RESUSCITATIVE THORACOTOMY

IT IS RARE THAT A PATIENT SURVIVE THIS HEROIC INTERVENTION

THE MECHANISM OF INJURY IS OF UTMOST IMPORTANCE

THE EMERGENCY PHYSICIAN MUST HAVE A SYSTEMATIC PLAN AFTER OPENING THE CHEST

INDICATIONS AND CONTRAINDICATIONS:

CHEST INJURIES (GENERAL POINTS):

- If a patient has a reasonable chance of survival but cannot tolerate a delay in operative intervention, then consider EDT
- The type of cardiac electrical activity is also helpful in determining who may benefit:
    - Survival improved if rhythm is VF, VT, or PEA
    - If asystole, idioventricular rhythm, bradycardia → outcomes are poor
- MECHANISM OF INJURY:
    - No blunt trauma patient survived EDT if there were no vital signs present in the field (Branney et al)
        - However, 2.5% survived if there were
    - Rhee et al reviewed 24 studies and 4620 cases of EDT → overall survival rate for blunt trauma was 1.4%
    - Penetrating trauma has better outcomes, but difficult to predict
        - Survivors often had CPR (ranging up to 15 minutes)
        - Some had asystole
- Survivors of EDT have good neurologic outcomes (92% neurologically intact in one study

CARDIAC INJURIES – PENETRATING:

- Stab wounds fare much better than GSW
- Wound size ≤1cm can lead to tamponade → greater than this → continue to bleed → better survival rates in those with tamponade

CARDIAC INJURIES – BLUNT:

- Most common cause of death is myocardial rupture (often with ascending aorta rupture)
- Those who survive EDT had vital signs in the field

PULMONARY INJURIES:

- THREE TYPES → parenchymal, tracheobronchial and large vessel
- Parenchymal and tracheobronchial injuries rarely need, either being rapidly fatal or treated initially by tube thoracostomy

AIR EMBOLISM:

- A complication of pulmonary parenchymal injuries and requires immediate thoracotomy

- Venous air well tolerated (up to 5-8mL/kg), arterial poorly tolerated (0.5mL in LAD can be fatal)
- Often missed
    - Consider if → haemoptysis or if arrest post intubation (positive pressure effect)
- EDT → flood lung with saline to look for small fistulae
- If survives → adjunctive therapy is HYPERBARIC

MAJOR VASCULAR INJURIES:
- Dismal prognosis, rarely survive

PENETRATING/BLUNT ABDOMINAL TRAUMA:
- CONTROVERSIAL
- Poor survival rates (even in penetrating)

OPEN CHEST RESUSCITATION (NON-TRAUMATIC ARREST):
- Better cardiac output
- Especially consider in setting of hypothermic arrest, rate of core rewarming can be as fast as 8C per hour.

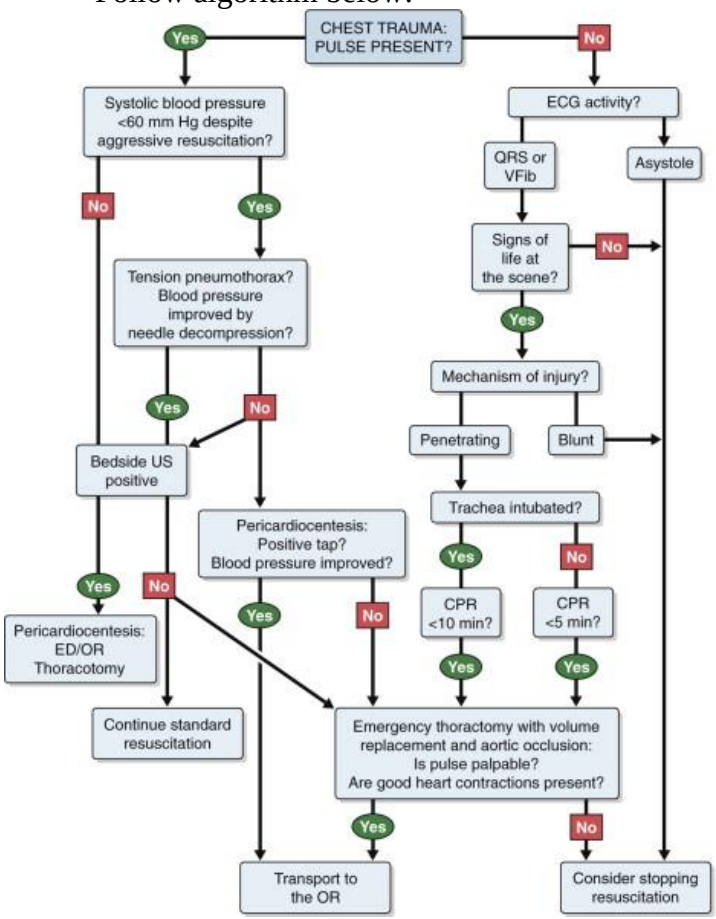
EQUIPMENT:

EVERY MAJOR TRAUMA CENTRE SHOULD HAVE THORACOTOMY TRAY, INCLUDING:
- Scalpel with 20 blade
- Mayo scissors
- Rip spreaders
- Gigli saw/trauma shears
- 2 tissue forceps
- Vascular clamps
- Needle holders
- Sutures
- Teflon patches (for pledglets)
- Aortic tamponade instrument
- Skin stapler

PROCEDURE

PRELIMINARY CONSIDERATIONS:
- EXCLUDE OTHER CAUSES OF SHOCK:
    - Tamponade
    - Tension
    - Air embolism
    - Neurogenic shock
- Airway control → selectively intubate right lung, as lung inflation can hamper resuscitation efforts
- If possible, pass an NG to aid in distinguishing aorta from oesophagus
- Adequate anaesthesia/amnesia, as patient can become aware during successful EDT

- Follow algorithm below:



ANTEROLATERAL INCISION:

- Wide exposure crucial
- Start 4th-5th intercostal space on right side of sternum and extend incision past the posterior axillary line
- Cut the intercostal muscles with scissors (just above the rib to avoid vascular bundle)
- First use your hands to open the chest cavity then place a chest wall retractor with ratchet bar directed down and open chest
- If the site of injury is not found, extend incision in to the right chest (using Gigli saw or trauma shears)

ONCE IN, WHAT CAN YOU DO?

PERICARDIOTOMY:

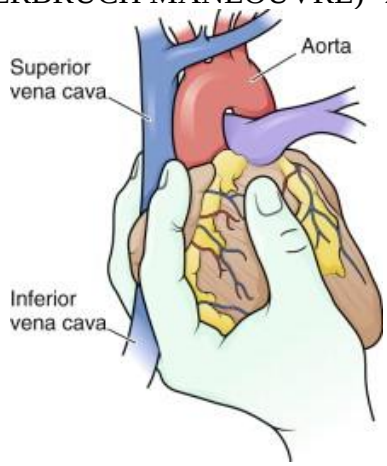
- To relieve tamponade
- Performed anterior and parallel to left phrenic nerve, beginning incision near the diaphragm
- Remove clots

DIRECT CARDIAC COMPRESSION:

- Two-handed technique best
- Avoid fingertip pressure
- Maintain normal anatomic position as able

CONTROL OF HAEMORRHAGIC WOUNDS:

- If ventricle bleeding → fingertip pressure
    - If heart not beating → close prior to resus and defibrillation
    - Can use staples or horizontal mattress sutures
    - Can occlude inflow to heart to make approximation of wound edges easier (SAUERBRUCH MANEOUVRE) → see figure below



    - Consider foley catheter for temporarily gaining haemostasis

CONTROL OF HAEMORRHAGIC GREAT VESSELS

AORTIC CROSS-CLAMPING:

- Limited role in controlling haemorrhage below the diaphragm, unless applied just prior to laparotomy
- The aorta can be very difficult to distinguish from the oesophagus in ED, especially when collapsed from exsanguination (NG can help)
- Potential complications:
    - Spinal cord, liver, bowel and renal ischaemia → infrequent
    - Exponentially worse outcomes after 30 minutes → intermittently release pressure as able

COMPLICATIONS:

- **Most complications relate to primary injury**
- SERIOUS INFECTION IS UNCOMMON → IV ANTIBIOTICS CRUCIAL
- Disease transmission to health care workers
    - Higher rates of HIV, HCV and HBV in trauma patients
    - Higher rates of needle stick injuries and broken ribs as portal of entry