

Queensland
Trauma Education

TRAUMATIC BRAIN INJURY

Closed head injury

Immersive scenario

Facilitator resource kit



Developed by

Dr Frances Williamson
Emergency Staff Specialist - Metro North Hospital and Health Service

Tracey McLean
Simulation Educator - Clinical Skills Development Service

Reviewed by

Kimberly Ballinger
Simulation Educator - Clinical Skills Development Service

Education Working Group, Statewide Trauma Clinical Network - Clinical Excellence Queensland

Designed by

Rebecca Launder
Product Designer - Clinical Skills Development Service

Queensland Trauma Education**Traumatic brain injury - Closed head injury: Immersive scenario - Facilitator resource kit
Version 1.0**

Published by the Clinical Skills Development Service
Herston, Queensland, Australia
csds.qld.edu.au/qte
Phone +61 7 3646 6500
Email CSDS-Courses@health.qld.gov.au

© Metro North Hospital and Health Service through the Clinical Skills Development Service (CSDS) 2003 - 2021.
All rights reserved.

Disclaimer: The content presented in this publication is distributed by the Queensland Government as an information source only. The State of Queensland makes no statements, representations or warranties about the accuracy, completeness or reliability of any information contained in this publication. The State of Queensland disclaims all responsibility and all liability (including without limitation for liability in negligence) for all expenses, losses, damages and costs you might incur as a result of the information being inaccurate or incomplete in any way, and for any reason reliance was placed on such information.

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.

National Safety and Quality Health Service (NSQHS) Standards



About this training resource kit

This resource kit provides healthcare workers with the knowledge and skills on how to assess and manage a closed head injury following traumatic incident.

Target audience

Emergency department medical and nursing clinicians.

Duration

45-60 minutes (setup, 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:

- Perform the assessment of a trauma patient with a closed head injury.
- Identify the need for neuroprotective measures in traumatic brain injury.
- Perform required neuroprotective treatment.
- Demonstrate early definitive management.

Facilitator guide

1. Facilitator to provide participant resource kit to the learner.
2. Facilitator to discuss the pre-simulation briefing and deliver the immersive scenario.
3. Utilise the supporting documents to maximise the learning throughout immersive scenario.
4. Utilise the debriefing guide to evaluate participant performance and provide feedback.

Participant resource kit

- Learning objectives.
- Overview of traumatic brain injury.
- Further reading.
- Supporting resources:
 - Clinical and radiological features of closed head injury - infographic poster.

Supporting resources

- Clinical and radiological features of closed head injury - infographic poster.

Overview of traumatic brain injury

Traumatic brain injury (TBI) is responsible for 50% of trauma deaths and 70% of all road crash deaths.¹

Further reading

Current assessment and management guidelines:

Clinical Pathway - Closed Head Injury (Adult)

<https://qheps.health.qld.gov.au/caru/clinical-pathways/head-injury>

Neurosurgical Society of Australasia - The Management of Acute Neurotrauma in Rural and Remote Locations - A set of guidelines for the care of head and spinal injuries (page 7 - 13)

<https://pubmed.ncbi.nlm.nih.gov/10833574/>

Primary Clinical Care Manual - 10th Edition (page 175 - 180)

<https://www.publications.qld.gov.au/dataset/primary-clinical-care-manual-10th-edition/resource/9ee849ab-ba4a-49d8-a582-dfa30f1d8a96>

Criteria for early notification of trauma for interfacility transfer

<https://www.publications.qld.gov.au/dataset/f26b0c15-8dbb-40f6-9513-dc79207ed9de/resource/5f15fdf6-d2ce-439d-abaa-aff3cdfa8c5a/download/pccm-10th-edition-criteria-early-notification-trauma.pdf>

Adult Trauma Clinical Practice Guidelines: Initial Management of Closed Head Injury in Adults

- 2nd Edition https://www.aci.health.nsw.gov.au/_data/assets/pdf_file/0003/195150/Closed_Head_Injury_CPG_2nd_Ed_Full_document.pdf

Mannitol or hypertonic saline in the setting of traumatic brain injury: What have we learned?

Myles Dustin Boone, Achikam Oren-Grinberg, Timothy Matthew Robinson, Clark C. Chen, Ekkehard M.

Kasper (2015) *Surgical Neurology International* <https://www.nejm.org/doi/pdf/10.1056/NEJMra1208708>

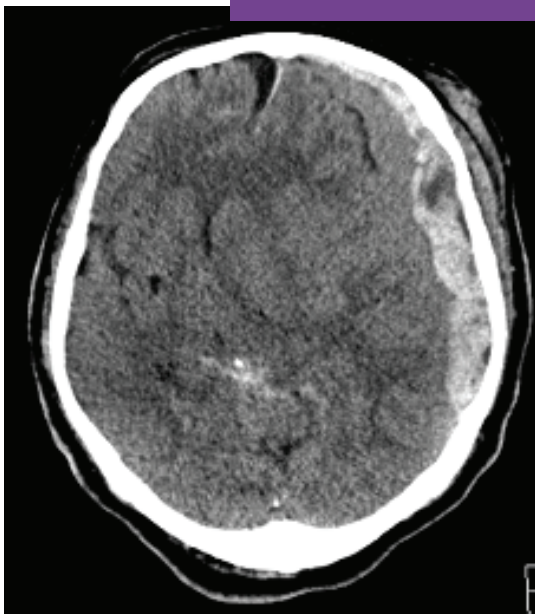
Traumatic Intracranial Hypertension. Nino Stocchetti, M.D., and Andrew I.R. Maas, M.D., Ph.D (2014) *The*

New England Journal of Medicine <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4665128/pdf/SNI-6-177.pdf>

TRAUMATIC BRAIN INJURY

Clinical and radiological features of closed head injury

Subdural haemorrhage



Clinical features

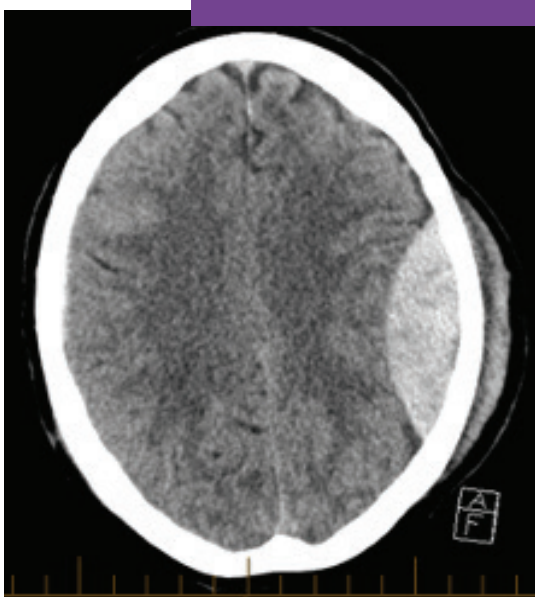
- Associated with trauma - younger patients high velocity, older patients low velocity.
- Confusion/vague neurological symptoms.
- Slower development of symptoms.
- History of anticoagulation use.

Radiological features

- Crescent shaped peripheral collection.
- Not limited by sutures.
- Fills dural reflections (falx cerebri/tentorium).
- Density can be varied (anticoagulants, acute bleed, mixed with CSF).

<https://radiopaedia.org/articles/subdural-haemorrhage-summary>

Extradural haemorrhage



Clinical features

- Associated with high energy trauma - younger patients.
- Arterial bleed - middle meningeal artery.
- Headache.
- Localising signs.
- Rapid loss of consciousness.

Radiological features

- Associated skull fracture.
- Hyperdense biconvex extra-axial collection.
- Lens (lentiform) or egg-shaped collection.
- Clearly demarcated area between brain and skull.

<https://radiopaedia.org/articles/extradural-haemorrhage-summary>

Simulation event

This section contains the following:

1. Pre-simulation briefing poster.
2. Immersive scenario.
3. Resource requirements.
4. Handover card.
5. Scenario progression.
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.

Adapted from Rudolph, J., Raemer, D. and Simon, R. (2014). Establishing a Safe Container for Learning in Simulation. *Simulation in Healthcare: Journal of the Society for Simulation in Healthcare*, 9(6), pp.339-349.



Immersive scenario

| | |
|----------------------------|---|
| Type | Immersive scenario |
| Target audience | Emergency department medical and nursing clinicians. |
| Overview | <p>58yr old male patient. Allegedly assaulted 1 hour ago. He has sustained a closed head injury and is confused with the ambulance.</p> <p>The patient is brought to the emergency department by ambulance confused and agitated. His vital signs with the ambulance are HR 100 BP 150/80 sats 98% RA and RR 20. He has a large bruise over his left parietal region.</p> <p>He is agitated, moving his limbs to painful stimuli but not obeying commands despite 10mg IV morphine prehospital.</p> |
| Learning objectives | <ul style="list-style-type: none"> • Perform the assessment of a trauma patient with a closed head injury. • Identify the need for neuroprotective measures in traumatic brain injury. • Perform required neuroprotective treatment. • Demonstrate early definitive management (may include retrieval services). |
| Duration | 45 minutes including debrief. |

Resource requirements

Physical resources

| | |
|---------------------------|---|
| Room setup | Resus bay in emergency. |
| Simulator/s | 1 manikin – SimMan3G / ALS Simulator |
| Simulator/s set up | <ul style="list-style-type: none"> • Street clothes, lying supine. • Haematoma to left parietal region. |
| Clinical equipment | <p>Standard resuscitation equipment for emergency department.</p> <p>Medications:</p> <ul style="list-style-type: none"> • intravenous analgesia, sedation and muscle relaxants. • intravenous fluids + osmotic agents. |
| Access | 2 IVC setups, with no IV stickers attached. |
| Other | <p>Clinical Pathway - Closed Head Injury (Adult).</p> <p>https://qheps.health.qld.gov.au/car/clinical-pathways/head-injury</p> |

Human resources

| | |
|--------------------------------|--|
| Faculty | 2 facilitators (Dr/Nurse with debriefing experience) to take on roles of scenario commander and primary debrief. |
| Simulation coordinators | 1 for set up and to control of manikin. |
| Confederates | QAS officer. |
| Other | <p>All participants in room to receive handover from QAS.</p> <p>Initially, 1 nurse and 1 doctor in room. The other nurses and doctors outside to be called when needed.</p> |

Handover card

Handover from QAS officer

This is John. He is a normally well 58-year-old man who was involved in an altercation with another person one hour ago. He has been allegedly assaulted with multiple blows to his head. He was initially alert and GCS 15 on scene but has become more confused during our transport to ED.

His vital signs currently are GCS 14 (E4, V4, M6), HR 90, BP 120/80, sats 99% RA and respiratory rate 20. He has a large haematoma to his left parietal region.

He has had 10mg IV morphine with minimal relief.

Thanks for looking after him.

Scenario progression

| STATE 1: INITIAL ASSESSMENT | | | |
|-----------------------------|---|--|---|
| Vital signs | Script | Details | Expected actions |
| ECG: SR | John I've got a terrible headache. | <p>Primary survey results</p> <p>A Maintaining own, anterior neck normal, no wounds/lacerations.</p> <p>B Nil chest wall tenderness, nil crepitus, nil subcutaneous emphysema, equal BS bilaterally.</p> <p>C Nil obvious bleeding; well perfused peripherally, warm peripherally.</p> <p>D GCS 14, confused to place and time, eyes open to voice, obeying commands. Pupils small and reactive, moving all limbs.</p> <p>E Nil abnormality.</p> | <p>Commence primary survey</p> <p><input type="checkbox"/> Assess airway.</p> <p><input type="checkbox"/> Assess breathing.</p> <p><input type="checkbox"/> Assess circulation.</p> <p><input type="checkbox"/> Assess disability.</p> <ul style="list-style-type: none"> • GCS. • Focal neurological deficits. • Pupils. <p><input type="checkbox"/> Expose patient.</p> |
| HR: 90 | | | |
| SpO2: 99% | | | |
| BP/ART: 120/80 | | | |
| RR: 20 | | | |
| Temp: 36.7°C | | | |
| BGL: 5.0mmol | | | |
| GCS: 14 (E4, V4, M6) | | | |
| Pupils: 3mm bilaterally | | | |

| STATE 2: DETERIORATION IN CONSCIOUS STATE | | | |
|--|--|--|--|
| Vital signs | Script | Details | Expected actions |
| <p>ECG: SR</p> <p>HR: 80</p> <p>SpO2: 95%</p> <p>BP/ART: 160/90</p> <p>RR: 12</p> <p>Temp: 36.7°C</p> <p>BGL: 5.0mmol</p> <p>GCS: 9 (E2, V2, M5)</p> <p>Pupils: L - 4mm R - 1mm</p> | <p>John Moaning, groaning. Incomprehensible sounds.</p> <p>Confederate To examine head and mention that patient has a large haematoma to L) parietal region.</p> | <p>Secondary survey Head – large bruise to L parietal region. Abdomen – soft, no other wounds. Pelvis – aligned, non-tender to palpation. Long bones and limbs – nil injury. Log roll – NAD.</p> <p>Results - see supporting documents ABG – normal. CXR – normal. Pelvic Xray – normal.</p> | <p>Secondary survey</p> <ul style="list-style-type: none"> <input type="checkbox"/> Perform head to toe assessment. <input type="checkbox"/> Arrange further analgesia. <input type="checkbox"/> Ensure oxygenation adequate. <input type="checkbox"/> Consider cx spine injury and discuss cx spine collar role. <p>Investigations</p> <ul style="list-style-type: none"> <input type="checkbox"/> Bloods – trauma panel- FBE, chem 20, Group and hold, lipase, coags. <input type="checkbox"/> CXR / Pelvic Xray. <input type="checkbox"/> VBG - normal. <p>Management</p> <ul style="list-style-type: none"> <input type="checkbox"/> Recognition of progressive and deteriorating traumatic brain injury. <input type="checkbox"/> Consider possibility of cervical spine injury. <input type="checkbox"/> Recognise need for intervention for neuroprotective measures. <input type="checkbox"/> Call for help early (communication and liaison with neurosurgical services/RSQ as applicable). |

| STATE 3: PATIENT BECOMES MORE OBTUNDED, BRADYCARDIC AND HYPERTENSIVE | | | |
|--|--|---|--|
| Vital signs | Script | Details | Expected actions |
| ECG: SB | <p>John Unresponsive.</p> <p>Confederate</p> <p>To check pupils and verbalise that pupils are now unequal and that John is not responding.</p> | <p>Reduced GCS and pupillary dilatation.</p> <p>Assessment results</p> <p>A Patent.</p> <p>B Equal breath sounds.</p> <p>C Warm peripherally, slow pulse.</p> <p>D GCS 3.</p> <p>Scenario progression</p> <p>If failing to recognise reduced GCS, prompt participants with a further drop of SpO2 to 85% to guide towards intubation.</p> | <p>Assessment</p> <p><input type="checkbox"/> Repeat primary survey.</p> <p><input type="checkbox"/> Recognition of need to instigate neuroprotection.</p> <p>Management</p> <p><input type="checkbox"/> Prepare for intubation.</p> <ul style="list-style-type: none"> • Equipment. • Sedation plan. • Team roles. • Consideration of manual in-line stabilisation. • Pre-brief. |
| HR: 40 | | | |
| SpO2: 88% | | | |
| BP/ART: 190/100 | | | |
| RR: 8 | | | |
| Temp: 37.4°C | | | |
| BGL: 5.0mmol | | | |
| GCS: 3 (E1, V1, M1) | | | |
| Pupils: L - 6mm R - 2mm | | | |

STATE 4: INTUBATION

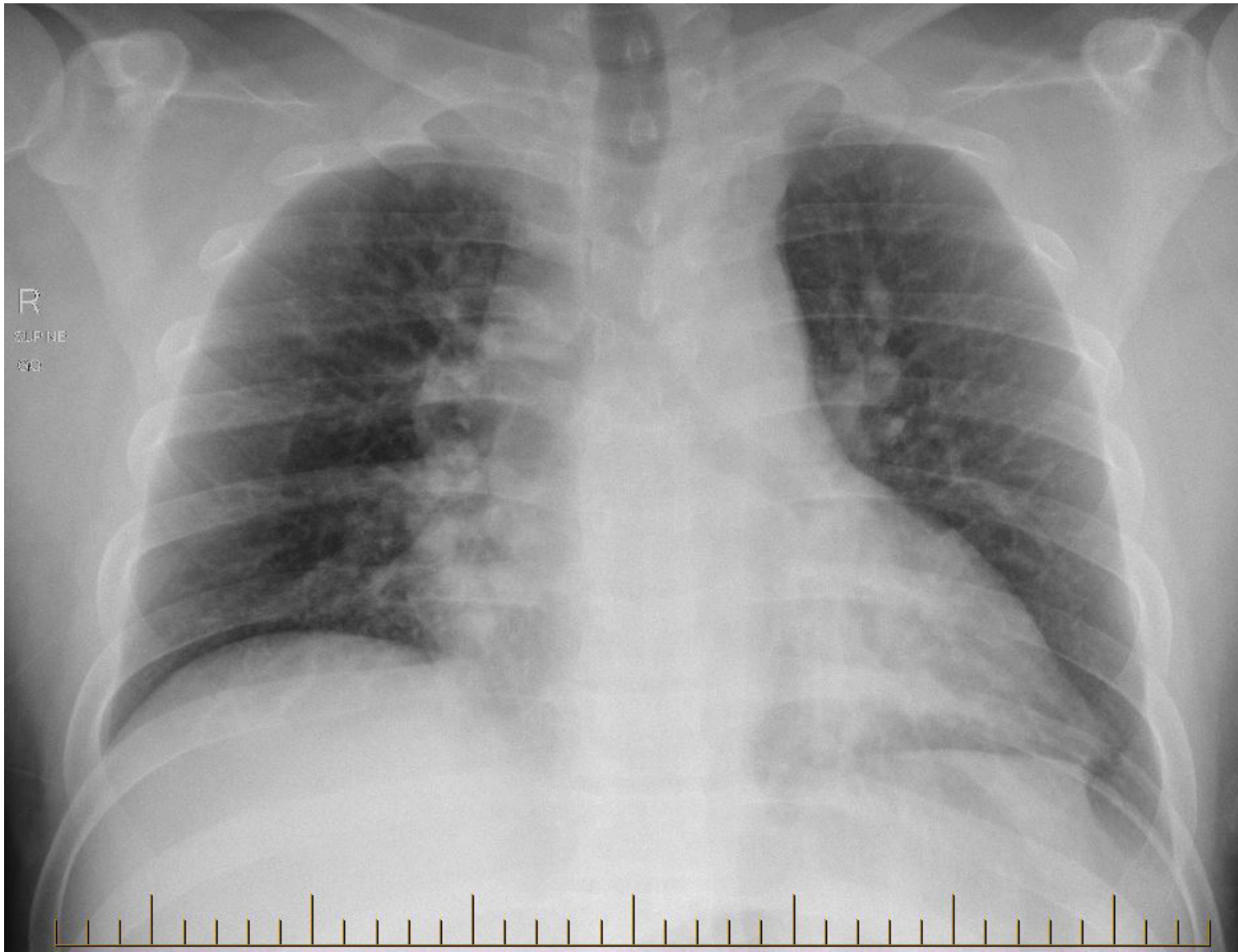
| Vital signs | Script | Details | Expected actions |
|-----------------------------------|--------|---|---|
| ECG: SB | | <p>Assessment results</p> <p>A Intubated.</p> <p>B Equal breath sounds. Post intubation: ETCO2 55 (reduce to 40 if adequate ventilations and RR), RR (as per ventilator settings), SpO2 - increase to 97% if FiO2 1.0.</p> <p>C Well perfused. HR increase to 65 and BP reduce to 150. 150/90 if effectively intubated and ventilated.</p> <p>D GCS 3.</p> | <p>Management</p> <p><input type="checkbox"/> Perform intubation.</p> <p><input type="checkbox"/> Neuroprotective management:</p> <ul style="list-style-type: none"> • Choice of sedation and paralytic medications. • Hypertonic saline/ mannitol. • CO2/O2 end points. • Supportive care - loose ties/head up/orogastric tube. <p><input type="checkbox"/> Definitive care:</p> <ul style="list-style-type: none"> • Communication/liaison with neurosurgical/RSQ as appropriate. • Demonstrate effective handover of patient. |
| HR: 40 | | | |
| SpO2: 88% | | | |
| BP/ART: 190/100 | | | |
| RR: 8 | | | |
| Temp: 37.4°C | | | |
| BGL: 5.0mmol | | | |
| GCS: 3 (E1, V1, M1) | | | |
| Pupils: L - 6mm R - 2mm | | | |

Supporting documents

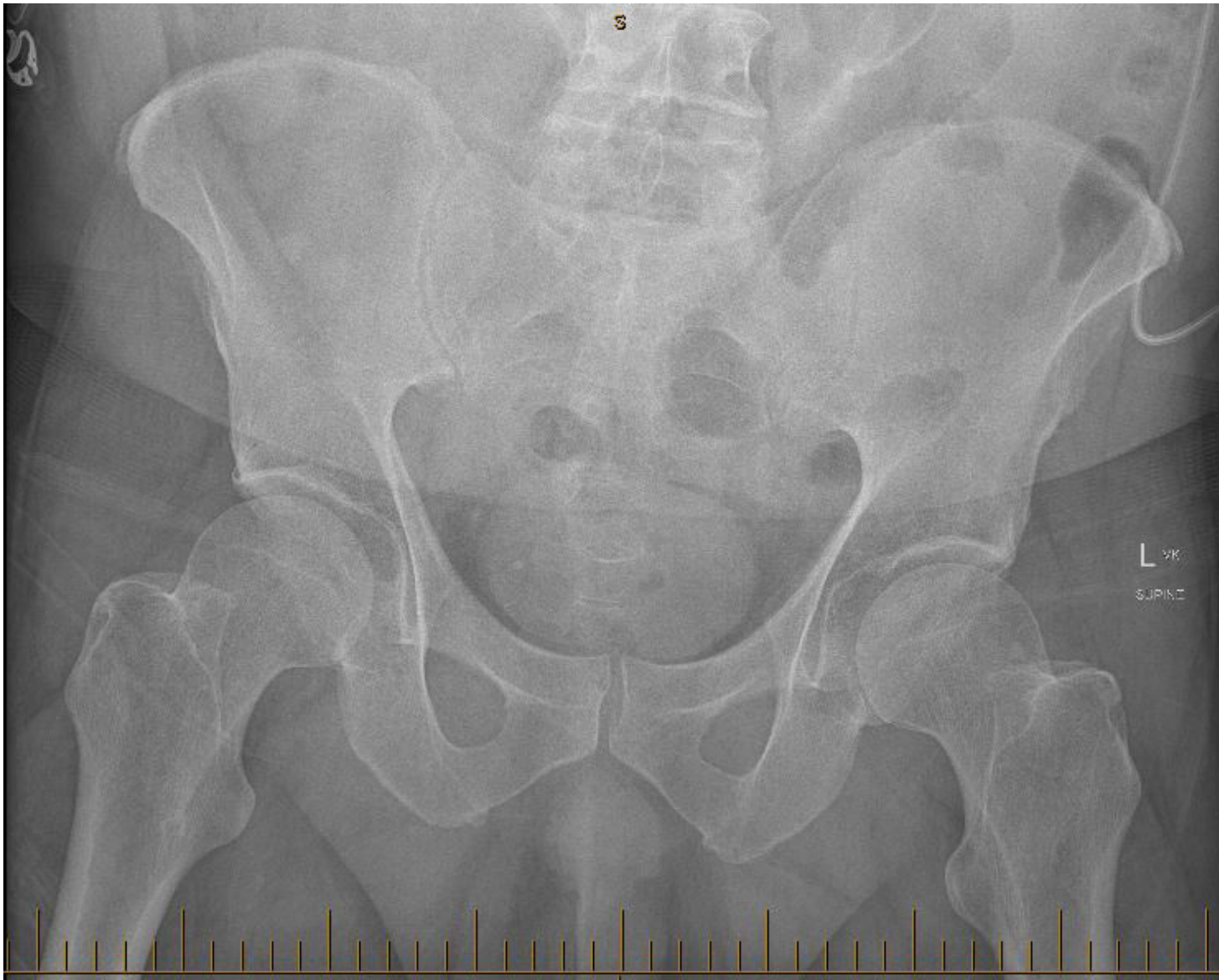
The following supporting documents are provided for this immersive scenario:

1. Radiology CXR 1: Pre-intubation.
2. Pelvic X-ray.
3. ABG/VBG template.

Radiology CXR 1: Pre-intubation



Pelvic X-ray



ABG/VBG template

| RADIOMETER ABL800 FLEX | | | |
|-------------------------------------|-------------------|----------|-------------------|
| ABL837 RH~RB PATIENT REPORT | Syringe – S 250uL | Sample # | 16538 |
| Identifications | | | |
| Patient ID | | | |
| Patient Last Name | | | |
| Patient First Name | | | |
| Sample type | | | |
| T | | | |
| FO2(l) | | | |
| Operator | | | |
| Blood Gas Values | | | |
| pH | | | [7.350 – 7.450] |
| pCO2 | | mmHg | [35.0 – 45.0] |
| pO2 | | mmHg | [75.0 – 100] |
| cHCO3~(P)c | | mmol/L | [21.0 – 27.0] |
| cBase(B)c | | mmol/L | [-3.0 – 3.0] |
| P50c | | mmHg | |
| Baro. | | mmHg | |
| Oximetry Values | | | |
| aO2 | | % | |
| ctHb | | g/L | [105 – 135] |
| Hct | | % | |
| FO2Hb | | % | [94.0 – 98.0] |
| FCOHb | | % | [0.0 – 1.5] |
| FMetHb | | % | |
| FHHb | | % | [-] |
| Electrolyte Values | | | |
| cNa+ | | mmol/L | [135 – 145] |
| cK+ | | mmol/L | [3.2 – 4.5] |
| cCl- | | mmol/L | [100 – 110] |
| cCa2+ | | mmol/L | [1.15 – 1.35] |
| AnionGap,K+c | | mmol/L | [-] |
| Metabolite Values | | | |
| cGlu | | µmol/L | [3.0 – 7.8] |
| cLac | | µmol/L | [0.7 – 2.5] |
| cCrea | | µmol/L | [36 – 62] |
| ctBll | | µmol/L | [-] |
| Temperature Corrected Values | | | |
| pH(T) | | | |
| pCO2(T) | | mmHg | |
| pO2(T) | | mmHg | |
| Notes | | | |

Debriefing guide

Scenario objectives

- Understand the clinical presentation in traumatic brain injury.
- Perform a primary and secondary survey assessment.
- Recognise clinical neurological deterioration and importance of localising signs in traumatic brain injury.
- Understand management principles of neuroprotection.

Example questions

Exploring diagnosis

- Explain your thought process in assessing a trauma patient for life threatening injuries.
- Do you have a system for rapid assessment following trauma?
- What clinical features suggest a raised intracranial pressure? What is Cushing's reflex?
- How do you classify mild/moderate/severe traumatic brain injury?

Discussing management

- What are your strategies to manage this patient's neurological deterioration?
- What are your options to manage his presumed raised intracranial pressure?
- What are the indications for intubation?
- What features on history would necessitate maintenance of spinal precautions during intubation in this patient?
- How do you decide on who needs osmolar therapy (mannitol/hypertonic saline)? Is there any evidence for agent used?
- What is the optimal timing for CT imaging (if available)?

Discussing teamwork / crisis resource management

- Calling for help early – Who do you call? Why did you call?
- How do you prioritise the team to manage the falling GCS?
- What would you do with your team to provide optimal conditions to perform the intubation?
- Where would that ideally occur in your department?

Key moments

- Systematic assessment of trauma presentation.
- Recognition of management priorities in major traumatic brain injury.
- Decision making for calling for help early.
- Decision making for intubation, timing and procedure.
- Analgesia/sedation/intubation strategy.
- Use of osmolar agents, end points for ventilation, supportive care management options.

Acronyms and abbreviations

| | |
|------------|--------------------|
| GCS | Glasgow Coma Scale |
| NAD | nil abnormalities |
| CXR | chest Xray |

References

1. Neurosurgical Society of Australasia. The Management of Acute Neurotrauma in Rural and Remote Locations. A set of guidelines for the care of head and spinal injuries. Third Edition: 2009 Published by: *Neurosurgical Society of Australasia*, Tenancy 5, Level 1 550 Lonsdale Street MELBOURNE VIC 3000 © Neurosurgical Society of Australasia. <https://pubmed.ncbi.nlm.nih.gov/10833574/>
2. Subdural haemorrhage. Dr Ayla Al Kabbani and Assoc Prof Frank Gaillard. *Radiopaedia*. <https://radiopaedia.org/articles/subdural-haemorrhage?lang=us>
3. Extradural haemorrhage. Dr Ayla Al Kabbani and Assoc Prof Frank Gaillard. *Radiopaedia*. <https://radiopaedia.org/articles/extradural-haemorrhage?lang=us>

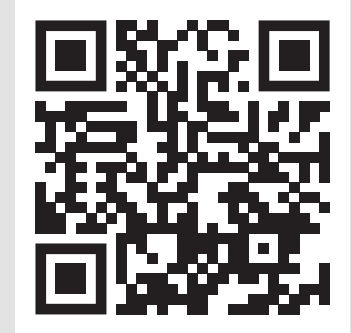
Share your feedback

**Please complete our survey to help make
Queensland Trauma Education better.**

The survey should take no more than 5 minutes to complete.

Scan the QR code or visit this link:

<https://www.surveymonkey.com/r/3FWL3ZD>



Queensland Trauma Education
Traumatic brain injury - Closed head injury: Immersive scenario - Facilitator resource kit

Published by the Clinical Skills Development Service
Herston, Queensland, Australia
csds.qld.edu.au/qte
Phone +61 7 3646 6500
Email CSDS-Courses@health.qld.gov.au