Severe Traumatic Brain Injury (TBI): Inpatient Guideline

POPULATION: All patients with diagnosis of severe TBI, GCS 3 - 8.
PURPOSE: To improve the clinical outcomes for patients with severe TBI in accordance with the Brain Trauma Foundation Guidelines

Care Guidelines

- Attempt to maintain O₂ saturation >95 %.[A]
- Attempt to maintain systolic MAP > 90 mmHg or CPP 50-70 mmHg when ICP monitoring is available (CPP=MAP - ICP). [B]
- Attempt to maintain PbtO₂ 15-40 mmHg. [C]
- Routine usage of glucocorticoids is not recommended. [A]
- Osmolar (Mannitol/Hypertonic Saline) Therapy:
  - Intermittent osmolar therapy should be utilized only after an euvolemic state has been achieved.
  - Attempt to maintain serum osmolarity <320 mOsm and sodium < 160 mmol. [C]
- Hyperventilation therapy may be necessary only for brief periods when there is acute neurologic deterioration, or for longer periods if there is intracranial hypertension refractory to sedation, paralysis, CSF drainage, and mannitol. [C]
- If barbiturate coma induced, consider use of continuous EEG (goal = burst suppression between 1-6 bursts per minute or as specified) or BIS monitor (goal = 40-60). [C]
- Maintain maximal ROM in weight bearing joints through positioning and splinting.
- Nursing: mouth care q 4 hours; place on continuous lateral therapy bed when spine is cleared.
- Consider IVC Filter if anticoagulation prophylaxis contraindicated.
- Obtain CSF samples from ventriculostomy when signs of infection are present.
- Obtain swallow evaluation prior to giving oral feeds.
- Maintain normothermia; applying targeted temperature management may be considered.
- Consider Keppra administration for the treatment of seizures or prophylactically. See recommendations on second page.

Referral Guidelines

- STAT consult to neurosurgery on admission.
- Consult physiatrist and appropriate rehab services (OT, PT, Speech, etc.) after resolution of intracranial hypertension or no evidence of increased ICP present.
- Consult social service within 24 hours of admission.
- Offer family pastoral care support services.

TARGET LOS Variable

Key Educational Issues To Address

1. Review with family “After Traumatic Brain Injury” booklet.
3. Instruct family on stages of agitation according to the Rancho Los Amigos Scale.
4. Encourage family participation in support group meeting. Group meets every third Thursday of the month at 7:00 p.m. at Rockford Center.

Key Outcomes

1. Clinical preservation and improvement of neurological function via GCS, GOS & FIM.
2. Decreased incidence venous thromboembolus.
3. Decreased incidence of pneumonia.

Discharge Criteria

Discharge to home/subacute/rehab care when:
- Hemodynamically normal
- No overt signs of infection
- Screened and/or treated for DVT as indicated
- Long term central line access as indicated
- Gastrostomy/Tracheostomy as indicated
- F/U CT Head completed prior to d/c and available for rehab
- Radiographic assessment of C-spine completed

✝ CCHS Strength of Recommendation

A =Good evidence to support the recommendation.
B =Fair evidence to support the recommendation.
C =Insufficient evidence to recommend for or against but recommendation is made on other grounds.

This guideline is to assist caregivers in the management of routine patients and should be modified for patient specific clinical indications.
GLASGOW OUTCOME SCALE

GR = Good Recovery: independent; able to return to work.
MD = Moderate Disability: Independent but has memory or personality deficits.
SD = Severe Disability: Conscious but dependent. Have marked personality and/or motor deficits.
VS = Vegetative State: No meaningful activity.
D = Death

RANCHO LOS AMIGOS SCALE

1. No response.
2. Generalized response.
3. Localized response.
5. Confused, Inappropriate, Inconsistent commands, Impaired memory.
6. Confused, follows commands consistently.
7. Oriented, Uncooperative, Social inappropriateness.
8. Purposeful, Appropriate, over/under estimates abilities.
10. Independent, social interaction consistently appropriate.

AVAILABLE ICP MONITORS

1. Fiberoptic ventriculostomy
2. Fiberoptic parenchymal (Bolt)
3. Fiberoptic subdural (placed in OR only)
4. Cerebral tissue oxygenation monitor
5. Trauma catheter (ventriculostomy – fluid-filled system)
(Fiberoptic Equipment available in the SCCC, ext. 2950)

NORMAL PARAMETERS

ICP/CPP  ICP = 0 – 15 mmHg
          CPP = 50-70 mmHg
PbtO₂      15-40 mmHg

PENTOBARBITAL DOSING

Give 10 mg/kg over 30 minutes, then 5mg/kg over 1 hour x 3, then 1-5 mg/kg/hr.
Titrate dosage according to ICP/CPP, bursts, PbtO₂ and BIS monitor.
*Refer to standardized order form

KEPPRA ADMINISTRATION INDICATIONS

1. Treatment of new onset or pre-existing seizure (length of therapy to be determined. Consider a neurology or NCC consult).
2. Prophylactically for:
   • Severe TBI with GCS <=8 or intubated with convexity SDH (not falx or tentorial)
   • Extra-axial hemorrhage >5mm
   • Fronto-temporal lobe contusions (a specific location) or any significant contusion defined as AS > 2cm
   • Depressed skull fracture
   • Discontinue at the time of discharge or after 7 days as an inpatient

References

Brain Trauma Foundation, Guidelines for the Management of Severe Head Injury, 3rd ed., 2007
Establish/Maintain Airway
Administer 100% FiO₂
Intubate as clinically indicated (Consider for GCS 3-8 or as clinically indicated) (Refer to RSI protocol)
Establish 2 large bore IVs - draw labs
Insert gastric tube/ Foley
Administer Mannitol 0.25-1 gram/kg if posturing or signs of pending herniation (i.e. blown pupil)
Obtain CT head/ C-spine
Prepare for insertion of ICP/ Licox/ Ventric placement and any other neurosurgical procedures
Insert a-line/central line as indicated
Administer fluids to keep CVP 4-8mmHg/ PCWP 8-12mmHg
• Administer NSS/LR/Hypertonic Saline
• Administer PRBCs as indicated
• Reverse coagulopathy with component therapy as indicated (Refer to Reversal of Oral Anticoagulants in Patients Suspected of Having an ICH Guideline)
Maintain MAP > 90 - add pressors if euvolemic

GOALS:
SaO₂ 100% PaCO₂ 35-45 mmHg
PaO₂ > 100mmHg MAP > 90mmHg
Maintain SaO₂ per pulmonary needs
Provide sedation and analgesia as indicated
HOB 30-40° unless otherwise indicated
Maintain normothermia 36-37°C
Maintain CPP > 60mmHg or optimal for patients needs

PbtO₂ > 15 mmHg and ICP ≥ 20 mmHg
1. Consider analgesia/sedative/ paralytic for ICP control
2. Drain CSF
3. Administer Mannitol 0.25-1 gram/ kg and/or Hypertonic Saline
4. Optimize PaCO₂ to decrease ICP (not to decrease PaCO₂ < 32mmHg)
5. Check CVP/ PCWP – administer fluids if low
6. Optimize MAP/ CPP – administer fluids or pressors if euvolemic
7. Consider therapeutic hypothermia

PbtO₂ < 15 mmHg and ICP ≥ 20 mmHg*
1. Administer FiO₂ 100% x15 minutes
2. Consider analgesia/sedative/ paralytic for ICP control
3. Drain CSF
4. Administer Mannitol 0.25-1 gram/kg and/or Hypertonic Saline
5. Optimize PaCO₂ (not to exceed PaCO₂ > 50mmHg)
6. Check CVP/ PCWP – administer fluids if low
7. Optimize MAP/ CPP – administer fluids or pressors if euvolemic
8. Consider therapeutic hypothermia
9. Administer PRBC’s as indicated

PbtO₂ < 15 mmHg and ICP < 20 mmHg
Administer FIO₂ 100% x 15 mins
Consider Pulmonary Cause
• Increase PaCO₂ if low
• Check breath sounds
• Alter vent settings as indicated
- evaluate I : E ratio
• Consider paralytics/ sedatives

Consider Hemodynamic Cause
• Check CVP/PCWP - if low administer fluids
• Optimize CPP - pressors if euvolemic
• Administer PRBCs as indicated

This tool is to assist caregivers in the management of routine patients and should be modified for patient specific clinical indications.

Team Members
* Denotes Team Leader(s)
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*Administer barbiturates and/or perform decompressive craniectomy if refractory to other therapies (refer to 2nd tier therapies of the BTF Severe TBI Guidelines)