

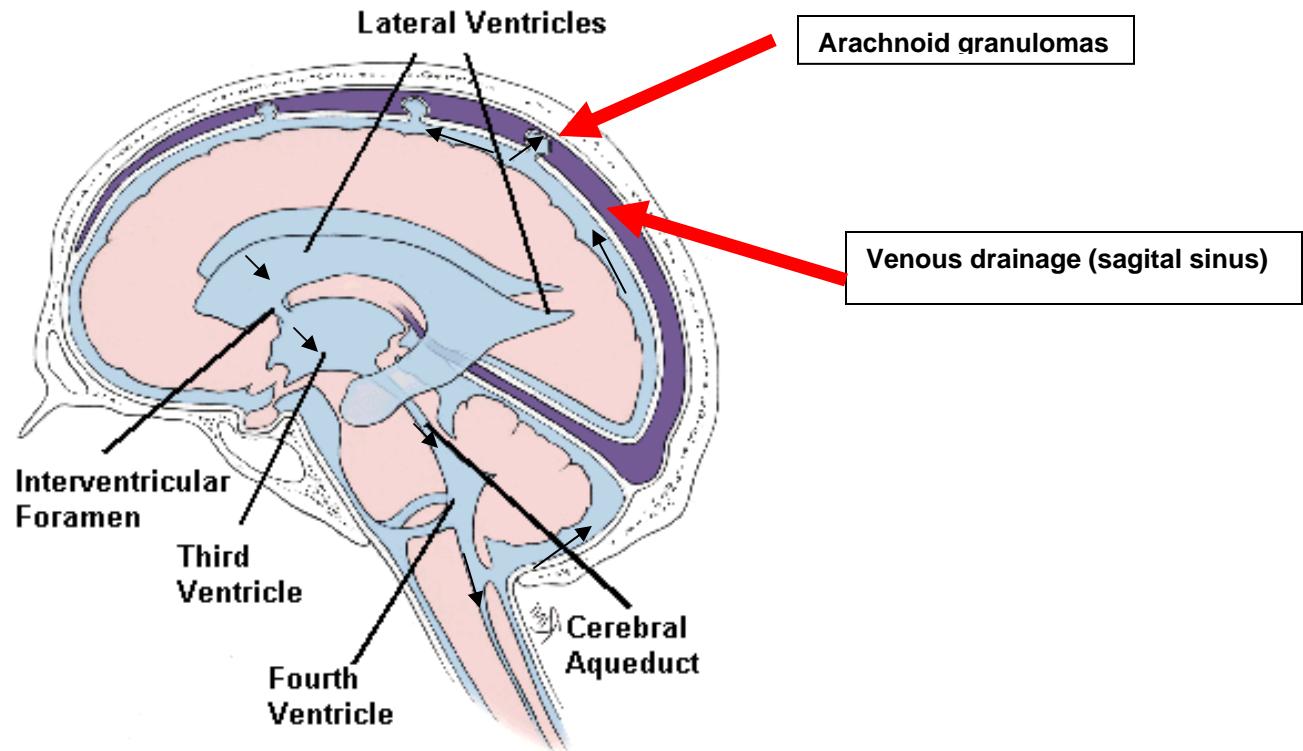
## HIGHLIGHTS: EVD and Lumbar Drains

### General Goals

- A Codman drain is to be connected to all External Ventricular Drains (ICP) and Lumbar CSF drains. If the patient comes from the OR without a Codman drain, these are to be connected by the nurse.
- The Codman drain provides a safe collection system that eliminates any risk of accidental backflow into the CSF. It contains an antimicrobial back-check valve and graduated collecting chamber and makes drainage positioning easy and safer.
- Procedures are available on-line at:  
EVD ICP:  
<http://www.lhsc.on.ca/critcare/icu/procedures/icpiv04.html>  
Lumbar CSF Drains:  
<http://www.lhsc.on.ca/critcare/icu/procedures/icplum04.html>
- Troubleshooting tips for ICP drains are available on-line at:  
<http://www.lhsc.on.ca/critcare/icu/edubriefs/icpincr.html>
- Normal CSF pressure is < 10 for both intraventricular and lumbar spaces.
- The set-up for an ICP versus lumbar drain is the same, except that the intraventricular drain is positioned to the external auditory canal, whereas, the lumbar drain is positioned at the iliac crest.
- It is extremely important to continue spinal cord testing from admission to CCTC discharge (or 3 days post surgery if no abnormal findings exist). The risk for cord injury from ischemia continues for up to 96 hours, usually peaking at 48-36 hours.

### CSF Production

- CSF is continually produced, filling the ventricles and ventricular system. We make approximately 20 ml per hour more than we have space. Most CSF is produced in the lateral and 3<sup>rd</sup> ventricles, with additional production occurring in the 4<sup>th</sup> ventricles. CSF must continually flow downward from the 3<sup>rd</sup> and lateral ventricles, to the 4<sup>th</sup> ventricle, and into the spinal canal. It then flows upward into the subarachnoid spaces above the cerebral cortex, where CSF is reabsorbed by arachnoid granulosas and into the venous blood. CSF is then returned via the jugular veins to the venous system, maintaining normal CSF volume.
- Hydrocephalus occurs any time the production of CSF exceeds reabsorption. This can occur because:
  - There is an obstruction of the outflow of CSF (e.g., brain swelling compresses the aqueduct of sylvius), trapping CSF within the ventricles.
  - There is blood in the subarachnoid spaces that is interfering with the ability of the arachnoid granulosas to reabsorb CSF.
  - Drainage from the jugular veins is impeded (e.g., patient has head tilted to the side), causing a back up of blood and CSF.
  - Swelling of the spinal cord can prevent outflow of CSF from the lumbar spinal canal, putting pressure on the spinal cord.
  - Blockage of a ventricular drain
- The usual goal is to maintain a steady pressure and avoid large swings upward and downward. Rapid drops in pressure can trigger rebleeding and lead to headache and/or disequilibrium syndrome among conscious patients.
- Because we make ~20 ml per hour in excess of what we have room to accommodate, the removal of ~20 ml per hour should maintain a relatively steady pressure.



### Lumber Drains

- Lumber drains are used to monitor the pressure in the lumbar CSF following thoracic aneurysm repairs. The thoracic and lumbar spinal cord receives blood flow from the thoracic aorta; cross clamping during surgery can compromise blood flow to the thoracic and/or lumbar cord causing paraplegia.
- Cord ischemia can obstruct the flow of CSF, causing the lumbar CSF pressure to rise above normal. Pressure should be < 10
- If pressure initially rises, CSF can be drained in an effort to reduce CSF pressure and prevent further cord injury.

### Orders:

- All orders should include:
  1. The position where the "0" reference on the Codman drain should be placed. This is generally the outer ear canal for intraventricular drains and the iliac crest for lumbar drains.
  2. The position for drainage (**ordered in cm of water**). This is the position above the "0" reference that defines the pressure when drainage will commence (if the system is open to drainage), and the lowest the pressure will be dropped by drainage (the pressure can fall lower if the patient's own pressure is below this level). The drip chamber is adjusted until the small arrow lines up with this level. Ensure you are reading the cm of H<sub>2</sub>O column.
  3. Orders for continuous or intermittent drainage. Note, even if the system is off to drainage, a leveling and drainage position must be ordered. This is required in case "prn" drainage is required.
  4. If continuous drainage is provided, orders should include a critical pressure when intervention is required. (For example "if ICP is > 15 cmH<sub>2</sub>O despite continuous drainage, contact neurosurgery or give 150 ml 20% mannitol q6h).
  5. If intermittent drainage is ordered, parameters must include:

- The pressure in mmHg (from the bedside monitor) when drainage should be initiated (e.g., Open to drainage if ICP > 20 mmHg for > 2 minutes).
  - The duration of time for drainage (e.g., X 5 minutes).
  - The frequency of drainage (e.g., drain up to 3 times per hour).
  - What to do if drainage is unsuccessful. (e.g., if ICP > 20 mmHg for > 5 minutes, despite drainage, give mannitol 100 ml over 20 minutes and call neurosurgery).
- To measure ICP accurately, turn the 3 way stopcock off to the drainage unit during hourly pressure measurements. The flat side of the 3 way stopcock is off. Measurements taken when the stopcock is open to drainage and pressure will be inaccurate, as they will reflect a blended pressure between the drain and ICP.
- CSF drains are highly susceptible to infection due to CSF glucose content. Daily CSF samples should be sent for gram stain and culture after the drain is in place ~24 hours.
- Nurse may obtain CSF samples following the on-line procedure.
- Monitor the ICP closely during nursing care, suctioning, and neck position changes. Coughing is another critical trigger of increased ICP. Avoid excessive stimulation if ICP is elevated and space procedures out over the 24 hour clock (do not cluster activities together as this can produce sustained ICP elevation).
- Hyperventilate and hyperoxygenate the patient prior to suctioning to provide some margin for error.
- Hyperventilation can buy time if ICP is elevated, and can be useful if the patient has a reversible cause such as increased bleed that will be surgically managed.