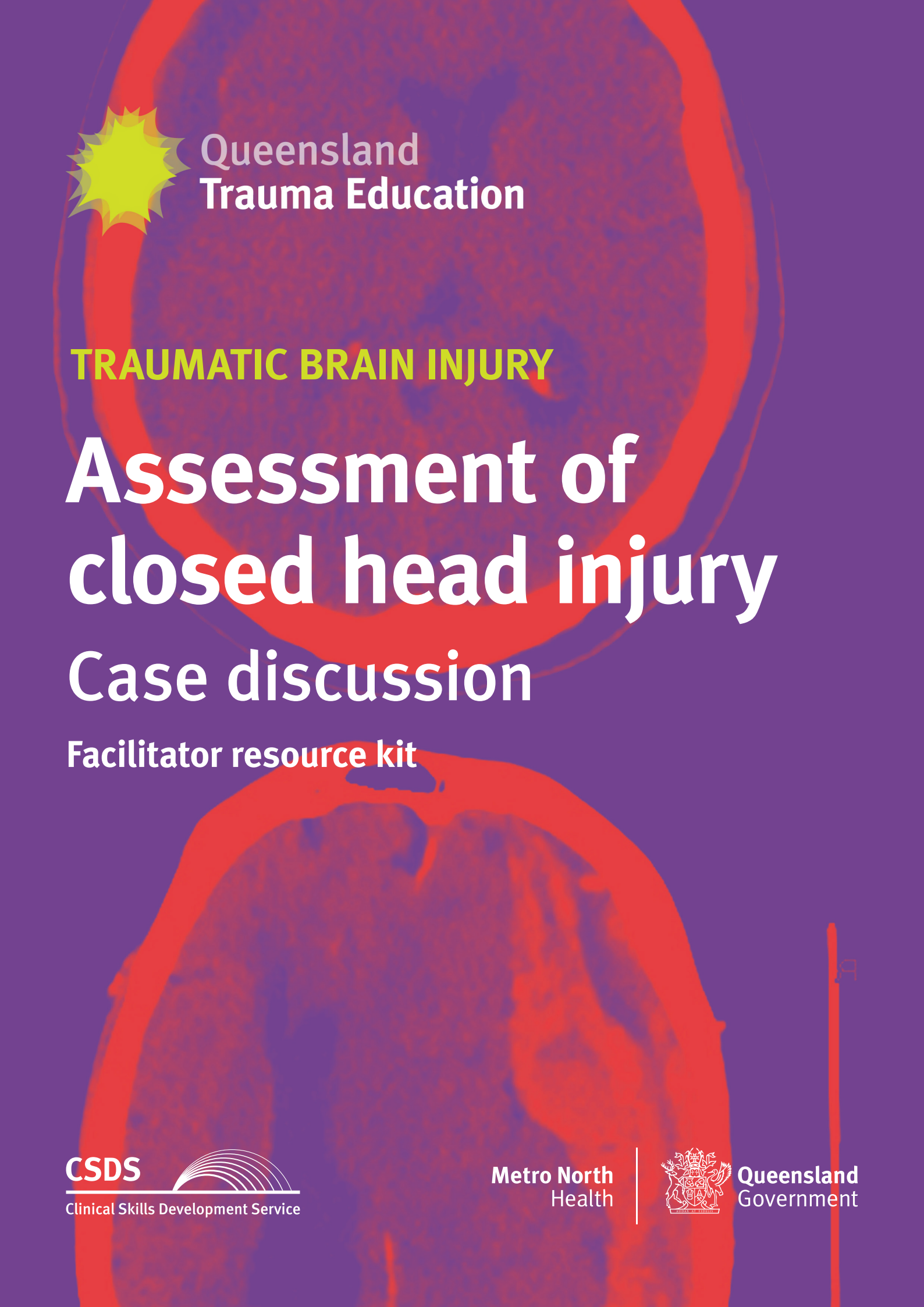

Queensland
Trauma Education

TRAUMATIC BRAIN INJURY

Assessment of closed head injury

Case discussion

Facilitator resource kit

CSDS
Clinical Skills Development Service

Metro North Health

Queensland Government

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Queensland Trauma Education
Traumatic Brain Injury - Assessment of closed head injury: Case discussion - Facilitator resource kit
Version 1.0

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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 package is designed to highlight the challenges in traumatic brain injury assessment and familiarise the learner with indications and interpretation of advanced imaging.

Target audience

Junior medical officers and nursing staff.

Duration

30-45 minutes.

Group size

Suited to small group participation.

Learning objectives

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

- Assessment - history and examination in suspected traumatic brain injury.
- Investigation - imaging interpretation.
- Management - severe traumatic brain injury.
- Procedural skill - GCS and demonstration of localising signs.

Facilitator guide

1. Present case discussion to participants via PowerPoint and use question and answer guide to support discussion.
2. Distribute supporting documents to participants to refer to throughout the discussion.
3. Guide the participants through the presentation to achieve learning outcomes.

Participant resource kit

- Learning objectives.
- Overview of traumatic brain injury.
- Further reading.

Supporting resources

- Facilitator slide deck (PPTX).

Overview of traumatic brain injury

A traumatic brain injury (TBI) is responsible for 50% of trauma deaths and 70% of all road accident deaths.[1]

The early assessment of patients suffering head injury is critical to determine the likely severity of the injury and therefore commence appropriate management strategies and escalation of care as necessary.

The stages of initial hospital management are:

1. Perform Primary survey.
2. Commence resuscitation efforts.
3. Perform Secondary survey.
4. Organise definitive care.

Further reading

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Case discussion

Case study

A 23 year old man is brought into your emergency department by ambulance following an alleged assault where he was struck multiple times across the head with a bat.

- No loss of consciousness.
- R) parietal haematoma, non-boggy.
- Complaining of mild headache and nausea.
- GCS with QAS 14/15 (E4, V4, M6).
- Fentanyl 25mcg IV given pre-hospital.

Question and answer guide

1. What important history will help risk stratify this presentation?

- ❑ Mechanism of injury.
  - Discuss importance of MOI:
    - patterns of injury
    - dangerous mechanisms of injury.
  - Discuss the MOI for this patient:
    - low velocity
    - blunt force
    - multiple blows.
- ❑ Timing of injury.
  - Why is the time of the injury important?
    - Early assessment and intervention reduces patient morbidity and mortality.[1]
    - Prevention of secondary brain injury through neuroprotective management strategies.[3]
- ❑ Modifying features (specific history including medications).
  - Why is a previous TBI relevant and how does this impact on subsequent traumatic brain injury?
    - Patients with recurrent TBI are known to have poorer outcomes even when a repeated injury is mild. Acutely, individuals with recurrent TBI have greater disability for a longer duration when compared to individuals with a single TBI.[4]
  - What are the key management strategies when a patient sustains a head injury and is taking anticoagulants?
    - Known coagulopathy is both a strong indication for early CT scan and to check the INR. Early reversal of anticoagulation if abnormal CT scan and consider reversal if initially normal CT scan with high INR (>4) depending on clinical situation.[3]

You commence your primary assessment, and your findings are:

- Airway - maintaining own.
- Breathing - nil respiratory distress, respiratory rate is 20 and saturations 98% on room air.
- Circulation - tachycardic 100bpm, well perfused with a BP 130/80.

2. Outline your disability assessment

- ❑ Structured Neurological assessment.
- ❑ Assess GCS.
- ❑ Assess motor score.
- ❑ Assess pupillary response.

Disability findings

Glasgow Coma Scale

- Eyes opening response: Spontaneously – score 4.
- Best verbal response: He is confused and disorientated – score 4.
- Best motor response: Obeys commands – score 6.
- Total score: 14 out of 15.

Limb movement

- Moving all limbs to command.
- Normal power.

Pupillary response

- Pupil scale (mm): 4mm bilaterally.
- Pupil reaction to light: bilateral reaction equal to light.

3. At this stage, how would you categorise this patients head injury?

GCS 14/15 – mild head injury.

4. What are the advantages and disadvantages of utilising the Glasgow Coma Scale?

Distribute *supporting document* titled "Advantages and disadvantages of the Glasgow Coma Scale" and discuss.

5. What factors contribute to the Glasgow Coma Scale?

❑ E, V, M

a. Of these, which is most predictive for traumatic brain injury?
M — motor reponse[1]

You re-assess your patient, and your findings are:

- Airway – maintaining own.
- Breathing – nil respiratory distress, respiratory rate is 16 and saturations 98% on room air.
- Circulation – tachycardic 110 bpm, BP 160/90.
- Disability – GCS E2, V2, M5- seen to move L side but not R.
- Pupils – R 2mm reactive to light, L 5mm non-reactive to light.

6. What are your immediate treatment priorities at this stage?

GCS 9/15. Significant reduction in GCS › 2 points. Airway protection is limited. Early intervention is required to secure the airway to reduce airway aspiration and promote effective ventilation/oxygenation in line with neuroprotective management.

7. What are localising signs?

Impairment of brain function affecting specific regions of the body eg. unequal pupils, lateralising motor weakness, retrograde amnesia.

a. How do they help identify the location of brain injury?
Localising signs reflect the lobe/s where the primary injury has occurred.

b. What impact does this have on management of this patient?
This patient is now demonstrating signs of having a severe traumatic brain injury. Management priorities include: early interventions, neuroprotective management and further investigations.

Discuss neuroprotective management, referring to PowerPoint slides.

Your patient is now intubated and ventilated.

8. What features on clinical assessment necessitate imaging studies?

Refer to Closed Head Injury (Adults) Clinical Pathway to discuss decision making for imaging. https://www.health.qld.gov.au/__data/assets/pdf_file/0017/432314/head-injury.pdf

9. Does a history of anti-coagulant or antiplatelet use alter your clinical concern?

Refer to Closed Head Injury (Adults) Clinical Pathway to discuss risk associated with anticoagulant use and decision making. https://www.health.qld.gov.au/__data/assets/pdf_file/0017/432314/head-injury.pdf

A CT head scan is performed.

10. Explain what you are seeing in these images.

Level of experience: beginner/junior/novice.

- ❑ Identify bleed on scan.
- ❑ Relate to clinical signs and symptoms.
- ❑ Identify emergency presentation- discuss management options for location.

Level of experience: experienced.

- ❑ Identify pathological differences between EDH and SDH, clinical presentation and management priorities.
- ❑ Discuss the imaging variations that indicate the timing of intracerebral haemorrhage (sworl sign, density of blood).

After CT you re-assess your patient, and your findings are:

- Airway – intubated and ventilated.
- Breathing – SIMV, FiO2 1.0, Rate 18, VT 500ml, SpO2 98%.
- Circulation – bradycardic 60 bpm, BP 180/90.
- Disability – GCS E1, VT, M1.

Refer to GCS

11. What is the significance of the above assessment findings relating to TBI?

- Signs of rising intracranial pressure (ICP) include: bradycardia, hypertension and respiratory suppression.
- Cushings triad is a peri-mortum sign and can lead to cerebral herniation if not immediately treated.

12. What is the difference between Cushings triad and Cushings reflex?

- Cushings triad refers to the 3 clinical signs associated with rising ICP: bradycardia, hypertension and respiratory suppression.
- Cushings reflex is a physiological nervous system response to raised ICP resulting in clinical signs of Cushings triad.

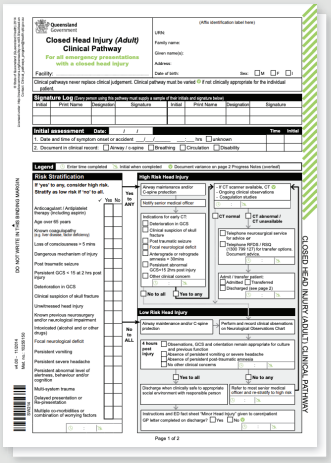
Supporting documents

The following supporting documents are provided for this case discussion:

1. Closed head injury (Adult) Clinical pathway.
2. Statewide Neurological Assessment (Adult).
3. Adult Trauma Clinical Practice Guidelines Initial Management of Closed Head Injury in Adults 2nd Ed.
4. Advantages and disadvantages of the GCS.
5. Glasgow Coma Scale vs Score.
6. GCS assessment - 2 x infographics.
7. GCS assessment.
8. Clinical and radiological features of closed head injury - infographic poster.

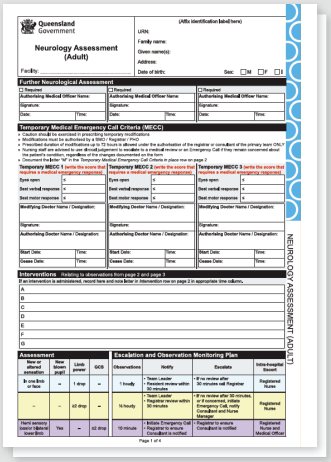
Closed head injury (Adult) Clinical pathway

https://www.health.qld.gov.au/__data/assets/pdf_file/0017/432314/head-injury.pdf



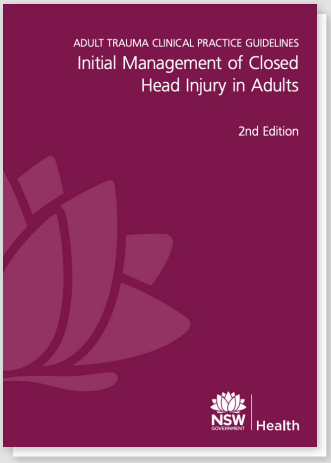
Statewide Neurological Assessment (Adult)

https://qheps.health.qld.gov.au/__data/assets/pdf_file/0026/2416922/sw977.pdf



Adult Trauma Clinical Practice Guidelines Initial Management of Closed Head Injury in Adults 2nd Ed.

https://www.aci.health.nsw.gov.au/__data/assets/pdf_file/0003/195150/Closed_Head_Injury_CPG_2nd_Ed_Full_document.pdf



Advantages and disadvantages of the GCS

Advantages

- The most widely recognised of all conscious level scoring systems in the world.
- Reproduceable by well-trained staff.
- Easy to perform with minimal training.
- GCS has “face validity” (i.e. it looks like it should work).
- It has prognostic value: the motor score particularly has a significant impact on the prognosis.
- The motor score findings (2,3,4) have specific pathophysiological correlations.
- It is used to categorise traumatic brain injury into mild, moderate and severe.
- It is used to determine the need for a pressure monitor in a patient with traumatic brain injury in the absence of any CT abnormalities (at a GCS of 8, you’d want an pressure monitor).
- It can be used to indicate a depth of coma at which one’s airway reflexes are likely to become unreliable.
- It has been incorporated into the APACHE-II scoring system.

Disadvantages

- Apart from being confused by the presence of drugs, the GCS has a few important problems.
- When first designed in 1974, it was never meant as an assessment tool for trauma. Teasdale and Jennett even said so themselves.
- It is unreliable in patients in the middle range of 9-12.
- People don’t know how to use it. Only 15% of military physicians were able to calculate it correctly.
- Even when calculated correctly, it has high inter-observer variability: even trained emergency staff get a different score on the same patient in 38% of cases. 6-17% of scores were 2 or more points apart.
- Its inter-observer variability means we should always report the exact findings rather than the number which the patient has scored.
- It is inadequate to assess higher cortical functions, and there may be a lot of variability at the upper range of the score. The delirious person scoring 14 could have a massively impaired cognition, or a mild confusion.
- It is inadequate to assess brainstem reflexes.
    - Therefore, it cannot be used as a trigger for intubation (GCS of 8).
- The eye score is unreliable if the eyes are damaged. Alternatively, it is possible to score an E4 even if one is braindead, provided one’s eyes are open. Intelligence in interpretation is called for, and perhaps because of this the GCS is not ideal as a screening tool among partially trained staff.
- The total score is meaningless.
    - The components are more important individually.
- Depending on the individual component score, the prognosis may be very different for patients with the same total score.
- It is affected by drugs and alcohol.
    - However, it is still used in assessing drug overdose patients.
- It is affected by language barriers.
- Intubation makes a mockery of its verbal component.
- It needs to be modified for use in young children.

Glasgow Coma Scale vs Score

http://www.glasgowcomascale.org/faq/

Scale versus score

The core concept in the Scale is that the patient's eye, verbal and motor responses are described in simple, objective terms in order to convey a clear unambiguous picture of their condition.(1) The allocation of numbers to the steps in the three responses (e.g. E=3, V=4, M=5) was introduced later to facilitate entry of clinical findings into a databank.

The Glasgow Coma Scale Score is produced by adding the numeric values of the three responses into a sum or composite total (e.g. E3, V4, M5 = Score 12).(2) The lowest Score possible is 3, indicating deep coma, and the highest Score is 15, indicating normal consciousness. The other 11 Scores can reflect 118 different combinations of the three responses. Not all of these are clinically realistic.

Although the Score was initially developed to summarise information about patient groups, it became widely used in clinical practice as a 'shorthand' way of communicating the severity of a patient's condition. A widely used classification system stratifies the early severity of head injury into mild (sum score 13–15), moderate (sum score 9–12) and severe (sum score ‹ 8).

Relation between the scale and the score

The contribution of the components of the Scale to the sum score depends on the severity of the patients' condition.(3) In mild head injury the motor score has reached its maximum 'ceiling' effect and changes in the Score result only from changes in verbal or eye responses; in moderate head injury the motor score has a stable value and in severe head injury changes in the sum Score reflect changes only in the motor score.

The findings in each component of the scale and of the sum score both relate to prognosis. Studies of a very large database of 54040 patients(3) showed definitively that taking account of the findings from the components separately yields more information than using only the sum Score. Furthermore, the importance of the components varies according to the sum score, the motor component contributing most information in severe injury, the eye and verbal in mild and moderate injuries.

These findings underline the importance of assessing a patient's impaired consciousness by the three separate clinical responses.

Clinical uses of the Score

The score is commonly used in the construction of clinical guidelines as produced by the Brain Trauma Foundation (severe TBI guidelines)(4), the American College of Surgeons and Centers for Disease for control and prevention (National Trauma Triage Protocol)(5) and the National Institute of Clinical Excellence (Head injury: assessment and early management NICE guideline)(6) for decisions such as transport to a hospital, the need for a head CT, admission to the hospital, intubation, cervical immobilisation, undertaking surgery, and providing air transport.

The Score is included in many clinical stratification and severity prediction scores, such as Acute Physiology and Chronic Health Evaluation (APACHE) II(7), Revised Trauma Score (RTS).(8)

It is a required component of the NIH Common Data Elements for studies of head injury.(9)

Recently the GCS Score and a pupil reactivity score have been combined into a new GCS-P score, with extended information about brainstem dysfunction (More information).(10)

Recommended practice in the use of the scale and score

The Score has limitations. It provides a less complete description of the patient than separate description of the three component responses of the scale. Also, the Score contains less prognostic information.[3] Therefore, in clinical practice the three responses of the Scale should always be described rather than the sum Score alone.

In a minority of patients one or other of the components cannot be tested, usually the verbal response. In clinical monitoring this can be denoted by recording N T. This should not be translated into a value of 1 or zero in calculating a sum score. Methods for estimating the verbal response from the combined information from motor and eye responses have been de scribed.[11]

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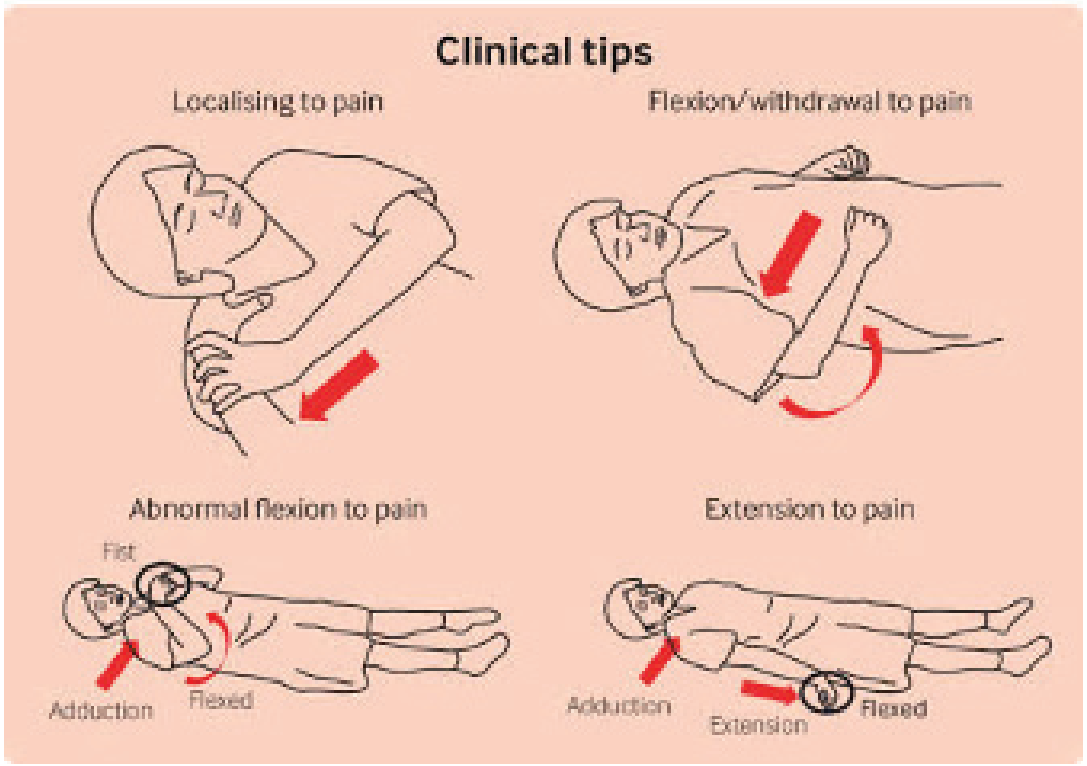
GCS assessment

"Grip my finger" "Make a fist"	**M6** Obeys commands
Trapezius squeeze Supraorbital pressure	**M5** Localises pain
Flexion of limbs	**M4** Flexion/withdrawal to pain
Adduction and internal rotation of upper limbs Extension of lower limbs	**M3** Abnormal flexion to pain
Extension of upper and lower limbs	**M2** Extension to pain
No motor response	**M1** No response



GCS assessment

Unprompted eye opening	**E4** Spontaneous eye opening
"Hello, open your eyes"	**E3** Eyes open to speech
Trapezius squeeze Supraorbital pressure	**E2** Eyes open to pain
No eye opening	**E1** No response

Clinical tips for painful stimulus

Trapezius squeeze

Supraorbital pressure

GCS assessment

Behaviour	Response	S
Eye opening response	Eyes open spontaneously	4
	Eyes open to verbal command, speech or shout	3
	Eyes open to pain (not applied to face)	2
	No eye opening	1
Best verbal response	Oriented	5
	Confused conversation, but able to answer questions	4
	Inappropriate responses, words discernible	3
	Incomprehensible sounds or speech	2
	No verbal response	1
Best motor response	Obeys commands for movement	6
	Purposeful movement to painful stimulus	5
	Withdraws from pain	4
	Abnormal (spastic) flexion, decorticate posture	3
	Extensor (rigid) response, decerebrate posture	2
	No motor response	1
Total score	Best reponse	15
	Comatose patient	8 or less
	Totally unresponsive	3

Queensland Trauma Education

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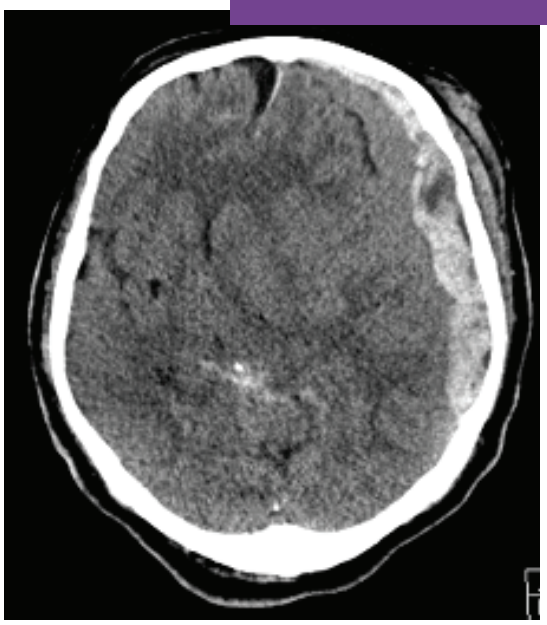
TRAUMATIC BRAIN INJURY

Clinical and radiological features of closed head injury

Subdural haemorrhage



Clinical features

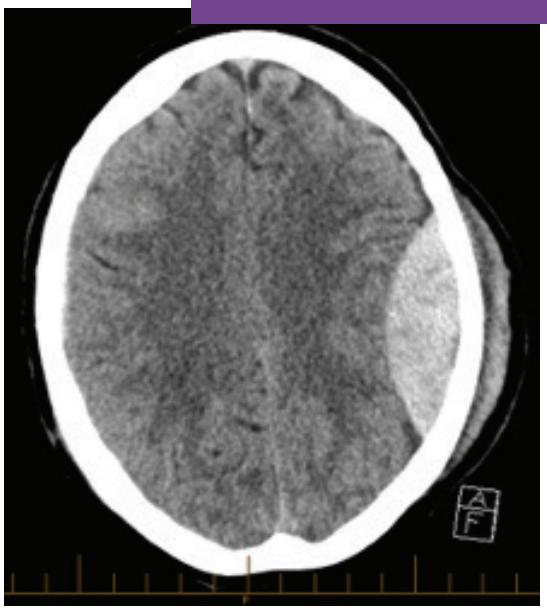
- Associated with trauma - younger patients high velocity, older patients low velocity.
- Confusion/vague neurological symptoms.
- Slower development of symptoms.
- History of anticoagulation use.

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

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

Queensland Trauma Education

Queensland Trauma Education
Traumatic Brain Injury - Assessment of closed head injury: Case discussion - Facilitator resource kit

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