

Guidelines on the management of a patient with a head injury

**College of Surgeons of Sri Lanka
2007**

Authors

- Dr. Prasanna Gunasena Consultant Neurosurgeon
Teaching Hospital Anuradhapura (Group Co-ordinator)
- Dr S.C. Abeysooriya- Consultant Neurosurgeon-
President Neurosurgeons Association Sri Lanka
- Dr Sunil Perera- Senior Consultant Neurosurgeon
National Hospital Sri Lanka
- Dr Himashi Kularatne- Consultant Neurosurgeon
National Hospital Sri Lanka
- Dr Saman Wadanambi- Consultant Neurosurgeon
Teaching Hospital Galle
- Dr Ranjith Wickramasinghe Consultant
Neurosurgeon Teaching Hospital Kandy
- Dr Jayantha Liyanage- Consultant Neurosurgeon
Teaching Hospital Kandy
- Dr A. Rajakaruna Consultant Neurosurgeon
National Hospital Sri Lanka

Contents

Summary of early management of Head Injury

		4-10
Chapter 1	Introduction	11
Chapter 2	Assessment, classification and stabilizing of a head injury patient	13
Chapter 3	Admission or discharge?	20
Chapter 4	Referral to a hospital with facilities to resuscitate and manage further	21
Chapter 5	Management in a specialized hospital without neurosurgical facilities	23
Chapter 6	Indications for a radiological evaluation of head injured patient	26
Chapter 7	Management of Intracranial Hypertension and post traumatic epilepsy	29
	Concluding remarks	35
	References	36
Annexures	Coma chart,	40
	Referral letter	41

Early Management of Head Injury

Summary

Assessment, stabilization and Transport

- Assessment should be done using the Glasgow coma scale.
- AVPU scale (Alert, response to Verbal commands, response to Pain, Unconscious) could be used in an emergency situation. However proper assessment using GCS should follow.
- Assess the parameters in the head injury observation chart while resuscitating.

- All patients with head injury should be resuscitated according to ATLS protocol
- Hypoxia, O₂ saturation < than 90%, Hypotension BP < than 90mmhg should be avoided.
- In children hypotension is defined as follows 0-1 year <65mmHg, 2-5 years <75mmHg, 6-12yrs <80mmHg , 13-16yrs <90mmHg. (Class 2 evidence).
- In any patient with a GCS below 12/15, the cervical spine has to be protected. Should be transported on a spinal board.
- If the GCS is blow 9/15, or if there is impending or established airway obstruction early action is needed to protect the airway.
- Dextrose or manitol should not be infused to treat hypotension. Crystalloids or colloids should be used for this purpose.

Glasgow Coma Scale

Feature	Scale	Score
Eye Opening	Spontaneous	4
	To speech	3
	To pain	2
	None	1
Verbal Response	Oriented	5
	Confusion conversation	4
	Words(inappropriate)	3
	Sounds (incomprehensible)	2
	None	1
Motor Response	Obey commands	6
	Localize pain	5
	Normal Flexion	4
	Abnormal Flexion	3
	Extension	2
	None	1
Total Coma Score		3/15- 15/15

Admission or discharge ?

Any patient with the following features should be admitted to the hospital.

1. The level of conscious is impaired
2. Fully conscious patient with following risk factors
 - Continuing amnesia (more than 5 minutes after the injury).
 - Continuing nausea and vomiting
 - A seizure
 - Focal neurological deficit
 - Irritability or altered behavior
 - Clinical or radiological evidence of recent skull fracture or suspected penetrating injury
 - Severe head ache or other neurological symptoms
 - An abnormal CT scan
3. The patient has significant medical problems.
4. The patient has social problems or cannot be supervised by a responsible adult.
5. Suspected non accidental injury

Referral to a Neurosurgery Unit

1. Impaired consciousness (GCS<15/15) at any time since the injury.
2. Presence of any neurological symptoms e.g.
 - Severe and persistent head ache.
 - Persistent nausea and vomiting
 - Irritability or altered behavior
 - Seizure
 - Focal neurological deficit
3. Clinical evidence of Skull fracture(e.g. CSF leak, periorbital haematoma)
4. Obvious penetrating injury
5. Amnesia for the incidence or subsequent events
6. Significant extracranial injury
7. Mechanism of injury suggest
 - High energy injury(RTA, Fall from height)
 - Possible penetrating injury
 - Possible non accidental injury(Child abuse)
8. Continuing uncertainty about the diagnosis.
9. Adverse social factors.

Inpatient observation

Frequency of observation

- ½ hourly for 6 hours, if stable
- 1 hourly for 4 hours if stable
- 2 hourly for 6 hours, if stable,
- 4 hourly thereafter until fit for discharge

When to get the Doctor to reassess?

- The development of agitation or abnormal behavior.
- A sustained decrease in conscious level of at least one point in the motor or verbal response, or two points in the eye opening response of the GCS
- The development of severe or increasing head ache or persisting vomiting.
- New or evolving neurological symptoms or signs such as pupil inequality or asymmetry of limb or facial movement.

Radiological Assessment

Indication for a CT scan

1. Patient is eye opening only to pain and does not converse (GCS12/15 or less)
2. A deteriorating level of consciousness or progressive focal neurological signs
3. Confusion or drowsiness (GCS13/15-14/15) followed by failure to improve within at most four hours of clinical observation.
4. New focal neurological signs which are not getting worse.
5. Radiological evidence of fracture regardless of the

level of consciousness

6. Full consciousness(GCS 15/15) with no fracture but other features e.g.
 - Severe and persistent headache
 - Nausea and vomiting
 - Irritability or altered behavior
 - A seizure

Indications for a Skull X-ray

Skull X-ray should be performed if any of the following apply and if a CT is not being performed.

- **If a patient is alert and oriented and obeying commands(but):**
 - **The mechanism of injury has not been trivial**
 - **Consciousness has been lost; or**
 - **Patient has lost memory or has vomited; or**
 - **The scalp has a full thickness laceration or a boggy haematoma; Or**
 - **The history is inadequate**
- **If the level of consciousness is impaired (GCS, 14/115).**

Dealing with specific problems related to Head Injury

General measure to lower the ICP

- Positioning; elevate head end of the bed 30-45 degrees, Prevent tilting of the head.
- Light sedation, Codeine 30-60mg 4 hourly or as needed, Lorazepam 1-2mg IV 6 hourly or SOS.
- Prevent hyperglycaemia(aggravate cerebral edema)
- Maintain eucapnoea (PCO₂ around 35 mmHg)
- Refer to the full text for the usage of manitol and guide lines on hyperventilation

Usage of prophylactic antiepileptic and management of status-epilepticus. - Refer to the full text

Head Injury management guidelines

Chapter1. Introduction

Note for the users of the guidelines

Management of head injury is a rapidly evolving area in Neurosurgery. The current guidelines are formulated using the acceptable evidence published to date. However the user should know the difference between the standard of care available and the guidelines before he or she adopts the recommendations of the guidelines .

Strength of recommendations

Grade A recommendations are made based on *Class 1* evidence (Evidence from Meta analysis of randomized controlled trial or from a single centre randomized controlled trail).

Grade B recommendations are based on *Class 2* evidence (Evidence from well designed controlled trails without randomization).

Grade 3 recommendations are based on *Class 3* evidence (Evidence from well designed non experimental descriptive studies such as comparative studies, correlation studies and case studies).

There are also good practice recommendations given in this document based on the experience of the guideline development group.

Head injury management guidelines are focused at the following levels of patient care

1. Pre-hospital care
2. Hospitals and primary care institutions where no facilities to handle surgical casualties (Central dispensaries, rural hospitals, peripheral units, general practitioners, ambulance services etc.).
3. Hospitals handling surgical casualties (Base hospitals and above).
4. Hospitals where neurosurgical facilities are available.

The guidelines will give information to deal with the following questions

1. How should head injured patient be assessed classified and stabilized?
2. What are the indications for referral to hospital of a patient with recent head injury?
3. What are the principles of care during transport and assessment at a primary care centre?
4. What are the indications for Neuro-imaging (skull x-ray, CT brain) following recent head injury?
5. Who should be admitted for observation either at primary secondary care or tertiary care?
6. Who should be discharged from the hospital?
7. How should the observation be continued in the hospital?
8. Who should be discussed with the neurosurgical unit?

Chapter 2 Assessment, classification and stabilizing of a head injury patient

Pre-hospital Care

Pre-hospital management of a head injured patient includes initial assessment and stabilization of the vital functions. There is no organized emergency paramedical or ambulance service support for head injured patients in Sri Lanka except in some areas in Colombo. Any health care institution below the district hospital level such as peripheral units, central dispensaries, general practitioners and any ambulance service authorized to deal with emergency patients are expected to follow the guidelines on assessment, stabilization, and transport of patients to a specialized centre. Any other hospital receiving an unattended patient should also follow the same guidelines to resuscitate them.

- **Assessment;** assessment of a severely head injured patient always starts with resuscitation. Early assessment and interventions help to reduce mortality and morbidity following head injury. Widely accepted Glasgow Coma Scale and the Score are recommended as the tools to evaluate the patients (Class 2 evidence). It is a reliable indicator of the severity of the head injury, specially changing score at two points of measurement. 77% of poor outcome (dead vegetative state or severely disabled) if the GCS is between 3-

5/15. 26% of poor outcome seen if the GCS is between 6-8/15.

- **Glasgow Coma Scale;** has three components. Eye opening, verbal response and motor response. Out of these three Motor response alone is the most reliable predictor of outcome.

Feature	Scale	Score
Eye Opening	Spontaneous	4
	To speech	3
	To pain	2
	None	1
Verbal Response	Oriented	5
	Confusion conversation	4
	Words(inappropriate)	3
	Sounds (incomprehensible)	2
	None	1
Motor Response	ObeY commands	6
	Localize pain	5
	Normal Flexion	4
	Abnormal Flexion	3
	Extension	2
	None	1
Total Coma Score		3/15-15/15

- As Some Centers in different parts of the world use an altered coma scale which has a score only up to 14, it is recommended to mention the denominator when ever documenting or communicating the GCS.
- Motor response to pain should be checked by applying nail bed pressure or pinching the axillary skin.

The AVPU (Alert, respond to Verbal commands, respond to Painful commands and Unresponsive) scale can be used as a quick evaluation tool at the field level. However these patients still need proper GCS assessment. It is recommended to communicate the level of consciousness using the coma scale rather than the score as three components of evaluation are more clearly described in the scale.

- **Assessment of Oxygenation and Blood pressure;** hypoxaemia (arterial oxygen saturation <90%) and hypotension (< 90mmhg systolic blood pressure) are significant parameters associated with poor outcome
- Oxygenation: should be measured using pulse-oxymeter and continuous monitoring is preferred to a single measurement.
- Blood pressure should be measured using a sphygmomanometer.

- In children hypotension is defined as follows 0-1 year <65mmHg, 2-5 years <75mmHg, 6-12yrs <80mmHg, 13-16yrs <90mmHg. (Class 2 evidence).
- **Assessment of pupils:** should be assessed after resuscitation. Asymmetry is defined as 1mm difference between pupils. Fixed pupil is defined as no response to bright light (<1mm). Any trauma to the frontal or periorbital region can cause discrepancies of pupillary size. Always mention the duration of pupillary dilatation in the clinical notes and on transfer forms.

Pupillary and light reflex pathways are situated adjacent to the structures that control the cognitive function and temporal lobe. Therefore the dilatations of pupils indicate herniation of brain or damage to the brain stem in a semiconscious or unconscious patient. Dilatation of one pupil denotes brain herniation and dilatation of both pupils indicate brain stem injury. In a large study of 305 in hospital patients absent pupillary reflex was associated with 91% mortality. However there is no class 1 or class 2 evidence to predict the poor outcome based on the duration of dilatation of pupils

- **Stabilizing the patient:** Initial stabilization of a patient should be done as specified in the ATLS[®] and paediatric trauma life support protocol. Any patient whose GCS is <12/15 or if the patient is not localizing

to the pain should be considered as having unstable cervical spine until the neck is cleared by doing either a Cervical spine X-ray or a CT. Until such time the neck of the patient should be protected using a Philadelphia collar and sand bags on either side of the head. This maneuver would give 40-50% protection to an unstable spine; therefore even with a collar the patient should only be moved by competent people (hospital staff or paramedics).

Recommendations for resuscitation and stabilization

- No A grade recommendations on maintenance of airway ventilation and oxygenation
- Grade B recommendations; Air way should be maintained by clearing the air way, keeping the patient on lateral position while protecting the cervical spine and oropharyngeal air way. The air way should be secured if the GCS is below 9/15 by endotracheal intubation in the ideal setting. However the clinician could adopt an alternate method of protecting the air way based on the available facilities and the man power in the locality. *(In children the threshold should be low. Hypoxemia should be avoided with supplementary O2 administration. There is no difference between ET intubation and bag- valve-mask ventilation to maintain oxygenation)*

- Routine **prophylactic hyperventilation should be avoided.**
- Normal ventilation is defined as approximately 10 breaths per minute (bpm), children 20bpm, and infants 30bpm. Hyperventilation is defined as approximately 20bpm for adults, 30bpm for children, and 35-40bpm for infants.

Hypoxia (defined as apnoea, cyanosis. PaO₂<60-65mmHg, O₂ saturation <90%) should be corrected without delay.

Oxygenation and ventilation should be continuously assessed using pulse-oxymeter and end tidal CO₂ monitoring.

- Fluid resuscitation; No A grade recommendations.
- Grade B recommendations suggest usage of isotonic crystalloid solutions should be used to prevent hypotension or to limit hypotension to the shortest possible time. Usage of hypertonic solutions and Dertran, should be done in consultation with a specialist. Colloid solution and blood could be used as needed. *Manitol and dextrose as solutions to treat hypotension should be avoided*
- Class 3(Grade C recommendations) evidence suggests Gauge 16 or bigger canulae for IV access preferable in the upper limbs.

If a patient with severe head injury has hypotension, it is important to look for another cause for blood loss (Abdomen Chest or limbs). However in infants and small children scalp bleeding itself can cause life threatening hypotension. The Cushing's reflex following head injury is due to raised ICP causing hypertension and bradycardia. However during terminal stages of coning the patient's blood pressure starts to drop which is difficult to control.

In children hypotension is defined as systolic blood pressure below the fifth percentile for the age or features of shock. The lowest limit of systolic blood pressure (5th percentile) is calculated by the formula $70\text{mmHg} + (2 \times \text{age in years})$

Chapter 3: Admission or discharge?

Patients are admitted with evidence of either pending or already existing injury to the brain. A patient should be admitted to the hospital if;

The level of conscious is impaired

Fully conscious patient with following risk factors

- Continuing amnesia (more than 5 minutes after the injury).
- Continuing nausea and vomiting
- A seizure
- Focal neurological deficit
- Irritability or altered behavior
- Clinical or radiological evidence of recent skull fracture or suspected penetrating injury
- Severe head ache or other neurological symptoms
- An abnormal CT scan

The patient has significant medical problems.

The patient has social problems or cannot be supervised by a responsible adult.

Suspected non accidental injury

A patient can be discharged from the primary care hospital if he or she does not have any of the above

Chapter 4: Referral or transfer to a hospital with facilities to resuscitate and manage further

- Recommendations are mainly directed towards the general practitioners, central dispensaries, peripheral units, rural hospitals and district hospitals.
- Hospitals with facilities to resuscitate and further managements include base hospitals and above in the hierarchy.

Patients should be referred to a hospital with neurosurgical services from a primary care institution, a general practice or any other similar institution guided by the recommendations in the box below.

Recommendation 1, 2, 3, 4 the patient can be directly transferred to a hospital where neurosurgical facility is available.

However considering the delay in transfer and the accessibility to transport facility the clinician in a far away hospital may have a lower threshold to transfer

Reasons for transfer

1. Impaired consciousness (GCS<15/15) at any time since the injury.
2. Presence of any neurological symptoms e.g.
 - Severe and persistent head ache.
 - Persistent nausea and vomiting
 - Irritability or altered behavior
 - Seizure
 - Focal neurological deficit
3. Clinical evidence of Skull fracture(e.g. CSF leak, periorbital haematoma)
4. Obvious penetrating injury
5. Amnesia for the incidence or subsequent events
6. Significant extracranial injury
7. Mechanism of injury suggest
 - High energy injury(RTA, Fall from height)
 - Possible penetrating injury
 - Possible non accidental injury(Child abuse)
8. Continuing uncertainty about the diagnosis.
9. Adverse social factors.

Chapter 5: Inpatient observation and evaluation of head injured patients during admission in a secondary or tertiary care hospital.

The patients who are admitted for observation to any hospital mentioned above should be carefully and regularly monitored as specified below. The aim is to detect promptly the patients who deteriorate neurologically who may need referral to a neurosurgical unit, to confirm satisfactory recovery and to enable discharge in the majority of patients.

Any hospital admitting the patients for observation;

- Should document the details of the mechanism of the injury; quantify the degree of force (Low velocity, high velocity) time of injury, and the neurological status as specified in the sample form (Annexure1).
- Nursing staff should assess the GCS at the time of admission to the ward and compare it with the GCS at the PCU or at the OPD or any other previous assessment. Any discrepancy between these assessments, suggesting deterioration, or other concerns about the patient's condition should be immediately discussed with the medical staff.
- Children under three years who have sustained head injury are particularly difficult to evaluate and the clinician should have a low threshold of

suspicion for early consultation with the specialist neurosurgical team.

- As the basis of early diagnosis and intervention is depend on the monitoring of the patients it is important to train the surgical team to properly assess and record the GCS pupils, limb movements and the other vital signs (BP, Pulse, Respiratory rate, temperature, saturation).
- **Frequency of observation;** The risk of rapid deterioration is higher during the first 6 hours after injury. therefore any patient who s admitted should be observed in the following frequency
 - ½ hourly for 6 hours, if stable
 - 1 hourly for 4 hours if stable
 - 2 hourly for 6 hours, if stable,
 - 4 hourly thereafter until fit for discharge
- Grade C recommendations. Medical staff should assess the patient on admission and at least once they have to check the patient during the first 24 hours on routine basis. Examination includes GCS, Neck movement, limb power, pupil reaction, other cranial nerves, and signs of basal skull fracture. In addition to this routine evaluation medical staff should attend when the nursing staff calls them for reappraisal.

Any of the following examples of neurological deterioration should prompt urgent neurological appraisal by a doctor;

- The development of agitation or abnormal behavior.
- A sustained decrease in conscious level of at least one point in the motor or verbal response, or two points in the eye opening response of the GCS
- The development of severe or increasing head ache or persisting vomiting.
- New or evolving neurological symptoms or signs such as pupil inequality or asymmetry of limb or facial movement.

If reappraisal confirms any neurological deterioration, first step is to ensure that the air way is clear, the oxygenation and circulation are adequate. If the above mentioned parameters are within the normal limits it is indicated to obtain a CT scanning of the brain and specialized neurosurgical opinion urgently.

Chapter 6; Indications for a radiological evaluation of head injured patient

There is view that A CT scan should be done in every head injured patient in whom there is any concern about an intracranial lesion. However Over use of CT scan has disadvantages. Time and effort to perform CT, possible hazards of transfer, and occasionally the need for anesthesia are some of these. Therefore guidelines specify the indications to perform a CT scan as a primary investigation or as secondary to Skull X-ray.

1. Patient is eye opening only to pain and does not converse (GCS12/15 or less)
2. A deteriorating level of consciousness or progressive focal neurological signs
3. Confusion or drowsiness (GCS13/15-14/15) followed by failure to improve within at most four hours of clinical observation.
4. New focal neurological signs which are not getting worse.
5. Radiological evidence of fracture regardless of the level of consciousness
6. Full consciousness(GCS 15/15) with no fracture but other features e.g.
 - Severe and persistent headache
 - Nausea and vomiting
 - Irritability or altered behavior
 - A seizure

Category (1) (2) should be scanned as an emergency. Category 3- 6 should be scanned urgently. When clinical features are strongly suggestive of an intracranial haematoma, there should be a discussion with the neurosurgeon about the benefits of transferring to a place with facilities for neurosurgical intervention.

In children significant intracranial injury can occur in the absence of a skull fracture more often than is the case in adults, therefore the clinician should have a high degree of suspicion when dealing with pediatric patients. Clinical features such as tense fontanelles should be considered to order a CT scan.

Indication for Skull X-ray

Indications for Skull X-ray have to be considered in the context of the indications for CT. If an urgent CT scanning of the brain is already planned there is no point getting a skull X-ray.

Features in the history that increases the chance of a positive finding in skull X-ray:

- Persisting impairment of level of consciousness or neurological signs.
- In those who have recovered, A history of loss of consciousness or amnesia, nausea vomiting.
- Inadequate history to establish the conscious state.

Clinical signs that correlate with the likelihood of a fracture include.

- A full thickness Scalp laceration.
- A boggy haematoma
- Leak of CSF or Blood from the nose or ear.
- Periorbital bruising.

Skull X-ray should be performed if any of the following apply and if a CT is not being performed.

- **If a patient is alert and oriented and obeying commands(but):**
 - **The mechanism of injury has not been trivial**
 - **Consciousness has been lost; or**
 - **Patient has lost memory or has vomited; or**
 - **The scalp has a full thickness laceration or a boggy haematoma; Or**
 - **The history is inadequate**
- **If the level of consciousness is impaired (GCS, 14/115).**

Doctors who interpret and make the clinical decisions based upon skull films or scans should be trained to do so. All imaging should be reviewed by an experienced radiologist as soon as possible.

Chapter 7: Management of Intracranial Hypertension and post traumatic epilepsy

In addition to the resuscitation and stabilization of a head injured patient, it is important to identify the life threatening problems that may arise during the first 24 to 48 hours. The following recommendations are to guide the clinician to deal with the problems in an emergency situation. However the discretion is with the clinician in charge of the patient to alter the treatment appropriately to suit the facilities in the hospital.

Management of Intracranial Hypertension

- Diagnosis of raised ICP based on clinical, radiological and by intracranial pressure monitoring. Deterioration of GCS (one from motor and verbal components and two from eye opening) pupillary changes (increasing in size, sluggish or no reaction to light) abnormal motor posturing, and progressive neurological deficit are clinical feature attributable to raised ICP.
- CT scan showing reduced CSF spaces (ventricles and basal cisterns), intracranial SOL, absent corticomedullary demarcation, indicate increased ICP.
- Intracranial pressure (ICP) of 20 mmHg measured by an ICP monitoring device is considered the upper limit, which require urgent intervention.

- No evidence to recommend pre-hospital prophylactic use of manitol to control ICP. Therefore until a patient comes to a secondary care centre where there are facilities to evaluate the head injury and plan for proper management use of manitol will only be an option for the clinician in the local hospital setting to use for life saving purposes.
- All the patients should be catheterized before starting manitol.
- 20% manitol 0.25-1g/Kg body weight could be given in as boluses infusions. Action starts 15-30 mts. Effect last 1.5-6 hours.
- There is no place for continuous manitol infusion. (As manitol opens the blood brain barrier (BBB) it can cross the BBB and draw fluid in to the brain, therefore manitol infusion can further aggravate vasogenic cerebral edema.

Complications of manitol use;

over enthusiastic bolus use can raise the blood pressure, leading to raised cerebral perfusion and aggravate coning, can precipitate acute renal failure, interfere with the diagnosis of Diabetes insipidus. If the raised ICP is due to hyperaemia manitol can further deteriorate the patient.

- Manitol used more than three occasions can be harmful to the patient unless there is a specific neurosurgical indication. Therefore Non neurosurgical

centers should only use manitol either to cover period of patient transfer to a neurosurgical centre or after discussing with the neurosurgical team.

- **Hyperventilation;** Based on the clinical and radiological feature if the patient's raised ICP is aggravated by hyperaemia of the brain, hyperventilation for a limited period will be benefited. (20bpm for adults, 30bpm for children and 35-40bpm for infants) hyperventilation should be stopped as soon as the features of coning disappeared.

General measures to lower the ICP

- Positioning; elevate head end of the bed 30-45 degrees, Prevent tilting of the head.
- Light sedation, Codeine 30-60mg 4 hourly or as needed, Lorazepam 1-2mg IV 6 hourly or SOS.
- Prevent hypergycaemia(aggravate cerebral edema)
- Maintain eucapnoea (PCO₂ around 35 mmHg).

<p>If the patients clinical deterioration is due to raised ICP. Patient should be transferred to a neurosurgical centre where intracranial pressure monitoring can be done. It is preferred to discuss the patient with the neurosurgical team before transferring</p>
--

Prevention and management of post traumatic seizures Use of prophylactic antiepileptics

- There is no indication to use prophylactic antiepileptics if the GCS is $> 8/15$ unless there is a space occupying lesion.
- Prophylactic use of antiepileptics are recommended in patients with GCS below 8/15 to prevent early post traumatic seizures. Anti epileptic drugs (AED) can be tailed off after one week of treatment.
- Any parenchymal injury, seizure within the first 24 hours after injury, Glasgow coma score less than 10/15, penetrating brain injury, and history of significant alcohol abuse carries a higher risk of developing **early post traumatic seizures**. Therefore the use of prophylactic antiepileptics as a short course is recommended.

Early post traumatic seizures (PTS); Occurs less than 1 week after head trauma 30% incidence after severe trauma. 1% incidence after minor trauma.

Late onset PTS; 7 days after head trauma. Incidence 10-13% with in 2 years after severe head trauma.

- Phenytoin sodium is recommended for the adults and children above 5 year. Loading dose 20mg/Kg body weight. Rate of administration $< 50\text{mg}/\text{min}$. In pediatric patients the rate is $1-3\text{mg}/\text{kg}/\text{min}$. Maintenance dose $4-8\text{mg}/\text{kg}$ body weight.

- Phenobarbitone is preferred in children below 5 yrs Paediatric patients the loading dose is 5-10mg/Kg/over 20-30min (total dose 20-30mg/Kg and maintenance dose 2-6mg/Kg in divided doses.
- Patient who is paralyzed and ventilated in the post head injury period may get non epileptic seizures, which will manifest as unexplained episodes of hypertension and tachycardia. EEG is helpful to confirm the diagnosis.

The rate of post traumatic seizures after severe head injury in children ranges from 20-30% which is significantly higher than in adults. However the rate of late onset seizures is less than that of adults which is about 10-12%.

In any patient on phenytoin treatment, with post head injury vertigo, cerebellar signs and lack of concentration, it is necessary to think about phenytoin toxicity in the deferential diagnosis.

Management of status epilepticus

Definition;

Continuous seizure activity for more than 30 mins or multiple seizures with out full recovery of consciousness between seizures.

Treatment;

- Lorazepam 4mg IV slowly over 2 mins, may repeat after 5 mins. Or Diazepam 0.2mg/Kg at a rate of 5mg/min can be given (takes 2-4 mins to start action). If ineffective give over 5 mins, up to three additional doses. In paediatric patients 0.2-0.5mg/kg with maximum 5mg if < 5yrs. Maximum 10mg if >5 yrs.
- Simultaneously load with phenytoin 1200mg (20mg/Kg) if not on treatment, 500mg if on treatment. (Takes 10- 15mins to start action). Phenytoin sodium is recommended for the adults and children above 5 year. Loading dose 20mg/Kg body weight. Rate of administration <50mg/min in adults. In pediatric patients the rate is 1-3mg/kg/min.
- Children less than 5yrs, neonates, patients with arrhythmias, phenobarbitone is preferred. Loading dose 15-20mg/Kg, rate should be <100mg/min for adults. Paediatric patients the loading dose is 5-10mg/Kg/over 20-30min (total dose 20-30mg/Kg and maintenance dose 2.5mg/Kg/hour.(Follow the EEG to maintain burst suppression)
- If Seizure continues 30 mins, intubate and begin general anesthesia.

If patients are given benzodiazepines to control status epilepticus, there should be facilities to maintain air way and ventilation of the patient.

Concluding remarks

Best practice guidelines are intended to improve the quality of care of head injured patients. You may find that some times it is difficult to implement the guidelines due to lack of facilities in the institution. However with time the facilities will be provided to implement the recommendations of the guidelines. It is also the responsibility of the local authorities to get the necessary facilities through their decentralized units. Incase of any difficulty in managing head injured patients, all the doctors who are in first contact with the patients are welcome to discuss the problem with the relevant neurosurgical centre.

References

1. US Department of Health and Human Services. Agency for Health Care Policy and Research. Acute pain Management: operative or medical procedures and trauma. Rockville (MD): The Agency; 1993. Clinical Practice Guideline No.1. AHCPR Publication No. 92-0023.p.107.
2. Jennett B, MacMillan R. Epidemiology of head injury. *BMJ* 1981; 282:101-7.
3. Thornhill S, Teasdale GM, Murray GD, McEwen J, Roy CW, Penny KI. Disability in young people and adult one year after head injury: prospective cohort study. *BMJ* 2000; 320:1631-5.
4. Rose J, Valtonen S, Jennett B. Avoidable factors contributing to death after head injury. *BMJ* 1977; 2:615-8.
5. Jennett B, Carlin J. Preventable mortality and morbidity after head injury. *Injury* 1978; 10:31-9.
6. Rockswold GL, Leonard PR, Nagib MG. Analysis of management in thirty-three closed head injury patients who 'talked and deteriorated'. *Neurosurgery* 1987; 21:51-5.

7. Mendelow AD, Karma MZ, Paul KS, Fuller GA, Gillingham FJ. Extradural haematoma: effect of delayed treatment. *BMJ* 1979; 1:1240-2.
8. Klauber MR, Marshall LF, Luerssen TG, Frankowski R, Tabaddor K, Eisenberg HM. Determinants of head injury mortality: importance of the low risk patient. *Neurosurgery* 1989; 24:31-6.
9. O'Sullivan MG, Gray WP, Buckley TF. Extradural haematoma in the Irish Republic: an analysis of 82 cases with emphasis on delay. *Br J Surg* 1990; 77:1391-4
10. The management of acute head injury: seminar papers. London: DHSS 1983.
11. Guidelines for initial management after head injury in adults. Suggestions from a group of neurosurgeons. *BMJ* 1984; 288:983-5
12. Report of the Working Party on Head Injuries. London: Royal College of Surgeons of England Commission on the Provision of Surgical Services: 1986.
13. Bartlett J, Kett-White R, Mendelow AD, Miller JD, Pickard J, Teasdale G. Recommendations from

- the Society of British Neurological Surgeons. *BrJ Neurosurg* 1998; 12(4): 349-52.
14. The Royal College of Radiologists. Making the best use of a department of clinical radiology: guidelines for Doctors. 4th Ed. London; The College; 1998.
 15. Royal College of Surgeons of England. Report of the Working Party on the Management of Patients with Head Injuries. London: The College; 1991.
 16. Working Party of the British Paediatric Association and British Association of Paediatric Surgeons, Joint Standing Committee in Childhood Accidents. Guidelines on the Management of Head Injuries in Childhood. London: British Paediatric Association; 1991.
 17. American College of Surgeons, Committee on Trauma. Advanced Trauma Life Support Manual. 6th Ed. Chicago: American College of Surgeons; 1997.
 18. Brain Trauma Foundation, American Association of Neurological Surgeons, Joint Section on Neurotrauma and Critical Care. Guidelines for the

- management of severe head injury. *J. Neurotrauma* 1996; 13:641-734.
19. Maas AI, Dearden M, Teasdale GM, Braakman R, Cohadon F, Iannotti F, et al. EBIC-guidelines for management of severe head injury in adults. European Brain Injury Consortium. *Acta Neurochir (Wein)* 1997; 139:286-94.
 20. Working Party of the Neuroanaesthesia Society and Association of Anaesthetists. Recommendations for the transfer of patients with acute head injuries to Neurosurgical Units. London: Neuroanaesthesia Society of Great Britain and Ireland and the Association of Anaesthetists of Great Britain and Ireland: 1996.

Disclaimer of liability

The recommendations given in this document reflect the current state of knowledge up to the year 2006, and intend to provide accurate and authoritative information regarding the subject matter covered. As the knowledge and the technology is continuously up graded it is assumed, these recommendations will be reviewed at appropriate time. Even though these recommendations are appropriate to use in all circumstances, adherence to the recommendations not ensure successful outcome every case. The ultimate judgment regarding particular clinical procedure or treatment plan must be made by the doctor in light of the clinical data presented by the patient and the diagnostic and treatment options available.

Significant departure from the national head injury management guide lines should documented with reasons in the patients clinical notes.

Review of guidelines

Any change to the current guide lines will be published in the College of Surgeons website and the amendments will be circulated among the government institutions through departmental circulars