

South West Paediatric Major Trauma Network

Severe Chest Injury in Children:

Guideline for Initial Management and Transfer



Authors:	A. Day, P. Davis, G. Haythornthwaite, J. Bareham, N. Adams, M. Lyttle
Approved by:	South West Paediatric Trauma Network
Date Approved:	November 2019
Date for Review:	November 2021

RECOGNITION:

**Any child < 16y with evidence and/or suspicion of significant chest trauma
And signs of respiratory compromise**

A Maintain airway with C-spine control (Manual In-Line Stabilisation)
Jaw thrust, oropharyngeal airway if required
Consider intubation as appropriate (use local checklist)

B High flow oxygen 15L/min via face mask
Assessment for evidence of:

- Tension pneumothorax
- Massive haemothorax
- Open pneumothorax
- Flail chest

If evidence of tension pneumothorax with severe respiratory compromise or haemodynamic instability, decompress before imaging
If evidence of open pneumothorax, apply vented/ported chest seal dressing if chest drain insertion and wound closure delayed

Consider chest XR +/- US for first line imaging
CT chest required (with contrast if suspected vascular injury)

If ventilated: Use lowest FiO₂ to achieve SpO₂ ≥95%

C Treat hypovolaemia

- At least two IV/IO access sites; consider arterial line
- Consider blood loss possibilities—chest as above, abdomen, pelvis, long-bones, external
- Consider possibility of cardiac tamponade, aortic injury, or spinal shock
- For penetrating trauma, consider early resuscitative thoracotomy
- If bleeding suspected, tranexamic acid 15mg/kg (max. 1g)
- Treat with warmed 10ml/kg 0.9% saline / plasmalyte or packed red cells if available
- Consider use of rapid transfuser
- For massive haemothorax, concurrent transfusion if draining

D Assess & document neurology, including pupil size + reactivity and GCS, prior to any RSI

E Maintain normothermia (36-37°C)
Check glucose (aim ≥ 3mmol/l)

OBJECTIVES

- Early diagnosis: immediate primary survey
- Imaging
- Decompression + chest drain if required
- Thoracotomy if indicated

CHEST DECOMPRESSION (THORACOSTOMY)

- Analgesia and sedation
 - Confirm side, bilateral procedure if any doubt
 - Locate 5th intercostal space (above 6th rib), mid-axillary line
 - Chloraprep, gloves (sterile if time)
 - 4cm incision along line of intercostal space, just above rib below
 - Blunt dissection through subcutaneous tissue with controlled puncture of parietal pleura
 - Finger sweep if space allows and reassess
 - Consider vented/ported chest seal dressing
- CHEST DRAIN INSERTION and RESUSCITATIVE THORACOTOMY guidance overleaf**

RAPID SEQUENCE INDUCTION

Use local RSI checklist
Suggested Induction: Ketamine 1-2 mg/kg +/-
Fentanyl 1-3 micrograms/kg
Muscle relaxant: Rocuronium 1-2 mg/kg
Monitor for and treat hypotension promptly (see C)

COMMUNICATION On recognition contact:
Paediatric Trauma Team Leader (Consultant ED PMTC)
Call: 0300 0300 789, choose Option 2
PTTL can conference-call:

- On-call surgical registrar/consultant
- WATCh Transport Team

Ensure that images transferred urgently to PMTC at Bristol Royal Hospital for Children (UH Bristol)

TRANSFER

Senior clinician and assistant (nurse/ODP) appropriately trained to safely transfer children
Use transfer checklist / trolley / bags
Call early for transport either by road or air
(BRI helipad open 7am - 7pm)
Contact PTTL (0300 0300 789) when 15 minutes away

BLOOD INVESTIGATIONS

FBC, Coagulation, U&E, Blood glucose, VBG /ABG
Cross match on arrival at PMTC (2 separate samples)

South West Paediatric Major Trauma Network

Severe Chest Injury in Children:

Chest Drain Insertion and Thoracotomy Guideline

TRAUMA CHEST DRAIN INSERTION—Required if significant traumatic pneumothorax, haemothorax or thoracostomies present

KIT LIST

- Sterile gloves
- Chloroprep x 2
- Lidocaine 1%
- Dressing pack
- Sterile gown and drapes
- Scalpel
- Artery forceps
- Suture kit + sutures
- Chest drain
- Chest drain bottle and tubing
- Sterile water

LIDOCAINE DOSING

- Maximum dose 3mg/kg
- 1% = 10mg/ml
- 2% = 20mg/ml

DRAIN SIZE

Maximum chest drain size = 4 x endotracheal tube (ETT) diameter
[Uncuffed ETT diameter = (Age/4) + 4]

PROCEDURE (use local LOCCSIP process)

Analgesia given
Indication and radiology reviewed, side of procedure confirmed
Consent and check allergies if able, check platelets/clotting if available
Select correct size of drain (see above)
Rapid skin prep followed by local anaesthesia (see below left)
Blunt dissection thoracostomy as described in “Initial management” (consider using pre-hospital thoracostomy for drain access with appropriate antibiotic cover)
Use gloved finger (or forceps if intercostal space too small) to keep tract to pleura open
Advance chest drain tube into pleural space during expiration
Ensure tube is in pleural space (listen for air movement and observe for fogging of tube), ensure all holes to distal tube are within thoracic cavity
Connect chest drain tube to an underwater seal
Suture drain in place, secure with mesentery-style dressing, reassess patient including CXR

RESUSCITATIVE THORACOTOMY (“Clam shell”)

INDICATION

- Last resort in patients with severe traumatic injuries in or distal to the thorax
- Cardiac arrest following penetrating chest/abdominal trauma with loss of output within the last 15 minutes
- Decision to proceed made by Trauma Team Leader

AIMS

- Drain cardiac tamponade
- Control significant intra-thoracic haemorrhage
- Repair significant cardiac lesion
- Apply pressure to the aorta to control distal haemorrhage

KIT LIST

- Scalpel
- Scissors
- Large forceps
- Gigli saw (if available)

PROCEDURE

Using scalpel and blunt forceps make bilateral 4cm thoracostomies in 5th intercostal spaces, mid axillary line (if tension pneumothorax decompression at this stage causes return of cardiac output, stop procedure)

Insert 2 fingers into thoracostomy to protect lung whilst cutting through the chest wall towards the sternum with heavy scissors

Perform this bilaterally leaving only a sternal bridge between the two extended thoracostomies

Cut through sternum using heavy scissors (or Gigli saw, if available)

Open the clamshell using one or two self retaining retractors / rib spreaders (if none available use assistants), ensure wide enough to allow access to thoracic structures

Lift the pericardium with forceps and make a large midline longitudinal incision using scissors (avoid phrenic nerve)

Evacuate blood and clots, look for sources of bleeding

Cardiac lacerations: <1cm, occlude with finger or gauze; >1cm, consider placing Foley catheter through the hole, inflate and gently pull back; consider attempting sutures with pledgets if bleeding not controlled (care regarding coronary arteries)

Internal cardiac massage if required

Transfer to theatre for definitive operative management (including from TU to PMTC)

