Vascular Injuries in the Neck

Lupe Taumoepeau
Capital & Coast DHB

Vascular injuries in the neck

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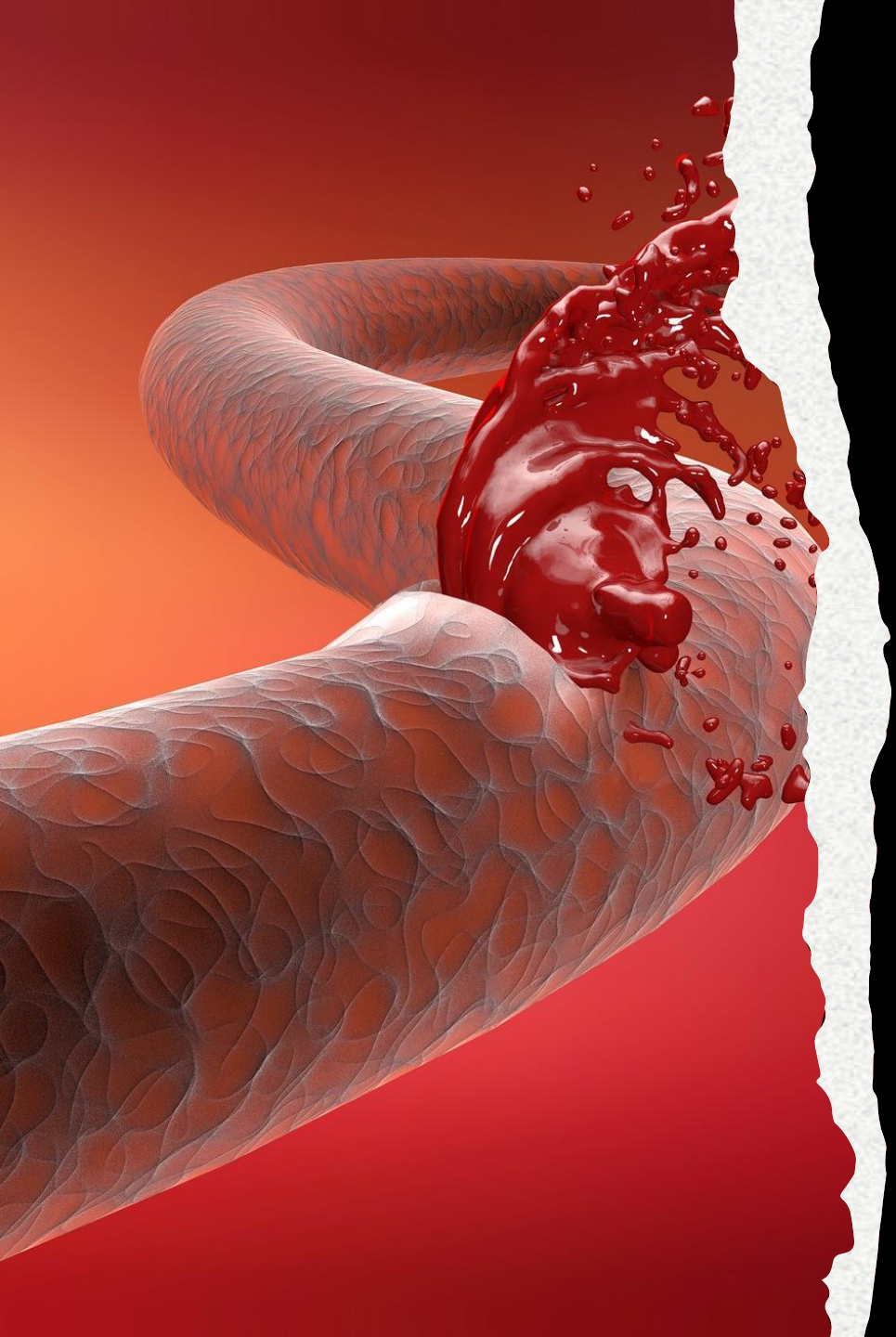
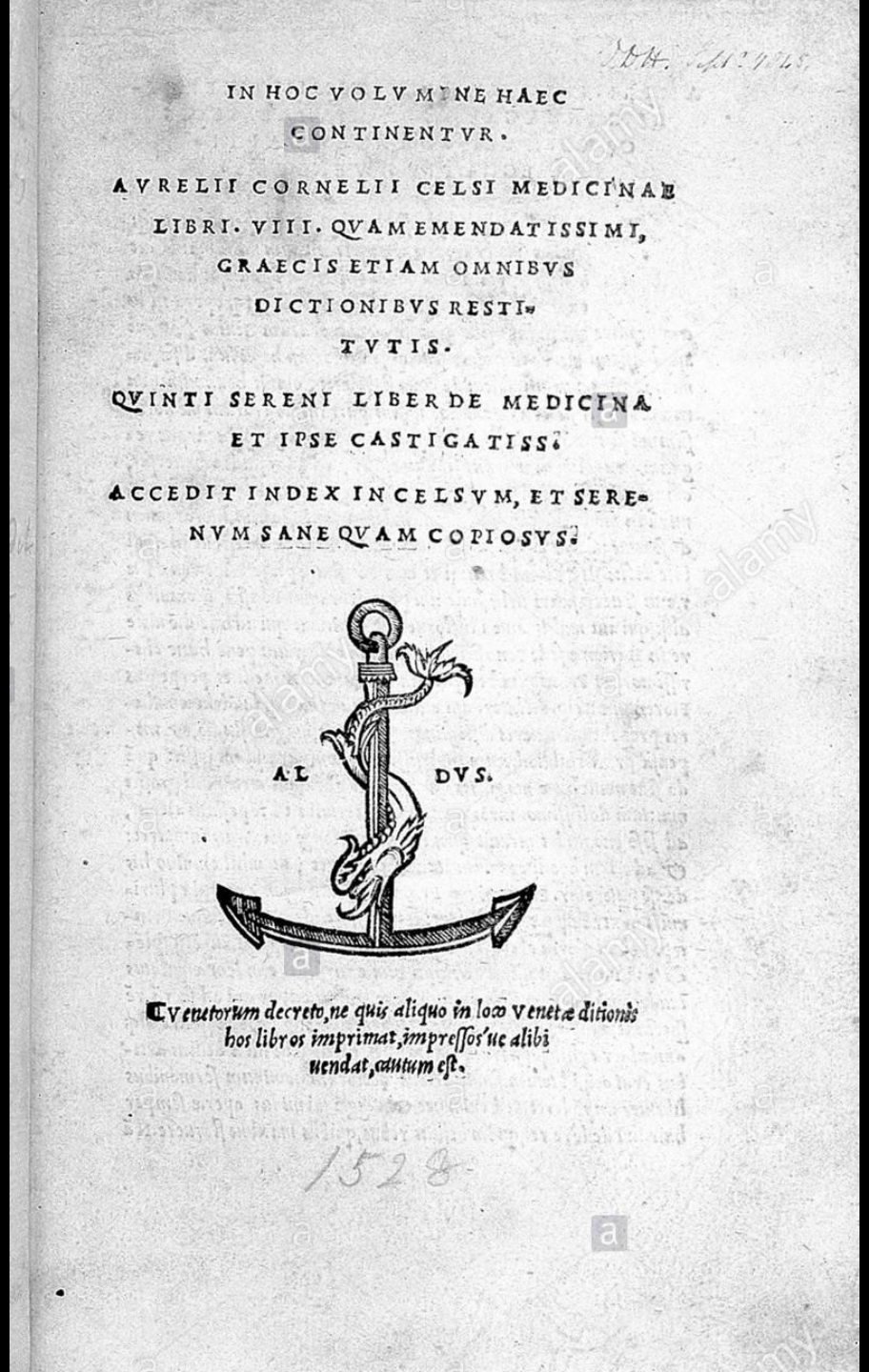
Capital & Coast District Health Board
ŪPOKO KI TE URU HAUORA



Trauma with bleeding from named vessels has been treated since antiquity

Techniques of operative repair have advanced

BUT WHAT HAS HISTORY TAUGHT US?



IN HOC VOLVMINE HAEC
CONTINENTVR.

AVRELII CORNELII CELSI MEDICINAE
LIBRI. VIII. QVAM EMENDATISSIMI,
GRAECIS ETIAM OMNIBVS
DICTIONIBVS RESTI-
TVTIS.

QVINTI SERENI LIBER DE MEDICINA
ET IPSE CASTIGATISS.

ACCEDIT INDEX IN CELSVM, ET SERE-
NVM SANE QVAM COPIOSVS.

ALDVS.

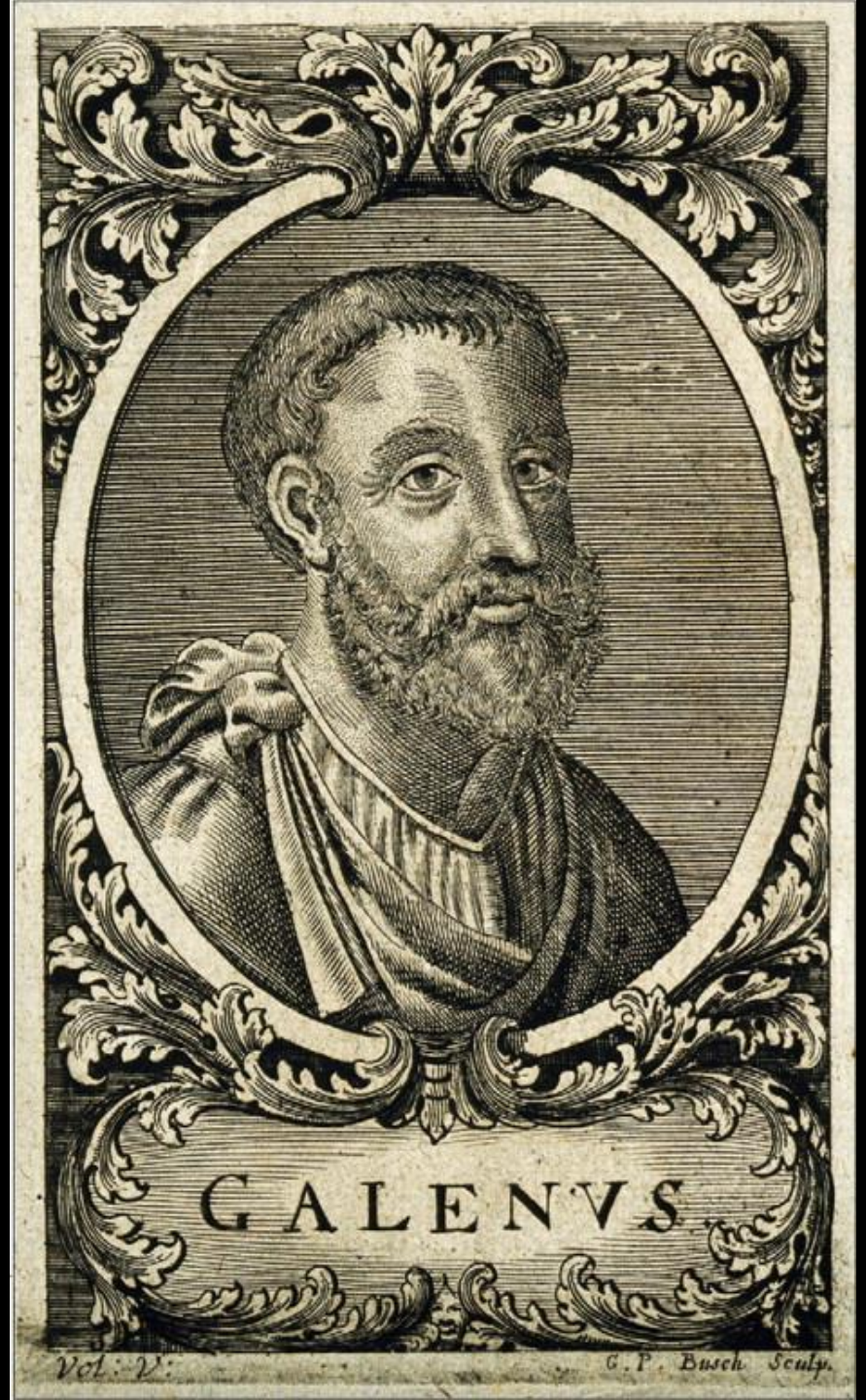
CVetitorum decreto, ne quis aliquo in loco Venetæ ditionis
hos libros imprimat, impressosue alibi
uendat, cautum est.

1528

Summarises medical knowledge from Hippocrates to the beginning of the Christian era

"…the bleeding vessels should be taken up, and ligatures have been applied above and below the wounded part, the vessels are to be divided into the interspace…"

Aulus Cornelius Celsus
25BC to 50AD



On how to control haemorrhage

"…by placing a finger on the orifice of a bleeding superficial vessel…"

Galen of Pergamum
129 to 210AD

The leading authority on surgery in the Middle Ages

4 methods of controlling haemorrhage:

1. By cauterisation
2. By division of the artery
3. By firm ligature
4. By the application of remedies

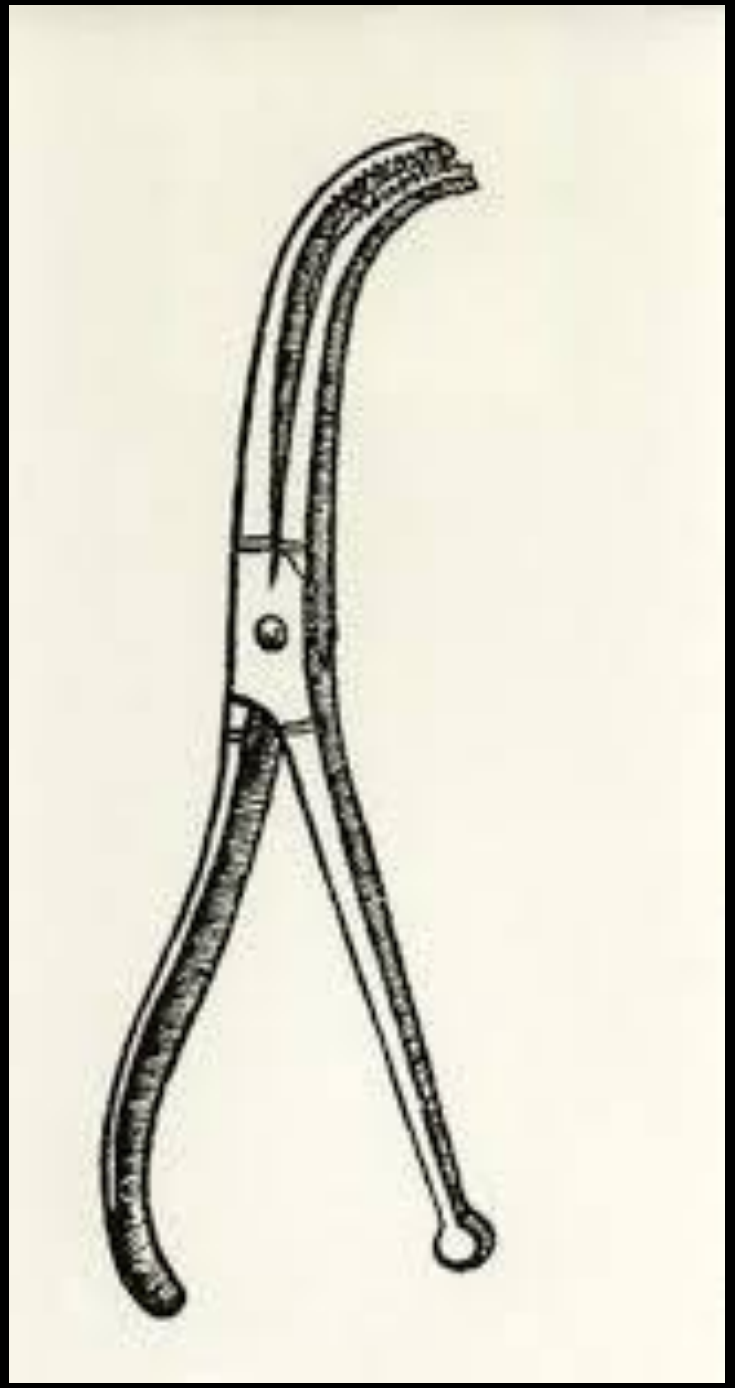
Albucasis or Abu al-Quasim

936 to 1013

”The Practice of Surgery"

First description of treatment of IJV injury

Rogerius
1140-1195



The father of modern surgery

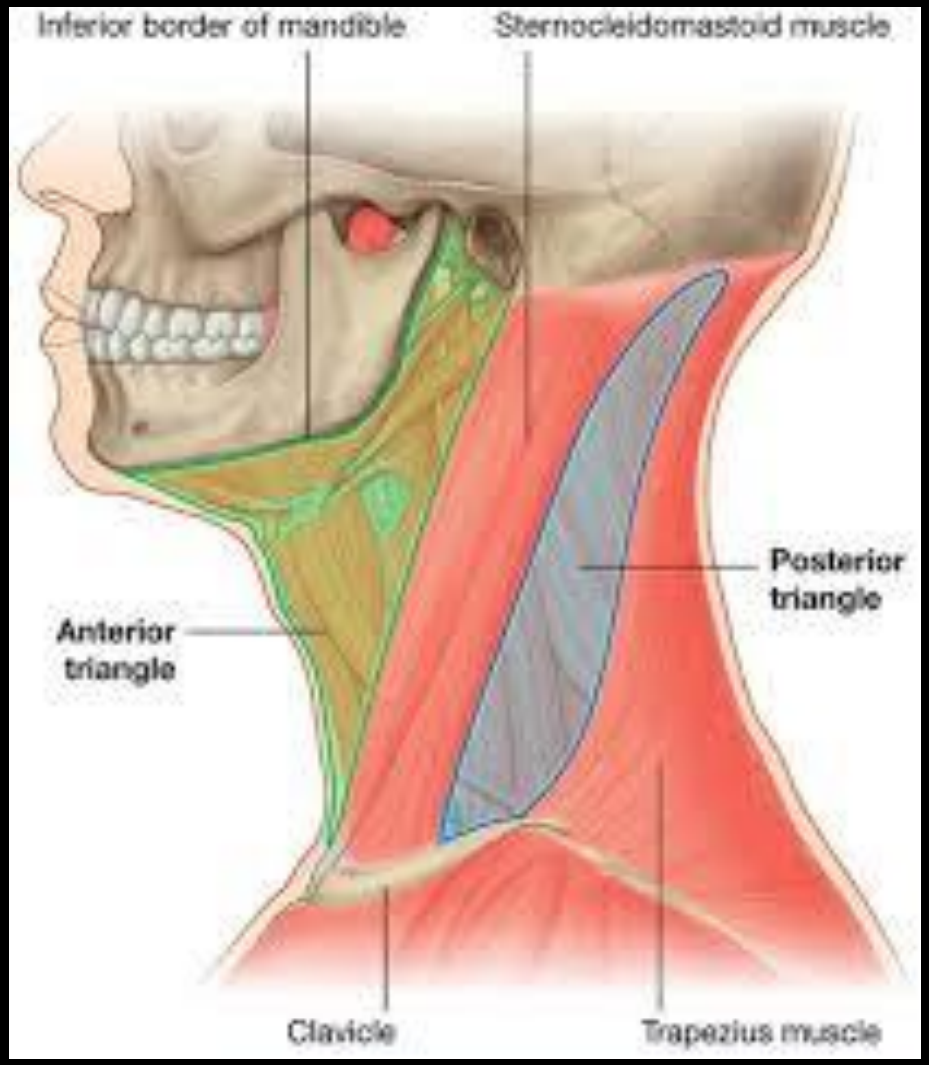
The development of the “Crow’s beak” – curved grasping instrument to grasp actively bleeding vesssels that had retracted from view

Ambroise Pare
(1510 to 1590)

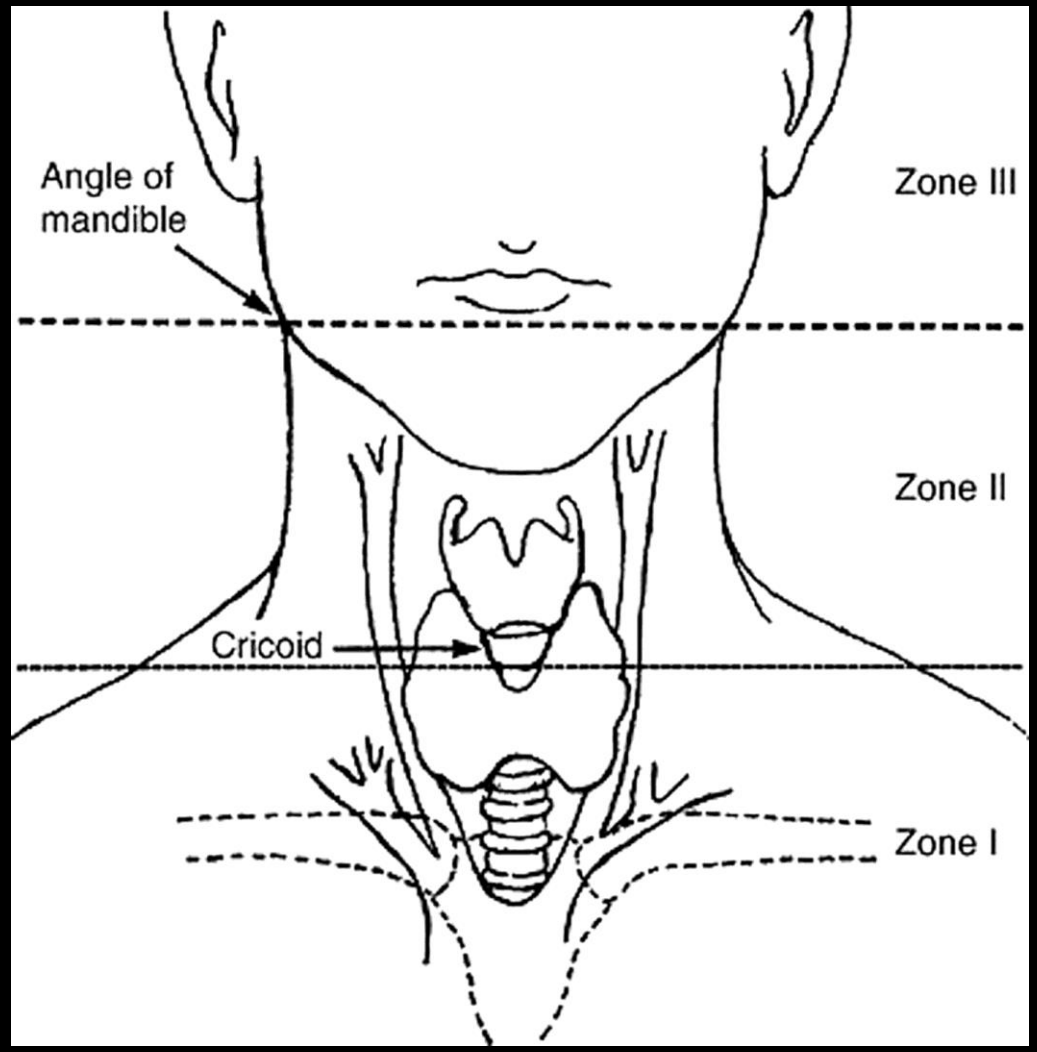
Vascular neck injuries

- 25% of head and neck trauma
- 5-10% of all arterial arterial injury
- Carotid injury
  - 10-20% mortality
  - 15-30% permanent neurological deficit
- More common in males
- Median age 20-30years

Relevant anatomy



Zones of the neck



Internal and external carotid artery
Vertebral artery
CN VII, IX, X, XI, XII
Salivary & parotid glands

Common, internal and external carotid artery
Vertebral artery
Jugular vein
Larynx
Hypopharynx
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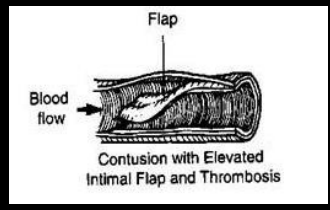
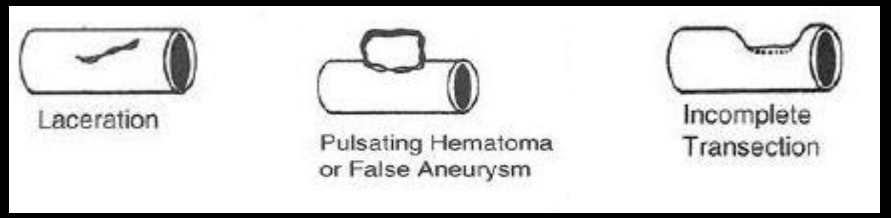
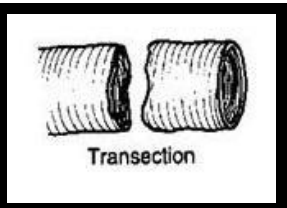
Common carotid, vertebral artery
Subclavian artery and vein
Mediastinal great vessels
Lung
Oesophagus
Trachea
Thyroid
Spinal cord & brachial plexus

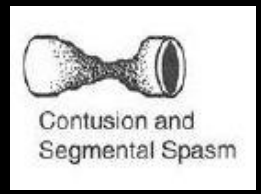
Vascular traumatic injury

1. Intimal injury
2. Complete wall defect with pseudoaneurysm or haemorrhage
3. Complete transection with haemorrhage or occlusion
4. Arteriovenous fistula
5. Spasm





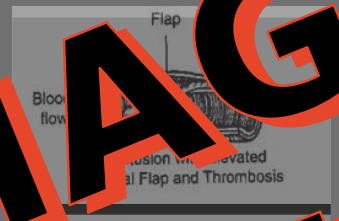


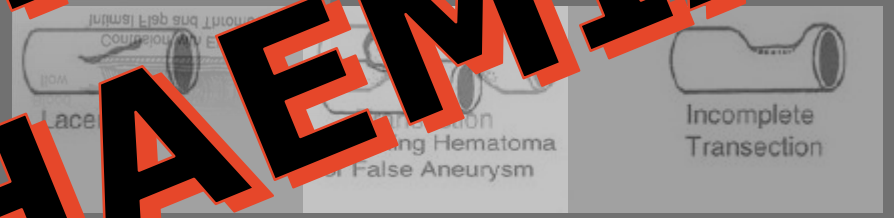


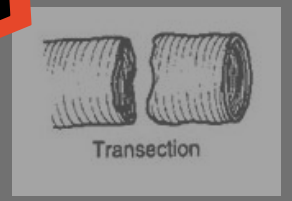
Vascular traumatic injury

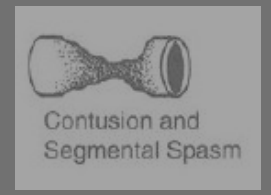
1. Intimal injury
2. Complete wall defect with pseu[illegible] or haemorrhage
3. Complete [illegible] with haemo[illegible] or occlusion
4. Arteriove[illegible]
5. Sp[illegible]

HAEMORRHAGE
DISTAL ISCHAEMIA









Penetrating neck injury (>90%)

- Stab/knife wounds
  - Straight and more obvious path
  - Less tissue damage
- Gunshot wounds and projectiles
  - Low velocity
  - High velocity
  - Cavitation and blunt type injury from concussive forces

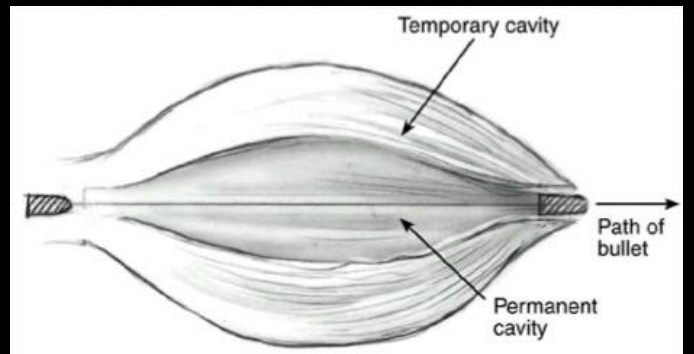


FIG. 73-1. Cavitation effects of a bullet wound to soft tissue.

Blunt cerebrovascular injury (<10%)

- Seatbelt injury/MVA
- Hanging/ligature/strangulation
- Punching/extreme chiropractic maneuvers

- Mechanisms:
  - Direct blow
  - Hyperextension with contralateral rotation of the head
  - Laceration of an artery by adjacent fractured bone
  - Intraoral trauma

- Thrombosis can lead to cerebral ischaemia

Iatrogenic injury

- Central line insertion
- Cerebral angiography
- C-spine/trans-sphenoidal/skull base surgery
- Radiotherapy (stenosis)
- Nerve blocks

Initial Evaluation

Airway

- Assess patency - stridor, respiratory distress, hoarseness
- Always be ready for intubation or surgical airway
- Routine C-spine immobilisation is not recommended

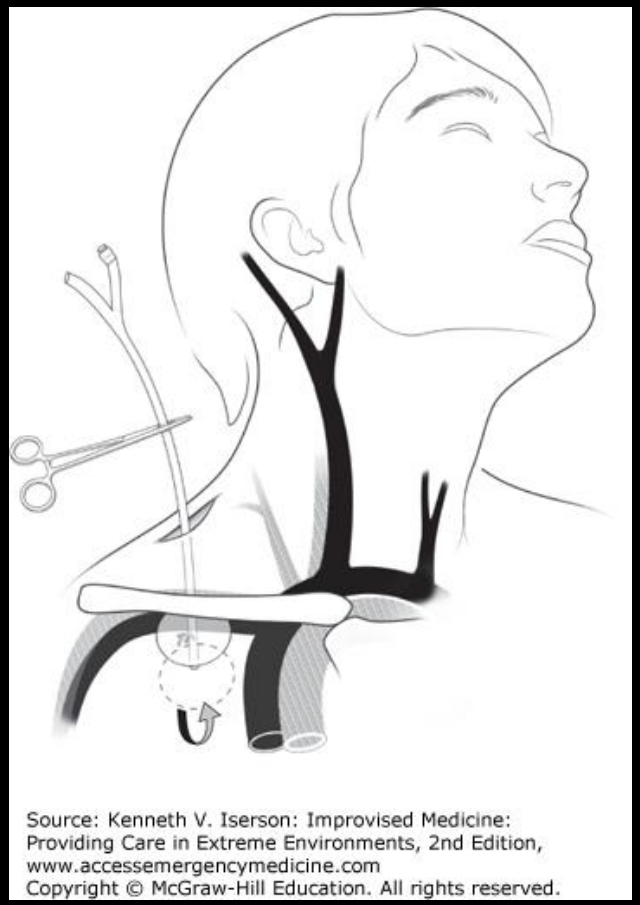
Breathing

- Give supplemental O2
- Assess chest expansion & for subcutaneous emphysema
- May have associated chest injury in high-risk mechanism
- CXR

Circulation

- Large bore IV access
- Fluid resuscitation
- Direct compression for bleeding

- Avoid probing the wound
- Do not clamp blindly



Source: Kenneth V. Iserson: Improvised Medicine: Providing Care in Extreme Environments, 2nd Edition, www.accessemergencymedicine.com

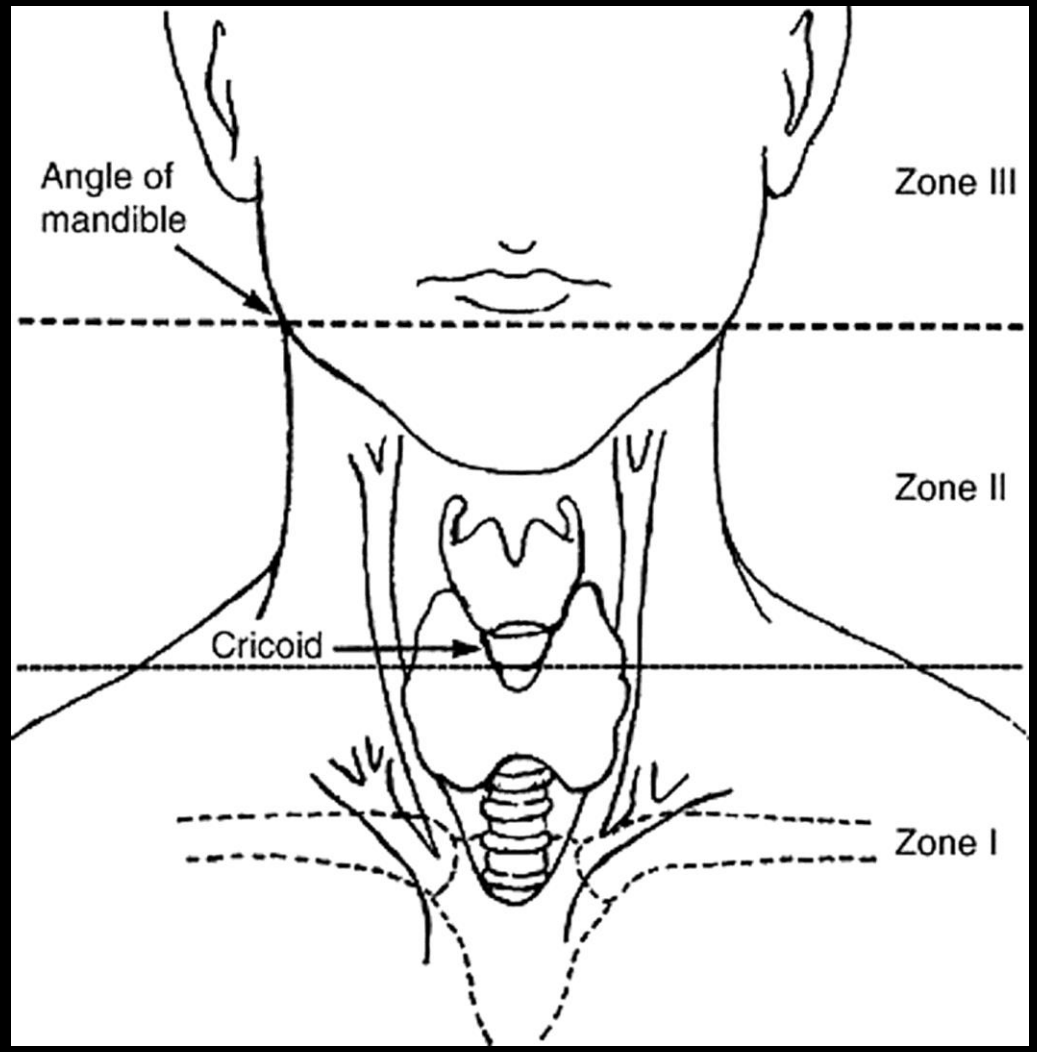
Hard signs of vascular injury

- Pulsatile bleeding
- Expanding haematoma
- Shock and ongoing bleeding
- Absent pulses
- Neurovascular symptoms – stroke/TIA
- Thrill or bruit

Soft signs of vascular injury

- Venous ooze
- Non-expanding/non-pulsatile haematoma
- History of significant bleeding/hypotension

Zones of the neck



Internal and external carotid artery
Vertebral artery
CN VII, IX, X, XI, XII
Salivary & parotid glands

Common, internal and external carotid artery
Vertebral artery
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Larynx
Hypopharynx
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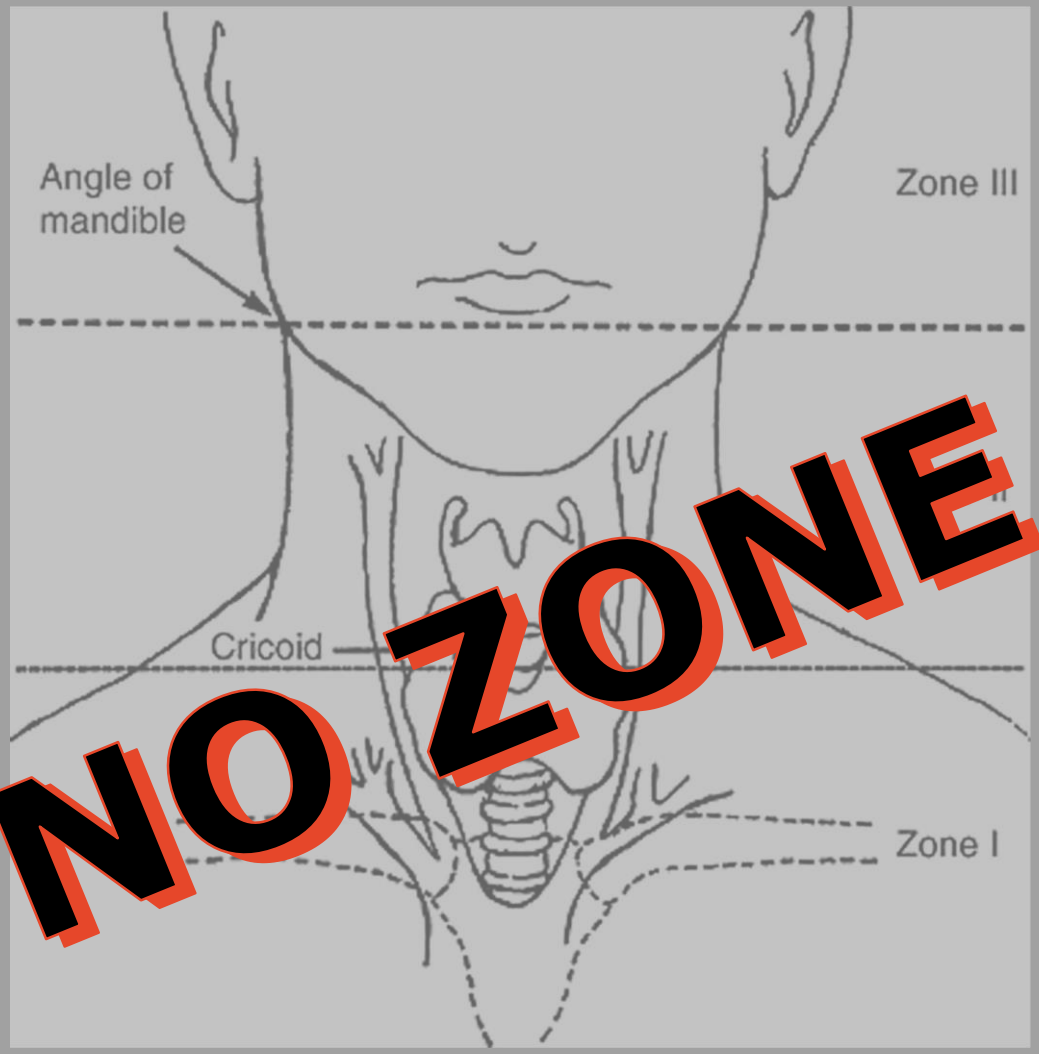
Common carotid, vertebral artery
Subclavian artery and vein
Mediastinal great vessels
Lung
Oesophagus
Trachea
Thyroid
Spinal cord & brachial plexus

Zones of the neck



NO ZONE APPROACH

Internal and external carotid arte
Vertebral artery
CN VII, IX, X, XI, XII
Salivary & par

ion, ternal and external
tid artery
ertebral artery
Jugular vein
Larynx
Hypopharynx
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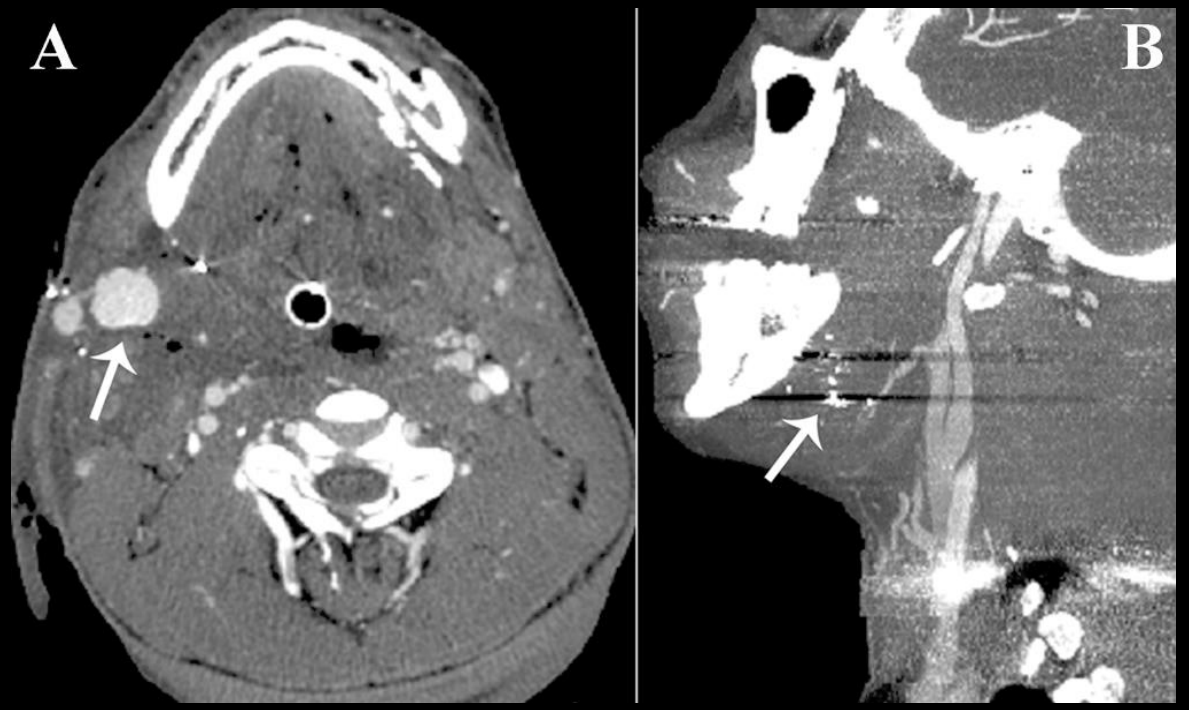
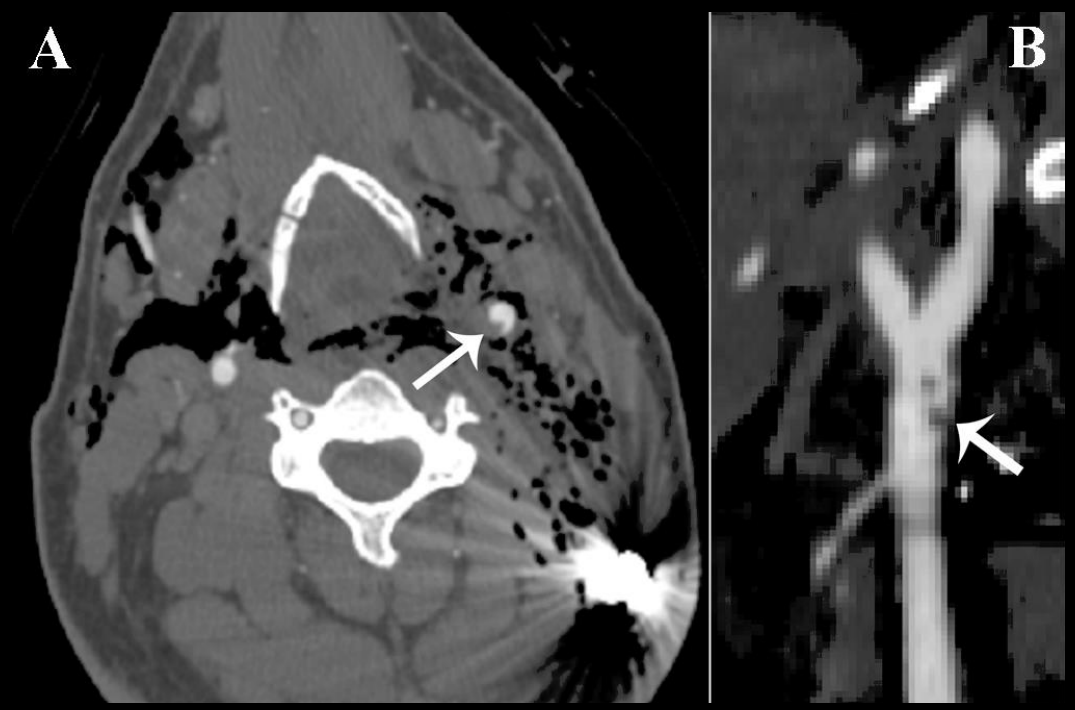
Investigation

CT Angiography

- >90% sensitivity in detecting arterial lesions
- Direct signs:
  - Wall irregularity
  - Contrast extravasation
  - Lack of vascular enhancement
  - Caliber changes
- Rapid
- Limitations:
  - Artefact
  - Poorly timed contrast injection
- Shown to reduce negative neck exploration

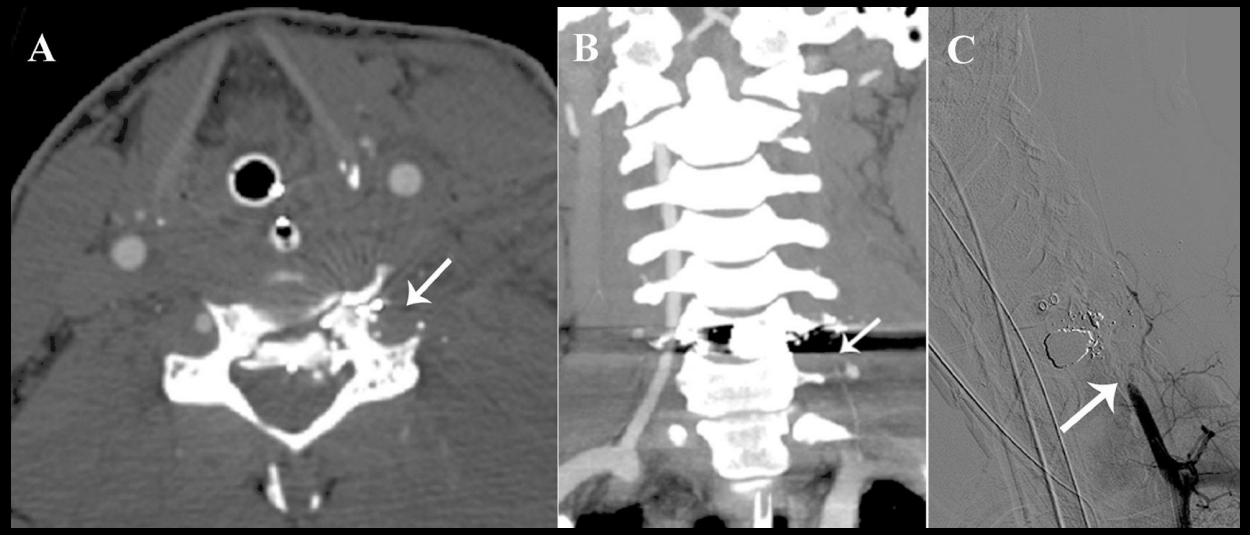
CT Angiography

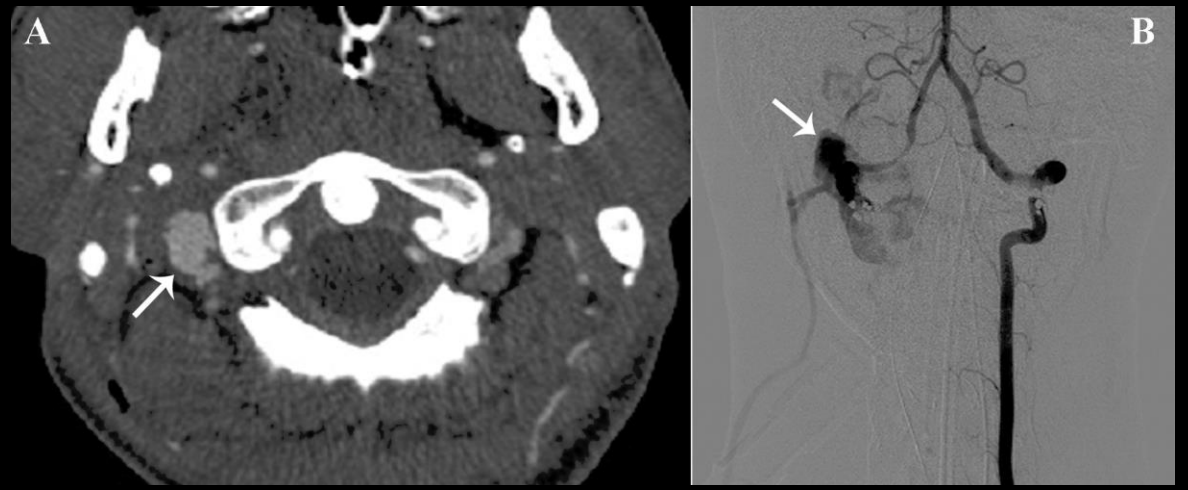




Saito et al. Keio J Med 2014

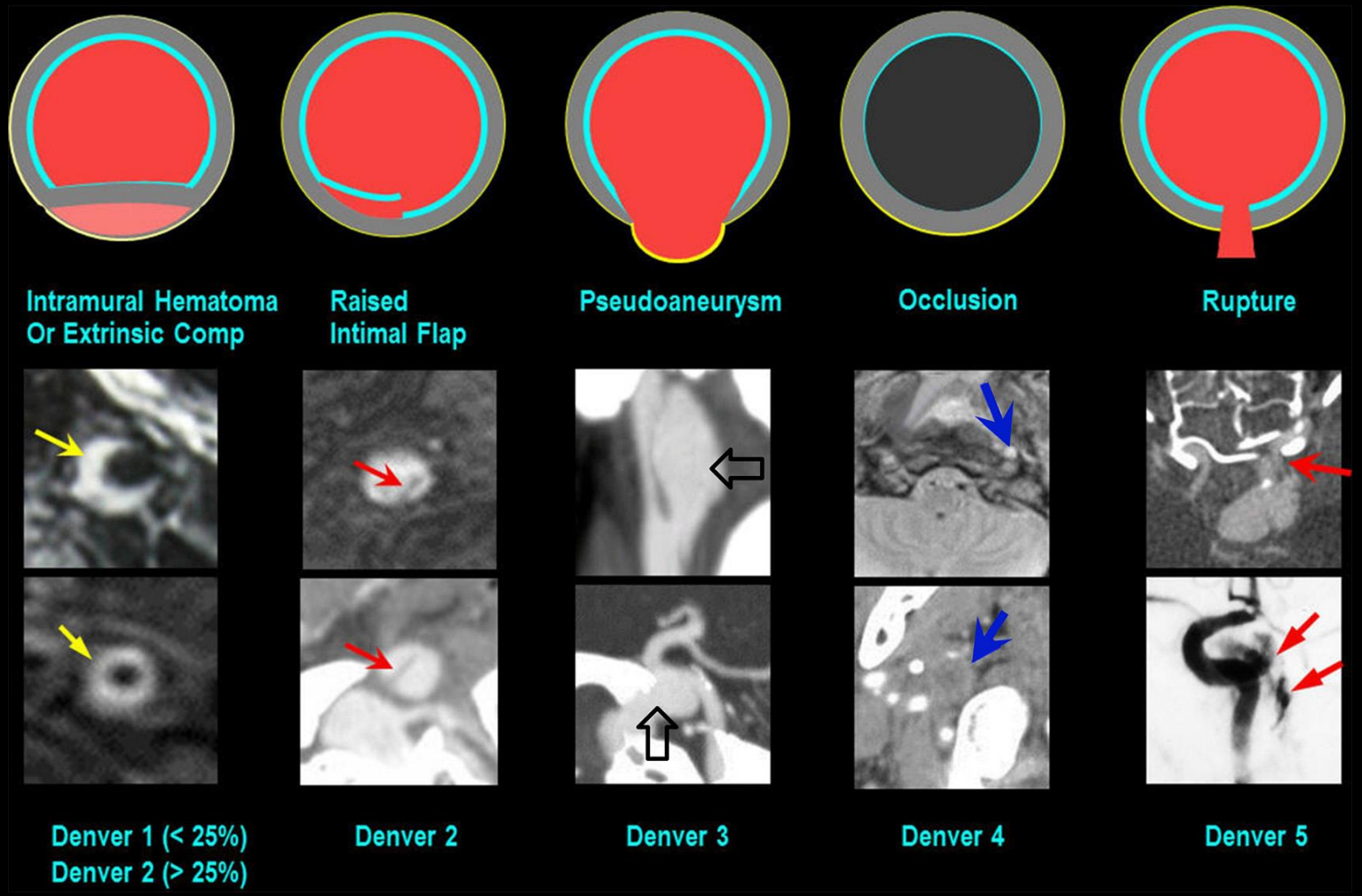
CT Angiography





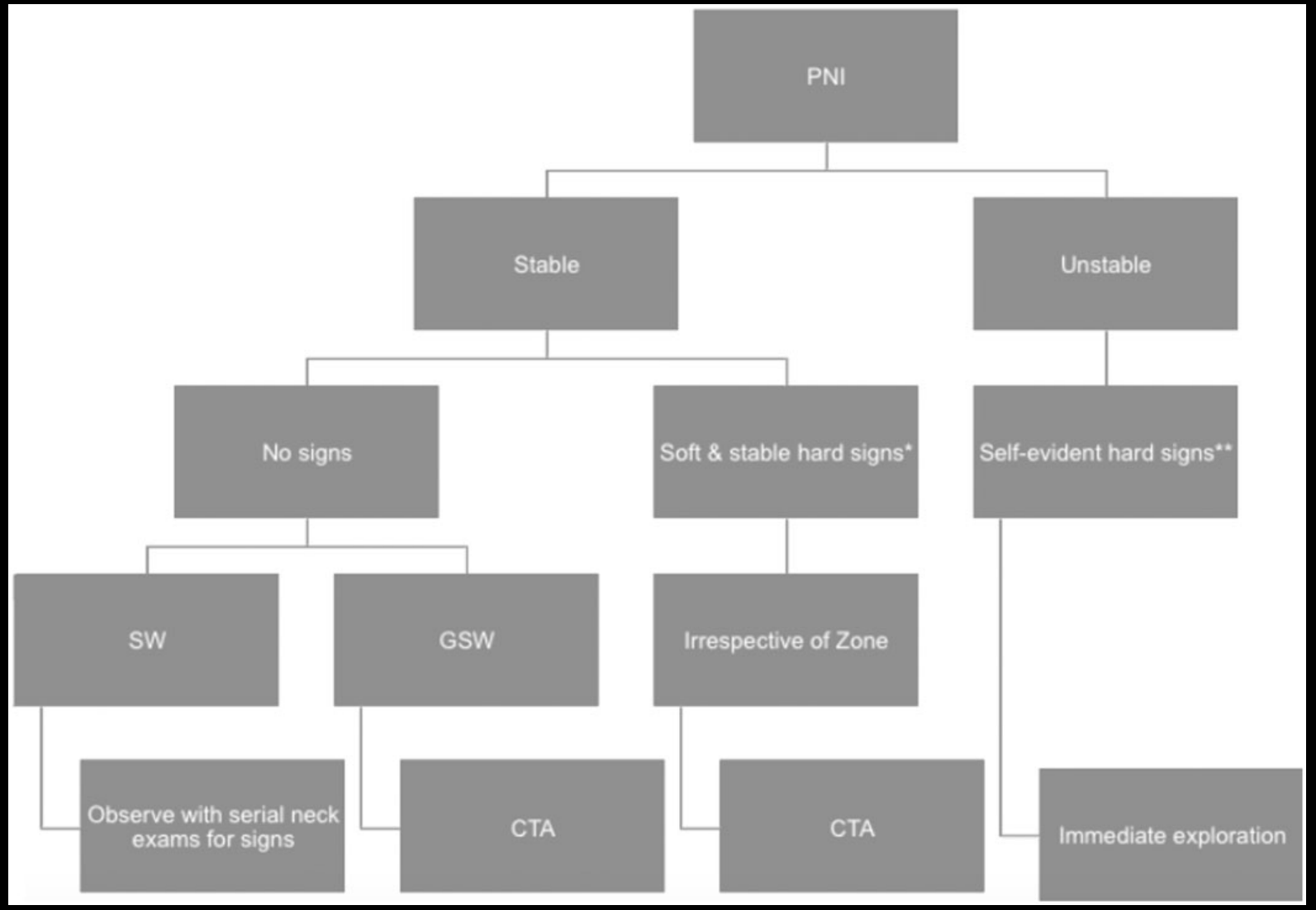
Saito et al. Keio J Med 2014

Blunt Cerebrovascular Injury Denver grading scale



Management

Algorithm for Penetrating Neck Injury

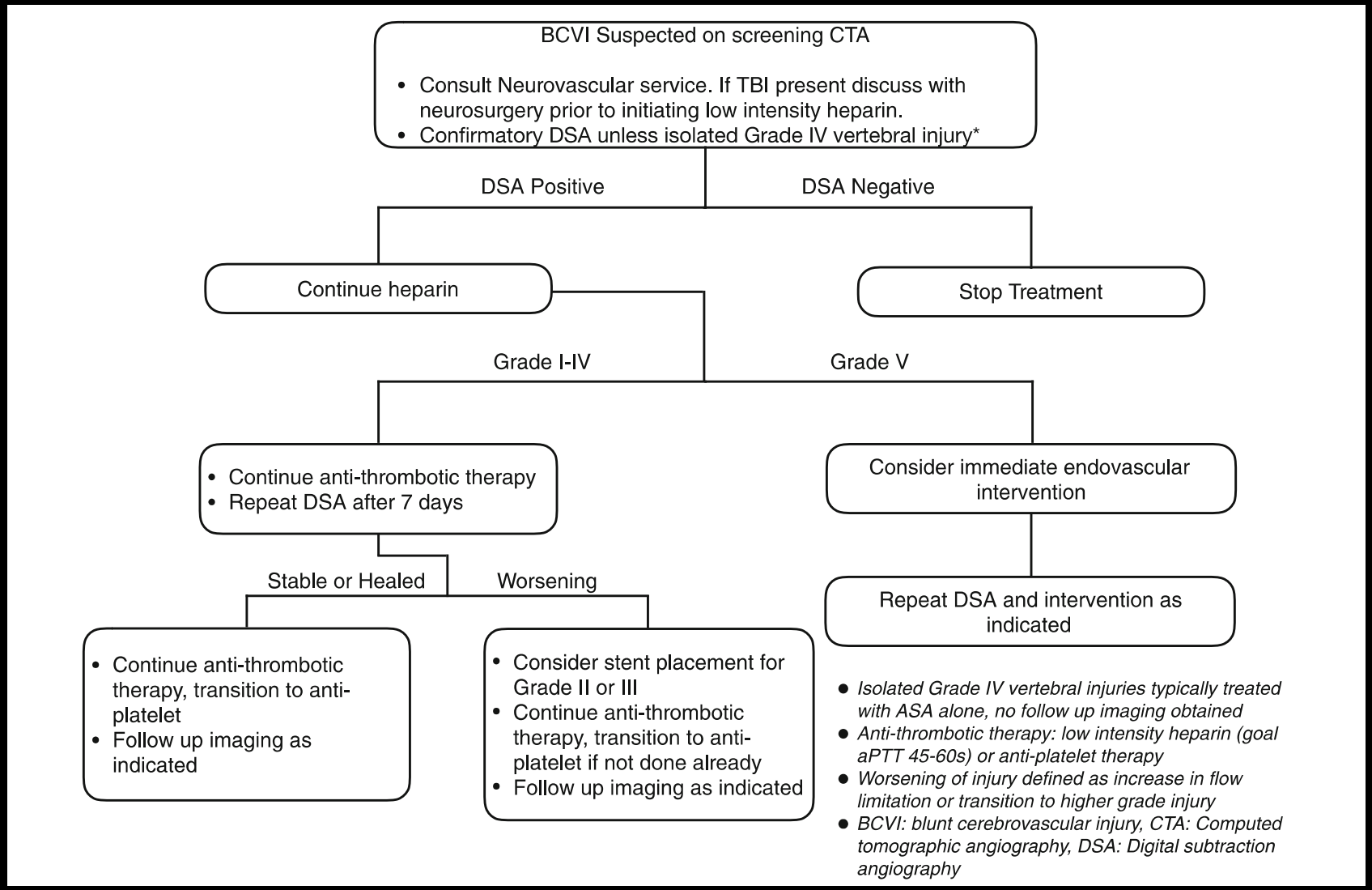


*Soft & stable hard signs
- Bruit, thrill, central neurological deficits, absent pulse

**Self-evident hard signs
- Exsanguinating haemorrhage
- Rapidly expanding neck haematoma

Weale et al. Trauma 2019

Algorithm for Blunt Cerebrovascular Injury



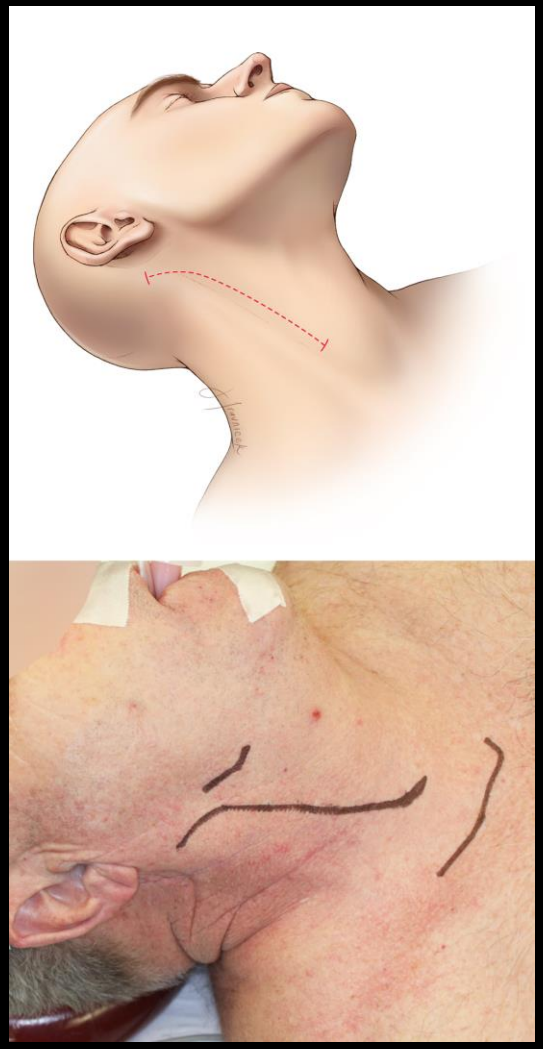
Shahan et al. Curr Trauma Rep 2019

Operative Management

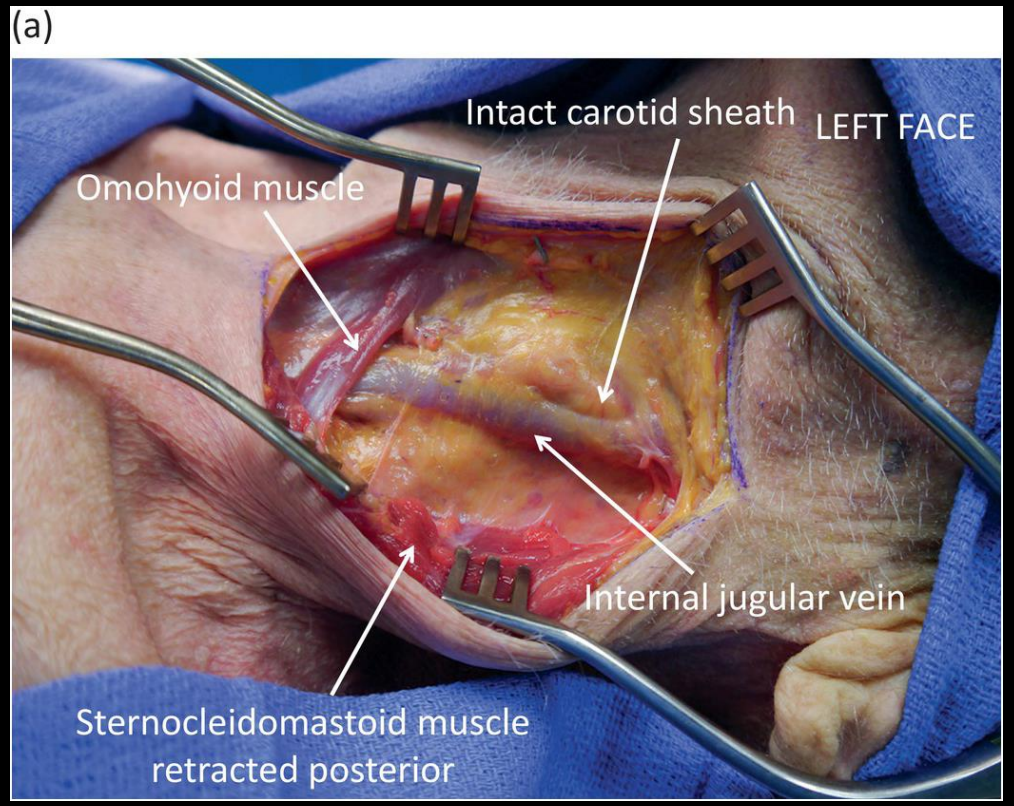
- General Principles
  - GA – consider nasotracheal tube
  - Position – supine, neck extended, turned to opposite side
  - Exposure – chest & face for zone 1 & 3 injuries

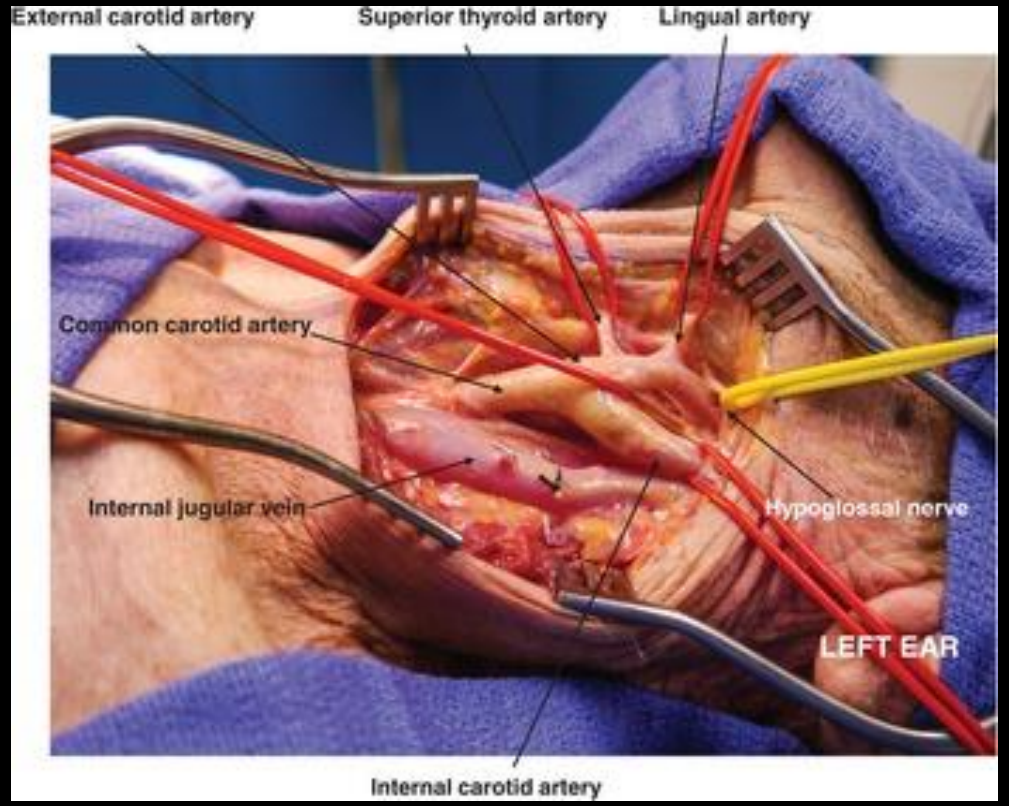
Operative Approach

- Zone 1 – SCM incision +/- sternotomy
- Zone II – SCM incision
- Zone III – post auricular extension with SCM incision +/- mandibular subluxation



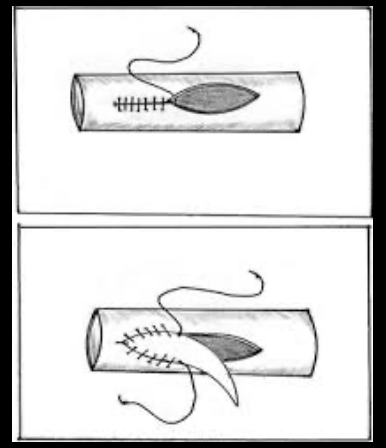
Operative Approach

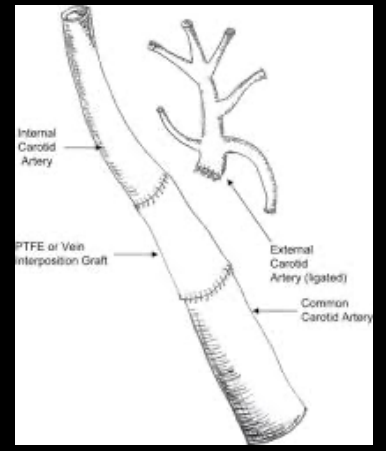




Carotid Injury

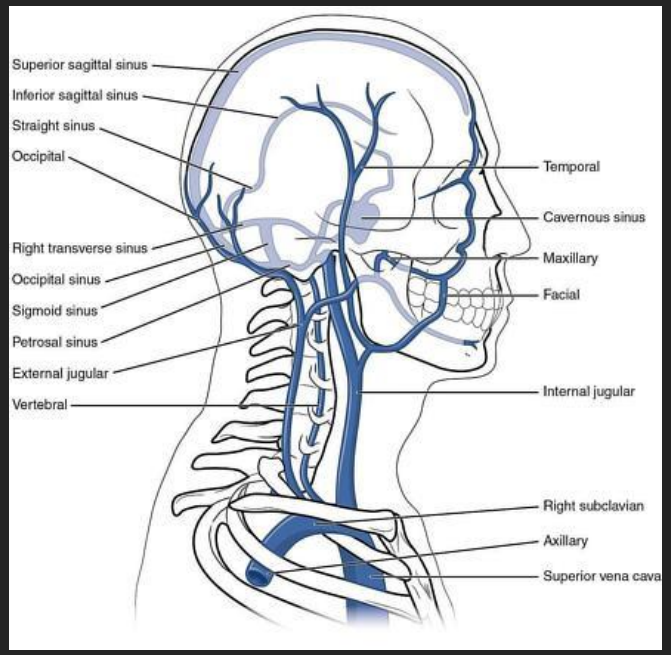
- 25% of patients with hard signs will have injury to carotid
- Primary repair, patch repair, interposition graft with GSV or prosthetic
- Ligation of ECA and its branches if necessary
- Ligation of CCA or ICA reserved for patients with devastating neurology





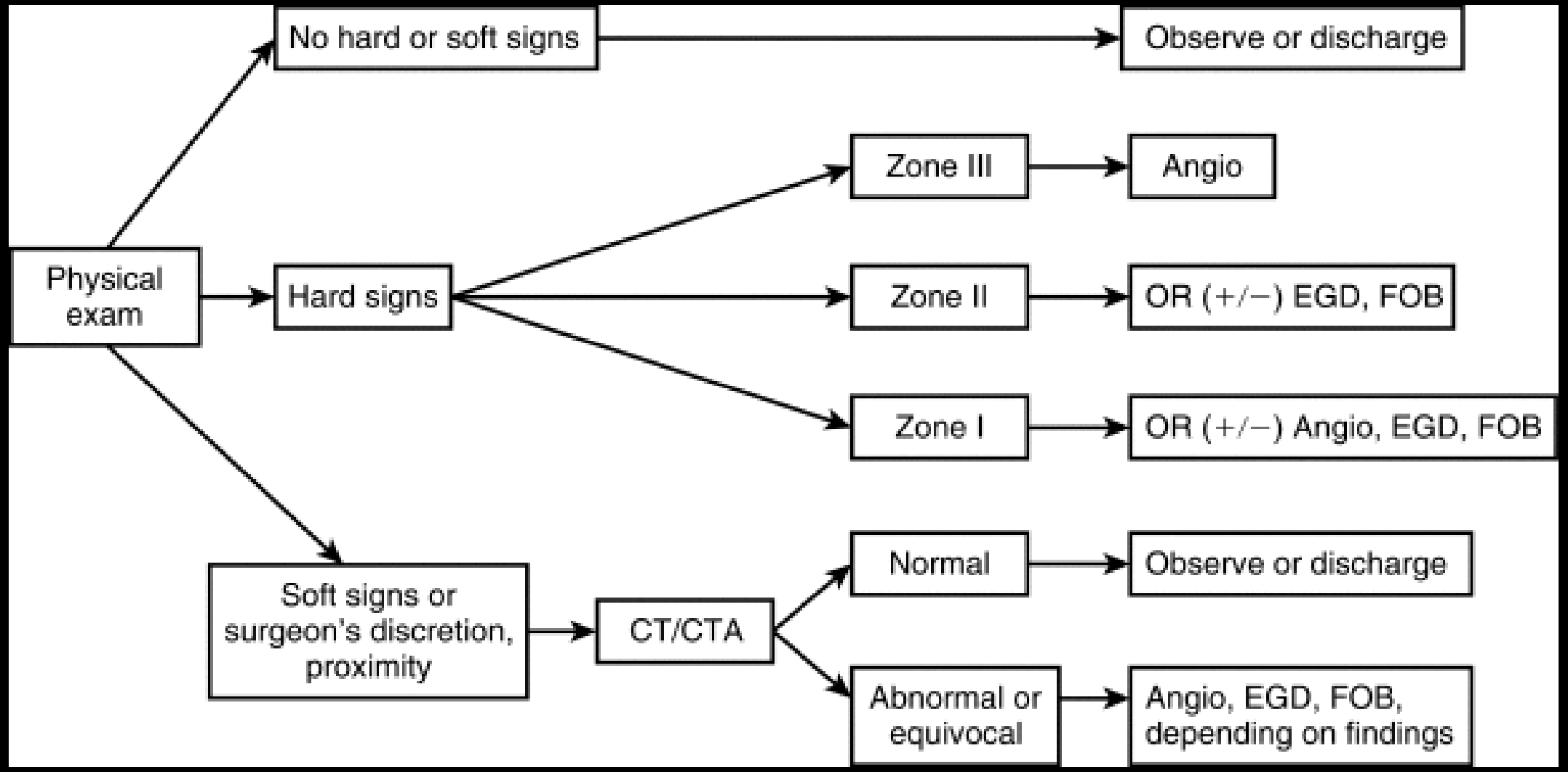
Venous injury

- ~15% of neck stab wounds that penetrate platysma will have injury to internal jugular vein
- Laceration of IJV best treated with lateral venorraphy
- Can ligate IJV if necessary. Should repair one side if both IJV injured.
- Small case series of IJV injuries treated non-operatively without complications



Role of Endovascular Treatment

- Effective where surgical localisation and control can be difficult – Zone 1 and 3
- Can maintain distal perfusion
- Stent graft deployment described in subclavian, axillary and proximal carotid artery injuries with good long-term follow-up
- Embolisation for vertebral artery injuries is the treatment of choice



Asenio et al. Curr Ther Trauma and Surg Crit Care 2016

Summary

- Vascular neck injury can have devastating consequences
- Modern standard of “no zone” management approach allows for selective non-operative management of penetrating neck injury
- Important to have a high suspicion for BCVI in blunt trauma patients. Prompt initiation of antithrombotic treatment is effective in reducing stroke risk