

Chest Trauma

Key Points

- Blunt chest-wall trauma accounts for 10-15% of all trauma admissions to Emergency Departments (EDs) globally. Rib fractures may complicate up to two thirds of these injuries. TARN Data suggests that 30% of major trauma patients seen in the ED at Frimley Health have chest trauma. Cross site data shows that 84-90% present with isolated rib fractures.
- Blunt chest-wall trauma accounts for 10-15% of all trauma admissions to Emergency Departments (EDs) globally. Rib fractures may complicate up to two thirds of these injuries. TARN Data suggests that 30% of major trauma patients seen in the ED at Frimley Health have chest trauma. Cross site data shows that 84-90% present with isolated rib fractures.
- Actively managing pain in patients with chest trauma is to ensure they can deep breathe and cough which prevents complications
- Patients with thoracic trauma who are admitted need to be placed in a care environment that can observe them closely and where they can access specialist support such as physiotherapy.

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Key words: Thoracic trauma, rib fracture, lung injury, analgesia.

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Abbreviations

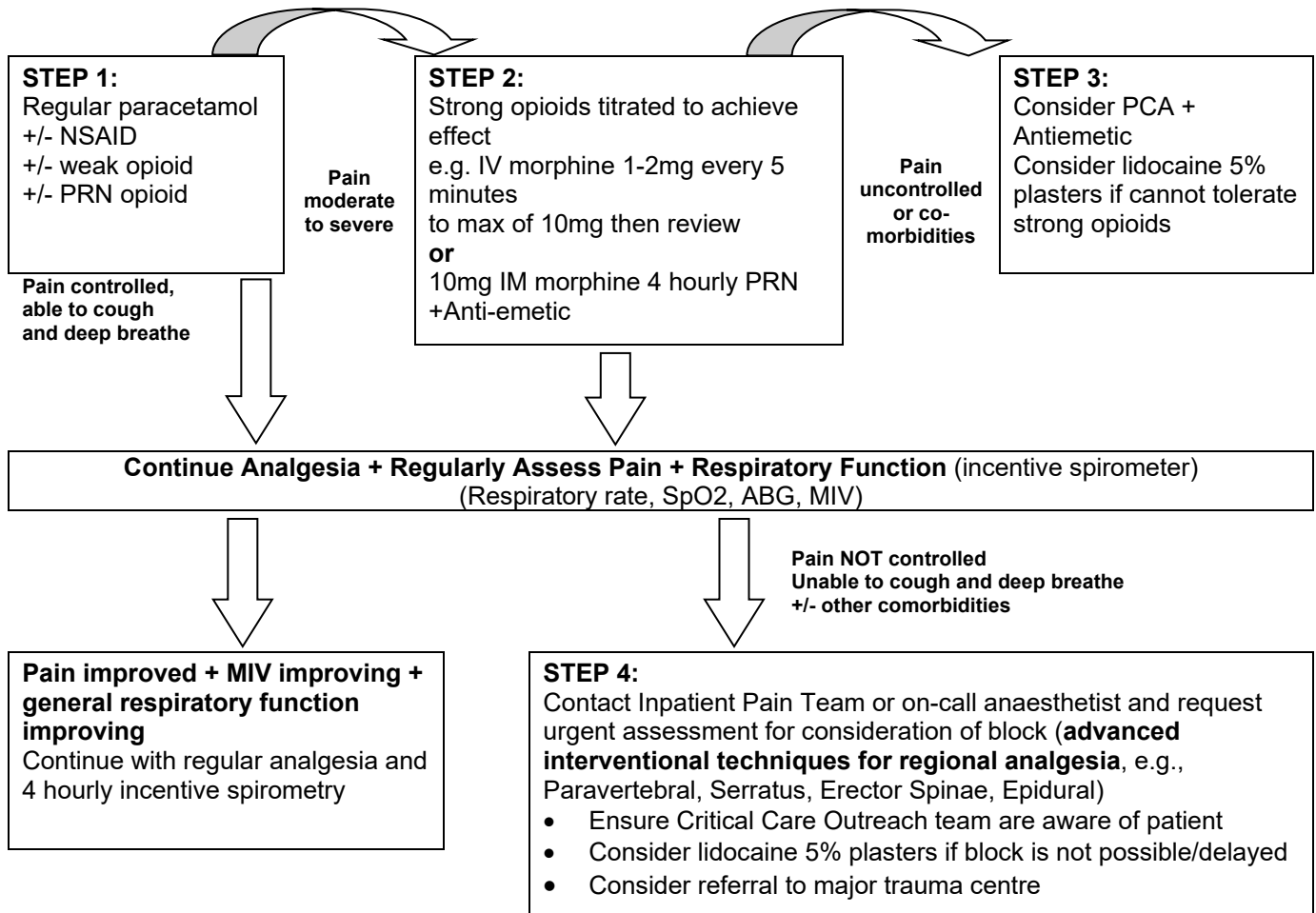
BP	Blood Pressure
CC	Critical Care
CT	Computerised Tomography (a type of radiological scan)
CXR	Chest X-ray
ED	Emergency Department
eFAST	extended Focused Assessment with Sonography
EPIC	Electronic Patient Record Documenting System
FPH	Frimley Park Hospital
GP	General Practitioner
HWD	Heatherwood Hospital
HWPH	Heatherwood and Wexham Park Hospitals
ICU	Intensive Care Unit
IM	Intramuscular
IV	Intravenous
IVI	Intravenous infusion
MTC	Major Trauma Centre
NSAID	non-steroidal anti-inflammatory
PO	by mouth
PPI	Proton Pump Inhibitor
PR	by rectum
PRN	as required
RR	Respiratory rate
SpO2	Oxygen saturation
SHO	Senior House Officer (ward doctor)
T	Thoracic vertebra
US	Ultrasound
VTE	Venous Thromboembolism
WBCT	Whole Body Computerised Tomography scan
WPH	Wexham Park Hospital

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Summary - Rib Fracture Flowchart

Within 1 hour of diagnosis of rib fractures: - Start incentive spirometry (monitor maximum inspiration volume [MIV]) refer to physiotherapy - Monitor SpO₂, provide supplemental O₂ if required - Assess pain score and respiratory function Establish Analgesia (see Step 2)	Assess risk factors: - Age >65 years - Pulmonary contusions - Pre-existing respiratory disease - Pre-existing cardiovascular disease - Smoker/Obesity/Sleep apnoea
Refer all inpatients to Inpatient Pain Team (See foot of chart) (Consider STEP 4)	



- Older patients and or those with frailty require significantly less opioid to achieve the same level of analgesia:** Initial doses should be reduced to **25-50%** of the doses used in young healthy patients.
- Δ Think Kidney:** These medications and their metabolites may also accumulate especially in patients with renal impairment (**eGFR <60**) necessitating an **increase in the dosing interval**.
- In the frail elderly (because of low muscle mass) eGFR may **over-estimate** renal function.
- Remember:** Codeine is broken down to morphine.
- Prescribe paracetamol according to weight:

PARACETAMOL DOSING	Adult 30-40kg	Adult 41-49kg	Adult 50kg and above
Oral and IV maximum dose	500mg three times a day	500mg four times a day	1g four times a day
Maximum daily dose	1.5g	2g	4g (reduce to 3g if risk factors for hepatotoxicity)
Irrespective of weight where the patients eGFR is < 30 interval between dosing must be minimum of 6 hours			

- NSAIDs:** consider contraindications before prescribing or giving.
- Lidocaine 5% plasters:** should be applied to unbroken skin 12 hours on 12 hours off maximum 2 patches at a time for up to 14 days. They are not a substitute for anaesthetic assessment for regional analgesia or a subsequent block.

1. Aim of Guideline

The aim of this guideline is to provide information regarding the assessment, diagnosis, and management of patients presenting to the hospital with chest trauma, to all members of staff who may be responsible for their care.

2. Introduction

2.1 Incidence

Blunt chest-wall trauma accounts for 10-15% of all trauma admissions to Emergency Departments (EDs) globally. Rib fractures may complicate up to two thirds of these injuries. TARN Data suggests that 30% of major trauma patients seen in the ED at Frimley Health have chest trauma. Cross site data shows that 84-90% present with isolated rib fractures.

2.2 Importance

70-80% of chest injuries occur in the >65 age group, who have a longer median length of stay in the hospital even with lower Injury Severity scores (ISS). Global data shows that the morbidity and mortality in this age group is significantly higher than the <65 group, even compared to patients with a higher ISS.

Rib fractures are the most common injury sustained following blunt chest trauma, accounting for more than half of thoracic injuries from non-penetrating trauma. Approximately 10% of patients admitted after blunt chest trauma have one or more rib fractures, which are potential markers of more severe injury, leading to poor overall clinical outcomes. While fractured ribs have the potential to cause haemothorax or pneumothorax, signs are not always evident on the first chest x-ray. Lung contusions may develop and worsen for 48 hours post injury. Some rib fractures arise spontaneously as a result of osteoporosis or malignant disease. Fractured ribs can also lead to chest infection or pneumonia, as pain affects chest expansion and inhibits effective coughing.

Pain management is essential in patients with fractured ribs to ensure adequate ventilation by allowing deep breathing and coughing to clear secretions. This then reduces the potential for atelectasis and pneumonia. Effective pain control also allows the patient to be mobile, which reduces complications of venous thromboembolism due to immobility.

The early detection of any deterioration is critical in these patients. Underlying causes that contribute to poor outcomes in patients can include:

- pneumothorax or haemothorax missed on the initial x-ray as reviewing clinician may be focused on checking for other injuries
- the need for frequent observations not understood by staff caring for the patient
- the need to actively manage pain from rib fractures is not well recognised

3. Scope

These guidelines are for all staff involved in the care of adult trauma patients with chest trauma but are of particular relevance to those working in the Emergency Department, Theatres, Anaesthesia, Surgical Wards and other wards receiving trauma patients.

Suspected Chest Trauma	
Assessment	Initial Management (DO NOT wait for imaging)
Primary Survey (A-E assessment)	Start Oxygen to maintain SpO ₂ >94% (88-92% for chronic CO ₂ retainers)
Routine Trauma Bloods – FBC, U&E, VBG, G&S x 2	See indications for immediate decompression of the chest below
ECG	Start appropriate analgesia: Paracetamol, NSAIDS, Opioids

Indication for immediate chest decompression

CXR not readily available and:

SpO₂ < 92% on High Flow Oxygen via NRBM

Systolic Blood Pressure < 90mmHg despite volume replacement

Respiratory Rate < 10/min

Decreased Level of consciousness on oxygen

Cardiac Arrest

NB: Chest Decompression in trauma is by finger thoracostomy NOT needle decompression

Imaging

Consider CT if haemodynamically stable. May need whole body CT (WBCT) in polytrauma

CXR if CT not feasible, or index of suspicion for significant chest trauma is low

USG only if appropriately trained/ signed off

Criteria for MTC Transfer

Flail Segments +/- pulmonary contusions

Sternal injury with significant displacement of the sternum or posterior haematoma

Massive Haemothorax

Polytrauma with other significant injuries requiring specialist care

Persistent Air leak

Ventilatory difficulties

Pain not controlled despite appropriate analgesic measures taken

General Management

All patient with isolated chest injuries secondary to blunt trauma will be admitted under the General Surgeons

All patients >65 years of age must be reviewed by a geriatrician with 48 hours of admission

Patient care may be transferred to a medical specialty if agreed upon by the surgical and medical teams after review by BOTH specialties

Patients with other injuries (eg #NoF) will be admitted under the most appropriate specialty

All patients admitted with chest trauma must have referrals made to inpatient physiotherapy and the inpatient pain team

Management of specific injuries

Haemopneumothorax

Usually requires the placement of a surgical chest drain

A seldinger chest drain may be appropriate in elderly/ frail patients with isolated pneumothoraces (Seek senior advice)

All haemothoraces require a surgical chest drain

All open pneumothoraces will require a chest drain. Seek specialist advice for closure of the open wound.

Rib Fractures

Assess Risk (Battle's Score)

Variable	Score
Age	+1 per additional 10 year increase, starting at 10 years of age
Number of rib fractures	+3 per rib fractured
Chronic lung disease	+5 if present
Pre-injury anticoagulant use	+4
Peripheral oxygen saturation levels (SpO2)	+2 per 5% decrease in SpO2 starting at 94% at the time of assessment
Total	
0-10 AND no risk factors for morbidity present	Consider discharge if appropriate
11-15 OR risk factors for morbidity present	Consider admission and more advanced analgesia
≥ 16	Consider early referral to Anaesthetics for nerve block
≥ 30	Consider early ITU review

Risk Factors for morbidity

Pulmonary contusion

Cardiovascular disease

Presence of ≥ 2 distant injuries

current smoker

Frailty

Obesity & OSA

Early Review for Rib Fixation

Flail chest

≥ 3 displaced rib fractures

≥ 65 years old

Chest wall deformity

CXR $\geq 25\%$ lung volume loss

NIV/ Ventilator dependent

Full Guideline

4. Assessment

4.1 All patients presenting to the ED with chest trauma should be identified at triage. Any trauma patient over the age of 65 should be reviewed by a senior ED clinician prior to discharge.

A full trauma ABCDE assessment should be performed in all patients as part of a Primary Survey. This should be repeated at regular intervals so that complications can be detected and managed early.

During the initial assessment of a chest trauma patient remember to consider the mechanism (blunt or penetrating) and keep in mind important complications that require immediate or urgent intervention:

Tension pneumothorax, Massive haemothorax, cardiac tamponade, flail chest with pulmonary contusion, pneumothorax, aortic injury. Always consider the analgesic requirements of your patient as poorly controlled pain can lead to complications.

Airway and C-spine: All patients with significant pain or suspected fractured ribs should be given oxygen at 15 litres/minute via a non-re-breathe mask if necessary. This should be titrated to an SpO₂ that is clinically appropriate for the patient. Early anaesthetic input should be sought if the airway is threatened or compromised.

Breathing: This may be compromised by pain, flail segment of chest wall and/or pneumo/haemothorax. Respiratory rate and SpO₂ should be monitored, and the chest physically examined. Early imaging should be ordered and equipment and staff available to intervene with remedial measures such as chest drain where required. The patient may require saline or other nebulisers and humidified room air or oxygen. It is noteworthy that localised muscular splinting (in the early phases of injury) often prevents/minimises paradoxical movement typically associated with a flail segment resulting in under diagnosis.

Circulation: Pulse, blood pressure and capillary refill should be observed. Patient may require IV access, bloods taking and fluid replacement therapy. In the context of major trauma blood products are the replacement fluid of choice.

Disability: Neurological status must be assessed. Blood sugar should be measured. A pain assessment should be performed, and analgesia given as required. Where indicated titrate IV Opioids for pain management and optimise multi-modal analgesia. Consider early referral to the anaesthetic/ Inpatient Pain team for advice and support.

Exposure: A thorough top-to-toe exposure of the patient should be undertaken to look for any other trauma or disability that may affect condition. Other comorbid conditions should be identified and treated.

It may be necessary to involve specialist help in the care of patients with fractured ribs. This may include: Critical Care Outreach Team, Inpatient Pain Team / On-call anaesthetist, and Physiotherapists. Consider early involvement of the pain team/ on call anaesthetist if the patient is in severe/ disproportionate pain despite analgesia. Specialty numbers are available in the Resus, purple and green areas of the ED and in the ED hub

and specialists can also be contacted via EPIC referral and the switchboard. 2222/NEWS/Crash calls can be made via switchboard if clinically indicated.

4.2 Investigations

The main imaging modalities that can be used for the evaluation of Chest Trauma are Ultrasound, Chest X-ray, and CT scans of the chest with or without contrast.

Chest x-rays are easily available, can be carried out with a portable machine, are easy to interpret, and expose the patient to less radiation than a CT scan. However, chest x-rays can miss up to 50% of rib fractures, 30% of pneumothoraces, and carry a lifetime cancer risk which varies according to age.

Bedside lung US can be used as part of an eFAST (extended focused assessment with sonography for trauma) in the ED. This is quick and can be more sensitive than a CXR to identify a pneumothorax. The quality of evidence for these studies is low, and the eFAST does require training and a level of skill and practice. the use of bedside US is likely to be beneficial only in cases where a CT/ CXR is unavailable or clinically infeasible. Outside of this the eFAST exam is only useful to augment clinical assessment, if a trained operator equipped with ultrasound is immediately available and onward transfer will not be delayed. It cannot be used as a 'rule out' examination.

CT imaging of the chest remains the gold standard imaging modality in chest trauma, with the highest diagnostic accuracy. The disadvantages of CT are the higher radiation risk than x-ray, and the increased time to diagnosis. As they are not portable, the patient must be clinically stabilised before the examination can be performed. In practice most patients can be stabilised sufficiently for a CT.

A Chest x-ray/ bedside US may be the appropriate imaging modality as part of a primary survey, particularly in adults (over 16 years old) who are in severe respiratory compromise/ too unstable for transfer to CT.

Chest x-rays may also be used as an additional diagnostic tool in patients with a low-risk mechanism of injury and a normal clinical examination.

The following is the guidance for the use of CT scan in the elderly from the HECTOR Manual, and as agreed with the Department of Radiology:

CT Chest NON-CONTRAST	-Suspected bony injury including multiple rib fractures +/- flail segments e.g., fall whereby the chest wall has made contact with a hard object and the patient has on-going pain and difficulty in breathing. This will aid decision making about indications for epidural analgesia. If there is no suspicion of great vessel injury, no suspicion of arterial injury and no history of penetrating trauma, a non-contrast CT scan will be appropriate to detect pulmonary contusions, haemopneumothoraces and bony injury.
CT chest CONTRAST ENHANCED	-suspicion of PE precipitating a fall -suspicion of mediastinal injury -suspicion of great vessel injury -penetrating trauma

In many patients with suspected chest trauma, a CT scan will be performed as part of a Whole Body CT (WBCT).

Consider chest X-ray and/or ultrasound for first-line imaging to assess chest trauma in children (under 16s). Do not routinely use CT for first-line imaging to assess chest trauma in children (under 16s).

4.3 Assessment of potential severity of Injury

Rib Fractures

Multiple risk factors have been identified for poor outcomes in rib fractures, but the variables can be simply classified into anatomical, physiological, and other categories, see table 1.

Many scoring systems are available to predict the risk of complications after blunt chest trauma, all of which combine different variables from table 1. These include the AISchest, Pulmonary Contusion score (PCS), Wagner-score, the Thoracic Trauma Severity score (TTS), the Chest Trauma Score (CTS), RibScore and Easter's Rib Fracture Score. Battle et al recently used robust methodology to develop an up-to-date risk prediction tool that is based on a UK population. This guideline recommends the use of Battle's tool to help predict the risk of complications after blunt chest trauma. This is consistent with the recommendations of the Thames Valley Trauma Network, and the South West London Trauma Network.

Variable	Score	Example
Age	+1 per additional 10-year increase starting at 10 years of age	4
Number of rib fractures	+3 per rib fractured	15
Chronic lung disease	+5 if present	5
Pre-injury anti-coagulant use	+4	0
Peripheral oxygen saturation levels (SpO ₂)	+2 per 5% decrease SpO ₂ starting at 94% at time of assessment	2
Total		26

4.4 Criteria for transfer to an MTC

Early contact with the relevant major trauma centre (MTC) is recommended to discuss possibility of fixation surgery for patients with multiple fractures, flail segments and sternal instability.

TVTN and SWLSTN Criteria for referral to the MTC are:

- Polytrauma
- Massive haemothorax
- Flail segment +/- pulmonary contusions
- Persistent air leak
- Sternal fractures with significant displacement or retrosternal haematoma
- Pain not controlled
- Ventilatory difficulties

4.5 Management

4.5.1 General Management

Patients should be managed in a care environment that meets their dependency and clinical requirements. Patients requiring PCA, regional or epidural analgesia must only be cared for in clinical areas where the nursing staff are competent to do so. Patients with PCA, CEA or RA pumps should not leave the ward except for clinical reasons, e.g., X-ray. Patients with multiple rib fractures may develop lung contusions 24 to 48 hours post initial injury so need to be monitored closely from a respiratory and cardiovascular perspective. Assessment should continue from admission to discharge, and adequate analgesia **must** be available and utilised. Critical Care Outreach Team should be made aware of the patient's admission as soon as is practicable.

Patients over the age of 65 should have geriatrician review within 24-48 hours.

Frequency of observations depends on clinical condition but as a minimum standard all patients admitted to hospital with rib fractures, who are receiving active treatment, should have respiratory rate, oxygen saturation, pulse and manual blood pressure, pain assessment and NEWS score recorded at least 4 hourly.

4.5.2 Analgesia

The immediate management of pain associated with fractured ribs may require strong opioid drugs given intravenously/intramuscularly/subcutaneously if the oral route is unavailable or unreliable. Patients may require high and repeated doses to maintain the ability to deep breathe. Therefore, regular assessment of pain and monitoring for effects of analgesia utilised is important and should be documented accordingly.

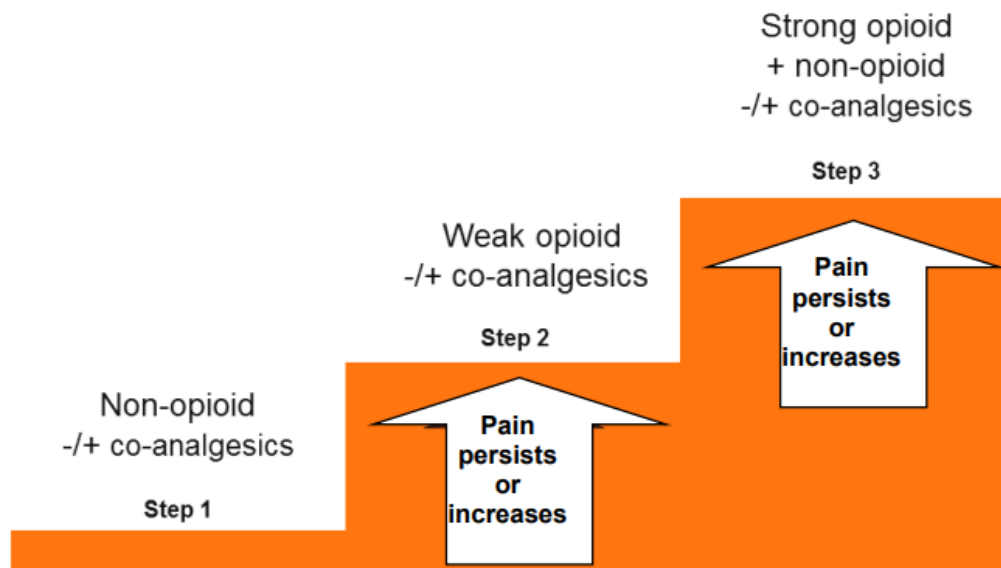
CAUTION: Older and/or patients with frailty require significantly less opioid to achieve the same level of analgesia: Initial doses should be reduced to **25-50%** of the doses used in young healthy patients.

Δ Think Kidney: These medications and their metabolites may also accumulate especially in patients with renal impairment (**eGFR <60**) necessitating an **increase in the dosing interval**.

In the older and/or patient with frailty (because of low muscle mass) eGFR may **over-estimate** renal function.

Always refer to current BNF for specific drug and dose information.
Seek senior advice if patient has renal, hepatic, cardiac or respiratory co-morbidities.

Multimodal analgesia (see picture below) should be prescribed for all patients with rib fracture to ensure they can comfortably deep breathe and cough. Pain may worsen as lung contusions/bruising develops. Oral analgesia may be insufficient. NSAID use is only possible in those with no contraindication.



If oral analgesics are not effective in controlling pain from fractured ribs, then the Inpatient Pain Team or on-call anaesthetist must be contacted so that regional analgesia (block) can be considered. If there is anaesthetic expertise available, regional analgesia could be actioned, e.g., paravertebral block, serratus plane block or erector-spinae block with or without an indwelling catheter. If there is an indwelling catheter, local anaesthetic may be administered either by intermittent bolus or by continuous infusion. In some clinical areas Patient Controlled Regional Analgesia bolus may be offered. Epidural analgesia could be considered, especially if there are bilateral fractures⁶. If patient requires on-going intravenous opioids, then PCA can be considered. An IM/SC opioid could be considered for severe pain if the IV route is not available or indicated.

CAUTION: Patients with advanced analgesic techniques such as PCA, CEA and RA will need to be cared for in an area where the nurses are competent in the care of patients with these analgesic techniques.

If patients cannot tolerate opioids and regional analgesia is not technically possible or is delayed, lidocaine plasters may be considered^{3,4,5}. Maximum 2 plasters applied to unbroken skin in painful area 12 hours on, 12 hours off. Lidocaine plasters are not a substitute for anaesthetic assessment for regional analgesia or a subsequent block but may be a useful adjuvant in patients unsuitable for a block.

If achieving adequate analgesia to enable patient to deep breath and cough is not being achieved advice can be sought and or referral made to the Inpatient Pain Team. (See Summary - Rib Fracture Flowchart, above.)

If it is out-of-hours or the inpatient pain team is not available, then the on-call anaesthetist should be contacted.

During office hours Monday – Friday staff should first contact the Inpatient Pain Team on:

FPH – Bleep 5252 or X134571

WPH – Bleep 4820 or X154435

Outside these times for urgent advice the owning medical/surgical team can contact the on-call anaesthetist on:

FPH–Bleep 5002

WPH – 07768 463877

4.5.3 Ventilation

Rib fractures are commonly associated with underlying pulmonary contusions and pleural injuries such as pneumothorax and haemothorax. These, combined with pain, can lead to respiratory failure.

To prevent complications and ensure a timely recovery, all patients admitted with rib fractures should receive respiratory support titrated to their individual needs. Patients should be managed on wards with nursing staff familiar with the injury. Supplemental oxygen should be prescribed and administered at the lowest concentration required to achieve peripheral oxygen saturations (SpO₂) of 94-98%, or 88-92% in patients at risk of carbon dioxide retention. If more than 2-4L/min via nasal cannulae is required, administered oxygen should be humidified to loosen secretions. Sodium chloride (NaCl) 0.9% nebulisers may be prescribed as required or regularly to assist expectoration. Salbutamol nebulisers can be prescribed for bronchospasm. Patients should be mobilised where possible and when in bed, be nursed sitting as upright as possible with attention to pressure area care. All rib fracture patients should receive physiotherapy input at least once a day (see below) until respiratory function normalises and mobility restored to baseline.

Advanced respiratory support including Continuous Positive Airways Pressure (CPAP), Non- Invasive Ventilation (NIV) and Nasal high flow oxygen (Optiflow/ Airvo etc) can be considered, in liaison with critical care staff, for patients with anticipated or deteriorating respiratory failure. Decisions regarding which of these treatment modalities is appropriate will be specific to individual patients and determined by the clinical judgement of the attending trauma, anaesthetic and critical care teams. Patients with significant flail segments in particular should be referred early for critical care review regarding advanced respiratory support, even without evidence of respiratory failure, with the goal of maintaining lung volume and effective cough. A proactive approach to Chest X-Rays should be adopted for patients with flail segments; changes such as atelectasis warrant prompt referral to critical care. Preventative ventilatory support is a key strategy that must be adopted.

4.5.4 Physiotherapy

All patients should be referred to Physiotherapy at an early stage for initial assessment as soon as possible following admission. Respiratory function can be compromised in this patient group due to decreased functional residual capacity, impaired muco-ciliary clearance of bacteria, reduced cough and reduction in compliance⁹. The physiotherapist should complete baseline incentive spirometry readings to determine respiratory function, which then can be the basis to assess improvement or deterioration. All patients should be issued with an incentive spirometer and be encouraged to take 5 deep breaths every hour, which can be encouraged and reinforced by other health care professionals. The incentive spirometry volumes should be reviewed daily until a satisfactory consistent volume is obtained.

If the patient is admitted out-of-hours then they should be referred to Physiotherapy first thing in the morning by the nursing staff on the ward. If the pain is controlled and the patient is deteriorating from a respiratory point, then the owning medical team can refer to the on-call physiotherapist. This may include if there are acute issues with secretion management and this should be the decision of the patients owning medical team. Please note that most physiotherapy interventions are contraindicated if a patient has an undrained pneumothorax.

4.5.5 Rib Fractures

Good analgesia, chest physiotherapy, and the early identification and management of complications remain the mainstays of rib fracture management in the hospital. Common immediate thoracic sequelae of rib fractures include pneumothorax, haemothorax, haemopneumothorax, pneumatocele, pulmonary contusions. Solid organs, such as the liver, kidneys and spleen, may also sustain lacerations from broken ribs.

Pain is the most common symptom from rib fractures and a key component in pulmonary complications. Pain restricts tidal volume, leading to hypoventilation, and impairs coughing ability, leading to sputum retention; these combine to cause atelectasis and predispose to pneumonia. Additionally, injured lung tissue underlying the fractures has impaired ability to exchange gasses (leading to shunt and VQ mismatch) and reduced compliance. Compensatory increases in respiratory rate may increase oxygen consumption. Pneumonia occurs in up to 30% of cases, with or without sepsis, causing further respiratory compromise. The combination of hypoventilation, atelectasis and/or lobar collapse and impaired gas exchange results in hypoxaemia, respiratory failure and, in some cases, a need for mechanical ventilation. Respiratory complications typically develop at 48 – 72 hours post injury. Other respiratory complications include pulmonary embolus, pulmonary effusions, empyema and acute respiratory distress syndrome (ARDS).

Elderly patients (aged 65 years or older), have been consistently shown to have worse outcomes, higher complication rates and greater mortality after rib fractures than younger patients.

In particular for rib fracture patients, assess pain at rest and on coughing/ deep inspiration and ask about features of neuropathic pain for example tingling, burning and electric shock like sensations. Multimodal oral analgesia should be started on admission and include regular paracetamol, ibuprofen and opioids. Morphine should be prescribed both regularly and for breakthrough (PRN).

Patients with multiple rib fractures may develop lung contusions 24 to 48 hours post initial injury so need to be monitored closely from a respiratory and cardiovascular perspective. Assessment should continue from admission to discharge and adequate analgesia **must** be available and utilised. Critical Care Outreach Team should be made aware of the patient's admission as soon as is practicable.

4.5.6 Sternal Fractures

All patients with sternal fractures must be observed in the Emergency Department for at least 4 hours from the time of injury. If this is not known, consider the time of ambulance arrival on scene as the time of injury. Sternal fractures can be diagnosed on CXR if specific Sternal views are requested. They are often diagnosed on CT Chest in conjunction with other thoracic injuries. All patients must have serial ECGs, Routine bloods and a Troponin. Any patient with chest wall injuries and acute ECG changes, raised cardiac markers, or confirmed myocardial contusions must be admitted to a CCU bed and monitored for at least 24 hours.

Consider discharge if the patient has normal serial ECGs, is haemodynamically stable, has their pain well controlled, is able to take deep breaths and is able to cope at home. The decision to discharge a patient is to be made by a senior decision maker (registrar in charge or ED consultant).

All other patients are to be admitted under general surgery.

4.5.7 Haemo/pneumothorax

Current ATLS, ETC and NICE guidance all recommend the placement of a Surgical Chest drain for all patients who have sustained a traumatic haemopneumothorax. This is typically placed in the [‘Triangle of Safety’](#).

There is a growing body of evidence that suggests that not all pneumothoraces need to be drained, and a conservative approach may be appropriate in some patients. There is no clear consensus on size of pneumothorax, and patient cohort, where a conservative approach may be adopted. Similarly a Seldinger chest drain may be more appropriate in an elderly patient with a small isolated pneumothorax on CT. The decision not to place a chest drain, or to place a non surgical chest drain may be appropriate in certain clinical scenarios, but only at the discretion of a senior trauma clinician.

A surgical chest drain must be placed if there is any evidence of a haemothorax.

4.5.8 Tension Pneumothorax

Tension pneumothorax was classically defined as a large pneumothorax with haemodynamic compromise caused by the pneumothorax. This definition was based on mechanically ventilated animal studies. Recent evidence suggests that this is not necessarily how a spontaneously ventilated patient will present. Spontaneously ventilated patients are more likely to present with tachypnoea, air hunger, and desaturation. While haemodynamic instability may occur, this is like to be a pre-terminal event. Recent ATLS guidelines have been updated to reflect this.

Where possible a chest Xray should be taken prior to decompression to confirm a pneumothorax. Treatment should not be delayed in a patient with suspected tension pneumothorax in order to wait for an Xray.

Needle decompression was widely advocated for use in traumatic tension pneumothoraces. Studies have shown that needle decompressions are often performed unnecessarily, are often unsuccessful, and have high failure rates. They are also associated with complications from direct trauma and failure of the procedure.

Open (Finger) thoracostomies are a more effective and stable method to decompress the chest in tension pneumothoraces. Expert consensus suggests this technique has fewer complications and better outcomes for patients. The technique comprises the initial steps in the placement of a surgical drain, without placement of the chest drain itself (see below).

This guideline recommends the use of open (finger) thoracostomies followed by a surgical chest drain for decompression of the chest in line with NICE and ATLS guidance.

All patients in whom an open thoracostomy has been performed must have a surgical chest drain placed as soon as is clinically feasible.

Box 7 Recommendations for immediate chest decompression in awake patients with tension pneumothorax as the suspected cause

Chest radiograph not immediately available and:

- SpO₂ < 92% on O₂
- Systolic BP < 90 mm Hg
- Respiratory rate < 10
- Decreased level of consciousness on O₂
- Cardiac arrest
 - bilateral finger or tube thoracostomy
 - not needle thoracocentesis

4.5.9 Open Pneumothorax

Current prehospital guidance recommends the use of simple occlusive dressings for the management of an open pneumothorax, followed by observation for signs of a tension pneumothorax. This replaces previous guidance for the use of a three-way occlusive dressing, or a dressing with a one way valve. It is important to bear this in mind when patients with open chest injuries are brought to the ED as the patient may then develop a tension pneumothorax.

All patients with open pneumothoraces will still require a chest drain. Seek specialist advice for closure of the open wound.

4.5.10 Admission

Isolated blunt chest trauma patients should be admitted under general surgery.

Patients may be transferred to medicine after 24-48 hours if they do not have a chest drain or a requirement for regional or epidural analgesia.

Transfer of care to general medicine or geriatric medicine will require a review by the accepting medical consultant.

Patients with other injuries, e.g., a fractured neck of femur will need to be admitted under the most appropriate speciality which is likely to be trauma and orthopaedics.

4.5.11 Intensive Care

Patients in ICU receiving level 2 care should follow the standard non-invasive or invasive pathway as appropriate. Patients who would benefit from non-invasive ventilation should also be considered for arterial line insertion and regular blood gases to assess respiratory function.

In patients who are receiving level 3 care (i.e. sedated, intubated and ventilated), the following principles should be considered:

Ventilation:

- Use lung protective ventilation strategies
- Nurse with head end elevation to to ≥ 30 degrees if not contraindicated by other injuries
- Regular Subglottic suctioning

Analgesia:

- Assess pain regularly and treat with multimodal analgesic therapy.
- Consider an epidural or regional block if:
 - o The patients showing signs of impaired respiratory effort, e.g., tachypnoea, poor tidal volumes, signs of pain or the patient indicates they are in pain
 - o In the 24 hours prior to planned extubation based on severity of the injuries

Consider referral for rib fixation if:

- Flail chest or paradoxical chest movement during weaning from a ventilator or > 6 ribs fractured
- Bilateral rib fractures
- Hypoxia and/or hypercarbia under 40% inspired oxygen inhalation
- Repeated atelectasis
- Significant chest wall deformity
- Not responding to thoracic epidural and do not require intubation and ventilation otherwise

4.6 Discharge and Follow-up

Prior to discharge, patients should be given information, for example the [NHS choices](#) rib injury sheet, to ensure their progress after discharge is optimal. Pain should be adequately controlled such that patients are discharged with weak opioids (as well as other multimodal agents) in the TTO pack. If stronger opioids, e.g., morphine, are still in use, a clear tapering plan should be in place for the GP. Patients should be advised to see their GP if the pain isn't responding to prescribed analgesics or if they develop features of chest infection. Other simple interventions that can be recommended for completion at home include continued use of the active cycle breathing technique, use of ice packs, use of splints when coughing (e.g., a rolled-up towel), encouragement of mobilisation but avoidance of heavy strenuous exercise or work. Patients who have received surgical rib fracture fixation should be followed up in fracture clinic at 6 weeks after discharge.

5. Monitoring of Guideline

This guideline will be monitored through incident reporting and audit.

6. Equality Impact Assessment

This guideline has been subject to an Equality Impact Assessment and it is not anticipated to have an adverse impact on any group.

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Full version control record

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This guideline has been registered with the trust. However, clinical guidelines are guidelines only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt, contact a senior colleague or expert. Caution is advised when using guidelines after the review date.

This guideline is for use in Frimley Health Trust hospitals only. Any use outside this location will not be supported by the Trust and will be at the risk of the individual using it.

Version Control Sheet

Version	Date	Guideline Lead(s)	Status	Comment
1.0	March 2023	Dr A Galley	Final	Cross-site use.