

TRAUMA SERVICE GUIDELINES

Title: Chest Wall Trauma Guideline

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Created: Version 1.0 November 2019, V1.1 June 2020

See Also: TRM 04.05 Blunt Aortic Injury

Background

Chest injuries are very common following blunt trauma. In Australia and at RMH, it is the 2nd most commonly injured body region in major trauma, with 54.6 % of all trauma patients admitted to the Royal Melbourne Hospital sustaining an injury to the thorax. ^{1,2}

Blunt chest injuries can affect any one or all components of the chest wall and thoracic cavity. The approach to these patients requires identification and treatment of immediately life threatening injuries during the initial assessment as per ATLS principles. ³

Rib fractures are associated with a wide range of other chest injuries from mild pulmonary contusions to complex injuries involving the diaphragm or other viscera. ⁴ There is a mortality risk with rib fractures, which increases with every rib that is fractured. ⁵ Elderly patients have double the mortality and morbidity risk of younger patients, with a 31% rate of pneumonia and an increase in mortality by 19% with each additional rib fracture. ^{6,7}

Treatment for Chest Wall Injuries

Clinically significant ribs fractures can be a source of mortality, morbidity and prolonged duration of care in high dependency areas. ⁸ There are three main pathophysiological processes associated with morbidity and mortality in-patient with rib fractures: hypoventilation due to pain, impaired gas exchange in damaged lung underlying the fractures, and altered breathing mechanics resulting from flail segments. ^{4,9,10}

The cornerstone to effective management for patients with clinically significant chest wall trauma is effective analgesia, respiratory support and intensive physiotherapy ¹¹. There is also mounting evidence that a patient's perception of pain early in the post injury phase is associated with the development of chronic pain. ¹² In addition poor pain control can lead to poor sleep, nutrition, decreased mobility and stress. ¹³

Despite the common nature of rib fractures in the traumatised population, the most effective analgesic regime is yet to be determined given the complex nature of these patients, their co-existing injuries and disease states. These complexities often necessitate the early involvement of the Acute Pain Service (APS) to offer expert opinion and analgesic management strategies.

For the best outcome of patients with chest wall injuries a multidisciplinary approach should be taken with medical, allied and nursing staff contributing to the care of the patient. ^{6,10}

Intensive Physiotherapy

Patients with chest wall fractures are at high risk of respiratory complications. Treatment should be aimed at the maintenance of functional residual capacity (FRC). FRC is impaired with chest wall trauma due to splinting from pain or mechanical instability which can lead to decreased lung volumes and atelectasis. If this is not prevented; sequelae including pneumonia, respiratory failure, ICU admissions, increased LOS and death may result. ^{6,7,10,13}

Patients with rib fractures should be referred to physiotherapy and commence hourly deep breathing and supported coughing exercises and daily chest physiotherapy with a physiotherapist. Improvements in functional residual capacity can also be achieved with head elevation and frequent mobilisation or sit out of bed as often as possible if able, this should be done by nursing staff and the physiotherapists. In addition patient and family education emphasising the importance of deep breathing and coughing exercises, mobilisation and analgesia can support the care of the patient. ^{6,7,10,14} (Chest Trauma Brochure)

Analgesia

Effective analgesia is important to: ^{4,10,15}

- Promote coughing and deep breathing
- Avoid sputum retention Maintain Functional Residual Capacity (FRC), lung compliance and adequate ventilation/perfusion matching
- Facilitate early weaning from invasive ventilatory supports
- Promote timely patient mobilization

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- Facilitate chest physiotherapy

Analgesia may be delivered in a number of different forms. Regional analgesic techniques may be offered to a patient who is deemed to be an appropriate candidate, after review by the APS Registrar and in consultation with the APS Consultant of the day. The technique offered to the patient will be guided by: ¹⁶⁻¹⁸

- Patient injuries
- Patient current clinical status
- Patient co-morbidities
- Expertise available

Each regional technique has a complement of advantages and disadvantages which need to be considered by the APS. A number of options are available and include paravertebral, erector spinae, epidural and intercostal blocks. Currently there is no evidence that any single regional block is superior. ^{4, 15-18}

Referral to the Acute Pain Service (APS) ^{9, 19}

The presence of **high risk factors** or those at **high risk of clinical deterioration** should result in immediate referral to APS for pain management; the presence of any of these risk factors should alert the treating team to the potential for serious morbidity

High risk factors

- Age \geq 64
- BMI \geq 40
- OSA
- Co-existing respiratory disease
- Co-existing Heart Failure
- Complex rib fractures (>2 ribs, flail segment, bilateral fractures, pneumothorax/haemothorax)

High risk of clinical deterioration

- Accessory respiratory muscle use
- Ineffective cough
- Sedated ⁸
- $>$ FiO₂ 35% or $>$ 6L/min via Hudson mask to maintain SpO₂ $>$ 94%
- RR $>$ 20

In those **without high risk factors** should have the following simple analgesic regime **prescribed**:

- Regular Paracetamol
- Regular NSAID or COX₂ inhibitor
± Tramadol
± Regular gabapentin
- PRN Oxycodone.

Trauma patients are already at a high risk of constipation, so if prescribing opioids, prescribe a bowel regime at the same time. If the patient deteriorates or pain relief is insufficient refer to APS for review.

How to Refer to Acute Pain Service

Identified patients with high risk factors and at high risk of clinical deterioration should be referred by the treating doctor to the APS registrar. An APS registrar is available 24 hours a day to give phone advice, triage patients for review, and commence complex systemic analgesia including patient controlled analgesia (PCA). Regional techniques, if considered appropriate, are performed in hours and are dependent on the availability of skilled staff and an appropriate location. All APS techniques are governed by RMH Pain Service Procedures and Medication Guidelines.

Rib Fixation in Chest Wall Trauma

Surgical stabilisation of rib fractures is a growing area of interest with an increasing evidence base to support its use. The literature now demonstrates that chest wall fixation improves outcomes in both the acute patient with rib fractures and in long term morbidity.¹⁵

Chest wall fixation decreases: ^{4, 9, 15}

- Ventilation days & ICU length of stay
- Respiratory failure
- Pneumonia (which occurs in up to 31% of all patients with rib fractures)
- Mortality especially in those $>$ 64, with $>$ 2 ribs # and with any pre-existing lung disease and comorbidities
- Overall LOS

If a non-operative treatment approach is taken in high-risk patients or those with multiple ribs and flails chests there are a number of potential long term sequelae which may result.

These include the following: ^{4, 15, 20-22}

- Due to issues related to chronic pain, chest wall deformity & scoliosis in addition to decreased respiratory function 20-60% chance of returning to work

- Ongoing and worsening displacement of the fractures due to increasing deformity as time passes resulting in decreased volume and collapse and scoliosis
- Non-union or malunion
- Chronic pain
- Significant impairment in quality of life.

Indication for Referral to Thoracic Surgery for Rib Fixation

- 3 or more displaced rib fractures
- Flail segment
- Rib fractures with a sternal fracture
- Severe chest wall deformity
- Potential visceral injury from the fractures

Contraindications to Rib Fixation

- Acute myocardial infarction
- Severe traumatic brain injury
- Unstable spinal fractures
- Empyema

How to Refer to Thoracic Surgery

All patients who fulfil the indication for referral for fixation or who have a haemothorax or pneumothorax with complications as described below; should be referred to thoracic surgery. During normal hours this referral should be made to the thoracic team's registrar or fellow. After hours or on the weekend, the referral is made to the cardiothoracic registrar on call.

Once the referral to thoracic has been made, the patient will be seen daily on the thoracic ward round or, on the weekend, the cardiothoracic ward round.

3D reformats

If patients meeting the above inclusion criteria require 3D reconstructions contact radiology as soon as possible, this will prevent delays and prevent possible repeat scanning.

Referral to Thoracic for persistent pneumothorax/ haemothorax/ empyema

Rib fractures often occur in tandem with other injuries, including haemothoraces, pneumothoraces and pulmonary contusions.

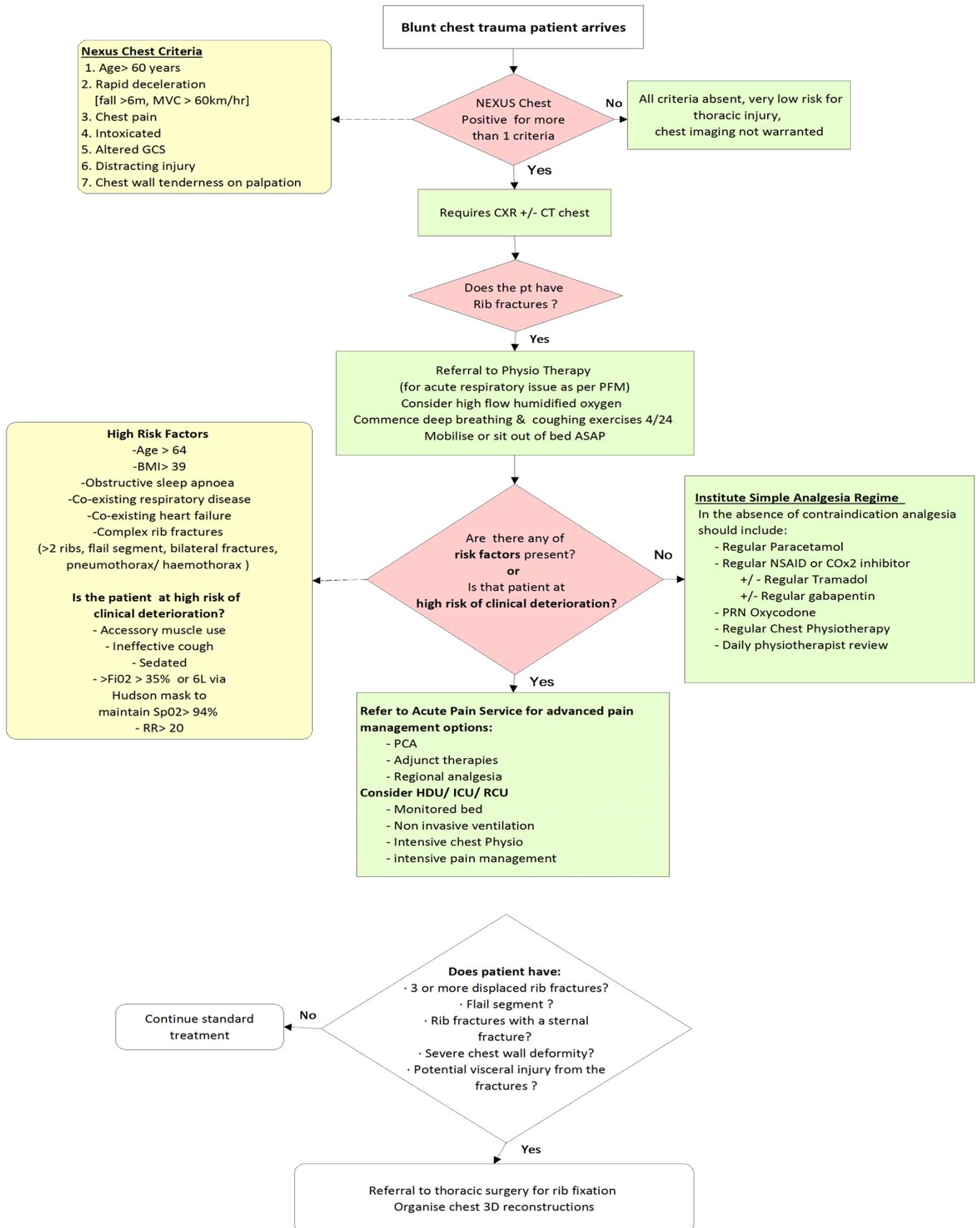
Pneumothoraces are managed with insertion of an intercostal catheter, but occasionally there can be a persistent air leak, PAL is defined as an air leak lasting longer than 5 days,²³ these if not resolved can lead to poor lung expansion, V/Q mismatch and infection.²⁴

Most haemothoraces which if retained may become infected (empyema).

Retained haemothoraces occur in 5% of cases with ICC drainage, these requires surgical decortication and drainage.

Referral for Video Assisted Thoracostomy (ATS) Indications: ²⁵

- Persistent haemothorax: significant haemothorax despite ICC
- Empyema those who have a loculated collection with appearances suspicious for empyema
- Persistent air-leakage penetrating trauma > 24hrs; blunt trauma 48hrs.



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