

Management of Penetrating Neck Trauma

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Types of Weapons

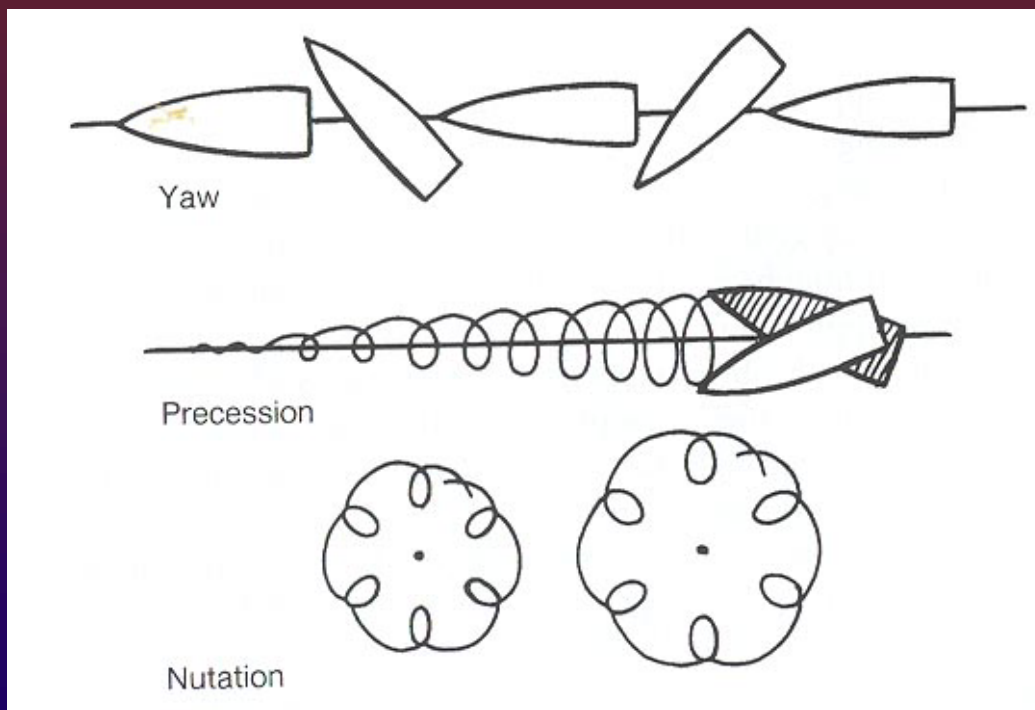
- ❖ Low velocity – knives, ice picks, glass
- ❖ High velocity – handguns, shotguns, shrapnel

$$K = \frac{1}{2}mv^2$$

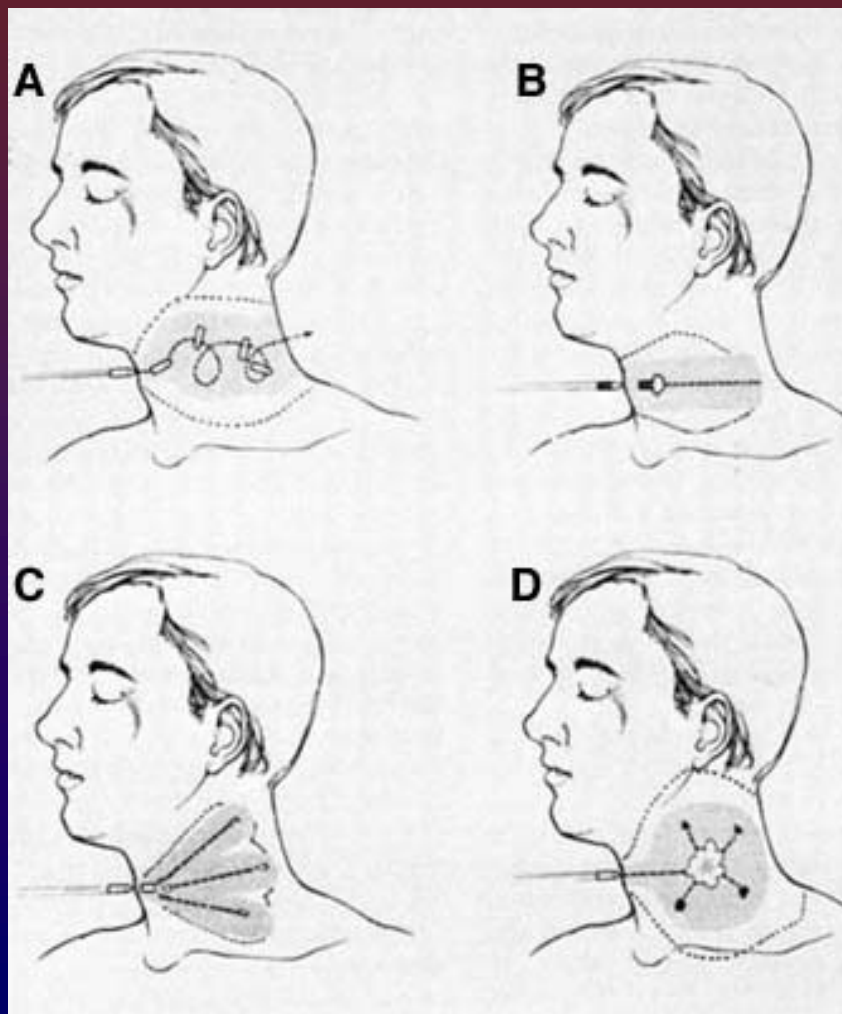
Guns



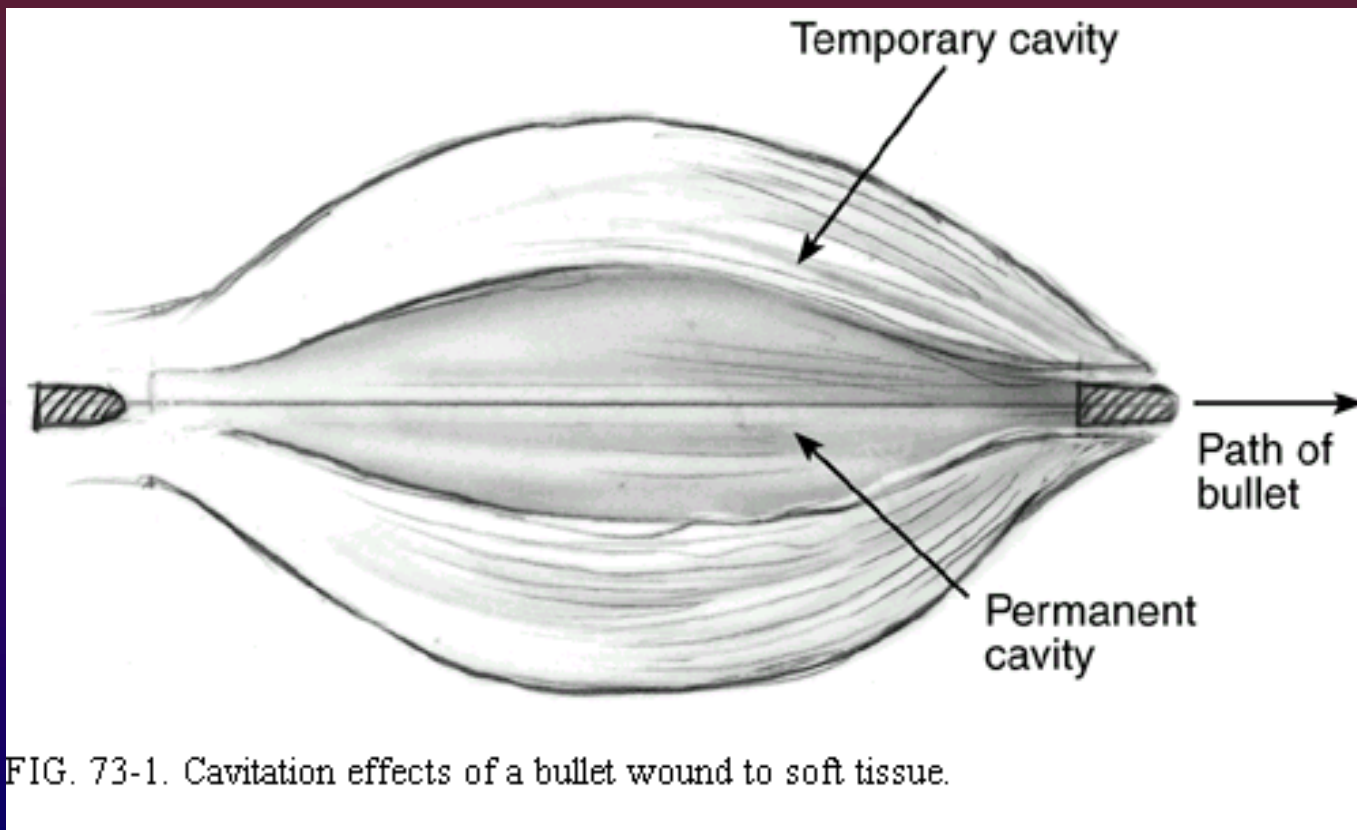
Ballistics



Ballistics



Ballistics



Anatomy

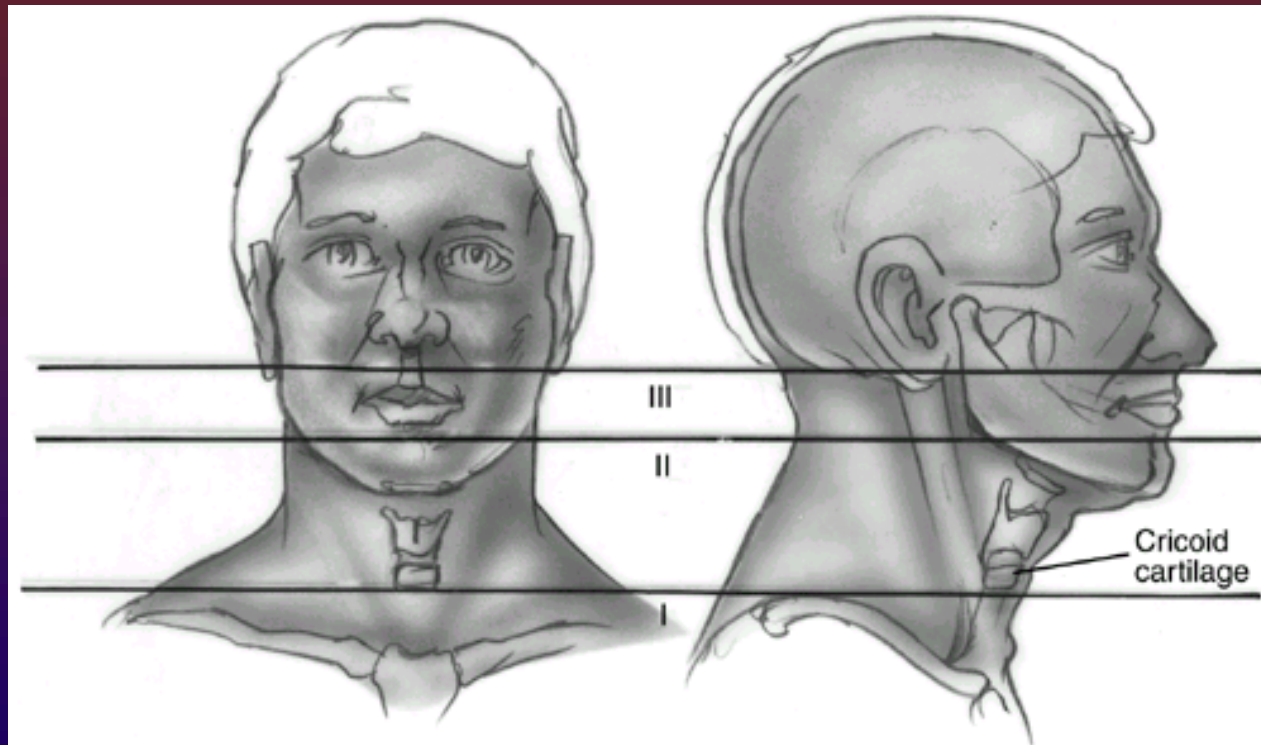


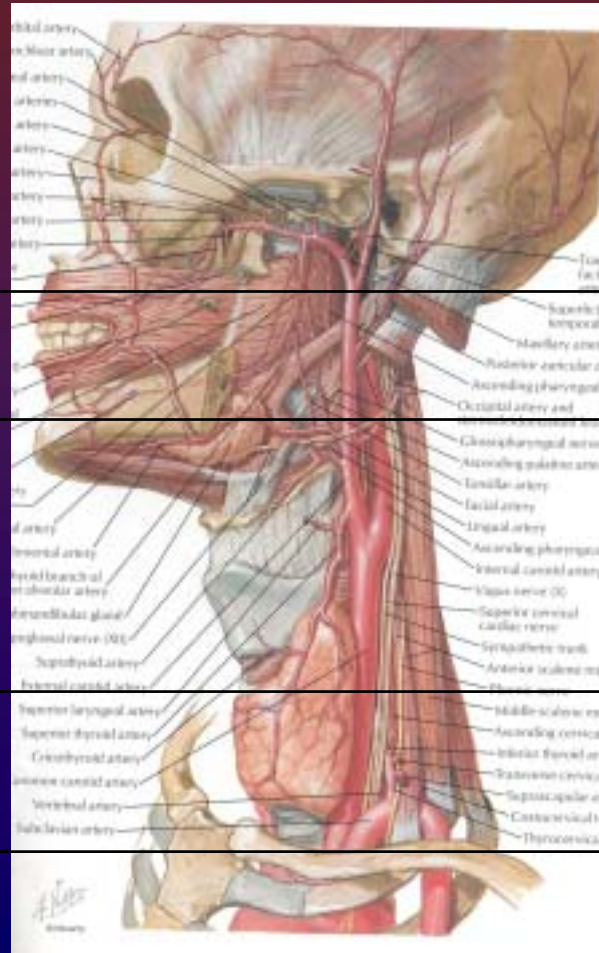
FIG. 73-8. Horizontal entry zones of the neck for penetrating injuries to the neck.
(Modified from Jurkovich GJ. The neck. In: Early care of the injured patient. Moore
EE, ed. Toronto: BC Becker, 1990:126.)

Anatomy

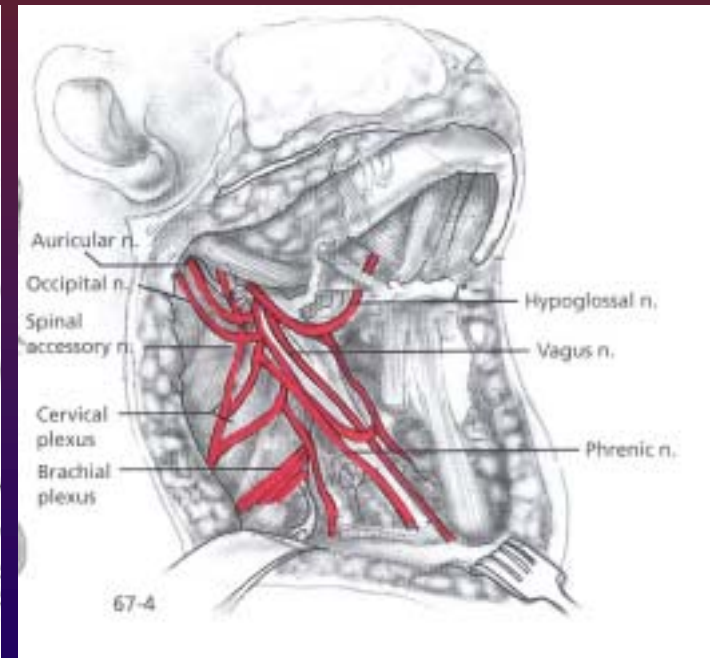
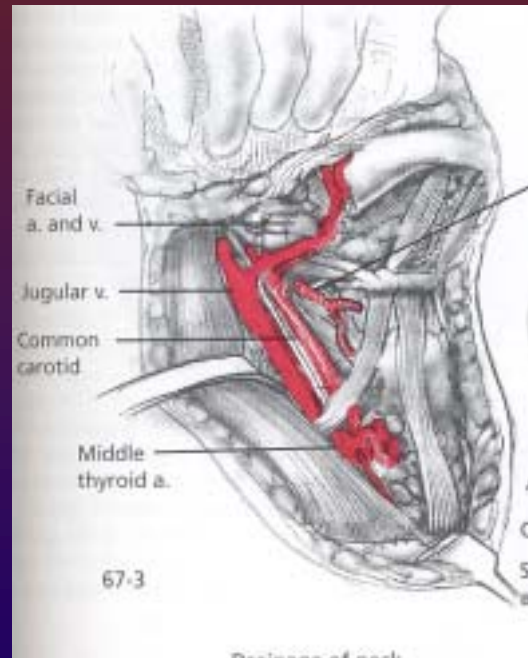
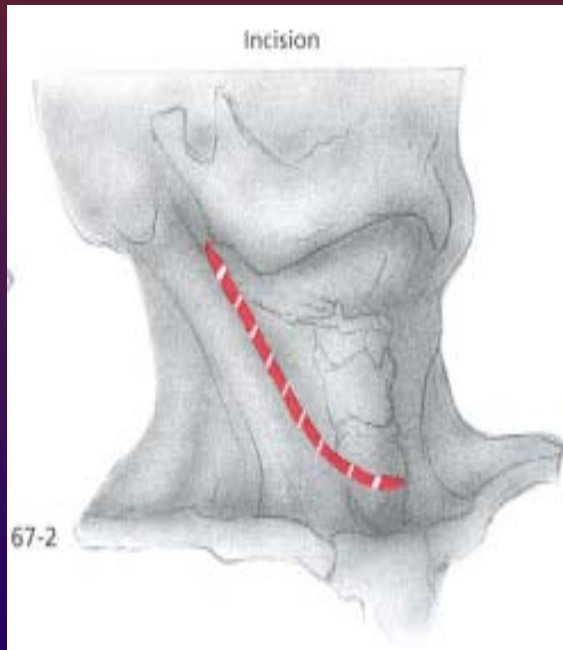
Zone III

Zone II

Zone I

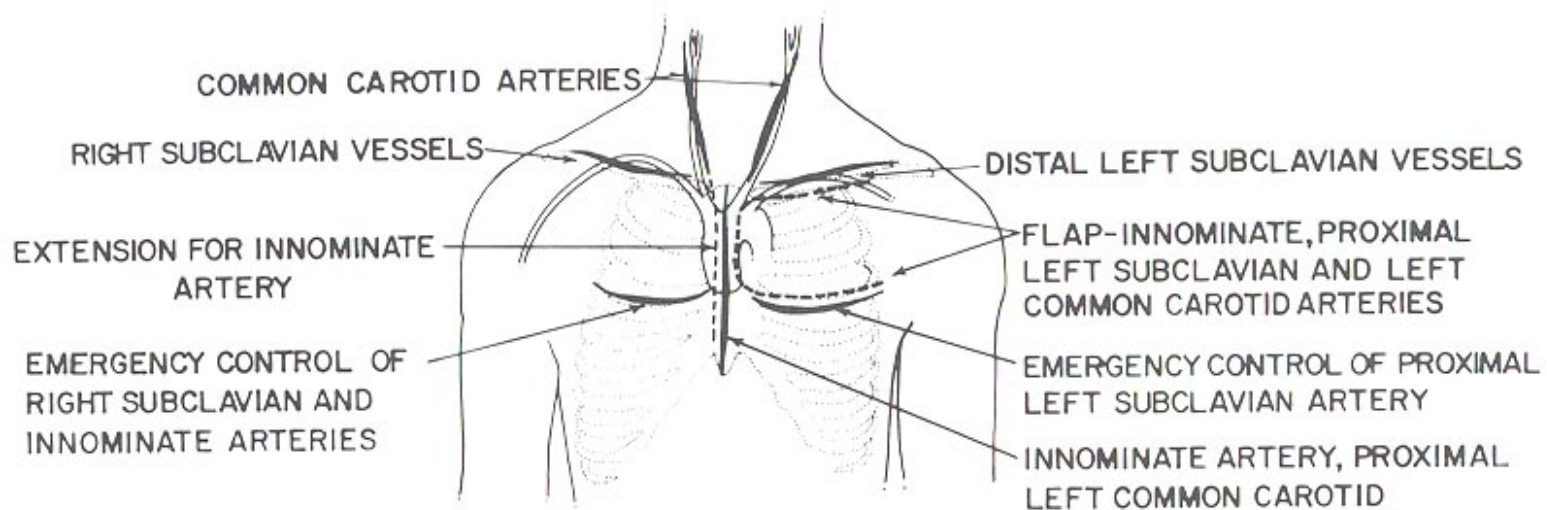


Incision for Neck Exploration:



Incisions for Neck Exploration:

INCISIONS AND EXTENSIONS FOR BASE OF THE NECK VASCULAR INJURIES



Incidence and Mortality

TABLE 1.
Mortality of Penetrating Neck Trauma in Wartime and Current Civilian Practice*

	No. of Injuries	Mortality
Civil War	4,114	15%
Spanish-American War	188	18%
World War I	594	11%
World War II	851	7%
Current civilian practice		3%–6%

*Data from Fogelman MJ, Stewart RD: *Am J Surg* 1956; 91:581–596.

TABLE 2.
Distribution of Neck Injuries*

	No. (%)
Vascular injury	
Arterial	
Carotid, common and int.	168(6.7)
Subclavian	57(2.2)
Carotid, external	51(2.0)
Vertebral	33(1.3)
Innominate	11(0.4)
Venous	
Internal jugular	225(9.0)
Subclavian	44(1.7)
Innominate	12(0.4)
Aerodigestive	
Larynx and trachea	253(10.1)
Pharynx and esophagus	240(9.6)
Neurologic	
Spinal cord	76(3.0)
Brachial plexus	48(1.9)
Hypoglossal nerve	14(0.5)
Vagus nerve	10(0.4)
Phrenic nerve	7(0.28)
Facial nerve	6(0.2)
Other	
Thoracic duct	20(0.0)
Total	<u>1,275</u>

*Data from references 6–21.



Initial Management

Airway
Breathing

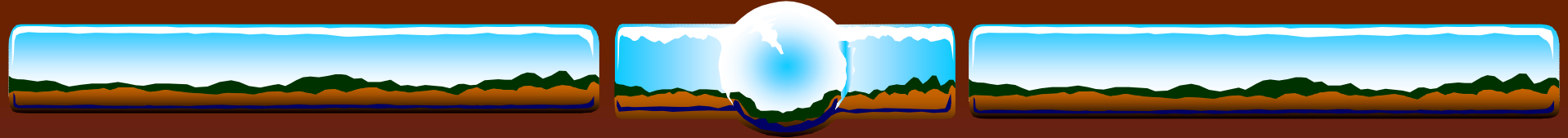
Intubation vs. Surgical Airway

Circulation

IV access, Immediate Exploration

Examination

Determine weapon trajectory



Signs of Injury:

Vascular

**Shock, Profuse bleeding,
Evolving stroke,
Expanding hematoma,
hemoptysis, hematemesis,
unequal pulses,
bruits or thrills**



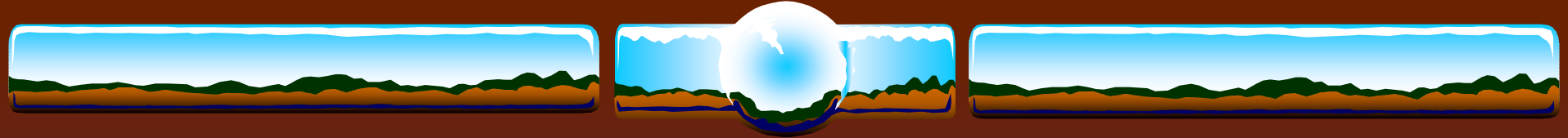
Signs of Injury:

Larynx/Trachea

Subcutaneous emphysema,
Hoarseness,
Respiratory distress,
Stridor

Esophagus

Neck pain,
Blood in saliva,
Fever, Odynophagia



Management of the Stable Patient:

The Old Standard:

Wound Penetrates Platysma?

Yes

No

Immediate Neck Exploration

Observation/Discharge

Laryngoscopy
Esophagoscopy



The Old Standard:

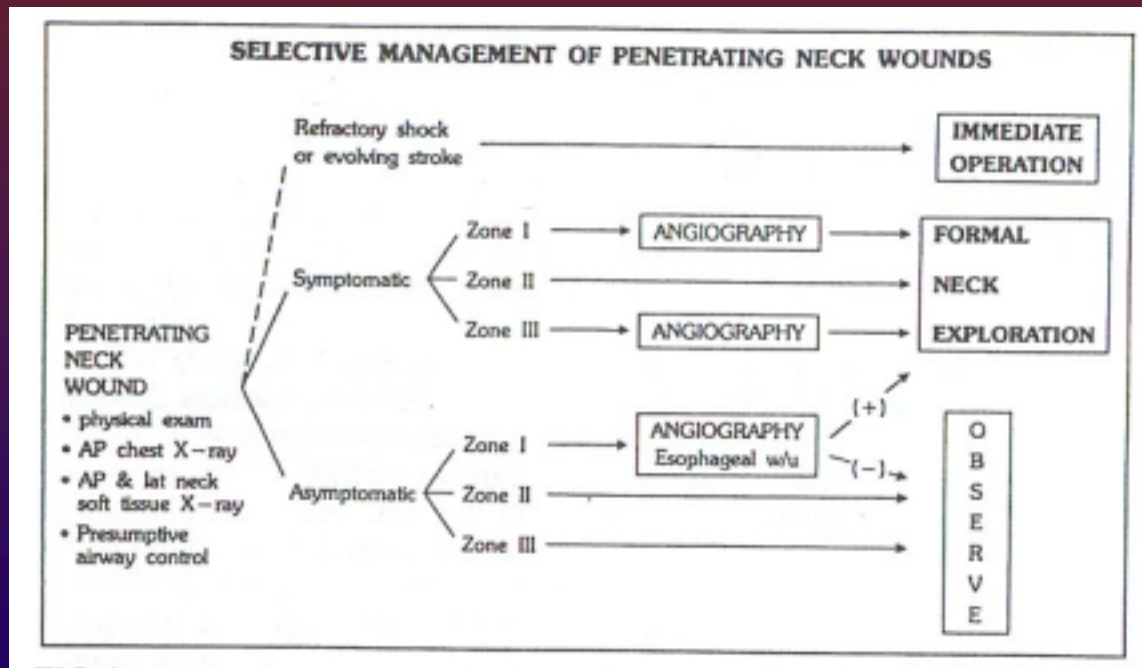
- ❖ Based on wartime experiences
- ❖ Fogelman *et al* (1956) showed that immediate neck exploration led to better outcomes in study group for vascular injuries.
- ❖ Led to rate of negative neck explorations in $> 50\%$
- ❖ Arteriogram slowly began to gain acceptance as screening tool before exploration, especially for zone 1 and 3 injuries (hard to detect on physical).



Arteriogram

- ❖ Zone 1 and Zone 3 vascular injuries are difficult to visualize by physical exam, making arteriogram useful in these patients.
- ❖ Flint *et al* (1973) reported absence of P.E. findings in 32% of pts. with major zone 1 vascular injury.
- ❖ Arteriogram can be accompanied by embolization.

A Newer Algorithm



Mansour *et al* 1991 retrospective study



Newer Algorithm (Mansour)

- ❖ 63% of the study population was in the observation group.
- ❖ Entire study population had a mortality of 1.5%, similar to those in more rigorous treatment protocols.
- ❖ Similar results obtained in other large studies with similar protocols (e.g. Biffi *et al* 1997).
- ❖ Still uses the Arteriogram in asymptomatic patients with zone 1 injury.



Points of Controversy:

- ❖ Most trauma surgeons accept observation of select patients similar to the Mansour algorithm.
- ❖ Study by Eddy *et al* questions the necessity for arteriogram / esophagoscopy in asymptomatic zone 1 injury (use of P.E. and CXR resulted in no false negatives).
- ❖ Other noninvasive modalities than arteriogram exist for screening patients for vascular injury.



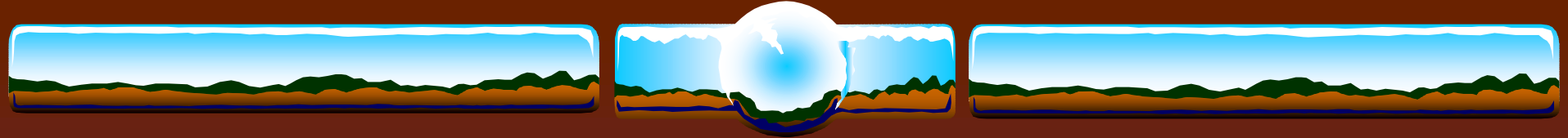
CT scan

- ❖ 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 was able to save patients from arteriogram indicated by other protocols 50% of the time and avoid esophagoscopy in 90% of tested patients who might otherwise have undergone it.



Duplex Ultrasonography

- ❖ Requires the presence of reliable technician and radiologist.
- ❖ A double blinded study by Ginsburg *et al* (1996) showed 100% true negative, 100% sensitivity in detecting arterial injury, using arteriography as the gold standard.



Management of Vascular Injuries:

- ❖ Common carotid: repair preferred over ligation in almost all cases. Saphenous vein graft may be used. Shunting is rarely necessary. Thrombectomy may be necessary.
- ❖ 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.

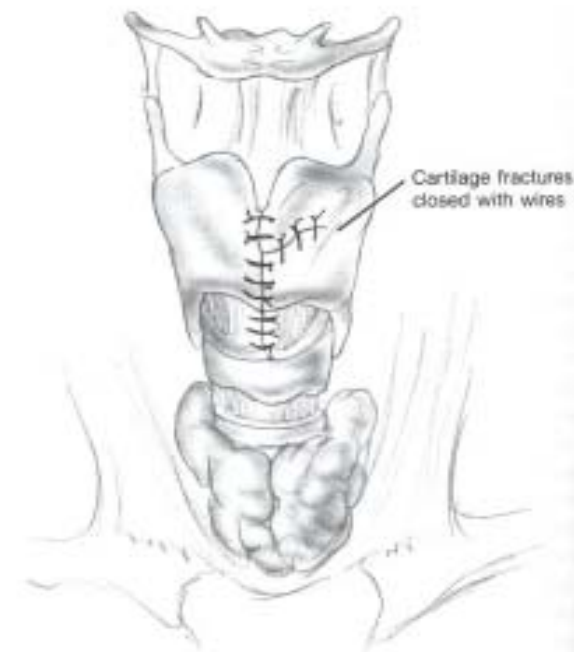
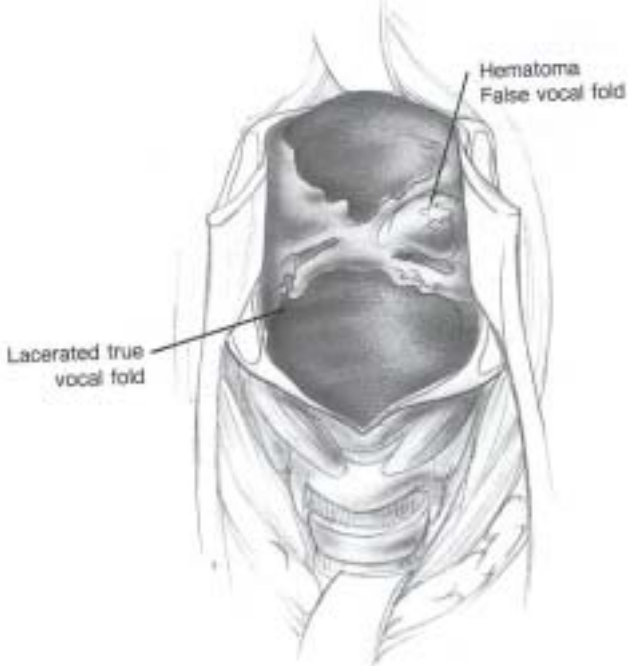


Esophageal Injury:

- ❖ Best detected by combination of esophagoscopy and esophagram in symptomatic patients.
- ❖ Injection of air or methylene blue in the mouth may aid in localizing injuries.
- ❖ Close wounds in watertight 2 layer fashion.
- ❖ Controlled fistula with T-tube or exteriorization of low non-repairable wounds
- ❖ Small pharyngeal lesions above arytenoids can be treated with NPO and observation 5-7 days
- ❖ All patients should be NPO for 5-7 days.

Laryngeal/Tracheal Injury

- ❖ Thorough Direct Laryngoscopy for suspicious wounds
- ❖ Tracheotomy for suspected laryngeal injury





Conclusions

- ❖ Mandatory neck exploration is no longer considered acceptable
- ❖ ABC's
- ❖ Physical Exam is probably the most useful diagnostic tool.
- ❖ Intervention should be directed to sites of possible injury
- ❖ Non-invasive diagnostic modalities should be considered.