Protocol # 11 NS

DMC Detroit Receiving Hospital DETROIT MEDICAL CENTER

Guidelines for Management of Severe Trauma Brain Injury (TBI)

Definition

Mild TBI – GCS ≥13
Moderate TBI – GCS 9-12
Severe TBI – GCS 8 ≤

1. Early identification of patients with possible TBI
    a. Visible trauma to the head
    b. Suspected head injury with evidence of intoxication (alcohol or illicit drugs)
    c. Head injury on anticoagulation
    d. "Found down (suspected fall) or altered mentation from a suspected head injury
2. Order Ct Scan of the head stat. Alert CT scan department the patient's need of immediate imaging to the brain.
3. Immediately consult trauma and neurosurgery
4. Patients with GCS of 9-15 with intracranial lesion will need a repeat CT of the head in 6 hours.
5. Neuro ICU maybe consulted by trauma or neurosurgery to assist with management.
6. Patient with GCS ≤ 8
    a. Negative Head CT
        i. Without the presence of drugs or alcohol repeat head CT in 6 hours if no clinical improvement and consider ICP monitor. See attachment A.
        ii. If positive for drugs/alcohol repeat head CT when sober if there is no clinical improvement and consider ICP monitor.
    b. Positive head CT
        i. If the patient has mass lesion or herniation proceed to the OR
        ii. If the patient is not a candidate for the OR then ICP monitor is highly recommended in the patient with a positive head CT in the absence of drugs or alcohol
7. If ICP reading is > 22mmHg, sustained > 30 seconds notify neurosurgery physician. Document hourly ICP readings and GCS to detect early deterioration.
8. Consider sedation and analgesia using short acting agents for mechanically ventilated patient if clinically appropriate. Avoid Benzodiazepines and Opiates.
9. If anticoagulation is suspected, order TEG. Correct coagulopathy using Policy 3DRH MS 014 Warfarin Reversal Protocol for Head Trauma.
10. Indication for craniotomy:
    a. Worsening GCS with expanding mass lesions
    b. Worsening brain edema with midline shift
    c. Sustained elevated ICP
11. For worsening GCS and elevated ICP consider other therapeutic intervention. See attachment B
    a. Hypertonic saline 3% NaCl
    b. Mannitol
    c. Hyperventilation
    d. Head of the bed (HOB) elevated at 30 degrees.
12. Consider tracheostomy within 8 days of admission or sooner if long term intubation is expected.
13. Maintain oxygen saturation ≥95%, keep the patient normothermic, SBP ≥100mmHg.
14. Monitor Na level, INR, Platelets, Hemoglobin, and blood sugar.

Protocol 11 NS

Attachment A

Integrated Approach to Intracranial Pressure (ICP) and Cerebral Perfusion Pressure (CPP) Management

Intracranial Pressure (ICP)

ICP is frequently elevated in patients with severe head injury. Mechanisms causing elevated ICP include cerebral edema, intracranial hematoma formation, and hydrocephalus. Normal ICP is from 10-15 mmHg; elevated ICP begins at 20-25mmHg.

Goals of Therapy

1. To detect elevated ICP in order to allow surgical and medical management to lower ICP and maintain cerebral perfusion pressure (CPP).
2. To allow for drainage of CSF (when available) as a means for treating elevated ICP.

Indications for ICP Monitoring

1) ICP monitoring is appropriate for all patients with severe head injury (GCS 3-8) with an abnormal admission head CT scan following hemodynamic resuscitation.
2) ICP monitoring is appropriate for all patients with severe head injury (GCS 3-8) with a normal head CT scan if two or more of the following are present:
   i. Age > 40 yo
   ii. Unilateral or bilateral motor posturing
   iii. One or more episodes of hypotension (i.e. systolic blood pressure < 90 mmHg)
3) ICP monitoring may also be considered in patients with head injury who are undergoing non-neurosurgical operative procedures early in their hospital course, during which time neurologic examination will be unavailable.

Technology for ICP Monitoring

1) Placement of a ventricular catheter is the preferred method for ICP monitoring as it allows CSF drainage for the treatment of elevated ICP.
2) When placement of a ventricular catheter with micro sensor is not deemed appropriate (i.e. slit ventricles, concerns of coagulopathy or platelet dysfunction, minimal findings on CT Scan), then use of a parenchymal monitor is preferred over other methods.

Threshold for Treatment of ICP

1) ICP treatment should be initiated at an upper threshold of 22 mmHg. Limits should be coordinated with the CPP.
2) ICP treatment should be taken in context of clinical examination and CPP data.

Protocol #11 NS

Attachment B

Integrated Approach to ICP and CPP
(ICP>22 mmHg and/or CPP<60)

Tier 1 interventions: To be started within 15 minutes if ICP > 22mmHg

- Adjust head of the bed to lower ICP.
- Ensure Temperature < 38.3 C.
- Adjust pharmacological analgesia and sedation
- CSF drainage (if EVD available).
- Optimize CPP to a max 70 mmHg with fluid boluses or vasopressors as clinically appropriate
- Low dose Mannitol (0.25 – 0.5 g/kg): (maintain Sosm < 320 mOsm or Ogap <20).
- Hypertonic saline: maintain serum Na^+ 150-160.
- Escalate anti-seizure medications (AEDs) if patient has clinical or electrographic seizures
- Adjust ventilator for a target PaCO2 of 35 - 40 mm Hg and target pH of 7.35 - 7.45

Tier 2 interventions: ICP is > 22 mm Hg for > 60 minutes despite Tier 1 therapies

- Optimize CPP: May increase CPP above 70 mm Hg with fluid boluses or vasopressors
- Adjust ventilatory rate for target PaCO2 of 33 – 38 mm Hg and target pH of 7.35-7.45
- High dose Mannitol 1.0-1.5 g/kg, or higher frequency of standard dose Mannitol (if Sosm <320 mOsm).
- Hypertonic saline bolus (i.e., 30 ml of 23.4%).
- Repeat CT to determine if increased size of intracranial mass lesions.
- Treat surgically remediable lesions with craniotomy according to guidelines.
- Adjust temperature to 35 – 36 C, using active cooling measures.

Tier 3 interventions: ICP is > 22 mm Hg for > 60 minutes despite Tier 2 therapies

- Pentobarbital coma, according to local protocol.
- Decompressive craniectomy.
- Adjust temperature to 32 – 35 C, using active cooling measures.
- Neuromuscular paralysis
- Adjust ventilatory rate for target PaCO2 of 30 – 35 mm Hg and target pH of less than 7.50