Blunt Mediastinal Trauma

Pump and Tubes

C.P. Bleeker
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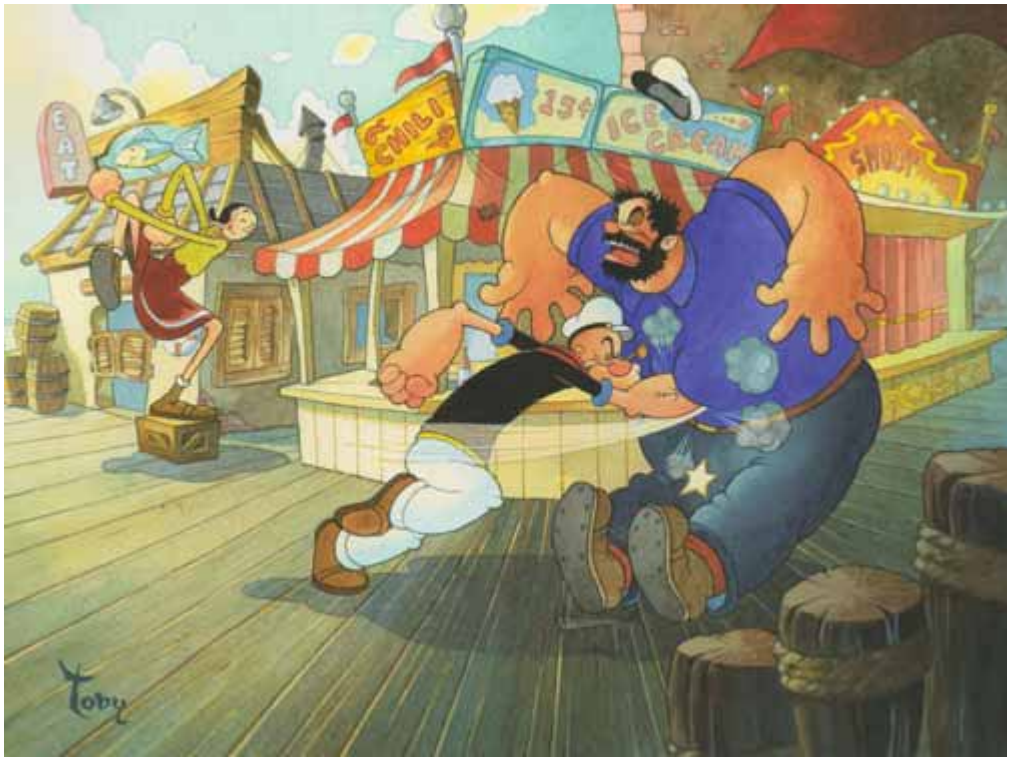
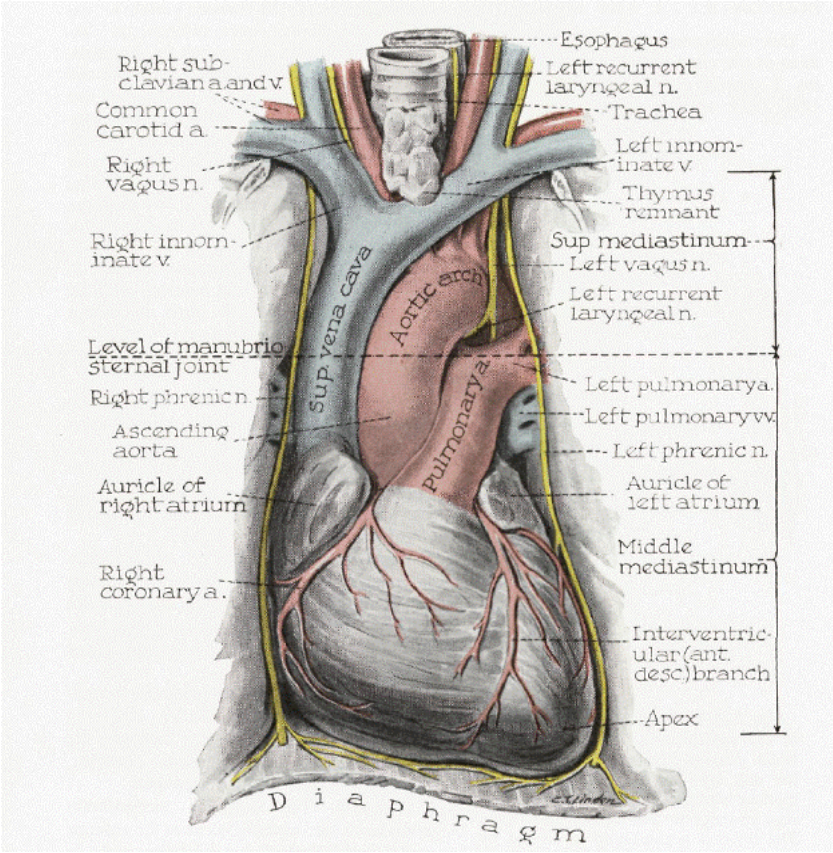
Blunt force trauma to the mediastinum

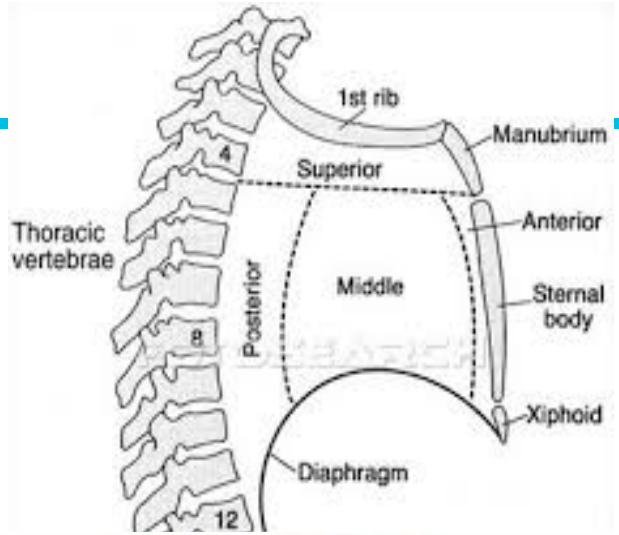


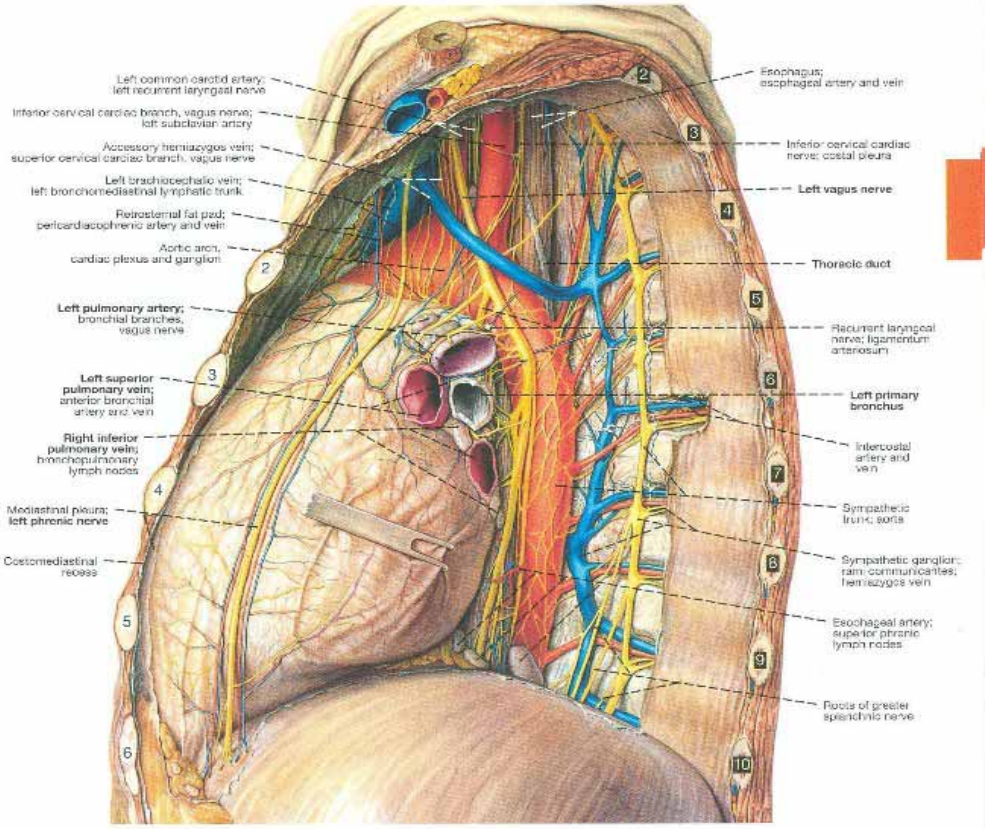
Introduction

No Conflict of Interests

The mediastinum







The different organs in the mediastinum

- Heart
- Aorta and vessels
- Trachea and Bronchi
- Oesophagus
- Thoracic duct

Blunt force sources

- Traffic accidents
- Falls and assaults
- Blast / Explosions
- Work-related accidents
- Crush/ Earthquakes

Accident Report NTSB/AAR-14/01 PB2014-105984

1.2 Injuries to Persons

Table 2.Injury chart.Injuries Flight Crew

	Cabin Crew		Passengers	
	Total			
Fatal	**0**	**0**	**3**	**3**
Serious	**1**	**8**	**40**	**49**
Minor	**2**	**2**	**134**	**138**
None	**1**	**2**	**114**	**117**
Total	**4**	**12**	**291**	**307**

Descent Below Visual Glide path and Impact With Seawall
Asiana Airlines Flight 214 Boeing 777-200ER, HL7742 San Francisco, California July 6, 2013

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NTSB/HAR-01/03

Highway Accident Report Collision of CSXT Freight Train and Murray County School District School Bus at Railroad/Highway Grade Crossing Conasauga, Tennessee March 28, 2000

Injuries

The following table is based on the International Civil Aviation Organization's injury criteria,[12] which the National Transportation Safety Board uses in accident reports for all transportation modes.

Table 1. Injuries.

Injuries	Driver	Train crew	Bus passengers	Total
Fatal	0	0	3	3
Serious	0	0	3	3
Minor	1	0	1	2
None	0	2	0	2
Total	1	2	7	10

[12] Title 49 *Code of Federal Regulations* 830.2 defines a fatal injury as any injury that results in death within 30 days of the accident. It defines a serious injury as one that requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received; results in a fracture of any bone

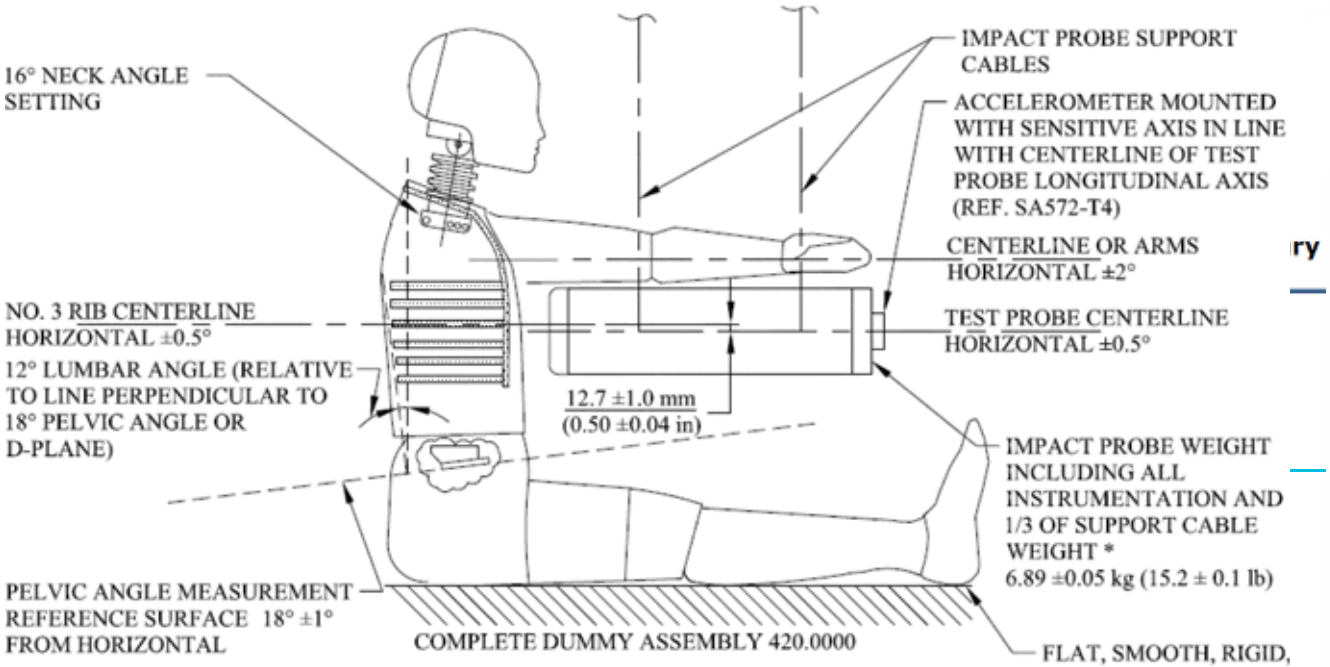
MVA research

EUROPEAN COMMISSION
DG RTD

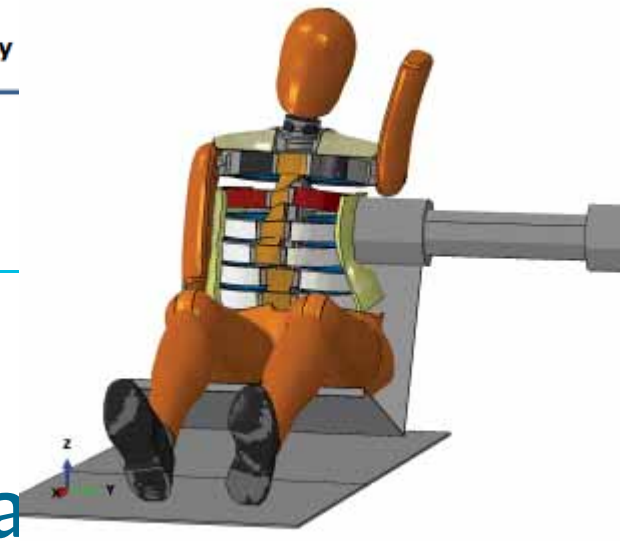
SEVENTH FRAMEWORK PROGRAMME
THEME 7
TRANSPORT - SST
SST.2007.4.1.2: Human physical and behavioural components
GA No. 218516

THORAX

FIGURE T4
THORAX IMPACT TEST SET-UP SPECIFICATIONS



* 1/3 CABLE WEIGHT NOT TO EXCEED 5% OF THE TOTAL IMPACT PROBE WEIGHT



Outcome

Rib fractures,

sternum fracture,

lung contusion,

clavicle fractures

TABLA III

Afectación traumática torácica: 1.772 casos

	N	%Quilotórax
5	0,3	
Roturas diafragmáticas	22	1,2
Lesión traqueal o bronquial	15	0,9
Lesión cardíaca o de gran vaso	25	1,4
Lesión vascular torácica	30	1,7

FREIXINET J ET AL. INDICADORES DE GRAVEDAD EN LOS TRAUMATISMOS TORÁCICOS Arch Bronconeumol. 2008;44(5):257-62

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Outcome
The differences in casualties

- Age,
- Gender
- Weight and size
- Physical fitness, muscularity

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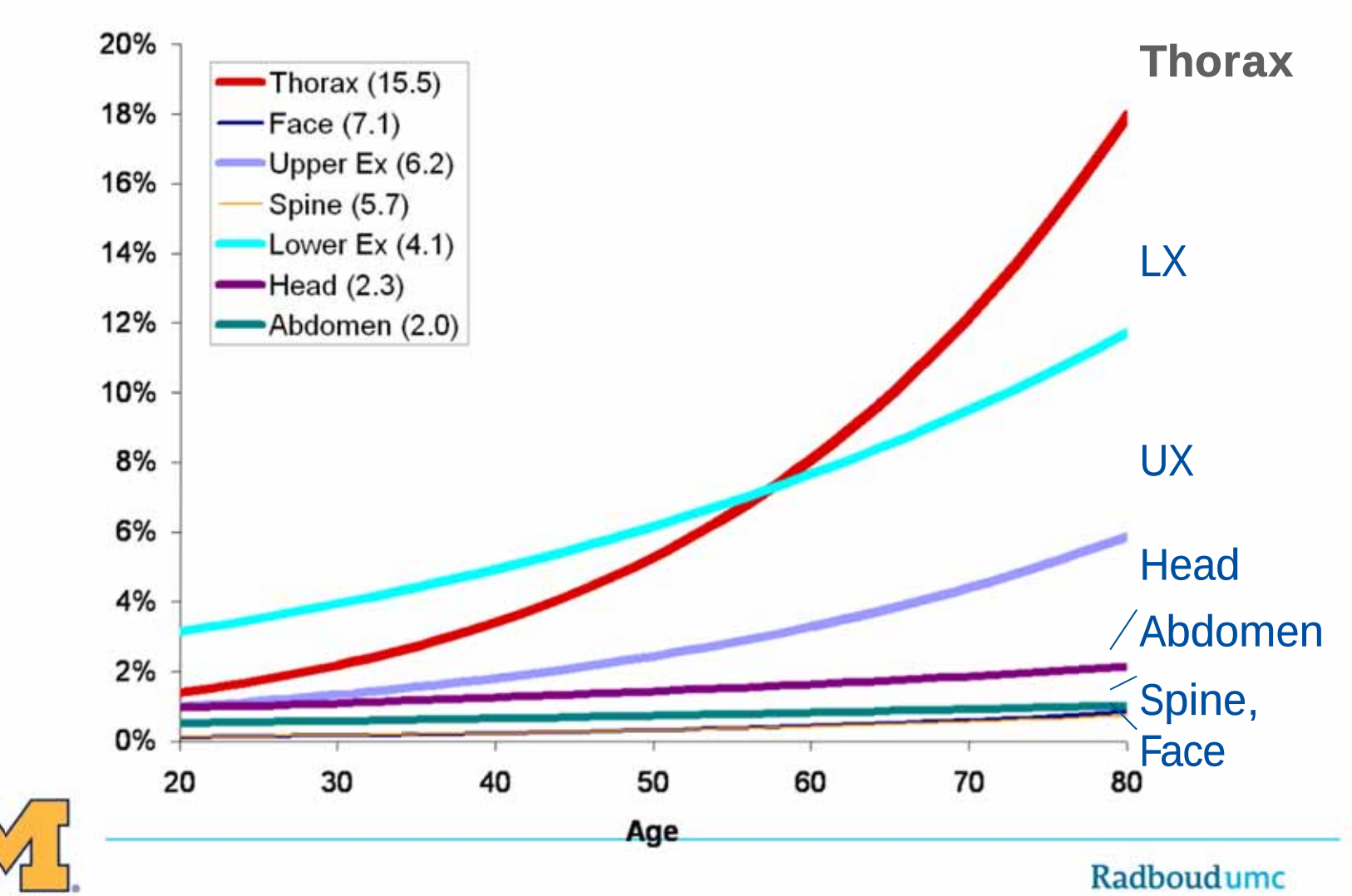
Age vs. Body Region FRAGILITY (AIS 3+injury)

(Frontal Crashes, Belted Drivers, 30 mph Crash Severity)



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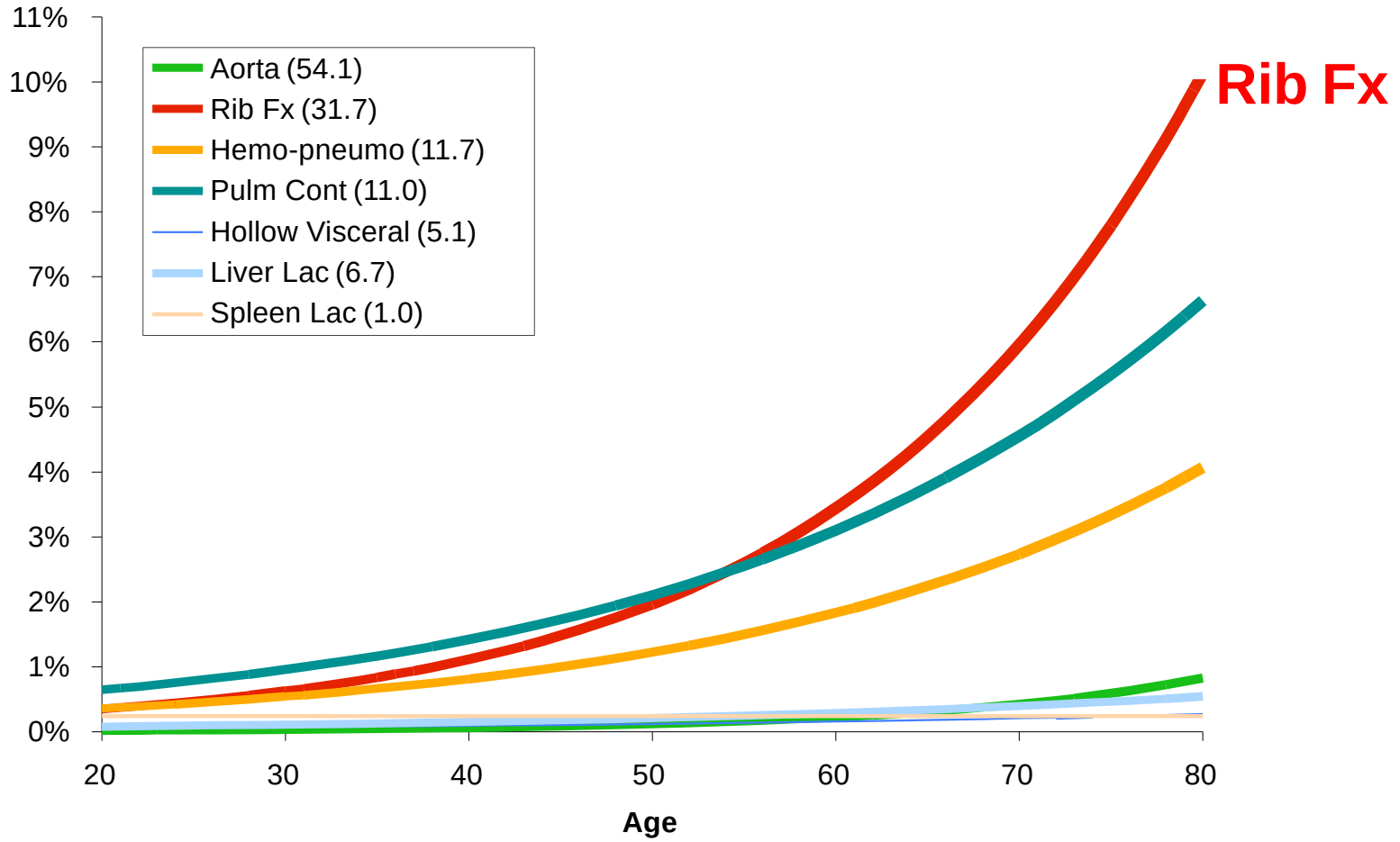
Chest Fragility: Particularly rib fractures



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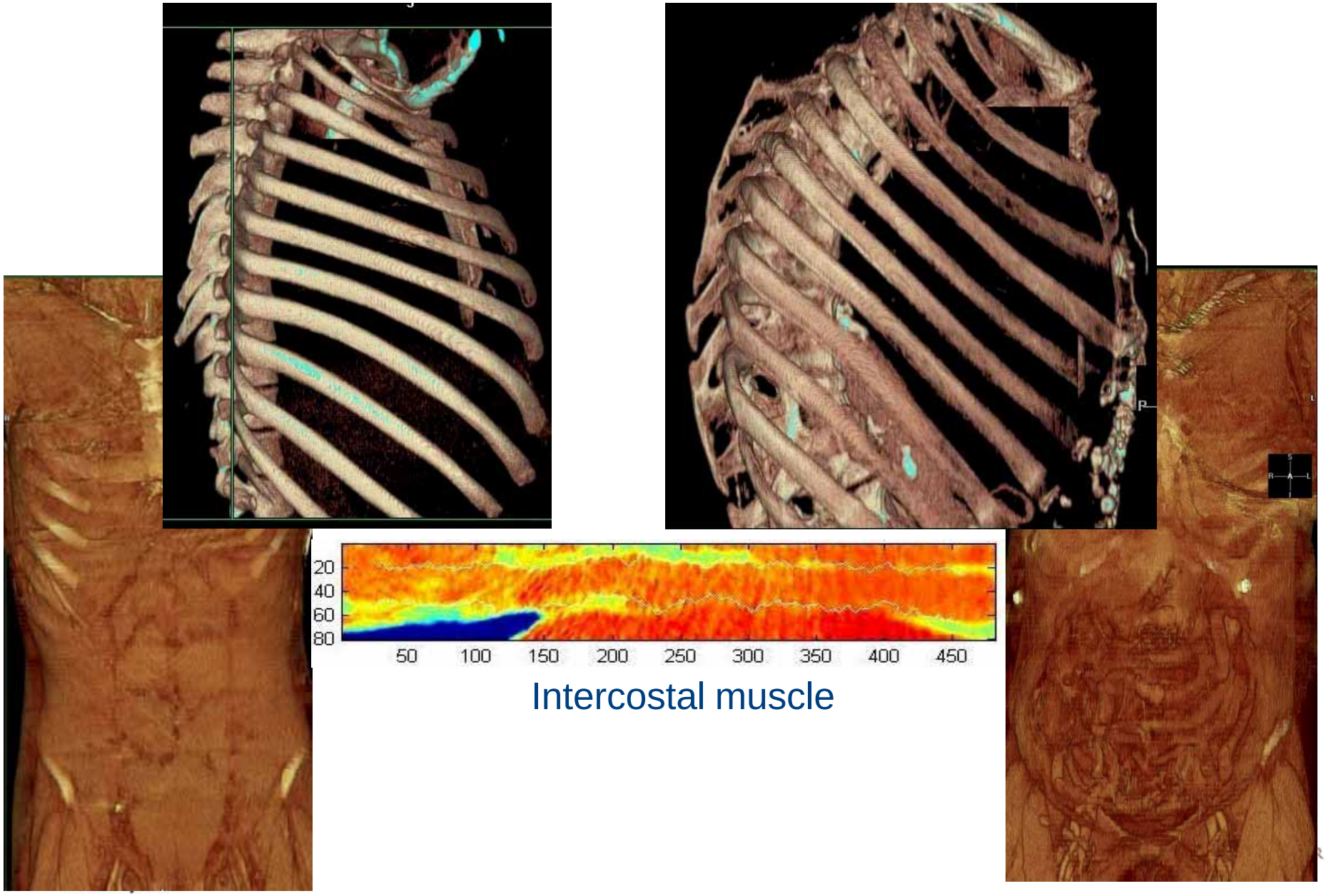
Young

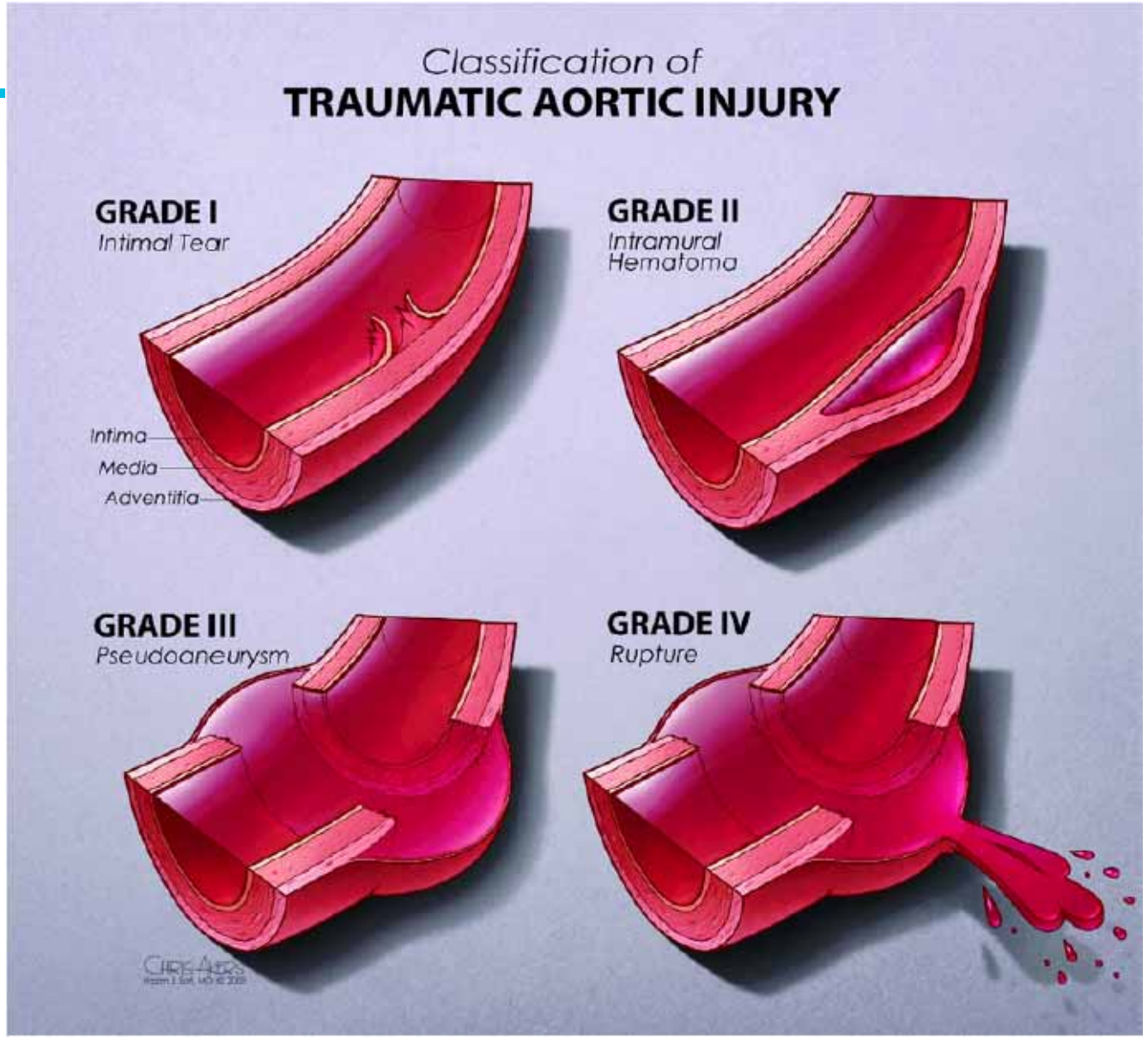
Old



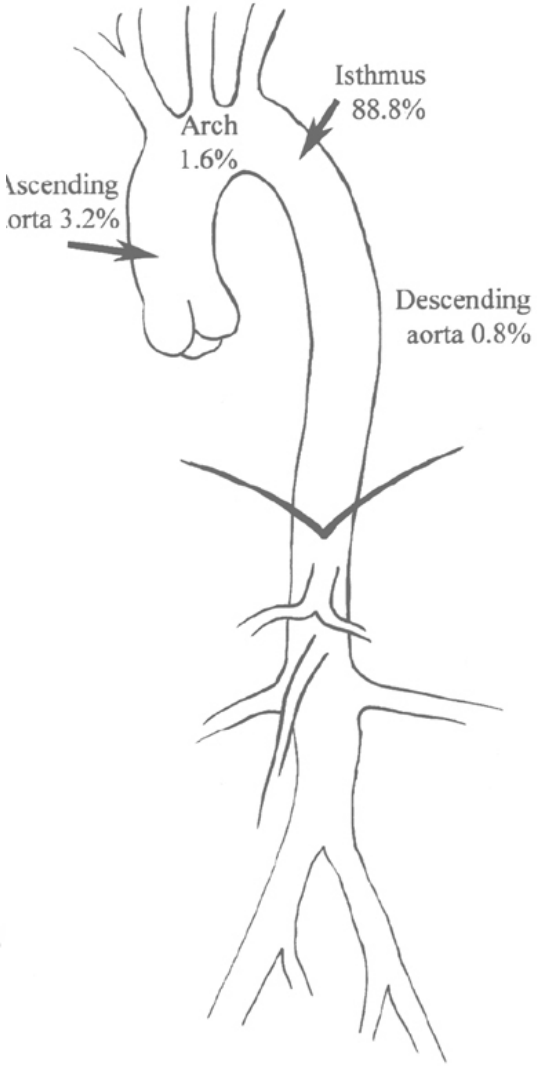
Intercostal muscle

Aorta

- Penetrating
- Iatrogenic lesions
- Blunt trauma



Azizzadeh A, et al.Blunt traumatic aortic injury: initial experience with endovascular repair.
J Vasc ~~Surg 2009;49:1403-08.~~
+ J Vasc Surg 2011;53:187-92



Blunt trauma to the thoracic aorta: mechanisms involved, diagnosis and management. Roberto Chiesa[1], et all *J Vasc Br 2003;2(3):197-209*

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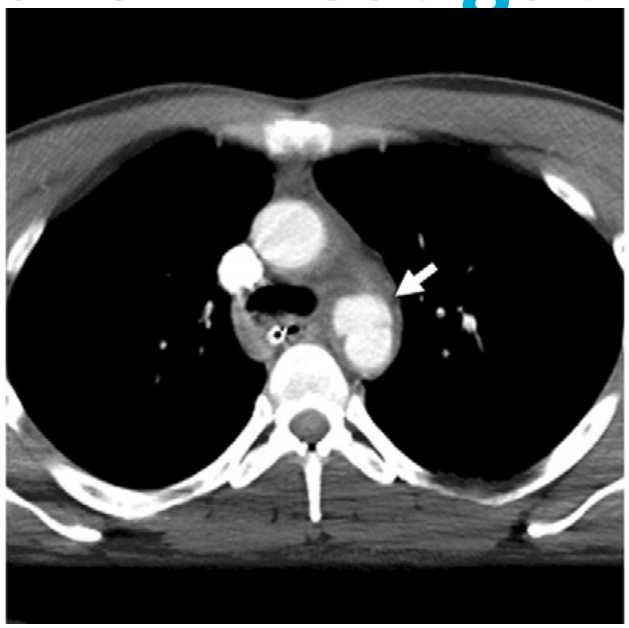
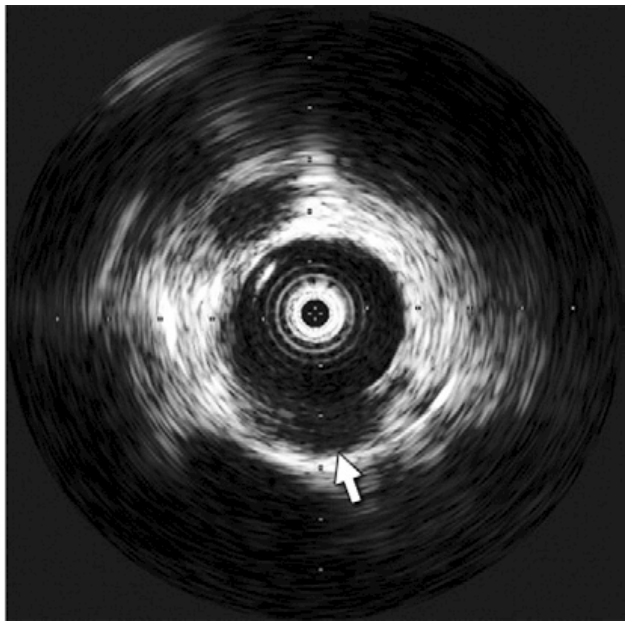
Aorta rupture investigations





- CXR
- CT-A
- TEE
- MRI
- IVUS

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Indications for delaying the aortic repair in the hemodynamically stable patient

- trauma to the central nervous system with coma,
- respiratory failure from lung contusion,
- body surface burns,
- blunt cardiac injury,
- tears of solid organs that will undergo non-operative management,
- retroperitoneal hematoma,
- contaminated wounds,
- age 50 years or older,
- medical comorbidities

Thoracic Aorta repair

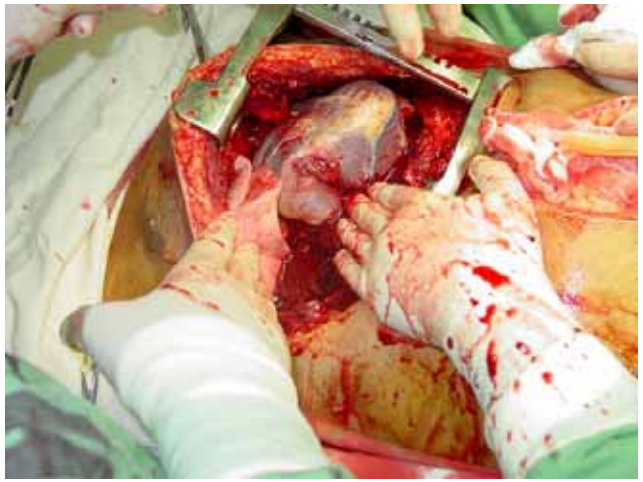
- open operative intervention for blunt aortic injury
  - thoracotomy,
  - single-lung ventilation
  - application of an aortic cross-clamp
  - cardiopulmonary bypass may be needed
  - Neuromonitoring included somatosensory and motor-evoked potential monitoring

- Thoracic endovascular aortic repair:
  - TEVAR best outcome survival, spinal cord ischaemia, renal failure, infections

Endovascular repair of traumatic thoracic aortic injury: Clinical practice guidelines of the Society for Vascular Surgery.
W. Anthony Lee, MD, et al. J Vasc Surg 2011;53:187-92.)

CARDIAC INJURY AND TAMPONADE

- Fatality rates > 80%
- Mostly ventricular, right > left
- Blood in pericardial sac causes tamponade



Blunt cardiac injury with coronary artery dissection

- We report on two cases of young adult presenting with segment elevation myocardial infarction related to CA dissection following rugby game

J Emerg Trauma Shock. 2015 Apr-Jun; 8(2): 110–111.
doi: 10.4103/0974-2700.155513

Blunt cardiac injury

- AAST Injury Scale for Cardiac Injuries

  - Grade 1: blunt cardiac injury with minor EKG abnormalities
  - Grade 2: with heart block or ischaemic changes
  - Grade 3:With sustained multifocal ventricular contractions, septal rupture, valve disruption, papillary muscle dysfunction, distal coronary occlusion **without cardiac failure,** blunt pericardial laceration with cardiac herniation, **with cardiac failure**
  - Grade 4: with septal rupture, valve incompetence, papillary muscle dysfunction **with cardiac failure**
  - Grade 5: proximal coronary artery occlusion, perforation left ventricular,
    Stellate injuries with < 50% tissue loss RV
  - Grade 6 Blunt avulsion of the heart; ventricular perforation

Blunt cardiac injury

DIAGNOSIS:

- Ectopy
- ST elevation
- Tachycardia
- Friction rub
- CPK enzymes, Troponin

Monitor in ICU & treat dysrhythmias

- Serial enzymes
- Analgesia

Screening for blunt cardiac injury
EAST practice management guideline

- ECG (level 1), continuous monitoring
- TTE / TEE
- Troponine 1 (level 2)
- Pulmonary artery catheter (Level 3)
- *CT scan: only haemopericardium, does not define origin*

Trachea and Bronchi

- Blunt force trauma to the tracheobronchial tree:
  mostly in the distal trachea and right main bronchus
- 1 - 2% blunt chest trauma
- Trachea fixed at the carina
- Shearing forces overcome elasticity of the trachea or bronchus
- Pressure increase against closed glottis

Physical findings trachea/bronchus rupture

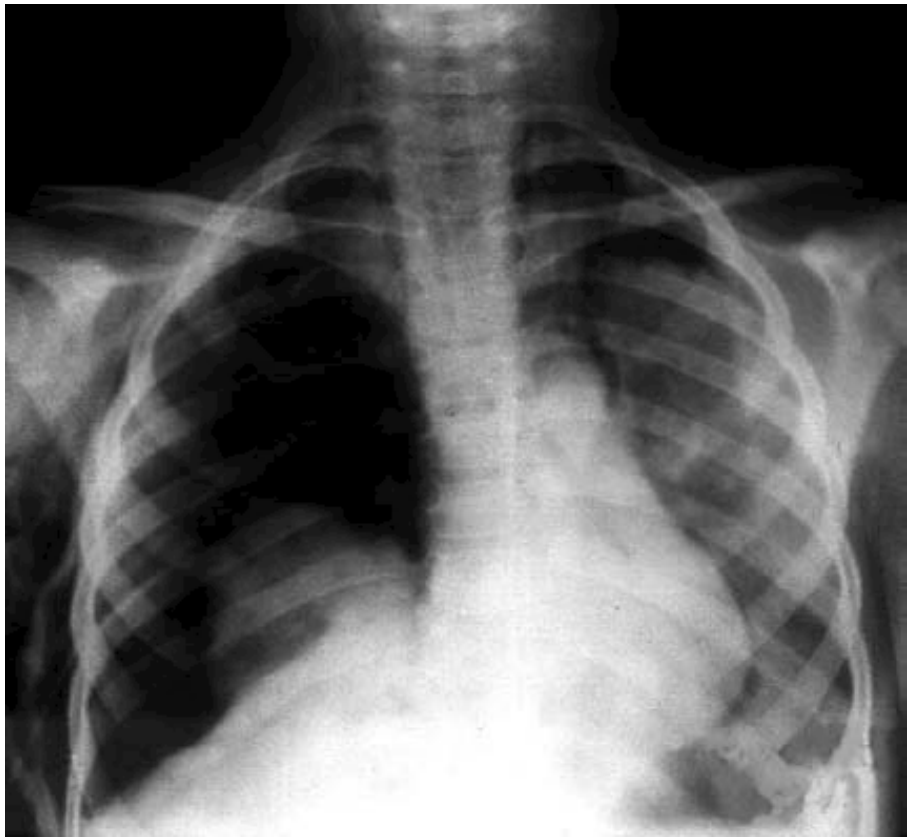
- Early death / non-arrival

- Breathing problems, hoarseness
- Cyanosis, hypoxia
- Haemophtysis
- Pain
- Loss of breath sounds
- Subcutaneous emphysema
- Large persistent air leak chest drain

Signs trachea, bronchus disruption

- Subcutaneous emphysema
- Clavicular fracture, rib fractures
- Widened mediastinum
- Pulmonary contusion
- Haemo- pneumothorax
- Fallen lung sign

Fallen lung sign



Fallen lung sign: radiographic findings
Recep Savaş, Hüdaver Alper,
Diagn Interv Radiol 2008; 14:120-121

Emergency Lun-Sparing Surgical Repair of a Complete Transection of the Right Mainstem Bronchus due to lunt Chest Trauma
A. Sachithnandan et al.
Med J Malaysia vol 69 no 2 April 2014

Therapy trachea, bronchus disruption

- Rapid diagnosis
- Rapid DLT intubation
- Bronchoscopy
- Thoracotomy
  - Bronchus repair
  - Pneumonectomy

Blunt oesophageal trauma

- Most due to penetrating trauma

- oesophageal rupture secondary to blunt chest trauma is 0.001percent
  - Shearing forces
  - Accidental ingestion sharp/caustic objects

- of these cases 82% occur above the level of the carina known as the cervico-thoracic esophagus

- 70% rate of delayed presentation; If delayed or missed, rapid sepsis & high mortality

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Oesophageal injury

- Difficult to diagnosis
- Radiography
- Endoscopy
- Thoracoscopy
- Treatment: surgical repair via thoracotomy

Oesophagus

Symptoms

- Pain, dyspnoea, fever, crepitus
- Severe mediastinitis
- Emphysema
- Multi-organ failure
- Sepsis
- Chest Drain : turbid fluid,
  stomach content/food

Oesophagus burns

- First-degree: oedema
- Second degree: ulceration
- Third degree: massive oedema with eschar formation with or without full thickness necrosis

Treatment options

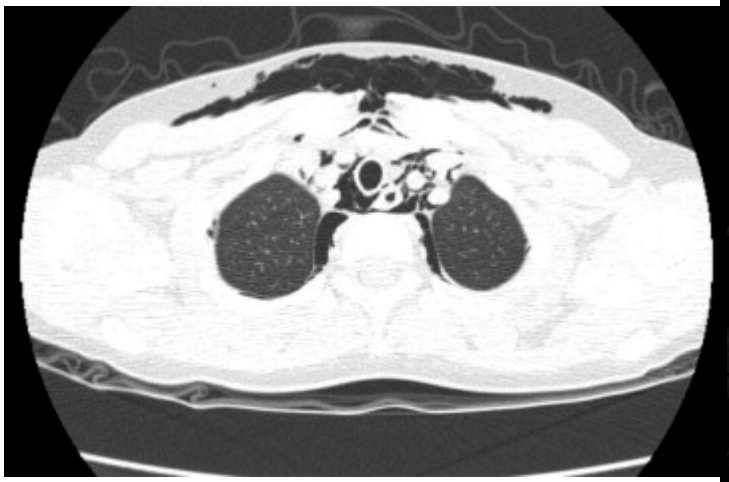
- Conservative
- Primary closure
- Reinforced primary closure
- T-tube drainage
- Exclusion and diversion
- Cave Stomach tube!

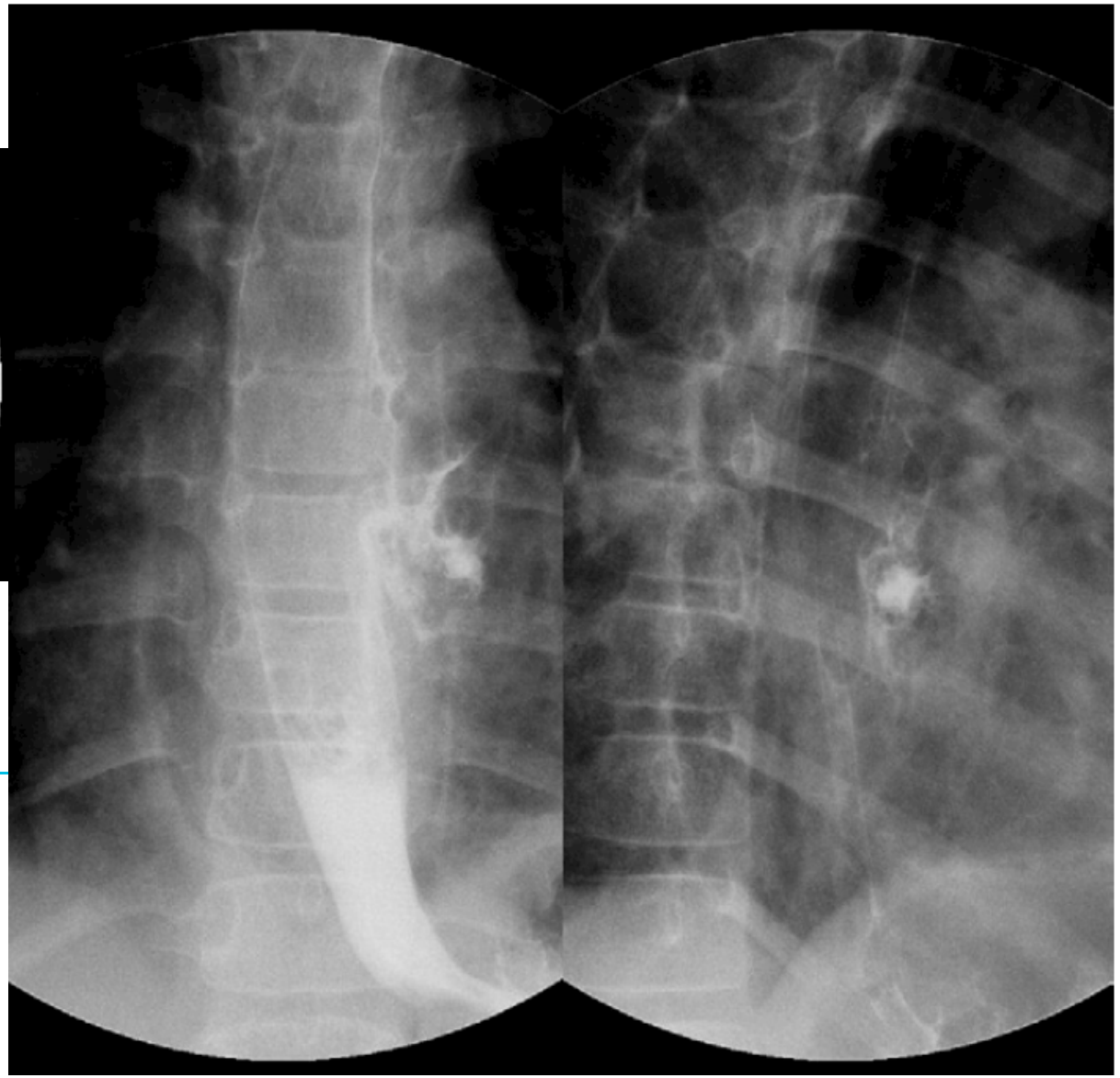
Blunt oesophageal trauma
Investigations / therapy

- Barium Swallow
- Oesophagoscopy

Therapy:
- < 24 hrs: surgery, primary repair with muscle flap/ pleural flap
- > 24 hrs: drainage, exclusion and diversion or repair

Intrathoracic esophageal rupture distal to the carina after blunt chesttrauma: Case-report
Alex Cede˜no, Karla Echeverría, Jan Vázquez, Aura Delgado, Pablo Rodríguez-Ortiz
International Journal of Surgery Case Reports 16 (2015) 184–186



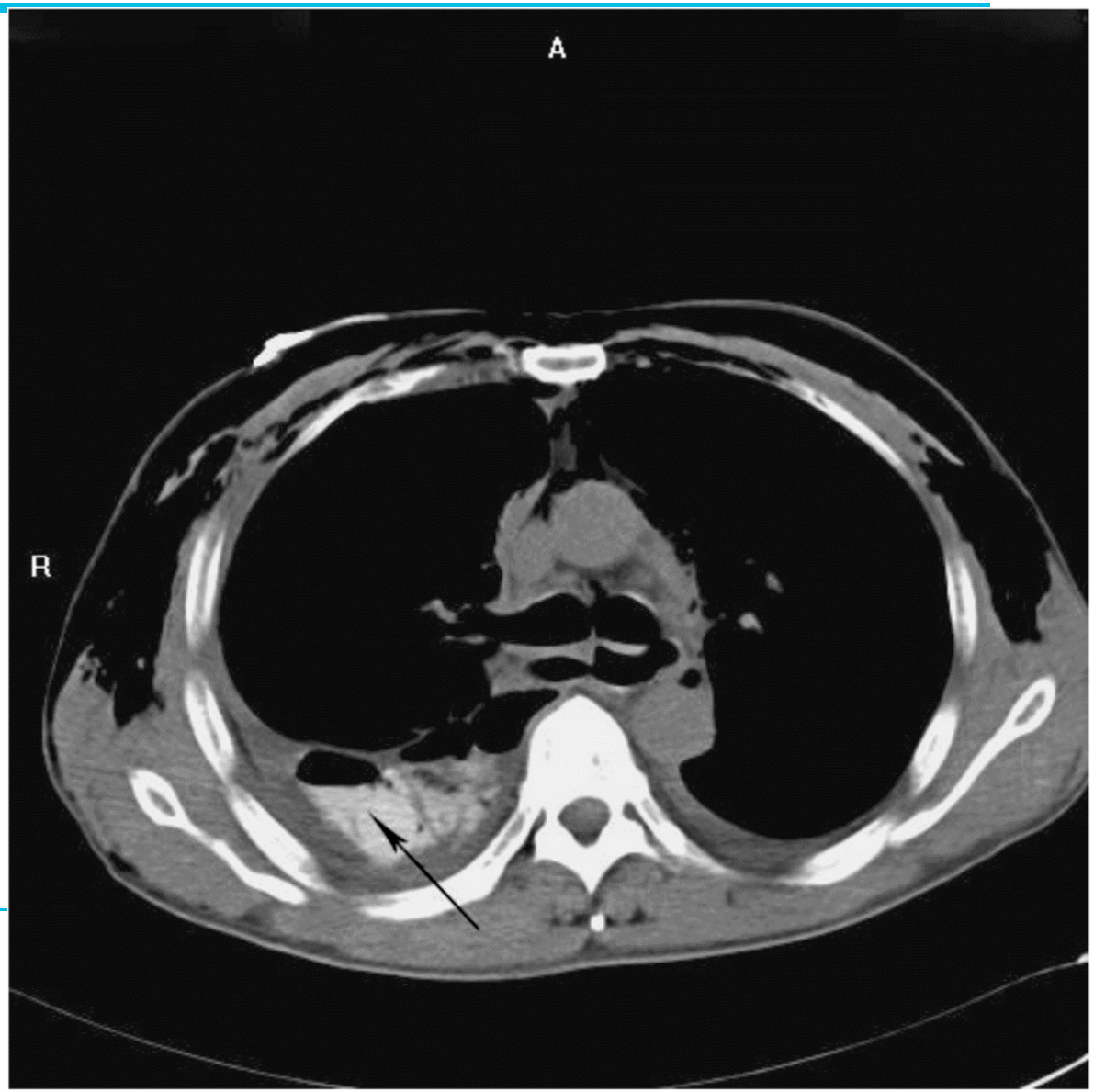


Barotraumatic Esophageal Perforation by Explosion of a Carbonated Drink Bottle.

Jae Bum Park et al.

The Annals of Thoracic Surgery

Volume 93, Issue 1, January 2012, Pages 315–316



Esophageal rupture caused by explosion of an automobile tire tube: a case report. Yongkang Yu, et al. *Journal of Medical Case Reports* 2013, **7**:211

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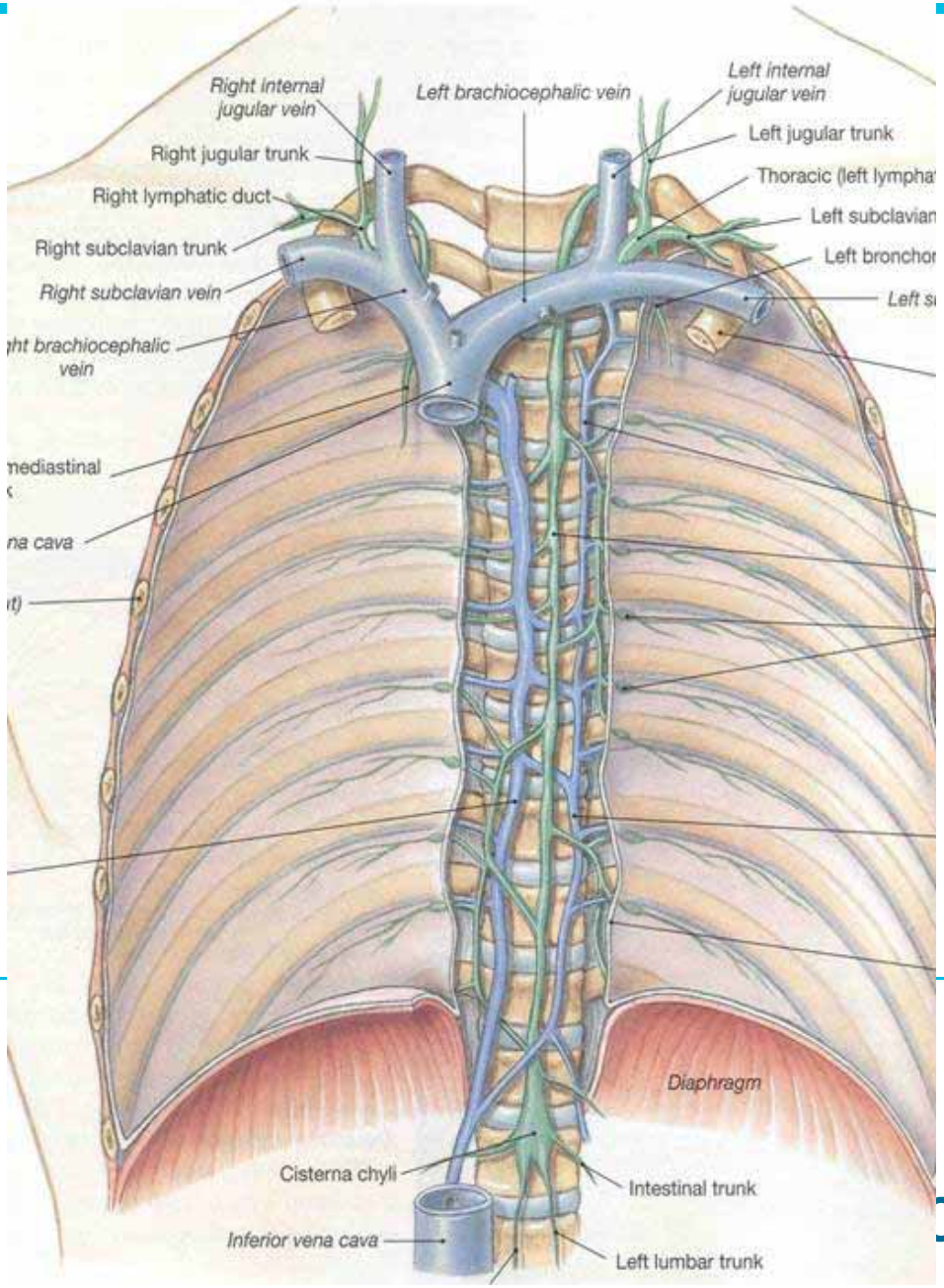
Anatomy Thoracic Duct



Thoracic duct

- **Causes**
  - Neoplastic
  - Traumatic
  - *Usually Penetrating*
  - *Iatrogenic*
  - CVL
  - Oesophagus resection
- ***Blunt***
  - Mostly hyperextention of the spine
    Just above diaphragm in the right thorax half
  - Seat belt injury
  - Miscellaneous
  - Congenital

Symptoms:

- Chylous pleural fluid
- *Milky*
- *Mixed with blood*
- *Yellow, green turbid*
- *triglycerid value > 110 mg.dl*
- *Chylomicrones (Sudan III)*
- *Lymphangiography*

- Late onset symptoms
- *Malnutrition*
- Chylothorax

Treatment

- Chest tube
- NPO
- Diet
- Nutritional support
- Surgical:
  - *VATS*
  - *Thoracotomy*
  - *Ligation Thoracic Duct*

Differential diagnosis broad mediastinum

- mediastinal widening of more than 8 cm: blood infiltrating normal mediastinal fat,
- downward displacement of the left main stem bronchus,: mass effect of the mediastinal blood
- upward displacement of the right main
- stem bronchus,
  obliteration of the contours of the aorta,
- obliteration of the aorto-pulmonary window,
- Displacement of the nasogastric tube or the tracheal tube to the right,
- left apical pleural widening (‘apical capping’): Mediastinal blood migrating to the pleural space will surround the left lung
- haemothorax and fractures of the chest wall

Mediastinum widening

- Traumatic:
  - aortic aneurysm, aortic dissection, aortic unfolding , aortic rupture
  - esophageal rupture
  - cardiac tamponade
  - pericardial effusion
  - Thoracic vertebrae fractures

- Non-Traumatic
  - hilar lymphadenopathy
  - anthrax inhalation - a widened mediastinum was found in 7 of the first 10 victims infected by anthrax
  - mediastinitis
  - mediastinal mass

Conclusion

- If they arrive alive they stand a good chance

- IF

- Correct interpretation of the forces involved
- High index of suspicion
- Low threshold for investigations