Thoracic Trauma

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Document control

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These guidelines are intended for use by trained medical and nursing staff within the South West London and Surrey trauma network. They provide guidance for the management of major trauma patients with thoracic trauma injuries and should be used in conjunction with ATLS/ETC principles and local Trust policies, including local chest drain, analgesia, major hemorrhage and transfer protocols.

These guidelines do not replace clinical judgement or the need for early senior involvement where there is physiological instability, diagnostic uncertainty or concern about clinical deterioration.

Scope

- Thoracic injury assessment and initial management
- Transfer to the Major Trauma Centre (MTC)
- Local management of chest injuries in Trauma Units
- Chest drain insertion and drain escalation criteria
- Guidance for resuscitative thoracotomy

Thoracic injury assessment and initial management

Initial assessment and management should follow ATLS and European Trauma Course principles, using an ABCDE approach and early recognition of immediately life-threatening chest injuries.

Immediate life threats to identify and treat during the primary survey

- Tension pneumothorax
- Massive haemothorax
- Open pneumothorax
- Flail chest with ventilatory compromise
- Cardiac tamponade
- Major airway injury or severe pulmonary contusion with respiratory failure

Trauma teams in Trauma Units should be led or directly supervised by an appropriately senior physician or surgeon, ideally a consultant or equivalent senior decision-maker. A senior clinician must be immediately available for invasive procedures, escalation decisions and transfer discussions.

Chest drain insertion and resuscitative thoracotomy should only be undertaken by clinicians with the relevant training and competence, or under direct supervision, except where a time-critical life-saving intervention is required and no competent clinician is immediately available. Local out-of-hours arrangements should specify who provides this support.

Transfer to the Major Trauma Centre

Polytrauma patients should be assessed and transferred according to the Network Secondary Transfer Protocol. The initial point of contact should be the Trauma Team Leader at the MTC. Thoracic surgery advice should be sought early when chest wall injury severity, ventilation, pain control or haemorrhage may influence transfer or operative planning.

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Patients who may require transfer or urgent MTC discussion

- Bilateral rib fractures or more than 4 unilateral rib fractures, particularly with increasing age, frailty, anticoagulation, oxygen requirement, pulmonary contusion, poor pain control or ventilatory compromise.
- Flail segment or clinical flail chest, with or without pulmonary contusion.
- Significantly displaced rib fractures with chest wall instability, mechanical failure or failure of analgesia/ventilation.
- Sternal fracture with significant displacement, retrosternal haematoma, suspected blunt cardiac injury, moderate/severe pain or associated chest wall injuries.
- Persistent air leak or suspected tracheobronchial injury.
- Large-volume haemothorax, retained haemothorax or ongoing blood loss after chest drain insertion.
- Diaphragmatic injury or suspected diaphragmatic rupture.
- Any thoracic injury associated with physiological instability or escalating respiratory support.

Risk tools such as STUMBL/Battle score may be used to support escalation decisions, particularly in elderly, frail or comorbid patients, but should not override clinical concern.

Haemothorax escalation thresholds

Consider urgent thoracic/MTC discussion and major haemorrhage escalation for haemodynamic instability, a large haemothorax on imaging, initial chest drain output of approximately 1500 mL, or continuing blood loss of approximately 200 mL/hour for 2-4 hours. Lower thresholds may be appropriate in frail, anticoagulated or deteriorating patients.

Management in the Trauma Unit

When to discuss with thoracic surgery at St George's

The following should be discussed with the thoracic team at St George's. Contact first by bleep, then email full details to confirm in writing.

- Bleep: 7129
- Email: thoracic@stgeorges.nhs.uk
- If no response is received within the locally agreed time frame, escalate via the St George's switchboard, MTC Trauma Team Leader or on-call thoracic surgery pathway.

Discussion with the thoracic team should not delay admission to a Trauma Unit when local admission criteria are met and the patient can be safely managed while advice is being sought.

Injuries or clinical features for thoracic discussion

- More than 4 rib fractures, bilateral rib fractures or a high-risk rib fracture score.
- Flail segment or chest wall instability.
- Significantly displaced rib fractures, especially if associated with deformity, severe pain or ventilatory compromise.
- Pulmonary contusion or lung laceration.
- Haemothorax or pneumothorax requiring chest drain.
- Diaphragmatic injury.
- Poor ventilation or increasing oxygen requirement with chest injury.
- Sternal fracture with displacement, retrosternal haematoma, moderate/severe pain or associated chest wall injuries.
- Persistent air leak, retained haemothorax or failure of expected progression.

Discussion with the thoracic team at St George’s should not be a condition of admission to a trauma unit for patients with injuries less severe than those listed above.

Re-contact thoracic surgery if

- No clinical progression or delayed recovery.
- Poor or escalating pain despite multimodal analgesia.
- Deterioration in physiology, oxygen requirement, respiratory mechanics or imaging.
- Persistent poor ventilation, secretion retention or inability to cough effectively.
- Ongoing drain output, persistent air leak or suspected retained haemothorax.

Local ward, Level 1 and escalation principles

Patients should be admitted under the appropriate local surgical/trauma team with early anaesthetic and pain team involvement. The place of care should be based on injury burden, physiology, analgesia requirements, age, frailty and nursing/monitoring capability.

- Minimum Level 1 monitoring is appropriate for patients requiring frequent observations, high-flow oxygen or escalating analgesia, and should include oxygen saturation monitoring, respiratory rate, early warning score, pain score, ability to cough and mobilise, and consideration of capnography when opioid burden or sedation risk is high.
- Some stable patients with mild injury burden, good pain control, normal ventilation and low frailty may be managed on a surgical ward with clear escalation triggers.

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- Continuous cardiac monitoring should be considered for significant sternal fracture, suspected blunt cardiac injury, abnormal ECG/troponin, arrhythmia, hypotension or significant retrosternal haematoma.
- Escalate urgently for increasing oxygen requirement, rising respiratory rate, hypercapnia, poor cough, secretion retention, delirium, inability to mobilise, uncontrolled pain or deterioration in imaging.

Clinical management

- Clinical assessment with appropriate imaging, usually CXR and/or CT according to local and network trauma imaging protocols.
- Oxygen delivery or ventilatory assistance as needed, with early anaesthetic/critical care input if ventilation is deteriorating.
- Multimodal analgesia with regular assessment of pain at rest, deep breathing and coughing.
- Early pain team referral for patients with multiple rib fractures, high pain scores, poor cough, frailty or escalating opioid requirement.
- Regional analgesia options may include erector spinae plane catheter, paravertebral catheter or thoracic epidural, depending on local expertise, injury pattern, anticoagulation status and contraindications.
- Interventions to maintain ventilatory function, including chest drain where indicated.
- Regular chest physiotherapy, supported coughing, secretion clearance and early mobilisation.
- Consider respiratory physician input for persisting oxygen requirement, pulmonary comorbidity, pneumonia risk or admission beyond 48 hours.
- Involve elderly care physicians for patients over 70 years or with high frailty scores.
- Trauma Units should have local rib fracture guidance including access to pain teams, regional anaesthesia, physiotherapy and escalation routes.

Surgical stabilisation of rib fractures (SSRF)

Consider early discussion with the MTC thoracic/chest wall team for selected patients who may benefit from fixation. Typical triggers include flail segment, displaced fractures with chest wall instability, mechanical failure, failure of analgesia or ventilation, retained haemothorax requiring operative management, or inability to wean from ventilatory support. Early review is preferable where fixation is being considered.

Sternal fracture and suspected blunt cardiac injury

Patients with significant sternal fracture, retrosternal haematoma, arrhythmia, hypotension, cardiac symptoms or concerning mechanism should have ECG and troponin according to local blunt cardiac injury guidance. Echocardiography should be considered if there is haemodynamic instability, abnormal ECG/troponin, suspected structural cardiac injury or significant retrosternal haematoma.

Intercostal chest drain

Chest drain insertion is a high-risk procedure. Practice has changed in recent years, with more injuries managed conservatively where safe and a move away from large-bore drains for all indications. Trauma indications differ from elective pleural disease practice: consider image-guided Seldinger drains for selected pleural fluid/air and surgical/open trauma drains where haemothorax, clot, major air leak or urgent decompression is suspected.

Chest drain insertion should take place after discussion with, and under the supervision of, a senior doctor unless immediate life-saving decompression is required. Local chest drain policies and current national pleural procedure guidance should be followed.

Chest drain insertion is associated with significant risks. The NPSA rapid response report following deaths and serious harm relating to chest drain insertion highlighted the need for competence, supervision, ultrasound guidance for fluid where appropriate, local guidance, training leads, consent where possible, incident review and reporting.

Minimum procedural standards

- Confirm indication, side and urgency; use a WHO/local procedure pause where feasible.
- Obtain written consent where possible; recognise that this may not be feasible in emergency situations.
- Ensure adequate analgesia, local anaesthesia and monitoring. Intravenous opioids should be carefully titrated to avoid respiratory depression. Ketamine may be useful where analgesic and sedative effects are required and locally supported.
- Use ultrasound guidance strongly when inserting a drain for fluid where time and clinical context allow.
- Document indication, technique, drain size, site, immediate output, complications, post-procedure imaging, ongoing drain plan and escalation triggers.
- Obtain post-procedure CXR or CT confirmation according to local policy and clinical context.
- Ensure clear nursing instructions for drain observations, swinging/bubbling, suction if used, output volumes and when to call a doctor.

More resources: Chest Drain Insertion: A practical guide - RCEMLearning. Local Trust guidance should remain the primary procedural standard for staff working in each hospital.

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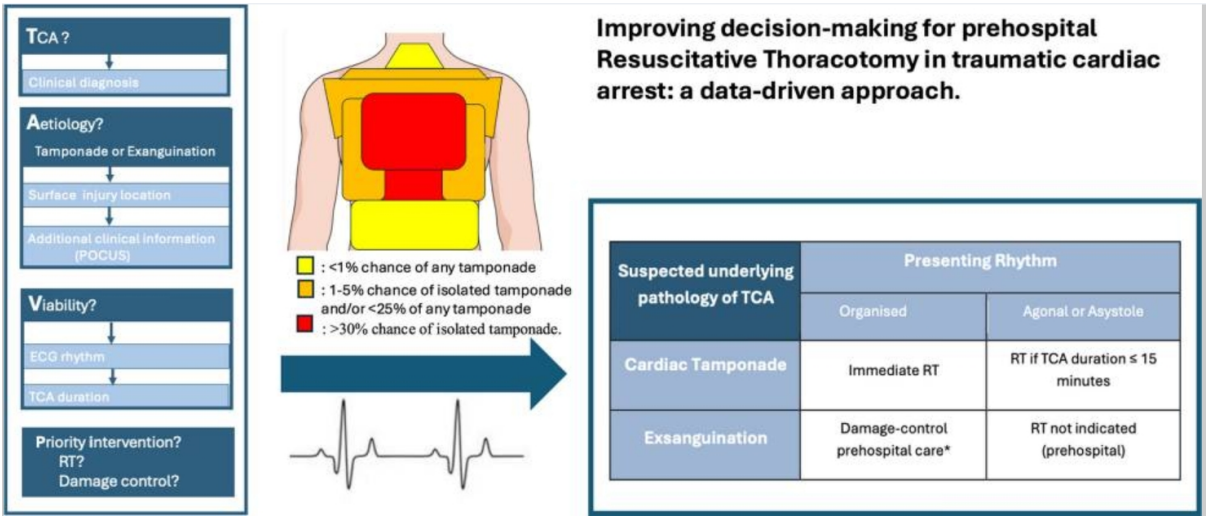
Resuscitative thoracotomy

Resuscitative thoracotomy is an infrequent, high-risk, time-critical intervention. Indications and decision-making should be separated into pre-hospital, ED/Trauma Unit and MTC settings and must reflect local capability, immediate senior support, equipment and transfer arrangements.

Recent London Air Ambulance data support careful patient selection. The decision should consider mechanism, time from arrest, presenting rhythm, witnessed signs of life, suspected tamponade versus exsanguination, and whether definitive damage-control surgery or blood component resuscitation is the priority.

This decision tool helps with deciding if a resuscitative thoracotomy is indicated.



General principles

- Suspected traumatic cardiac tamponade after penetrating chest trauma with very recent arrest is the classic scenario in which resuscitative thoracotomy may be beneficial.
- If the cause of arrest is exsanguination, aggressive blood component transfusion and damage-control surgery are generally indicated rather than thoracotomy alone.
- Blunt traumatic cardiac arrest has a much lower survival rate and should only be considered in highly selected circumstances with appropriate expertise and local policy support.
- Resuscitative thoracotomy should only be attempted where trained personnel, equipment, blood products, airway/anaesthetic support and an immediate route to definitive care are available.
- Patients who receive resuscitative thoracotomy and achieve return of spontaneous circulation require urgent expert transfer to the MTC with pre-alert to the TTL.

Contacts and escalation

A pre-hospital critical care team has significant expertise in this area and should be contacted early where traumatic cardiac arrest or peri-arrest physiology is present, both services are available 24 hours a day.

> London's Air Ambulance: Confirmed or strongly suspected traumatic pericardial effusion/tamponade AND/OR Unstable patients with uncontrolled traumatic major haemorrahage (CODE RED) Raise LAS IFT request - ‘HEMS REQUESTED’ via 0203 162 7525 OR 999. **For TUs in London only**
> Air Ambulance Kent Surrey Sussex: HEMS dispatch desk 0300 123 5811 or 0782 798 2152 - verify numbers before final governance approval. **For TUs in Surrey only**

The St George's MTC TTL should also be contacted for advice and guidance.

The RCEM position statement on resuscitative thoracotomy should be referenced in local guidance and used alongside network policy.

Training and simulation

Each Trauma Unit should ensure that suitable clinicians have access to training in resuscitative thoracotomy through HALO training days, Code Red Trauma, cadaveric resuscitation courses or similar. Team simulation for traumatic cardiac arrest, massive transfusion, chest decompression and transfer should occur regularly.

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References and sources to verify before final governance sign-off

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- Ter Avest E, Kocierz L, Alvarez C, Hurst T, Ballard D, Lockey DJ, Christian MD, Perkins ZB. Improving decision-making for prehospital Resuscitative Thoracotomy in traumatic cardiac arrest: a data-driven approach.
- RCEM. Resuscitative thoracotomy position statement.
- RCEMLearning. Chest Drain Insertion: A practical guide.
- Current local Trust chest drain, rib fracture, analgesia/regional anaesthesia, major haemorrhage and transfer protocols.

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