INTRACRANIAL PRESSURE (ICP/EVD) MONITORING - ICU

PURPOSE: To outline the management of the patient requiring intracranial pressure (ICP) monitoring via the external ventricular drain (EVD).

SUPPORTIVE DATA: Normal ICP is 0-15 mmHg and is read as a mean pressure. Increased ICP is a sustained elevation in pressure of greater than 15 mmHg (usually for longer than 5-10 minutes). Intracranial hypertension is a sustained elevation in ICP of greater than 20 mmHg (usually for longer than 5-10 minutes).

Cerebral perfusion pressure (CPP) is the pressure at which brain cells are perfused. CPP is a calculated value, derived by subtracting ICP from MAP. Normal CPP is 80-100 mmHg. A CPP of greater than 60-70 mmHg is generally acceptable.

ICP monitoring is done via either a hydraulic (fluid-filled) or fiberoptic monitoring system.

The hydraulic system used is an intraventricular catheter (IVC) inserted into a lateral ventricle. Pressure readings are transmitted through fluid-filled pressure tubing to an external transducer. The IVC monitors pressure and allows for cerebral spinal fluid (CSF) drainage.

The fiberoptic system may be either an IVC or a monitoring bolt. It is inserted into one of the following areas: cerebral tissue, subdural, or subarachnoid space. Its internal transducer is located at the distal end of the IVC or bolt and pressure readings are transmitted through fiber optics. The tubing is not fluid-filled, leveling is not necessary and zeroing is only done prior to insertion.

Neurosurgical physicians (R1 and higher), nurse practitioners and physician's assistants assigned to the neurosurgery service may withdraw CSF samples and change EVD dressings. Attending physicians and fellows from the neurocritical care service, with proper training, may also withdraw CSF samples and change EVD dressings with permission from the neurosurgery service, or in case of emergency.

ASSESSMENT:

1. Assess the following a minimum of every hour:
   - ICP (closed to drainage while taking reading)
   - CPP
   - Level of consciousness
   - Pupillary size, shape, reactivity
   - Motor response (on Glasgow Coma Scale)
   - Vital signs (VS) including:
     - Presence of Cushing's response: Increasing systolic blood pressure, widened pulse pressure, bradycardia, abnormal respiratory pattern
   - Presence of headache, seizure activity
   - IVC dressing site for CSF leak
   - Amount, color and clarity of drainage (when on continuous drainage)
2. Monitor ICP waveform continuously.
   - Evaluate for absent or dampened waveform
3. Level external transducer to foramen of Monro (tragus of the ear), and zero:
   - Upon assuming care of the patient
   - Every 12 hours
   - To verify accuracy of questionable values
   - With any change in head elevation (relevel only)
4. Zero IVC/EVD by performing the following in order:

- Level transducer with tragus
- Bring drainage level (the top of the drip chamber) down to zero
- Allow tubing between transducer and drip chamber to completely fill with fluid
- Immediately turn stopcock off to the patient (ensure transducer is open to drip chamber)
- Press zero on the monitor
- Return drip chamber to previous level (ordered parameter)
- Open stopcock to the patient

5. Zero fiberoptic system prior to insertion only.
6. Synchronize the fiberoptic system (Camino bolt) monitor and bedside monitor (refer to fiberoptic system user guide):
   - Upon initial insertion
   - At the beginning of every shift
   - To verify accuracy of questionable values
7. Evaluate CSF drainage for the following every time CSF is manually drained:
   - Color, clarity
   - Amount
   - Ease of flow

SAFETY:

8. Notify neurosurgery resident if a CSF culture is ordered by another service. (**Withdrawal of CSF for culture and sensitivity is done only by neurosurgical physicians (R1 and higher), nurse practitioners or physician's assistants on the neurosurgery service.** Attending physicians and fellows from the neurocritical care service, with proper training, may also withdraw CSF samples and change EVD dressings with permission from the neurosurgery service, or in case of emergency).
9. Ensure EVD is secured at all times.

MAINTENANCE:

10. Ensure EVD device is set on "mm Hg."
11. Maintain:
    - Sterile, closed system
    - EVD leveled at tragus of the ear
    - Head of bed at ordered elevation
12. Encourage and assist patient with activity (e.g. out of bed) as tolerated and as ordered.

DRAINAGE:

13. Maintain drainage system at ordered parameters
    - Intermittent drainage: Drain as ordered
    - Continuous Drainage: Turn off clamp (temporarily) to drainage chamber
      - To obtain ICP readings
      - To obtain strip recordings
      - During transport of patient
      - During head of bed position change
14. Empty drainage and document amount a minimum of every 8 hours, and when there is approximately 30-40 mL in the drainage meter.
15. Change drainage bag when approximately ¾ full
16. Scrub connection with chlorhexidine for a minimum of 15 seconds before changing drainage bag.

DISLODGEMENT:

17. Place sterile gauze over insertion site.
18. Set up new system.
19. Inspect the integrity of the catheter and document.

DISCONNECTION:

20. Do the following in case of disconnection at stopcock-catheter interface:
    - Place sterile gauze over catheter
    - Apply rubber-tipped hemostat to end of IVC
21. Do the following in case of disconnection at stopcock-tubing interface:
    - Turn stopcock off to patient
    - Apply sterile gauze to end of stopcock
    - Set up new system for provider reconnection

REPORTABLE CONDITIONS:

22. Notify the provider immediately for:
    - Deterioration in neurological status
    - Deterioration in VS including presence of Cushing's response
    - ICP/CPP outside of specified parameters
    - Need for set up of new system
    - Change in CSF color, clarity, flow
    - Dampened or absent ICP waveform
    - Dislodgement or disconnection
    - Wet dressing
    - Change in amount of CSF output per provider's order

PATIENT/FAMILY TEACHING:

23. Instruct on the following:
    - Purpose of ICP monitoring
    - Need for patient's head to be shaved
    - ICP values may elevate with patient stimulation
    - Need to report presence of headache, seizure activity

ADDITIONAL STANDARDS:

24. Refer to the following as indicated:
    - Barbiturate Coma - ICU
    - Restraints
    - Sedation/ Analgesia (Intravenous) - ICU

DOCUMENTATION:

25. Document in accordance with documentation standards.

Initial date approved:	Reviewed and approved by:	Revision Date:
04/95	Professional Practice Committee Nurse Executive Council Attending Staff Association Executive Committee	08/96, 01/00, 11/00, 03/05, 01/13, 12/15, 04/17, 8/20