

HEAD INJURY IN ADULTS - MINOR



"Manning the Navy", hand colored Print, Samuel Collings (Eighteenth Century British)

"...At the end of the Eighteenth century, the Royal Navy's need for men was at least double the number of able-bodied seamen who willingly served. Short of raising wages and improving conditions, the only method that could guarantee a ready supply of sailors was to take them by force as depicted by this Eighteenth century print. As a consequence in Eighteenth century Britain men frequently "disappeared" from seaport towns and villages. Wandering alone one evening they would suddenly receive a "minor" head injury from members of the "impressment gangs", dragged aboard a ship in port and "recruited" into His Majesty's Navy. Wives were often left wondering what became of

their husbands, and children of their fathers. Because of the very high mortality rates due to scurvy and other diseases at sea, many were never seen by their families again...”

S.R Brown, “Scurvy”

The impressment gangs apparently became quite good at delivering just the right amount of energy in order to render their “recruits” momentarily senseless. Occasionally, however the blow would result in a moderate or severe head injury and only time would tell what the consequences would then be for the new recruit. Fortunately today with the use of modern CT scanners the Royal Navy does not have to rely on tedious head injury observations before they know whether or not their new recruit will be fit for service!

HEAD INJURY IN ADULTS - MINOR

Introduction

There is no universally accepted definition of what constitutes a “**minor**” head injury.

In general terms, acute blunt head trauma severity has been technically described in terms of the presenting GCS as: ^{1,2}

Mild: **GCS that is 14-15**

Moderate: **GCS that is 9-13**

Severe: **GCS that is 8 or less**

It should be noted however significant intracranial injury may exist with potential for rapid deterioration even in patients who initially have a GCS of 15.

Head injury in other words requires dynamic assessment.

The best definition of “mild” head injury should really involve 2 components:

- A GCS of 14 or better and improving over time if less than 15.

And

- CT scan findings that show a normal brain or minor degrees of contusion only, without evidence of subarachnoid, extra-axial hematoma, intracerebral hemorrhage, cerebral edema, signs of raised intracranial pressure or skull fracturing.

The major clinical decisions in the ED will involve:

1. **The need for CT imaging of the brain**
2. **A period of observation**
3. **Disposition**

Pathology

The typical characteristics of a minor head injury include:

1. Direct blow to the head or acceleration / deceleration injury.
2. Transient loss of consciousness or brief post traumatic amnesia.
3. Transient abnormal alertness, behaviour or cognition.
4. Rapid clinical improvement
5. Neurosurgical intervention rare (1-3%)
6. Abnormality on CT scan relatively uncommon (5-15%)
7. Post concussion symptoms common.
8. Long term functional outcome good.

A “complicated” mild head injury is a mild head injury resulting in one of the following:

1. Significant structural lesion on CT scan
2. Significant acute clinical symptoms
3. Significant post concussion symptoms

Note that since 2004 the adult literature has clearly identified that patients may sustain significant head injuries **without** loss of consciousness or post traumatic amnesia. ¹

Therefore, the presence of loss of consciousness or post traumatic amnesia should not be used to *define* mild head injury or guide management. ¹

Clinical Assessment

Important points of History:

1. The mechanism of injury:
 - Was it witnessed?

- What was the likely force of the injury?
 - ♥ Does the mechanism fulfill standard criteria for a “Trauma Call”?
- Does the *nature* of the injury suggest a possible skull fracture?
 - ♥ In particular a large degree of energy delivered to a small area (for example, struck by golf ball at close range or a hammer blow).

This is important as this type of mechanism may result in a depressed skull fracture in the absence of LOC or neurological signs.

2. Loss of consciousness:

- Was this < 5 minutes or > 5 minutes.

From a practical viewpoint however, obtaining a reliable history and duration of loss of consciousness from lay witnesses is often / virtually always problematic.

3. Amnesia (retrograde or antegrade):

- Was retrograde amnesia > 30 minutes?
- Was / is antegrade amnesia > 2 hours or > 4 hours?

4. Co-morbidities:

Does the patient have any co-morbidity factors that put them at greater risk with a head injury?

- Is the patient on Warfarin or a NOAC?
- Do they have any other coagulopathy?

5. Secondary injury:

Could the injury have been secondary to some other primary pathology?

- A seizure
- Syncope

6. Communication barriers:

Are there any factors of communication, which make neurological assessment more difficult such as:

- **Drug or alcohol affected**

Drugs and alcohol are recurring factors for missed diagnoses of significant head injury.

- Extremes of age, confused elderly and the very young.
- Language barriers
- Intellectual impairment
- Mental illness

7. Associated injuries:

- Does the patient have any significant associated injuries, in particular a **cervical spine injury**?

These may readily be missed in confused patients or those with impaired ability to communicate in general.

Diving type injuries in particular are very high risk for associated cervical spine injury.

Important points of Examination:

1. ABC/ vital signs
2. Assess the GCS (where possible)
3. Full primary and secondary trauma surveys
 - With particular focus on the cervical spine.
4. Bedside blood glucose level, as for any patient with an altered conscious state.
5. Pupil size and responsiveness
6. Look for evidence of injury, including signs of base of skull fracture:
 - The presence of a subconjunctival haemorrhage that does not have a discernable posterior margin, (indicating possible injury to the region of the retro-orbit)

- CSF rhinorrhea:
- Hemotympanum
- CSF otorrhea
- Bilateral peri-orbital bruising:
 - ♥ Otherwise known as “Raccoon eyes”. This may also be seen in direct peri-orbital orbital or nasal fractures as well however.
- Mastoid bruising:

7. Post traumatic amnesia assessment:

- The **Abbreviated Westmead Post Traumatic Amnesia Scale (A-WPTAS)** can be useful in objectively identifying patients *with cognitive impairment* who are at increased risk of structural lesions and post concussion symptoms.

A patient is considered to be out of PTA when they score 18/18.

Investigation

Blood tests:

Blood tests are not routinely required. These will depend on the clinical suspicion for other pathology.

The following may be *considered*:

1. FBE
2. U&Es / **glucose**, especially in cases of ongoing confusion
3. **INR for patients on warfarin**
4. Blood alcohol level

CT Scan:

This is **the** investigation for any patient with a head injury.

The key clinical decision after assessment is whether or not to CT scan the patient. Frequently the cervical spine will also need to be included

Decision rules such as the Canadian Head Injury Rules (or CHALICE rules in children) have been developed to assist in decision making, however none are 100% reliable and each has its limitations and so each case must be judged on its merits, and “rules” **should assist but not override experienced clinical judgment.**

Considerations for CT scanning in *apparently* minor head injuries include the following risk factors that indicate a potentially significant mild head injury:

1. GCS < 15:

- Particularly at **2 hours**

A persistent GCS <15 at two hours post injury is a **strong indication** for CT scanning.

An initial GCS 14 on admission (i.e just after the injury) is a *relative indication* for CT scanning.

2. Vomiting:

- Persistent or recurrent vomiting, (i.e ≥ 2 occasions). is a strong indication for CT scanning.

Any vomiting is a relative indication for CT scanning.

3. Severe and persistent headache:

- Persistent severe headache is a strong indication for CT scanning.

4. Any patient with a coagulopathy especially those on **anticoagulant** or **antiplatelet** therapy:

- Known coagulopathy and particularly supratherapeutic anticoagulation are significant risk factors for intracranial injury and that these patients must have early CT scans and be considered for reversal of anticoagulation.

5. Drug or Alcohol intoxicated patients with a **history** or **possibility** of head trauma.

- Drug or alcohol ingestion with a **normal mental state** is a relative indication for CT scanning, in the absence of other risk factors.

Drug or alcohol intoxication resulting in an **abnormal mental state** is a strong indication for CT scanning.

6. Cases of clinically apparent or suspected skull fractures:

- Clinical suspicion or evidence of **skull fracture** is a strong indication for CT scanning.

Large scalp hematomas or lacerations are **relative indications** for CT scanning in adults.

Large non frontal scalp lacerations have been identified as significant risk factors in young children.

7. Antegrade or retrograde amnesia:

- Retrograde and anterograde amnesia are typically used to refer to the duration of loss of memory for events preceding or following an injury.

Post traumatic amnesia (PTA) is the period of time during which a person is unable to lay down new memories following an injury.

PTA and anterograde amnesia essentially refer to the same phenomena but some patients may have memory for events yet still be unable to lay down new memories - the so called islands of memory.

A duration of **> 30 minutes of retrograde amnesia** is a significant risk factor for intracranial injury.

A duration of **PTA of > 2 hours** is a minor risk factor and **> 4 hours** is a major risk factor for intracranial injury.

Simple isolated amnesia for the **event** is common and of little clinical significance, and in the absence of other risk factors does *not* mandate a CT scan.

8. Loss of consciousness:

- Absence of loss of consciousness does **not** rule out the possibility of a significant injury.

Brief loss of consciousness (**< 5 minutes**) slightly increases risk of intracranial injury but should not be considered a *routine* indication for CT scan *in the absence* of other risk factors.

Prolonged loss of consciousness (**> 5 minutes**) should be considered a strong indication for CT scanning.¹

9. Post traumatic seizure:

- Brief generalized seizures *immediately* following head injury are of less concern.

Prolonged, focal or **delayed** seizures are significant risk factors for intracranial injury, and are of far greater concern. ¹

10. Age > 65 years:

- Elderly patients have increasing risk of intracranial injury with increasing age.

Patient age > 65 years is a strong indication for CT scanning.

Routine CT scanning is indicated unless the patient is totally asymptomatic patient with no other risk factors. ¹

*The threshold for CT scanning should also be **low** in the following:*

12. Representations:

- Delayed presentation or representation are relative indications for CT scanning. Clinical judgment is required.

Patients who present more than four hours post injury with persistent or new clinical symptoms should be regarded as being at relatively high risk for intracranial injury.

13. Significant mechanism of injury.

14. Patients with impaired ability to communicate.

15. Patients who have received parenteral opioid analgesic agents.

16. Patients with known neurosurgery conditions such as hydrocephalus with shunt or AVM or tumour.

Note that some of the above require an unequivocal and reliable history - this may not be available and in such cases the threshold to CT should be lower.

The presence of **multiple** risk factors is more concerning than a single isolated risk factor. In most uncomplicated mild head injury patients clinical symptoms start to improve by 2 hours post injury and are returning to normal by 4 hours post injury.

Clinical symptoms that are deteriorating or not improving by 4 hours post injury on serial observation such as abnormal alertness / behaviour / cognition, PTA, vomiting or severe headache are of significant concern.

Limitations of CT scanning in minor head injury include:

- Some patients, particularly the elderly or those with a known coagulopathy, may develop delayed focal neurosurgical lesions (especially subdural lesions) *despite* initial normal CT scanning; and so rescanning is important when the clinical picture suggests a deterioration. ¹
- Early CT scans may not demonstrate intra-cerebral contusions which take time to become apparent on CT scanning.
- CT scanning will not demonstrate diffuse axonal injury in most patients.

Uncooperative patients:

For patients who are uncooperative / drug affected and who are unable to make a competent decision, CT scanning is problematic.

A decision on whether to CT will need to be made by the senior clinician based on the index of clinical suspicion for an intracranial injury. This can only be judged on a case by case basis.

The uncooperative patient will usually require sedation or intubation, and the risks versus benefits of these need to be considered.

If CT is not performed, then a period of observation under verbal de-escalation, chemical and/ or physical restraint as required will be warranted until such time as the patient is alert and can be adequately assessed. Deterioration or failure to improve will warrant a CT scan.

Cervical Spine Radiology:

Current best practice also suggests a CT scan of the cervical spine, when there is any possibility of an associated neck injury.

Head injured patients who are confused may not be able to adequately communicate their symptoms, due to the confusion or the distracting nature of their head injury.

An important consideration in these cases is the need for a cervical spine CT scan, (**see also cervical spine radiology document**).

Cervical spine injury is a not uncommon association with head injuries, whether they are “major” “moderate” or “minor”

Skull X-Ray

In remote regions without CT scan access, a skull x-ray may be useful to confirm the presence of a skull fracture (that mandates an early CT scan due to the increased risk of deterioration), and hence initiate the organization of an urgent transfer. ¹

Management

The management of “moderate” and “severe” head injury is relatively straight forward and is based initially on usual ABC and resuscitation guidelines.

The best management for patients with so called “minor” head injuries is somewhat less clear cut.

The principle management decisions will involve:

- **The decision to CT scan**
- **The period of observation - generally this will be for a minimum period of 4 hours, (unless the injury is trivial)**

Once a patient has had a CT for a head injury it must be reported by the radiologist before the patient leaves the Department.

Patients with minor head injury must be admitted if:

1. There is any abnormality on the CT.
2. The GCS is less than 15
3. There is ongoing vomiting.
4. There is a skull fracture.

All patients with minor head injuries requiring admission should be discussed with the Neurosurgical Unit

Analgesia: ¹

Most headaches associated with isolated **mild** head injury will respond to simple analgesia such as paracetamol or oxycodone.

Avoid the use of aspirin / NSAIDS due to increased risk of bleeding.

If patients require stronger opioid parenteral analgesia for headache, then a CT scan must be performed, if this has not already been done.

Anticonvulsants:

Prophylactic anti-convulsants are not indicated for patients with uncomplicated mild head injury.

Prophylactic anti-convulsants, such as **phenytoin**, should be considered in patients with *complicated* mild head injury or moderate to severe head injury who have specific risk factors that put them at increased risk of seizures.

Clinical judgment is required and neurosurgical consultation is advisable if there is any uncertainty.

Coagulopathic patients:

Known coagulopathy or bleeding disorder is both a strong indication for early CT scan and also an indication to check the INR and to consider reversal of anticoagulation.

Anticoagulated patients with any evidence of haemorrhage on CT scan should have early rapid reversal of anticoagulation.

Patients with a supra-therapeutic INR (>4) should be considered for either partial or full reversal and admitted to hospital for prolonged observation.

Prolonged observation and follow up repeat CT scan should be considered for any anticoagulated patients or patients with bleeding disorders.

Disposition:

Disposition may be:

- Home
- To a Neurosurgical Center
- Ward admission for ongoing observation:
 - ♥ Some of these may be suitable for observation in an **ED Short Stay Unit**
 - ♥ If they do not fulfill local SSU admission criteria, then they should be admitted under the **General Surgical Unit**

Deterioration of **mild** head injury patients following a normal CT scan is rare.

Caution is advised however for patients with known coagulopathy and elderly patients where the risk of a delayed subdural haemorrhage is increased.

Mild head injury patients can be safely discharged for home observation after an initial period of in-hospital observation/ CT scanning if they meet specified **clinical, social** and **discharge advice** criteria.

Social criteria include:

- Responsible person available to take patient home.
- Responsible person available for home observation.
- Patient able to return easily in case of deterioration.
- Written and verbal discharge advice able to be understood.

All patients with mild head injury **must** be given both verbal and written discharge advice covering:

- Signs and symptoms of acute deterioration
- When to seek urgent medical attention
- Lifestyle advice to assist recovery
- Information about typical post concussion symptoms and reasons for seeking further medical follow up.

Patients with ongoing symptoms and/ or CT scan abnormalities will require hospital admission.

Routine repeat CT scanning within 24 hours is not indicated for most *clinically improving* mild head injury patients with minor abnormalities on initial CT scan. The need for this should be discussed with the Neurosurgical Unit. ¹

Patients who have suffered significant symptoms, especially those who required admission, are ideally offered **Neuropsychiatric follow-up** assessments.

Appendix 1

Summary of closed head injury classification and outcome: ¹

Feature	Mild Head Injury	Moderate Head Injury	Severe head Injury
Initial GCS	14-15	9-13	3-8
% of Total	80%	10%	10%
Abnormal CT Scan (%) ^{1,2}	5-15%	30-50%	60-90%
Neurosurgical Intervention (%) ^{1,2} (excluding ICP monitoring)	1-3 %	5-30%	30-50%
Mortality (%) ¹	< 1%	10-15 %	30-50 %
Good Functional Outcome (%) ^{1,2,3}	> 90%	20-90%	< 20%

Notes:

1. Generally the lower the GCS the worse the prognosis or the higher the rate of complications
2. Outcome deteriorates with increasing age - “children do better and elderly do worse”
3. Good functional outcome being return to independent ADL and to work or school at 6 months

References:

1. Initial Management of Closed Head Injury in Adults NSW Government Health Policy Statement 2nd ed: Issue date: February 2012
2. G. O'Reilly et al, Neurotrauma in Textbook of Adult Emergency Medicine, Cameron et al 4th ed 2015.

Dr J.Hayes

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