Royal Cornwall Hospitals
NHS Trust

Adult Chest Wall Injury Pathway Policy and Procedure

V3.0

December 2023

Summary Adult Chest Wall Injury Pathway

Is a Trauma Call indicated?

Serious mechanism of injury with abnormal physiology or anatomical features of major trauma,
Or
High risk group (elderly / pregnant).

Imaging obtained?
In view of the poor sensitivity of CXR for significant and associated chest injury, all patients requiring admission for rib fractures should have **at least** a CT chest. However, a full Trauma CT will often be more clinically appropriate. The threshold for a full body scan should decrease with age.

Chest Injury Score

- Age: **+1 for each 10 years over age 10.**
- Rib fractures: **+3 for each individual fracture (i.e. 2 fractures on 1 rib = +6).**
- Chronic lung disease: **+5 if present.**
- Anti-coagulant or anti-platelet use: **+4 (exclude Aspirin 75mg).**
- Oxygen saturation on air (see ambulance chart): **+2 for each 5% decrease below 95%**.

Risk Stratification
Calculate and document the Chest Injury Score following imaging. This should be used to stratify analgesia, risk of complications and hence further care.

Multiple injuries or a high chest injury score should be discussed with Trauma Team Leader at Derriford ED for consideration of secondary transfer.

Analgesia

Prescribe analgesia using EPMA **'Major Trauma' chest injury analgesia bundle.** Protocols stratified by Chest Injury Scoring and populated by selecting 'Prescribable' or 'Treatment Protocols' and entering '**Major Trauma'**, **not** rib fractures.

Patients should be able to cough and take a deep breath. If they cannot, consider escalating their analgesia.

Consider most appropriate catheter regional anaesthesia technique (epidural, ESP, SAP, parasternal).

0-10 Conservative
Regular oral analgesia. Consider for home discharge if pain sufficiently managed. Consider PCA if pain persistent despite optimisation of oral analgesia.

11-20 Progressive
Regular oral analgesia. Consider home is pain sufficiently managed on oral analgesia. Consider regional anaesthesia (low threshold for elderly or comorbid).

21-30 Aggressive
Regular oral or PCA analgesia. Refer for regional anaesthesia. Refer to Critical Care for discussion.

>31 Emergent
Regular oral or PCA analgesia.
Refer for regional anaesthesia. Refer to Critical Care for discussion.

Other injuries?
Make all referrals and get a plan at point of review in ED. All injuries should have a documented plan from either Registrar or Consultant from the relevant specialty.

- Orthopaedics - Limb or pelvic fractures and wounds.
- General Surgery - Intra-abdominal injury and all open 'surgical' chest drains outside ED/ICU.
- Urology - Urinary or renal tract injury.
- Neurosurgeons - Head or spinal injury.
- Thoracics - Cardiac or lung injury.
- Max fax or ENT - Facial or soft tissue neck injuries.

Thoracics Referral Criteria

- Flail chest.
- 3 or more consecutive ribs involved.
- Significant co-morbidities.
- Chest injury score>21.
- Complications e.g., open injury or significant haemo- or pneumothorax.
- Difficult analgesic management.
- Failure to wean from ventilatory support.
- Discuss anyone if in doubt.

Destination of Care - Patients **NOT** to go to the wards other than those specified on pathway unless indicated for specialist care.

Surgical Ward

- ≤ 75 years.
- Frailty score ≤4 (admission Rockwood Frailty Score).
- **No** chest drains.

Tintagel Ward

- >75 years **or**
- Frailty score ≥5 (admission Rockwood Frailty Score).
- **No** chest drains.

Refer to Critical Care

- Chest wall injury score >21 if clinically appropriate.
- Management of multiple or severe injuries +/- chest drain.
- Clinical deterioration.
- Management of epidural analgesia.

Wellington Ward

- Non-Critical Care management of patients with chest drain is available only on Wellington ward.
- Refer to General Surgical on-call team – the patient will be a surgical 'outlier' while on Wellington.
- Once the drain has been removed, the patient should promptly be transferred to surgical/Tintagel ward.

- All specialities to review and document plan before patient leaves ED.
- Refer to Critical Care if Chest Injury Score >20, chest drain, advanced regional anaesthesia, or multiple injuries.
- For non-Critical Care management of chest drains, a bed on Wellington ward is the only clinical area suitable for these patients.
- **WCH to RCH transfer only-** As above Tintagel criteria and Chest Injury Score >20 or >20 and pain unusually difficult to control and requiring advanced analgesia such as PCA +/- regional anaesthesia following discussion with RCH Eldercare Consultant and formal acceptance.

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Data Protection Act 2018 (UK General Data Protection Regulation – GDPR) Legislation

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Royal Cornwall Hospital Trust rch-tr.infogov@nhs.net

1. Introduction

1.1. This is a pathway designed to guide the assessment, admission, management, and rehabilitation of adult patients who present to Royal Cornwall Hospital with a chest wall injury.

1.2. This version supersedes any previous versions of this document.

2. Purpose of this Policy/Procedure

2.1. Clinical Pathways aim to improve the quality, continuity, and co-ordination of care for the patient across different disciplines and sectors.

2.2. This pathway has been written to:

- To ensure that patients within RCH sustaining a chest wall injury receive the correct care in the correct timeframe.
- Improve the quality, continuity, and coordination of care for the patient by a multidisciplinary team and reduce the risks associated with poor chest wall injury care.

3. Scope

This pathway relates to the following staff who may be involved in the assessment and delivery of chest wall injury care:

- Medical staff.
- Registered nurses.
- Physiotherapists and occupational therapists.
- Support workers.

4. Definitions / Glossary

- CCOT - Critical Care Outreach Team.
- NIV - Non-invasive ventilation.
- PTN - Peninsula Trauma Network.
- SOP - Standard of Operating Practice.
- TARN - Trauma, Audit and Research Network.
- TTC - Major Trauma and Transfer Consultant.
- RCH – Royal Cornwall Hospital.
- RTC – Road Traffic Accident.

- ED – Emergency Department.
- COPD – Chronic Obstructive Pulmonary Disorder.
- CXR – Chest X-ray.
- CT – Computerised Tomography.
- CWI – Chest wall Injury.
- MTC – Major Trauma Centre.
- PIC – Pain, Inspiration, Cough.
- PCA – Patient-controlled analgesia.
- ESP – Erector spinae plane.
- SAP – Serratus Anterior Plane.
- ODP - Operating Department Practitioners.

5. Ownership and Responsibilities

5.1. Lead professional

- Clinical lead for Major Trauma.

5.2. Specialist staff

- Major trauma coordinator / practitioners.
- Physiotherapists.
- Occupational therapists.
- Critical care outreach.
- Inpatient pain team.

5.3. Role of the Managers

Line managers are responsible for ensuring this guideline is disseminated to the affected staff and reviewed at the appropriate time.

5.4. Role of the Major Trauma Review Group/Committee

The Major Trauma Review Group/Committee is responsible for reviewing this guideline and monitoring of its implementation.

5.5. **Role of Individual Staff**

All staff members are responsible for ensuring they have read this guideline and refer to it when managing patients with chest wall injury.

6. Standards and Practice

6.1. **Background**

In RCH we frequently see patients with significant thoracic trauma (TARN and local audit data), often from standing. Thoracic trauma is seen in all adult ages. Falls from a low height (<2m) are a major cause of chest wall injury in all ages but particularly the elderly; with road traffic accidents (RTCs) as the cause of injuries in the under-65s. Chest wall injury is rarer in children due to the higher energy impact required to break their bones; as such, this pathway is for adult use only (>16-years).

A third of thoracic injuries from low falls are classified as major trauma (Injury Severity Score >15), whereas 60% from RTCs and 80% from high falls (>2m) are major trauma. Rib fractures are the most common injuries, with pneumothorax, lung contusions and haemothorax commonly associated. Sternal fractures are less common.

6.1.1. Although most patients with chest wall trauma present via the Emergency Department (ED) with a clear history of trauma, many patients with serious chest wall injuries are not diagnosed at the time of initial presentation. These patients are frequently frail and elderly who may present via the medical take after an episode of collapse and the diagnosis of chest wall injury can be delayed, by which time complications such as hypoxia and pneumonia are already established.

6.1.2. Patients with thoracic trauma are at risk of serious deterioration over the first 72-hours. Early identification, risk stratification and management with chest physiotherapy and appropriate analgesia will provide a better patient journey, reduce morbidity and mortality and early, effective analgesia and mobilisation as appropriate may reduce complications.

6.1.3. Risk factors for mortality include [Battle et al 2012, Pape et al 2000, Livingstone et al 2008]:

- Underlying lung disease e.g., COPD.
- Elderly age.
- Rib fractures seen on CXR.
- Bilateral rib fractures or flail chest seen on CT.
- Consolidation (contusion or pneumonia) on CXR, especially if bilateral.

6.2. **Imaging**

6.2.1. Less than 50% of pulmonary contusions are apparent on admission, compared to 92% at 24hrs (Pape et al 2000). Initial CXR misses rib fractures >50% of the time (Livingston et al 2008) and under-reports most of the rest.

6.2.2. All patients with suspected thoracic trauma should have a CXR as a minimum. Peninsula Trauma Network (PTN) guidance (August 2022) suggests a CT Thorax should be considered in the following patients:

- Age >65-years.
- Significant cardio-respiratory disease.
- Associated alcohol excess.
- ≥ 3 ribs on Chest Xray (CXR).

6.2.3. Consider CT in patients who have multiple risk factors for mortality (above) [expert opinion], or one of:

- An increased likelihood of bleeding e.g., on anticoagulants, known bleeding tendency, haemopoetic disorder.
- Multiple co-morbidities.
- Patients in whom clinical examination may have low utility in determining injuries e.g., elderly, low or altered GCS.
- Severe Mechanism of injury (fall >2m, RTC, fall onto edge of sink/table etc.).
- The RCH Trauma Team Activation criteria should be followed.
- The RCH Polytrauma CT guideline should be followed: consider whole-body (Trauma) CT in all patients meeting criteria for Trauma Team activation.
- Whole-body (Trauma) CT, or thorax-abdomen-pelvis CT, should be considered if there is suspicion of other injuries, especially intra-abdominal injury. Remember that chest wall injuries can be very painful and mask an associated spinal injury.
- CT scans performed for thoracic injury should have spinal reconstructions to exclude concomitant injury.

6.2.4. Patients not meeting any of the above criteria for CT scanning (6.2.2 and 6.2.3) nor admission (6.7) may not require a CT scan. A clinical decision with senior input is recommended. It is likely that those meeting all these criteria will be relatively younger, with few co-morbidities, have few rib fractures on CXR without other concerning features and be managing well with simple oral analgesia.

6.3. Chest Injury Score

All patients should have a chest injury score (see Appendix 3) calculated and documented in the medical notes.

This can be calculated directly on NerveCentre by inputting the required information into the CWI score assessment (Assessments → Chest Wall Injury → Chest Wall Injury). For details of how to perform this on NerveCentre, see Appendix 10.

6.4. Transfer of patients for CT scan

The RCHT 'Safe Transfer of Patients Between Care Areas or Hospitals Policy' should be adhered to.

6.5. Discussion with Major Trauma Centre – automatic acceptance

Any patient with a chest injury score >30, or multiple injuries, especially with an injury severity score (ISS) known or suspected to be >15, should be discussed with the Major Trauma Centre (MTC) at Derriford.

Contact the Major Trauma Centre Trauma Team leader on 01752 245066 to discuss any patients meeting the above criteria, causing concern or whose care needs exceed RCHT capabilities.

6.5.1. Cardiothoracic surgery is not available at RCH. Patients with massive haemothorax, tracheobronchial injury, mediastinal or great vessel injury should be transferred to the MTC as 'send then call' transfers as per the Peninsula Trauma Network. The latest version of this guidance is available at the URL in Appendix 9.

6.5.2. Patients meeting the referral criteria (see Appendix 4 - Adult Chest Wall Injury Pathway – RCH inpatient use) are discussed with the Cardiothoracic Registrar via Derriford Switchboard if there are acute concerns, or if non-urgent via email plh-tr.chest-trauma@nhs.net. This email should 'cc' the Major Trauma inbox (rcht.majortrauma@nhs.net) and the responsible consultant for the patient at RCHT.

6.6. Transfer of Patients to Derriford Hospital

The RCHT 'Safe Transfer of Patients Between Care Areas or Hospitals Policy' should be adhered to.

6.7. Admission of patients

Consider admission for any patient with significant chest wall trauma with one or more of the following features:

- Chest injury score >10.
- Frailty and /or social isolation.
- Significant co-morbidities especially underlying pulmonary disease.

- Pain not controlled with conventional oral analgesia.
- Clinical evidence of respiratory compromise.
- Radiographical evidence of flail chest (may require CT to determine early before lung consolidation-collapse).
- Multiple injuries.
- Other condition requiring admission.

6.7.1. Adult Chest Wall Injury Pathway – RCH Inpatient use document

CHA 3949: Adult Chest Wall Injury Pathway– RCH inpatient use (Appendix 4) should be printed, completed in full and included within the medical notes for all patients admitted with a chest wall injury. Reviewing clinicians should clearly date/time their entries on this document.

6.7.2. Critical Care Team

Patients with any of the following should be referred to Critical Care for review:

- Chest drain with other critical care needs.
- Need for epidural analgesia.
- Chest injury score >20.

6.7.3. Critical Care Outreach Team (CCOT).

If patients require the Critical Care Outreach Team, contact via Switchboard for discussion. This will be dependent on severity of injury and ongoing care needs - the outreach team will prioritise their workload accordingly. They provide a valuable source of support for complex and high-risk patients.

6.7.4. Multiple polytraumatic injuries

Patients with multiple injuries should also be considered for Critical Care admission and discussed with Critical Care Outreach.

If Critical Care admission not clinically indicated, admit to the most appropriate ward for the most severe injury.

6.7.5. Isolated chest wall injury

Patients with isolated chest wall injury and no requirement for a chest drain, should be admitted to appropriate clinical destination depending on age, frailty score and ongoing clinical need as per chest wall injury SOP.

6.7.6. Non-critical care management of chest drain.

Patients who require a chest drain for management of traumatic chest injuries without other requirement for critical care should be cared for on Wellington ward:

These patients should be referred to the General Surgical on-call team who will be responsible for their care on Wellington as a surgical 'outlier'. Routine nursing and day-to-day medical care will be provided by the Wellington ward staff and junior doctors.

Once chest drain is removed, the patient should be transferred to appropriate clinical speciality/ward area as per SOP as soon as possible.

6.7.7. Mobilisation guidance

Before leaving the emergency department all patients should have any mobilisation restrictions (e.g., as recommended by spinal surgery or orthopaedics) clearly documented in their medical notes and communicated in both medical and nursing handovers. If this is not possible, a responsible individual for this decision should be identified and the decision documented as soon as possible after their admission. While chest injuries rarely require imposed limitations to mobilisation, other injuries may limit patients' ability to sit out and engage with physiotherapy. Unnecessary periods of imposed immobilisation should be avoided.

6.7.8. In-patient Pain Team

Refer patients to the In-Patient Pain Team via as per Appendix 4, ensuring the 'Major Trauma' analgesia bundle is prescribed on EPMA as indicated by chest injury score (Appendix 3). If regional analgesia such as Erector Spinae/Serratus Anterior Block/Epidural/Parasternal is indicated, contact CEPOD anaesthetist (baton mobile **07979707573**) or the Senior Anaesthetic Trainee (SAT) directly out-of-hours. Upon discussion with the CEPOD anaesthetic team, the patient can be listed on the NerveCentre CEPOD list (Assessments → Not Grouped → CEPOD booking).

6.7.9. Major Trauma Team

Ensure the patient is identified as a '*Major Trauma Outlier*' on Nerve Centre to identify for routine Monday - Friday review. If more urgent Major Trauma Team review is indicated during weekday hours, contact the Major Trauma baton phone on **07917167942** or for urgent matters the on call TTC via switchboard (out-of-hours).

6.7.10. Chest trauma dashboard

Patient should be added to the Chest Wall Injury dashboard on NerveCentre at the point of diagnosis. This will collate much of the key clinical information and reviews required by this patient group and help co-ordinate the MDT approach to these patients. See Appendix 10 for guidance on how to do this.

6.7.11. Physiotherapy

Refer to a Physiotherapist for assessment once the patient has received appropriate analgesia.

- During normal weekday working hours contact the appropriate Physiotherapy team for the relevant clinical area. For ED admissions, this will be the respiratory physiotherapists.

- After hours, the Doctor admitting the patient should record in the notes of when physiotherapy assessment is indicated for example urgent overnight review or routine next day.

- For urgent out-of-hours (between 1700 and 0830) review for patients who have secretion retention or lobar collapse with respiratory failure, contact call the on-call Physiotherapist via switchboard for patients.

6.7.12. General Surgery

Age (≤75yrs) and frailty (CFS≤4) appropriate patients will be referred to on-call general surgery. Referrals can also be made to general surgery for ongoing trauma support for medical teams as required.

Patients with a chest drain not requiring Critical Care admission should also be referred to the on-call general surgery team. These patients will be cared for on Wellington ward as surgical ‘outliers’. If a patient develops a need for a ‘surgical’ chest drain and they are not located in ED or ITU, this drain should be sited by the general surgical team, and they are first port of call for troubleshooting.

6.7.13. Treatment Escalation Plan (TEP form)

Complete and document a Treatment Escalation Plan (TEP form).

A ceiling of care should be established before the patient leaves ED, with senior Critical Care and ED input in circumstances where prognosis is likely to be poor. Consideration should be given to the appropriateness of chest drains and other aggressive medical therapies. Regional anaesthesia may still have a role even in the patient approaching palliative treatment for analgesia.

6.7.14. Incentive spirometer

Patients admitted with a chest wall injury should be encouraged to use an incentive spirometer. This device acts as a reminder to patients to consciously take deep breaths and allows self-assessment of the efficacy of analgesia. Values obtained during patient assessment should be documented in the medical and/or nursing notes and can be added to the PIC (Pain, Inspiration, Cough) score on NerveCentre.

6.7.15. RCHT Patient Information Leaflet

Ensure 'Chest Wall Injuries' RCHT1683 patient information booklet offered and provided to patient as appropriate.

6.8. Tertiary survey

The tertiary survey is a top-to-toe systematic assessment to identify all injuries.

- All patients admitted with a chest wall injury must have the need for a tertiary survey determined at the first post admission ward round.
- Document on Tertiary Survey Nerve Centre assessment (under 'Not Grouped' list).
- If admitted to Critical Care Unit to be completed by senior clinician.
- If a patient has not received one, contact the Major Trauma Team via the baton phone on **07917167942**. (See also Tertiary Survey Policy).

6.9. Observation and Treatment

All patients admitted with a chest wall injury should receive SpO2 monitoring at a minimum 4-hourly for 24-72 hours or more frequently as determined by a NEWS score or clinician. Patients on this pathway should have an incentive spirometer at the bedside, be encouraged to use it (with appropriate guidance) and values achieved during assessments documented in the medical and nursing notes.

- Pain scores must be recorded with all observations, no less than 4-hourly.
- The PIC observations score (Pain, Inspiration, Cough) should be used in patients admitted with an acute chest wall injury for the first 3-5 days of their stay. This can be documented on a dedicated NerveCentre assessment which will populate within the CWI dashboard. (See Assessments → Chest Wall Injury → Chest Trauma PIC Chart). See Appendix 10 for guide for completing PIC observations on NerveCentre.
- For patients with advanced analgesia (e.g., epidural, PCA, regional anaesthesia) follow an increased observation regime as per RCHT hospital protocol.

6.9.1. Beneficial treatments [Parris 2007; Duggal et al 2013; low grade evidence/expert opinion] are:

- Judicious approach to analgesia (regular + PRN).
- Analgesics (advanced analgesia refer to Inpatient Pain Team).
- Early diagnosis of deterioration (regular observation and SpO2 monitoring).
- Erector spinae plane (ESP), Serratus Anterior Plane (SAP) or, if these fail or in the presence of bilateral injuries, a thoracic epidural (discussion with Critical Care / Anaesthetics / CEPOD / Major Trauma Team / Inpatient Pain Team as appropriate). Generally speaking, mid-high thoracic epidurals are likely to require critical care admission.
- Chest physiotherapy for secretion retention or lung collapse.
- Humidified air / oxygen.
- Non-invasive or invasive ventilatory support in selected patients (contact respiratory team / NIV physio in working hours or Critical Care Outreach out-of-hours).

6.9.2. Constipation

Constipation is a common consequence of chest wall injury due to reduced mobility and the use of strong analgesia reducing gut motility. Clinical teams should carefully monitor for signs of constipation and treat appropriately. Regular laxatives should be prescribed as part of the 'Major Trauma' analgesia bundle and can be omitted if not clinically indicated.

6.9.3. Acute kidney injury

It is not uncommon for patients with chest wall injuries to experience a reduction in GFR (glomerular filtration rate) in the early part of their in-patient stay, especially the elderly and those being treated for cardiac failure. This should be monitored closely in those at risk and appropriate changes to medications (e.g., opiates / LMWH) made in a timely fashion.

6.10. Regional anaesthesia in chest wall injury patients (epidurals or nerve catheters)

- Provide patient with patient – RCHT 'Nerve Blocks for Chest Wall Injury' patient information leaflet (Appendix 6).
- For siting of Erector Spinae Plane/Serratus Anterior, please use CHA447 'Erector Spinae Plane/Serratus Anterior Plane Block Proforma' (Appendix 8).

- Consider regional anaesthesia in all patients with chest injury score>20 or where aggressive regular analgesia proves inadequate. PCA should only occasionally be used sole analgesic technique but may more commonly compliment a nerve catheter technique. Nerve catheters should be considered even with CWI score <20 in those with:

    - Significant underlying cardiorespiratory disease (e.g., bronchiectasis, cardiac failure).

    - Significant renal impairment (absolute value or marked downward trajectory e.g., Acute kidney injury).

    - In those poorly tolerating oral opioids due to side effects or those with prominent nausea/vomiting limiting the use of enteral medications.

- Catheter techniques are the option of choice due to the need for extended analgesia. Single shot blocks should only be used as a temporising measure where necessary, ensuring a satisfactory plan for longer duration analgesia is in place.

- The peak benefit of regional anaesthesia techniques is early in the patient's admission within the first 5-7 days post injury. It is rare to require these interventions after 7-10 days from injury.

6.10.1 Procedure for provision of regional anaesthesia:

- It is the responsibility of the anaesthetic team to site epidurals or other regional anaesthesia techniques. Once the need for such a procedure has been identified, referral should be made to the Consultant Anaesthetist covering CEOPD in Theatre 7, or the Senior Anaesthetic Trainee at night as per Appendix 4. The patient should be booked on the CEPOD theatre list as 'Urgent' (<8hrs).

- It is up to the anaesthetising individual to check they are happy to site an epidural catheter (standard contraindications apply) or truncal nerve catheter. Patients should not be sent for until the anaesthetist has confirmed they are happy to perform the procedure and should not leave ED until secondary survey is complete and documented, CT report is available, and the ED component of the 'Adult Chest Injury Pathway – RCH inpatient use' (Appendix 4) is complete.

- If the correct skills and equipment are available, consideration should be given to performing the regional anaesthesia procedure in ED Resus. Epidurals should be loaded once sited with the patient fully monitored as per AAGBI guidance in the presence of the anaesthetist who should escort the patient to ICU once bed available, or to recovery as below.

- Nerve catheters may be sited in ED, recovery, ward areas or anaesthetic rooms as circumstances permit so long as an appropriate assistant and monitoring are in place. The patient should be monitored in the presence of a suitably trained

individual for 30 min following bolus of local anaesthetic with observations recorded as per the block proforma (Appendix 8).

- Once the decision to site / re-site regional anaesthesia has been made, this should be treated as an urgent request. For requests ‘in hours’ the aim should be to site the same working day. For ‘out of hours’ requests where workload/expertise precludes provision of regional techniques, consideration should be given to temporising options and the insertion prioritised for next daylight hours. Patients should not wait >24 hours for these important analgesic interventions. Early provision of good quality analgesia is important.

- The epidural may take place in an anaesthetic room, or in recovery. The procedure does not require an ODP, just a pair of appropriately capable hands. The anaesthetist is responsible for consenting the patient however they wish. Documented verbal consent is default, as with labour epidurals. Patients do not require a theatre booklet.

- Epidural sited and loaded at clinician discretion. Suggest initial titration of 10-20ml 0.125% Levobupivacaine with 2mcg/ml Fentanyl for epidural, increased if analgesia not adequate after 20 minutes. Patient then transferred to ICU bed and pump is started. If ICU bed not yet available, patient is to remain in recovery until it is ready, under the care of the ICU team.

- Nerve catheters can be loaded with an adequate volume of levobupivacaine (maximum dose 2mg/kg; typically, 30ml of 0.25% levobupivacaine).

- Patient monitored as per RCHT clinical pain guidelines.

6.11. Rehabilitation

During the inpatient stay (within 72-hours of admission) the patient will be assessed by the Major Trauma Rehabilitation Coordinator if an ongoing rehabilitation prescription is required as per TARN guidance. Not all patients will require this once assessed. If ongoing rehabilitation is required upon discharge from RCHT, the in-patient therapy teams will refer to community services upon discharge as appropriate. Any queries can be emailed directly to rcht.majortrauma@nhs.net.

6.12. Discharge

If a nerve block (single shot) or an indwelling nerve catheter has been used as part of a multi-modal analgesic approach, this will need to be removed (if indwelling) and all blocks/regional anaesthesia resolved prior to discharge. In addition to being clinically stable and medically fit, patients should be stable and managing on oral analgesia for 12-24 hours prior to discharge.

Consider giving individualised advice regarding SCUBA diving and flying to those who sustain a pneumothorax due to their chest wall injury.

6.13. References

- Pape HC, et al. Appraisal of early evaluation of blunt chest trauma: development of a standardized scoring system for initial clinical decision making. J Trauma. 2000 Sep;49(3):496-504.
- Livingston DH, et al. CT diagnosis of Rib fractures and the prediction of acute respiratory failure. J Trauma. 2008 Apr;64(4):905-11.
- Battle CE, et al. The risk factors for the development of complications during the recovery phase following blunt chest wall trauma: a retrospective study. Injury. 2013 Sep;44(9):1171-6.
- Parris R. Towards evidence-based emergency medicine: best BETs from the Manchester Royal Infirmary. Epidural analgesia/anaesthesia versus systemic intravenous opioid analgesia in the management of blunt thoracic trauma. Emerg Med J. 2007 Dec;24(12):848-9.
- Duggal A, et al. Safety and efficacy of non-invasive ventilation in patients with blunt chest trauma: a systematic review. Crit Care. 2013 Jul 22;17(4): R142.

7. Dissemination and Implementation

7.1. Publish to internet guidelines.

7.2. Provide link in ED handbook.

8. Monitoring compliance and effectiveness

Information Category	Detail of process and methodology for monitoring compliance
Element to be monitored	Audit destination wards of patients. Audit documentation of referral to critical care outreach, pain team and respiratory physiotherapy. Audit timeliness of regional anaesthesia.
Lead	ED audit lead or other audit lead as designated by Major Trauma Review Group.
Tool	Periodic audit of notes identified through TARN as chest injury.
Frequency	Within 6 months of publication or substantial amendment and yearly thereafter.
Reporting arrangements	Report to Major Trauma Review Group. Whilst chest wall injury remains a National Trauma Measure, MTRG will report audit findings to annual Peer Review.
Acting on recommendations and Lead(s)	This is the responsibility of the Major Trauma Review Group.

Information Category	Detail of process and methodology for monitoring compliance
Change in practice and lessons to be shared	Required changes to practice will be identified and actioned within 3 months. A lead member of the team will be identified to take each change forward where appropriate. Lessons will be shared with all the relevant stakeholders

9. Updating and Review

Review six months after publication or substantial amendment and every three years thereafter.

10. Equality and Diversity

10.1. This document complies with the Royal Cornwall Hospitals NHS Trust service Equality and Diversity statement which can be found in the Equality Diversity And Inclusion Policy or the Equality and Diversity website.

10.2. Equality Impact Assessment

The Initial Equality Impact Assessment Screening Form is at Appendix 2.

Appendix 1. Governance Information

Information Category	Detailed Information
Document Title:	Adult Chest Wall Injury Pathway V3.0
This document replaces (exact title of previous version):	Adult Chest Wall Injury Pathway V2.0
Date Issued / Approved:	27 October 2023
Date Valid From:	December 2023
Date Valid To:	December 2026
Author / Owner:	Dr Matthew Beardmore, Clinical Lead – Major Trauma
Contact details:	rcht.majortrauma@nhs.net
Brief summary of contents:	Guidelines on management of chest wall injuries in adult inpatients.
Suggested Keywords:	Chest wall injury, rib fracture, pneumothorax, haemothorax, chest drain, major trauma, chest trauma.
Target Audience:	**RCHT:** Yes **CFT:** No **CIOS ICB:** No
Executive Director responsible for Policy:	Chief Medical Officer
Approval route for consultation and ratification:	Clinical Directors' Group. Major Trauma Review Group.
Manager confirming approval processes:	Nigel D'Arcy
Name of Governance Lead confirming consultation and ratification:	Paul Evangelista
Links to key external standards:	Network Guidance | Peninsula Trauma PTN Clinical Guidelines Chest-Wall-Injuries V3.4
Related Documents:	None required
Training Need Identified:	No

Information Category	Detailed Information
Publication Location (refer to Policy on Policies – Approvals and Ratification):	Internet and Intranet
Document Library Folder/Sub Folder:	Clinical / Major Trauma

Version Control Table

Date	Version Number	Summary of Changes	Changes Made by
Aug 2017	V1.0	Initial issue	Dr Ben Warrick, Consultant Anaesthetist
May 2018	V2.0	Appendix 4 Insertion of 'Adult Chest Wall Pathway – RCH inpatient use' to update standard of operation (SOP) pathway document and replace previous SOP within Appendix 2 of V1.1. Appendix 4 ratified and minuted by Major Trauma Review Group (January 2018). Appendix 3 Mobile Guideline link inserted. Updated Governance and IEIA forms.	Dr Ben Warrick, Clinical Lead – Major Trauma
October 2023	V3.0	Update of pathway to reflect current clinical practice and change to medical team caring for patients with chest drains on Wellington ward. Insertion of updated 'Adult Chest Wall Pathway – RCH inpatient use' to update standard of operation (SOP) pathway document and replace previous SOP (Appendix 4). Insertion of patient information leaflets CHA RCHT1683 'Chest Wall Injuries' (Appendix 6) and RCHT2006 - Nerve Blocks for Chest Wall Injury' (Appendix 7). Inclusion of Erector Spinae Plane/Serratus Anterior Plane Block Proforma (Appendix 8). Updated mobile guidelines to reflect updated 'Adult Chest Wall Pathway – RCH inpatient use' SOP pathway document. Update of RCHT Major Trauma Clinical Lead details. Updated mobile guidelines. Updated Governance and IEIA forms.	Dr Matthew Beardmore, Specialty Lead – Major Trauma

Date	Version Number	Summary of Changes	Changes Made by
		Insertion of Appendix 10 guidance for Chest Wall Injury dashboard, CWI score and PIC observations scoring.	

All or part of this document can be released under the Freedom of Information Act 2000

All Policies, Strategies and Operating Procedures, including Business Plans, are to be kept for the lifetime of the organisation plus 6 years.

This document is only valid on the day of printing.

Controlled Document

This document has been created following the Royal Cornwall Hospitals NHS Trust The Policy on Policies (Development and Management of Knowledge Procedural and Web Documents Policy). It should not be altered in any way without the express permission of the author or their Line Manager.

Appendix 2. Equality Impact Assessment

Section 1: Equality Impact Assessment (EIA) Form

The EIA process allows the Trust to identify where a policy or service may have a negative impact on an individual or particular group of people.

For guidance please refer to the Equality Impact Assessment Policy (available from the document library) or contact the Equality, Diversity, and Inclusion Team rcht.inclusion@nhs.net

Information Category	Detailed Information
Name of the strategy / policy / proposal / service function to be assessed:	Adult Chest Wall Injury Pathway V3.0
Department and Service Area:	Major Trauma Urgent, Emergency and Eldercare Care Group
Is this a new or existing document?	Existing
Name of individual completing EIA (Should be completed by an individual with a good understanding of the Service/Policy):	Dr Matthew Beardmore, Specialty Lead – Major Trauma
Contact details:	rcht.majortrauma@nhs.net

Information Category	Detailed Information
1. Policy Aim - Who is the Policy aimed at? (The Policy is the Strategy, Policy, Proposal or Service Change to be assessed)	This is a pathway designed to guide the assessment, admission, management, and rehabilitation of adult patients who present to Royal Cornwall Hospital with a chest wall injury.
2. Policy Objectives	This pathway has been written to: • To ensure that patients within RCH sustaining a chest wall injury receive the correct care in the correct timeframe. • Improve the quality, continuity, and coordination of care for the patient by a multidisciplinary team and reduce the risks associated with poor chest wall injury care.

Information Category	Detailed Information
3. Policy Intended Outcomes	• To ensure that patients within RCH sustaining a chest wall injury receive the correct care in the correct timeframe. • Improve the quality, continuity, and coordination of care for the patient by a multidisciplinary team and reduce the risks associated with poor chest wall injury care.
4. How will you measure each outcome?	As per audit schedule within the policy.
5. Who is intended to benefit from the policy?	Patients with chest wall injury.
6a. Who did you consult with? (Please select Yes or No for each category)	• Workforce: Yes • Patients/ visitors: No • Local groups/ system partners: No • External organisations: No • Other: No
6b. Please list the individuals/groups who have been consulted about this policy.	**Please record specific names of individuals/ groups:** Major Trauma Review Group, Clinical Directors' Group, Medical Director, Director of Nursing.
6c. What was the outcome of the consultation?	Policy agreed.
6d. Have you used any of the following to assist your assessment?	**National or local statistics, audits, activity reports, process maps, complaints, staff, or patient surveys:** No

7. The Impact
Following consultation with key groups, has a negative impact been identified for any protected characteristic? Please note that a rationale is required for each one.

Where a negative impact is identified without rationale, the key groups will need to be consulted again.

Protected Characteristic	(Yes or No)	Rationale
Age	No	
Sex (male or female)	No	
Gender reassignment (Transgender, non-binary, gender fluid etc.)	No	

Protected Characteristic	(Yes or No)	Rationale
Race	No	
Disability (e.g. physical or cognitive impairment, mental health, long term conditions etc.)	No	
Religion or belief	No	
Marriage and civil partnership	No	
Pregnancy and maternity	No	
Sexual orientation (e.g. gay, straight, bisexual, lesbian etc.)	No	

A robust rationale must be in place for all protected characteristics. If a negative impact has been identified, please complete section 2. If no negative impact has been identified and if this is not a major service change, you can end the assessment here.

I am confident that section 2 of this EIA does not need completing as there are no highlighted risks of negative impact occurring because of this policy.

Name of person confirming result of initial impact assessment: Matthew Beardmore

If a negative impact has been identified above OR this is a major service change, you will need to complete section 2 of the EIA form available here:
Section 2. Full Equality Analysis

Appendix 3. Chest Injury Score

Age: +1 for each 10 years over age 10.

Ribs: +3 for each **individual** fracture.

Chronic lung disease: +5 if present.

Anti-coagulant or anti-platelet use: +4 (exclude Aspirin 75mg).

Oxygen saturation on air (see ambulance chart): +2 for each 5% decrease below 95%.

Appendix 4. CHA3949: Adult Chest Wall Injury Pathway – RCH Inpatient Use

Place patient sticker **within** this box

NHS
Royal Cornwall Hospitals
NHS Trust

Adult Chest Wall Injury Pathway - RCH inpatient use

Rib fractures are a significant yet often unappreciated injury. Prior to the introduction of a dedicated Adult Chest Wall Pathway in 2017, rib fractures and pneumonia, in combination, were associated with a 30% 30-day mortality. With thorough assessment, timely intervention and multidisciplinary care, mortality and morbidity have reduced and care, more standardised.

This document acts as an SOP, pathway and audit tool to enable performance improvement. To be stored in patient notes. Please complete in full, and sign, time and date each entry. This includes the onward care on the ward following admission.

Clinical course

- Rib fractures imply a damaging transfer of energy from object to patient. Whilst patients with rib fractures may appear well at first, they often have significant underlying lung injury, whether this is haemo/pneumothorax or pulmonary contusion. They may also have associated injuries outside the chest (eg. spinal fractures).
- Pulmonary contusions evolve over the first 48 - 72hrs, leading to deterioration in respiratory function.
- Inadequate analgesia leads to decreased tidal volumes, atelectasis and pneumonia.[2]
- Damage to the structure of the chest wall (eg. flail segment) affects respiratory mechanics and increases the work of breathing.
- Patients struggle to cough and clear secretions, leading to sputum retention and pneumonia. It is insufficient to acheive comfort 'at rest', patient must be able to move and cough effectively.

Named Consultant

Eldercare Consultant:

Surgical Consultant:

Date: **Time:** **Print name:** **Signature:**

At presentation in ED (to be completed by ED doctor at review):

1. Trauma response and identification of injuries:

Trauma call -Trauma call is indicated if: Serious mechanism of injury, abnormal physiology or anatomical features of major trauma, or if high risk group (elderly, pregnant)

Type of trauma call: Hospital ☐ ED ☐ Code Red ☐ None ☐

Date: **Time:** **Print name:** **Signature:**

Imaging - CXR has poor sensitivity for significant and associated chest injury. All patients requiring admission for rib fractures should have at least a CT chest. Full Trauma CT will often be more clinically appropriate. Threshold for full body scan should decrease with age.

Imaging: Trauma CT ☐ Chest CT ☐ CXR ☐

Date: **Time:** **Print name:** **Signature:**

CHA3949 V3 Printed 05/2023
Review due 2026

Place patient sticker **within** this box

2. Risk stratification: For convenience there is a calculator within Nerve Centre under 'assessment' to electronically calculate chest wall injury

Chest injury score =

Date: **Time:**

Signature:

Multiple injuries should be discussed with Trauma Team Leader at Derriford ED for consideration of secondary transfer.

WCH – Patients with Chest Injury Score >20 or if <20 and pain unusually difficult to control and requiring advanced analgesia, to be discussed at the earliest opportunity with the RCH Eldercare Consultant for likely direct transfer to Tintagel ward for MDT care (See Box 10).

Chest injury score:[2]

- **Age: +1** for each 10 years over age 10
- **Oxygen saturation on air (see ambulance chart): +2** for each 5% decrease below 95%
- **Rib fractures: +3** for each individual fracture
  (ie. 2 fractures on 1 rib = +6)
- **Anti-coagulant or anti-platelet use: +4**
  (exclude Aspirin 75mg)
- **Chronic lung disease: +5** if present
  (not smoking alone)

3. Secondary survey must be completed and documented prior to leaving ED with plan for all injuries and all referrals made.

Date: **Time:** **Print name:** **Signature:**

4. Other injuries identified? Make all referrals and get a plan at point of review in ED. All injuries should have a documented plan from either Registrar or Consultant from the relevant specialty.

- Orthopaedics - Limb or pelvic fractures and wounds
- General Surgery - Intra-abdominal injury
- Urology - Urinary or renal tract injury
- Neurosurgeons - Via ReferaPatient
- Thoracic - Via email: Plh-tr.chest-trauma@nhs.net
- Max fax or ENT - Facial or soft tissue neck injuries

Ensure RCHT Patient information leaflet 'Chest Wall Injuries' RCHT1683 provided to patient

5. Escalation plan (to be completed prior to leaving ED)

TEP completed in notes ☐

Date: **Time:** **Print name:** **Signature:**

Place patient sticker **within** this box

6. Analgesia

ED Doctor to prescribe EPMA Major Trauma Chest Injury bundle: ☐

Acute pain control as needed in ED as per bundle

Ongoing analgesia stratified by chest injury score:

0 - 10 Conservative	11 - 20 Progressive	21 - 30 Aggressive	>31 Emergent
Regular oral analgesia. Consider home discharge if pain sufficiently managed. Consider PCA if pain persistent despite optimisation of oral analgesia. ☐	Regular oral analgesia. Consider home discharge if pain sufficiently managed on oral analgesia. **Consider regional anaesthesia** (low threshold in the elderly or comorbid) or PCA ☐	Regular oral or PCA analgesia. Refer for regional anaesthesia. Refer to Critical Care for discussion. ☐	Regular oral or PCA analgesia. Refer for regional anaesthesia. Refer to Critical Care for discussion. ☐

Date: **Time:** **Print name:** **Signature:**

Patients should be able to cough and take a deep breath.
If they cannot, consider escalating their analgesia.

7. Referrals to be made (at presentation):

☐ Identify patient to Major Trauma Outlier and add to chest wall injury dashboard on Nerve Centre.

☐ Discuss with the In-patient pain service and place referral on Maxims if patient to be admitted:

- Mon - Fri: Acute Pain Team (0830-1630 Mon-Fri) via bleep 3233. 1st-on call anaesthetist (1630-2000 bleep via Switch), Senior Anaesthetic Trainee (2000-0800 via Switch)
- Sat - Sun / Bank holidays: 1st-on call anaesthetist (1300-2000, bleep via Switch), Senior Anaesthetic Trainee (2000-0800, 0800-1300, bleep via Switch)

☐ Refer to Critical Care Outreach (bleep via Switchboard)

☐ Refer for chest physiotherapy

- During daytime weekday hours - Bleep 3212 (ask for chest physiotherapist).
- Contact on call Physio via switchboard if urgent out-of-hours.
- Urgent referrals only overnight - non-urgent to be referred next day if overnight admission.

Date: **Time:** **Print name:** **Signature:**

8. Is chest drain required? Yes ☐ No ☐

Arrange a bed on Wellington ward and refer to General Surgical on-call team.

Refer to Pleural Nurses via Inpatient Respiratory Pleural Service on MAXIMS to notify of chest drain.

Date: **Time:** **Print name:** **Signature:**

Place patient sticker **within** this box

9. Frailty Score (See Rockwood frailty score)

Date: Time: Print name: Signature:

10. Admission destination of care and management of other injuries

(Please tick appropriate clinical area)

Surgical ward

- ≤ 75 years
- Non-frail (admission Rockwood frailty score 1-4)
- No chest drains

Tintagel ward

- >75 years or
- Frailty score 5+ (admission Rockwood frailty score)
- No chest drains
- **WCH to RCH transfer only**- As above Tintagel criteria and Chest Injury Score >20 or <20 and pain unusually difficult to control and requiring advanced analgesia such as PCA +/- regional anaesthesia following discussion with RCH Eldercare Consultant and formal acceptance.

Wellington ward

- Non-Critical Care management of patients with **chest drain** is on Wellington ward only. Refer to General Surgical on-call team - the patient will be a surgical 'outlier' while on Wellington. Once the drain has been removed, the patient should **promptly** be transferred to surgical/Tintagel ward (as for those without chest drains).

Refer to Critical Care

- Chest wall injury score >21 if clinically appropriate
- Management of multiple or severe injuries +/- chest drain
- Clinical deterioration
- Management of epidural analgesia

Date: Time: Print name: Signature:

Patients not to go to wards other than those specified on the pathway unless indicated for specialist care which must be documented in the medical notes.

Place patient sticker **within** this box

Next morning (to be completed by Critical Care or Surgical Doctor at review):

11. Tertiary survey

Completed on Day 1 post admission on Nerve Centre by the Major Trauma Transfer Consultant (TTC) or senior surgical team (ST3 or above) if TTC unavailable/ at weekend, or senior ICU doctor on admission to Critical Care.

Date: **Time:** **Print name:** **Signature:**

12. Thoracics referral if indicated

To be completed by the weekend or bank holiday admitting team or in the absence of the Major Trauma Transfer Consultant (TTC)

Thoracics referral criteria:

- Flail chest
- 3 or more consecutive ribs involved
- Significant co-morbidities
- Chest injury score >21
- Complications eg. open injury or significant haemo- or pneumothorax
- Difficult analgesia management
- Failure to wean from ventilatory support
- Discuss anyone if in doubt

Refer to Thoracics via email: Plh-tr.chest-trauma@nhs.net with Cc to RCHT Major Trauma service: rcht.majortrauma@nhs.net

Date: **Time:** **Print name:** **Signature:**

13. Falls Screening Tool

- Please refer to the Older Person Service via MAXIMS for in-patient or outpatient review if high risk of future falls identified. Consider bone protection if appropriate.

14. Alcohol Screening Tool

- Assess pre-admission alcohol use using screening tool M-SASQ or AUDIT-C on Nerve Centre and commence CIWA scoring if required.
- Refer to Alcohol Liaison Nurse as appropriate via MAXIMS.

Place patient sticker **within** this box

Weekend & bank holiday surgical review / unavailability of Major Trauma Transfer Consultant during weekday hours

Day 1

- ☐ Ensure all elements of Adult Chest Trauma Pathway (CHA3949) are completed, addressing omissions as appropriate.
- ☐ Consider referral to Critical Care **if new or increasing oxygen requirement,** pneumothorax or effusion.
- ☐ Ensure patient identified as 'Major Trauma Outlier' on Nerve Centre.
- ☐ Consider further imaging if appropriate.
- ☐ If Thoracics referral made, ensure outcome actioned and documented in medical notes.
- ☐ Ensure tertiary survey complete and documented on Nerve Centre.
- ☐ Review bloods including monitoring of renal function, inflammatory markers, haemoglobin.
- ☐ Check adequate analgesia/Major Trauma analgesia bundle prescribed - evaluate effectiveness, escalating to In-patient Pain Team (weekdays) or anaesthetist (weekend/out-of-hours) as appropriate.
- ☐ Review all medications, ensure prophylactic laxatives and Naloxone available. Monitor for delirium and alcohol withdrawal.
- ☐ Ward based referral to respiratory physiotherapist if not already done.
- ☐ Ensure clear management plan for ward based care, liaising with ward nursing and medical staff.
- ☐ Chest drain management plan if applicable. When chest drain removed, for management on surgical or Tintagel ward as per admission criteria (Box 10).

Date: **Time:** **Print name:** **Signature:**

Days 2 - 3+

- ☐ Reassessment for delayed complications **Eg:** Falling haemoglobin, increasing oxygen requirements, raised inflammatory markers, persistent or escalating EWS.
- ☐ Encourage mobility within the limits of injury.
- ☐ Review estimated discharge goals.

Please note - This list is not exhaustive, please re-evaluate and escalate care as appropriate based upon individual patient clinical need

Date: **Time:** **Print name:** **Signature:**

Any queries or suggestions for this document? Please email Matt Beardmore, Consultant in Anaesthesia and Pre-Hospital Care, RCHT Lead for Major Trauma. Email: rcht.majortrauma@nhs.net

References:

1. N Roberts, E Harrison, L Shepherd, R Creamer, J Butler, R Norman, J Gibb, J Outlaw, J Abeles, B Warrick. Breaking Point? Rib fracture care at RCHT. Local audit, presented Jan 2017.
2. Battle C. Predicting outcomes after blunt chest wall trauma: development and external validation of a new prognostic model. Critical Care 2014http://ccforum.biomedcentral.com/articles/10.1186/cc13873.
3. O Quick, N Roberts, E Harrison, L Shepherd, R Owens, B Warrick. Rib fractures: Implementing a Chest Injury Pathway in a district general hospital is associated with improvements in analgesia, standardisation of care and decreases in overall and pneumonia mortality. Local audit, presented June 2019.

Appendix 5. Mobile Guideline for Adult Inpatient Rib Fracture Care Pathway

Clinical course

- Rib fractures imply a damaging transfer of energy from object to patient. Whilst patients with rib fractures may appear well at first, they often have significant underlying lung injury, whether this is haemo/pneumothorax or pulmonary contusion. They may also have associated injuries outside the chest (e.g., spinal fractures).
- Pulmonary contusions evolve over the first 48-72hrs, leading to deterioration in respiratory function.
- Inadequate analgesia leads to decreased tidal volumes, atelectasis, and pneumonia.
- Damage to the structure of the chest wall (e.g., flail segment) affects respiratory mechanics and increases the work of breathing.
- Patients struggle to cough and clear secretions, leading to sputum retention and pneumonia.
- Patients are at high risk of tiring and succumbing to respiratory failure if not properly managed.

Important Interventions

- Identification and early stratification of injury severity.
- Identification and management of all other injuries.
- Early analgesia stratified according to injury severity with regular evaluation of effectiveness. This may require advanced analgesia with such as a regional anaesthesia, a PCA or an epidural.
- Early chest physiotherapy.
- Oxygenation or ventilatory support if required.
- Vigilance for and management of pneumonia.
- Rib fixation in selected patients (see Thoracics referral criteria).

PATIENTS MUST BE ABLE TO TAKE A DEEP BREATH AND COUGH EFFECTIVELY

Start

Is a Trauma Call indicated?

Serious mechanism of injury with abnormal physiology or anatomical features of major trauma
Or
High risk group (elderly / pregnant)

Imaging obtained?
In view of the poor sensitivity of CXR for significant and associated chest injury, all patients requiring admission for rib fractures should have **at least** a CT chest. However, a full Trauma CT will often be more clinically appropriate. The threshold for a full body scan should decrease with age.

Risk Stratification
Calculate and document the Chest Injury Score following imaging. This should be used to stratify analgesia, risk of complications and hence further care.

Multiple injuries or a high chest injury score should be discussed with Trauma Team Leader at Derriford ED for consideration of secondary transfer.

Chest Injury Score

- Age: **+1 for each 10 years over age 10**
- Rib fractures: **+3 for each individual fracture (i.e. 2 fractures on 1 rib = +6)**
- Chronic lung disease: **+5 if present**
- Anti-coagulant or anti-platelet use: **+4 (exclude Aspirin 75mg)**
- Oxygen saturation on air (see ambulance chart): **+2 for each 5% decrease below 95%**

Analgesia

Prescribe analgesia using EPMA **'Major Trauma' chest injury analgesia bundle.** Protocols stratified by Chest Injury Scoring and populated by selecting 'Prescribable' or 'Treatment Protocols' and entering '**Major Trauma**', **not** rib fractures.
Patients should be able to cough and take a deep breath. If they cannot, consider escalating their analgesia.
Consider most appropriate catheter regional anaesthesia technique (epidural, ESP, SAP, parasternal).

0-10 Conservative
Regular oral analgesia. Consider for home discharge if pain sufficiently managed. Consider PCA if pain persistent despite optimisation of oral analgesia.

11-20 Progressive
Regular oral analgesia. Consider home is pain sufficiently managed on oral analgesia. Consider regional anaesthesia (low threshold for elderly or comorbid)

21-30 Aggressive
Regular oral or PCA analgesia. Refer for regional anaesthesia. Refer to Critical Care for discussion.

>31 Emergent
Regular oral or PCA analgesia.
Refer for regional anaesthesia. Refer to Critical Care for discussion.

Other injuries?
Make all referrals and get a plan at point of review in ED. All injuries should have a documented plan from either Registrar or Consultant from the relevant specialty.

- Orthopaedics - Limb or pelvic fractures and wounds.
- General Surgery - Intra-abdominal injury and all open 'surgical' chest drains outside ED/ICU.
- Urology - Urinary or renal tract injury.
- Neurosurgeons - Head or spinal injury.
- Thoracics - Cardiac or lung injury.
- Max fax or ENT - Facial or soft tissue neck injuries.

Thoracics Referral Criteria

- Flail chest.
- 3 or more consecutive ribs involved.
- Significant co-morbidities.
- Chest injury score>21.
- Complications e.g., open injury or significant haemo- or pneumothorax.
- Difficult analgesic management.
- Failure to wean from ventilatory support.
- Discuss anyone if in doubt.

Destination of Care - Patients **not** to go to wards other than those specified on pathway unless indicated for specialist care.

Surgical Ward

- ≤ 75 years.
- Frailty score ≤4 (admission Rockwood Frailty Score).
- **No** chest drains.

Tintagel Ward

- >75 years **or**
- Frailty score ≥5 (admission Rockwood Frailty Score).
- **No** chest drains.

Refer to Critical Care

- Chest wall injury score >21 if clinically appropriate.
- Management of multiple or severe injuries +/- chest drain.
- Clinical deterioration.
- Management of epidural analgesia.

Wellington Ward

- Non-Critical Care management of patients with chest drain is available only on Wellington ward.
- Refer to General Surgical on-call team – the patient will be a surgical 'outlier' while on Wellington.
- Once the drain has been removed, the patient should **promptly** be transferred to surgical/Tintagel ward as for those without chest drains.

- All specialities to review and document plan before patient leaves ED.
- Refer to Critical Care if Chest Injury Score >20, chest drain, advanced regional anaesthesia, or multiple injuries.
- For non-Critical Care management of chest drains, a bed on Wellington ward is the only clinical area suitable for these patients.
- **WCH to RCH transfer only-** As above Tintagel criteria and Chest Injury Score >20 or >20 and pain unusually difficult to control and requiring advanced analgesia such as PCA +/- regional anaesthesia following discussion with RCH Eldercare Consultant and formal acceptance.

On presentation to ED

Ensure printed 'Adult Chest Wall Injury Pathway – RCH inpatient use' (CHA3949) completed and available in-patient notes with reviewing clinician/date/time clearly documented.

- Calculate and document Chest Injury Score.
- Prescribe 'Major Trauma' analgesia chest injury bundle on EPMA according to Chest Injury Score.
- Refer to Acute Pain Service:
  - Mon-Fri: Acute Pain Team (0830-1630 Mon-Fri) via bleep 3233. 1st-on call anaesthetist (1630-2000 bleep via Switch), Senior Anaesthetic Trainee (2000-0800 via Switch).
  - Sat-Sun/Bank holidays: 1st-on call anaesthetist (1300-2000, bleep via Switch), Senior Anaesthetic Trainee (2000-0800, 0800-1300, bleep via Switch).
  - If unable to reach above anaesthetic trainees out of hours via bleep – suggest phoning CEPOD or Trauma theatre to discuss patient.
  - Place an inpatient Pain referral on Maxims.
- Refer to Critical Care Outreach (bleep via Switchboard) if clinically indicated.
- Flag as 'Major Trauma Outlier' on Nerve Centre and add to 'Chest Wall Injury dashboard'.
- Contact Major Trauma Baton phone **07917167942** (weekday hours Mon – Fri) or oncall Major Trauma and Transfer Consultant TTC via Switchboard (out-of-hours).
- Monitor for alcohol withdrawal.
- Refer for chest physiotherapy.
  - Referral route will depend on destination ward and time of day – contact On-call Physio via switchboard if out-of-hours. Urgent referrals for secretion retention or lung collapse only overnight – non-urgent to be referred the next day if overnight admission.
- Escalation plan for all patients before leaving ED (in conjunction with Critical Care Outreach/SAT).

Next day post admission

Day 1

- Ensure all elements of Adult Chest Trauma Pathway (CHA3949) are completed, addressing omissions as appropriate.
- Consider referral to Critical Care if new or increasing oxygen requirement, pneumothorax, or effusion.
- Refer to Older Persons Service via MAXIMS if high risk of future falls.
- Ensure patient identified as 'Major Trauma Outlier' on Nerve Centre.
- Consider further imaging if appropriate.
- If Thoracics referral made, ensure outcome actioned and documented in medical notes.
- Ensure tertiary survey complete and documented on Nerve Centre.
- Review bloods including monitoring of renal function, inflammatory markers, haemoglobin.
- Check adequate analgesia/Major Trauma analgesia bundle prescribed – evaluate effectiveness, escalating to In-patient Pain Team (weekdays) or anaesthetist (weekend/out-of-hours) as appropriate.
- Review all medications, ensure prophylactic laxatives and Naloxone available.
- Monitor for delirium and alcohol withdrawal.
- Ward based referral to respiratory physiotherapist if not already done.
- Ensure clear management plan for ward-based care, liaising with ward nursing and medical staff.
- Chest drain management plan if applicable.
- When chest drain removed, for management on surgical or Tintagel ward as per admission criteria.

Day 2-3+

- Reassessment for delayed complications E.g.: Falling haemoglobin, increasing oxygen requirements, raised inflammatory markers, persistent or escalating EWS.
- Encourage mobility within the limits of injury.
- Review estimated discharge goals.

Please note - This list is not exhaustive, please re-evaluate and escalate care as appropriate based upon individual patient clinical need

End

Appendix 6. Patient information leaflet – Chest Wall Injuries (RCHT1683)

NHS
Royal Cornwall Hospitals
NHS Trust

Chest wall injuries

(Rib fractures, sternum fractures and chest wall bruising)

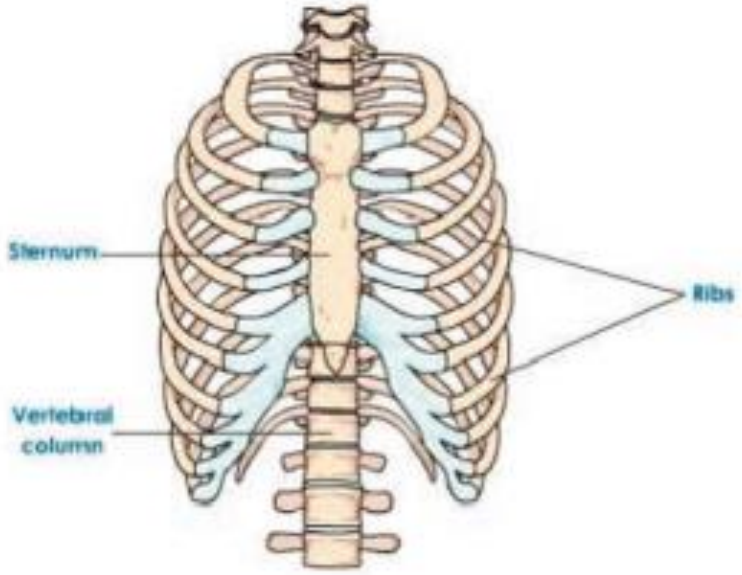
One + all | we care

Who is this leaflet for?

This leaflet is for adults who have been admitted to hospital with an injury to your chest wall. It explains what to expect during your stay in hospital and provides information about the importance of good pain relief and deep breathing exercises to aid your recovery. It also describes the different ways that your chest wall can be injured and the possible side effects associated with this (and what we can do to treat this if appropriate).

Please do speak with the doctor or nurse caring for you if you have any questions that are not covered within this leaflet. Chest wall injuries include:

- fractured ribs (break in one or more of your ribs)
- fractured sternum (break in your breast bone which connects your ribs to form a protective rib cage)
- chest wall contusions (bruising to your chest wall which may involve the skin, muscle or ribs of your chest wall)
- pulmonary contusions (bruising or bleeding of your lung tissue)
- flail chest (multiple ribs broken in more than two places)



Injuries to the chest can be very painful. Unlike other parts of the body, it is difficult to rest your chest as you use it when you breathe. It also supports you when you sit up, lie down and move around.

How long will it take to heal?

Fractured ribs and/or sternum take around 4 – 6 weeks to heal, but you may still feel some discomfort after this time. This is perfectly normal and should improve over time. Bruising can take 2 – 4 weeks to heal, but can be sore for longer.

Who will I see?

During your admission you will usually be seen by different nurses and specialities of doctors, with support and specialist advice from respiratory physiotherapists and members of the Critical Care Outreach and Acute Pain Teams. All of the teams involved in your care will be working together to make sure you are receiving the best management of your injuries.

Pain

Pain is one of the main problems experienced following chest wall injuries. The amount of pain you feel and how long it lasts will depend on the type of injury that you have. As your ribs start to heal and any bruising becomes less, pain should reduce. This does depend on your injury and the individual patient.

Why is pain relief important?

It is very important to have good pain relief to enable you to sit in the chair and do your breathing exercises. This will help reduce complications such as pneumonia that may occur if you cannot breathe or move around properly because your pain relief is not enough. Whilst you are in hospital you may be given one or more different types of pain relief. This will depend on the individual patient and the severity of your injury. During your stay you will be seen regularly by the Acute Pain Team who specialise in the management of pain and offer support and advice to all areas of the hospital. The Acute Pain Team is made up of Consultant Anaesthetists and experienced Pain Specialist Nurses. Your pain relief will be regularly reviewed to check its effectiveness and for possible side effects. The type of pain relief can be changed according to your pain. Types of pain relief commonly used in chest wall injuries include:

- **Tablets** – there are many different types and strengths of pain relieving tablets/liquids that can be given by mouth. Your doctors or the Acute Pain Team will prescribe the most appropriate medication for you.

- **Injections** – these are usually given in your muscle or vein. You may have an injection when you are first admitted to control severe pain or if you are unable to take tablets by mouth.
- **Patient-controlled analgesia (PCA)** – pain relief is given through a dedicated pump connected to a drip inserted into a vein in your arm. You will be taught how to control your pain by pressing a button on the handset to deliver a measured dose of a strong pain relieving medication, usually morphine or fentanyl. A safe level is programmed into the pump so you can't give yourself too much.
- **Thoracic epidural** – a small flexible plastic tube inserted by an experienced anaesthetist between two of your backbones (vertebrae). The tube is secured in place by a special type of plaster. Pain relieving medication is delivered to the nerve roots in your spine that carry the pain signals to the painful area. These are usually placed in more severely injured patients or if pain control is a problem. If you need this, it is likely that you will be remain under the direct supervision of the anaesthetist or transferred to the Critical Care Unit for observation. Thoracic epidurals are usually left in place for approximately 2-3 days and then removed, although they may remain for longer if they have been tunnelled under the skin.
- **Nerve block** – this may be given for immediate 'short-term' pain relief. Local anaesthetic is injected around the nerves supplying sensation to the site of injury. This area will feel numb for a few hours afterwards, although some nerve blocks can last for 18-24 hours.
- **Local anaesthetic catheter** – similar to a nerve block but where a small flexible tube is placed close to the nerves supplying sensation to the site of pain. This may be attached to a local anaesthetic infusion pump or local anaesthetic given as a regular injection 3-4 times a day.

How will my pain be assessed?

You will be asked to score your pain when you are resting and moving using the following system:

0 = No pain

1 = Mild pain

2 = Moderate pain

3 = Severe pain

It is really important that we manage your pain as effectively as we can to ensure your comfort and help you improve. If your pain relief is not enough, please tell a member of staff before the pain becomes too bad. It is easier to control pain when it is mild, rather than when it has become severe.
Pain should not prevent you moving.

Are there any risks or complications?

Chest infections are one of the most common complications after suffering a chest injury. Taking deep breaths and coughing are important normal actions that our bodies do every day – they help us to avoid developing chest infections. You are more likely to develop a chest infection if pain limits your ability to cough and take a deep breath. You are also likely to not be as mobile as normal.

Other less common complications include:

- **Pneumothorax** (air in the space surrounding the lung) – this may cause shortness of breath and increasing pain. In some cases, a chest drain may be required.
- **Haemothorax** (blood in the space surrounding the lung) – this may cause shortness of breath and pain in the lower chest. In some cases, a chest drain may be required.
- **Surgical emphysema** – air trapped under the skin can cause a bubbly swollen area on the chest wall and may be linked to a pneumothorax.
- **Pulmonary contusions** (bruising or bleeding of your lung tissue) – this may cause one or more symptoms of chest pain, changes or difficulty in breathing or coughing up blood or watery sputum (spit). A bruised lung does not absorb oxygen properly and may reduce levels of oxygen in your blood stream. You may need additional oxygen until the bruising/bleeding improves.

Will I need a chest drain?

A chest drain may be inserted to drain air or blood from the space surrounding your lungs. This area is called the pleural space. Air or blood in the pleural space stops your lungs inflating completely when you breathe in, causing breathing difficulties.

To relieve this pressure, a tube is inserted between your ribs in to the pleural space to allow your lungs to fully expand and remove air or blood from around the lung. Removing the air allows your lung to re-expand and seal the leak. The tube will remain in your chest until all, or most of the air or blood has drained out. This is usually a few days.

Will I need further treatment?

If lots of ribs are fractured, or are unstable, you may need surgery to stabilise the fractures. In this case you would need to be transferred to Derriford Hospital in Plymouth – this would be discussed with you by your surgical team upon admission if appropriate.

For most rib or sternal fractures, there are no specific treatments. Good pain relief and the ability to breathe effectively is the most important part of the recovery process. The most important thing is to avoid developing a chest infection whilst your injury heals. To help yourself recover as quickly as possible and minimise your chances of developing a chest infection:

- take regular pain relief so that you can take deep breaths and cough
- sit out in your chair and mobilise as soon as you are able
- cough when you need to.

You will see a respiratory physiotherapist during your admission who will teach you breathing exercises and how to minimise pain when you need to cough. If you have not seen a respiratory physiotherapist, please ask your nurse to refer you.

Deep breathing exercises

1. Breathe in slowly and deeply through your nose, expanding your lower rib cage.
2. Hold for a count of three (if you are able).
3. Breathe out slowly.
4. Repeat steps 1 – 3 a total of 5 times (don't do more as you may get dizzy).
5. Repeat every 1 – 2 hours during the day.

If you are unable to take a deep breath or cough due to pain, please speak to your nurse or doctor who will review your pain relief. They can contact either the Pain Team or anaesthetists to review as needed.

Supported cough

When you need to cough, use a pillow or towel to support the area of your chest wall that is uncomfortable to help reduce the pain.

It is very important that you sit out in your chair and start walking around on the ward as soon as you are able to – the nurses and physiotherapists will guide you with this.

Remember

- Do breathing exercises hourly.
- Sit out in your chair as much as possible.
- Walk around as soon as you are able to – the nurses and physiotherapists will advise you regarding this.
- Take enough pain relief to enable you to do the above.
- Speak with the nursing staff if you feel that your pain control is not enough.

What happens when I go home?

- Gradually increase your mobility daily.
- Make sure you do not just sit in bed or on the sofa all day.
- Avoid heavy lifting for 6 – 8 weeks.
- If your pain does not improve or if you start coughing up blood or green phlegm, please seek advice from your GP.

Appendix 7. Patient Information Leaflet - [Nerve Blocks for Chest Wall Injury (RCHT 2006)]

NHS
Royal Cornwall Hospitals
NHS Trust

Nerve blocks for chest wall injury

Single injection or nerve catheters for pain management

One + all | we care

Who is this leaflet for?

This leaflet is for adults who have been admitted to hospital with a painful injury to their chest wall. This is often one or more rib fractures. A separate booklet will also be provided to you covering the overall care and management of chest wall injuries.

Why is pain relief important for chest wall injuries?

Chest wall injuries make it difficult for you to breathe and cough effectively. Breathing effectively and coughing is an everyday action that keeps your lungs working well and clear of naturally produced fluids. If you are unable to breathe and cough effectively because of pain, then those fluids can build up and cause infections. Pain from chest wall injuries can be worse on the first two days following injury so it is important that we control your pain early. Good early pain relief will allow you to take effective breaths and cough.

Why I am being offered a nerve block?

Sometimes managing your pain may be tricky due to pre-existing health problems or medications, or if the injury is too painful to be managed with simple tablets or pain relief.

When we can't control your pain well with simple pain relief, we offer a local anaesthetic injection. This can be either a:

- nerve block – a one-off injection of local anaesthetic
- nerve catheter – local anaesthetic through a flexible plastic tube.

This nerve block or catheter is to control your pain and you will usually still need other pain relief at certain points in the day.

What is a nerve block or nerve catheter?

- **Nerve block** – a single injection that is given for immediate 'short-term' pain relief. This one-off injection only lasts for 8-24 hours, but is quicker, safer and easier to do. We often use a single injection to get on top of severe pain, or until we can free up space and doctors to offer you a nerve catheter.

- **Nerve catheter** – similar to a nerve block, but where a catheter (small flexible tube) is placed instead. This tube is attached to a local anaesthetic infusion pump or local anaesthetic is given as a regular injection 3-4 times a day to provide continuous pain relief. A nerve catheter is usually kept in for 3-7 days, giving continuous pain relief during this time.

What are local anaesthetics?

Local anaesthetics are commonly used to reduce pain during or after surgery. They are also used when you have painful injuries such as rib fractures or chest wall injuries. They work by stopping the signals that pass along your nerves from the site of injury up to the brain. A more common example of this is when you go to the dentist and they numb an area around a tooth.

What nerve blocks may be offered?

The chest wall nerves come from the upper part of the spine (called the thoracic spine). As the nerves move away from the spine, they travel along planes of muscles to supply the bone muscle and skin of your chest wall.

We can target these nerves on their journey at different points from the spine to the chest wall:

1. **Epidural** – the epidural space is just outside a fluid filled sac (called the dura) protecting the spinal cord. Epidurals are most often used in pain relief for women in labour. A catheter is placed in this space close to the nerves in the spine and local anaesthetic is given regularly to offer good pain relief. It is quite rare for us to offer an epidural but if both sides of your chest wall are damaged it may be the best option.
2. **Paravertebral** – the paravertebral space is to one side of the epidural space next to the spine. It can be thought of as a one sided epidural. We usually only use this as a 'single shot' (one-off injection) to control your pain for 12-24 hours whilst we arrange for you to have a catheter technique. It gives very good pain relief but has a very rare chance of damaging the lining of your lung.

3. **Erector spine plane** – the erector spinae are a collection of muscles which run down your back. The nerves to your chest wall pass in a plane beneath this collection of muscles. Local anaesthetic put into this space travels up and down the spine, stopping the nerves sending pain signals to your brain. This is the most common catheter technique we use as it offers a balanced combination of safety but also good pain relief. A catheter can be placed in this area so you can have pain relief for 3-7 days.
4. **Serratus anterior plane** – similar to an erector spinae block but slightly further away from the spine. This block offers another option for a catheter with 3-7 day pain control. This is one of the safest places to put a catheter.

These pictures will help us explain to you where and why we put the different blocks and catheters. The numbers on the left image match the numbers next to the blocks.

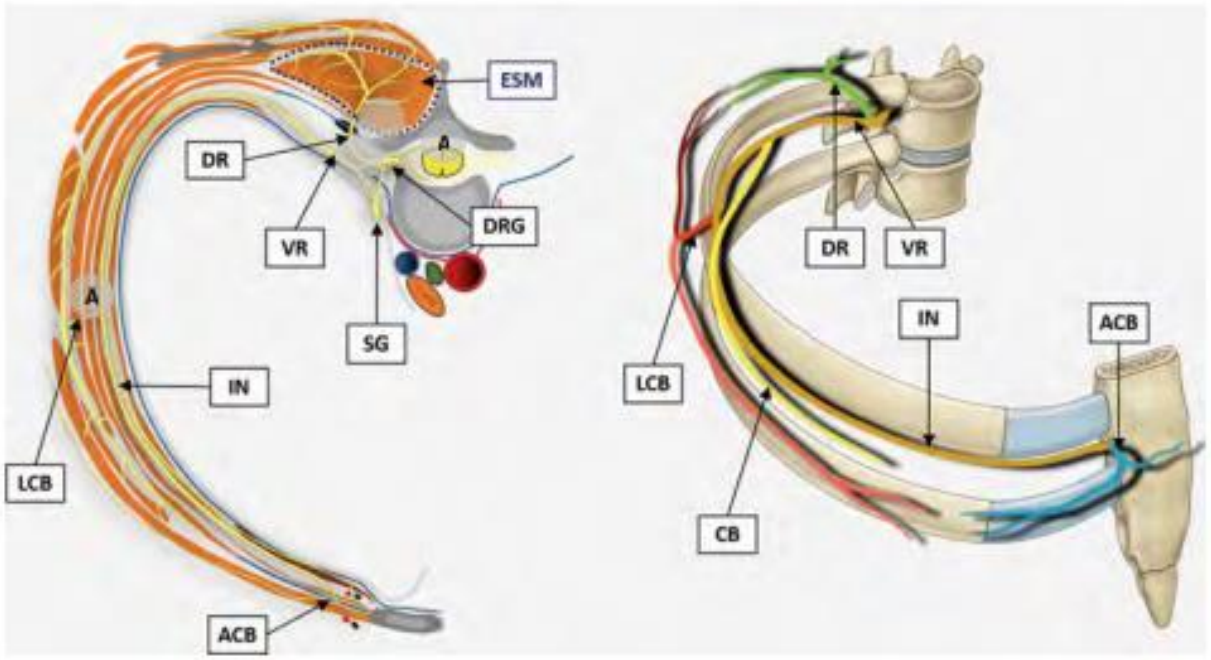


Figure 1 Cross section of spine

Who performs the procedure?

Nerve blocks and nerve catheters are usually performed by anaesthetists or emergency doctors. To make the technique as safe, quick and painless as possible, after local anaesthetic is put in place in the skin using special needles, an ultrasound machine is used to find exactly the right area for injecting or placing a catheter.

The block or catheter is usually placed with you sat up or lying on your side at the edge of the bed. We understand that this may be uncomfortable or feel not possible due to your pain, but we will do everything we can to assist and support you.

Are there any risks or complications?

Nerve blocks are generally very safe, however as with all procedures there are some risks. The risks of a nerve catheter or block are outweighed by the benefit that they provide. The person performing the block will discuss this with you.

The most common risks are:

- partial or no effect from the block
- infection at the injection or nerve catheter site
- bruising or bleeding.

The person performing the block will discuss any specific risks to the block you choose together. We support shared decision making so please do ask as many questions as needed – we want you to feel safe and in control.

How long will a nerve catheter stay in place?

Catheters are used for the initial, most painful part of your injury and so normally stay in place for 3-7 days. Nursing staff will then usually remove them.

The site of the catheter is regularly inspected for signs of infection or swelling as part of ongoing nerve catheter management.

Once the nerve catheter is removed, your ward team will make sure that alternative pain relief is available to you, if you need it.

Appendix 8. CHA4774: Erector Spinae Plane Serratus Anterior

Place patient sticker **within** this box

NHS
Royal Cornwall Hospitals
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Erector Spinae Plane / Serratus Anterior Plane Block Proforma

Pre-Procedure

Chest wall injury score: _____ Weight: _____ Pain score at rest: _____ (0-10)

Affected side: RIGHT LEFT Pain score on deep breath: _____

Pain score: 0 = no pain, 10 = severe pain

Consent (verbal): ☐

IV access: ☐

Coagulation status: ☐

PREP... STOP... BLOCK

Procedure: (circle) SAP ESP

Clinician performing procedure: Grade:

Date: Time: Signature:

Position: Sitting/Lateral Aseptic technique: Yes ☐ No ☐

Levobupivicaine concentration: **mls:** **Equal to:** **mg (max 2mg/kg)**

Added drug:

Catheter inserted? Yes ☐ No ☐ Anticipated removal date:

EPMA Px: ☐ CEPOD recorded: ☐

Signature: **Print:** **Designation:** **Date:**

Post Procedural Care:

Observations must be recorded every 5 minutes for at least 30 minutes:

Observations	RR	HR	Sats	BP
0 min (pre-procedure)				
5 min				
10 min				
15 min				
30 min				

Warning:
Frail patients are at risk of decompensation when the painful stimulus is removed following a block, especially if opiates administered pre block. Always observe at least 30 minutes post block.

Pain score at 30 minutes at rest: _____ **On deep breath:** _____

Nurse's Signature: **Print:** **Designation:** **Date:**

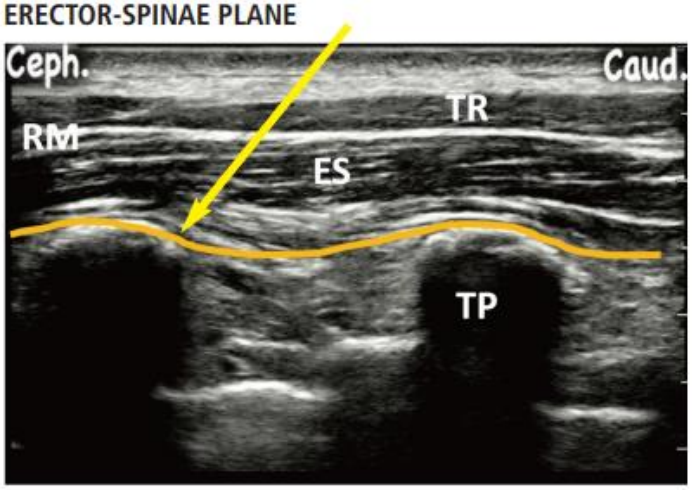
Autumn 2022 for Anaesthesia in ED audit please complete https://forms.gle/iqo4EG43PeMKsPfe7

In the event of catheter related problems, please escalate to: acute pain team bleep 3233 (in hours), 1st on-call anaesthetist bleep 3088 (13.00-23.00), senior anaesthetic trainee (SAT) bleep 3513 (20.00-08.00), critical care outreach bleep 3504

CHA4774 V1 01/2023 **Review due:** 2026

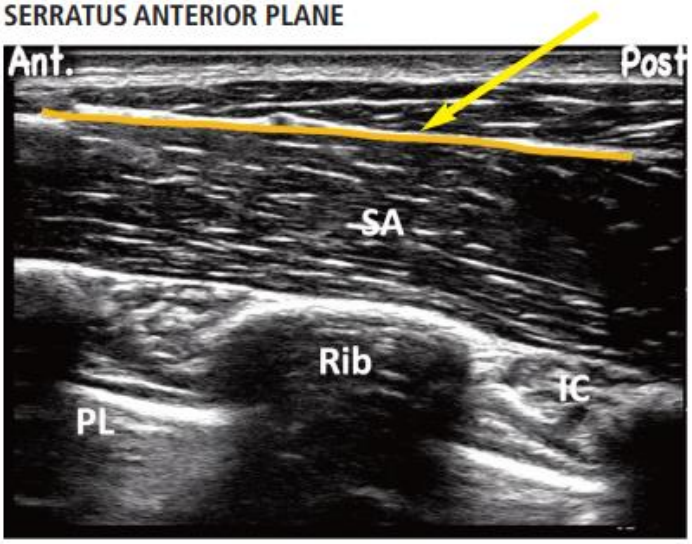
QUICK REFERENCE SONO-ANATOMY

ERECTOR-SPINAE PLANE



ES: erector-spinae muscle
TR: trapezius
RM: rhomboid major
TP: transverse process
Needle path:
Erector-spinae plane:

SERRATUS ANTERIOR PLANE



SA: serratus anterior muscle
LD: latissimus dorsi
IC: intercostal muscle
PL: pleura & lung
Needle path:
Serratus anterior plane:

Images taken from Anaesthesia Sonoanatomy (AnSo) app learning platform

NYSORA Serratus Anterior

ESP: current understanding

AAGBI Local anaesthetic toxicity guideline

In the event of catheter related problems, please escalate to: acute pain team bleep 3233 (in hours), 1st on-call anaesthetist bleep 3088 (13.00-23.00), senior anaesthetic trainee (SAT) bleep 3513 (20.00-08.00), critical care outreach bleep 3504

CHA4774 V1

Appendix 9. Peninsula Trauma Network Guidelines

The latest Peninsula Trauma Network (PTN) guidance for Major Trauma and Chest Wall injuries can be found at the following URL: https://www.peninsulatraumanetwork.nhs.uk/network-guidelines.

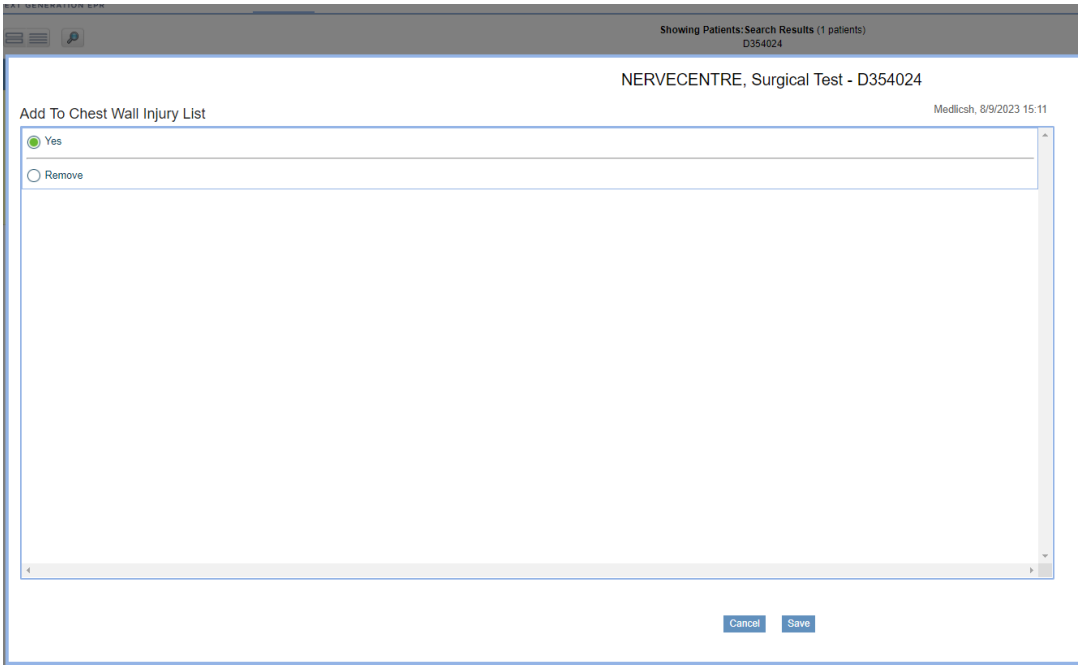
Specific regional guidance of relevance to this RCHT guideline includes:

1. “PTN Automatic Acceptance Secondary Transfer” and “Trauma Patient Acceptance and Discussion Guide” for ‘auto-accept’ injuries and those requiring urgent transfer.
2. “PTN Clinical Guidelines – Chest Wall Injuries”.
3. “Pathway 2 – Isolated Chest Injury”.

Appendix 10. Chest Wall Injury Dashboard, Chest Wall Injury Scoring and PIC scoring observations tool – NerveCentre guide

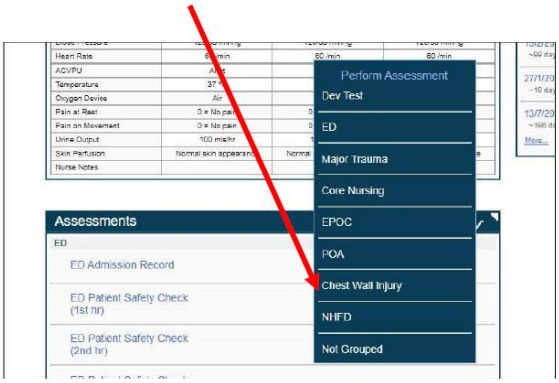
Adding patients to the Chest Wall Injury dashboard:

1. Within ‘Patient list’ tab, search for patient (circled in red).
2. Select ‘Chest Wall Injury DB’ (circled in orange).
3. Double click on ‘Add to Chest Wall Injury list’ (circled in green) and select ‘Yes’ to add to the Chest Wall Injury dashboard.



Calculating Chest Wall Injury Score and completing PIC (Pain, Inspiration and Cough) score:

Click on 'Chest Wall Injury'



Within the patient's NerveCentre screen, click on '+' icon within the assessments tab.

Select 'Chest Wall Injury' option.

To complete a PIC score observation (top option) or Chest Wall Injury score (bottom option).

PIC score

Chest wall injury score (will auto calculate score with inputted data)