EMERGENCY TRAUMA GUIDELINES

ON

MEDICAL, SURGICAL, NURSING AND REHABILITATION MANAGEMENT OF HEAD INJURY EXPECTED IN THE EVENT OF MASS CASUALTY INCIDENT SCENARIO

Kathmandu, Nepal
2014
Emergency Trauma Guidelines
On
Medical, Surgical, Nursing and Rehabilitation Management of Head Injuries Expected in the Event of Mass Casualty Incident Scenario

Developed by
Curative Services Division, Ministry of Health and Population
Government of Nepal
(2014, Kathmandu, Nepal)

Prepared under
“Enhancing Emergency Health and Rehabilitation Response Readiness Capacity of Health System in The Event of High Intensity Earthquake in Kathmandu Valley” Project

Facilitated by
Handicap International and Nepal Red Cross Society

Funded by
Humanitarian Aid and Civil Protection Department of the European Commission

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Consortium Sponsor:</td>
<td>Humanitarian Aid and Civil Protection Department of the European Commission</td>
</tr>
<tr>
<td>Consortium Coordinator</td>
<td>WHO Country Office Nepal</td>
</tr>
<tr>
<td>National Partner:</td>
<td>Nepal Red Cross Society</td>
</tr>
<tr>
<td>Activity coordinator:</td>
<td>Handicap International.</td>
</tr>
</tbody>
</table>
### CORE TECHNICAL WORKING GROUP:

<table>
<thead>
<tr>
<th>Names</th>
<th>Position</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Gunraj Lohani</td>
<td>Chief (Coordinator)</td>
<td>MOHP / Curative Services Division</td>
</tr>
<tr>
<td>Dr. Mohan Raj Sharma</td>
<td>Consultant Neurosurgean and Lead for technical working group</td>
<td>TUTH</td>
</tr>
<tr>
<td>Dr. Nilam Kumar Khadka</td>
<td>Consultant Neurosurgean</td>
<td>Bir Hospital/NAMS</td>
</tr>
<tr>
<td>Ms. Roshani Laxmi Tuitui</td>
<td>Hospital Nursing Administrator</td>
<td>Bir Hospital/Neuro</td>
</tr>
<tr>
<td>Ms Amrita Shrestha</td>
<td>Nurse, Head of OT</td>
<td>Annapurna Neuro Hospital</td>
</tr>
<tr>
<td>Mr. Prashidha Khadgi</td>
<td>Physiotherapist</td>
<td>Annapurna Neurological Hospital</td>
</tr>
<tr>
<td>Mr. Anil Devkota</td>
<td>Physiotherapist</td>
<td>Sahara Care Home- Rehabilitation hospital</td>
</tr>
<tr>
<td>Mr. Tulsi Prasad Dahal</td>
<td>Section Officer</td>
<td>MOHP / Curative Services Division</td>
</tr>
</tbody>
</table>

### HIGH LEVEL ADVISORY GROUP

<table>
<thead>
<tr>
<th>Names</th>
<th>Position</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Sheela Verma</td>
<td>Chief Specialist (Coordinator)</td>
<td>MOHP / Curative Services Division</td>
</tr>
<tr>
<td>Dr. Gunraj Lohani</td>
<td>Chief</td>
<td>MOHP / Curative Services Division</td>
</tr>
<tr>
<td>Ms. Ishwori Devi Shrestha</td>
<td>Chief</td>
<td>MOHP / Nursing Section</td>
</tr>
<tr>
<td>Mr. Mahendra Shrestha</td>
<td>Director</td>
<td>MOHP/ NHTC</td>
</tr>
<tr>
<td>Mr. Sunil Raj Sharma</td>
<td>Director</td>
<td>MOHP/ NHEICC</td>
</tr>
<tr>
<td>Mr. Kushumakar Dhakal</td>
<td>Under Secretary</td>
<td>MOHP / Curative Services Division</td>
</tr>
<tr>
<td>Prof. Dr. Bachchu Ram K.C</td>
<td>Commandant, Orthopaedic Surgeon</td>
<td>Shree Birendra Hospital</td>
</tr>
<tr>
<td>Dr. Babu Ram Marasini</td>
<td>Director</td>
<td>MOHP / EDCD</td>
</tr>
<tr>
<td>Dr. R. P. Choudhary</td>
<td>Surgeon and Inter burns Unit</td>
<td>Kanti Bal Hospital</td>
</tr>
<tr>
<td>Prof. Dr. Pawan K. Sultaniya</td>
<td>HOD- Neurosurgean and former President, Nepalese Society of Neurosurgeons</td>
<td>Bir Hospital/ NAMS</td>
</tr>
<tr>
<td>Prof. Dr. Pradeep Vaidya</td>
<td>Surgery and President Association of Surgeons</td>
<td>TUTH</td>
</tr>
<tr>
<td>Prof. Dr. Basant Pant</td>
<td>Neurosurgeon and President, Nepalese Society of Neurosurgeons</td>
<td>Annapurna Neuro Hospital.</td>
</tr>
<tr>
<td>Ms. Sudha Vaidya</td>
<td>Nursing Director</td>
<td>Bir Hospital/ NAMS</td>
</tr>
<tr>
<td>Ms. Gayatri Thapa</td>
<td>HOD, Physiotherapy</td>
<td>Bir Hospital</td>
</tr>
<tr>
<td>Dr. Edwin C. Salvador</td>
<td>Technical Officer</td>
<td>WHO</td>
</tr>
</tbody>
</table>
### List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABCDE</td>
<td>Airway, Breathing, Circulation, Disability, Exposure</td>
</tr>
<tr>
<td>ADL</td>
<td>Activities of daily living</td>
</tr>
<tr>
<td>CPP</td>
<td>Cerebral perfusion pressure</td>
</tr>
<tr>
<td>C- Spine</td>
<td>Cervical spine</td>
</tr>
<tr>
<td>CSF</td>
<td>Cerebrospinal fluid</td>
</tr>
<tr>
<td>CT</td>
<td>Computed tomography</td>
</tr>
<tr>
<td>GCS</td>
<td>Glasgow Coma Scale</td>
</tr>
<tr>
<td>ECG</td>
<td>Electrocardiography</td>
</tr>
<tr>
<td>Hb</td>
<td>Hemoglobin</td>
</tr>
<tr>
<td>ICP</td>
<td>Intracranial pressure</td>
</tr>
<tr>
<td>ICU</td>
<td>Intensive care unit</td>
</tr>
<tr>
<td>IV</td>
<td>Intravenous</td>
</tr>
<tr>
<td>LOC</td>
<td>Loss of conscious</td>
</tr>
<tr>
<td>MBP</td>
<td>Mean blood pressure</td>
</tr>
<tr>
<td>MCI</td>
<td>Mass casualty incident</td>
</tr>
<tr>
<td>NG</td>
<td>Nasogastric</td>
</tr>
<tr>
<td>TBI</td>
<td>Traumatic brain injury</td>
</tr>
<tr>
<td>TENS</td>
<td>Transcutaneous nerve stimulator</td>
</tr>
<tr>
<td>TOPICS</td>
<td>PAGE NO.</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>I. Background and the rationale for developing head injury management guideline</td>
<td></td>
</tr>
<tr>
<td>II. Head Injury Overview</td>
<td></td>
</tr>
<tr>
<td>III. Principle of care for Head Injury Injuries in MCI scenario through a multidisciplinary approaches</td>
<td></td>
</tr>
</tbody>
</table>
| IV. Management of Injuries  
1. Diagnostic Considerations  
2. Definite Management |  |
| V. Referral service |  |
| VI. Patient Instructions |  |
| VII. Reference Documents |  |

Appendix

Appendix I: Places in Nepal where trained Neurosurgeons work full time.
Appendix II: Places in Nepal where CT scan facility exists.
Appendix III: Key points in Nursing Management
Appendix-IV: Key points in Physiotherapy Management
I. BACKGROUND AND THE RATIONALE FOR DEVELOPING HEAD INJURY MANAGEMENT GUIDELINE

The entire territory of Nepal lies in high seismic hazard zone. The country's high seismicity is related to the movement of tectonic plates along the Himalayas that has caused several active faults. The entire country falls in a high earthquake intensity belt: almost the whole of Nepal falls in high intensity scale of MMI IX and X for the generally accepted recurrence period. Nepal is identified as the 11th most vulnerable country for earthquakes (UNDP/BCP 2004) (NRRC, 2011).

For seismic vulnerability, Kathmandu Valley is placed in the first place even if the whole country is vulnerable to earthquakes due to Nepal’s geographical position. Kathmandu is considered as one of the most at risk cities in the world in terms of potential deaths because of the poor urban planning and high density population. The expansion of urban areas in the Valley is poorly planned and haphazard. Building codes are not followed and most of constructions are not earthquake resilient. The urbanization rate and population growth are concentrated in the Kathmandu Valley, which hosts more than 31% of Nepal urban population. Not only do these factors greatly contribute to the Valley’s vulnerability to earthquake, they present additional earthquake risk.

Major earthquakes reported during the 20th Century in Nepal have claimed over 11,000 lives (NSDRM, 2009). The country has a long history of destructive earthquakes. Records from 1255 AD suggest that major earthquakes like the great Bihar Nepal (1934) occur on average every 75 years and are inevitable in the long run and likely in the near future. If an earthquake of the 1934 magnitude strikes today, reports estimate that we could expect over 100’000 deaths, over 300’000 injured, over 60% buildings destroyed or collapsed, over 700,000 homeless population, over 50% bridges impassable and up to 95% Water supply pipes damaged (MoHA 2011).

Additional risk factors consist in lack of systematic emergency response system and preparedness capacity, which will contribute to be major causative factors for large scale damages to property and lives. Furthermore, logistical constraints will put pressure on the whole country if an earthquake hits the capital, particularly on the most vulnerable Regions.

At this stage, in a Kathmandu Valley earthquake scenario, the overall health response during the first days to first weeks would be gravely chaotic, without any access to international assistance. Most Institutions would most likely be non-operational due to earthquake impact on lives and infrastructures, health actors will respond to the best of their knowledge without pre-established coordination and information sharing mechanisms.

Most of the coordination issues faced during other major natural disasters, such as those of the 2010 Haiti earthquake would appear: (1) the access to national health information management system would be impossible; without shared and agreed upon contingency and response plans health actors would immediately respond in an uncoordinated manner therefore increasing the risk to exclude victims in certain areas due to the irrelevant dispatch of human and material resources; (2) the lack of medical, surgical, nursing and rehabilitation protocols/guidelines for the injuries expected during earthquake disasters would result in a higher number of medical and rehabilitation cases and (3) the poor implementation of national mass casualty strategy would create additional burden for first responders.

The lessons that came out from Haiti (which resembles Kathmandu valley- in topography, population) earthquake disasters were the highly variable quality and methods used to treat people:

(1) With injuries necessitating (or not) amputation there were over 4000 amputations, causing excessive burden on the country’s health system. We extrapolate that situation to the less publicized but also likely
situations of people with trauma cases like complex fractures, spinal cord injuries, amputations, head injuries and burn injuries.

(2) Varied approaches adapted by different health humanitarian actors arriving in country due to lack of national emergency trauma protocols / guidelines on medical, surgical, nursing and rehabilitation management of injuries approved by MOHP. This resulted in variable treatment approaches resulting in high number of complications including highly disabling consequences latter requiring complicated and at times high cost medical and surgical intervention.

(3) The discontinuity of care resulting when a multidisciplinary approach is not implemented well and when there is not a common file to follow the patients or no transmission of data from one organization to another and back to community level.

High casualty numbers pose a tremendous challenge to any national health system particularly when planning and preparedness for comprehensive response are not in place. The health sector is particularly vulnerable to the effects of disasters because of the Nepal’s development challenges which translate into a limited margin of human, material and financial resources. Disasters tend to have a two-fold impact on health systems: directly, through damage to the infrastructure and health facilities and the consequent interruption of services at a time when they are most needed, and indirectly through the unexpected number of casualties, injuries and illnesses in affected communities. Avoiding preventable mortality and morbidity is critical and is more than a health issue: it is a multi-sectorial effort that requires the participation of a wide variety of actors at all levels.

Learning from the above disasters, the rationale is to have national standards approved by MOHP for medical, surgical, nursing and rehabilitation management trauma cases on mass casualty incidences (earthquake scenarios) resulting from earthquake disaster that will be abiding for all the national and international health stakeholders providing services in the aftermath of mass casualty scenarios (earthquake disasters).

Head injury is one of those areas of health care where such discrepancy is most notable. Currently the number of patients requiring active care of qualified neurosurgeons, CT scans, and ICU care far outweigh the number of such resources. In this backdrop, if there happens to be a mass disaster such as a significant earthquake (which experts say is long pending in the Himalayan region), care of these patients can very well be suboptimal. In this background, it was felt that if necessary knowledge and skills in medical, surgical, nursing and rehabilitation management of head injured patients could be imparted to a wider group of healthcare professionals, a difference could be made in the final outcome. To fulfill this purpose, this guideline has been developed by a technical team under the aegis of Ministry of Health and population, Government of Nepal, with support from Handicap International and Nepal Red Cross Society.
II. HEAD INJURY GUIDELINE

A. OVERVIEW

Definition

Head injury also referred to as traumatic brain injury (TBI), is a broad term that describes a vast array of injuries that occur to the scalp, skull, brain, and underlying tissue and blood vessels in the head. It is a non-degenerative, non-congenital insult to the brain from an external mechanical force resulting in cognitive, emotional, sensory, and motor impairments which can lead to a variety of temporary or permanent disabilities. The number and extent of impairments vary tremendously with the severity of injury. Head Injury is one of the most common causes of disability and death worldwide. Also, it is one of the most misdiagnosed, misunderstood and underfunded public health problems meriting it to be called a ‘silent epidemic’.

Epidemiology

We have no national data on incidence of head injury in Nepal. In the US, the incidence is quoted between 200-400 cases per 100,000 populations. Worldwide every 21 seconds, someone sustains a TBI. Every year: 50,000 people die, 235,000 hospitalized, 1.1 million treated and released from an emergency department. Approximately 5.3 million live with TBI-associated long-term disabilities. TBI accounts for 40% of all deaths from acute injuries. Not included in these counts are those who are not seen in a hospital or emergency department, or those who receive no care. 20% suffer from severe head injury requiring prolonged intensive care and/or neurosurgical intervention. The aggressiveness and rapidity with which care is provided ‘determine’ the outcome. About 20% of patients with severe HI are surgically treated for traumatic mass lesions and/or fractures. Proper management of head injured patient involves neurosurgeons as the lead specialists, even when approximately 2/3 of all patients are treated conservatively.

Economics

Estimates for average lifetime cost of care for a person with severe TBI range from $600,000 to $1,875,000. The annual cost of acute care and rehabilitation in the United States for new cases of TBI is estimated at $56-76.6 billion. The interactions of physical, cognitive, and behavioral sequel can also interfere with the task of new learning which is particularly a significant consequence for children.

Head Injury in the Earthquake Scenario

Earthquakes in resource-limited geographic areas can result in substantial morbidity and mortality because of inadequate engineering, building construction, transportation infrastructure, and search and rescue capabilities. The most common injury-related diagnoses are fractures/dislocations, wound infections, and head, face, and brain injuries and as high as 22.9% injuries are located in the head. However, the head injury is milder compared to non-earthquake situations. The problem of catering a large number of patients is a big constraint in these situations. Specialists service (Appendix I), transport, CT services (Appendix II), ICU and ventilator facilities may be in short supply.

Pathophysiology

Primary injury occurs at the time of impact. Treating physicians have little control over the matter. Examples include contusions, hematomas etc. Secondary injuries occur at a time when they are already under supervision of healthcare professionals. These are preventable to a large extent. Examples include hypoxia, hypovolemia, hypoglycemia, electrolyte imbalance etc. Differentiation between these two types of injuries is highly critical.
The injured brain is susceptible to ischemia. Avoidance of hypoxia and hypotension is of the highest importance. Intracranial causes for deterioration are usually based on the primary injury. Delayed intracranial hemorrhage into or worsening brain edema from a pre-existing lesion should also be taken into account. The final common pathway after a significant head injury is shown in figure 1.

![Diagram](image)

**Figure 1: Final common pathway in ICP due to head injury**

Prognosis of patients with head injury is dependent on the severity of injury to the skull and brain at the time of primary impact which is beyond the scope of clinical care providers. However, secondary injuries, happening after the primary impact, such as hypoxia, hypotension are to a large extent are treatable and will make a difference in the final outcome. The priority of approach is to prevent further injury to the already compromised brain and complications from neurological injury. This has implication for all levels of intervention: right from extrication and rescue from the scene to safe transport to patient care facility. In the event of a large-scale urban disaster, access to specialty care including ICU and ventilator, diagnostic facilities (including CT-scan), skilled nursing and physiotherapy care are likely to be in short supply. The goal of treatment is to minimize further neurological damage and optimize brain for recovery.
B. PRINCIPLES OF CARE OF HEAD INJURY IN MCI SCENARIO (A MULTI-DISCIPLINARY APPROACH)

1) Establish the fact that the patient has head injury- history of antegrade amnesia or LOC, presence of decreased level of conscious or neurological deficit attributed to head.

2) Identify other injuries- ensure no other trauma injury due to diminished level of consciousness or agitation in the setting of head injury.

3) Prevent further neurological injury to brain and spinal cord- open depressed fracture, brain evisceration; stabilize neck with cervical collar during transfer and movement.

4) Provide Oxygen and enough IV fluid.

5) Identify- the rare, special cases that may require further expertise and often require surgery- unstable patients with large epidural and subdural hematomas or acute hydrocephalus.

6) Care with transport- Transport and movement of the patient by the trained personnel, whether from the accident scene, within the facility, or between facilities, presents the greatest danger for increasing the severity of neurological damage. At all times, transport the patients with support by trained personnel (at least with people who have had adequate instructions) to prevent hypoxia and hypotension at all cost.

7) Prevent complications of neurological deficit- ophthalmological, skin, bowel, and bladder care.

8) Appropriate Nursing care and counseling - Key points in managing patients from the nursing point of view are described in Appendix III.

9) Provide physiotherapy and counseling - to prevent atelectasis and subsequent pneumonia, pressure ulcers, contractures and maintain strength of functioning muscles. Key points in managing patients from the physiotherapy point of view are described in Appendix IV.

10) Consent for treatment and information of multidisciplinary approach with attention toward rehabilitation, psychosocial support, occupational and social re-integration for each patient whenever possible.

C. MANAGEMENT OF INJURIES

1. DIAGNOSTIC CONSIDERATIONS

Though the initial investigation of choice is a plain CT scan of head, it is unlikely during the scenario of a large-scale disaster. Often subtle head injuries are missed because the patient has other obvious injuries, e.g. long bone fractures, hemo-peritoneum etc. A systematic effort must be made to identify head injury based on history and careful physical exam. As the best prognosticator of neurological outcome is the GCS (figure 2) at admission after resuscitation, it should be recorded at the earliest.

<table>
<thead>
<tr>
<th>Eye opening</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>spontaneously</td>
<td>4</td>
</tr>
<tr>
<td>to speech</td>
<td>3</td>
</tr>
<tr>
<td>to pain</td>
<td>2</td>
</tr>
<tr>
<td>none</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Verbal response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>oriented</td>
<td>5</td>
</tr>
<tr>
<td>confused</td>
<td>4</td>
</tr>
<tr>
<td>inappropriate</td>
<td>3</td>
</tr>
<tr>
<td>incomprehensible</td>
<td>2</td>
</tr>
<tr>
<td>none</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Motor response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>obeys commands</td>
<td>6</td>
</tr>
<tr>
<td>localises to pain</td>
<td>5</td>
</tr>
<tr>
<td>withdraws from pain</td>
<td>4</td>
</tr>
<tr>
<td>flexion to pain</td>
<td>3</td>
</tr>
<tr>
<td>extension to pain</td>
<td>2</td>
</tr>
<tr>
<td>none</td>
<td>1</td>
</tr>
</tbody>
</table>

Maximum score 15

Figure2. Glasgow Coma Scale
Diagnostic points to consider include-

I. Evaluate patients neurologically
   a) Decreased level of consciousness
   b) Seizure
   c) CSF otorrhea/rhinorrhea
   d) Panda sign/ Raccoon’s eyes
   e) Battle’s Sign
   f) Subtle – h/o amnesia or LOC, irrelevant talks especially elderly.
   g) Vomiting • 2 episodes in adults

II. Grade severity of injury based on GCS

   Mild
   GCS 13-15

   Moderate
   GCS 9-12

   Severe
   GCS 3-8

Since the level of consciousness in head-injured patients is dynamic, the exact circumstances and the time of examination have to be taken into account. Also, over time, trend is more important than an absolute value.

III. Classify Head Injury

   Scalp lacerations

   Fractures
      Closed
         Overlying skin intact

   Open
      - Discontinuity of the skin overlying a skull fracture often with dural laceration.
      - Indirect open, e.g. small fractures of the frontal sinus or skull base fractures (only possible to diagnose after CT head).

   Subdural/epidural hematomas, contusions

IV. Imaging

It may be difficult to obtain in disaster scenario. X-ray skull has no value in the evaluation of head injured patient. However, C-spine should be evaluated radiologically as up to 15% patients with head injury have associated C-spine injury and if missed have a disastrous consequences. CT scan of head with brain and bone sequence has a very high sensitivity and specificity and should be obtained in all moderate to severe head injured patients if available. CT is not recommend if patient is alert and has no history of loss of conscious or antergrade amnesia. Many hospitals have their own protocols for obtaining CT scan in suspected head injury.
Also refer to the respective hospital for guidelines. Generally agreed upon indications on obtaining a CT scan in patient with head injury are as follows:

a) GCS less than 13 on initial assessment in the emergency department.
b) GCS less than 15 at 2 hours after the injury on assessment in the emergency department.
c) Suspected open or depressed skull fracture.
d) Any sign of basal skull fracture (hemotympanum, ‘panda’ eyes, cerebrospinal fluid leakage from the ear or nose, Battle’s sign).
e) Post-traumatic seizure.
f) Focal neurological deficit.
g) More than one episode of vomiting.
h) Amnesia for events more than 30 minutes before impact.

V. Lab tests

Labs-Hb, coagulation studies, Na+ K+, glucose, Blood grouping and X-match.

2. DEFINITIVE MANAGEMENT

Early identification and treatment of injury and skilled nursing and physiotherapy are key to successful outcome.

A) ACUTE CARE

a) Assess patients with ABCDE approach; secondary exam with removal of clothes.
b) Prevent and treat hypoxia. Several large studies have shown it to be an independent risk factor for poor outcome.
c) Prevent and treat hypotension and hypovolemia. IV infusion with RL or NS Avoid 5% D.
d) Monitor respiratory and cardiac status especially in the elderly.
   Note: Ensure hypotension not caused by missed chest, abdominal or extremity injuries.
e) Keep patient NPO unless abdominal injuries ruled out or patient unconscious. Consider NG tube; or orogastric tube in suspected anterior skull base fracture.
f) Catheterize bladder and begin bladder care.
g) Give antiulcer prophylaxis.
h) Anticonvulsants- Phenytoin is the drug of choice. Load (15 mg/kg for adults and 18 mg/kg for children IV over half an hour) and maintain (5 mg/kg/day) if patient has history of seizure or if patient has mass lesions on CT even if no seizure.
i) Mannitol. Patients with moderate to severe HI- start mannitol 1g/kg bolus pending investigation/transfer. Option- continue as a maintenance dose (0.25 to 0.5 gm/kg every 6-8 hourly) if no surgically ‘evacuable’ lesions and GCS low. Almost never give mannitol to a patient with a GCS of 15/15.
j) Steroids not indicated. Harmful.

Criteria for Admission or Observation

1. Impaired level of consciousness
2. Skull fracture
3. Positive neurological symptoms or signs
4. Difficulty in assessing the patient (for example alcohol, epilepsy, significant medical problems e.g. anticoagulant use)
5. Other sources of concern (for example other injuries, shock, meningism, CSF leak)
6. Continuing worrying signs (for example persistent vomiting, severe headaches)
7. Lack of guardian to supervise at home

B) PREVENT FURTHER INJURY

a) Patient position

30° head up in neutral position (figure 3). This results in an improvement of cerebrovenous return and ICP while CPP and cerebral oxygenation remain constant. Remove potentially constricting clothes at the neck level. Change position in unconscious patient every two hours maintaining the same level.

![Proper 30° head up position](image)

b) Temperature Control

Hyperthermia aggravates brain injury by increasing energy metabolism and demand. Therefore hyperthermia ought to be treated aggressively in all patients with cerebral lesions. Fever caused by infections has to be treated promptly (physical, pharmacological, and causal treatment, i.e. antibiotics). The most common nosocomial infection in neurosurgical critical care patients is pneumonia. Traditional methods of fever treatment such as cooling blankets are not that effective. Empiric, calculated or targeted antibiotic treatment is indicated based on the degree of suspicion or proof of infection.

c) Normoglycemia and Nutritional Balance

Hyperglycemia is associated with significantly worse clinical outcomes. Consequently, normoglycemia is the goal in all neurologically critical patients. If necessary, insulin is administered to maintain serum glucose at 100–200 mg/dl. Nutritional balance has to be kept in order to respond to the altered requirements of post-injury metabolism.

d) Sodium and Hemoglobin Balance

Since both hypo- and hypernatremia increase the risk of edematous brain swelling, prevention or cautious normalization needs to be undertaken. Similarly, hemoglobin concentrations should be maintained above 10 g/dl in all severe HI patients to ensure adequate tissue oxygenation.
e) **Coagulation Status**

Bleeding and hypocoagulable states are not infrequent seen in HI and may contribute to enlarging hemorrhagic contusions as well as traumatic intracerebral hematomas. Hence, monitoring and stabilization of coagulation parameters are of paramount objectives.

f) **Sedation/Analgesia**

Adequate analgosedation is necessary to avoid stress, pain and fear. Sedation also efficiently reduces cerebral metabolism, cerebral blood volume, and therefore supports ICP treatment. On the other hand, the need for neurological assessments requires to minimize sedation as much as possible. Commonly, a combination of a benzodiazepine (e.g. midazolam 0.09 mg/kg/h) and an opioid (e.g. fentanyl 1.2 mcg/kg/h) is used. Individual variations exist and increased ICP eventually makes a higher sedation level desirable. Careful and gentle restraining is justified in agitated patients provided the cause of agitation is simultaneously addressed. Avoid restraining on fingers, for it may damage the phalanges (redness, abrasions, loss of blood circulation & dislocation, even fractures of phalanx). Therefore apply padded bandage on wrist and have the patients wear mitts (figure 4).

![Figure 4](image)

(A): Wrapping the patient hand with mitts, (B): Correct way to restrain the hand. (C) Incorrect way to restrain the hand.

C) **PREVENT COMPLICATIONS OF NEUROLOGICAL INJURY (LONG TERM CARE):**

  Goals = no bedsores, no contractures, no pneumonia, no UTIs, no cognitive deterioration (communication, awareness, orientation)

a) **Respiratory**

  1. Prevent atelectasis/pneumonia- cough and deep breath in conscious patients. Chest physio in obtunded patients
  2. Maintain O$_2$ sat > 90%.

b) **Skin- prevent pressure sore**

  1. Position change every 2 hours. Involve family members too.
  2. Examine daily for evidence of pressure sore: sacrum, iliac crest, hips, sides of knees, malleoli, occipital region of head, penis (if using condom catheter).
iii. Note: Redness, blisters and ulcer. In case of skin damage, avoid pressure to the area. Place padding around the area of concern.

c) **Bladder**
   i. Avoid bladder distension- increases ICP.
   ii. Strictly monitor fluid intake and output.

d) **Bowel** - be alert for fecal impaction
   i. Laxative daily
   ii. High residue diet
   iii. Enema or dis-impaction if necessary.

e) **Osteomuscular system** - to prevent contractures and preserve muscular strength
   i. Begin gentle range of motion exercise in all paralyzed and normal limbs.
   ii. Active strength exercise in conscious patients.

f) **Cognitive and communicative skill**
   Start as soon as the patient is able to participate in an aphasic or dysphasic patient.

D) **SPECIFIC FRACTURE/HEMATOMA MANAGEMENT**

In all likelihood, in a large scale disaster scenario, access to specialty diagnostic, clinical and nursing resources may not be available. Generally, major neurosurgical undertaking should not be undertaken unless considered life saving- such as unilateral pupillary dilatation with contralateral hemiparesis/plegia.

⇒ **THOSE THAT CAN BE EFFECTIVELY CARRIED OUT BY NON SPECIALISTS:**

**Scalp lacerations**
   - Closure of wound in 2 layers with adequate debridement.

**Skull fractures**
   - Closed- no surgery.
   - Open- undisplaced - repair scalp laceration only.

⇒ **THOSE THAT NEED SPECIALISTS' HELP:**

**Skull fractures**
   - Depressed- debridement of wound, removal of bone pieces, repair of dura and scalp.

**Epidural/ Subdural hematomas**
   - Craniotomy/craniectomy and removal of clot. Often needs specialist's help.

**Ventriculostomy**
   - In cases of acute hydrocephalus due to intraventricular hemorrhage.

**Massive hemispheric swelling**
   - Decompressive craniectomy. Only in select cases. ICU and ventilator support is required.
CRITERIA FOR DISCHARGE FROM THE HOSPITAL

Goal of any successful treatment is to send patient home with a very low risk of deterioration further. No full proof criteria exist as of yet. In general no patients presenting with head injury should be discharged until they have achieved GCS equal to 15, or normal consciousness in infants and young children.

a) Discharge of low risk patients with GCS equal to 15

When the CT is negative for acute pathology or the CT was not indicated initially based on history and physical examination, and if the patient is neurologically intact with a normal mental status for at least 24 hours, discharge home has been established as a safe policy as long as no other factors that would warrant a hospital admission are present (for example, drug or alcohol intoxication, other injuries, shock, suspected non-accidental injury, meningism, cerebrospinal fluid leak) and there are appropriate support structures for subsequent care (for example, competent supervision) at home.

b) Discharge of patients with GCS <15

Patients admitted after a head injury may be discharged if the intracranial pathology has been taken care of; if there is improvement of GCS to 15; and if there is resolution of all significant symptoms and signs of head injury provided they have suitable care takers at home.

c) All patients deemed safe for discharged should be sent home with written and verbal instructions as to when to report to a healthcare facility. These include:

- Severe headache
- Confusion
- Increasing sleepiness or difficulty waking
- Seizure
- Repeated vomiting
- Walking off balance
- Change in vision or double vision
- Weakness of an arm or leg

D. REFERRAL

Transfer Vs treatment at makeshift facility

1. The majority of patients are best treated with conservative therapy and good nursing and physiotherapy care at local institution.

2. All salvageable patients with severe head injury (GCS score 8/15 or less) should be transferred to, and treated in, a setting with 24-hour neurological ICU facility. Transfer of a child to a specialist neurosurgical unit should be undertaken by staff experienced in the transfer of ill children.

3. The multiply injured patient: consider the possibility of occult extracranial injuries, and do not transfer to a service unable to deal with other aspects of trauma.

4. Consultation on the best method of transfer for a patient should be done with referring health care professionals, transfer clinicians and the receiving neurosurgeon. It should take into account the clinical circumstances, skill of available staff, imaging, mode of transfer and timing issues.

5. Transfer only when benefits clearly outweigh the risk of transport. Make sure the referral mechanisms and capacity are clear. Transfer of patients purely on the purpose of imaging should be avoided.

6. Medical care during transfer:
• In all circumstances: complete initial resuscitation and stabilization of the patient and establish adequate monitoring before transfer to avoid complications during the journey.

• Patient persistently hypotensive despite resuscitation: do not transport until the cause of hypotension has been identified and the patient stabilized.

7. Once the acute care is over, patients with moderate to severe injuries often require rehabilitation services. Appropriate referral should be done to these places as far as possible.

E. PATIENT INSTRUCTIONS

• Information must be given to the family on potential impairment of emotional, behavioral, communication and motor skills; Moral supports for the patient care at all levels- treat them and their families with respect and compassion. Monitor and address mood- Many of these patients develop post head injury syndrome- a type of depression. Treat it if needed. Patient instructions should include psycho-social support and community & occupational integration.

• Support early teaching of activities of daily living and education of health and function maintenance to patient and family.

F. REFERENCES


APPENDIX I: PLACES IN NEPAL WHERE TRAINED NEUROSURGEONS WORK FULL TIME.

<table>
<thead>
<tr>
<th>District</th>
<th>Hospital Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kathmandu Valley</td>
<td>• Bir Hospital;</td>
</tr>
<tr>
<td></td>
<td>• Teaching Hospital;</td>
</tr>
<tr>
<td></td>
<td>• Neuro Hospital, Bansbari;</td>
</tr>
<tr>
<td></td>
<td>• Annapurna Neuro Hospital, Maitighar,</td>
</tr>
<tr>
<td></td>
<td>• Norvic Hospital, Maitighar;</td>
</tr>
<tr>
<td></td>
<td>• B and B Hospital, Gwarko</td>
</tr>
<tr>
<td>Morang</td>
<td>• Neuro Hospital, Biratnagar</td>
</tr>
<tr>
<td>Sunsari-Chitwan</td>
<td>• BP Koirala Institute of Health Sciences, Dharan</td>
</tr>
<tr>
<td>Chitwan</td>
<td>• BP Koirala Memorial Cancer Hospital</td>
</tr>
<tr>
<td></td>
<td>• College of Medical Sciences</td>
</tr>
<tr>
<td></td>
<td>• Chitwan Medical College</td>
</tr>
<tr>
<td>Kaski</td>
<td>• Manipal Medical College</td>
</tr>
<tr>
<td>Palpa-Rupandehi-Banke</td>
<td>• Lumbini Medical college, Parvas</td>
</tr>
<tr>
<td></td>
<td>• Universal college of Medical Sciences, Bhairahawa</td>
</tr>
<tr>
<td></td>
<td>• Nepalgunj Medical College, Kohalpur, Nepalgunj</td>
</tr>
</tbody>
</table>
APPENDIX II PLACES IN NEPAL WHERE CT SCAN FACILITY EXISTS.

<table>
<thead>
<tr>
<th>Place</th>
<th>Hospital / Facility Name</th>
</tr>
</thead>
</table>
| Kathmandu Valley | • Bir Hospital;  
                       • Teaching Hospital;  
                       • Patan Hospital;  
                       • Neuro Hospital, Bansbari;  
                       • Annapurna Neuro Hospital, Maitighar;  
                       • Norvic Hospital, Maitighar;  
                       • B and B Hospital, Gwarko;  
                       • Medicare Hospital;  
                       • Blue cross Hospital;  
                       • Om Hospital;  
                       • Greencity Hospital;  
                       • Grande Hospital |
| Jhapa       | • Mechi Model Hospital, Birtamod,  
                       • Om Sai Pathivara Hospital, Bhadrapur |
| Morang      | • NeuroHospital, Biratnagar                                                             |
| Sunsari     | • BP koirala institute of health sciences, Dharan                                      |
| Dhanusha    | • Janaki Medical College, Janakpur                                                     |
| Kavre       | • Dhulikhel Hospital, KUMS, Dhilikhel                                                  |
| Chitwan     | • BP Koirala Memorial Cancer Hospital;  
                       • College of Medical Sciences, Chitwan Medical College                                |
| Kaski       | • Manipal Medical College, Pokhara;  
                       • Gandaki Imaging, Pokhara                                                             |
| Palpa       | • Lumbini Medical college,Parvas                                                       |
| Rupandehi   | • Universal college of Medical Sciences, Bhairahawa                                     |
| Banke       | • Nepalgunj Medical College, Kohalpur, Nepalgunj                                        |
| Kailali     | • Sewa Nursing Home                                                                     |
APPENDIX III: KEY POINTS IN NURSING MANAGEMENT

Aims of Nursing Management
- To preserve brain homeostasis
- To prevent secondary injury
- To provide psychological support.

A) Acute Nursing Care
1. Make sure patient has patent airway
2. Avoid suctioning nasal passage & over extending head neck during suctioning.
3. Do not pack the nose & ears if there is CSF leakage. Clean orifices with sterile cotton.
4. Frequent assessment of vitals, GCS, LOC, Na+ K+, sugar, pupillary response etc.
5. Care of the agitated and restless patients
   - Patient may be restlessness due to hypoxia, pain, fever or full bladder. Patient may be agitated due to indwelling urinary catheter, intravenous lines, restraints and repeated neurological checks or even the bright light.
   - Minimize environmental stimuli by keeping the room quiet, limiting visitors, speaking calmly and providing frequent orientation.
   - Provide adequate light to prevent visual hallucination.
   - Use padded side rails
   - Assess the patient frequently to ensure that the bladder is not distended, catheterize if necessary.
   - Check bandages and casts for constriction.
   - Lubricant the skin with oil to prevent irritation due to rubbing against the bed sheet.
6. Adequate pain management (round the clock) as per instruction because pain also increase ICP.
7. Collect all necessary investigations e.g. CT scan, MRI, X-Ray, ECG and lab tests.

B) Long Term Care
1. Provide rest & comfort
   - Carryout all nursing procedures at a time.
   - Provide adequate sedatives and analgesics as per instruction.
2. Skin care (In collaboration with Physiotherapists)
   - Patient with traumatic head injury often requires assistance in turning and positioning.
   - Provide skin care every 4 hourly.
   - Assist to get out of the bed to a chair as the condition permits 3 times a day.
3. Bladder & bowel care
   - Assess abdomen for bowel sound and abdominal distention.
   - Avoid soiling of bed sheets. Use of adult napkins if required.
4. **Maintain intake and output**
   - Serious patients usually have IV infusion, NG tube and urinary catheter as well as other drainage tube. So strictly monitor intake output balance to prevent fluid and electrolyte imbalance.

5. **Eyes, ear, nose and mouth care**
   - To prevent corneal ulcer, protect the eyes from injuries by using paper tape or eye shield.
   - To prevent from mucosal ulcers, provide mouth care two times a day.

6. **Prevention of complications (in collaboration with Physiotherapists)**
   - Encourage early mobilization.
   - Ensure adequate nutrition.
   - Deep breathing and coughing, ROM (active and passive), muscular strengthening exercise in coordination with physiotherapy.

7. **Communication and counseling**
   - Provide psychological support and counseling throughout management, explain the patient about the condition and intended procedure.
   - Inform authorized personnel in your chain of command about the progress of each patient.
   - Participate in the consent taking process for invasive procedures and operations.
APPENDIX IV KEY POINTS IN PHYSIOTHERAPY MANAGEMENT

Early identification and treatment of injury and handling and use of skilled physiotherapy is key to successful outcome.

**Goal of Physiotherapy management:**
- Improve lung function
- Improve mobility
- Pain Management
- Prevent deformity
- Restore physical function

A. **Acute care**

1. Chest Physiotherapy: It improves respiratory efficiency, promote expansion of the lungs, strengthen respiratory muscles, and eliminate secretions from the respiratory system.
   - i) Percussion consists of rhythmic clapping on the chest with loose wrist and cupped hands.
   - ii) Vibration consists of a fine oscillation of the hands directed inwards against the chest performed on exhalation after deep inhalation.
   - iii) Shaking (rib springing) is a rhythmic coarser movement against the chest wall during expiration.
     - Breathing exercises (diaphragmatic and costal) are taught to the conscious patients to enhance the lung function capacity.
     - Coughing (forceful expiration with closed glottis), huffing (forceful expiration with open glottis) and sniffing (short expiration from nose) technique are also taught.

2. There is a greater risk of development of spasticity and contracture in a bed-ridden patient. So, proper positioning is necessary to prevent it. (figure1, 2, 3)

![Figure 1: Proper positioning of the affected side (i.e. right side) of the patients](image-url)
3. Range of motion exercises:
   - Passive range of motion exercises are given to
     - Maintain muscle tone.
     - Prevent development of contractures.
     - Maintain proper blood circulation.
     - Reduce the swelling on the limbs.
   - Active, active assisted and resisted exercises are given to enhance the muscle strength.

4. Stretching exercise is given to release the tightened muscles.

5. Use of electrical modalities
   - Electrical stimulation to re-educate muscle.
   - TENS therapy for pain relief.

6. Use of orthotic appliances like cervical collar (to prevent further spinal injury) or splints to avoid contracture in plantar flexor of feet.

7. Elevation of the limbs on the level of heart to reduce the edema developed after injury.

8. Sensory Integration
   - For unconscious patients, effort should be made to stimulate the reticular activating system by using various sensory stimulation like tactile, auditory etc.
   - For conscious patients, the sensory stimulation in form of tactile, auditory, visual and proprioceptive stimulation can be given to send facilitatory signals to the brain.
Sensory integration uses principles such as:
- Vestibular based activities
- Tactile based activities
- Proprioceptive
- Auditory and Visual

9. Tilt table standing to manage postural hypotension and stimulate proprioceptors

10. As patients become stable, rehabilitation program should be introduced.

B. Long term Phase (Rehabilitation phase)

1. Active and strengthening exercises to improve the muscle strength.

2. Mat exercises are given to improve bed mobility.
   - Rolling
   - Supine to sit and sit to supine
   - Bridging
   - Sitting
   - Sit to stand and stand to sit

3. Train transfer techniques; to enable independent transfer, like from bed to floor or wheel chair.

4. Co-ordination exercises and balance training
   - Frenkel’s exercises for co-ordination in lying, sitting and standing.
   - Vestibular ball for sitting balance and dynamic control.

5. Proprioceptive Neuromuscular Facilitation (PNF)
   - It deals with making use of the proprioceptors to modify the action of the motor system.
   - The main proprioceptor utilized for this purpose is the muscle spindle.
   - In rehabilitation of neurological conditions, PNF are used for strengthening (repeated contraction technique) and lengthening (hold relax or contract relax technique).

6. Gait training
   - Parallel bar training
   - Staircase climbing
   - Use of quadripod, tripod, crutches and sticks for ambulation


8. Home care program - Teach the physiotherapy exercises to the patient and care givers with do’s and don’ts. Train the patients and care givers, the use of wheelchairs if prescribed to prevent further complications, promote mobility and autonomy.

***