



Medical Management of Head Injuries

Revision notes for
DFMRT Casualty Care Examination Course
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Indicating special information in “Revision Notes” presentations

NEW

New information since *Casualty Care in Mountain Rescue* was published in 2006.

*NOTE: This presentation only includes essential information. To know the subject in greater depth, you must read *Casualty Care in Mountain Rescue*.*



Casualty Care Syllabus 2009-13

Head Injury

Primary Survey

- Appreciate basic anatomy & physiology of the CNS
- Be able to assess CNS function, including AVPU, and recognise abnormalities
- Understand general treatment principles, particularly the need for cervical spine immobilisation when appropriate



Casualty Care Syllabus 2009-13

Head Injury

Secondary Survey - HEAD

- Appreciate the pathological changes to the brain and surrounding structures following a head injury
- Be able to discuss the common types of injury
- Describe signs & symptoms associated with head injuries
- Understand assessment of consciousness including GCS with aid of Casualty card
- Discuss the treatment of head injuries



This is a very important topic

“Head injuries are common in mountain rescue and, as early treatment has a major effect on outcome, both in terms of survival and quality of life, this imposes a responsibility on all team members to be well versed in the management of head injuries.”

John Ellerton
Casualty Care in Mountain Rescue



Important terminology

- **Head injury**
 - Generic term for any bang on the head.
 - May just be superficial damage.
- **Traumatic brain injury (TBI)**
 - Brain injury due to physical trauma.
 - Different from the brain damage that occurs e.g. after a stroke.
- **Primary Brain Injury**
 - The initial injury e.g. blunt, penetrating.
- **Secondary Brain Injury**
 - = further damage occurring to the already injured brain.
 - PRESENT IN ONE THIRD OF PATIENTS ON ADMISSION TO HOSPITAL
 - Due to potentially correctable factors e.g. hypoxia, hypotension.
 - Severity is influenced by what YOU do or don't do.



Anatomy

- The scalp loosely covers the skull
- Skull protects the brain from injury
- The brain & spinal cord are surrounded by 3 membranes called 'meninges'
- Cerebrospinal fluid (CSF) circulates throughout the central nervous system. Functions:
 - Nutrition
 - Helps to physically support the brain
 - Cushioning



Two important bits of physiology

Brain blood flow

- Brain needs $\cong 700$ ml/minute to provide a continuous supply of oxygen and glucose.
- Normal brain regulates its own blood flow so it is constant regardless of the BP unless very high (>160) or very low (<80).

Intracranial pressure (ICP)

- The pressure inside the skull.
- Normally regulated and quite low.
- ICP rises after brain injury \rightarrow jeopardises brain oxygenation & nutrition.



Practical implications of the anatomy

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■ **Scalp**

- Can bleed profusely if cut
- Elastic nature holds blood vessels open
- Child can lose significant proportion of its blood volume from a scalp injury

■ **Skull**

- Restricts how much room there is for the injured brain to swell
- Without room to swell freely, the brain squashes itself
- Squashed and injured brain does not function normally and give rise to a variety of clinical signs – see next slide

■ **CSF**

- Clear coloured fluid, but red if blood-stained
- CSF dripping from the nose or ear indicates a fracture of the base of the skull i.e. deep inside the head



Effects of direct injury to the brain

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- Injured part swells.
- This stops the brain from regulating its own blood supply so it becomes very dependent on systemic blood pressure
- Brain function is reduced or stops altogether in damaged areas. This can affect:
 - Consciousness
 - Breathing
 - Control of blood pressure
 - Pupils
 - Other e.g. seizures, posture, memory, language, etc.
- This deranged function leads to further brain damage on top of the primary injury e.g. impaired breathing control causes a rise in blood carbon dioxide that makes the brain swell further.



Clinical assessment of Head Injury

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■ CERVICAL SPINE

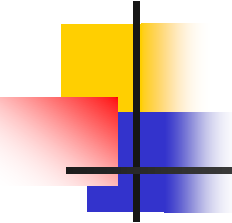
- $\cong 10\%$ of general casualties with head injury also have a *cervical spine injury*, especially if GCS < 8 .
- May be more common in MR because of mountain environment.

■ History

- Alcohol/drugs
- Distance fallen
- Loss of consciousness, vomiting, seizures, etc.

■ Examination

- Conscious level
- Abnormal Posture (person lies in an abnormal position after some brain injuries)
- AVPU or GCS (+ see later slide)
- Breathing
- BP
- Pupils



Prehospital management of Traumatic Brain Injury (TBI)

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Prehospital management of TBI focuses on two things

1. Full clinical assessment of the casualty
 - Indicates the severity of the injury
 - Alerts you to any deterioration during evacuation
 - Provides a picture at a point in time for hospital staff
2. Minimising the amount of secondary brain injury

National Trauma Audit in 2007 (didn't include MR)

- Many TBI patients arrive at hospital with partially or completely obstructed airway.
- Secondary insults due to hypoxia, high CO₂ and low BP are common. These worsen eventual outcome (higher mortality and more severe disability).
- Management of potentially unstable spine unsatisfactory in 10% cases.
- These are preventable on the hills.



Important points

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- Scalp lacerations can bleed a lot, and this is not related to any underlying brain injury.
- 2-10% of head-injured patients will also have a cervical spine injury, especially if the Glasgow Coma Score is <8 .
- Long-term outcome after TBI is influenced by how well you prevent secondary brain injury and how quickly you can get the casualty to hospital.

Essential head injury management – Airway & Breathing

AIRWAY AIRWAY AIRWAY

Important

- Make sure the airway is clear and stays clear.
- Ensure good oxygenation ($SpO_2 >96\%$ if possible).
- Try not to allow the patient to cough or strain e.g. due to partial airway obstruction, fluid in back of the throat.
- Head injury patients are at risk of regurgitation and vomiting.
- Can assist breathing via i-Gel or LMA if respiratory rate slow or breathing laboured.

Essential head injury management – Circulation & brain blood flow

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- Major trauma combined with Traumatic Brain Injury cause a fall in brain blood flow, accompanied by a reduction in the brain's ability to tolerate that lower flow.
- Shock in a head-injured patient means the patient is bleeding somewhere else in the body.
- In Traumatic Brain Injury, the blood pressure should ideally be >90-100 mm Hg systolic. If the blood pressure is lower than this, if possible, give small amounts of saline (100-200 ml) by drip to try to bring BP up.

Essential head injury management – Circulation & brain blood flow

Ensure blood can drain freely out of the brain

- Avoid anything tight around the neck e.g. check cervical collar is not obstructing neck veins.
- If possible, keep patient slightly head up (about 30°).
- If BP is low, this might not be achievable if a head up position makes the blood pressure fall further.

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Essential head injury management – Other

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- Treat raised body temperature or sustained seizures as these increase brain's requirements of oxygen and food.
- Check the blood glucose. Administer glucose if the level is below 5 mmol/litre.
- **Monitor the casualty as frequently as practicable. Watch out for adverse trends and focus on areas that are starting to show deterioration. Where possible, take appropriate action.**

Assess & Record Conscious Level REGULARLY

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- AVPU (= Eye Opening of the GCS)
 - A = Alert
 - V = Responds to voice
 - P = Responds to pain
 - U = Unresponsive

- Glasgow Coma Score (GCS)
 - See next slide

Glasgow Coma Score

Eye opening		Motor response	
Spontaneous	4	Obeys commands	6
To voice	3	Localises pain	5
To pain	2	Withdraws (pain)	4
None	1	Flexion (pain)	3
Verbal response		Extension (pain)	2
Orientated	5	None	1
Confused	4		
Inappropriate words	3		
Incomprehensible	2		
None	1		

- Assess best response in each area.
- Minimum score 3 (not zero). Maximum score 15/15.
- Coma ≤ 8 .
- Eye opening section = AVPU
- Cannot assess motor response if spinal cord injury in which case, record the rest of the GCS as e.g. 4/9 (i.e. 4 out of maximum of 9)



Artificial ventilation

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- Patients with an i-Gel or LMA will need to be ventilated.
- Can be done manually using Ambu bag.
- Oxygen-enriched air.
- Rate \approx 12-15/min.
- Do not use very large breaths as this:
 - Reduces blood CO₂ too much (\rightarrow \downarrow brain perfusion).
 - Causes hypotension (low blood pressure).
 - May worsen situation if pneumothorax.



Analgesia in casualty with minor head injury

- Casualty might have minor head injury + other injuries e.g. fracture.
- Be very cautious in presence of
 - Open (compound) skull fracture
 - Loss of consciousness at any time
 - Altered level of consciousness, even if casualty never became completely unconscious.
- Try 'safe' analgesics first e.g. paracetamol, diclofenac.
- If ineffective, will have to use morphine provided that
 - No loss of consciousness
 - GCS is currently 14 or 15
 - Casualty is not confused or drowsy
 - It will be possible for you to monitor the casualty for adverse effects
 - There is someone available to administer naloxone if necessary
 - The BP is acceptable



Analgesia in casualty with minor head injury

- If using morphine, start with small dose
- Morphine & diamorphine have the following relevant side effects
 - Reduce conscious level
 - Respiratory depression
 - Causes pupils to get smaller (constrict)
 - Nausea & vomiting (dangerous as vomiting raises intracranial pressure)
 - Slow heart rate
 - Reduce blood pressure
 - Itching



Head Injury – summary

You can make a difference

- Scalp laceration can bleed profusely. It can usually be controlled with direct pressure but you may have to press for 10-15 minutes.
- Ensure
 - CLEAR AIRWAY. Recheck during the rescue to ensure it has not deteriorated.
 - Prevent hypoxia if possible. Give oxygen.
 - Cervical collar correctly applied.
 - Assist breathing if casualty's breathing is obviously grossly inadequate.
- If possible, position the casualty slightly head up.
- Record as full a history and examination as you have time for. Don't forget to record the time of important events e.g. seizure, etc.
- Treat seizures, hyperthermia and hypoglycaemia immediately.



Practical skills

- Manual inline stabilisation
- Removing a helmet
- Sizing and applying a cervical collar
- AVPU
- GCS
- Examination of pupils
- Spinal lift
- Log roll

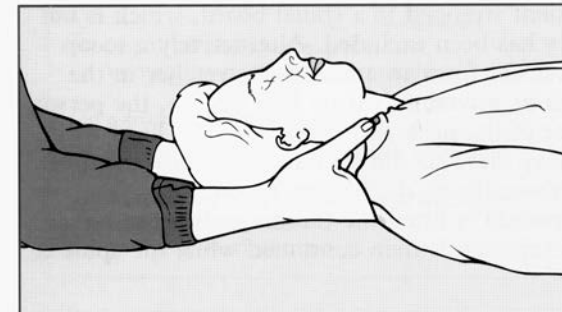
Manual in-line stabilisation (M.I.L.S.)

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- Stabilise head in neutral position in relation to rest of body.
- Do not forcibly move head if painful to do so, especially if no neurological signs in current position.
- Do not exert traction on head.
- Do not use soft foam collars (ineffective).

Person stabilising the spine:

- Must have no other responsibilities.
- Can hold side of head (Cas Care p21).
- Must also hold the upper shoulders to prevent the torso being moved independently of the head/neck if casualty needs to be moved.



Manual immobilisation of the neck.