

## Chest Wall Trauma (Blunt) - Full Clinical Guideline For Emergency Department use

Reference No: CG-T/2023/120

### Introduction (adapted from Reference 1)

- The primary injury mechanisms in blunt chest wall trauma patients are road traffic collisions, sporting injuries and low velocity falls in those typically aged 65 years or more (e.g. falling from standing or down a flight of stairs)
- The blunt chest wall trauma patient commonly presents to the ED initially with no respiratory difficulties, but develops complications approximately 48-72 hours later; importantly these patients often do not display any signs or symptoms other than pain for up to two days
- Patients aged 65 years or older with 3 or more rib fractures fall into the high-risk group; however local audit has demonstrated significant morbidity in younger patients with lesser injury.
- Blunt chest wall trauma accounts for over 20% of all trauma patients presenting to the Emergency Department in 2010 (TARN 2010)
- The true incidence of bony injury to the chest wall may be underreported as up to 50% of rib fractures are undetected on plain CXR
- Reported mortality from blunt chest wall trauma is highly significant (up to 22% often due to delayed respiratory complications)
- Incidence of pulmonary complications is reported to be as high as 36% in isolated rib fracture patients aged 65 years or older and 20% in patients of all ages
- The mean length of stay on ICU was reported to be 3.5 days in all patients with isolated blunt chest trauma
- 35% of elderly patients (> 65 years) with isolated chest wall trauma required ICU care, 12 had a mean stay of 6.1 days on ICU and 12% required mechanical ventilation
- The mean hospital length of stay in elderly patients with isolated chest wall trauma is reported to be 14 days

### Aim and Scope

- To ensure that all patients presenting to the ED with blunt chest wall trauma are assessed in a standardised manner and are triaged to the most appropriate destination for on-going care.
- To ensure all patients receive optimal management to decrease the likelihood of secondary complications and achieve the shortest possible mean hospital length of stay.
- To ensure that serious chest wall trauma (for example those with an Injury Severity Score of  $\geq 16$  such as a patient with a flail segment and bilateral chest contusions or injury to chest and another body region such as head or abdomen) are being sent to the Major Trauma Centre from the ED or at least being discussed with the MTC regarding timely internal fixation of a significant flail segment.

**Areas for Use**

- This guideline is for the use in the Royal Derby Hospital Emergency Department. For details of on-going management and care, please refer to the separate in-patient management guidelines that can be found on Net-i.

**Abbreviations**

APT	Acute Pain Team
CCOT	Critical Care Outreach Team
CXR	Chest X Ray
DME	Department of Medicine for the Elderly
ED	Emergency Department
FiO <sub>2</sub>	Fraction of inspired Oxygen
GCS	Glasgow Coma Scale
ICU/HDU	Intensive Care Unit/High Dependency Unit
IPPV	Intermittent Positive Pressure Ventilation
ISS	Injury Severity Score
MDT	Multidisciplinary team
MEWS	Modified Early Warning Score
MTC	Major Trauma Centre
NEWS	National Early Warning Score
NIV	Non-Invasive Ventilation
NSAID	Non steroidal anti-inflammatory drugs
PaCO <sub>2</sub>	Partial Pressure of arterial Carbon Dioxide
PaO <sub>2</sub>	Partial Pressure of arterial Oxygen
QMC	Queens Medical Centre, Nottingham University Hospitals NHS Foundation Trust
SAU	Surgical Admissions Unit
SDU	Step-Down Unit
TARN	Trauma Audit & Research Network
TU	Trauma Unit

**Definitions**

*Rib Fractures:* Injuries to the upper ribs are potentially associated with injuries to adjacent great vessels. A fracture of the 1<sup>st</sup> rib requires a significant amount of force to break and indicates a major energy transfer; it should prompt a careful search for such injuries. Fractures to the lower ribs may be associated with diaphragmatic tears, visceral injuries to spleen and/or liver.

*Flail Chest:* occurs when two or more adjacent ribs are fractured in two or more places resulting in a free or floating 'flail' segment of the chest wall. As a result, the floating segment moves paradoxically with spontaneous ventilation (moving in during inhalation, and out during exhalation). This leads a significant decrease in vital capacity and functional residual capacity. It causes significant pain and is almost always associated with a lung injury such as lung contusion.

*Lung contusion:* is an injury to the lung parenchyma with loss of blood vessel integrity resulting in intra-parenchymal and alveolar haemorrhage. The end result is severe endothelial injury at the alveolar-capillary membrane which usually develops over the first 24 hours but may be absent on initial presentation of the patient with blunt chest wall trauma in the ED. Lung contusion is often associated with rib fractures and the extent is proportional to the severity of the thoracic injury sustained.

**Risk Factors for poor outcomes in blunt chest wall trauma** (adapted from Reference 1)

- Age 65 years or more
- Three or more rib fractures
- High/Mid chest wall rib fractures
- Flail Segments
- Chronic lung disease
- Onset of pneumonia post-injury
- Oxygen saturation < 90% in ED on air on presentation
- PaO<sub>2</sub>/FiO<sub>2</sub> ratio < 33 on admission [*note: normal is 12kPa : 0.21 ~ 57*]
- Body Mass Index > 25kg/m<sup>2</sup>

**Initial assessment and management including analgesia** (See Appendix 1 for algorithm)

The use of a simple scoring system such as the Chest Wall Trauma Scoring System (suggested by Pressley CM et al, see reference 3) predicts the likelihood of patients requiring mechanical ventilation and enhanced supportive care and therefore assists in making safe and appropriate referral decisions. The referral decisions should involve a dynamic approach with assessment of the severity of injury, associated complications of the blunt chest wall trauma and response to treatment, including adequacy of analgesia.

- Early effective analgesia must be established (defined as the ability to deep breathe and cough effectively)
- All patients should receive multi-modal analgesia with Paracetamol and NSAIDS unless contraindicated +/- opioids. (**Prescribe the appropriate 'Rib fracture' order set on EPMA for inpatients**)
- Patients with multiple rib fractures will likely require intravenous morphine as initial rescue followed by further 'rescue' morphine subcutaneously or intravenously as per the trust guideline 'Pain Management Guidelines for Adults' available on Net-i.
- A regional anaesthetic technique (Erector spinae block/ Epidural) should be considered (contraindications such as coagulation disorders, platelet deficit, fractured thoracic vertebrae or suspected major haemorrhage may affect choice of technique) to
  - Patients with ≥3 or more rib fractures
  - Patients aged ≥65 years
  - Patients with 1-2 rib fractures when:
    - Parenteral morphine fails to diminish pain scores to <5 out of 10 or severe pain on coughing
    - There is an ineffective cough (unable to clear secretions) due to pain
    - Where the patient develops a lower respiratory tract infection indicated by the presence of pyrexia, productive sputum +/- CXR changes
- Where limb fractures co-exist with 3 or more rib fractures, epidural analgesia using standard infusions (0.1% plain Bupivacaine with 2mcg Fentanyl) can be combined with receiving parenteral morphine if patient is placed in SDU or ICU/HDU

**Inpatient admission pathway – Chest Wall Trauma scoring system** (See Appendix 2)

Surgical fixation of rib fractures has been controversial for years. Its efficacy is recognised and patients should be referred to the MTC, Queens Medical Centre, Nottingham if they meet any of the following nationally recognised criteria.

- Flail chest where mechanical instability in the chest wall is severe enough to hamper ventilation
- On going inadequate analgesia
- Chest wall deformity
- Chronic symptomatic mal-union or non-union of rib fractures
- Pulmonary herniation
- Lung impalement
- Thoracotomy for other indications

**References:**

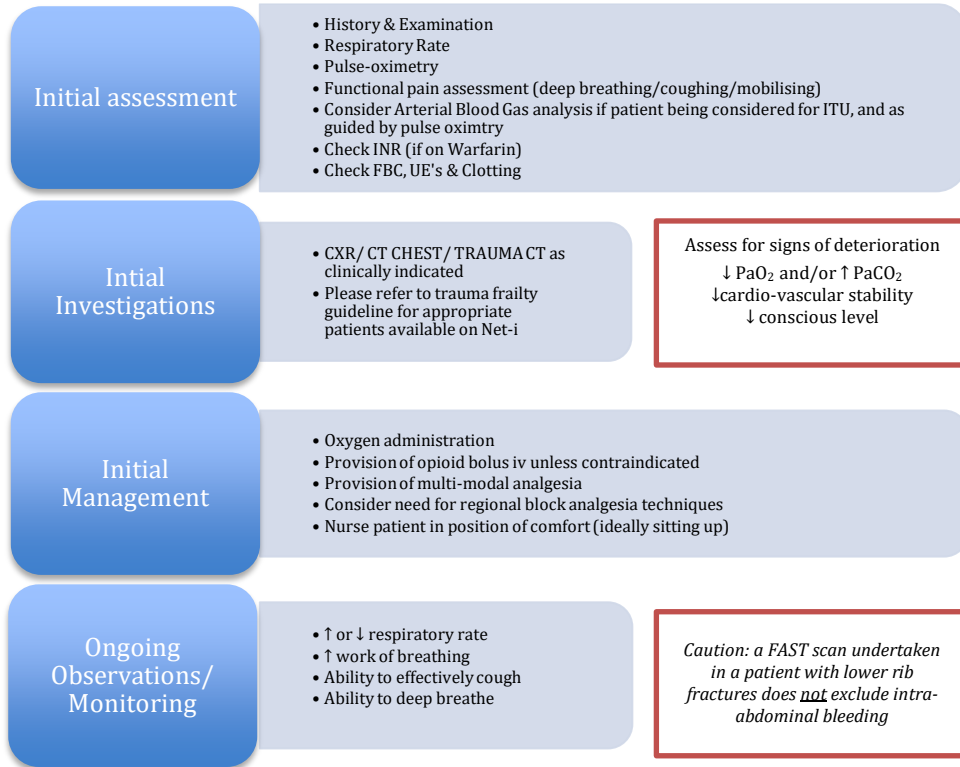
- 1) Battle C, Hutchings H and Evans PA (2013) Blunt Chest Wall Trauma: a review; *Trauma* 15(2): 156-175
- 2) Battle CE, Hutchings H, Evans PA (2012) Risk factors that predict mortality in patients with blunt chest wall trauma: a systematic review and meat-analysis; *Injury* 43(1): 8-17
- 3) Pressley CM, Fry WR, Philp AS et al. (2012) Predicting outcome of patients with chest wall injury; *Am J Surg* 204(6): 910-913
- 4) Chen J, Jeremitsky E, Philp F et al. (2014) A chest trauma scoring system to predict outcomes *Surgery* 156(4): 988-933
- 5) Battle C, Hutchings H, Lovett S, et al. (2014) Predicting outcomes after blunt chest wall trauma: development and external validation of a new prognostic model; *Critical Care* 18; R98
- 6) Simon B, Ebert J, Bokhari F et al. (2012) Management of pulmonary contusion and flail chest: an Eastern Association for the Surgery of Trauma practice management guideline *J Trauma Acute Care Surg* 73(5) 351-361
- 7) Forward DP, Ollivere BJ, et al. (2016) Current concepts in rib fracture fixation *Bone & Joint* 5(5): 2-7

**Document Controls:**

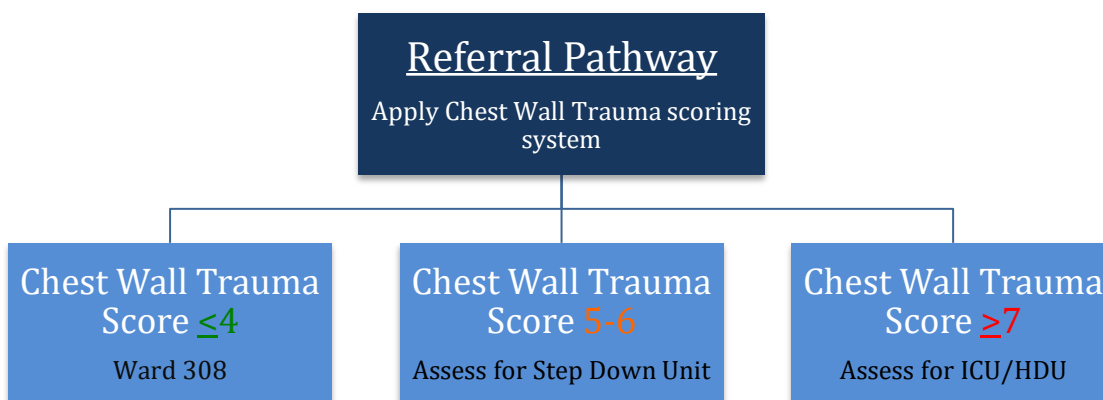
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APPENDIX 1

Algorithm for Assessment & Initial Management of Blunt Chest Wall Trauma



Once patient is clinically stable, apply the Chest Wall Trauma Scoring system (see appendix 2) to determine most appropriate destination for inpatient admission



## APPENDIX 2

Pathway for the patient presenting with isolated chest wall trauma or patients with chest wall trauma associated with other traumatic injuries who have NOT been transferred to the MTC:

1. Obtain a **Chest Wall Trauma Score**

CHEST WALL TRAUMA SCORING SYSTEM							
Age	points	Pulmonary Contusion	points	No of rib fractures	points	Bilateral rib fracture	points
< 45	1	None	0	<3	1	No	0
45-65	2	Mild	1	3-5	2	Yes	2
>65	3	Severe	2	>5	3		
		Bilateral	3				
						<b>Total Score =</b>	

Pressley CM et al, Am J Surgery (2012); 204: 910-14

Minimum score: 2  
Maximum Score: 11

**A score of  $\geq 7$  predict increased risk of mortality. Assess the need for intubation and IPPV, and consider admission to ICU.**

## 2. Use score obtained to score to guide admission and referral

- Score of  $\leq 4$ : Patient maybe transferred for care in ward 308 under the admitting surgical team with initiation of the NEWS/MEWS score unless need for epidural takes precedence as below when a referral to SDU will be required
- Score of **5-6**: Patient to be considered for SDU unless additional head injury or cardiovascular instability as below; they are under the care of the admitting surgical team
- Score  $\geq 7$ : Patient to be considered for ICU/HDU as they are at high risk of deterioration and likely will require NIV or IPPV; they are under the care of the admitting surgical team

Irrespective of the score:

- All patients with a significantly altered GCS should go to ICU/HDU after their trauma CT scan
- All patients who are cardiovascularly unstable should go to ICU/HDU
- All patients who went to theatre for a significant visceral injury and blunt chest wall trauma should go to ICU/HDU
- All patients with significant hypoxaemia likely to require advanced respiratory support (eg CPAP, Optiflow, Intermittent NIV) or hypercarbia should be admitted to ICU/HDU

Any patient not being directly admitted to SDU or ICU/HDU will likely be transferred to SAU pending inpatient transfer to Ward 308 where possible. Ward 308 will act as a cohorting ward for all blunt chest wall injury patients to consolidate on going care.

Affix patient label here

## Chest wall injury bundle

Chest wall injuries are associated with high morbidity and mortality rates – most decompensate 48-72 hours after injury.

Comprehensive approaches to pain relief are an essential part of management in the acute period and it is everyone's responsibility to assess and respond to patients in pain.

Please complete the checklist below for all patients with high clinical suspicion of significant chest wall injury or following radiological diagnosis. Relevant guidelines overleaf.

All patients		
Patient discussed with a <b>Consultant or SDM</b> ?		<input type="checkbox"/> Completed
Pain assessment – goal directed		
a)	Assess pain minimum 2 hourly (TRIPP standard)	
b)	Assess ability to <b>deep breathe and cough</b>	
Pain management – regular, multimodal and break through		
a)	<b>IV opiate</b> should be used as the initial mode of analgesia to establish good pain control	<input type="checkbox"/> Completed
b)	Prescribe all patients <b>multimodal</b> analgesia (reference standard bundle cited overleaf) and complete prescription card regular/PRN When e-prescribing please use the rib fractures order set. Search using term 'rib fractures'	<input type="checkbox"/> Completed
c)	Offer all patients <b>breakthrough parenteral opiates</b> if standard analgesia bundle inadequate	<input type="checkbox"/> Completed
d)	Offer all patients with a decision to admit <b>lidocaine patch(es)</b>	<input type="checkbox"/> Completed
e)	Offer <b>explanation</b> to all patients with chest wall injuries re goal directed pain management and avoidance of complications	<input type="checkbox"/> Completed
Escalation and admission		
a)	Calculate and document <b>chest wall injury score</b> for all patients and refer to guidance regarding admission pathway (SAU, SDU, ITU).	<input type="checkbox"/> Completed
b)	Create 'Major Trauma' patient alert on Lorenzo	<input type="checkbox"/> Completed
c)	Where <b>standard analgesia is inadequate escalate</b> to SDM and anaesthetics for consideration for regional anaesthesia	<input type="checkbox"/> Completed <input type="checkbox"/> N/A
c)	<b>Specific circumstances</b> where a regional anaesthetic technique (Erector spinae block/ Epidural) should be considered: <ul style="list-style-type: none"> <li>- Patients with 3 or more rib fractures</li> <li>- Patients aged &gt;65 years</li> <li>- Patients with 1-2 rib fractures when: <ul style="list-style-type: none"> <li>- Parenteral morphine fails to diminish pain scores to &lt;5 out of 10 or severe pain on coughing</li> <li>- There is an ineffective cough (unable to clear secretions) due to pain</li> </ul> </li> </ul>	<input type="checkbox"/> Completed <input type="checkbox"/> N/A

### Standard analgesia bundle(s)

Please note that this is a guideline only and prescribers should use their clinical judgement in all cases.

<b>For &lt;75s or eGFR &gt;60</b>
<p>Paracetamol 1g QDS PO/IV  Regular opiate (codeine 30-60mg QDS or oramorph 10mg QDS)  Ibuprofen 400mg TDS + PPI (unless contraindicated)  1-2 Lidocaine patch(es) (700mg medicated plaster [ Lidocaine 50mg/1g] )  Apply plaster(s) to skin over fracture site and leave for 12 hours.  Remove plaster(s) after 12 hours. Ensure 12 hours elapse before applying the next plaster(s)  (Not to be used with bupivacaine infusions)</p>
<b>For &gt;75s or eGFR &lt; 60</b>
<p>Paracetamol 1g QDS PO/IV  Oramorph 5-10mg QDS  1-2 Lidocaine patch(es) (700mg medicated plaster [ Lidocaine 50mg/1g] )  Apply plaster(s) to skin over fracture site and leave for 12 hours.  Remove plaster(s) after 12 hours. Ensure 12 hours elapse before applying the next plaster(s)  (Not to be used with bupivacaine infusions)</p>
<b>For all patients:</b>
<p>Consider additional PRN use of PO/IV morphine sulphate</p> <p>Refer to trust guideline 'Pain Management Guidelines for Adults' and 'Morphine - Intravenous Bolus - Full Clinical Guideline' available on Koha.</p>

Adapted from Chest Wall Trauma (Blunt) - For In-Patient Use - Full Clinical Guideline  
14/12/2020

### References

Chest Wall Trauma (Blunt) - ED - Clinical Guidelines - 01/09/2020 which provides guidance concerning assessment, investigation and management of patients with blunt chest wall injury