

Queensland
Trauma Education

CHEST TRAUMA

Delayed respiratory deterioration post blunt chest trauma Immersive scenario

Facilitator resource kit

CSDS



Clinical Skills Development Service



Queensland Trauma Education

The resources developed for Queensland Trauma Education are designed for use in any Queensland Health facility that cares for patients who have been injured as a result of trauma. Each resource can be modified by the facilitator and scaled to the learners needs as well as the environment in which the education is being delivered, from tertiary to rural and remote facilities.

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Queensland Trauma Education

Chest Trauma – Delayed respiratory deterioration post blunt chest trauma: Immersive scenario – Facilitator resource kit

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About this training resource kit

This resource kit provides healthcare workers with useful resources and key practice points to assist them to identify and manage respiratory complications in patients following blunt chest trauma injuries.

National Safety and Quality Health Service (NSQHS) Standards



Target audience

Ward-based nursing and physiotherapy clinicians.

Duration

45-60 minutes (set-up, scenario and debriefing).

Group size

4-6 participants (or team composition applicable to local area).

Learning objectives

By the end of this session the participant will be able to:

- Identify patient and injury-related factors that place a patient at greater risk of delayed respiratory complications post chest trauma.
- Identify three key signs of impending respiratory deterioration – poorly controlled pain, impaired inspiration, and impaired cough.
- Demonstrate the skill of teaching a patient the correct incentive spirometry technique.

Facilitation guide

1. Facilitator to provide participant resource kit to the participants.
2. OPTIONAL: Utilise associated powerpoint presentation to provide participants with clinical management of blunt chest trauma prior to delivery of immersive scenario.
3. Facilitator to discuss the pre-simulation briefing and deliver the immersive scenario on blunt chest trauma.
4. Utilise the supporting documents to maximise the learning throughout immersive scenario.
5. Utilise the debriefing guide to evaluate participant performance and provide feedback.

Supporting resources

- Structured assessment
- Specific management
- Facilitator PowerPoint

Overview of chest trauma

Chest trauma is the second most common traumatic injury in non-intentional trauma.²

After blunt chest trauma patients are managed in a number of locations including the emergency department, the intensive care unit, a dedicated trauma unit, or orthopaedic, medical or surgical wards. Ongoing assessment and early identification of respiratory deterioration is crucial as patients who appear stable on early assessment may later deteriorate on the ward due to respiratory complications such as atelectasis and pneumonia.

A number of factors have been associated with a higher risk of respiratory complications post blunt chest trauma¹, including:

- number of ribs fractured (>3)
- age (>55 years)
- other serious injury such as head, extremity, abdominal, cardiac, or spinal cord injury
- smoking history or chronic lung condition.

Best practice management for the prevention and management of respiratory deterioration:

1. Regular monitoring and patient assessment.
2. Early identification of at-risk patients and signs of respiratory deterioration, such as:
 - a. early warning scores (EWS)
 - b. PIC score algorithm (pain, inspiration, cough).⁴
3. Effective pain management.
4. Optimisation of lung volumes and cough effectiveness through upright positioning and chest physiotherapy.
 - a. Incentive spirometry devices can be used as a visual aide to teach optimal deep breathing technique (slow, deep breath with inspiratory hold).
 - b. Poor performance of incentive spirometry (volumes <1L) may be predictive of higher risk of respiratory complications.³
5. Multidisciplinary care and communication.

Structured assessment

A	Airway <ul style="list-style-type: none">• Voice – quality, breathiness, speaking in sentences.• Airway noises – stridor, audible upper airway secretions.
B	Breathing <ul style="list-style-type: none">• RR, SpO₂, supplemental oxygen requirement.• Breath sounds on auscultation.• Chest wall – external bruising or deformity, symmetry, flail.• Estimated inspiratory capacity – chest wall movement with quiet and deep breathing, performance of incentive spirometry (ability to sustain max inspiration or achieve volume >1000ml on volume device).• Cough – moist or dry, maximal volitional effort or pain inhibited.• Dyspnoea rating score – VAS or Modified BORG dyspnoea scale.• CXR.
C	Cardiovascular/circulatory <ul style="list-style-type: none">• HR, cardiac rhythm, BP.
D	Disability <ul style="list-style-type: none">• Assess GCS.• Pain rating scores – at rest, on movement/deep breath/cough.
E	Exposure <ul style="list-style-type: none">• Assess other injuries.• ICC observations.

Specific management

1. Referral to Acute Pain Management service and effective pain relief.
2. Upright positioning when in bed.
3. Early mobilisation and sitting out of bed.
4. Deep breathing exercises (+/- incentive spirometry).
5. Oxygen therapy +/- humidification.

Simulation event

This section contains the following:

1. Pre-simulation briefing poster
2. Immersive scenario
3. Resource requirements
4. Handover card
5. Scenario progression
 - a. State 1: Initial assessment / recognition of deterioration
 - b. State 2: Ongoing management / secondary assessment
 - c. State 3: Reassessment
6. Supporting documents
7. Debriefing guide

Pre-simulation briefing

Establishing a safe container for learning in simulation



1

Clarify objectives, roles and expectations

- Introductions
- Learning objectives
- Assessment (formative vs summative)
- Facilitators and learners' roles
- Active participants vs observers

2

Maintain confidentiality and respect

- Transparency on who will observe
- Individual performances
- Maintain curiosity

3

Establish a fiction contract

Seek a voluntary commitment between the learner and facilitator:

- Ask for buy-in
- Acknowledge limitations

4

Conduct a familiarisation

- Manikin/simulated patient
- Simulated environment
- Calling for help

5

Address simulation safety

Identify risks:

- Medications and equipment
- Electrical or physical hazards
- Simulated and real patients



Note: Adjust the pre-simulation briefing to match the demands of the simulation event, contexts or the changing of participant composition.

Immersive scenario

Type	Immersive scenario
Target audience	Ward-based nursing and physiotherapy staff.
Overview	<p>69 year old patient who is day 2 post a 2m fall from a ladder at home. Injuries sustained include fractured ribs R) 3-7 with no flail, right fractures to mid shaft tibia and fibula, and minor head abrasions.</p> <p>CT head, chest and pelvis were NAD except for the above rib fractures, a R) pneumothorax, and bilateral pulmonary contusions.</p> <p>A R) intercostal catheter (ICC) was inserted in the emergency department on admission to their local hospital.</p> <p>Yesterday they underwent ORIF for the lower limb fractures and is now on the orthopaedic surgical ward.</p>
Learning objectives	<ul style="list-style-type: none">• Identify patient and injury-related factors that place a patient at greater risk of delayed respiratory complications post chest trauma.• Identify three key signs of impending respiratory deterioration – poorly controlled pain, impaired inspiration, and impaired cough.• Demonstrate the skill of teaching a patient the correct incentive spirometry technique (optional).
Duration	45-60 minutes, including debrief.

Resource requirements

Physical resources

Room setup	Hospital bed in ward environment
Simulator/s	Simulated patient x1 (male or female)
Simulator set up	<ul style="list-style-type: none"> Hospital gown and TED stockings, lying supine in bed Moulage: Bruising to right chest, apical and basal chest drains attached to UWSD. Right leg in POP backslab or Moon boot. Dressing on forehead.
Clinical equipment	<ul style="list-style-type: none"> NIBP, ECG and SpO2 monitoring. Nasal prongs attached to oxygen source. ICC and UWSD set up. Patient controlled analgesia (PCA), labelled "Morphine". PPE – hand sanitizer gloves. Incentive spirometer (if available). Fisher & Paykel – Airvo. High flow humidification device (Airvo), HFNP interface, circuit, water for irrigation.
Access	Left cubital 1 x IVC attached to PCA system
Other	<ul style="list-style-type: none"> Vital signs observations chart – QADDs or iEMR Patient Deterioration. PowerPoint slides.

Human resources

Faculty	2 facilitators (physiotherapist or nurse with debriefing experience) to take on roles of: <ul style="list-style-type: none"> scenario commander/primary debrief confederate nurse.
Simulation coordinators	Standardised patient – facilitators to control simulated monitor.
Confederates	Confederate nurse in room to give handover and responses.
Other	Simulation technical or faculty staff to run the vital signs monitor (if available).

Handover card

Handover from bedside nurse

This is Lesley, a 69 year old new admission to the orthopaedic ward overnight.

They were BIBA from home to the emergency department yesterday morning after an unwitnessed fall of approximately 2 metres from a ladder while attempting to trim trees. QAS reported the patient was lying on their right side with pain in the right chest, lower leg, and minor forehead abrasions but no loss of consciousness at the scene.

CT head, chest and pelvis were NAD except for fractured ribs R) 3-7 with no flail, a R) pneumothorax, and bilateral lung contusions. A R) intercostal catheter (ICC) was inserted in the emergency department on admission to their local hospital. Yesterday they underwent ORIF for the lower limb fractures. Post-operative weight bearing orders are for NWB on the right leg for six weeks.

Lesley has no significant PMHx, and is normally fit and well.

Lives with partner and two university-aged children.

Smoking history of 1 pack of cigarettes per day since age 22.

Lesley has slept poorly overnight due to high levels of pain and they needs to be frequently reminded to use the PCA. I am concerned because in the last two hours their respiratory rate has increased and SpO2 has decreased.

Scenario progression

STATE 1: INITIAL ASSESSMENT / RECOGNITION OF DETERIORATION				
Vital signs		Script	Details	Expected actions
ECG	Sinus	Lesley "My ribs hurt!!" "My pain is 6/10 at rest, and 10/10 (chest) when I try to cough." "I can't cough, I have phlegm stuck." "I haven't slept a wink in 2 days."	Primary survey results A: Patent B: Breathing pattern looks laboured, using accessory muscles. Reduced chest wall movement right side. Unable to take full inspiration or cough, pain inhibited. C: Well perfused D: GCS E3V5M6 E: Lying slumped in bed with right leg elevated, in back slab or Moon boot. R) ICC minimal output, nil bubble or swing	<input type="checkbox"/> Commence Primary Survey <input type="checkbox"/> Assesses "Pain, Inspiration, Cough" <ul style="list-style-type: none"> Evaluate pain levels – rest, movement. Evaluate inspiratory capacity – observe chest wall movement, auscultate, perform incentive spirometry (if available). Evaluate cough effectiveness – pain inhibited. <input type="checkbox"/> Recognises "red flags" for potential deterioration. <ul style="list-style-type: none"> >3 fractured ribs age >55 years uncontrolled pain increased WOB, RR decreased SpO₂ smoking history pulmonary contusion decreased mobility (leg ORIF). <input type="checkbox"/> Request Acute Pain Management Service/ medical review/notify team leader. <input type="checkbox"/> Nurse administered bolus morphine. <input type="checkbox"/> Refer to physiotherapy if not already involved.
HR	99			
SpO ₂	92% on 3L O ₂ via nasal prongs			
BP/ART	159/99			
RR	25			
Temp	38.1			
GCS	14			
		Nurse "They keep forgetting to use their PCA." "I've had to turn the oxygen up from 2 to 3 litres/min in the last hour." "I have just given some paracetamol but it doesn't seem to be working yet." "They haven't yet mobilised out of bed because of the leg fractures" "The chest drain output was about 100mls in total overnight"		

STATE 2: ONGOING MANAGEMENT / SECONDARY ASSESSMENT				
Vital signs		Script	Details	Expected actions
ECG	Sinus	Lesley "My pain is a bit better, 5/10." "It's still a bit hard to breathe." "It hurts when I cough." "I'm knackered." Nurse "I'm a bit concerned about this patient. I looked after them on the late shift yesterday and they seem a bit worse today."	Secondary survey results Moist sounding cough. ICC site visible, dressing and connections intact. Left calf examination NAD. Pulses intact. Right calf immobilized in boot or backslab, but neurovascularly intact. Results CXR, blood and sputum results – pending.	Secondary survey <input type="checkbox"/> Assess other injuries, order investigations. Investigations <input type="checkbox"/> Septic screen – FBC, sputum m/c/s, CXR. Management <input type="checkbox"/> Reposition high sitting in bed. <input type="checkbox"/> Hourly deep breathing exercises +/- incentive spirometry. <input type="checkbox"/> Commenced on high flow nasal oxygen therapy (e.g. flow rate 40L/min, FiO2 0.32 or similar). <input type="checkbox"/> Acute Pain Management Service review – consideration for regional block. <input type="checkbox"/> Medical/ICU review.
HR	92			
SpO ₂	94% on 4LO ₂ nasal prongs			
BP/ART	144/81			
RR	22			
Temp	37.8			
GCS	15			

STATE 3: REASSESSMENT				
Vital signs		Script	Details	Expected actions
ECG	Sinus	<p>Person</p> <p>“That’s a bit better (breathing).”</p> <p>Nurse</p> <p>These are the CXR results (hand hard copies of Day 1 and Day 2 CXRs to participants to review)</p>	<p>Assessment results</p> <p>Reported pain levels improved to 2/10 rest, 4/10 with movement.</p> <p>Coughing more effectively.</p> <p>Incentive spirometry performance improved.</p> <p>WCC 15.1.</p> <p>CXR – as per image.</p>	<p>Assessment</p> <p><input type="checkbox"/> Pain, inspiratory capacity and cough.</p> <p>Investigations</p> <p><input type="checkbox"/> Review CXR.</p> <p>Management</p> <p><input type="checkbox"/> Continue regular analgesia and deep breathing exercises.</p>
HR	88			
SpO ₂	96% on HFNP FiO ₂ 0.32			
BP/ART	134/79			
RR	20			
Temp	37.5			
GCS	15			

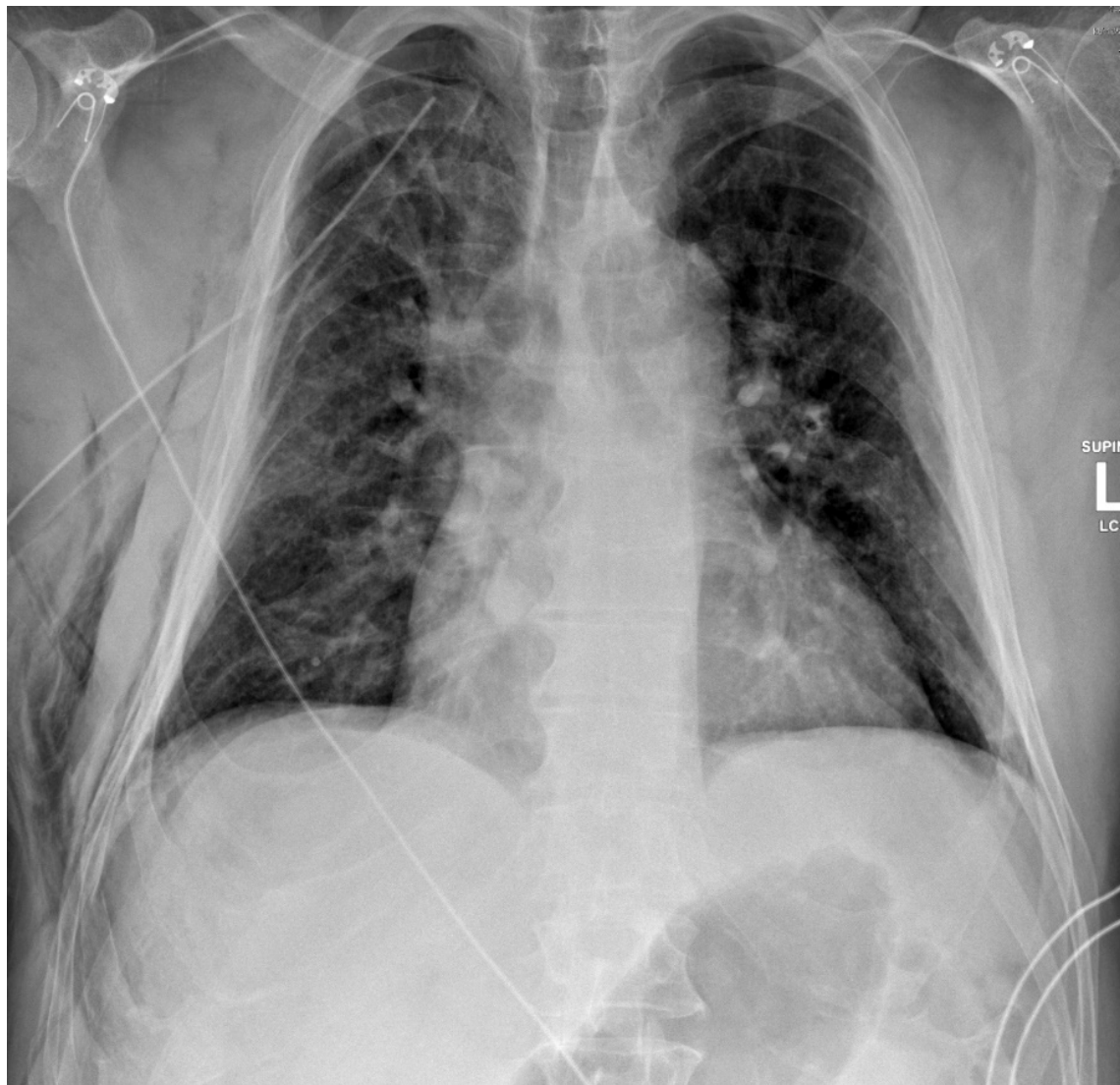
Supporting documents

The following supporting documents are provided for this immersive scenario:

1. CXR1: Day 1
2. CXR2: Day 2
3. Flowchart: Blunt Chest Trauma
Source: Queensland Health, Clinical Excellence Queensland https://qheps.health.qld.gov.au/_data/assets/pdf_file/0024/2629401/guideline-blunt-chest-trauma.pdf
4. PIC Score

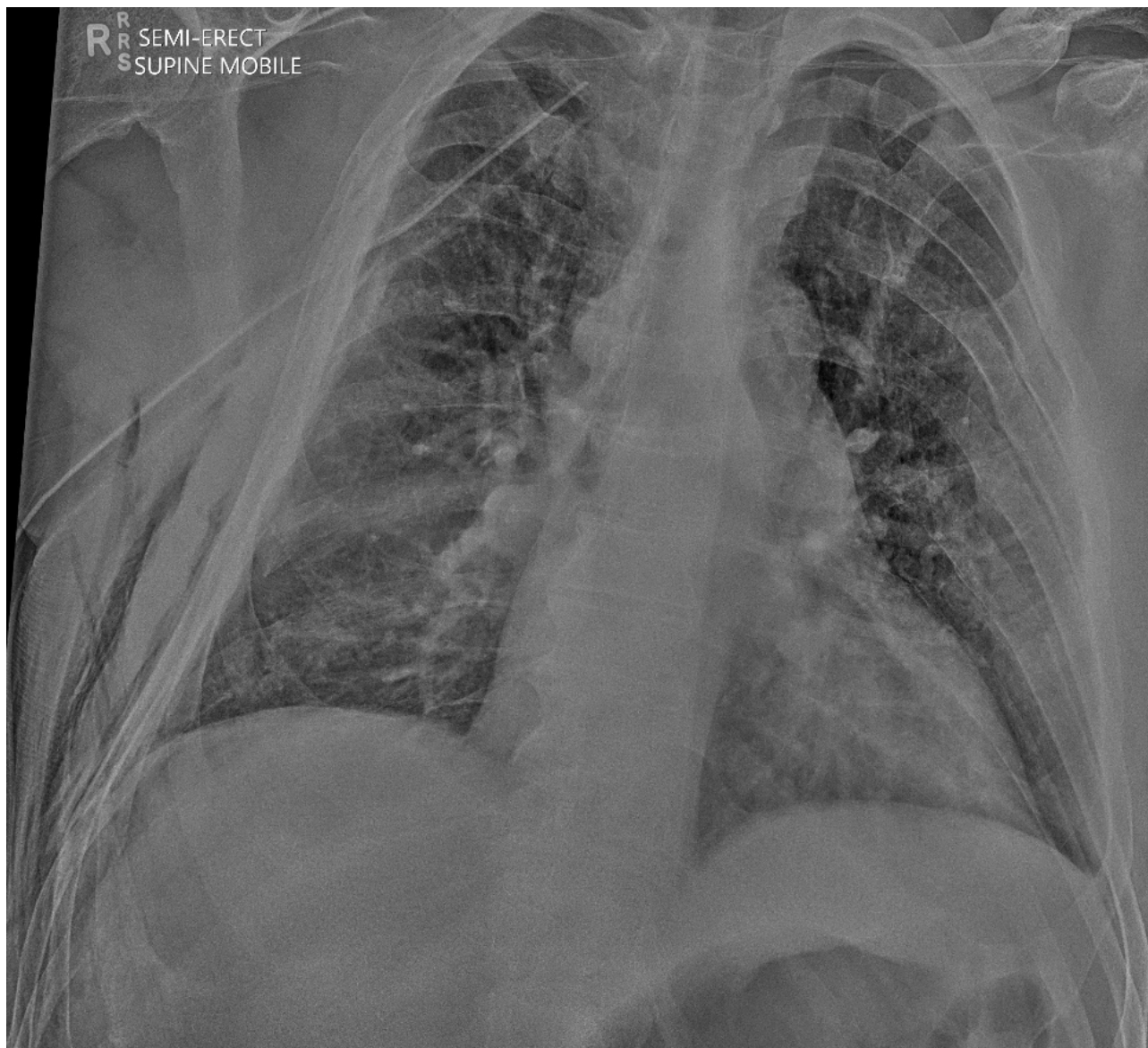
CXR1

Day 1

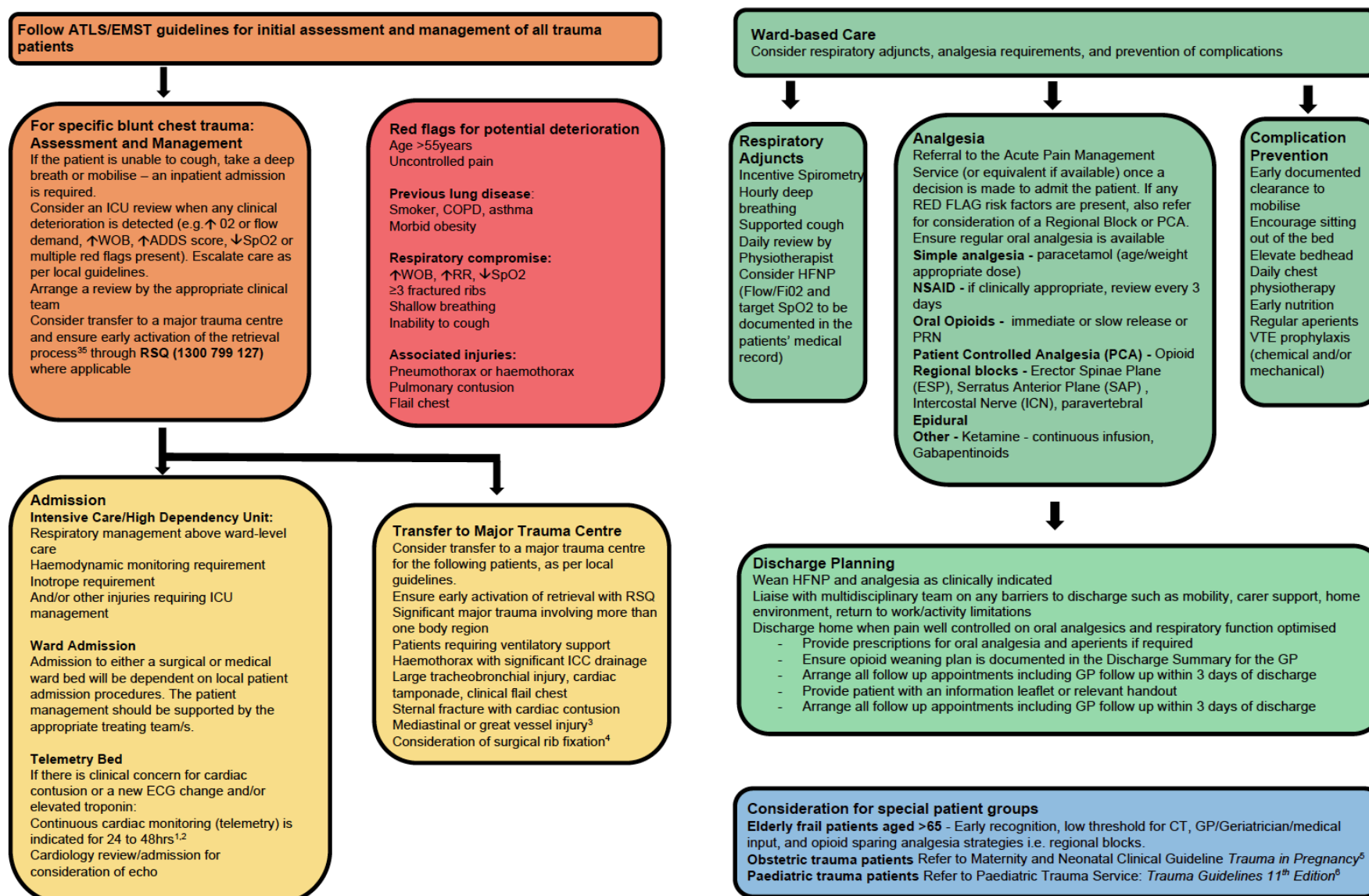


CXR2

Day 2



Clinical Practice Guideline: Blunt chest trauma (Queensland Health)



PIC Score

1 2 3 4 5 6 7 8 9 10

Pain

Patient-reported, 0-10 scale

Inspiration

Inspiratory spirometer; goal and alert levels set by respiratory therapist

Cough

Assessed by bedside nurse

3 - Controlled (Pain intensity scale 0-4)	4 - Above goal volume	3 - Strong
2 - Moderate (Pain intensity scale 5-7)	3 - Goal to alert volume	2 - Weak
1 - Severe (Pain intensity scale 8-10)	2 - Below alert volume	1 - Absent
	1 - Unable to perform incentive spirometry	

Patient name:

Date:

IS Goal:

Debriefing guide

Scenario objectives

- Identify factors that place a patient at greater risk of delayed respiratory complications post chest trauma.
- Demonstrate the bedside assessment of a patient with chest trauma, including estimation of pain, inspiratory capacity and cough effectiveness.
- Identify and act on signs of respiratory deterioration.
- Demonstrate the skill of teaching a patient the correct incentive spirometry technique (optional).

Example questions

Exploring diagnosis

- What chest trauma “red flags” for respiratory deterioration, if any, were present in this case scenario? *Refer to flowcharts from Clinical Practice Guideline: Blunt chest trauma (supporting documents).*
- What could be some of the pathologies responsible for Lesley’s deterioration on day 2?
- What abnormalities did you see on the CXR?

Discussing management and teamwork

- What members of the multidisciplinary team are involved in the detection and management of respiratory deterioration?
- Why was an ICU review recommended for Lesley?
- What are some other possible options (other than a PCA) for improved pain management for Lesley?
- How might Lesley’s other injuries have affected her presentation and management? (possible head injury - although serious pathology excluded on CT, the timing of her ORIF under general anaesthetic yesterday for her leg fractures).

Key moments

- Recognising the “red flags” for potential deterioration in Lesley’s history and presentation.
- Alerting team leader/ medical team / requesting Acute Pain Management Service review.
- Implementing steps to improve Lesley’s pain control and inspiratory capacity.

Acronyms and abbreviations

Term	Definition
CXR	chest x-ray
GCS	Glasgow coma scale
HFNP	High flow nasal prongs
ICC	Intercoastal catheter
ORIF	Open reduction and internal fixation
QAS	Queensland Ambulance Service
CT	computed tomography

References

1. Battle, C.E., Hutchings, H., James, K., Evans, P.A. The risk factors for the development of complications during the recovery phase following blunt chest wall trauma: a retrospective study. *Injury*, 44(9), 1171-6. <https://doi.org/10.1016/j.injury.2012.05.019>
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