Management of Penetrating Neck Injuries

Rosemarie E. Hardin, MD
Kings County Hospital Center
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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
Penetrating Neck Trauma

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
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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
ABC’s – Control Hemorrhage
Zones of the Neck
Neck Zones Dictate Approach

Problem

Inaccessible Distal Carotid

Accessible

Explore or Selectively Manage?

Solution

Great Vessels

Angiography

Penetrating Neck Trauma

Neck Zones Dictate Approach

Great Vessels Angiography

Inaccessible Distal Carotid

Accessible

Explore or Selectively Manage?

Angiography
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

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%

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."

Penetrating Neck Trauma

Trajectory
Neck CT
Penetrating Neck Trauma

Neck CT
Penetrating Neck Trauma

Neck CT
Penetrating Neck Trauma

The Future of Neck Workup???
Penetrating Neck Trauma

**Symptomatic**

- Physical exam
- AP CXR
- AP/lat soft-tissue neck X-ray
- Airway control

**Asymptomatic**

- CTA

**Direct Exam**: Angiography, esophagoscopy, and/or laryngoscopy based on path of projectile and clinical exam

**Zone I**
- Angiography
  - Neck exploration
  - Interventional radiology

**Zone II**
- Directed exam**
  - Neck exploration
  - Observation

**Zone III**
- CTA
- Observation
How to Explore the Neck?

TRAIL OF SAFETY

Sternocleidomastoid muscle
Internal Jugular vein
Facial vein
Carotid artery
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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

Technique for Zone 2 Neck Exploration

Facial Vein = Gate Keeper of the Neck
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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”

Conservative Management

Prospective Study

97 patients GSW to neck

33/97 (34%) transcervical

Clinical Assessment
Angio, endoscopy, esophagography

24/33 (73%) had significant cervical injury

21% underwent therapeutic operation

80% of patients can be safely managed non-operatively

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%)

Evolution


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

achieve airway patency and tamponade hemorrhage

↓

CXR & A/P and lateral cervical spine

Unstable
N=105 (34%)

↓

OR
N= 88 (84%) + injury

Stable

↓

+S/S
Selective Testing
OR

-S/S
Observation *
n= 207 (66%)

1 pt = delayed OR
Penetrating Neck Trauma

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 ?