Chest Trauma

Epidemiology
80% MVA
Responsible for 25% trauma deaths (contributes to further 25%; abdo responsible for 10%; but abdo more important trt wise over anything over diaphragm)
90-95% blunt
5-10% mortality in isolated chest trauma

Grading
I: unilateral contusion, <1 lobe
II: unilateral contusion, 1 lobe; simple pneumothorax
III: contusion >1 lobe; air leak from distal airway >72hrs; non-expanding contusion
IV: 1Y branch intrapul BV injury; major air leak; expanding contusion
V: hilar BV injury
VI: total uncontained transection of pul hilum

Assessment
No pain/tenderness/auscultatory abnormality = 100% NPV for significant chest injury
Decr BS = 50-85% sens, 90% spec for haemothorax; percussion less sens
85% sens, 95% spec for pneumothorax

Investigation
CT chest:
Pros: more sens than XR at detecting lung contusion, pneumothorax, mediastinal haematoma, rib #’s; can do CT angiogram; non-invasive; cheap
CXR:
Pros: erect film can view haemathorax 200-300ml
Cons: supine film (mediastinum widened, may miss small haem/pneumothorax (800-1000ml needed); miss 50% ant/lat rib #’s
TOE:
Pros: can be done in resus, quick, minimally invasive, low complication rate
Cons: requires sedation, limited info on distal ascending aorta / aortic arch

Management
Thoracotomy required in 10% blunt trauma

When to stop resus
Irreparable injury (eg. blunt cardiac trauma)
Volume replacement not achieved within 15mins of thoracotomy
Heart in non-viable rhythm after 30mins

Indications for ED thoracotomy
Cardiac arrest + penetrating chest trauma (30% survival)
Likely to arrest before reaching OT + vital signs present in ED

Do L thoracotomy regardless of findings (extend to R if needed) - long ant 5th ICS incision - retractor
- release of pericardial tamponade (incise vertically in front of phrenic nerve)
- suture cardiac lacs, control bleeding lung tissue
- clamp descending aorta (if terminally hypotensive)
- internal cardiac massage
**Indications for OT thoracotomy**

Cardiac tamponade
Vascular inj at thoracic outlet
Massive air leak from IDC
Massive/continuing haemothorax
Mediastinal transversing penetrating injury
Oesophageal/tracheal/bronchial/great vessel injury

**Rib fractures**

Most common chest inj; uncommon in children; usually clinical diagnosis; 50% not visible on 1st CXR

*1st and 2nd*: severe trauma; ?neurovascular injury

*Middle rib*: compression force; assoc with pulm contusion

*Lower rib*: assoc with abdo/diaphragmatic inj

**Treatment**

Analgesia
Intercostal nerve block (bupivicaine 0.5% with 1:200,000 adrenaline, 2ml per segment, 20ml max, lasts 8-12hrs, block also level above and below; 1.5% incidence of pneumothorax per rib blocked; 1st-7th ribs and post ribs hard

Epidural if multiple lower rib #

decr mortality/pulm complications in elderly; complications = decr BP, masking abdo inj

Local chest wall strapping
Admit if: 3+ rib #, resp comorbidity, complications of #, IV analgesia needed, acopia

HDU/ICU if: >3 #, flail, elderly, resp comorbidities

**Sternal fracture**

Most commonly from MVA

1.5% incidence of arrhythmia due to contusion requiring treatment

Mortality <1%; incr risk if >65yrs, IHD, on digoxin

**Investigations**

CXR + ECG; sternal views of no help (site and degree of displacement has no prognostic significance)

Isolated # with no obvious CV sequalae doesn’t require further Ix

**Treatment**

Analgesia; deep breathing and coughing

Admit for cardiac monitoring if: CV instability, >65yrs, IHD, on dig, other criteria as per rib #

**Myocardial contusion**

Usually of no clinical significance

Can cause localised contusion or cardiac rupture (immediate/delayed 4-5/7)

Chest pain present in only 50%

VF on impact, delayed AF (delayed ventricular arrhythmia rare), non-sig arrhythmias (ectopics)

**Investigations**

Contusion excluded if normal trop and ECG at 8hrs

ECG: 95% sens for clinically significant contusion, 30% spec (ST elevation highly predictive)

Bloods: do trop (sens 90%, spec 20%) if abnormal ECG

TOE: assesses CO, anatomy outside heart; shows dyskinesis

Indications: evidence of decr CO, pericardial tamponade, new murmur

Coronary angiogram: if STE on ECG
**Treatment**
Admit for ECG monitoring if: prev IHD / AF, transmural AMI on ECG, haemodynamically significant arrhythmia/conduction defect, Inotropes, IVF

**Prognosis**
No long term sequelae in survivors; EF normalises in 3/12

**Flail chest**
Negative intrathoracic pressure develops during inspiration - flail moves inward - decr TV
Assoc with pulmonary contusion in 75%

**Treatment**
Analgesia
Ventilatory assistance for 2-3/52, but usually don’t need stat intubation
External fixation if severe

**Haemothorax**
Small <350ml
Medium 350-1500ml - diffuse incr opacity on supine CXR
Large >1500ml - ground glass appearance on supine CXR
USS = 90% sens, 95% spec; CT gold standard
CXR: erect can detect 200-300ml; supine can only detect 800-1000ml

**Treatment**
Large bore (28-32F) pleural catheter; may use suction (20 cmH20)

**Indication for thoracotomy**
Stable + blood loss >200ml/hr for >2hrs or >1500ml overall
Unstable + blood loss >100ml/hr for >2hrs or >1000ml overall
Indication for thoracoscopy: haemothorax failed to resolve after 3/7

**Pneumothorax**
Sucking chest wound = allows air to pass in AND out; will occur preferentially through this if opening >2/3 diameter of trachea - resp failure
In penetrating chest trauma, appearance of PTX on CXR may be delayed - rpt at 6hrs/12hrs

**Investigations**
CXR: up to 25% missed on initial CXR
Supine CXR: air will collect ant-inf-medial - etched diaphragm/mediastinum, deep sulcus sign
USS: use linear transducer, loss of sliding lung sign; >90% sens, >95% spec
  - Small - mid clavicular point or 4th IC space ant axillary line
  - Medium - mid axially line
  - Large - post axillary line

**Treatment**
If tension, finger thoracostomy better than needle (prone to occlusion) - then immediate chest drain
If IPPV and cardiac arrest - bilat pleural decompression
If IPPV + unequal AE + Sa <90% on 100% O2/SBP <100 despite IVF - immediate uni decompression
If sucking, immediate occlusive dressing taped on 3 sides then chest drain
If small, no haemothorax, no other significant inj, and IPPV unlikely - trt conservatively
If mod/large - do IDC, don’t do needle decompression
Pneumo-mediastinum

Investigations
CXR: air stripe, prominent heart border, dark line along superior surface of central diaphragm making it look continuous from L – R hemithorax
CT: >95% sens, 85% spec; indicated if suggestion of GI inj or decr LOC
Always investigate GI tract if penetrating inj

Management
Conservative; if tension – decompression at suprasternal notch

Pulmonary contusion
Due to blunt trauma/ GSW
Alveolar rupture, fluid into alveolar spaces - decr lung compliance (lowest at 3/7)
CXR and examination changes usually occur within 6hrs (can take 24hrs to develop)
If opacity becomes more circumscribed over days – 2/52, consider lung haematoma
Severe if >20% lung vol (80% develop ARDS, 50% develop pneumonia)
If IPPV, use low vol, low p techniques to avoid barotrauma
Usually recover over 3/52

Tracheo-bronchial injury
Rare
65% penetrating
Consider if pneumomediastinum, subC emphysema, persistent air leak from ICC, lung collapse, haemoptysis

Investigations
CXR: subC/mediastinal emphysema, pneumothorax, deviated ETT tip, distension/migration ETT balloon; bronchoscopy

Management
Primary closure

Diaphragm injury
Penetrating
L sided more common
CT (95% sens and spec), laparoscopy (100% sens)

Blunt
70% L sided
More common with lateral torso trauma
90% from MVA., 80% have abdo inj, 50% have pelvic #
33% mortality, 10% delayed diagnosis by 48hrs
50% present with delayed rupture - defect enlarges with time
Herniation of omentum, transverse colon, stomach, SI

Investigation
CXR: elevated hemidiaphragm, pleural effusion, lower rib #, diaphragm shadow doesn’t reach chest wall, hemithorax opacity and displacement of mediastinum despite ICC, gas/NG in bowel filled chest; collapse of lower lung fields; homogenous mass in hemithorax; displaced mediastinum away from inj
CT (50% sens for R, 78% sens for L); laparoscopy (90% sens); DPL (50% sens); MRI
**Gas embolism**

**Arterial**
Due to communication between pulm vessels and airways
Gas enters pulm vein when airway p > venous p
Usually due to penetrating trauma
Causes FND, air bubbles on fundoscopy, CV collapse after IPPV, gas in ABG's

**Pulmonary**
Iatrogenic from CVL insertion
Gas in heart - decr CO
Treat with 100% O2 and IVF

**Aortic injury**
Usually high energy inj; side impact incr risk
50% will have had episode of low BP; 30% have normal chest examination; 30% decr pulse p in legs

**Classification**
Intimal tear = intima only; tear = intima and muscularis (60% strength); rupture = complete
I = intramural haematoma, limited intimal flap
II = subadventitial rupture, altered shape of aorta
III = aortic transection with active bleeding/aortic obstruction with ischaemia

**Location**
65-90% in isthmus (prox descending, between origin L subclavian and attachment of lig arteriosum)
5-10% ascending aorta/arch (rapidly fatal)
10% distal
15% multiple sites

**Investigations**
CXR: supine CXR 90% sens, 30% spec; erect CXR 95% sens, incr spec
Wide upper mediastinum (90% sens, 10% spec; >8.5cm in supine film, >6cm in erect)
Blurring of upper descending aorta and L side of arch
Loss of aortic knuckle
Incr R paratracheal stripe >4mm, incr L paratracheal stripe >5mm
L apical cap
Massive haemothorax
Tracheal/oesophageal deviation (to R of T4 spinous process)
Depression L main bronchus;
CT chest angiography: 95% sens, 80% spec, NPV 99-100%
Aortic angiography: if mediastinal haematoma seen on CT, but no aortic inj
Transoesophageal echo: 100% sens, 98% spec; Cl if oesophageal inj; good if too unstable for CT

**Management**
Unstable (SBP <90) - OT (mortality >85%)
If stable + CAD/>55yrs/intimal tear only - conservative with control HTN as for dissection

**Prognosis**
85% pre-hospital death
If reach hospital, 85% survive 1hr, 70% 6hrs, 50% 24hrs, 25% 1/52, 10% 4/12
99% die without repair
Myocardial laceration and pericardial tamponade
Assoc with penetrating injury
Beck’s triad: Hypotension, decr HS, incr JVP
Suggested by PEA in absence of hypovolaemia or tension

Investigations
Echo (indication for ED thoracotomy if FAST +ive and SBP <70 unresponsive to IVF)

Management
Urgent surgical intervention; see indications for ED thoracotomy

Oesophageal perforation
Rare. Usually lower ⅓. Delayed diagnosis in ⅔
Associated with tracheal, T3-4 injuries
5% mortality, 25% infectious complications (mediastinitis)

Investigations
CXR - pleural effusion on L
Gastrograffin swallow (70% sens) or gastroscopy

Management
NG, Abx, acid suppression, OT (mortality related to time to OT)