HEAD INJURY

Risk factors include male sex, recreational drugs (including alcohol and substance abuse) and youth, with a peak at 15–30 years of age.
Road traffic accidents are the leading cause of head injury, being responsible for up to 50 per cent of cases. Other common mechanisms of injury include falls and assault. There is significant geographical variation, for example firearms are the third leading cause in the US.

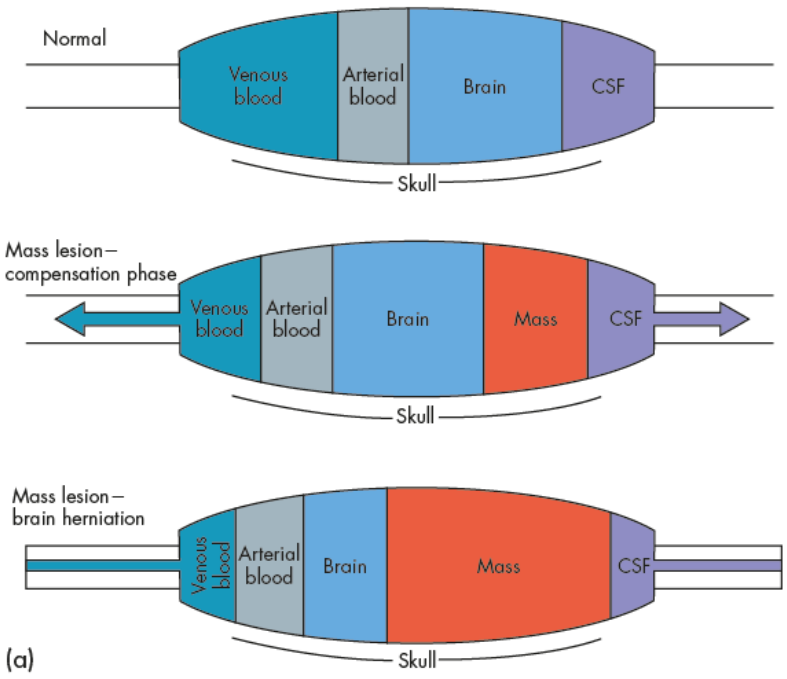
Cerebral blood flow

The brain is dependent on continuous cerebral blood-flow for oxygen and glucose delivery, and hence survival. Normal cerebral blood flow (CBF) is about 55mL/minute for every 100 g of brain tissue. Ischemia results when this rate drops below 20 mL/min, and even lower levels will result in infarction unless promptly corrected.
The flow rate is related to cerebral perfusion pressure (CPP), the difference between mean arterial pressure (MAP) and intracranial pressure (ICP): CPP (75–105 mmHg) = MAP (90– 110 mmHg) − ICP (5–15 mmHg).

ICP

Alexander Monro observed in 1783 that the cranium is a ‘rigid box’ containing a ‘nearly incompressible brain’. Therefore, any expansion in the contents, especially hematoma and brain swelling, may be initially accommodated by exclusion of fluid components, venous blood and cerebrospinal fluid (CSF).

Further expansion is associated with an exponential rise in intracranial pressure (see Figure below). The result is hypoperfusion and herniation.



Intracranial pressure

- Perfusion of the brain with oxygenated blood is critical for its survival
- Cerebral perfusion pressure is the difference between mean arterial pressure and intracranial pressure
- Cerebral perfusion is kept constant across a range of perfusion pressures by the process of autoregulation
- Autoregulation is compromised in the injured brain

Initial evaluation and management

The modern management of trauma is based on a firm understanding of the pathophysiology of trauma and an understanding of how patients actually die. This understanding has led to the development of several trauma systems, of which the Advanced Trauma Life Support (ATLS) is now generally recognized as the ‘gold standard’. ATLS was originally introduced by the American College of Surgeons Committee of Trauma and is now taught in over 50 countries worldwide. It provides a systematic approach that should ensure that life threatening and subsequent injuries are identified and managed in an appropriate and timely manner. Management is based on a number of well-established principles

History

Vital information may need to be obtained from paramedics and observers when the patient is unable to give a full history (as is usually the case).

Mechanism

Head injuries arising from high energy mechanisms of injury, such as a fall from a height or a high-speed road accident. This makes multisystem injury (especially to the spine) likely so.

The possibility that a fall or crash may have resulted from a prior medical problem, such as myocardial infarction, hypoglycemia or subarachnoid hemorrhage, should be borne in mind when trying to get a full history

Neurological progression

A specific check should be made for any loss of consciousness at the time of injury, and its duration. The Glasgow Coma Score (GCS) and pupil responses at the scene and on arrival in Accident and Emergency should be obtained and documented.

GCS is an important index of developing, and potentially reversible, secondary injury. It is also useful to assess the extent of amnesia, retrograde (events prior to the injury) and anterograde (events afterwards).

Examination: primary survey

Patient assessment commences with a rapid primary survey during which lifesaving

Rapid primary survey in order of priority
Airway with cervical spine control
Breathing and ventilation (oxygenation)
Circulation and control of hemorrhage
Disability – assessment of neurological deficit
Exposure and environmental control

interventions are undertaken. Urgent investigations and other interventions are then performed. The patient is then re-evaluated (secondary survey), stabilized and when required, transferred to a facility for specialized care. It is during the rapid primary survey that consideration of life-threatening complications of facial injuries should be made.

The presence of facial injuries, even minor facial injuries, can have a significant influence on the overall management of the multiply injured patient. For example, a facial injury may mean that the airway needs to be protected, if necessary, by intubation, before CT scanning. In the same way associated general injuries may compromise the ideal management of the facial injury. Severe general injuries may be of such priority that any definitive management of facial trauma, other than control of bleeding will of necessity have to be postponed.

Facial injuries can broadly be placed into one of four groups, based on the urgency of treatment they require . Although true maxillofacial and ophthalmic emergencies that require immediate identification and/or management to preserve life or sight are uncommon, it is nevertheless important to be aware that delayed presentation can still occur.

Life- and sight-threatening problems can also develop following apparently minor injuries and may be easily overlooked. Because some problems may take a while to become clinically apparent anticipation is the key to good management. It is therefore important to be aware of such early warning signs as snoring, repeated requests to sit up, agitation or persistent tachycardia. Continual reassessment is an important part of patient care and helps to identify these problems early.

Triaging of facial injuries

1 'Within a few seconds'

Immediate life or sight-saving intervention is required – such as establishment of a surgical airway, control of profuse hemorrhage, or lateral canthotomy and cantholysis.

2 'Within a few hours'

Clinically 'urgent' injuries, such as heavily contaminated wounds and some contaminated open fractures (especially skull fractures with exposed dura). The patient is otherwise clinically stable.

3 'Within a few days'

Treatment can wait 24 h if necessary – some compound fractures and most clean lacerations.

4 'Within a week'

Treatment can wait over 24 h if necessary – many simple or closed fractures.

Neurological deficit

Gross focal neurological deficits, such as paraplegia, may be evident at the primary survey, and an assessment to exclude such deficit should be carried out, especially if the patient is to be intubated so that subsequent examination will be impossible. Detailed neurological examination is included in the secondary survey.

Glasgow Coma Score

The GCS is the sum of scores on three components as detailed in Table below. The breakdown of the GCS into eye opening, verbal and motor components should always be recorded and used when communicating the situation to other doctors. Remember that the score represents the best performance elicited, so a patient flexing in response to a painful stimulus on the left and localizing on the right scores

‘M5’. A sternal or supraorbital rub, or trapezius squeeze will usually be an appropriate stimulus.
Remember that 3/15 is the lowest possible GCS score!

Table Head injury severity: clinical classification.

Eyes open Spontaneously--- **4**
To verbal command---------- 3
To painful stimulus---------- 2
Do not open ----------1
Verbal Normal oriented conversation------ **5**
Confused ----------4
Inappropriate/words only ---------- 3
Sounds only ----------2
No sounds ----------1
Intubated patient ----------T
Motor Obeys commands ---------**6**
Localizes to pain----------5
Withdrawal/flexion---------- 4
Abnormal flexion----------3
Extension----------2
No motor response----------1

secondary survey

Head

Examination of the head should include inspection and palpation of the scalp for evidence of sub-galeal hematoma and scalp lacerations, which may bleed profusely, and potentially overlie fractures. Examine the face for evidence of fractures, especially to the orbital rim, zygoma and maxilla. Clinical evidence of a skull base fracture may include Battle’s sign (bruising over the mastoid), and ‘racoon’ or ‘panda’ eyes (bilateral periorbital bruising). Haemo-tympanum, or overt bleeding from the ear if the tympanic membrane has ruptured, and CSF rhinorrhea
or otorrhea (clear cerebro-spinal fluid usually mixed with blood coming from the nose or the ear) are also highly suggestive of a fracture of the base of the skull.
A complete examination of the cranial nerves will reveal, for example, facial or vestibulo-cochlear nerve damage associated with skull base fracture. Midbrain or brainstem dysfunction may produce gaze paresis (inability of eye to look across beyond the midline), dysconjugate gaze (inability of the eyes to work together), or roving eye movements. Inspect the conjunctiva and cornea of the eyes, and the retina using an ophthalmoscope, looking for hyphaema (blood in the anterior chamber of

the eye), papilloedema or retinal detachment. Blood in the mouth may be due to tongue-biting at seizure or at the time of trauma.
The GCS and pupil status, assessed as part of the primary survey, require re-evaluation at the secondary survey and regularly thereafter

Neck and spine

In moderate or severe traumatic brain injury (TBI), there is an associated cervical spine fracture in around 10 per cent of cases. Therefore, cervical spine injury must be presumed in the context of head injury until actively excluded. In a high energy mechanism, such as road traffic accident or fall from a height, thoracic and lumbar spine injuries must also be excluded. Plain x-rays are of limited value in excluding significant cervical spine injury. Even computed tomography (CT) imaging does not exclude the possibility of significant ligamentous injury.
Therefore, where possible, these patients should be managed in a hard collar until their spine can be cleared clinically

CLASSIFICATION OF SEVERITY AND TYPE OF HEAD INJURY

1- GCS

as it is the GCS – and in particular the motor score – that is the best predictor of neurological outcome.

-Discharge criteria in minor and mild head injury.

- GCS 15/15 with no focal deficits
- Normal CT brain if indicated (see below)
- Patient not under the influence of alcohol or drugs
- Patient accompanied by a responsible adult
- Verbal and written head injury advice: seek medical attention if:
    - Persistent/worsening headache despite analgesia
    - Persistent vomiting
    - Drowsiness
    - Visual disturbance
    - Limb weakness or numbness

  National Institute for Health and Clinical Excellence (NICE) guidelines for computed tomography (CT) in head injury.
- GCS <13 at any point
- GCS 13 or 14 at 2 hours
- Focal neurological deficit
- Suspected open, depressed or basal skull fracture
- More than one episode of vomiting
- Any patient with a mild head injury over the age of 65 years or
- with a coagulopathy, for instance warfarin use, should be scanned urgently

- Dangerous mechanism or injury or antegrade amnesia >30 minutes warrants CT within 8 hours

2- Intracranial hematoma

Hemorrhage within the cranium occurs in four main sites: extradural, subdural, subarachnoid and intraparenchymal. Each has a characteristic cause, presentation and treatment.

However, a common characteristic is that all cause a rise in intracranial pressure, which may compromise perfusion of the brain. Minimizing the secondary injury by making sure that the patient is well oxygenated and that their blood pressure is within normal limits is important in the early management of these cases

Management of head injuries

- Early discharge if NICE criteria are met
- Scalp wounds need closure
- Significant depressed fractures need elevating, antibiotics and antiepileptics
- Skull base fractures may be associated with CSF leak.
- Pneumococcus vaccination is valuable, but prophylactic antibiotics are not usually indicated

Types of Injury

Extradural hematoma

It results from rupture of an artery, vein or venous sinus, in association with a skull fracture. Typically, it is damage to the middle meningeal artery under the thin temporal bone. A low energy injury mechanism, perhaps with brief loss of consciousness, is sufficient to start the extradural bleeding. The patient may then present in the subsequent lucid interval with headache, once the limits of compensation have been reached after as long as some hours (see Monro Kellie doctrine) rapid deterioration follows. Overall mortality is around 10–20 per cent

Acute subdural hematoma

arises from rupture of cortical vessels. associated with a high energy injury mechanism and significant primary brain injury.

Conscious level is usually therefore impaired at presentation, but may deteriorate further as the hematoma expands. mortality in this group is about 50 per cent

Chronic subdural hematoma

The patient is generally elderly, may be taking antiplatelet or anticoagulant medications, and there is usually a history of a recent fall, or falls. Cerebral atrophy commonly found in the elderly is believed to stretch bridging veins. These can then rupture after only minor trauma, bleed, and then tamponade (stop bleeding due to

the pressure which has been produced by the bleed). Subsequent degradation of the blood clot over days or weeks
Drainage is performed using burr holes, often under local anesthetic (especially in elderly patients who present a substantial anesthetic risk).
Anticoagulation should be reversed either by administration of vitamin K.

Outcomes of a head injury

- Post-concussion syndrome gives persisting headaches and problems in concentrating
- Players concussed when playing sport should not return immediately to the field
- Good recovery is not necessarily a return to normal; it may be independent living

-The End -