TRAUMATIC BRAIN INJURY (TBI)

(Last updated 08/05/2019; Reviewed by: Andrew M. Harrison, MD, PhD; Amit Vasireddy MD)

PRESENTING COMPLAINT: Trauma, Loss of consciousness

FINDINGS

- **A** N or Compromised
- **B** ↓/↑ RR, possible hypoxia,
- **C** ↓/↑ HR, ↓/↑ BP (autonomic dysfunction)
- **D** Variable altered (V,P,U,D)
- **E** Seizures, reflex's asymmetries, traumatic injuries to head and body
- **L_{PC}** ABG, ↓/↑ pH, ↓ PO2, ↓/↑ PCO2, ↓ CBC, Blood group and cross-match
- **U_{PC}** NA

***V** (verbal), **P (**pain), **U** (unconsciousness), **D** (delirious)

U_{PC} (point of care ultrasound) **L_{PC}** (point of care labs)

OTHER HISTORY

- **Signs and Symptoms:** Agitation, confusion, reduced consciousness, +/- headache, amnesia, nausea and vomiting, after trauma
- **Predisposing Conditions:** Motor Vehicle Collision, trauma, fall

DIFFERENTIAL DIAGNOSES

- Seizure, intoxication, delirium, meningitis/encephalitis, stroke, metabolic and electrolyte abnormalities, shock

OTHER INVESTIGATIONS

- **Imaging**: Non-contrast head CT

THERAPUETIC INTERVENTIONS

- **Initial Actions**
- **Prevention of secondary neurologic injury**
    - **Airway protection** and PO_2/PCO_2 control
        - Consider intubation, mechanical ventilation and expired CO_2 monitoring
        - **Oxygenation**: SpO_2 > 90% or PO_2 > 60mmHg, PCO_2 ~35mmHg
    - **Avoid Hypotension**
        - **Blood Pressure**: SBP>90mmHg, MBP>80mmHg
    - **Establish IV access**

        - Consider placement of arterial line and central line, but do not let this delay other essential interventions in an unstable patient
    - **Avoid hypo-/hyperglycemia and hyponatremia**
- **Evaluation and Diagnosis**
    - Note any abnormalities in pupils (deviation, size, responsiveness to light)
    - Note best response on AVPU (alert, voice, pain, unresponsive) scale
    - Calculate **GCS score; exclude** associated traumatic **spine injury**
    - **Blood draw for type and screen electrolytes and hemoglobin**
    - If at any point the patient has signs of a focal neurologic deficit, symmetric pupils, deteriorating level of consciousness or is intubated for airway protection, request urgent neurosurgical team evaluation
- **CT head (noncontrast) once safe to transport**
    - **Rule out intracranial hemorrhage**: neurosurgical evaluation
- **Intracranial Pressure (ICP) monitoring**
    - Place ICP monitor if risk of secondary neurologic injury
    - Target Cerebral Perfusion Pressure (CPP=MAP-ICP) **to 60 mmHg** (higher than 50 mmHg and lower than 70 mmHg)
- **Arterial line for MAP monitoring**
- **Central line for pressors and CVP monitoring**
- **Ongoing Evaluation**
    - Continuously assess for signs of transtentorial herniation or neurological deterioration not attributable to extracranial causes
        - Increased ICP, focal neurology, new eye signs, sudden change in mental status, seizure or fall in calculated GCS
        - **Head elevation**
        - Short-term **hyperventilation, increased depth of sedation, adding muscle relaxant**
        - Hyperosmolar therapy
            - **Mannitol** 20%: 0.25-1g/kg, avoiding hypotension
            - **Hypertonic Saline**: 2-23.4%, either bolus or infusion
        - Avoid hyperthermia: treat low Cerebral Perfusion Pressure **< 50 mmHg** with fluid and pressors
    - With sustained increase in ICP > 30 mmHg, consider re-CT and surgical intervention
    - Barbiturate may have a role in the short term control of refractory ICP elevation
- **Sedation-analgesia choice**

- Prevent secondary injury by preserving hemodynamic stability
- If intubating, treat as a high aspiration risk/full stomach and consider rapid sequence induction

- **Anti-seizure Prophylaxis**: Consider anticonvulsant drugs if early posttraumatic seizures

ONGOING TREATMENT

- **Further Treatment**
  - Judicious fluid resuscitation with close monitoring of electrolytes and avoidance of hyponatremia
  - Aspiration and lung injury are common in patients with significant traumatic head injury
- **Prophylaxis**
  - Ventilator associated pneumonia prevention bundle
  - DVT-Prophylaxis (avoid LMWH if risk of ICH)
  - Gastric ulcer prophylaxis

CAUTIONS

- **Complications**
  - **Secondary Brain injury**: can occur hours to days after the initial trauma
  - Aspiration and lung injury are common in patients with significant traumatic head injury
  - **Bleeding**: may occur several days after the injury
  - **Seizures**: most seizures occur within the first week following injury; however, some injuries may cause recurrent seizures and persist for years as posttraumatic epilepsy
  - **Nerve damage**: if the base of the skull is affected by trauma, cranial nerves could be damaged; facial paralysis, double vision, loss of vision, swallowing problems, etc. should be examined frequently

REFERENCES & ACKNOWLEDGMENTS

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