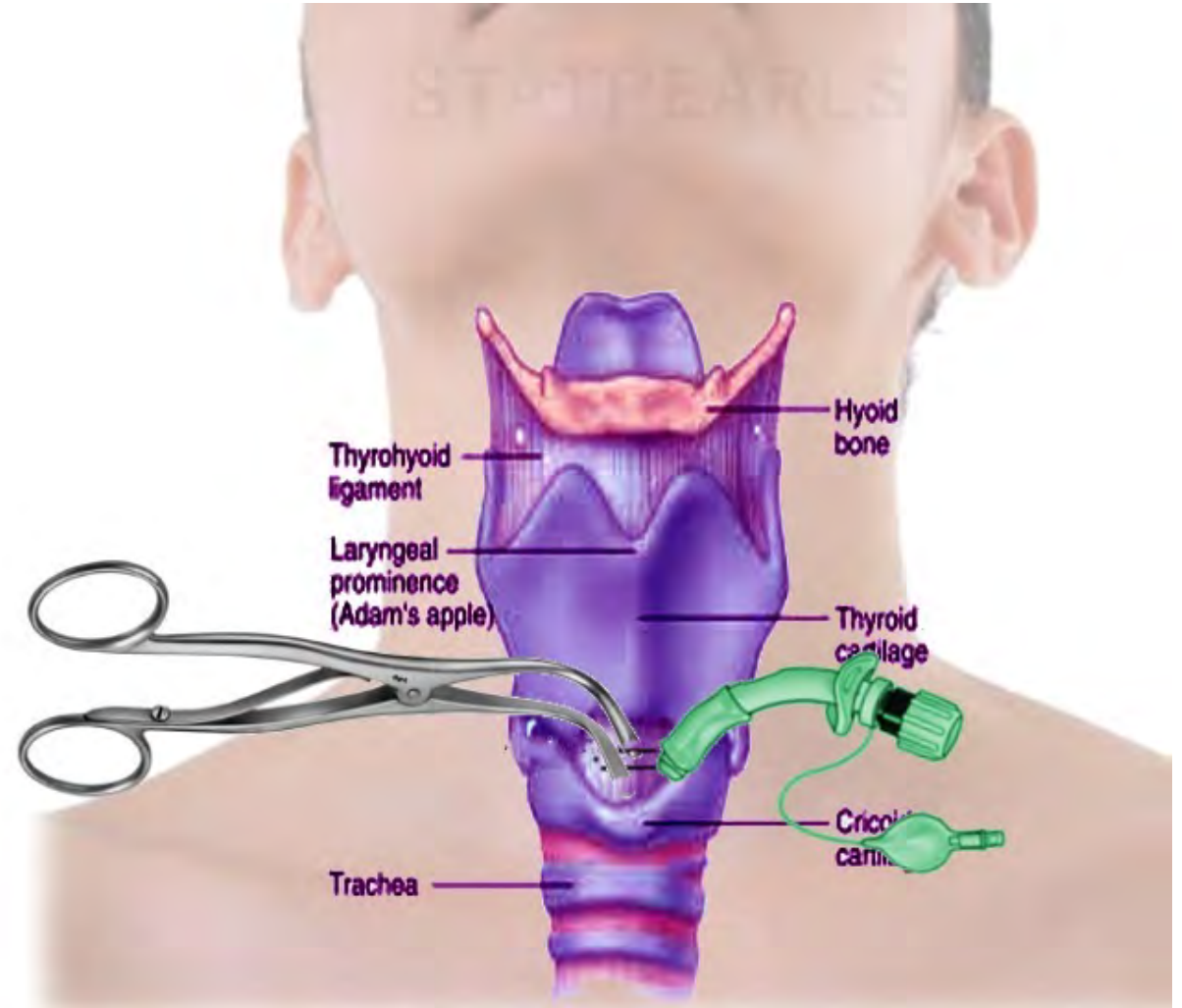


Airway Considerations

Who requires immediate intubation?

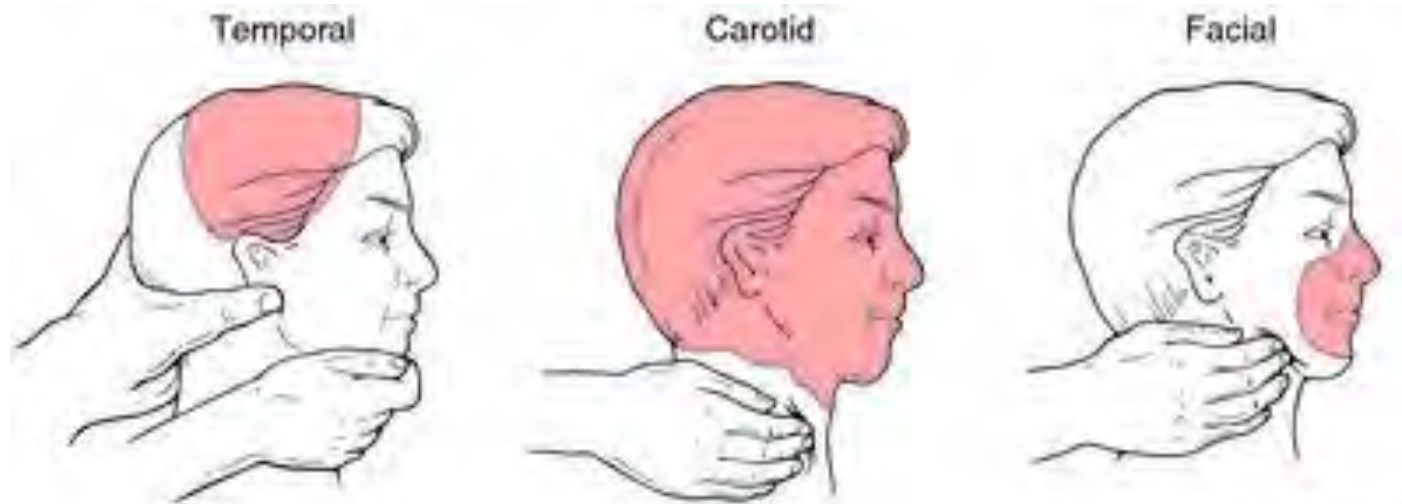
Airway Considerations

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



Control Bleeding

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





Physical Exam

- Violation of platysma
- Contusions, lacerations, abrasions
- Expanding hematomas, bleeding
- Hoarseness, stridor
- Subcutaneous emphysema
- Hemoptysis, drooling
- Dyspnea
- Distortion
- Mandibular/midface instability

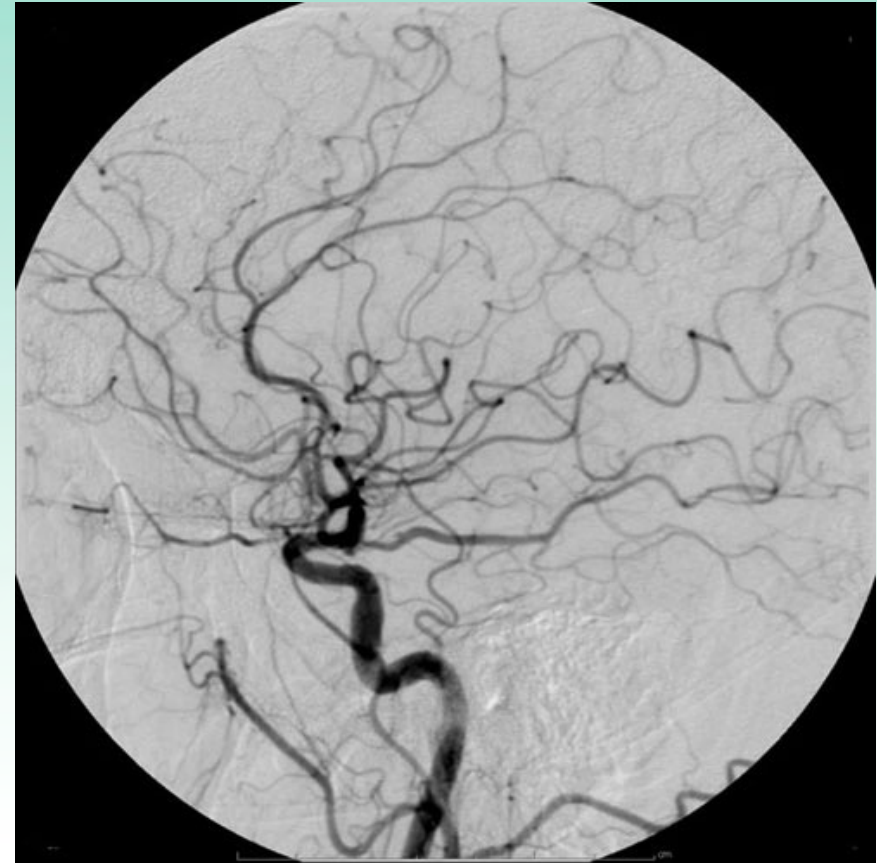
CTA

- Chest radiograph
- CT and CT angiogram
- High resolution CT is the initial diagnostic study of choice when available.
- Should only be used in stable patients



DSA

- Invasive
- Complications
- Expensive
- Therapeutic interventions



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Diagnostic Studies

- Laryngoscopy
- Bronchoscopy
- Esophagoscopy
- Color flow doppler, duplex ultrasonography
- MRA



Specific Injuries

- Vascular
- Aerodigestive
- Cranial nerves
- Thoracic duct



Vascular Injuries

Physical Exam

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



Injuries That Increase Suspicion for BCVI

- Le Fort II or III fractures
- Basilar skull fracture involving the carotid canal
- Mandible fracture
- 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
- Thoracic injury - rib fracture and thoracic injury



Primary Diagnostics

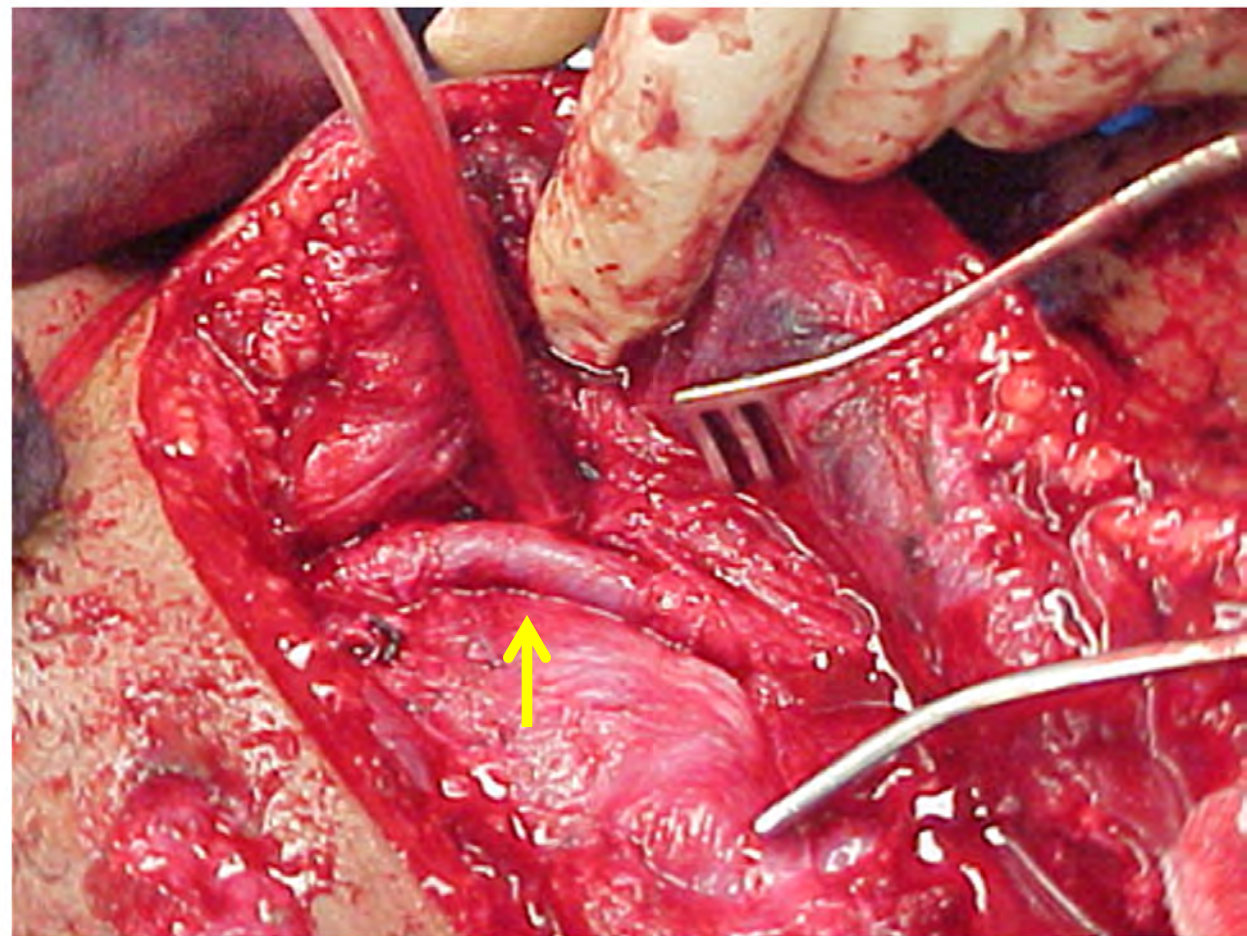
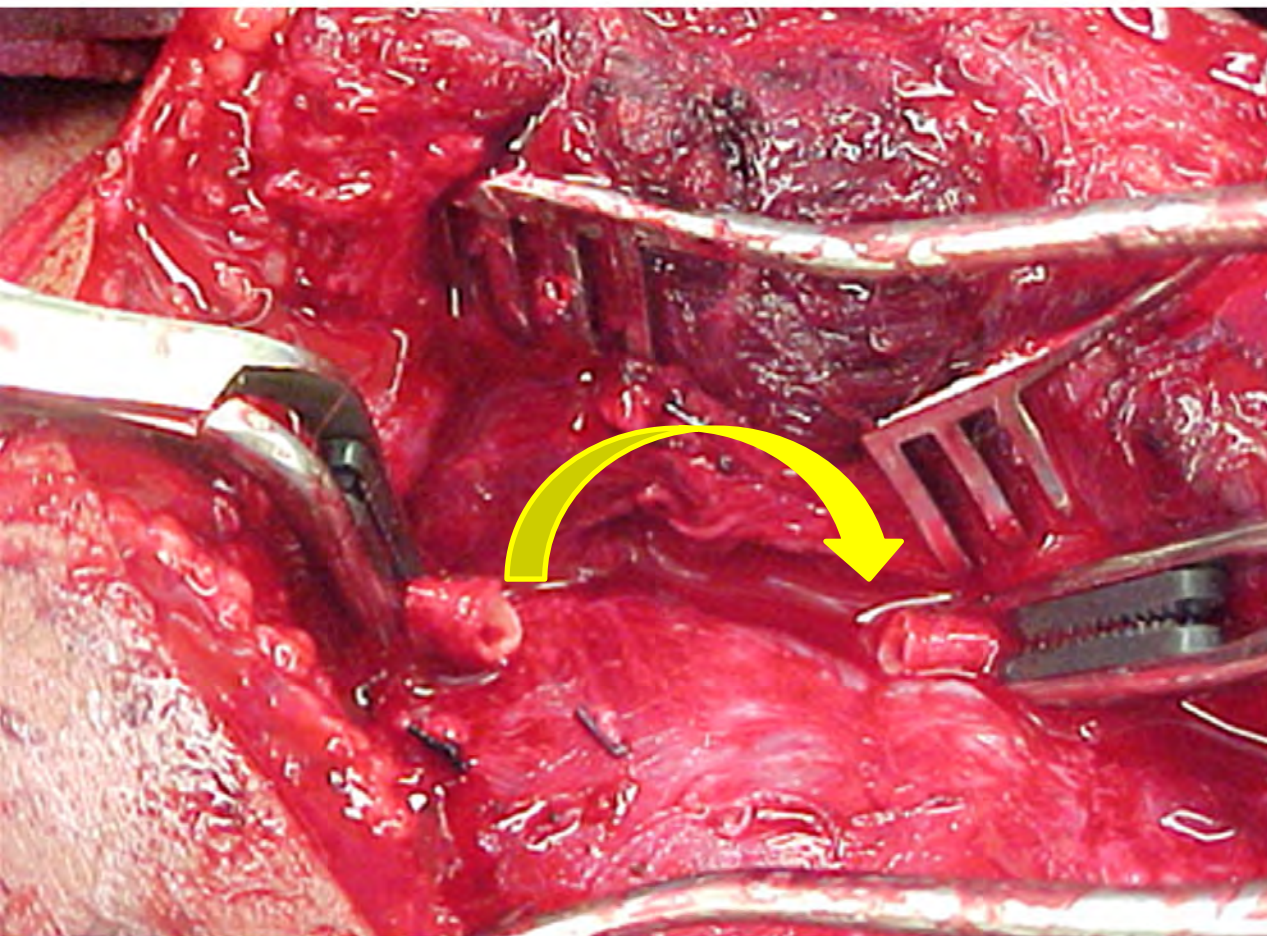
- CT angiogram of the neck
- Chest x-ray indicated in Zone I injuries because of their proximity to the chest
- Consider complete blood count, basic metabolic panel, toxicology and blood alcohol content



Vascular Injury Management: Penetrating

- 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 Artery Interposition Repair



Blunt Cerebral Vascular Injuries (BCVI)

Management dependent on the grade of injury: Grade I - V

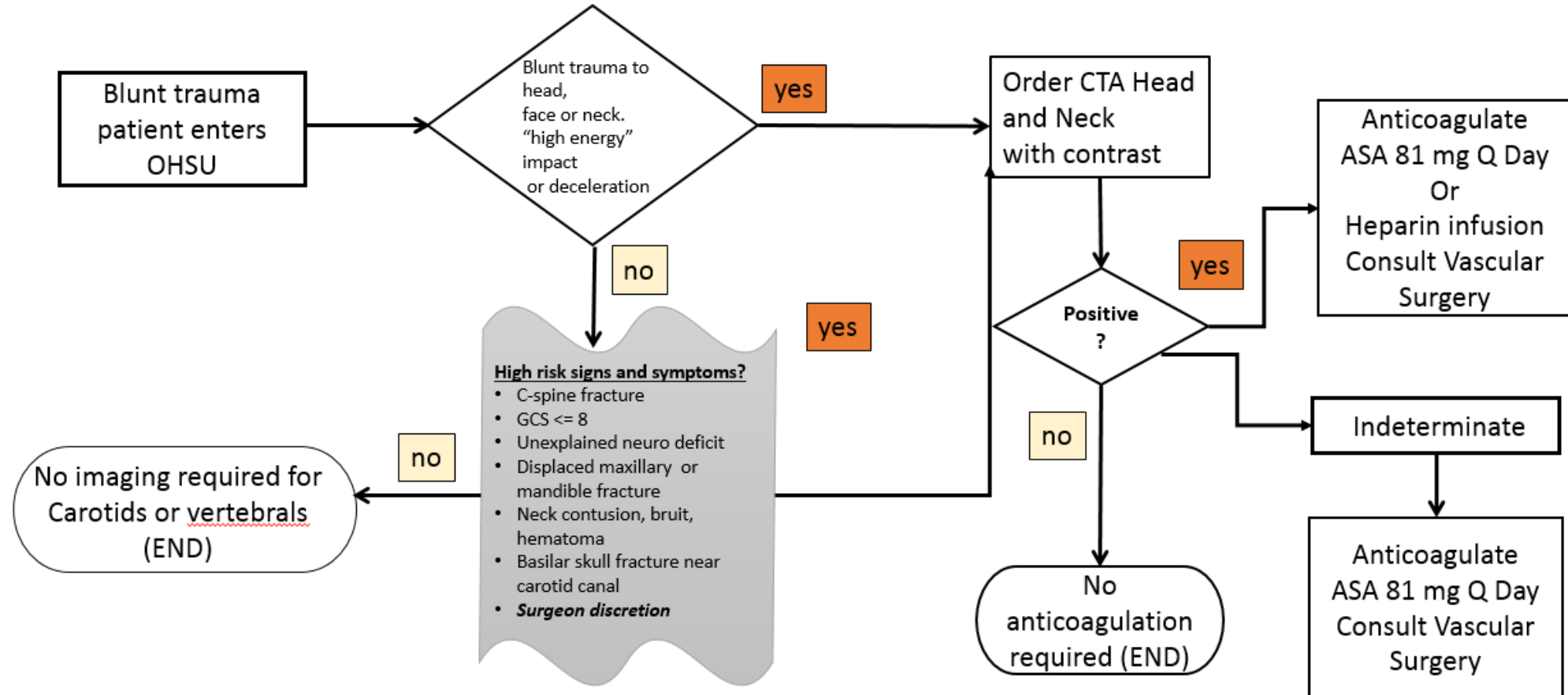
- Grade I: Irregular appearance of vessel wall or dissection/intramural hematoma with less than 25% luminal narrowing
- Grade II: Intimal flap or intramural hematoma with > 25% narrowing
- Grade III: Pseudoaneurysm
- Grade IV: Occlusion
- Grade V: Transection or hemodynamically significant injuries

Carotid Intimal Flap: Example of Grade II Injury



Example BCVI Management Protocol

Guideline for evaluation of blunt trauma patients at risk for Blunt Cerebral Vascular Injury (BCVI)



Management Summary

Vascular Injury

- Surgical exploration unstable and stable Zone II
- CTA 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

- **Esophagus**
 - < 1% of all traumatic injuries
 - < 0.1% are secondary to blunt trauma
 - > 80%
 - Secondary to penetrating neck trauma
 - However, 05 – 7% of penetrating neck injuries are associated with esophageal involvement
- **Trachea**
 - 3 – 8% injure cervical trachea
 - Only 4% of all injuries related to the cervical trachea are from blunt trauma
- **Both**
 - May be as much as 28%

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Tracheal and Laryngeal Injuries

Signs of injury

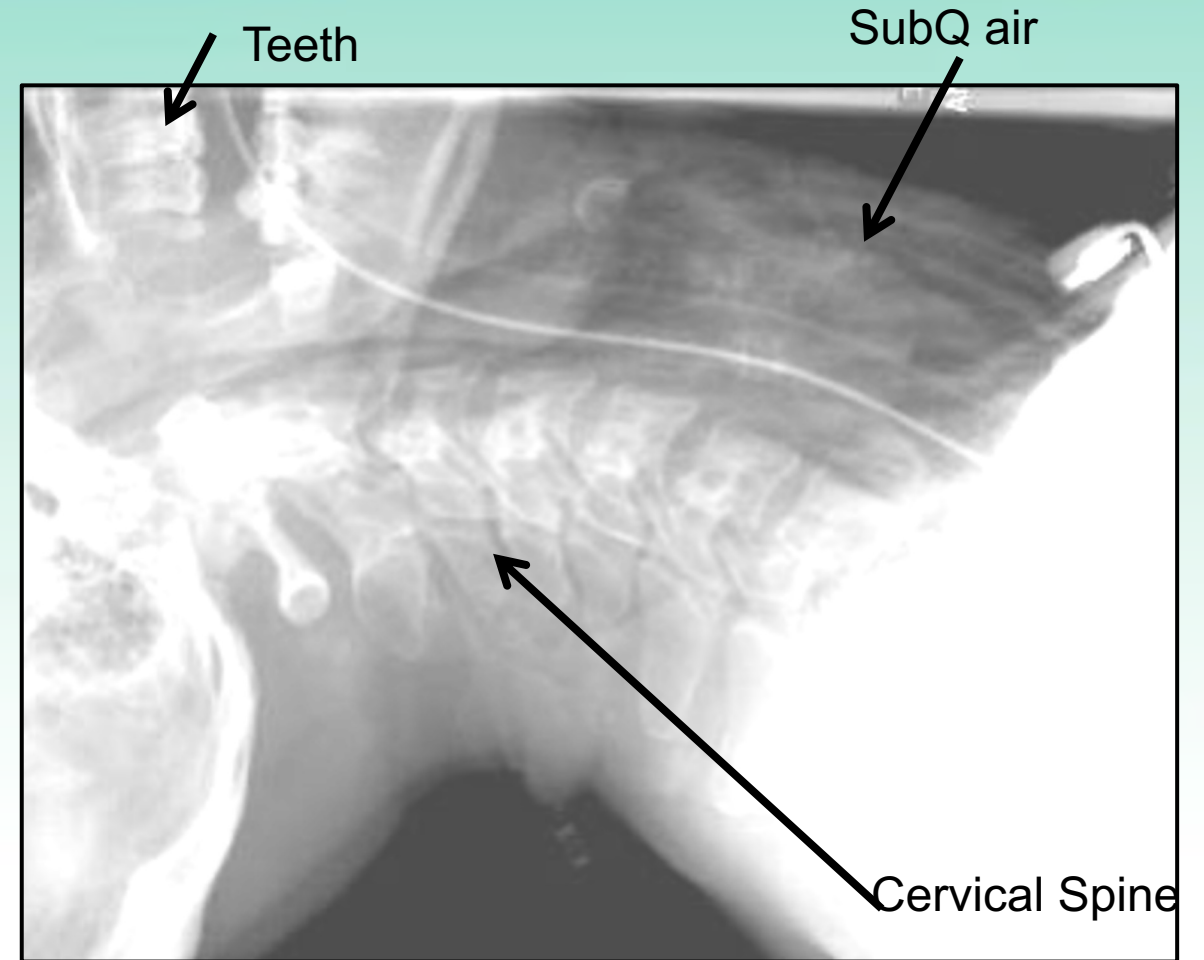
- Hoarseness and dysphonia
- Hemoptysis
- Subcutaneous emphysema in the neck and trunk
- Tenderness over the trachea



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 cartilage 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 (ingestion of sharp object)



Esophageal Injury

Blunt

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



Esophageal Injury

Signs of Injury

- Hematemesis
- Odynophagia
- Dysphagia
- Drooling, hypersalivation
- 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
- Esophagoscopy
- CTA

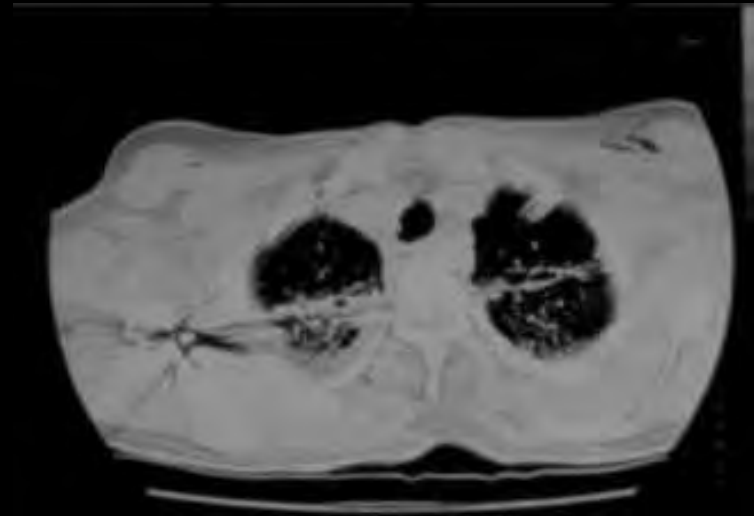
Laboratory Findings

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

Esophageal Injury Diagnostics

CTA

- Expedites diagnosis
- Trajectory of missile
- Associated injuries



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

Practice Guidelines

- Few published practice guidelines for the management of neck injuries
- Eastern Association for the Surgery of Trauma (EAST)
 - Neck trauma, penetrating Zone II, 2008
 - Blunt cerebrovascular injury, 2020

EAST Guidelines BCVI

- Recommend using a screening protocol to detect BCVI in adult polytrauma patients
- Perform screening CTA to detect BCVI in patients with high-risk cervical spine injuries
- Conditionally recommend performing CTA to detect BCVI in low-risk cervical spine injuries
- Recommend using ATT to prevent both stroke and mortality in adult patients with BCVI
- Recommend against the use of routine endovascular stenting in adult patients with Grade II or III BCVIs

EAST Guidelines

Zone II Penetrating Injuries

- Selective management of penetrating Zone II injuries is recommended to minimize unnecessary operations.
- High resolution CT angiography is the initial diagnostic study of choice when available.
- Either contrast esophagography or esophagoscopy can be used to rule out an esophageal perforation that requires operative repair.

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.



What About Cervical Spine Immobilization?

- Immobilization in penetrating injury only necessary when neurologic deficit is present or physical exam cannot be performed **and** mechanism suspicious for spinal cord injury.
- Unnecessary immobilization may actually obscure recognition of other injuries or visualization of the airway.

Potential Complications

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

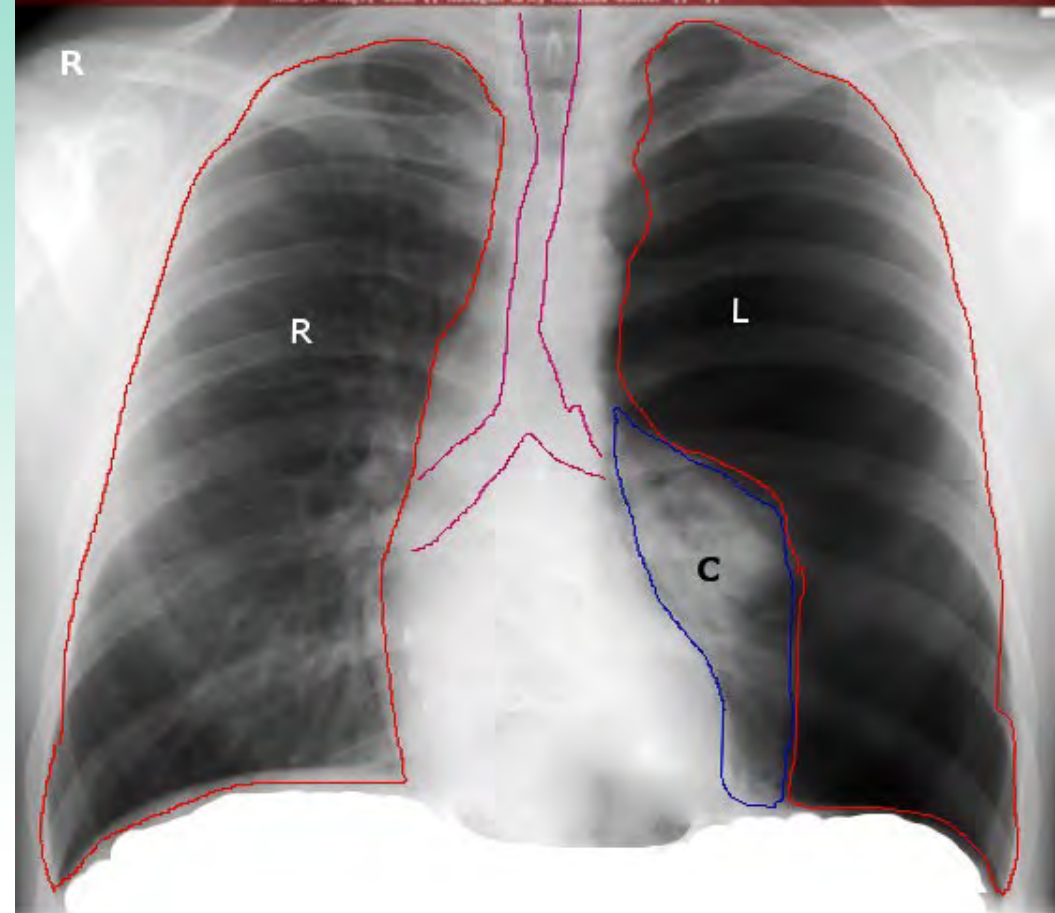


Image courtesy S.Bhimji MD. Jalota, 2021

Be Alert For:

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

Be Ready For:

- Rapid transport to CTA or operating room
- RSI and emergency intubation
- Emergency tracheostomy/ cricothyrotomy



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
- High level of suspicion for initially benign appearing injuries
- Unrecognized vascular or aerodigestive injuries have a high mortality.

Neck Trauma

1. What is a potential injury in a patient with a stab wound to the neck in Zone 1?
 - a. Laceration aortic arch
 - b. Laceration jugular vein
 - c. Perforated esophagus
 - d. Vertebral artery laceration

2. An unrestrained driver has a head on collision with a tree. She arrives with stridor, drooling, and hoarseness. She has likely injured her:
 - a. Trachea
 - b. Esophagus
 - c. Mandible
 - d. Sternum

3. A restrained driver is T-boned on the driver's side in a high- speed collision with another vehicle. He has a significant seat belt mark over abdomen and lateral neck. He sustains rib fractures on the left from 2nd to 5th ribs. His primary survey is completed. Initial work up should include:
 - a. MRI chest
 - b. Aortogram
 - c. CTA head, neck, chest, abdomen
 - d. Cardiac ultrasound

4. The majority of neck trauma is a result of blunt trauma.
 - a. True
 - b. False

5. Which injury pattern(s) would have a high risk of airway compromise?
 - a. Tracheal injury
 - b. Expanding hematoma in neck
 - c. Mandibular fracture
 - d. All of the above

6. The Eastern Association for the Surgery of Trauma (EAST) penetrating neck trauma guideline mandates that all penetrating injuries to the Zone II region of the neck MUST be explored in the operating room.
 - a. True
 - b. False

7. Why is it imperative to identify esophageal injuries within the first 24 hours?
 - a. May cause a compromised airway
 - b. May cause nutritional deficits
 - c. May interfere with discharge planning
 - d. May cause infection

8. What is the thick, fibrous muscle sheath over the neck that, if violated, indicates that the patient has a higher risk for serious injury?
 - a. The sternocleidomastoid muscle
 - b. The trapezius muscle
 - c. The platysma

9. Which of the following physical findings are specific for esophageal injury?
 - a. Hematemesis, dysphagia, odynophagia
 - b. Tracheal deviation, hoarseness, dysphonia
 - c. Hemoptysis, subcutaneous emphysema, tenderness

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