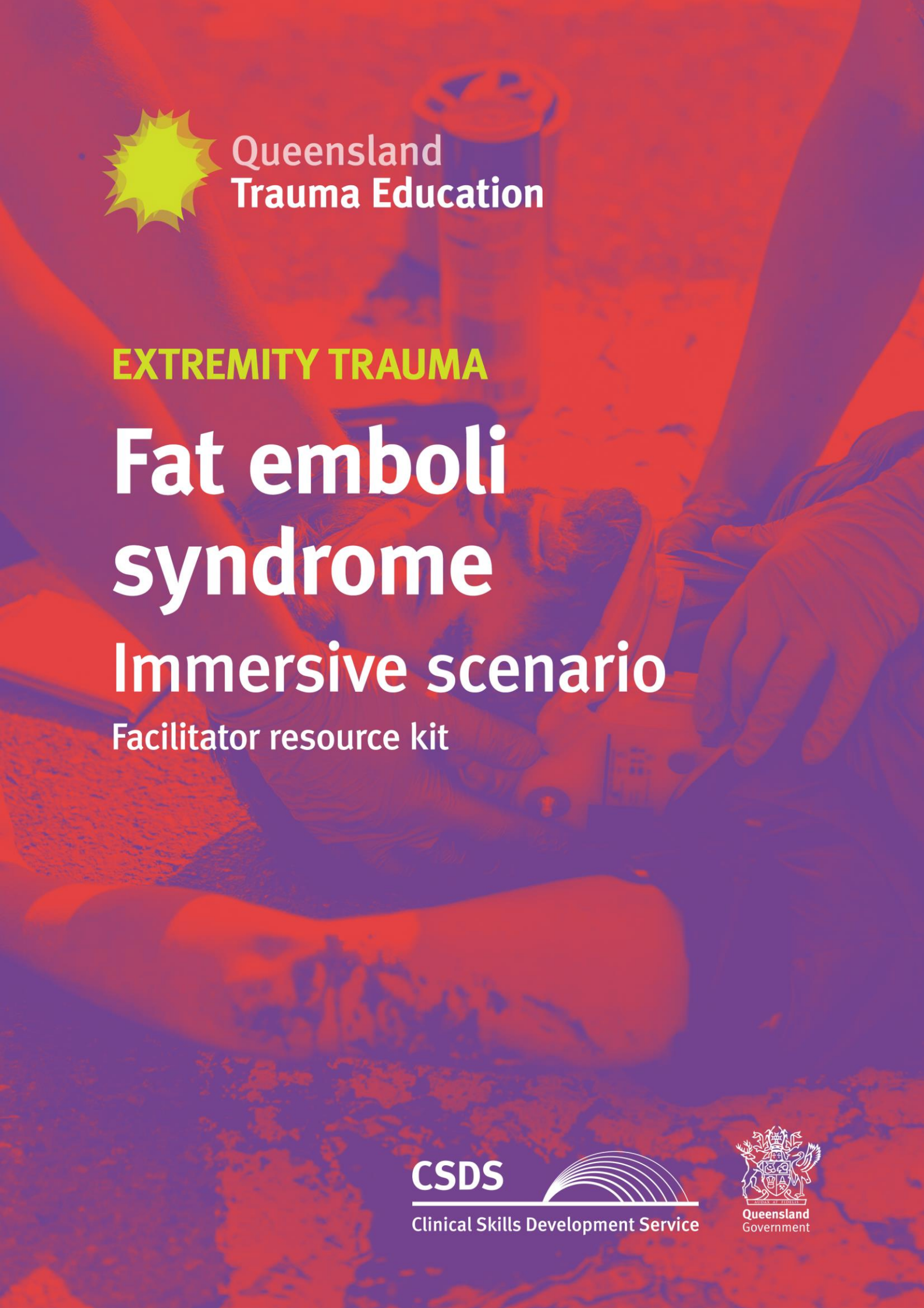

Queensland
Trauma Education

EXTREMITY TRAUMA

Fat emboli syndrome

Immersive scenario

Facilitator resource kit

CSDS
Clinical Skills Development Service

Queensland
Government

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
Extremity Trauma – Fat emboli syndrome: Immersive scenario – Facilitator resource kit
Version 2.0

Published by the State of Queensland (Clinical Skills Development Service), 2024

An electronic version of this document is available via csds.qld.edu.au/qte

About this training resource kit

This resource kit provides healthcare clinicians with the skills to assess and manage a patient with fat emboli following orthopaedic limb trauma.

National Safety and Quality Health Service (NSQHS) Standards

Target audience

Emergency department medical and nursing clinicians

Duration

45-60 minutes (set up, scenario and debrief)

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 the potential causes for the deteriorating patient following limb trauma
- Perform an assessment of the patient with an altered conscious state following trauma
- Describe the management of fat emboli syndrome

Facilitation guide

1. Facilitator to discuss the pre-simulation briefing and deliver the immersive scenario on fat emboli syndrome.
2. Utilise the supporting documents to maximise the learning throughout immersive scenario.
3. Utilise the debriefing guide to evaluate participant performance and provide feedback.

Supporting documents (in Printable resources)

The following supporting documents are provided for this immersive scenario:

1. Fat emboli syndrome criteria
2. Specific management of Fat Emboli Syndrome

3. Pre-simulation briefing poster
4. Group and hold
5. Coagulation
6. Chem20
7. FBE
8. Arterial blood gas
9. CXR
10. Pelvic Xray
11. R femur Xray
12. CT Chest: Findings - diffuse centrilobular air space consolidation with surrounding ground-glass opacity and smooth interlobular septal thickening in the lungs.
13. CT Abdo/Pelvis: Findings - fat density filling defect in proximal right femoral vein upstream from femoral fracture.
14. CT Brain: Findings - subtle hypodensity in subcortical white matter

Simulation event

This section contains the following:

1. Immersive scenario
2. Resource requirements
3. Handover card
4. Scenario progression
    a. State 1
    b. State 2
    c. State 3
    d. State 4
5. Debriefing guide

Immersive scenario

Type	Immersive scenario
Target audience	Emergency Department medical and nursing clinicians
Overview	Fat emboli syndrome is a rare but significant complication following orthopaedic injury that should be considered in the patient with respiratory distress and cognitive decline following trauma. This scenario will explore a patient requiring transfer to a tertiary centre for definitive management and deteriorates en route requiring the prompt recognition and management of a patient suffering fat emboli syndrome following limb trauma.
Learning objectives	By the end of this session the participant will be able to: • Identify the potential causes for the deteriorating patient following limb trauma • Perform an assessment of the patient with an altered conscious state following trauma • Describe the management of fat emboli syndrome
Duration	45 minutes, including debrief

Resource requirements

Physical resources

Room setup	Resuscitation bay in ED
Simulator/s	ALS advanced, SimMan ALS, SimMan 3G
Simulator set up	Street clothes lying supine Moulage: normal patient, traction splint on R leg, Hudson Mask, attached to transport monitoring (if available)
Clinical equipment	Standard resus bay setup and equipment Intubation medications and equipment
Access	2 x PIVC setups. 1x 18G R ACF and 1x 'No IV' sticker attached
Other	ED chart and relevant paperwork Radiological and laboratory resources

Human resources

Faculty	2 facilitators (Dr/Nurse with debriefing experience) to take on roles of scenario commander and primary debrief
Simulation coordinators	Simco X 1 for manikin set up and control
Confederates	Retrieval Doctor/paramedic to perform handover (if available)
Other	Team composition as appropriate for local environment Available staff to call in

Handover card

Handover from flight doctor performing interhospital transfer

Carl is a 24-year-old man who was involved in a motor bike collision 48 hours ago. He was initially managed in a rural facility until the weather cleared and he could be retrieved. Injuries identified by the team who initially cared for him include R clavicle and R proximal femoral fractures. This has been managed with traction splinting and femoral nerve block. He has had a CXR which is normal. His vitals were within normal limits when we arrived at the rural hospital approx. 1 hr ago. But I'm worried as he's deteriorated since we retrieved him, his vitals are presently: BP 100/80, HR 120, SpO2 92% 6LHM, RR 26 and his GCS is 14 (E4V4M6).

In addition to the femoral nerve block, his pain has been managed with IV morphine (total 80mg in 48 hours) and IV ketamine (total 500mg in 48 hours). With us he has been managed with IV ketamine during the flight (included in the above total).

He is previously well, with no medical history, is on no regular medications and has no allergies.

His parents are on the way to the hospital via road.

Scenario progression

STATE 1: INITIAL ASSESSMENT				
Vital signs		**Script**	**Details**	**Expected actions**
ECG	ST	**Carl:** Moaning: 'Oh my leg hurts' 'I can't breathe' *mild agitation*	**Primary survey results** A: Intact B: Crepitus bilaterally, L > R, no chest wall tenderness or bruising C: Well perfused, HS dual, tachycardic D: Confused to place, unable to move R leg due to pain E: Afebrile	**Commence Primary Survey** ❑ Identify respiratory distress ❑ Optimise oxygenation, increase oxygen flow ❑ Call for help, escalate concerns
HR	120			
SpO_2	90% RA			
BP/ART	100/80			
RR	28			
Temp	37.9			
BGL	6.0			
GCS	14 (E4V4M6)			

<table>
<tr><th colspan="4">STATE 2: ONGOING MANAGEMENT / SECONDARY ASSESSMENT</th></tr>
<tr><th colspan="2">Vital signs</th><th>Script</th><th>Details</th><th>Expected actions</th></tr>
<tr><td>ECG</td><td>ST</td><td rowspan="8">Carl “Ahhhh, I’m…ahhhhh’
Less responsive, mumbling words only, localizing to pain

Confederate (prompt participants if required) “Carl’s breathing seems to be getting worse…”</td><td rowspan="8">Secondary survey results
No external evidence of facial or head injury
Fine petechial rash to face and torso
Abdo soft, non-tender
Pelvis aligned, no tenderness
R femur deformity, no wounds, neurovasc intact distally, femoral splint in position
Results
CXR: diffuse bilateral opacification

Pelvic XRay: ring intact, binder well placed

R femoral XRay: midshaft femoral facture- traction splint in-situ, fracture displaced</td><td rowspan="8">Secondary survey
❑ Head to toe assessment

Investigations
❑ Bloods- trauma panel, XMatch
❑ CXR, Pelvic XRay and R femoral XRay

Management
❑ Ensure fracture immobilised
❑ Neurovascular assessment R leg
❑ Recognise and communicate ongoing respiratory and CNS deterioration with team</td></tr>
<tr><td>HR</td><td>120</td></tr>
<tr><td>SpO₂</td><td>92% NRB 15L/min</td></tr>
<tr><td>BP/ART</td><td>100/80</td></tr>
<tr><td>RR</td><td>28</td></tr>
<tr><td>Temp</td><td>37.9</td></tr>
<tr><td>BGL</td><td>6.2</td></tr>
<tr><td>GCS</td><td>11 (E3V3M5)</td></tr>
<tr><td></td><td></td></tr>
</table>

<table>
<tr><th colspan="4">STATE 3: AIRWAY MANGEMENT</th></tr>
<tr><th colspan="2">Vital signs</th><th>Script</th><th>Details</th><th>Expected actions</th></tr>
<tr><td>ECG</td><td>ST</td><td rowspan="9">Confederate
Prompt team if required
“He really seems to be struggling to breathe… and is he responding?’</td><td rowspan="9">Further deterioration of conscious state and respiratory status

Continue to reduce SpO2 and BP if team fails to recognise deterioration</td><td rowspan="9">Assessment
❑ Identification of escalating respiratory support required in the setting of CNS dysfunction

Management
❑ Intubation for oxygenation/ventilation- protective lung strategy
• Could use NIV as bridge to RSI
• Avoid hypovolaemia
• DVT/PPI

Arrange advanced imaging
❑ Discuss options with team and consultant
❑ CTB: to exclude mass lesion (SDH/EDH), confirm DAI pattern with FES
❑ CT Chest: identify pulmonary infiltrates, exclude chest trauma, exclude PE
❑ CT Abdo/pelvis: exclude trauma injury</td></tr>
<tr><td>HR</td><td>120</td></tr>
<tr><td>SpO₂</td><td>89% NRB 15L/min</td></tr>
<tr><td>BP/ART</td><td>100/80</td></tr>
<tr><td>RR</td><td>35</td></tr>
<tr><td>Temp</td><td>37.9</td></tr>
<tr><td>BGL</td><td>6.5</td></tr>
<tr><td>GCS</td><td>11 (E3V3M5)</td></tr>
<tr><td></td><td></td></tr>
</table>

<table>
<tr><th colspan="4">STATE 4: POST ADVANCED IMAGING/SENIOR PARTICIPANTS</th></tr>
<tr><th colspan="2">Vital signs</th><th>Script</th><th>Details</th><th>Expected actions</th></tr>
<tr><td>ECG</td><td>ST</td><td rowspan="9"></td><td rowspan="9">For Senior Participants scenario can be paused and restarted as patient returns from CT

Patient intubated and ventilated

Patient has returned following CT imaging:

Provide participants with CT slice of CTChest, CTBrain and CTAbdo/Pelvis</td><td rowspan="9">❑ Senior participants discuss findings of CT images with team
❑ Discuss immediate/ongoing patient management strategies
• protective lung strategy – mechanical ventilation ARDS
• inotropic support for RV failure
• management of cerebral oedema
❑ Discuss ongoing options patient disposition
❑ Consult with specialist surgical/Ortho/neuro and intensive care teams</td></tr>
<tr><td>HR</td><td>105</td></tr>
<tr><td>SpO₂</td><td>93% FiO2 1.0</td></tr>
<tr><td>BP/ART</td><td>105/75</td></tr>
<tr><td>RR</td><td>16</td></tr>
<tr><td>Temp</td><td>37.1</td></tr>
<tr><td>BGL</td><td>7</td></tr>
<tr><td>GCS</td><td>3 (E1VTM1)</td></tr>
<tr><td>ETCO2</td><td>55 (reduce to 38 if hyperventilate)</td></tr>
</table>

Debriefing guide

Scenario objectives

1. Identification of the deteriorating patient
2. Assessment of the patient with altered conscious state
3. Management of fat emboli syndrome

Example questions

Exploring diagnosis

- Describe the assessment of this patient, who was a delayed trauma assessment?
- How does this differ in injury risk from early presentations?
- What is the significance of the skin rash and respiratory distress?
- What are the criteria for diagnosis of fat emboli syndrome? When does it occur? Can it be prevented?

Discussing management

- Should the femoral traction splint be adjusted in this scenario?
- In suspected fat emboli syndrome is there a preference for fluid choice in resuscitation? (Albumin preferred as will bind free fatty acids)
- What strategy was used to manage the patient's respiratory distress?
- What are the pros and cons for NIV vs Intubation in this patient?

Discussing teamwork/crisis resource management

- How do you prioritise your team in clinical assessment of the trauma patient?
- What roles are allocated?
- What strategies do you utilise to encourage all team members to voice their concerns/recognition of the deteriorating patient?

Key moments

- Decision process for respiratory support- NIV vs intubation
- Identification of fat emboli syndrome
- Management of multiple orthopaedic splint/binders

Acronyms and abbreviations

Term	Definition
FES	Fat emboli syndrome
NIV	Non-invasive ventilation
ARDS	Acute respiratory distress syndrome
RV	Right ventricular
CNS	Central nervous system
RSI	Rapid sequence induction
DVT	Deep vein thrombosis
PPI	Proton pump inhibitor
CTB	Computed tomography brain
SDH	Subdural haematoma
EDH	Extradural haematoma
DAI	Diffuse axonal injury
PE	Pulmonary embolus
FBE	Full blood examination

References

1. Kwiatt, M. E., & Seamon, M. J. (2013). Fat embolism syndrome. *International journal of critical illness and injury science*, *3*(1), 64–68. https://doi.org/10.4103/2229-5151.109426
2. Johnson, K. D., Cadambi, A., & Seibert, G. B. (1985). Incidence of adult respiratory distress syndrome in patients with multiple musculoskeletal injuries: effect of early operative stabilization of fractures. *The Journal of trauma*, *25*(5), 375–384. https://doi.org/10.1097/00005373-198505000-00001
3. Gurd A. R. (1970). Fat embolism: an aid to diagnosis. *The Journal of bone and joint surgery. British volume*, *52*(4), 732–737.

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