

# Management of Penetrating Neck Injuries

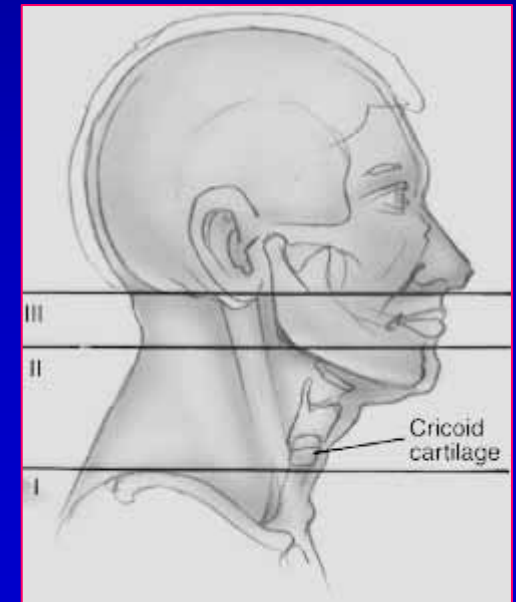


**Rosemarie E. Hardin, MD**  
**Kings County Hospital Center**  
**December 15, 2006**



# Case Presentation

- xx year old AA male
- GSW to L neck; high zone II●
- Hemodynamically stable, GCS 15
- No history of blood loss at scene
- Mild difficulty breathing
- PMHx unremarkable



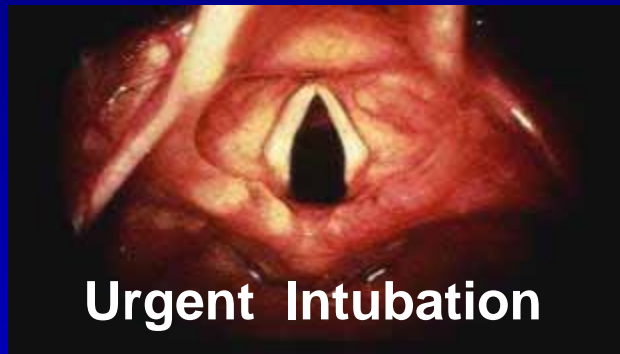
# Physical Exam

- Vitals: tachycardic, normotensive, sat 95%
- Airway intact
- Neck: entry wound zone 2 left neck; high
- Subcutaneous emphysema b/l neck ; >> R
- L neck **hematoma** , non-expanding
- No other injuries



# Resuscitation

Agitation & difficulty breathing ; **stridor!!**

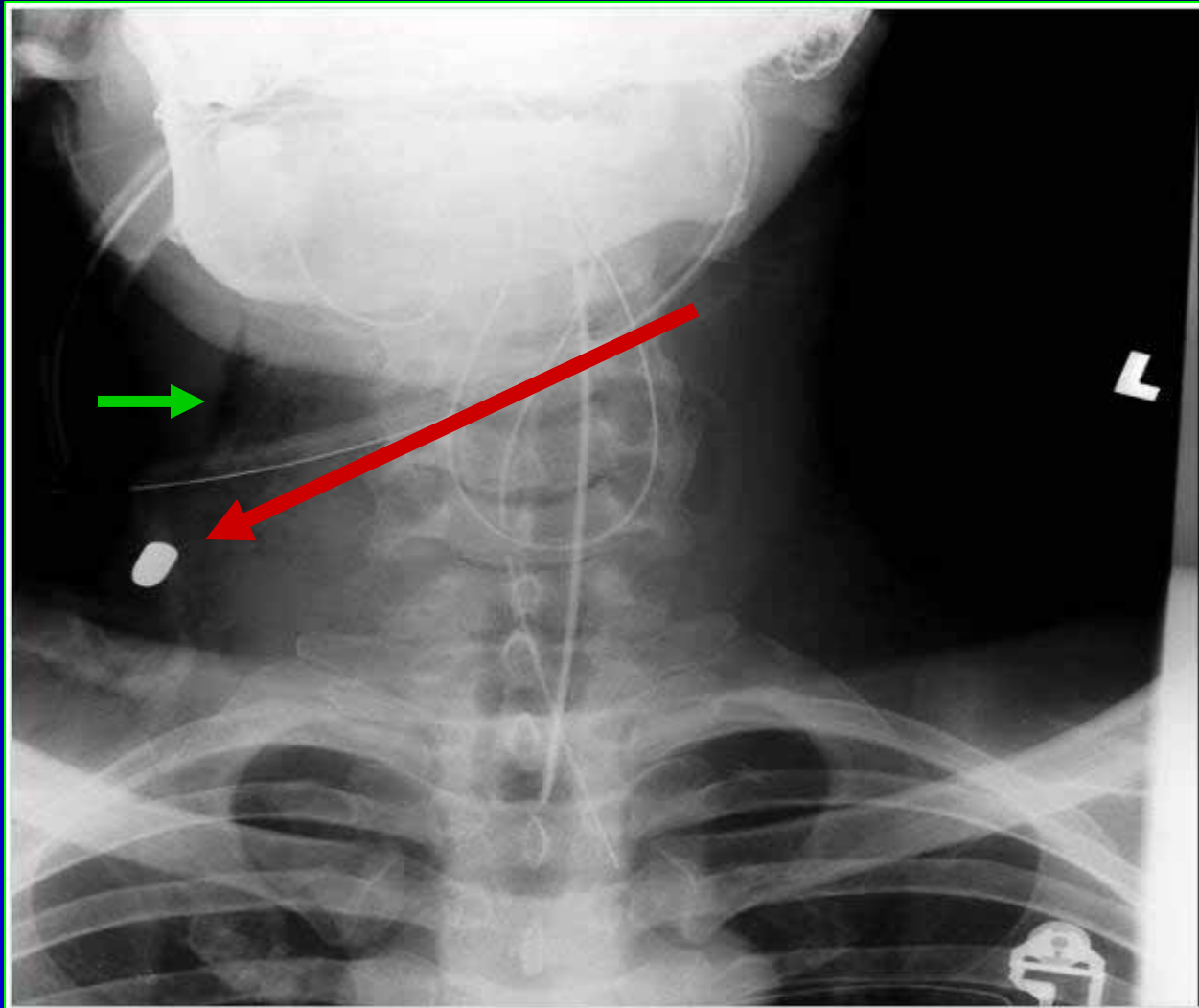


Urgent Intubation



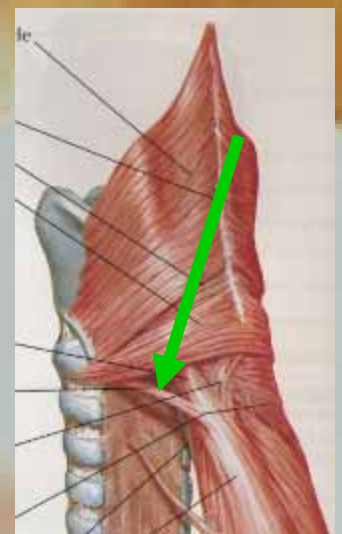
**Operating Room**

# Pre-op Imaging



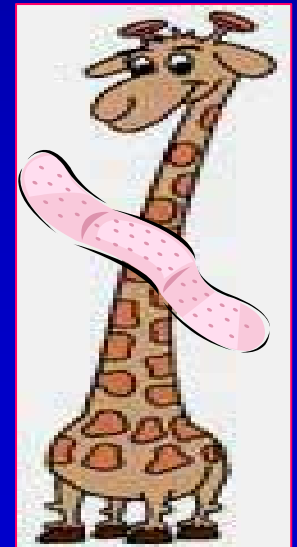
# Operative Procedure

- Right neck exploration
- Injury at the pharynx-esophagus junction
- 2 cm defect; repaired primarily
- No other injuries – but what about the left side???
- Intra-operative ENT consult for panendoscopy
- Injury high left pharynx - no intervention
- JP drain left for wide drainage



# Hospital Course

- Patient remained intubated & transferred to SICU
- Extubated POD #1 with ENT & anesthesia
- Pt swallowing intact; trial of clears well tolerated
- JP removed on POD#3, diet started
- D/C home on POD #4





# *Penetrating Neck Trauma*



# ACGME Core Competencies



Patient Care



Medical Knowledge



Practice Based Learning / Improvement



Interpersonal Communication Skills



Professionalism



Systems-Based Practice

# History

- 1950's: Zone 2 injuries managed conservatively
- Surgical repair first attempted during Korean War
- Fogelman & Stewart (1956):
  - benefit of direct carotid repair in comparison to ligation
  - Advent of **mandatory exploration**
- In 1970-80's : angiography and panendoscopy
  - Advent of **selective management**

# Some Useful Anatomy

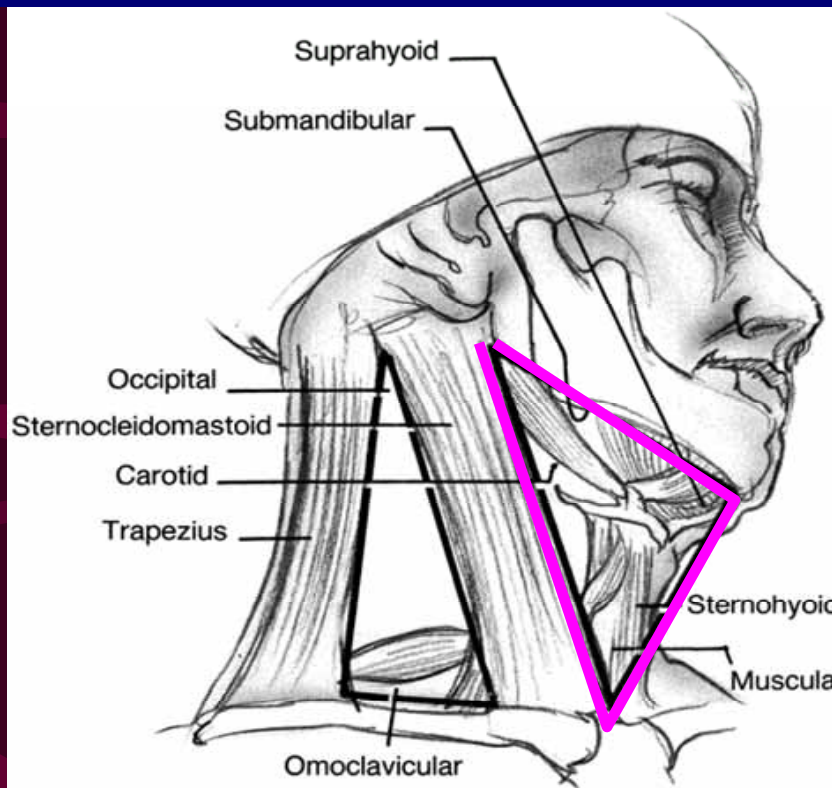
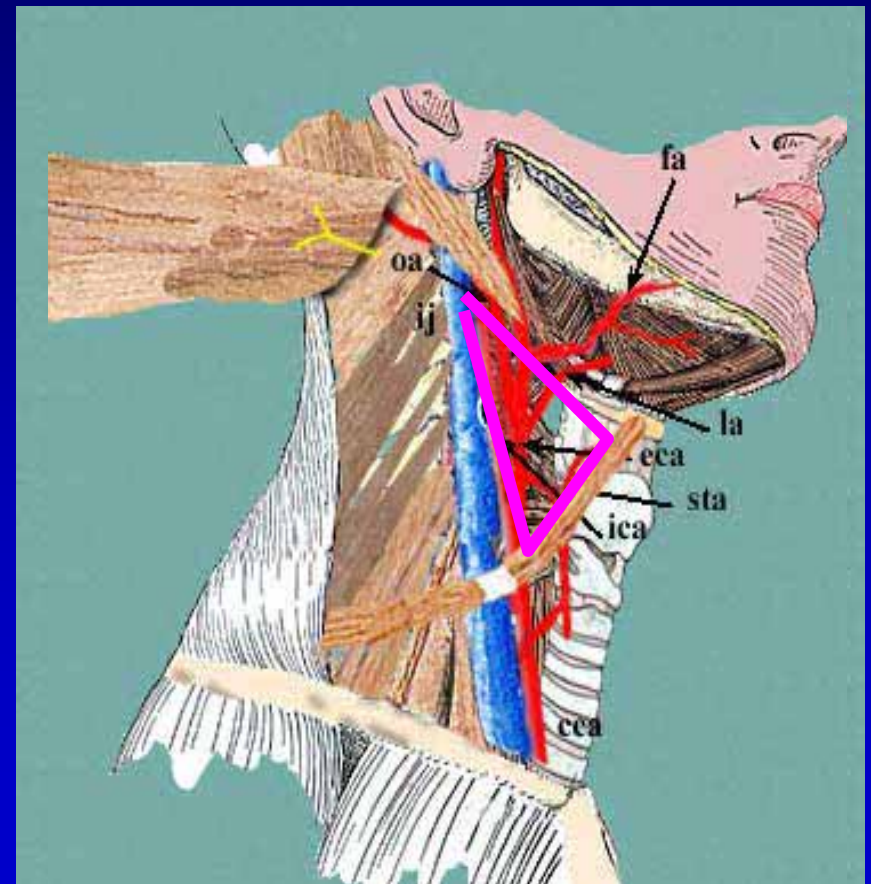


FIG. 73-7. Anatomic triangles of the neck: the neck is divided into anterior and posterior triangles by the sternocleidomastoid muscle.



# Management Priorities

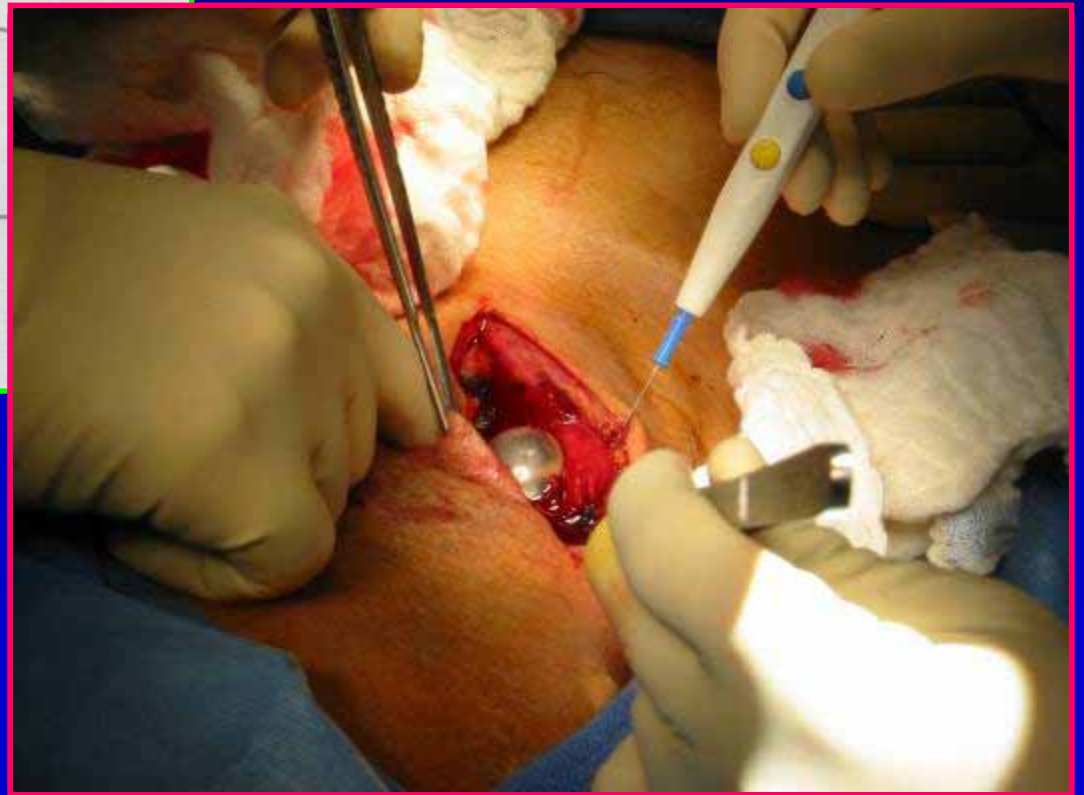
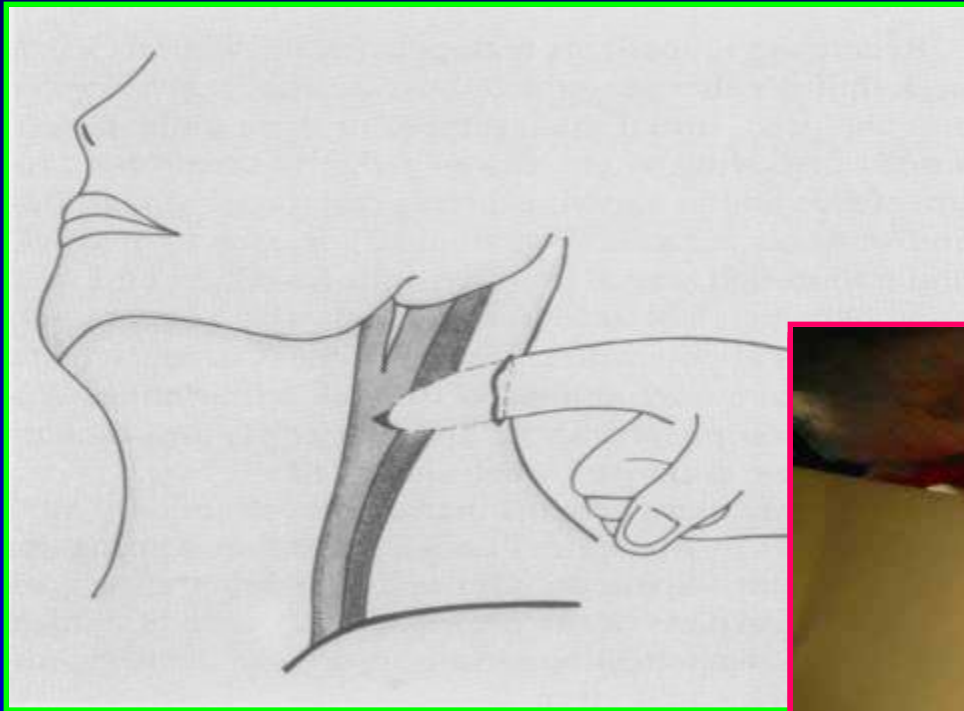
## Airway!

- Early (“prophylactic”) intubation
- Cricothyroidotomy

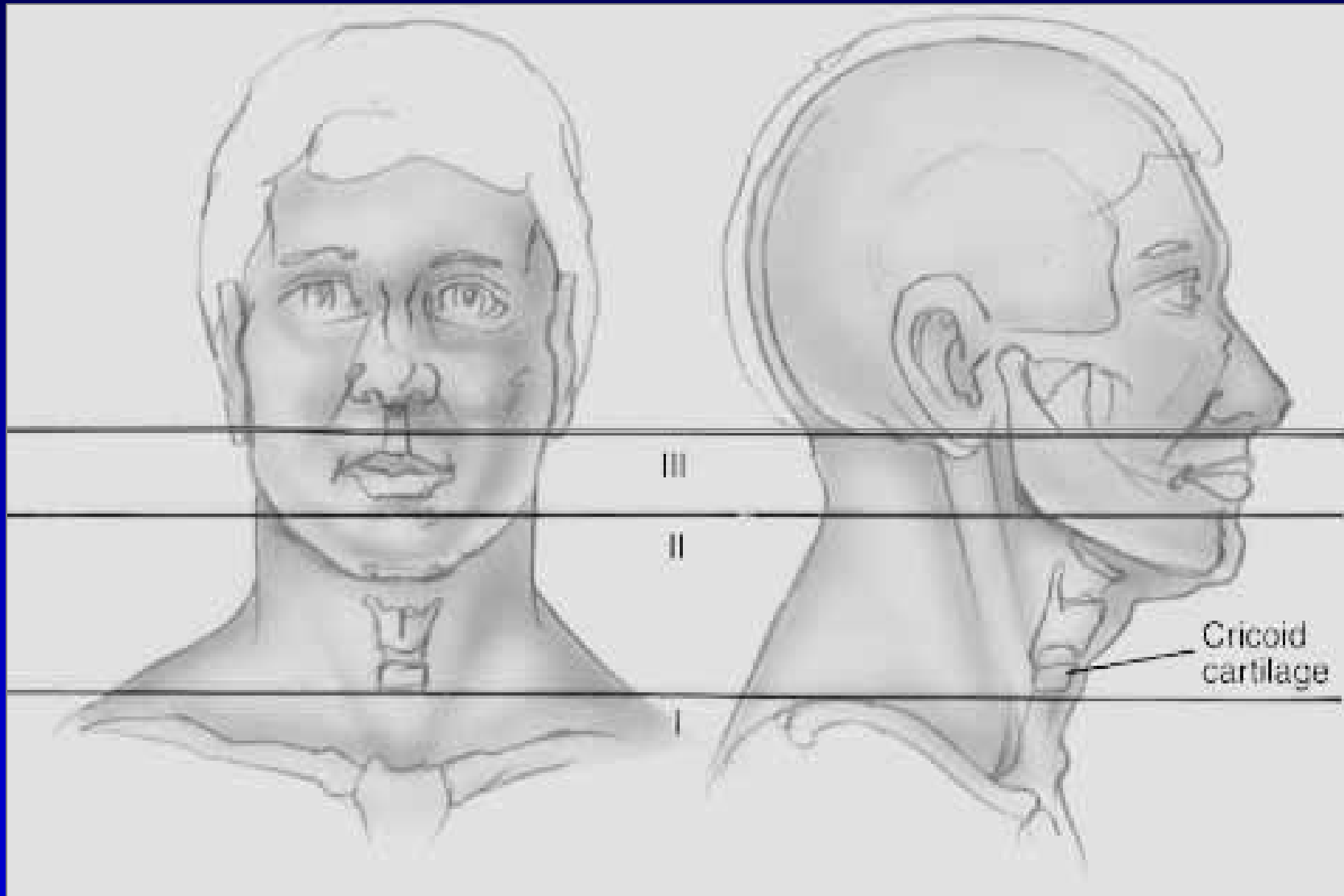


Penetrating Neck Trauma

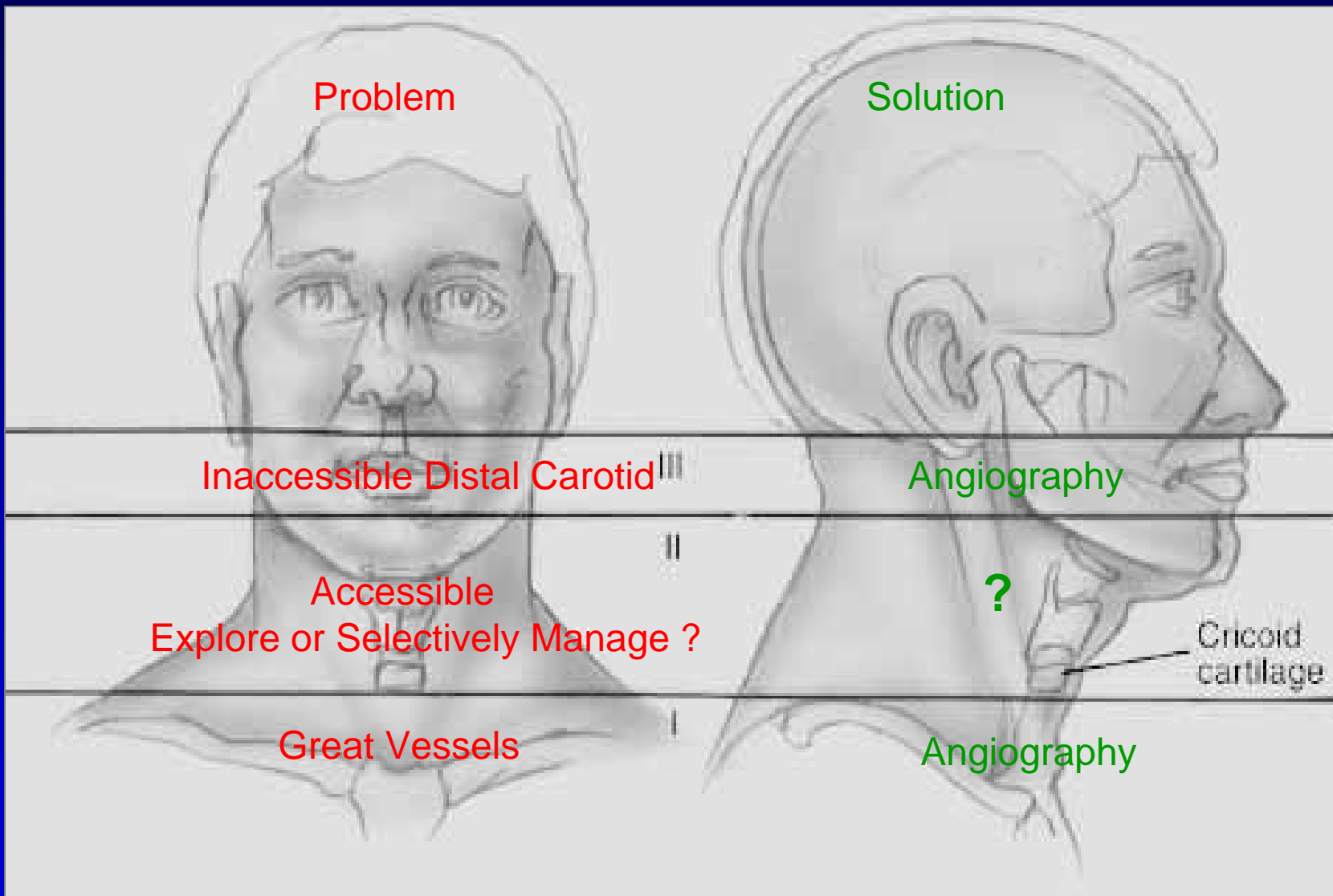
# ABC's – Control Hemorrhage



# Zones of the Neck

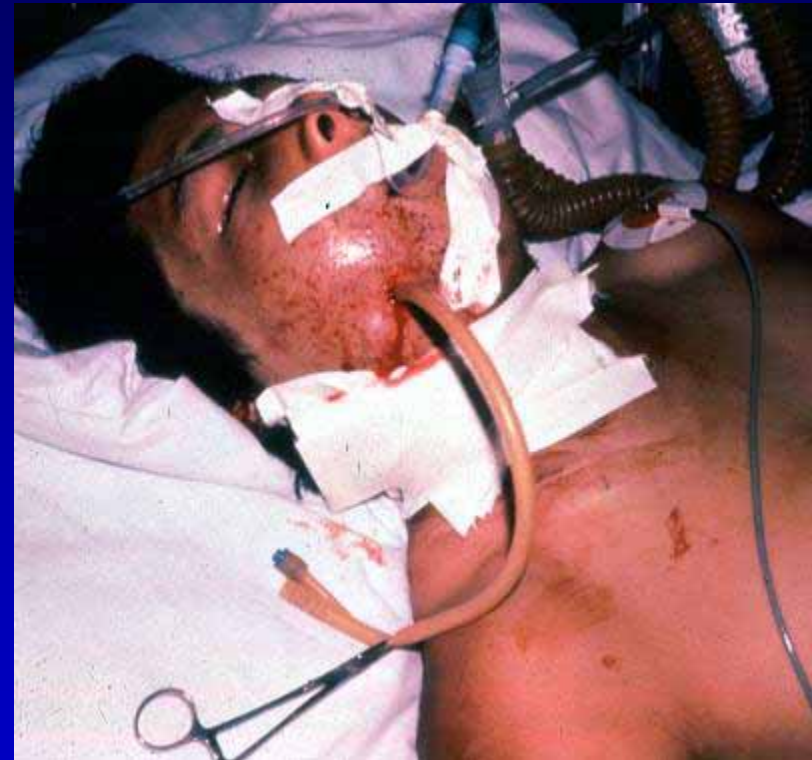
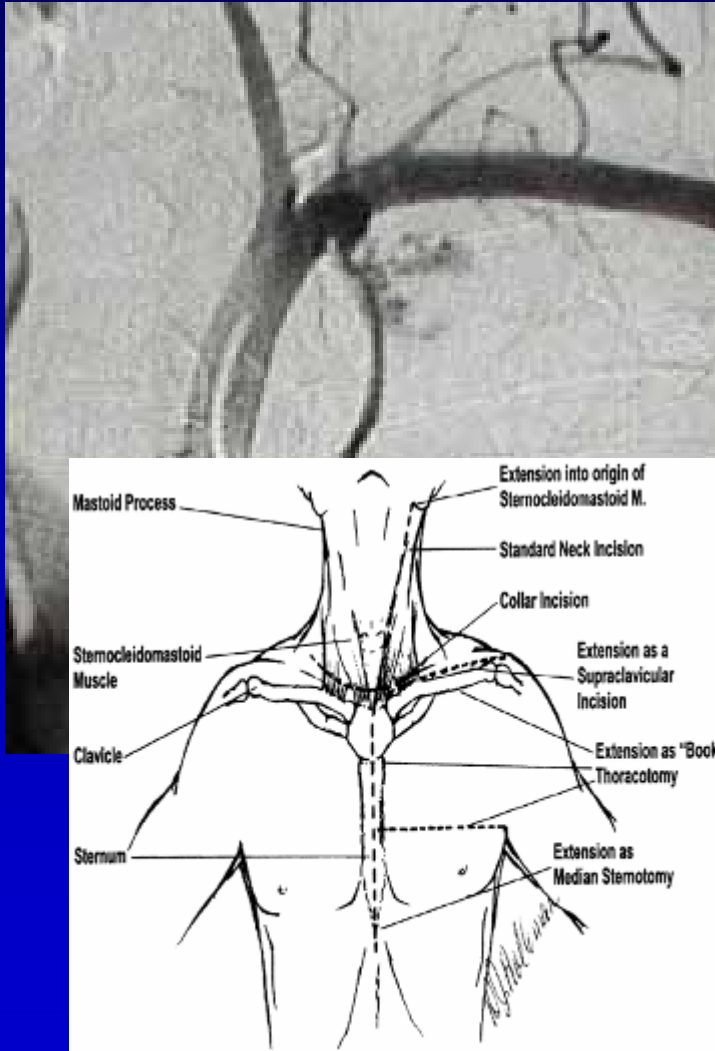


# Neck Zones Dictate Approach



## Penetrating Neck Trauma

# The Inaccessible Zones





# Indications for Exploration

## Vascular

- Expanding hematoma
- External hemorrhage
- Diminished carotid pulse

## Digestive

- Dysphagia
- Subcutaneous air
- Blood in oropharynx



# The Zone 2 Controversy

- Gold Standard = Mandatory Exploration
  - “high incidence of innocuous-looking wounds harboring serious injury” ; (1/5 explorations -)
- Alternative = Selective Management
  - Radiographic and endoscopic studies
  - Mandates hospital admission
- Recent advances
  - CT scan to delineate trajectory
  - Observation alone?



## Utility of CT for Zone 2

- 14 stable patients with zone II injuries
- PE, CT scan & operative exploration performed
- CT scan = high /low probability for injury
- Surgical findings compared with preoperative CT

*Mazolewski PJ, Curry D, Browder T and Fildes, J. Computed Tomographic Scan Can Be Used for Surgical Decision Making in Zone 2 Penetrating Neck Injuries. The Journal of Trauma. 2001; 51: 315-319*

## Utility of CT/ Zone 2

- 3/14 = 5 injuries; 4 / 5 injuries diagnosed pre-op
- All had “high probability” of injury CT scans
  - Hematoma or SQ air adjacent to carotid sheath
  - Intravenous contrast extravasation
  - Tracks in close proximity to vital structures
- Sensitivity = 100% ; Specificity = 91%
- PPV = 75%; NPV= 100%

*Mazolewski PJ, Curry D, Browder T and Fildes, J. Computed Tomographic Scan Can Be Used for Surgical Decision Making in Zone 2 Penetrating Neck Injuries. The Journal of Trauma. 2001; 51: 315-319*

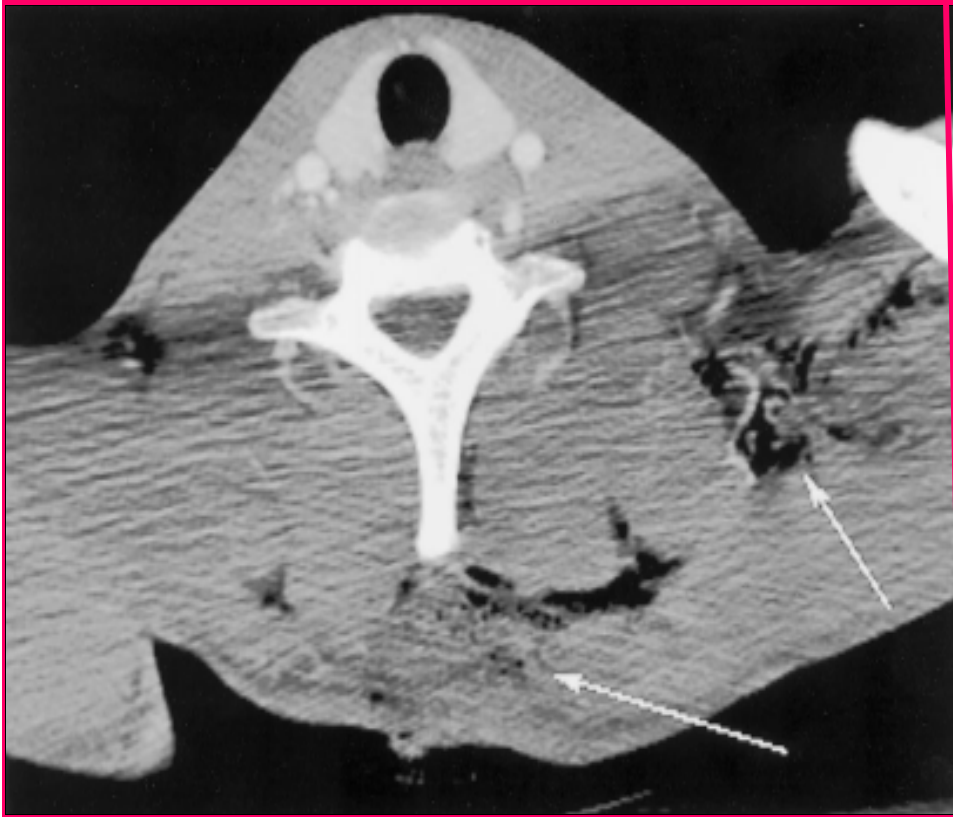
## Utility of CT / Zone 2

- CT scan in stable patients eliminates invasive studies with trajectories remote from vital structures
- Trajectory in close proximity to vital neck structures = targeted diagnostic studies to exclude injury

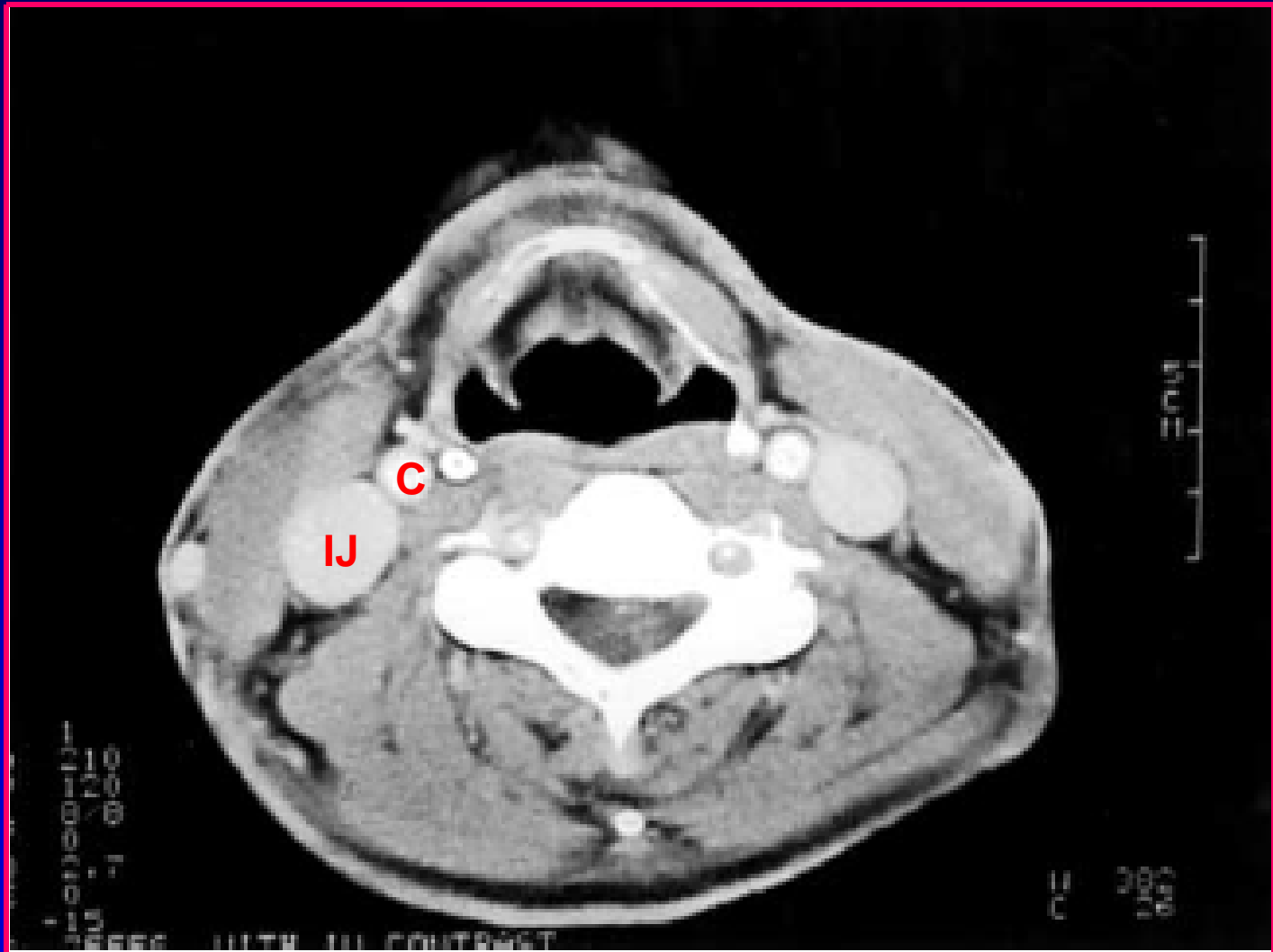
**“ Accurate trajectory determination = injury identification ”**

*Mazolewski PJ, Curry D, Browder T and Fildes, J. Computed Tomographic Scan Can Be Used for Surgical Decision Making in Zone 2 Penetrating Neck Injuries. The Journal of Trauma. 2001; 51: 315-319*

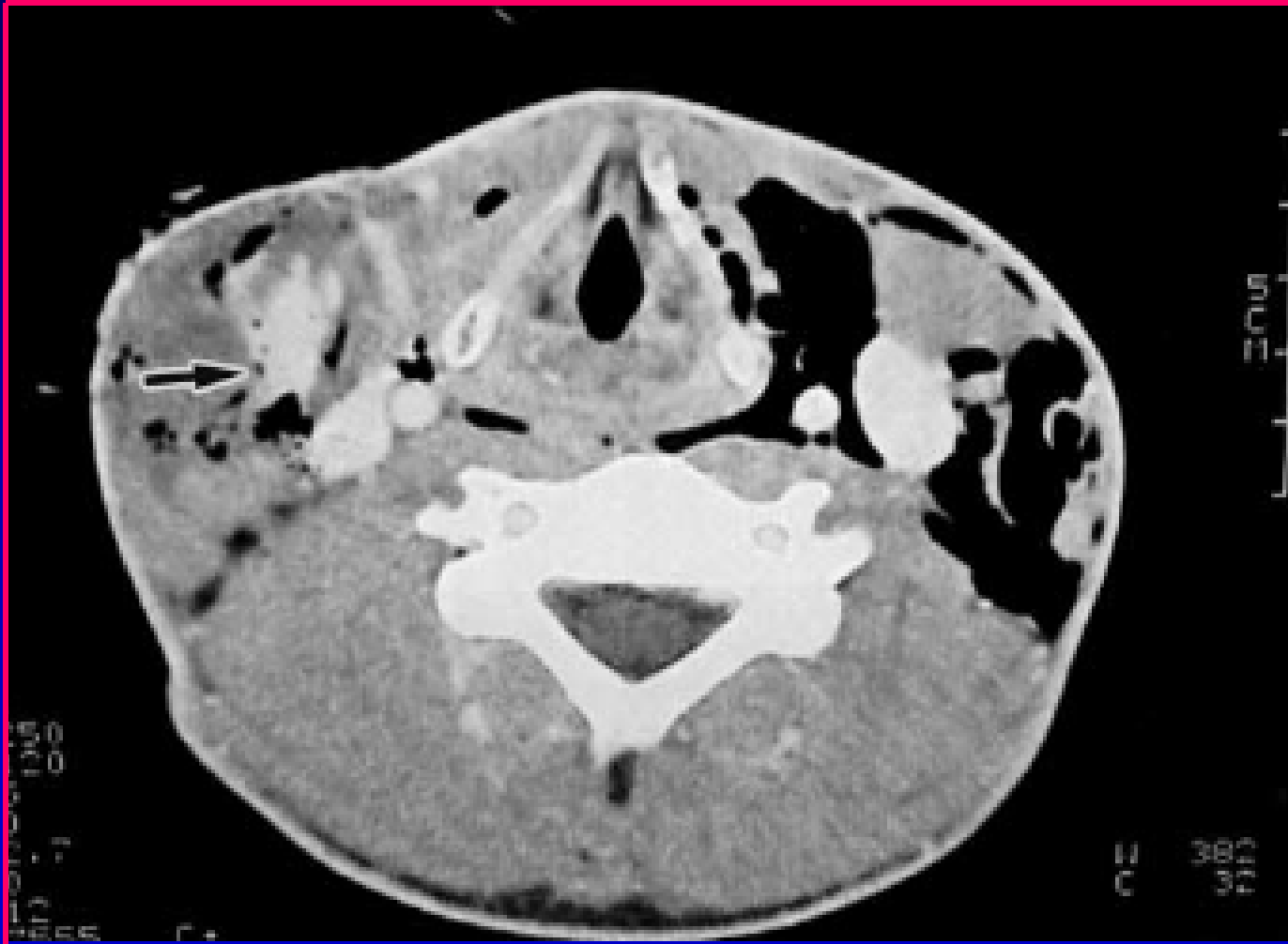
# Trajectory



# Neck CT

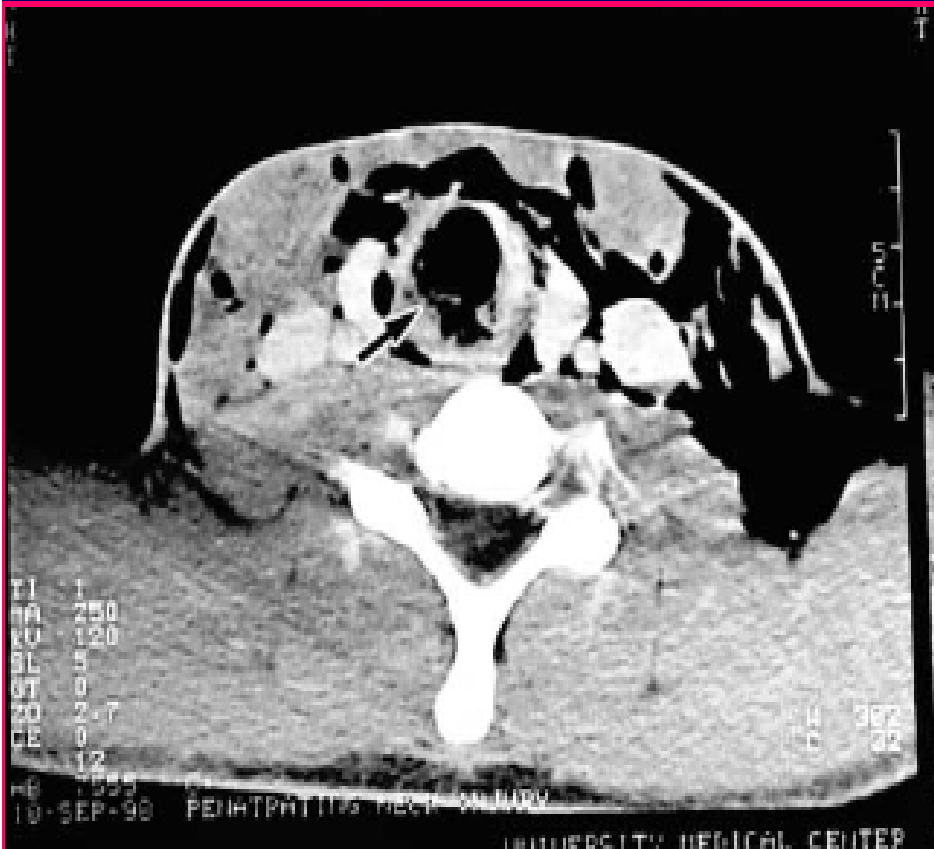


# Neck CT





# Neck CT



# The Future of Neck Workup???

2

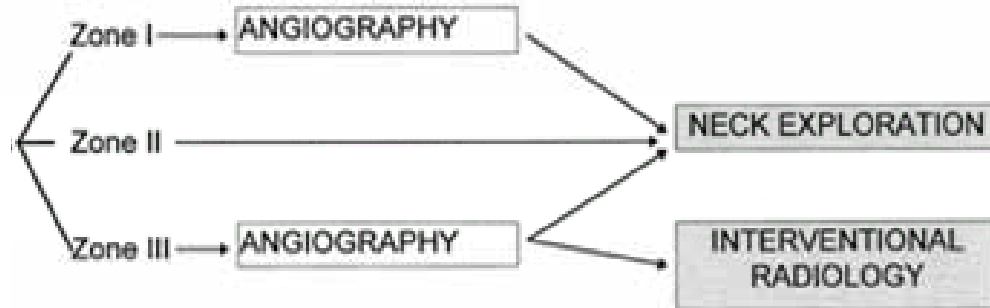


# Penetrating Neck Trauma

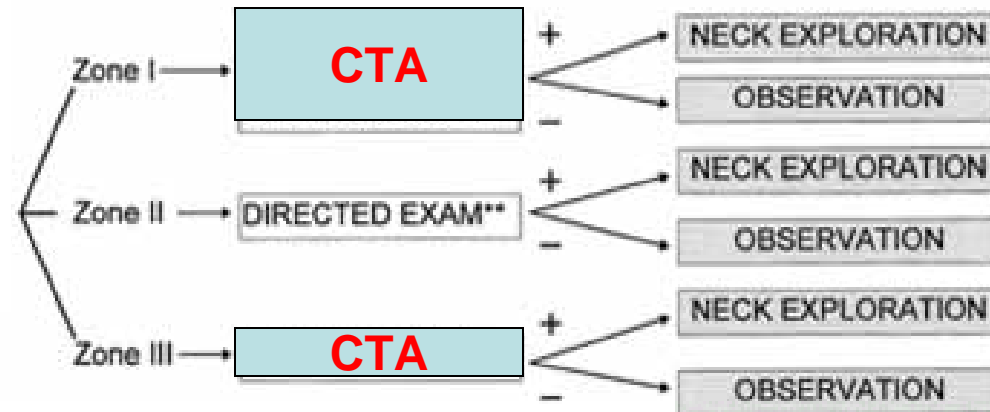
## PENETRATING NECK WOUND

- physical exam
- AP CXR
- AP/lateral soft-tissue neck X-ray
- airway control

### Symptomatic



### Asymptomatic



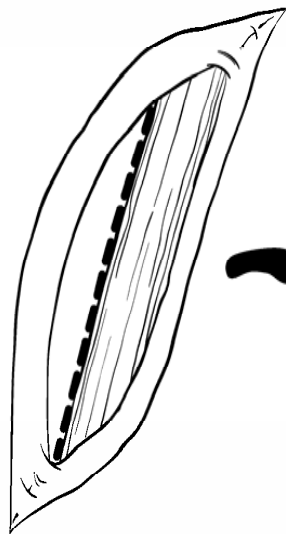
\*\*DIRECTED EXAM: Angiography, esophagoscopy, and/or laryngoscopy based on path of projectile and clinical exam



# How to Explore the Neck?

2,3

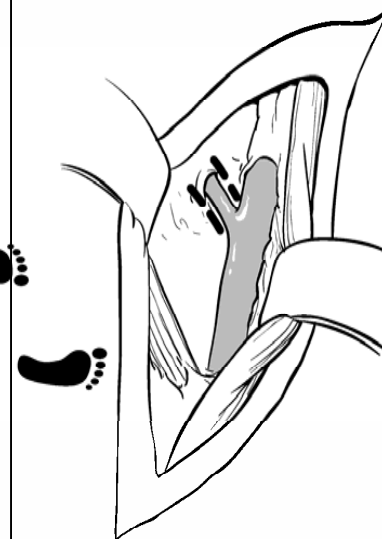
## TRAIL OF SAFETY



Sternocleido-  
mastoid muscle



Internal  
Jugular vein



Facial  
vein



Carotid  
artery

Penetrating Neck Trauma

# Technique for Zone 2 Neck Exploration



2,3

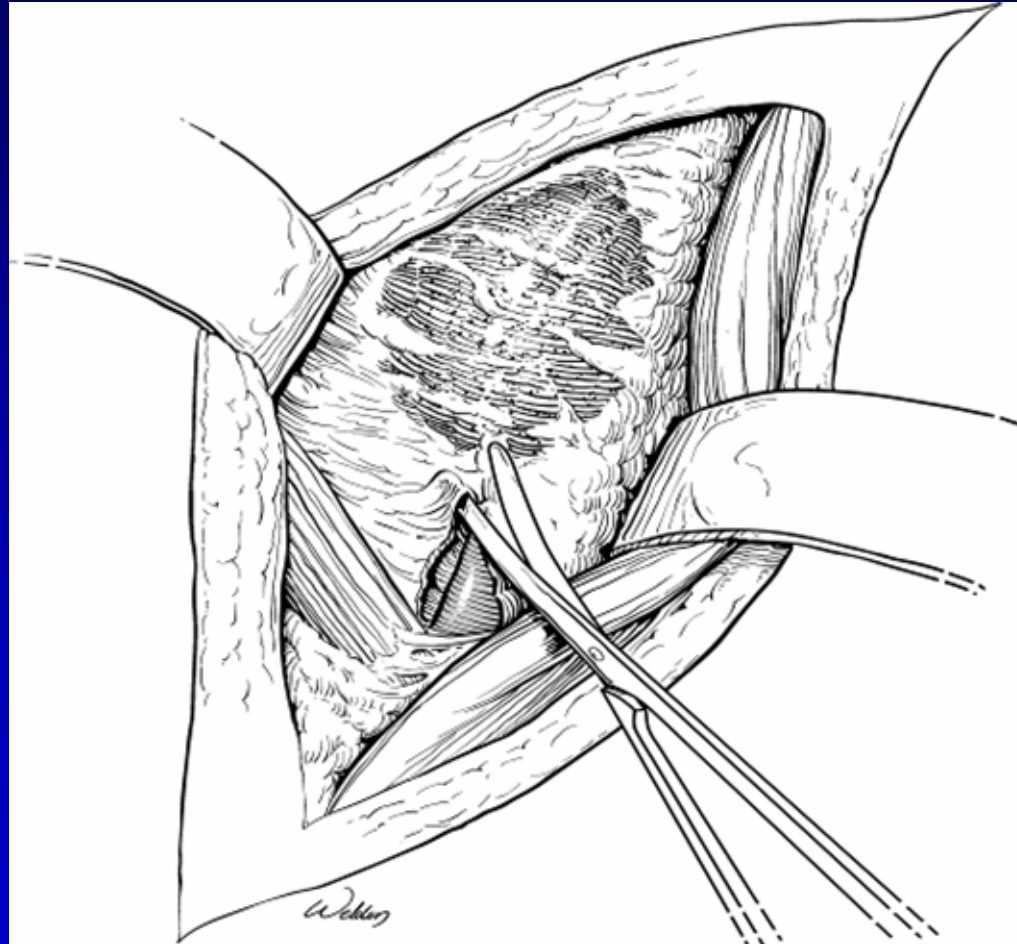


# Technique for Zone 2 Neck Exploration



Penetrating Neck Trauma

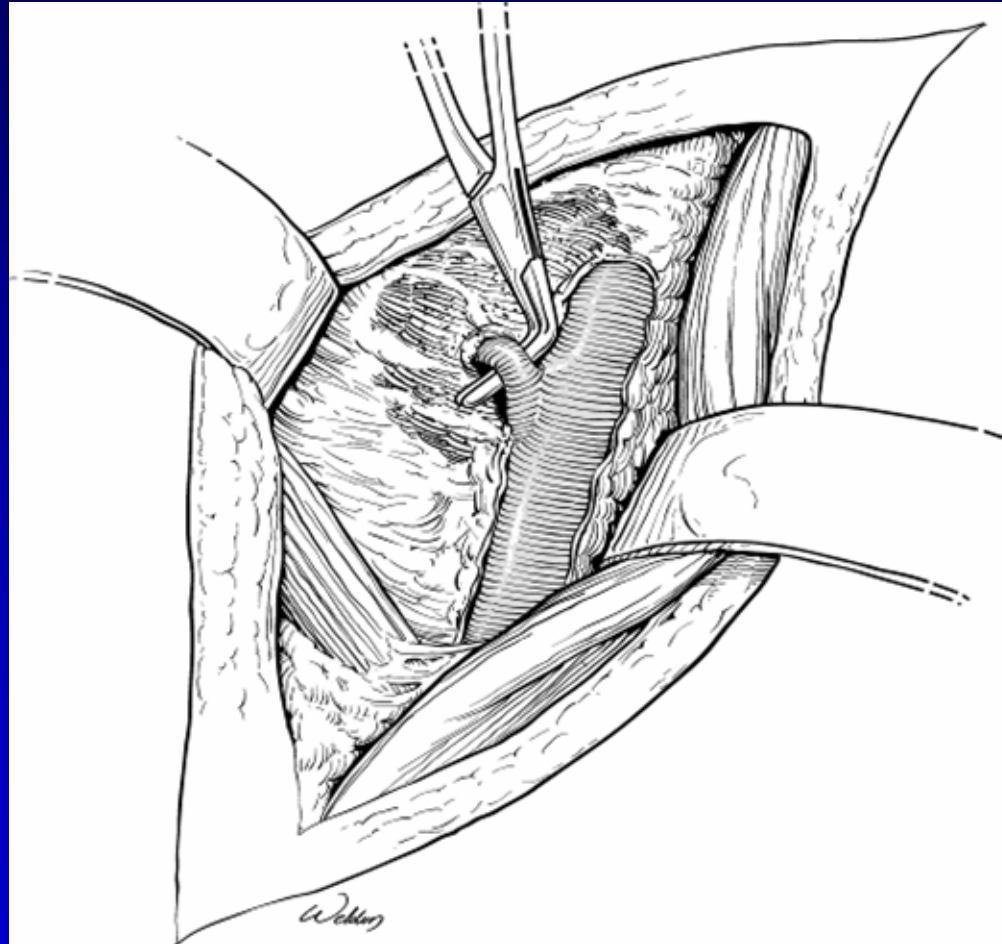
# Technique for Zone 2 Neck Exploration



Penetrating Neck Trauma



# Technique for Zone 2 Neck Exploration

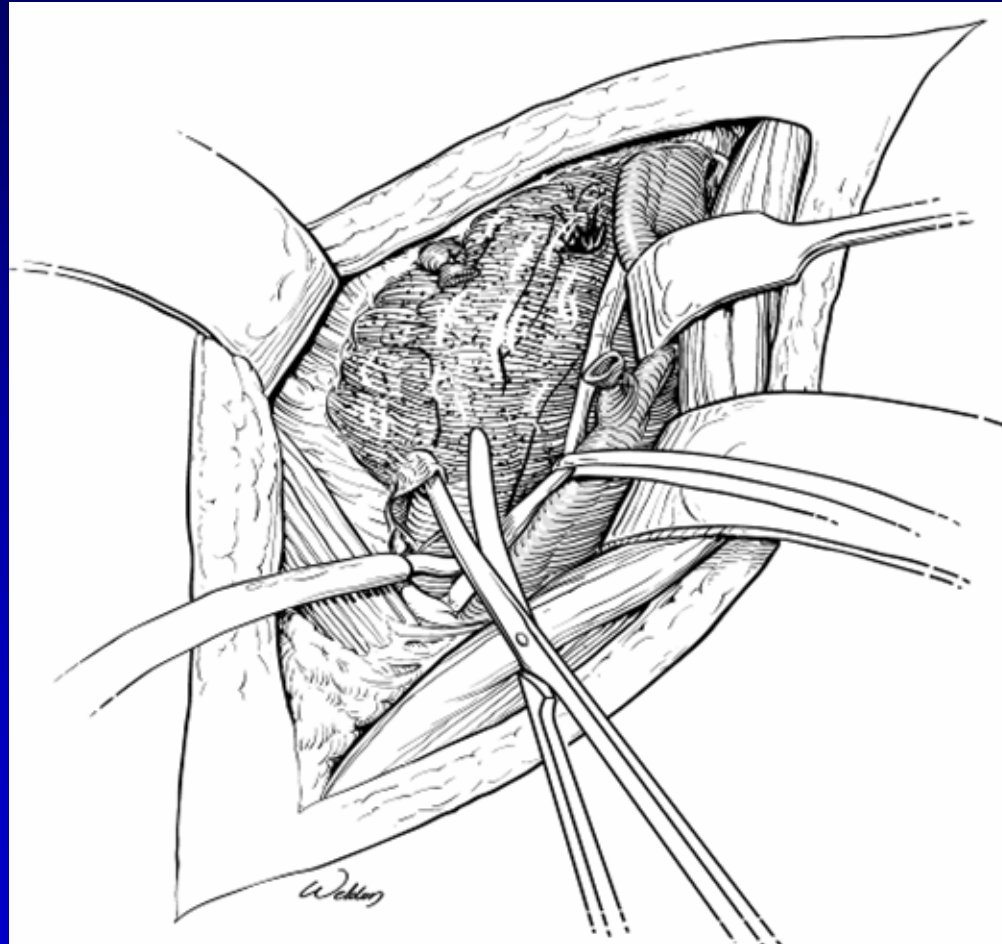


**Facial Vein = Gate Keeper of the Neck**



Penetrating Neck Trauma

# Technique for Zone 2 Neck Exploration



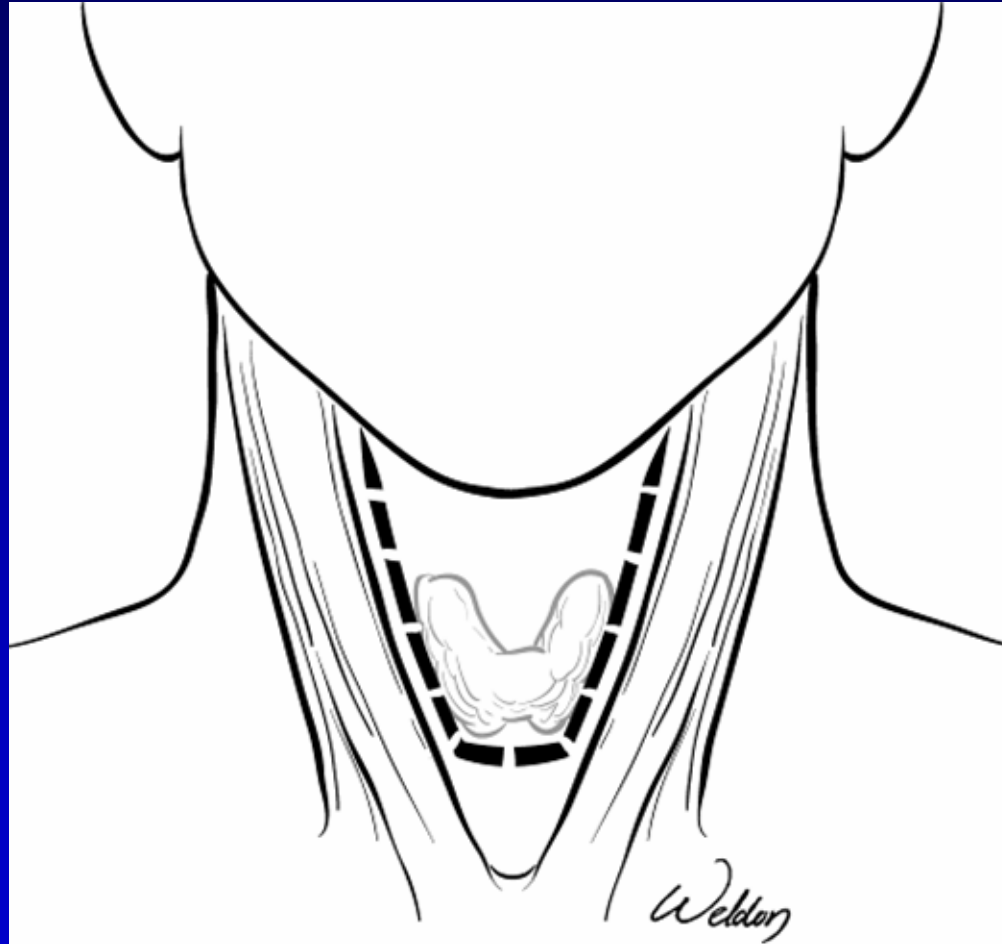
Penetrating Neck Trauma

# Technique for Zone 2 Neck Exploration



Penetrating Neck Trauma

# Technique for Zone 2 Neck Exploration



## Penetrating Neck Trauma

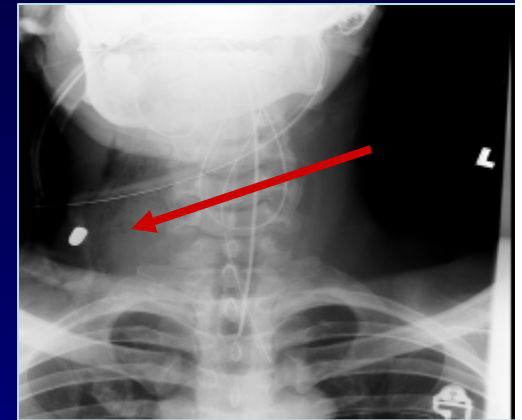
# Trans - cervical GSW

Retrospective study; Level 1 Trauma Center

N = 41 patients

34/41 pts = 52 major neck injuries

30/36 explorations +



Transcervical injuries = excellent markers for visceral injury

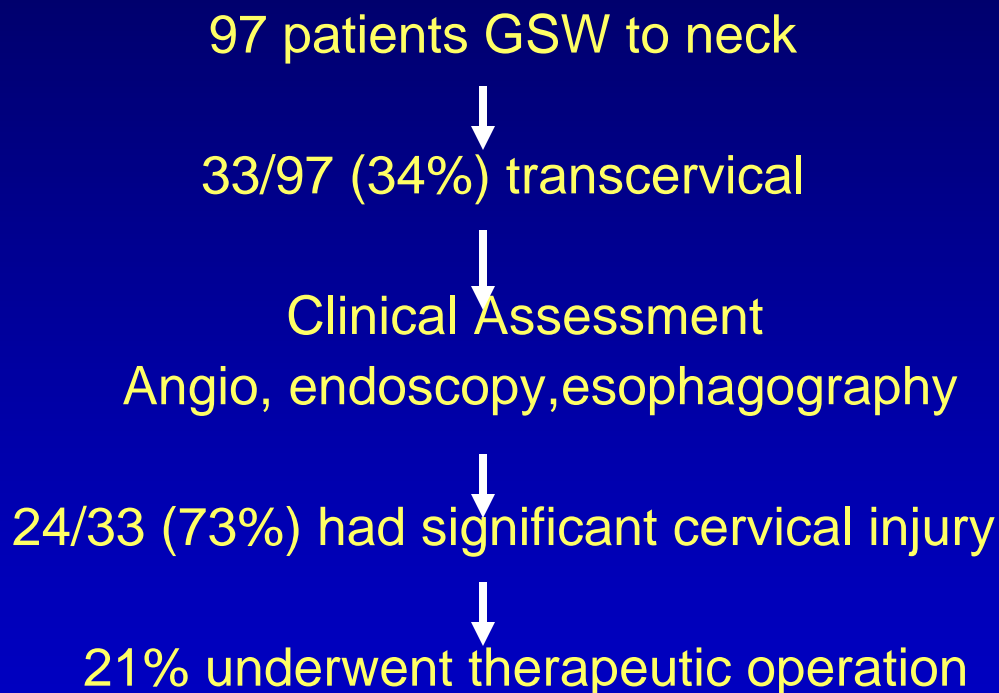
- More likely to involve vital structures
- Often result in bilateral injury
- “ characterized by a high incidence of local visceral damage requiring surgical management. This is due to the multitude of vital structures within a relatively small space, an anatomical situation the bears resemblance to the mediastinum”

*Hirshberg A, Wall MJ, Johnston RH, et al. Transcervical Gunshot Injuries. The American Journal of Surgery. 1994; 167: 309-312*

# Conservative Management

2,3,6

## Prospective Study



**80% of patients can be safely managed non-operatively**

*Demetriades D, Theodorou D, Cornwell E, et al. Transcervical Gunshot Injuries: Mandatory Operation is Not Necessary. Journal of Trauma. 1996; 40 (5): 758-760*

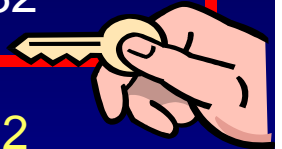
# Clinical Exam Alone ?

- Prospective study, level 1 Trauma center, over 8 years N = 145
- 31 pts (21%): hard signs of vascular injury =OR
- 114 pts : negative PE
  - 23 proximity angiograms (3/23 abnormal; 1 required OR)
  - 91 pts = observation alone; 1 missed injury
  - 1/114= False – rate for PE of 0.9%
  - 28/31 underwent repair of major injury (False + rate for PE= 10%)

Sekharan, J et al. Continued experience with physical examination alone for evaluation and management of penetrating zone 2 neck injuries. J Vascular Surgery. 2000; 32: 483-489

# Evolution

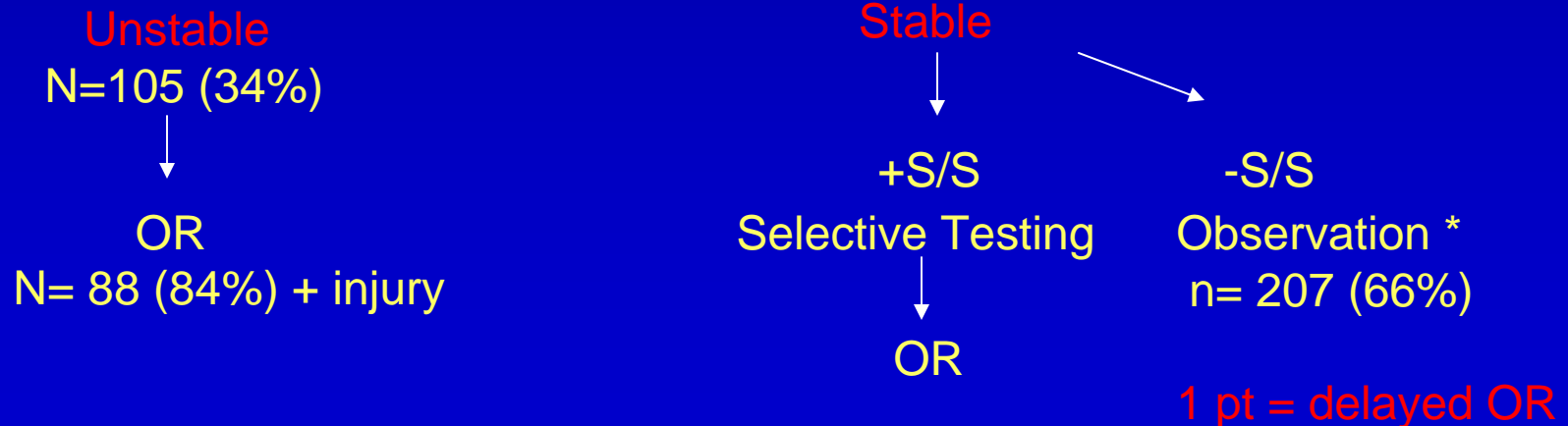
Biffi WL, Moore EE, et al. Selective Management of Penetrating Neck Trauma Based on Cervical Level of Injury. Am J Surg.1997; 174: 678-682



18 year prospective evaluation of a progressively selective approach; N=312

achieve airway patency and tamponade hemorrhage

CXR & A/P and lateral cervical spine



# Summary

Unstable or symptomatic = surgical exploration

Asymptomatic Zone II : **CONTROVERSIAL**

## Options:

- surgical exploration
- selective management
- physical exam and observation

CT scan is useful to help determine trajectory





Questions ?

