TITLE: INTRACRANIAL PRESSURE MONITORING AND DRAINAGE OF CEREBROSPINAL FLUID VIA VENTRICULAR CATHETER
(DRC10)

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ISSUED FOR: Nursing

RESPONSIBILITY:
RN—Critical Care (Med-Surg-Neuro/trauma)
RN—PACU

PURPOSE: To describe the setup and maintenance of intracranial pressure (ICP) monitoring devices.

INDICATIONS: Monitoring of ICP may be indicated after head injury, craniotomy or intra-cerebral hemorrhage to identify and control life threatening increases in intracranial pressure.

KNOWLEDGE BASE:
1. This procedure will cover ICP monitoring and monitoring with drainage of CSF with the Codman Ventricular Catheter, which is inserted through a burr hole between the skull and dura and connected to the Codman External Drainage System.
2. The transduced ventricular catheter can record intraventricular pressures, as well as drain CSF.
3. Intracranial pressure monitoring will be done in the medical/surgical/neuro/trauma ICU.
4. The neurosurgeon and assisting RN will don gown (sterile), sterile gloves, mask and head covering prior to the procedure. Glass doors to the patient's room will be closed and traffic kept at a minimum in the patient's room and curtain pulled. All other persons entering the room are to don a mask.
5. Preparation of the site will be done as per Infection Control Department Policies.

EQUIPMENT:
1. Codman External Ventricular Drain Set [obtained from Equipment/Storage Room 5CCT].
2. Codman cranial access kit [obtained from Equipment/Storage room 5CCT].
3. Codman ventricular catheter (Bactiseal) If patient is allergic to Rifampin or Clindamycin, use non-antibiotic impregnated Codman ventricular catheter [obtained from Equipment/Storage Room 5CCT].
4. Uniflow disposable pressure transducer and disposable pressure tubing.
5. Sterile 12 ml syringes
6. 10 ml sterile preservative-free saline
7. Povidone iodine swabs
8. 4 x 4s
9. 4x4 Tegaderm clear transparent dressing.
10. Povidone-Iodine
11. Electric clipper with disposal head
12. Sterile gloves, sterile gowns, head coverings and mask

PROCEDURE: SETUP OF THE EXTERNAL VENTRICULAR DRAINAGE SYSTEM FOR MONITORING OF ICP AND DRAINAGE OF CSF

Positive patient identification is required prior to performing this procedure. Refer to SMH Policy (01.PAT.09) Patient Identification: Inpatient/Outpatient.

NOTE: The ventricular catheter may be placed in the OR or at the bedside in Critical Care or in the ECC. Perform "timeout" per hospital policy (01.PAT.18) to verify correct patient, procedure and site. In emergent situations, the critical care staff will assist with the procedure while the patient is in the ECC.

Preparation of the Drainage and transduced systems

1. Perform hand hygiene. Don mask.

2. Open the Codman drainage set and transduced system Packaging (do not remove items).

3. Draw up 10 ml of sterile preservative-free saline.

4. Don sterile gloves.

5. Remove Codman drainage set from package and place on rolling IV pole.

6. Remove transduced set from packaging; discard all pressure tubing keeping only the transducer.

7. Connect the transducer to the stopcock located on the Codman bracket adjacent to the laser light holder.

8. Attach the saline filled syringe to the open end of the Transducer; flush the entire system to remove all air.

9. Remove and discard syringe, place a sterile closed end cap where the saline syringe was, also place a sterile closed end cap on the stop cock.

10. Connect the pressure module cable to the transducer.
11. If the ventricular catheter is going to be to drain ONLY, follow the above procedure with this EXCEPTION: Do not connect the single transduced set to the Codman Drainage System. You will need to place a sterile closed end cap on the stopcock adjacent to the laser light holder.

**Insertion of Ventricular Catheter**

1. Perform “Time Out” (per policy 01.PAT.18)

1. Both neurosurgeon and staff member who will be holding the patients head must perform hand hygiene. Don mask, head covering, sterile gowns, and sterile gloves.

2. Once the ventricular catheter is in place, the flushed Codman Drainage System will be connected to the ventricular catheter using sterile technique.

3. The air filter/valve at the top of the collection chamber must be upright at all times and kept dry. If it becomes wet, it must be changed as drainage of CSF will not be possible.

4. Place the laser level at proximal stopcock, this is the “zero” mark for the system.

**DETERMINING THE HEIGHT OF THE CHAMBER:**

1. The physician will specify the height of the chamber above the external auditory canal. For example: 5 cm of H₂O above the external auditory canal. If not specified by MD, nursing staff will default to 15 cmH₂O.

2. To level the drain/transduced system: first level the drain system using the horizontal level located with the laser light. Turn the laser light on, align the laser light to the tragus or external auditory canal/meatus, by adjusting the height of the Codman Drainage System on the IV pole up or down as needed; this will level the system to the Neuro-phlebostatic axis.

3. Leveling the system must be done with each patient position change.

NOTE: The cmH₂O marks on the Codman External Drainage Set are used to adjust height, not the cubic centimeter markings on the collection chamber. Adjust the collection chamber up or down on the Codman scale using the cmH₂O scale to the height ordered by the neurosurgeon.

NOTE: The higher the chamber is placed, the less the
drainage; the lower the height of the chamber from the landmark, the more the drainage of CSF.

**TO ZERO, ONCE CONNECTED TO THE PATIENT:**

Make sure pressure module is labeled “ICP.”

1. Prior to zeroing the ICP ensure that the ICP is leveled to the neuro phlebostatic axis.

2. Perform hand hygiene.

3. To level: Sight laser to the level of the tragus or external auditory canal/meatus or landmark the physician has indicated.

4. Turn the stop-cock on the transducer off to the patient. *(this MUST be done prior to lowering the collection chamber)*

5. Lower the collection chamber, placing the arrow at the Zero mark.


7. After the monitor shows the ICP has been successfully zeroed turn the stop-cock so that it is monitoring only. Assess the ICP waveform and the ICP reading ensuring that it is accurate and there is a good waveform.

8. Raise the collection chamber back to the ordered height for the chamber.

9. Place the stopcock in the correct position; based on the MD order (monitor only, monitor and drain intermittently or monitor and drain).

10. Observe intracranial waveform and place on appropriate scale. Record a strip of the ICP at the beginning of each shift and place in the progress note section of the patients chart.

1. When draining, allow CSF to collect in the small fluid chamber in order to accurately measure the amount of CSF drained. Keep the stop-cock between the small chamber and the drainage bag turned off to the chamber at all times, (except when emptying the fluid from the chamber into the bag). Empty the chamber at least every 4 hrs, into the drainage bag and record the amount in the I&O flowsheet.
2. When the drainage bag is approximately 3/4’s full, change the bag only, using sterile technique. (Extra drainage in the Equipment/Supply Room 5CCT).

FOR DRAINAGE:

1. The stopcock of the external drainage set, closest to the drip chamber should remain “OFF to drainage” and the drainage tubing should be clamped at all times except during actual drainage or if ordered by physician to be open for continuous drainage.

2. If order – **Drain Intermittently**.
   To drain the patient (specific physician’s orders or written parameters are needed): Open the stopcock to drainage (“OFF to monitor”) and unclamp the drainage tubing. Observe the air port chamber for drops of CSF. Allow 20 drops of CSF to be drained before turning the stopcock “off to drainage” and rechecking ICP. Repeat as needed, allowing sufficient time for ICP to equilibrate before draining further. When ICP is within parameters ordered by the neurosurgeon, return stopcock to “off to drainage” and re-clamp drainage tubing.

3. If order – **Continuous Drain**
   Stopcock of external drainage set, closest to drip chamber should be turned to allow monitoring and draining of CSF simultaneously.
   **NOTE:** The ICP waveform will be dampened and the ICP will not be accurate. Once per hour and PRN the stopcock **MUST** be turned off to the drip chamber (drain) and on to monitor only. Allow a few minutes from the ICP to calibrate. Obtain ICP reading. Return Stopcock to allow continuous monitoring and draining once reading obtained.

4. Clamp drain when moving the patient onto a stretcher/bed for tests, etc. Re-level and re-set per orders when the patient is stable. Avoid tipping the collection chamber and getting the air filter wet. Ask the physician if patient may have drain clamped during transport, if appropriate.

5. When draining, allow CSF to collect in the small fluid chamber in order to accurately measure the amount of CSF drained. Keep the stop-cock between the small chamber and the drainage bag turned off to the chamber at all times, (except when emptying the fluid from the chamber into the
bag). Empty the chamber at least every 4 hrs, into the drainage bag and record the amount in the I&O flowsheet.

6. When the drainage bag is approximately 3/4’s full, change the bag only, using sterile technique. (Extra drainage in the Equipment/Supply Room 5CCT).

TECHNIQUE FOR WITHDRAWING CSF SAMPLES:

1. A physician’s order is required.

2. Turn the proximal stopcock OFF to the patient (this is the stopcock closest to the patients head).

3. Place sterile towel under the catheter.

DO NOT use the resealable port located in the drainage system to obtain the CSF sample.

4. Perform hand hygiene, wear a mask, sterile gloves and using sterile technique, make sure the stopcock is turned off to the patient. Place a sterile towel under tubing where the proximal stopcock is located, remove the closed end cap. Clean the proximal aspiration port with Povidone-Iodine and allow to dry for three (3) minutes. Retract the syringe to the 1 ml mark then place either a 3 ml syringe (no smaller) or a 5ml syringe on the stopcock. Turn the stopcock so that it is open to the patient and closed to the drainage chamber. Use a 3 ml syringe for cultures or 6 ml for culture plus cell count, allow CSF to fill the syringe. If no CSF drains, VERY GENTLY aspirate amount of CSF needed. Turn the stopcock off to the patient, then remove the syringe. Place a new sterile closed end cap on the stopcock. Maintaining sterile technique, inject the CSF specimen into (sterile white plastic tube). Gram stain and culture needs to be placed in a separate sterile white plastic tube from CSF cell count or chemistries.

5. Specimen Amounts:

<table>
<thead>
<tr>
<th>TESTS</th>
<th>OPTIMAL AMOUNT</th>
<th>MINIMAL AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gram stain/culture</td>
<td>2.0cc</td>
<td>0.5cc</td>
</tr>
<tr>
<td>Cell Count</td>
<td>1.0cc</td>
<td>0.5cc</td>
</tr>
</tbody>
</table>
6. Sterile white plastic tube should be kept in the Trauma supply room and 5EB nurses' station cupboard. They are special ordered.

7. The order of specimens drawn is not critical when drawing from the Codman catheter.

8. Send the CSF specimen to the Lab immediately, properly labeled.

TROUBLESHOOTING THE TRANSDUCED SYSTEM:

1. Dampened waveform; and/or no CSF Drainage

   a. Check the transducer and tubing for air.
   b. Lower Codman drainage system below level of patient's head; observe for drainage of CSF into collection chamber.
   c. If there is still no improvement, flush the system away from the patient towards drip chamber after turning the stopcock OFF toward the patient.
   d. Use only preservative-free non-bacteriostatic normal saline to flush the system.
   e. If there is no improvement in the waveform, consider blockage within the intraventricular catheter. Follow the steps for drainage of CSF. Allow 20 drops to drain; clear the catheter of potential air or particulate matter. Close the system OFF to drainage and OPEN it to monitor, recheck the ICP and waveform.
   f. If there is still no improvement in the waveform, contact the physician for an order to flush the catheter or check. Fill a 3 ml syringe with 0.2 ml preservative-free normal saline. Follow same procedure for prep as you would to withdraw CSF. Slowly inject preservative-free normal saline into the ventricular catheter using aspiration port or stopcock. Pay particular attention to maintaining sterility of tubing tips, stopcock aspiration port, needle, and dressing. Tubing connections or aspiration ports should be cleansed with Povidone iodine for one minute, and allowed to dry. If increased resistance to flushing is noted, do not force; stop and notify the physician.

   **NOTE:** Flushing of the ventricular catheter may only be performed with a specific order from the neurosurgeon.

   g. **Never** attempt to flush the ventricular catheter (toward the patient); if there is air located in the tubing.
h. If there is still no improvement in the waveform, notify the physician and do not attempt further manipulation of the system.

i. Discontinuing of the ventricular catheter will be done by a neurosurgeon only. Have skin stapler available at bedside.

**DRESSING CHANGES:**

1. The physician will secure the ventricular drain and specify the dressing type.

2. A dry, sterile, occlusive dressing will be maintained while the drain is in place. **DO NOT** change the dressing unless ordered by the physician. Dressing may be reinforced with tape, as needed, if non-occlusive.

**DOCUMENTATION:**

1. Vital Sign Flowsheet (EMR): Intracranial pressure and calculated cerebral perfusion pressure (CPP=MAP-ICP) will be recorded every hour and PRN. **Place waveform strip in chart once per shift.**

2. Record insertion date, CSF color, status, level, waveform, assessment of insertion site, dressing and interventions every hour and PRN with any changes in the ICU Assessment Flowsheet; Neuro section of EMR.

3. Record the amount CSF drained every 4 hours and PRN in the I&O Flowsheet EMR. Notify physician if greater then 100 ml per 8-hour period. Document in the ICU Vital Sign Section; Physician communication.

4. CSF specimens sent for culture, EMR, ICU Vital Sign Flowsheet under focus note.

5. Notification of physician:
   a. For drainage greater than 100 ml/8 hours
   b. Change in color or clarity of drainage and or clots occluding the tubing
   c. Patient complaints of headache or increased WBC count, stiff neck, fever, neurologic changes air in tubing (pneumocranium)
   d. If, after discontinuation of the ventricular catheter, drainage is noted at the site.


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