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Version control/amendments

Date	Amendment	Lead
August 2023	New recommendations for best practice Updated appendices Addition of section for older adults with rib fractures	P Ramamurthi C Leech

Oct 2018	Made to draft version:
	• Editing of text body for accuracy and syntax
	• Reference to intercostal drain insertion network guideline
	• Clearer inclusion of BOAST 15 guidance
	• Revision of overall management plan:
	  • Life ± limb threatening transfer moved to be generic consideration & made more clear when to decide
	  • Minor errors in RAS scores shown within guidance corrected so there is no overlap / gaps in sequence
		J.Hulme,
		R.Steyn

	• Advice to refer to rib fixation indications for range of RAS scores • Addition of planned review with MTC approximately 24h after injury for all major injury group patients remaining within trauma unit • Addition of additional consultation regarding rib fixation if worsening condition or poor pain control • Addition of consultation with thoracic surgeon if persistent air leak > 48h • Amendment to analgesia regime to include paediatric advice • Recommendation of common fixation decision-making tool	

Purpose

The aim of this document is to highlight the important strategies in the management of patients with blunt chest trauma and specifically rib fractures. Each hospital within the trauma network should have local pathways and guidelines in place to ensure optimal management of this patient group.

Scope of document

A multi-disciplinary approach is essential for patients to have their chest trauma diagnosed in the emergency department, to receive effective timely and targeted pain management to prevent deterioration in respiratory function and complications, and to be referred to the Major Trauma Centre when specialist surgical care is required. This guideline applies to patients being treated at a LEH, TU or MTC.

Recommendations for Best Practice

The following principles are considered best practice for the management of rib fractures. When developing or updating rib fracture guidance Networks/MTCs/TUs should ensure that these principles are included:

1. **Primary survey**: Acute management of blunt chest injury/ rib fractures should follow standard algorithm-based care e.g. cABCDE to identify life threatening injuries.

2. **Pathway**: Patients should be managed on a local rib fracture/ chest injury pathway that acknowledges evidence-based practice and is relevant to the individual hospital.

3. **Risk score**: A validated scoring system should be used to risk stratify patients with rib fractures for risk of complications, need for admission and type of analgesia. Examples include STUMBL, Easter Rib Fracture Score or the Chest Trauma Score.

4. **Pain assessment**: patients should have early and repeated pain assessment throughout their hospital stay. This should include a pain score at rest, a pain score on deep breathing/ coughing and assessment of neuropathic features.

5. **Prescribed analgesia**: patients should receive early multimodal analgesia starting in the Emergency Department. If there is evidence of neuropathic pain, anti-neuropathic drugs should be given.

6. **Regional anaesthesia**: multiple techniques are described for rib fracture analgesia. Current commonly cited examples include thoracic epidurals, paravertebral, erector spinae plane and serratus anterior plane blocks. Units should select one, or a small selection of blocks that can be performed by most anaesthetic staff most of the time, so that patients do not have to wait for advanced analgesia. Relevant staff should have regular training on these techniques.

7. **Respiratory monitoring**: patients' respiratory status should be monitored with pulse oximetry and respiratory rate. Advanced monitoring e.g. with spirometry may be of value.

8. **Respiratory support**: patients should receive humidified oxygen targeting oxygen saturations within their normal range. Advanced respiratory support e.g. CPAP, non-invasive ventilation, high flow nasal cannulae and invasive ventilation should be available and used as indicated. Referral to Critical care and outreach teams should occur early if there are any signs of deterioration or high severity on risk scores.

9. **Rehabilitation**: simple patient led breathing exercises should be performed regularly. Early mobilisation and chest physiotherapy are key.

10. **Referral and admission**: every hospital should have documented guidelines on the referral of patients with rib fractures and the specialty responsible for admission to avoid time-delays in the Emergency Department. This includes guidelines for patients who are over 65 years of age with low energy mechanisms of injury. Patients should be admitted to wards familiar with the management of blunt chest trauma. Ward nursing staff may need further training in the management of patients with intercostal drains, patient-controlled analgesia, and continuous catheters for regional anaesthesia.

Introduction

Chest wall injury is extremely common following blunt trauma. It varies in severity from minor bruising or an isolated rib fracture to severe crush injuries of both hemithoraces leading to respiratory compromise. Multiple rib fractures are often associated with an underlying pulmonary contusion, which may not be immediately apparent on initial chest radiography. Fractures of the lower ribs may be associated with diaphragmatic tears and splenic or liver injury. Injuries to upper ribs are associated with injuries to adjacent great vessels. This is especially true of a first rib fracture, which requires a significant amount of force to break and indicates a major energy transfer. A fracture of the first rib should prompt a careful search for other injuries.

Note that the rib cage and sternum provide a significant amount of stability to the thoracic spine. Severe disruption of this 'fourth column' may convert what would otherwise be a stable thoracic spine fracture into an unstable one.

A flail chest occurs when a segment of the thoracic cage is injured and moves freely in comparison from the rest of the chest wall. A segment of the chest wall that is flail is unable to contribute effectively to lung expansion. Large flail segments will involve a much greater proportion of the chest wall and may extend bilaterally or involve the sternum. In these cases, the disruption of normal pulmonary mechanics may be large enough to require early mechanical ventilation.

Pain following major trauma poses many challenges for clinicians. Timely repeated thorough assessment and a multidisciplinary approach to pain management is essential. Evidence suggests a failure to manage acute pain effectively in the early stages increases the incidence of early and late complications and of chronic pain.

The impact of initial chest injury can worsen 2-3 days post injury and is likely to be worsened by inadequate pain control. It is vital that patients with thoracic injuries be monitored closely; any deterioration requires rapid escalation of treatment.

PRINCIPLES OF MANAGEMENT

Initial Assessment

Patients with blunt chest trauma should be assessed in the Emergency Department using the standard trauma primary survey to identify any life-threatening injuries. Simple multimodal analgesia and chest imaging should be organised on arrival to the Emergency Department, where indicated.

Chest x-rays have a sensitivity of 39-55% for the diagnosis of rib fractures and do not effectively diagnose underlying lung injury or abdominal injury. They should not be used routinely to rule out rib fractures. Patients in whom there is suspicion of multiple rib fractures, pulmonary or abdominal visceral injury will require a CT scan with or without contrast. Local hospitals should have guidelines with their radiology department to be able to obtain timely imaging for patients with blunt chest trauma.

Risk Stratification

There are several risk factors in patients with rib fractures that predict severity and therefore deterioration. These include a combination of anatomical and physiological variables. There are many validated scoring systems available, including Easter's Rib Fracture Score, STUMBL score and the Chest Trauma Score.

Each should document and implement a structured, tailor-made pathway with adequate training and support to ensure compliance. Ensuring multi-disciplinary involvement by adherence to such clinical pathways has been proven to improve patient outcomes in terms of reduced length of hospital stay, need for ITU admissions and improved outcome in patients over 65 years of age.

Although the emphasis is on risk stratification and management according to risk scores, clinical judgment should always be relied on when patients present more unwell than predicted by risk score.

An example of different pathways used in the region is provided in Appendix 1 a sample guideline for using STUMBL and Appendix 2 a sample guideline for using RFS.

Analgesia and Pain Assessments

Timely administration of simple analgesia is a priority. Early assessment and documentation of pain scores should be undertaken, including pain scores at rest and with deep breathing and coughing. Inadequate early pain relief is the most common cause for deterioration over the next 24-72 hours, during which areas of pulmonary contusion are replaced by atelectasis and form a focus for evolving pneumonia. Daily assessments and input from in-house Acute Pain teams is valuable in following up the effectiveness of pain interventions.

Patients need to be referred early to Anaesthetics to enable institution of advanced analgesic techniques such as regional anaesthesia, analgesic infusions, or patient-controlled opioid-based analgesia (PCA). There are several regional anaesthesia techniques reviewed in the literature. Thoracic epidural has been recognized as the

gold standard for analgesia and continues to be the technique of choice in patients with bilateral rib fractures and extensive injury. Other techniques include paravertebral blocks, fascial plane blocks including Serratus Anterior Plane and Erector Spinae Plane blocks with options for continuous catheter techniques for all these routes. PCA or regional anaesthesia can be commenced within the Emergency Department for patients who are high-risk for deterioration.

Each hospital needs to identify a small choice of techniques which can be performed by the majority of anaesthetists, both during and out-of-hours. Some trusts have also explored training for Emergency Medicine clinicians to undertake regional blocks for rib fractures. This enables advanced analgesia being performed out-of-hours, rather than patients waiting for appropriate pain relief until the availability of appropriately trained personnel.

Physiotherapy

Physiotherapy should be initiated early, within 24 hours from admission, with the aim of supporting ventilation and preventing complications. Adequate analgesia is essential to ensure adequate coughing and to allow patients to mobilise on the ward to minimise complications.

Admission

Every hospital should have documented guidelines on the referral of patients with rib fractures and the specialty responsible for admission to avoid any disagreements causing time delays in Emergency Department. This includes guidelines for patients who are over 65 years of age with low energy mechanisms of injury. Admitting specialities may include General Surgery, Trauma & Orthopaedics, Elderly Care or Acute Medicine, or Thoracic Surgery within the MTC.

Patients should be admitted to wards familiar with the management of blunt chest trauma. Ward nursing staff may need further training in the management of patients with intercostal drains, patient-controlled analgesia, and continuous catheters for regional anaesthesia.

Patients with rib fractures being treated in a LEH or TU may need referral to the regional MTC in the event of the following:

- Associated significant lung injury eg large pneumothorax or haemothorax. (*note not all small or moderate pneumothoraces require drainage and some can be safely observed)*

- Patients with respiratory failure who are suitable for escalation of care and ITU admission/invasive ventilation
- Persistent air leak greater than 48 hours after insertion of chest drain
- Indications for rib fracture fixation (if imaging report states grossly displaced rib fractures or significant deformity or bilateral multiple rib fractures)

Decision to offer secondary transfer will be assessed on a case-to-case basis in liaison with the MTC.

In patients with chest injury and spinal fracture, discussion with senior specialists will be required to agree a management plan balancing the risks of flat bed rest over respiratory deterioration in a supine patient with severe chest injury.

Older adults with rib fractures

It is recognised that multiple rib fractures are common in older adults following a low mechanism of injury and are associated with high mortality. Haemothorax is also common following rib fracture in patients on prescribed anticoagulants. Any older patient with a fall should have rib fractures excluded by a thorough clinical examination with full exposure, followed by imaging if appropriate. This includes in the Emergency Department, medical admission areas, and when inpatient falls occur on the wards, in order to ensure the correct pathways are initiated.

Pain from inadequate analgesia is one of the causes of delirium in older patients. Each hospital should have a specific pain guideline for this population with an emphasis on limiting opioid use, guidance in renal impairment and avoidance of non-steroidal medications.

Clinical frailty scale scoring is a more useful measure than age, when considering the ceiling of care for older adults with major trauma. Older frail patients with isolated rib fractures who only require conservative management (analgesia, physiotherapy, mobilisation, assessing medical causes for the fall) may benefit from admission under elderly care medicine. However agreed pathways must be in place in the local hospital to support safe care. An example of a referral pathway is found in Appendix 3.

If rib fractures have been sustained from a low energy mechanism of injury e.g. fall from standing, patients should have a bone health review and be prescribed bone protection medication where indicated.

Early sitting and mobilisation should be encouraged to decrease the complications of immobilisation.

APPENDIX 1- SAMPLE GUIDELINE USING STUMBL SCORE

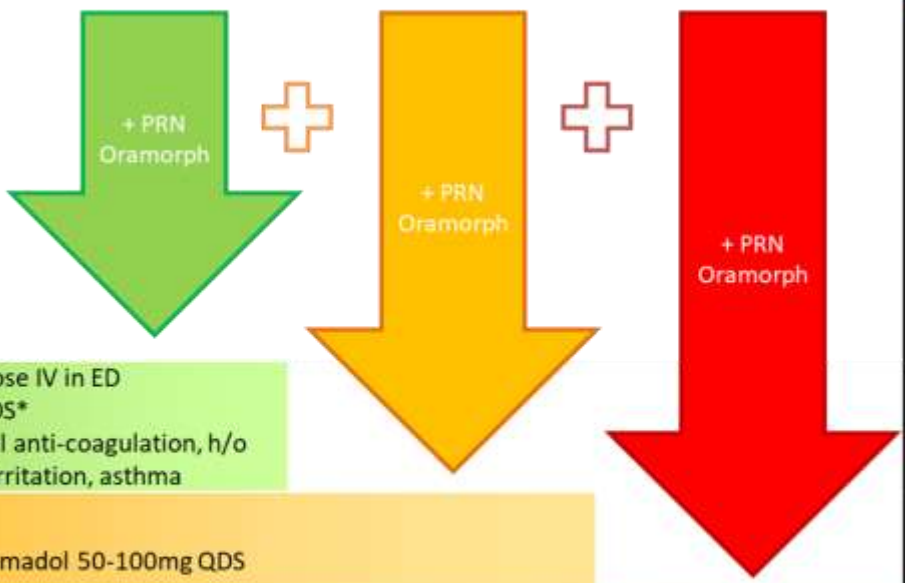
RIB FRACTURES

RISK STRATIFICATION BY RISK ASSESSMENT SCORE (RAS)

AGE: ADD +1	SpO2: ADD +2	RIB FRACTURES: ADD +3	ANTICOAGULANT USE: ADD +4	CHRONIC LUNG DISEASE: ADD +5
Score +1 for every decade above 10 years of age	Score +2 for every 5% drop from 95% on room-air 90-94%: +2 86-89%: +4 81-85%: +6	Score +3 for each rib fractured Flail: +3x2 for each flail rib	Score +4 for pre-injury anticoagulant use. Exclude sole aspirin use	Score +5 for pre-injury chronic lung disease Eg. Asthma, COPD

Calculate total risk assessment score and follow suggested guidance for analgesia and referrals

RAS 0-10	RAS 11-15	RAS 16-20	RAS >20
Minor Injury Simple analgesia May be discharged from ED	*Moderate Injury* Refer to Pain Refer to physio Refer to Surgeons	*Severe Injury* Refer to Pain Refer to Physio Refer to Surgeons Refer to ITU/ Outreach Consider regional analgesic techniques	*Major Injury* Refer to Pain Refer to Physio Admit under Surgeons Refer to higher centre Refer to ITU/Outreach Anaesthetic referral for regional analgesia
Analgesic Plan A		**Analgesic Plan B**	**Analgesic Plan C**



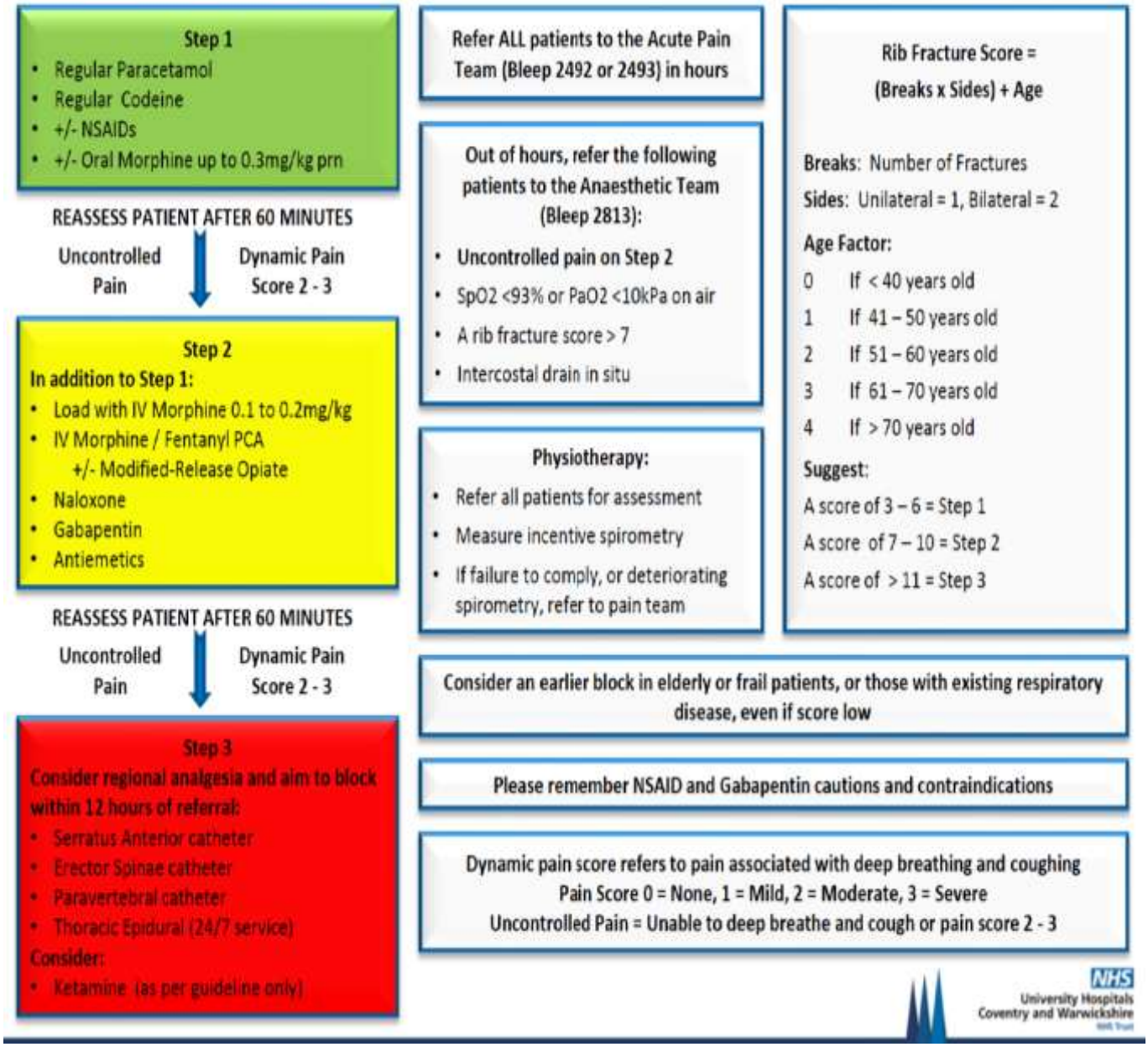
Regular PCM 1g QDS; first dose IV in ED
Regular ibuprofen 400mg TDS*
*Caution – renal disease, oral anti-coagulation, h/o hypersensitivity, h/o gastric irritation, asthma

Regular weak opioid:
Codeine 30-60mg QDS or Tramadol 50-100mg QDS

IV PCA *or*
Regional analgesia

Assess pain on deep breathing, cough and movement as none, mild, moderate and severe.
If pain is **moderate** *or* **severe**, consider escalation to the next analgesic plan.

APPENDIX 2 – SAMPLE GUIDELINE USING RIB FRACTURE SCORE



APPENDIX 3 – SAMPLE PATHWAY FOR REFERRAL OF OLDER ADULTS WITH RIB FRACTURES

ACUTE RIB FRACTURE PATHWAY FOR PATIENTS OVER 65 YEARS

To start in ED or MDU

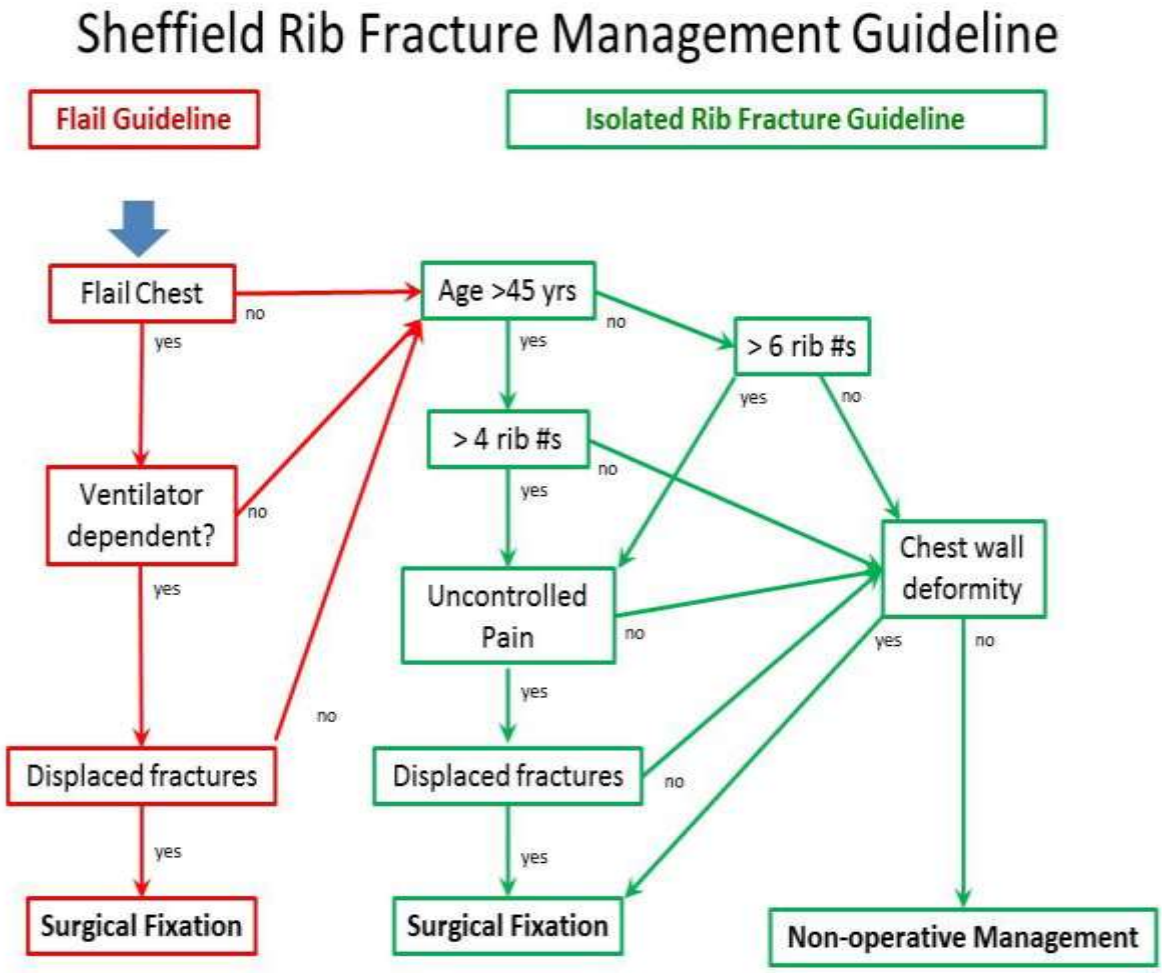
INCLUSION CRITERIA FOR THIS PATHWAY	Tick
Rib fractures diagnosed on imaging	
Age 65 years or over AND CFS 3 or more	
No other traumatic injury requiring admission under a surgical specialty	

Refer & admit under MEDICINE only if ALL of the following apply:	Tick
Isolated simple rib fractures (any number, diagnosed radiologically) requiring admission for analgesia	
No criteria to admit under Cardiothoracic Surgery (see below)	

OR

Refer & admit under CARDIOTHORACIC SURGERY if any of the following apply:	Tick
Lung injury (pneumothorax or haemothorax) requiring chest drain	
Patient requires epidural for analgesia (can only be managed on Ward 53 ECU or HDU)	
Patient suitable for rib fracture fixation (if imaging report states grossly displaced fractures, significant deformity or flail chest refer to Cardiothoracic Registrar for decision)	
Patients with respiratory failure suitable for escalation of care and HDU/GCC admission	

APPENDIX 4- WHEN TO REFER FOR CONSIDERATION OF SURGICAL FIXATION



Further Reading

British Orthopaedic Association Standards for Trauma: BOAST 15: The management of blunt chest wall trauma. 2016 https://www.boa.ac.uk/static/ef5f6208-c6dd-4f19-b9b3ee628d28b774/boast%20-%20the%20management%20of%20blunt%20chest%20wall%20trauma.pdf

BOAST: The care of the older or frail or orthopaedic trauma patient. May 2019. https://www.bgs.org.uk/sites/default/files/content/attachment/2019-06-03/BOA%20FFN%20BGS%20BOAST_0.pdf

Williams, A., Bigham, C., Marchbank, A., 2020. Anaesthetic and surgical management of rib fractures. BJA Education 20, 332–340. https://doi.org/10.1016/j.bjae.2020.06.001

May, L, Hillermann, C, Patil, S, 2016. Rib fracture management. BJA Education 16, 26–32.https://doi.org/10.1093/bjaceaccp/mkv011

London Rib Injury Toolkit https://www.c4ts.qmul.ac.uk/rib-injury-toolkit/clinical-management Accessed 3rd August 2023.