

This guidance covers;

- **Tube thoracostomy insertion**
- **Blunt chest pain management**
- **Rib fixation guidance**
- **Criteria for referral to cardiothoracic services**

Background

Thoracic trauma is believed to be the primary cause of death in 25% of all trauma deaths, and a significant contributing factor in a further 25-50%. Whilst such casualties are also likely to have other significant and possibly life-threatening injuries, it is essential that these injuries are identified as rapidly as possible, and life-saving procedures performed emergently to save the casualty's life.

It is not acceptable for a casualty to die from hypoxia or cardiovascular collapse resulting from pathology caused by trauma that can be treated emergently. Less than 10% of blunt trauma and 15-30% of penetrating trauma requires operative intervention; up to 85% of thoracic trauma could be treated by Trauma Physicians/Surgeons using techniques that are now well-established and taught on Trauma Life Support Courses (like the Advanced Trauma Life Support Course and the European Trauma Course).

Traumatic pneumothorax and traumatic tension pneumothorax, as well as haemothorax, are potentially immediately life-threatening as a result of their effects on the lungs and cardiovascular system. Early recognition of these injuries, by clinical or radiological/sonographic means, could ensure immediate treatment and thus prevent further deterioration in the clinical course. Traumatic pneumothorax, tension Pneumothorax and haemothorax, are pathologies which can be treated by means of pleural decompression, using needle thoracocentesis, finger thoracostomy and/or chest tube thoracostomy. These procedures have a significant risk of morbidity and mortality if performed poorly, and must therefore be performed only when indicated, and either by an experienced and competent Trauma Team member, or under direct supervision.

Whilst tube thoracostomy is undoubtedly a life-saving procedure, it is also associated with significant risks. In 2008, the NPSA issued a rapid response report following reports of 12 deaths and 15 cases of serious harm relating to chest drain insertion between 2005 and 2008. The report made the following recommendations:

- Chest drains only inserted by staff with relevant competencies and adequate supervision
- Ultrasound guidance strongly advised when inserting a drain for fluid
- Clinical guidelines are followed and staff made aware of the risks
- Identify a lead for training of all staff involved in chest drain insertion
- Written consent obtained from patients before the procedure, wherever possible
- Local incident data relating to chest drains reviewed
- Staff encouraged to report further incidents

Admittedly some of these recommendations are not wholly relevant in the context of this policy. Trauma teams in the MTC and TU should always be led by a senior physician/surgeon, ideally of Consultant level, and as such should always have the required expertise available during insertion. These procedures are generally required as an emergency in critically-unwell patients and cannot therefore be postponed. Written consent is often not possible in major trauma patients, though verbal consent is advisable if possible.

Chest drain insertion is a core competency expected of doctors doing core accident and emergency, anaesthetic, intensive care, medical, radiology, respiratory and surgical training. All doctors expected to be able to insert a chest drain should be trained using a combination of didactic lecture, simulated practice and supervised practice until considered competent. There is a hierarchy of competencies; see Appendix 1. All incidents, accidents or near misses related to the insertion and management of chest drains should be reported through the Trust Incident reporting system and reviewed by appropriately trained staff.

Tube Thoracostomy Insertion

Indications

Pneumothorax (simple and tension), haemothorax

Equipment for tube thoracostomy
Local anaesthetic, needle and syringe Skin cleansing solution Surgical drapes Artery forceps Scalpel Appropriately sized chest drain Suture Dressing Underwater drainage system correctly assembled.

Procedure

1. If conscious inform patient of procedure and obtain verbal or written consent as able. If patient is not able to consent document senior clinician making best interests decision.
2. Ensure IV access has been secured. If massive haemothorax is suspected ensure blood products are available
3. Confirm correct side for insertion and identify safe insertion site.
 - a. Fully abduct the patients arm to allow a clear approach to the axilla and lateral chest wall
 - b. Drain should be inserted in the “safe triangle” (see figure1)
 - c. If trained, and immediately available, use sonography to confirm the correct site for insertion.
 - d. When sonography is not available or possible identify the sternal angle and the medial end of the 2nd costal cartilage. Count down to the 4th or 5th ICS and make a mark 1 cm anterior to the mid axially line.

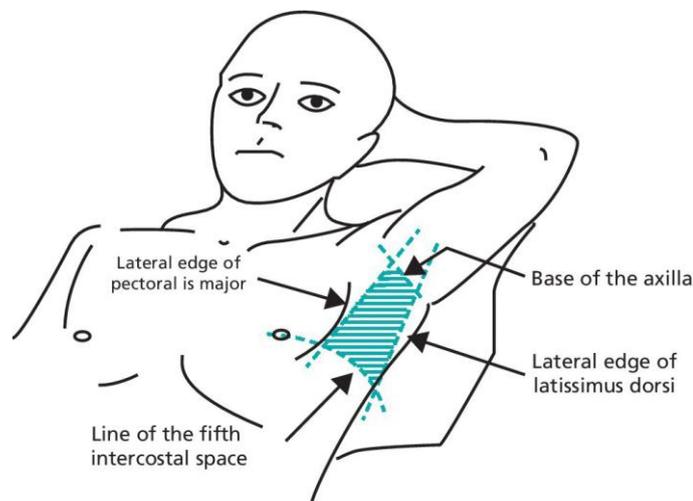


Figure 1 – safe triangle for tube thoracostomy insertion

4. Clean area fully and apply sterile drapes
5. If patient is conscious, infiltrate with local anaesthetic and consider systemic analgesia
6. Make a 3-5 cm incision along the line of the rib
7. Use blunt dissection to reach the pleura. As the neurovascular bundle runs along the lower boarder of the rib, dissect over the superior boarder of the lower rib
8. Pierce the pleura using artery forceps
9. Insert a finger into the pleural cavity and sweep around the space to detect any adhesion (or bowel in the case of ruptured diaphragm). Take care in presence of rib fractures.
10. Direct the chest drain into the pleural cavity using an artery forcep/clamp through the distal side hole in the drain.
11. Connect drain to underwater drainage system. Swinging, bubbling or the presence of blood confirm placement in the pleural cavity.
12. Secure the chest drain using sutures and an appropriate dressing
13. Re-examine the patient following insertion to assess for improvement or deterioration

14. Chest radiograph is required not only to confirm the position of the tip, but also to ensure that all the drain holes are within the pleural cavity: if one or more chest drain holes are outside of the pleural cavity, the drain will need to be reinserted as otherwise air/fluid will leak into the chest wall tissue, and result in severe emphysema. The chest drain should not simply be pushed in but should be replaced all together so as not to increase risk of infection; the same chest wall hole can be used however, following appropriate cleaning and draping of the site.

Post tube thoracostomy care

1. Patients with chest drains should be managed on wards familiar with chest drains and their management.
2. Drains should be checked daily for signs of wound infection, fluid drainage volumes and documentation for swinging and/or bubbling.
3. Accurate daily recordings of the drain and bottle readings, any changes instituted to the drain and any microbiological swabs taken should be documented appropriately on a dedicated chest drain chart.
4. Any concerns regarding the drain should be escalated to an appropriate clinician

For more information please see link to the British thoracic society guidance:

[Pleural procedures and thoracic ultrasound: British Thoracic Society pleural disease guideline 2010 | Thorax \(bmj.com\)](#)

Blunt Chest injury – Pain management

Blunt thoracic trauma with rib fractures accounts for a large proportion of trauma patients in the United Kingdom. Rib fractures are commonly associated with underlying pulmonary injury and therefore, patients with rib fractures are at an increased risk of adverse outcomes. Good analgesia is essential in all patients to reduce the risk of chest infections and morbidity.

Patients can have radiographic rib fractures or “clinical” rib fractures (significant pain with no radiologic abnormality). All patients should have an initial assessment of their level of pain and an appropriate analgesia regimen commenced

The management should aim to achieve a patient who is able to cough; move and can take deep breaths. In all patients requiring admission, regular analgesia should be prescribed.

On initial assessment respiratory co-morbidities should be considered - underlying COPD, for example, may influence threshold for regional anaesthesia. Chronic opioid use and cardiovascular disease may also influence choice of analgesic regimen.

1. Rib fractures confirmed
Document site and number of rib fractures along with any other findings

2. Start multimodal analgesia		
Adult patients	Adults >65 years	Renal impairment (eGFR<30)
Initial STAT IV morphine 1-10mg to achieve pain control (repeated as required)	Initial STAT IV morphine in 1-5mg to achieve pain control (repeated as required)	Initial STAT IV morphine 1-5mg to achieve pain control (repeated as required)
Paracetamol 1g PO/IV QDS (if weight <50kg IV dose at 15mg/Kg)	Paracetamol 1g PO/IV QDS (if weight <50kg IV dose at 15mg/Kg)	Paracetamol 1g PO/IV QDS (if weight <50kg IV dose at 15mg/Kg)
Ibuprofen 400mg PO TDS add PPI	Ibuprofen 400mg PO TDS add PPI if no contra-indications	Avoid NSAIDS
Immediate release Oral Morphine sulphate liquid (oramorph) 5-10mg QDS	Immediate release Oral Morphine sulphate liquid (oramorph) 5-10mg QDS	Oxycodone immediate release (oxynorm) 2.5-5mg QDS
Immediate release Oral Morphine sulphate liquid (oramorph) 10mg PO PRN 4 hourly	Immediate release Oral Morphine sulphate liquid (oramorph) 5mg PO PRN 4 hourly	Oxycodone immediate release (Oxynorm) 2.5mg PO PRN 4 hourly
Laxatives prescribed regularly	Laxatives prescribed regularly	Laxatives prescribed regularly
Antiemetics prescribed PRN	Antiemetics prescribed PRN	Antiemetics prescribed PRN

3. Assess risk	
Rib fracture score:	
BREAKS – total number of breaks (not number of ribs effected) SIDES – unilateral = 1, bilateral = 2 AGE factor <50 = 0 51-60 = 1 61-70 = 2 71 -80 = 3 >80 = 4	(Breaks x sides) + age factor = Rib fracture score
Risk factors for morbidity:	
<ul style="list-style-type: none"> Pulmonary contusion Current smoker Cardiovascular disease 	<ul style="list-style-type: none"> Frailty Obesity Presence of distant injuries
Early review for HDU/MTC transfer if:	
<ul style="list-style-type: none"> Flail chest > 3 displaced rib fractures > 65 years old 	<ul style="list-style-type: none"> Chest wall deformity CT/CXR with >25% lung volume loss NIV/ventilator dependent
Commence appropriate pathway	
Rib fracture score 0-5 If score 0-5 and no other risk factors present consider if discharge with analgesia and chest injury advise is appropriate. If not follow non invasive pathway	Rib fracture score > 6 or high risk for morbidity If score >6 or other high risk factor present consider escalation to invasive pathway.

Non invasive pathway

1. Admit to appropriate ward

- Monitor oxygen saturations (SpO₂)
- Baseline VBG/ABG, repeat as required
- Assess pain severity using dynamic pain scoring, pain on movement, deep breathing and cough, minimum of 4 hourly.

2. Start respiratory support

- Encourage to sit upright and mobilise early where possible
- Provide supplemental oxygen at the lowest concentrate to achieve appropriate SpO₂
- Oxygen should be humidified where possible
- Consider Prescribing NaCL 0.9% 10ml nebulisers 4 hourly as required to assist expectoration
- Consider prescribing Salbutamol 2.5-5mg nebulised as required

3. Confirm analgesia is prescribed and **titrate** as required

- Commence multimodal analgesia as per page 1.
- **Contact pain team** if pain remains uncontrolled.
- Consider IV PCA Morphine/Fentanyl.
- Consider Gabapentin if features of neuropathic pain present.
- Daily pain review documented

4. Commence physiotherapy on admission

- Supported cough
- Active cycle of breathing technique with huff hourly
- Upper and lower limb exercises
- Sitting in chair daily

5. Regular reassessment and titration of therapy

SpO ₂ / PaO ₂ improving/stable Oxygen needs reducing/stable Pain score improving/stable <div style="text-align: center; margin-top: 10px;">  </div>	SpO ₂ /PaO ₂ reducing Oxygen needs increasing Pain score/analgesia needs increasing <div style="text-align: center; margin-top: 10px;">  </div>
Continue regular reassessment and discharge planning	Invasive pathway

Invasive pathway

1. Admit to appropriate ward (consider HDU)

- Monitor oxygen saturations (SpO₂)
- Baseline VBG/ABG, repeat as required
- Assess pain severity using dynamic pain scoring, pain on movement, deep breathing and cough, minimum of 4 hourly.

2. Start respiratory support

- Encourage to sit upright and mobilise early where possible
- Provide supplemental oxygen at the lowest concentrate to achieve appropriate SpO₂
- Oxygen should be humidified where possible
- Consider Prescribing NaCl 0.9% 10ml nebulisers 4 hourly as required to assist expectoration
- Consider prescribing Salbutamol 2.5-5mg nebulised as required

3. Confirm analgesia is prescribed and **titrate** as required

- Commence multimodal analgesia as per page 1.
- **Contact pain team** if pain remains uncontrolled.
- Consider IV PCA Morphine/Fentanyl.
- Consider Gabapentin if features of neuropathic pain present.
- Daily pain review documented

4. Commence physiotherapy on admission

- Supported cough
- Active cycle of breathing technique with huff hourly
- Upper and lower limb exercises
- Sitting in chair daily

5. Referral for regional anaesthesia

If contraindicated or out of hours – Consider commencing Morphine/ Fentanyl PCA if pain uncontrolled.

Absolute contraindications	Relative contraindications
Patient refusal Local or general sepsis Open wound at site of insertion	Unable to position patient Coagulopathy: INR >1.4 or platelets <80 x 10/L* Active anticoagulant therapy*
*Discuss with practitioner performing block	

Document daily review of regional anaesthesia as per local protocol

6. Regular reassessment and titration of therapy

SpO2/ PaO2 improving/stable
Oxygen needs reducing/stable
Pain score improving/stable



Continue regular reassessment
Consider step down to non-invasive pathway
when appropriate
Commence discharge planning

SpO2/PaO2 reducing
Oxygen needs increasing
Pain score/analgesia needs increasing

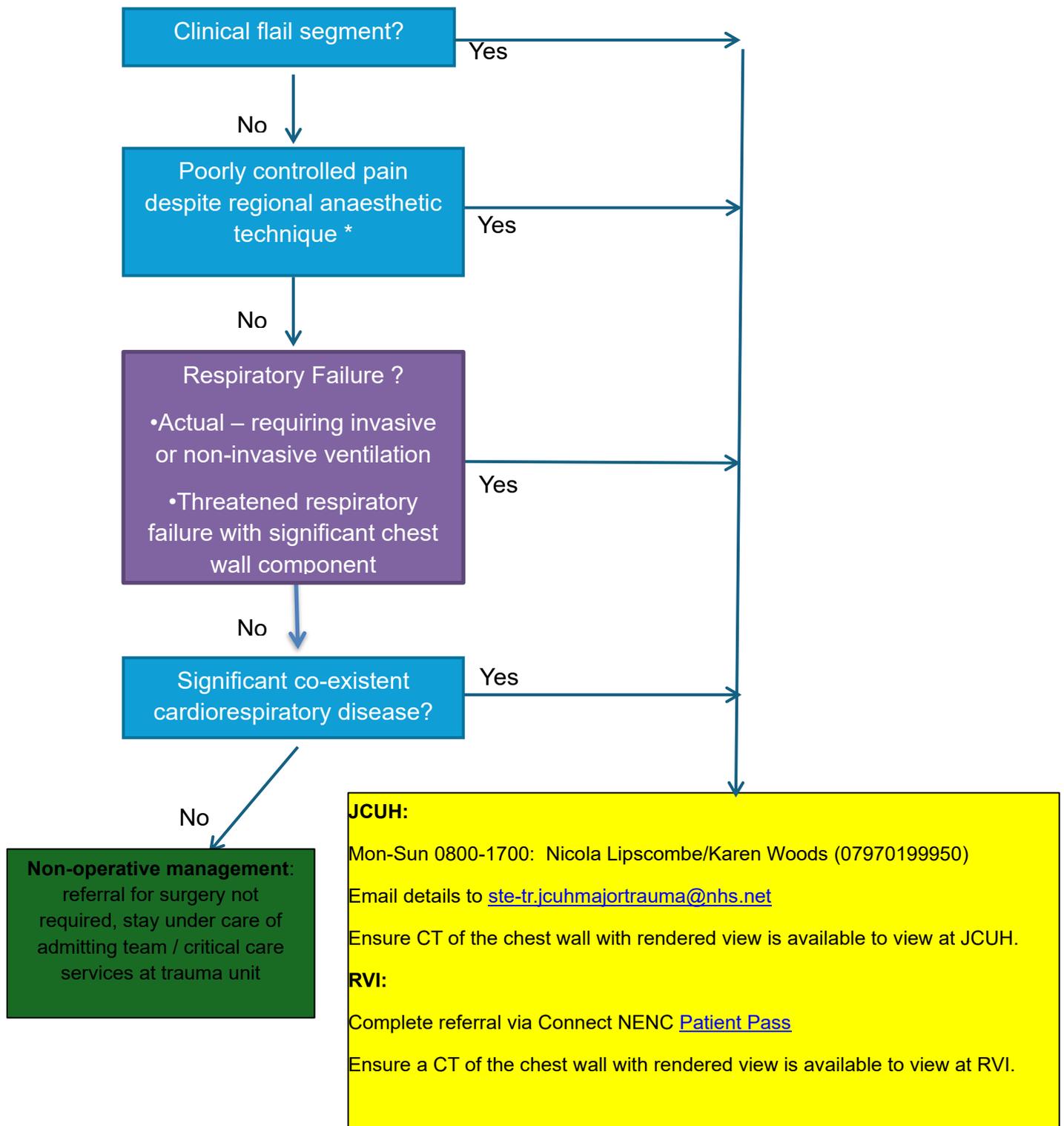


Contact Critical Care Outreach
Consider CXR/
Consider NIV/nasal high flow O2
Call for Anaesthetics for review of block

Consider if patient a candidate for

- Mechanical Ventilation
- Surgical Rib Fixation (see rib fixation pathway)
- Transfer to MTC (if at TU)

Referral algorithm for consideration of surgery in patients with four or more contiguous rib fractures



*** Pain**

Pain control is the mainstay of management. All patients should receive early multimodal analgesia, regular pain scoring and local pain service review with a view to early regional analgesia.

Referral to cardiothoracic surgery

Cardiothoracic Surgery in the South of the region is based at James Cook Hospital and the Cardiothoracic Consultant on call will be available as part of the team for trauma involving the chest.

In the North of the region it is based at Freeman Hospital. The patient will be taken to the RVI and the Cardiothoracic Consultant will require to be contacted directly by ED Consultant to be part of the trauma team. Therefore forward planning should be considered.

If immediate resuscitative thoracotomy is deemed necessary, the senior trauma team leader is to make the decision and proceed and inform the Cardiothoracic Surgeon immediately.

If a patient at a Trauma Unit requires immediate resuscitative thoracotomy the senior trauma team leader is to make the decision and proceed. They should inform the on call Consultant Cardiac Surgeon at James Cook or Consultant Thoracic Surgeon at the Freeman immediately. They can then provide over the phone telephone advice as events unfold and they can decide the next steps as regards transfer or them going to the hospital

Referrals

Trauma requiring immediate referral to the Cardiothoracic service

- Penetrating anterior chest wounds medial to the nipple line and posterior chest wounds medial to the scapula requiring immediate surgery
- Initial drainage of 1500mls of blood following chest tube insertion
- Continued drainage of blood from the chest tube at a rate of 200 mls/hr over the following 2 hours
- Cardiovascularly unstable patients where a major source of blood loss could be into the chest
- Patient requiring ongoing transfusion to maintain cardiovascular stability in the context of chest trauma and no other obvious source of bleeding
- Persistent large air leak following a chest tube insertion
- Suspected cardiac laceration
- Suspected cardiac contusion or tamponade
- Tracheobronchial foreign bodies in adults
- Traumatic Type A aortic dissections referred after CT confirmed the diagnosis
- Angulated sternal fractures or sterno-clavicular dislocations

Appendix 1

Chest drain insertion competencies		
Stage 1 competency	CT1, CT2, or equivalent in core accident and emergency, anaesthetic, intensive care, medical, radiology, respiratory, and surgical training	Can perform chest drain insertion with supervision by an operator (level 2 or greater) who has recent experience of chest drain insertion.
Stage 2 competency	Accident and emergency, anaesthetic, intensive care, medical, radiology, respiratory, and surgical trainees ST3/equivalent and above	It is expected that doctors within this grade will have undertaken a number of chest drain insertions and have been directly supervised undertaking the procedure on at least 2 occasions in each year. Following such assessment, they may carry out the procedure independently.
Stage 3 competency	Any senior medical personnel experienced at performing these procedures, preferably with experience in ultrasound assisted drain insertion.	These doctors are experienced and independent operators and may undertake the observation and assessment of other operators carrying out the procedure.

AUTHOR/CONTRIBUTORS	C Garland
VERSION NUMBER/DATE	March 2026 v1
REVIEW DATE	01/03/2029
RELATED INFORMATION	