



CLINICAL GUIDELINE

Blunt Chest Wall Trauma Management in Adults, Queen Elizabeth University Hospital

A guideline is intended to assist healthcare professionals in the choice of disease-specific treatments.

Clinical judgement should be exercised on the applicability of any guideline, influenced by individual patient characteristics. Clinicians should be mindful of the potential for harmful polypharmacy and increased susceptibility to adverse drug reactions in patients with multiple morbidities or frailty.

If, after discussion with the patient or carer, there are good reasons for not following a guideline, it is good practice to record these and communicate them to others involved in the care of the patient.

Version Number:	1
Does this version include changes to clinical advice:	N/A
Date Approved:	24 th March 2024
Date of Next Review:	1 st August 2025
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Approval Group:	South Sector Clinical Governance Forum

Important Note:

The Intranet version of this document is the only version that is maintained. Any printed copies should therefore be viewed as 'Uncontrolled' and as such, may not necessarily contain the latest updates and amendments.

QUEEN ELIZABETH UNIVERSITY HOSPITAL
MAJOR TRAUMA SERVICE
MANAGEMENT OF BLUNT CHEST WALL TRAUMA IN ADULTS

Guideline Key Points

- **All patients who require inpatient admission with blunt chest wall trauma should be assessed to determine the risk of respiratory deterioration.**
- **Escalation status should be considered for all patients admitted to QEUH with blunt chest wall trauma.**
- **All patients admitted with severe chest wall trauma should have a holistic assessment including pain assessment, respiratory function assessment, simple bedside physiotherapy, incentive spirometry, laxatives and anti-emetics.**
- **All patients admitted with severe chest wall trauma should receive multi-modal analgesia.**
- **All patients admitted with severe chest wall trauma should have their severity of injury determined using the STUMBL scoring system.**

Reference	Management of blunt chest wall trauma in adults.
Version	V1.4
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Date	December 2023
Date for review	January 2025
Distribution	<p>TACCE Directorate (Theatres, Anaesthetics + Critical Care)</p> <p>Surgical Directorate (General and Orthopaedics & Trauma)</p> <p>DME + Medical Directorate</p> <p>MTC Directorate</p> <p>Emergency Medicine Directorate</p> <p>WoS Scottish Trauma Network Clinical Governance Team</p>

Objectives

This guideline describes the optimal management of patients who require hospital admission with severe blunt chest wall trauma. Rib fracture management including invasive regional anaesthetic techniques and surgical fixation have evolved over the past decade. This document will ensure that all patients admitted to QEUH receive protocolised care, which will include regular respiratory assessment, multi-modal analgesia including regional anaesthetic techniques and consideration to surgical fixation.

Background and Importance

Blunt chest wall trauma accounts for a significant proportion of all trauma patients admitted to hospital in the UK. The exact incidence is difficult to quantify due to the variation described in the published literature but has been cited to range between 10% and 35% of all trauma related hospital admissions. Blunt chest wall trauma is associated with severe pain that can be challenging to manage. Patients often develop a vicious cycle of pain, requirement for opioid analgesia, respiratory dysfunction, hypostatic pneumonia and ultimately respiratory failure. This is more common in those with high-risk features such as increasing age, respiratory co-morbidities and significant burden of injury. Poorly managed chest wall pain can lead to prolonged hospital stay, potential critical care admission, invasive ventilation and increased likelihood of morbidity and death, along with development of chronic pain.

Surgical rib fixation has also evolved over the last decade. Traditionally surgical rib fixation was reserved for patients who were unable to be liberated from mechanical ventilation with multiple rib fractures and associated flail segment. However, it is becoming more common for patients to be considered for rib fixation, both to improve pain management but also in anticipation of potential respiratory failure.

Our hospital has recently become a Major Trauma Centre and, as such, we expect to see an increasing number of patients with severe chest wall trauma, particularly those patients who are at increased risk of respiratory deterioration such as the silver trauma cohort.

Given the volume of patients with chest wall trauma that will present to our hospital, it is prudent that all patients receive protocolised care, receive best evidenced based treatment and undergo risk assessment.

Definitions

Radiological Flail chest. A radiological diagnosis when at least **2** fractures are present per rib in at least **3** adjacent ribs, producing an intercalated flail segment, as visualised on three-dimensional scanning.

Physiological flail chest. A clinical diagnosis based on observed paradoxical chest wall movement when the intercalated flail segment fails to rise with the normal chest wall during inspiration. Physiological flail is associated with increasing pain and respiratory compromise. This risk increases as the size (number of ribs contributing to the flail) increases.

Patient-controlled analgesia (PCA). An analgesic technique that involves patient controlled delivery of intravenous opioid such as fentanyl, oxycodone or morphine. Dose, lockout time, background infusion and opioid type will depend on patient specific factors and be guided by the acute pain team.

Non-invasive ventilation (NIV). An advanced respiratory technique useful for atelectasis, obstructive sleep apnoea and pulmonary oedema. It involves a tight fitting face mask and the application of positive pressure ventilation either continuously (CPAP) or at varying pressures throughout the respiratory cycle (BiPAP). This will reduce work of breathing and optimise cardiopulmonary function.

Nasal high flow humidified oxygen (NHFO2). An advanced respiratory technique used to match oxygen delivery with peak inspiratory flow rate in patients with impending respiratory failure. It provides respiratory humidification, can help prevent atelectasis and improves work of breathing.

Invasive ventilation (IPPV). An advanced respiratory technique which involves passage of either an endotracheal or tracheostomy tube into the trachea and the application of a closed positive pressure ventilation circuit. The delivery of general anaesthetic drugs are required to facilitate IPPV, with the potential for cardiorespiratory collapse and airway loss. For this reason IPPV can only be delivered by anaesthetists/intensivists in the ICU.

Protocolised assessment and management for all patients admitted to QEUH with severe chest wall trauma.

All patients who are admitted to QEUH should:

1. Be assessed to determine risk of respiratory failure. The Rib Fracture Quick Assessment Tool (Figure 2) should be used in the emergency department to help identify high risk patients. Upon ward / critical care admission, the Chest Wall Trauma Care Pathway should be completed by the admitting team.
2. Receive a holistic package of care which includes simple bedside chest physiotherapy, incentive spirometry, strong analgesia and laxatives.
3. Have escalation decisions discussed and documented early, particularly in the group at high risk of respiratory failure.

Identification of the high-risk patient

Features that would be consistent with high risk of respiratory failure can be categorised into patient factors, acute physiological factors and trauma related factors.

Patient Factors

- Age > 60
- Smoker
- Respiratory disease
- Prescribed regular anti-coagulant drugs
- Obstructive sleep apnoea
- Morbid obesity
- Clinical frailty score > 3

Physiological Factors

- SpO₂ < 92%
- RR > 20 breaths per minute
- FiO₂ > 40%
- Physiological flail segment
- Unable to deep breath and difficulty undertaking an effective cough
- Consistently triggering pain score > 4
- Incentive spirometry < 15 ml/kg ideal body weight (for average 70 kg patient this is approximately 1000 ml)

Trauma Factors

- Increasing number of ribs fractures and increasing number of total fractures.
- Bilateral rib fractures
- Radiological flail segment (Risk proportional to increasing number of ribs contributing to flail segment)
- Pneumothorax/haemothorax requiring intercostal chest drain (ICD).
- Radiological evidence of pulmonary contusions
- Significant fracture displacement

Figure 1: STUMBL Chest Scoring System.

Score 1-10 = Mild

Score 11 – 30 = Moderate

Score > 30 = Severe

+ 1 point per every 10 years over 10

+ 2 points per 5% reduction in SpO₂ < 95%

+ 3 per individual fracture

+ 4 if pre-existing anticoagulant/antiplatelet drug

+5 chronic lung disease

Patients with any high-risk features should be considered high risk of respiratory deterioration, particularly those with a STUMBL score > 10. These patients should be discussed with the Major Trauma Team and Acute Pain Service and considered for admission to the Major Trauma Ward (1C). Patients with STUMBL score > 30 or who may require advanced respiratory therapy such as nasal high flow humidified oxygen, non-invasive ventilation or invasive ventilation should be discussed with the critical care team, providing there are no obvious contraindications to escalation beyond ward level care.

Imaging

In order to accurately diagnose and prognosticate risk of respiratory failure, appropriate imaging is essential. Less than 50% of pulmonary contusions are visible on admission CXR, compared to >90% after 24 hours. Initial CXR misses rib fractures on more than half of occasions and commonly under reports the number of fractures / presence of pulmonary contusions.

All patients with suspected rib fractures should have an initial CXR performed as a minimum.

CT Imaging is much more sensitive, particularly in the early stages of pulmonary contusions and should be considered strongly in the following cases:

- Increasing bleeding risk (on anti-coagulant drugs)
- Multiple co-morbidities, particularly respiratory disease AND would still be considered for escalation of care to HDU/ICU environment, regional anaesthesia or rib fracture fixation
- Severe mechanism of injury (many of these patients will already have had CT chest imaging completed as part of a trauma pan-scan)
- High risk of requiring invasive ventilation
- Increasing oxygen requirement.

Delayed presentation of pneumothorax is common in patients with rib fractures, particularly those with multiple displaced fractures +/- flail segments. Repeat chest imaging should be strongly considered in the event of worsening respiratory function and / or deteriorating pain control.

It is important to note that CT imaging should be used for appropriate cases as listed above and NOT simply as a means to accurately describe STUMBL score, in patients who do not have high risk features or who would not be appropriate for invasive management.

Analgesia for chest wall trauma (See Appendix 2: QEUH Chest Wall Analgesia Protocol)

Simple analgesia bundle

All patients should receive simple regular analgesia providing there are no contraindications:

- Paracetamol 500 mg – 1 g four times daily.
- Ibuprofen 400 mg three times daily or naproxen 500mg twice daily. Note contraindications in renal dysfunction, bleeding, cardiac disease and gastric ulceration. Use with caution in elderly patients.
- A regular weak opioid such as dihydrocodeine 30 – 60 mg every 6 hours.
- Morphine sulphate immediate release 5 – 10 mg every 1 - 2 hours as required.
- The addition of sustained release opioid preparations such as morphine MR (MST / Zomorph) or oxycodone MR (OxyPro / Longtec) can be considered and guided by clinicians with experience in acute pain management.
- Patient-controlled analgesia (PCA) can also be considered for patients with high pain scores as a temporising measure until regional anaesthesia can be established, or in those patients in which regional anaesthesia is contraindicated.

Analgesic adjuncts

In order to provide holistic care the following adjuncts should be utilised:

- Regular laxatives such as lactulose 10 ml twice daily and senna 15 at night.
- Regular proton pump inhibitor if not already prescribed in community – lansoprazole 30 mg once daily or omeprazole 20 mg – 40 mg daily, especially if prescribed an NSAID.
- Ensure anti-emetics are prescribed as required – for example, ondansetron 4 mg three times daily as required and / or buccastem 3 mg twice daily as required. Ensure QTc interval is checked in patients being prescribed multiple anti-emetics, particularly if already receiving medication that prolongs QT interval such as anti-psychotic drugs, clarithromycin and methadone.
- If requiring oxygen, then humidified oxygen is recommended.
- Incentive spirometry and consider completion of dynamic pain score assessment chart (work in progress, will be published in due course).

Physiotherapy

Patients who are deemed at risk from a respiratory perspective should be referred to physiotherapy to support ventilation and prevent complications. The ability of patients to participate in physiotherapy is dependent on adequate analgesia using non-sedative doses.

All patients should be provided with an incentive spirometer to optimise lung expansion, alveolar ventilation and prevent complications. The incentive spirometer should be used at least x4 times daily using x10 breaths by the patient with use encouraged by the MDT throughout the day.

Patients can also be taught to perform a simple active cycle breathing technique (ACBT), huffing and encouraged to cough. This can be initiated by nursing staff if necessary, for example at weekends and in the evenings (see appendix 6 for patient exercise leaflet). Alternative treatments to mobilise secretions include those that combine CPEP, CHFO and aerosol therapy.

In patients who are able to mobilise, early and regular mobilisation should be encouraged. Exercises can be provided to assist patients who are only able to move into a chair. Shoulder exercises should

be taught in appropriate patients to prevent movement restrictions post injury which can limit return to work longer term.

(See Appendix 5: Patient information leaflet)

Scottish Trauma Network Considerations

It is expected that each Major Trauma Unit will provide care for patients with severe chest wall trauma / rib fractures. Assessment and management of these patients will be delivered as per local hospital guidelines. Most hospitals can deliver novel regional anaesthetic techniques described in this guideline. However, there may still be a requirement for transfer to QEUH MTC. Indications for QEUH MTC transfer include:

- ISS Score > 15
- Injuries to multiple body regions
- Requirement for specialist tertiary service such as interventional radiology
- Consideration of surgical rib fixation.
- Other co-existing injuries requiring transfer to QEUH for definitive management, such as spinal or pelvic injuries

If a patient has been identified for consideration of transfer to QEUH MTC, the Major Trauma Team should be contacted as soon as possible:

- **Major Trauma Co-ordinator: 82149/82150 (0141 452 2149 / 0141 452 2150)**

The Major Trauma Coordinator will ensure appropriate information obtained to allow full consideration of RFF weighted against the burdens of transfer to MTC. If accepted for RFF, the Major Trauma Coordinator will ensure appropriate dialogue occurs between critical care, surgery, major trauma and the referring hospital to work out the logistics of transfer (eg transfer to critical care vs MTC Ward).

Helpful additional contacts:

- **Major Trauma Consultant: 83909 (0141 452 3909)**
- **ED Consultant in Charge: 82828 (0141 452 2828)**
 - o Should be informed of all secondary trauma transfers into QEUH from MTU ED.
- **ICU Consultant in Charge: 83081 (0141 452 3081)**
 - o The ICU Consultant must be informed of all secondary trauma transfers, especially overnight.
 - o Secondary transfer cases for chest wall trauma are likely to require critical care and bed capacity needs to be considered BEFORE the patient is transferred.
 - o Note at present, the Major Trauma Ward cannot accept admissions after 5 pm. Secondary trauma transfers admitted to QEUH, after 5pm, can be admitted to parent specialty ward, HDU or ICU depending on the clinical context.

Patients undergoing secondary transfer from MTU Emergency Department to QEUH MTC **MUST ALWAYS** be transferred to QEUH Emergency Department and be received by the ED Team with an appropriate trauma tier call being placed depending on patient physiology. It is therefore essential that the ED Consultant is aware of these patients prior to transfer to give consideration to ED clinical activity and appropriate trauma call placement, in addition to the ICU Consultant on call to give consideration to critical care capacity.

Quality assurance and audit

We aspire to provide patients presenting to the QEUH MTC the highest standard of care using the latest evidenced based practice.

All patients who are admitted to QEUH MTC with severe chest wall trauma will be captured via the Scottish Trauma Audit Group tool.

We have a robust morbidity and mortality process, patients who die under the MTC or critical care will be reviewed to ensure that there were no unnecessary contributing factors. We utilise M&M Datix to conduct team based quality review meetings, which allows discussion of case narrative and human factors analysis of events to ensure our processes are optimised.

All patients who receive a regional anaesthetic technique will be captured by our acute pain service. These patients are continually audited to ensure we understand both the patient group that we are providing regional anaesthetic techniques to, but also that we quality assure our time to intervention. Funding options to support this are currently being explored.

We have recognised that it is difficult to stratify and accurately compare acute pain data due to the heterogenous nature of our patient group. Patient experience in general is easier to capture a valid marker of quality assurance. We are in the process of designing a patient related outcome measure (PROM) audit tool which will provide further feedback, particularly patient experience pre and post regional anaesthetic intervention.

Appendix 1: List of reviewers contributing to this guideline:

Role	Name
Major Trauma Team	Dr Robert Hart Dr Sandy Binning Dr Sarah Gill Lynn Wallace Helen Fraser
Critical Care	Gill McDivett Julie Kennedy Dr Bob Docking Dr Peter Stenhouse Dr Sarah Ramsay
Emergency Medicine	Dr Fraser Denny Dr Alan Whitelaw
General Surgery	Mr Paul Glen
Department of Medicine for the Elderly	Dr Eileen Capek
Acute Pain Services	Dr Stephen Hickey Jackie Bell Stephanie Brockie Freya Burwaiss
Anaesthesia	Dr Iain Thomson Dr Indy Raju Dr Malcolm Watson Dr Kenny Pollock Dr Shubh Gupta Dr Arran Keir
West of Scotland Scottish Trauma Network	Dr Brian Digby Dr Malcolm Gordon
Procurement	Gill Heirs
Pharmacy	Alison Oprey
Physiotherapy	Helen Devine
Radiology	Dr Luthan Lam Dr Simon Sheridan

Appendix 2: QEUH RIB FRACTURE ANALGESIA QUICK REFERENCE CHART

ASSESS RISK OF RESPIRATORY DETERIORATION

HIGH RISK INJURY FEATURES

- MORE THAN 4 FRACTURED RIBS
- BILATERAL FRACTURES
- FLAIL SEGMENT
- ESCALATING OPIOID REQUIREMENT
- ESCALATING OXYGEN REQUIREMENT

HIGH RISK CO-MORBIDITY FEATURES

- SMOKER
- OBESE (BMI > 40)
- CHRONIC RESPIRATORY DISEASE
- AGE > 65
- OBSTRUCTIVE SLEEP APNOEA
- ANTICOAGULATION

NO

3 OR MORE HIGH RISK FEATURES PRESENT?

YES

LOW RISK BUNDLE

HIGH RISK BUNDLE

1. Humidified oxygen
2. Regular paracetamol
1 gram every 6 hours if weight > 50 kg
Reduce dose if < 50 kg.
3. Regular NSAIDs + PPI (unless contraindicated)
4. Consider regular weak opioid initially (for example, dihydrocodeine 30 – 60 mg qds)
5. PO 5 - 10 mg oramorph PRN 2-hourly
6. Consider PCA opioid
7. Regular laxatives + PRN antiemetics
8. VTE prophylaxis (unless CI)
9. INCENTIVE SPIROMETRY
10. Monitor for signs of deterioration.

As per Low Risk Bundle PLUS:

1. Ensure coagulation screen + FBC checked,
2. Low threshold for referral to CRITICAL CARE.
3. Ensure regular strong opioid analgesia prescribed (eg MST/Oxycodone MR) OR consider use an opioid PCA infusion.
4. Consider ketamine/clonidine in selected patients (Critical care environment only).

TREATMENT TARGETS

- Improving/stable SpO₂/PaO₂
- Reducing/stable FiO₂
- Improved analgesia
- Effective cough
- Able to complete incentive spirometry

SIGNS OF DETERIORATION → REFER ICU

- Treatment targets not met
- Escalating FiO₂
- Decreasing SpO₂/PaO₂
- Fluctuating GCS
- Haemodynamic instability
- Deteriorating pain scores

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