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CLINICAL PRACTICE

Managing severe head injuries in Papua New Guinea

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Head injuries are the most important cause of death from trauma in developing countries. In Papua New Guinea (PNG) they account for 60% of trauma deaths, two-thirds of which occur before the patient reaches hospital.

The commonest causes of head injuries are assault, motor vehicle accidents and falls. In urban areas motor vehicle accidents are an important cause of severe head injury and in the tropics many people travel unprotected and unrestrained in the back of open utilities. The introduction and enforcement of safety regulations such as seat belts or bicycle helmets is also much less prevalent in developing countries. In rural areas falls from trees or falling coconuts cause some head injuries. Epidemiological data on head injuries are available from a number of sources listed in the reference list (1-9).

The first priority in head injury management is the airway (with cervical spine immobilization)

The brain needs oxygen and so always treat hypoxia first. Failure to secure the airway and establish ventilation in a patient are common causes of secondary brain damage.

The next priority is to maintain the circulating blood volume and blood pressure so that cerebral perfusion is adequate

A cerebral perfusion pressure (mean arterial pressure – intracranial pressure) of less than 60 mmHg is critical and damaging. You will not be able to measure the intracranial pressure but you can assume in a severe head injury it is at least 20 mmHg (normal is 12 mmHg) and so if the blood pressure drops below 100/70 (mean arterial pressure is therefore 80 mmHg) your patient is suffering secondary brain damage from hypotension.

The next priority is to assess the Glasgow Coma Score (GCS) and pupillary responses

This is the D of disability and then, providing the patient's ABC – airway, breathing and circulation – remain stable, you can proceed to a secondary survey. Repeated observation will detect deterioration in conscious level or a change in vital signs and indicate when to intervene.

The timing of X-rays: you will want to obtain a lateral cervical spine X-ray showing all 7 cervical vertebrae and the top of the first thoracic vertebra. Until you see such an X-ray you should assume the cervical spine may be injured and someone senior should look after the head and neck at all times. A lateral cervical spine may still miss up to 10% of cervical spine injuries. If you do not have a Stiffneck collar then sandbags on either side of the head may prevent rotation. Skull X-rays are not so important at this stage as you are going to admit the patient anyway.

All severe head injuries (GCS <9) need good observation. Some also need investigation. All unconscious patients would benefit from a computed tomography (CT) scan which will show the pathology but only a few will be able to afford it. If a patient goes to X-ray or for a CT scan someone senior must accompany the patient in case of deterioration. Never send patients away for investigation who may have an abdominal or thoracic injury. Most hypotensive patients have some other cause for their hypotension than the head injury.

Abdominal or thoracic injuries take priority over the head. The brain needs oxygen. It is extremely rare to have to do both a laparotomy and a craniotomy. Anaesthetists should

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recognize the need to explore an abdomen or thorax in unstable cases. The brain is more at risk from hypotension or hypoxia than from an anaesthetic.

When to make burr holes

In PNG up to half of the patients with a severe head injury will need exploration in order to evacuate a potential haematoma. Providing a patient is adequately oxygenated and resuscitated prompt evacuation of an extradural or subdural haematoma can be lifesaving and the results are gratifying despite the lack of technology or specific neurosurgical skills.

The indications for urgent craniotomy/burr holes are:

1 An unconscious patient with focal signs

2 An unconscious patient with history of a lucid interval

3 Deteriorating conscious level despite secure airway and blood pressure

4 Severe head injury with coma (GCS <9) and failure to improve

5 An open fracture in an unconscious or deteriorating patient.

When craniotomy is indicated operate without delay. Do not walk away from the patient and rely on others to transport him or her to theatre. Do not admit a patient to the ward who you know needs urgent burr holes. Take him straight to the theatre. Burr holes should commence within 15 minutes or faster if there is rapid deterioration. Do not wait for an anaesthetist who fails to turn up. Give local anaesthesia and try to decompress the head. Start at the most likely site of haematoma. In the event of a negative finding always explore the other side with 3 burr holes on each side. If the bone falls out do not worry about replacing it. Just try to close the dura or use some temporalis fascia to close the dura. Never be ashamed of doing a negative burr hole. It is much better to try, and in the absence of a CT scan it is difficult to know what the pathology is without making a burr hole. Diffuse cerebral injury in adults will result in death whatever you do but evacuation of a haematoma will often save a life.

Postoperative care

Ideally patients should be nursed in an intensive care unit (ICU) and preferably remain intubated and ventilated. Otherwise have the patient monitored in the best place to provide maximal care. Most patients die from lack of attention rather than lack of equipment.

Intensive care means doing your best for the patient with the resources you have available

The importance of maintaining intubation for at least a few hours postoperatively may need to be stressed in some parts of the country. Even in a rural hospital a patient could be ventilated overnight using an ambu bag. Keep the patient on oxygen.

Prolonged intubation and ventilation has many hazards in the tropics (blocked tubes or dislodged tubes in sedated patients). They are most common when the nurse:patient ratio falls below 1:1 and the staff are not well trained in intensive care.

Nurse the patient so that rises in intracranial pressure are minimized

Intracranial pressure monitoring is not available in PNG and its introduction is not a priority. It could sometimes be performed using a feeding catheter in the extradural space and a manometer (similar to that used for central venous pressure) if a burr hole had already been made. The best means of minimizing rises in intracranial pressure include nursing the patient with 15°-30° head up and keeping the core temperature below 38°C; an end tidal capnometer would enable cerebral vasodilatation due to hypercarbia to be avoided. Hyperventilation may be difficult to control, especially if blood gases are not available round the clock. Anaesthetists are usually in short supply and fully employed running operating lists and there are insufficient medical staff to roster a resident 24-hour ICU doctor even in Port Moresby.

Head wound management

Head wounds tend to heal well and so can be closed up to 24 hours after being inflicted.

Always try to cover exposed bone so the cranium does not necrose. Clean and debride the wound. Immunize against tetanus. If there is an underlying fracture it may need to be elevated before the wound can be completely cleaned. Elevation of a fracture will need a surgeon.

Prognosis

Research on head injuries in the tropics shows that the outcomes as judged from admission GCSs are fairly similar to overseas. A high proportion of head injuries are GCS 3-5 on admission perhaps because their ABCs are neglected in the early phase. If the GCS is 3-5 after resuscitation you can expect at least an 80% mortality. Patients with GCS 6-8 do better and audit figures suggest that up to 70% may survive. The mortality of subdural haematoma is over 60% even in the best centres. Bilateral haematomas also have a poor prognosis. You can expect to save 80% or more of the patients with extradural haematomas if you evacuate them promptly.

Finally you must sometimes stop treatment for the unsalvageable. Try to diagnose brain death in those with fixed and dilated pupils. Discontinue all sedative and opiate medications. The absence of any respiratory effort, pupillary response (to light or ice-cold water in the ears), corneal reflex or gag reflex suggests that the patient is brain dead. Repeat the tests an hour or two later. Then switch the machine off. Explain to the relatives that the patient is dead and that it is only the machine that is working. Discontinuing ventilation is a difficult decision and one that should preferably be made by two senior doctors and not left to the intern or junior registrar.

If you have never done burr holes try and practise on a cadaver and make yourself familiar with the instruments. 'Neurosurgery in the Tropics' (1) has a well-illustrated section on how to do burr holes and also how to manage head injuries.

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