Unknown young man admitted in agonal state with GSW to the base of the right neck

- Cardiac Arrest → Left thoracotomy
- Cardiac activity restored → exsanguinating hemorrhage from neck wound controlled with digital pressure and Foley balloon
- To OR

Position the Patient for Maximum Exposure

- Hyperextend the neck
- Brace the shoulders with an interscapular bolster
- Abduct the arm to 90 degrees if a subclavian artery injury is suspected

Challenging Vascular Injuries in the Neck
Basic Principles and New Options

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When a large superior mediastinal hematoma obscures the anatomy, open the pericardium without disturbing the hematoma. Proximal control of the great vessels can be achieved through a clean plane.
Options for Exposure of the Right Subclavian Artery

- Supraclavicular Approach—Elective Surgery only
- Divide Clavicle and retract end superiorly and inferiorly
- Excise medial third of clavicle

Exposure of the Axillary Artery

Options for Reconstruction

- Primary Repair- rarely an option for GSW
- Damage Control Situation
  - Ligation
  - Shunt
- Patient Stable
  - PTFE*
  - Autogenous vein graft
Outcome

- Hemorrhage controlled but the patient’s Ph never rose above 6.9.
- He developed an abdominal compartment syndrome requiring decompressive laparotomy
- Died in OR receiving continuous Intensive Care 2 hours after completion of procedure

06-04-1993

- 40 year-old man with hemorrhage from zone II stab wound right neck
- Air in neck soft tissues
- Explored—No injury identified

06-06-1993

- Increase drainage from the neck
- Esophageal swallow – no extravasation: to OR for endoscopy and wound exploration
- No hole identified in esophagus
06-14-1993

- Sepsis, mediastinal abcess
- Neck explored
- No infection
- No tracheal leak
- Esophagus not well seen

Right thoracotomy – drainage of apical mediastinal abcess

06-20-1993

- Exsanguinating hemorrhage from right chest tube near cardiac arrest
- Left thoracotomy in ICU
- In OR
  - Median Sternotomy
  - Control of Innominate Artery does not control bleeding
  - Excision of Medial Third of Clavicle exposes injury

Findings

- Mycotic aneurysm of right proximal subclavian artery at level of vertebral artery requiring ligation of both arteries

Outcome

- Right arm survives
- Severe Right Chest Wall Deformity
- Left hemiparesis (Probably due to Prolonged clamping of right carotid artery associated with hypotension
Left Subclavian Artery

- Left anterior thoracotomy
- “Trap door”: limited median sternotomy extended laterally in the 4th intercostal space
- Median sternotomy with operator on patient’s right. Rotate OR table from left to right.

Options for Control and Exposure of Left Subclavian Artery

- Median sternotomy with operator on patient’s right. Rotate OR table from left to right.

Endovascular Management of Subclavian Artery Injuries??

- 15 patients with SCA Injury treated over a 2 year period at Ben Taub
- 5 patients died in the ER
- 2/10 surviving patients went straight to the OR b/o hemodynamic instability and hard signs of arterial injury
- 8 of the surviving 10 had the dx made by A/G
  - 2 patients had minor injury not requiring Rx
  - 6/10 patients had endovascular repair
  - 4/6 endovascular repairs were successful
  - 1/6 endovascular repair patients died (of an associated head injury)
- 3 patients had open repair—1 of these patients died
  - 1 Ligation (died)
  - 2 PTFE grafts
- Overall Mortality Rate from SCA Injury = 7/15 (46%)

Conclusion

- Endovascular Stents will have an increasing role to play in the stable patient with SCA
- You have to be having a very good day to salvage a patient with a SCA who presents with torrential hemorrhage at the base of the neck!!

Shrapnel Injury, Right Common Carotid Artery, 2\textsuperscript{nd} Lebanon War

Early Control of Airway Essential!!!
30 Year-Old With 22 Caliber Gunshot Wound to Left Neck

- Airway intact
- Blood pressure stable
- Left neck swelling moderate at the junction of zones 1 and 2
- What should we do next?
Summary—Complex Vascular Injuries of the Neck

- Exsanguinating Hemorrhage-Balloon Tamponade—Be Bold, you and the patient have nothing to lose!
- Right Subclavian Artery—Median Sternotomy – Tee Off Over or Above the Clavicle
- Left Subclavian Artery—Median Sternotomy vs Left Thoracotomy??
- Subclavian Injuries without hemorrhage—Consider Endovascular Stent

Arch Aortogram

- Arch OK
- Carotids OK
- Arteriovenous fistula of left vertebral artery to venous plexus

How should we control the bleeding and fix the injury?

Contained Hemorrhage or Intimal Injury

- High index of suspicion
- Pulse deficit
- Auscultable bruit
- Hematoma
Carotid Artery Injury Controversies

- Exposure: longitudinal vs. transverse incision
- Carotid artery injury associated with neurologic deficit: first repair vs. ligation
- Carotid repair: shunt vs. clamp and repair
• The vertebral artery was occluded by the interventional radiology
• A detachable balloon was placed in the proximal left vertebral artery
• A second balloon was placed in the distal left vertebral artery by catheterizing right vertebral artery and traversing the Circle of Willis

Right Subclavian Artery
• Proximal injury: Median sternotomy with supraclavicular extension to the right
• Middle in distal injury: Resection vs. division of clavicle

• Hypotensive
• Poor ventilation (pH=6.9, pCO2=62)
• Intubated
Consider the Possibility of Injury to Other Mediastinal or Cervical Structures

- Airway
- Esophagus
- Recurrent Laryngeal Nerve
- XI Nerve
- Hypoglossal Nerve
- Phrenic Nerve
- Stellate Ganglion
- Internal Jugular Vein
- Thoracic Duct
- Spinal Cord – Particularly with GSW
- Brachial Plexus

Tricks to Control Vigorous Hemorrhage from the Neck

Findings

1. Laceration left superior thyroid artery
2. Laceration left jugular vein
3. Tracheal laceration through cricothyroid cartilage and first tracheal ring

Physical Examination

- Airway
- Neck deformity – Hematoma
- Pain on swallowing
- Hoarseness
- Crepitus
- Taste on anterior 2/3 of tongue
- Trapezius function
- Horner’s syndrome
- Hypoglossal nerve function
- Neurovascular exam of upper extremity
- General neurologic exam
Mandatory vs. Selective Neck Exploration for Penetrating Trauma

At least 10 retrospective and prospective studies published over the past 10 years show no difference in morbidity and mortality between mandatory vs. selective neck exploration for penetrating trauma.
Distal Control of Right Subclavian Artery