PURPOSE: Intracranial Pressure (ICP) Monitoring allows for early detection of increasing intracranial pressure and provides for immediate intervention and evaluation of treatment.

INDICATION: Monitoring of ICP and/or drainage of CSF 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, which is inserted through a burr hole between the skull and dura and connected to the ICP Codman device.

2. The transducer can record parenchymal, subdural and intraventricular pressures, dependent upon where it is placed by the neurosurgeon.

3. The monitor provides a continuous digital readout of ICP Mean pressure and can also be connected to existing hemodynamic monitoring.

4. The pressure transducer catheter must be zeroed and inserted by the neurosurgeon in the OR or in the ICU.

5. Some neurosurgeons may request the following zeroing process (this is optional):

Prior to zeroing the microsensor, nursing will add sterile preservative free water/saline into reservoir kit. The neurosurgeon will connect the end of the microsensor/bolt microsensor/ventricular catheter microsensor (built into catheter) with the assistance of the nurse, to the cable on the ICP Codman machine. The neurosurgeon will then place the tip of the microsensor into the preservative free sterile/water followed by nursing zeroing the ICP Codman machine.

6. OBTAIN REFERENCE NUMBER FROM SURGERY IF
7. Intracranial pressure monitoring will be done in the critical care unit.

8. The neurosurgeon and assisting RN will perform hand hygiene don sterile gown sterile gloves, and mask and head covering prior to the procedure. Glass doors to the patients' room will be closed and traffic kept at a minimum in the patient's room and curtains pulled. All other persons entering the room are to don a mask and head covering.

9. Preparation of the site will be done as per Infection Control Department Policy #113-129.

EQUIPMENT:

1. Codman Cranial Access kit
2. Intracranial Pressure Monitor – ICP Codman Device in Equipment/Storage Room (5CCT) with patient monitor cable (for connection to the bedside Phillips monitor pressure module).
3. Intracranial Pressure Monitoring Kit (3 kits available). Intracranial Pressure Monitoring Kit (for monitoring only) Microventricular Bolt Pressure Monitoring Kit (for monitoring and or Microventricular pressure monitoring kit for drainage of CSF) (GRAY, RED AND BLUE BOX)
4. Clipper with disposable head.
5. Betadine
6. Sterile 4 x 4’s
7. 4 x 4 Tegaderm clear transparent dressing
8. Sterile surgical gowns
9. Sterile gloves
10. Masks/head covering
11. Extra 3.0 nylon sutures
12. Mastisol
13. Surgical Stapler
14. Line cart
15. (2) preservative free saline or water

FOR DRAINAGE OF CSF ONLY
16. Codman external drainage system.
PROCEDURE:  PREPARATION AND USE:

1. Perform “timeout” per hospital policy (01.PAT.18) to re-verify correct patient, procedure and site.

2. Obtain the monitor and assemble:
   
b. Place the ICP Codman Device at the patients’ bedside (make sure that the ICP CODMAN Device is securely attached to the pole with the pole clamp).

c. Insert the power cord in the rear of the ICP CODMAN Device into a grounded AC outlet.(Battery life is 4-5 hours)

d. Make sure the power switch on the back of the ICP CODMAN is in the ON position (switch should be in the up position).

e. **DO NOT** attach the patient monitor cable to the rear of the ICP CODMAN and the other end to the pressure module on the Phillips bedside monitor until the procedure is completed and mean ICP reading obtained from ICP Codman machine.

SET-UP AND ZEROING: IMPORTANT NOTE

1. Prior to the insertion of the ICP Catheter or bolt inserted-- the cable, ICP microsensor / transducer and ICP Codman machine must be Zeroed. THIS MUST BE COMPLETED BEFORE ICP,MICROSENSOR OR BOLT MICRO SENSOR OR DRAINAGE CATHETER MICROSENSOR PLACED IN PATIENT.

2. Some neurosurgeons may request the following zeroing process (this is optional):

Prior to zeroing the microsensor, nursing will add sterile water/saline into reservoir kit. The neurosurgeon will connect the end of the microsensor/bolt microsensor/ventricular catheter microsensor (built into catheter) with the assistance of the nurse, to the cable on the ICP Codman machine. The neurosurgeon will then place the tip of the microsensor into the sterile preservative free saline/water followed by nursing zeroing the ICP Codman machine.
3. The neurosurgeon under sterile conditions will apply end of microsensor/transducer to cable end that is being held in place by bedside RN. A sterile towel will be wrapped around cable end and secured to prevent contaminating the sterile field. Zeroing of ICP CODMAN machine will then take place! (SEE BELOW)

Note: No ICP Codman microsensor/transducer is to be placed into the patient’s cranium without being zeroed first!!

a. Turn on the ICP CODMAN monitor by pressing the ON button.

b. After the burr hole has been drilled by the neurosurgeon, just prior to the insertion of the microsensor or catheter, the neurosurgeon with the assistance of an RN will attach the end of the cable to the microsensor/ transducer using sterile technique. The RN will then press the word ZERO (BLUE BUTTON) ON THE ICP CODMAN DEVICE THIS MUST BE DONE PRIOR TO INSERTION.

4. Some neurosurgeons may request the following zeroing process (this is optional):

Prior to zeroing the microsensor, nursing will add sterile preservative free water/saline into reservoir kit. The neurosurgeon will connect the end of the microsensor/bolt microsensor/ventricular catheter microsensor (built into catheter) with the assistance of the nurse, to the cable on the ICP Codman machine. The neurosurgeon will then place the tip of the microsensor into the preservative free sterile/water followed by nursing zeroing the ICP Codman machine.

a. YOU MUST RECORD REFERENCE NUMBER THAT APPEARS ON THE ICP CODMAN MACHINE AFTER ZEROING. This number is to be documented into the patients chart. This number will be used to identify the ICP Codman device with the individual patient if cable is disconnected for any reason.

b. Once the procedure is completed also document the reference number with a sharpie on the white cable connection.

c. OBTAIN REFERENCE NUMBER FROM SURGERY IF PLACED IN OR.

d. Press menu enter on the ICP CODMAN device this
brings you to the mains screen states “ICP 0” you MUST wait until “0” appears in the screen before placing catheter in patient! (This may take up to 15 seconds) You may accept plus or minus 1 if “0” does not appear on the ICP Codman machine

e. Once the catheter has been zeroed, the neurosurgeon is ready to proceed to implant into patient.

NOTE: If for any reason your ICP Codman machine during initial setup does not say to zero transducer/microsensor turn off ICP Codman machine and then turn back on. Request the neurosurgeon to hold the microsensor/transducer steady.

ZEROING PHILLIPS BEDSIDE MONITOR ONLY AFTER ICP/BOLT IMPLANTED

1. Following Catheter insertion and ONLY AFTER physician has initial ICP reading from ICP Codman device:

   a. Slave the bedside monitor cable to the ICP Codman device to the Phillips bedside monitor, press and re-zero on the Philips bedside monitor only.
   b. Press the menu button on the ICP Codman machine then calibrate bedside monitor by pressing *20* button that is labeled on the ICP Codman machine.
   c. The bedside monitor will then give a signal of 20 plus or minus 1
   d. If the bedside monitor does not go to 20 verify all connections are secure then re-zero Philips monitor as instructed above.
   e. If 20 plus or minus 1 does not appear on bedside monitor change slave cable to monitor only (IF YOU NEED TO CHANGE THE CABLE FROM ICP CODMAN MACHINE TO PATIENT YOU MUST VERIFY REFERENCE NUMBER!)

DRESSING AND CARE OF THE CATHETER:

1. Direct the catheter over the patient’s head and tape in a loop securely to the side of the face. This will minimize pull on the catheter with patient movement. You must loop patient catheter and secure to bed to avoid pulling of catheter.

2. Dress the site with an appropriate dressing per the Neurosurgeon’s preference.
DO NOT change the dressing unless specifically ordered by the neurosurgeon. Reinforce if the dressing is not occlusive.

NOTE: If dressing appears soiled, becomes loose or needs changing, nursing staff will change the dressing under maximal sterile barriers (mask, gown, sterile gloves, head cover) only with a Neurosurgeon’s order.

TRANSPORTING:

1. When moving or transporting the patient for tests and procedures, disconnect the transducer cable from the Phillips bedside monitor at the module. Transport the ICP CODMAN DEVICE with the patient so that the ICP can be continuously monitored.

2. **NONE of the ICP Codman implanted devices are MRI compatible.**

3. Transporting patients who are stable can be done without the ICP Codman Device Monitor if the neurosurgeon writes the order “Patient may go without ICP CODMAN DEVICE Monitor.” In this case disconnect the microsensor/transducer Catheter from the cable on the ICP Codman device.

4. Remember when the ICP Codman device Monitor is reconnected to the Phillips bedside monitor; you must reconnect microsensor/transducer to the cable of the ICP Codman device that WAS previously connected to the patient! **Once reconnected screen appears and says: Transducer detected zero reference number = You can only accept the reference number if it correlates to what is documented on the chart or written in sharpie on the patient white end of microsensor.**

If the number does not correlate to the number in the chart or, on the cable arrow down on the ICP Codman device until highlight reference number appears and press menu enter.

CATHETER REMOVAL:

1. The catheter will only be removed by the neurosurgeon.

2. Have available: Skin stapler Neosporin ointment 4 x 4 and tape
3. The tip may be cut and sent to the lab for culture and sensitivity if requested by the neurosurgeon. If the surgeon requests this have a sterile suture set and sterile specimen cup at the bedside.

IF ICP CODMAN IS USED FOR DRAINING PLUS MONITORING:

1. Follow the same procedure for set-up, calibration and transducing.

2. Using sterile technique, connect the CNS drainage set to the port of the catheter.

3. Keep the clamp on the drainage tubing closed except when you are draining the ICP. You must have a physician order to leave the catheter continuously open to drain.

4. 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.

5. When the drainage bag is approximately ¾’s full, change the bag only, using sterile technique. (Extra drainage bags are kept in the Equipment/Supply Room 5CCT).

6. The re-sealable port at the lower stopcock is not to be used for culture or sampling.

7. Drainage systems should not be changed unless they become obstructed, or the air/filter port becomes soaked, or a physician specifies.

WITHDRAWING CSF SAMPLES FROM THE CATHETER MONITOR/DRAIN:

1. A physician’s order is required.
2. Turn the proximal stopcock OFF to the patient.
3. Place sterile towel under the catheter.

**DO NOT** use the re-sealable port located in the drainage system to obtain the CSF sample.
4. Perform hand washing, wear a mask, sterile gloves and using sterile technique, make sure the stopcock is turned off to the patient, place sterile towel under tubing where sampling port located, remove the luer lock cap from the stopcock close to the patient’s head. Clean the proximal aspiration port with Povidone-Iodine and allow to dry 3 minutes. Place a 3 ml syringe (no smaller) on the stopcock. Turn the stopcock so that it is open to the patient and closed to the drainage chamber. Using a 3 ml syringe for culture or 6 ml for culture and cell count retracted to the 1 ml mark, 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 luer lock cap on stopcock. Maintaining sterile technique inject the CSF specimen into a sterile specimen bottle(s). Gram stain and culture needs to be placed in a separate bottle 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/bacterial cultures</td>
<td>2.0cc</td>
<td>.5cc</td>
</tr>
<tr>
<td>Cell Count</td>
<td>1.0cc</td>
<td>.5cc</td>
</tr>
<tr>
<td>Chemistries</td>
<td>1.0cc</td>
<td>.5cc</td>
</tr>
</tbody>
</table>

6. Sterile specimen bottles are located in the Trauma equipment room and in a bin in the Lab cabinet in the nurses’ station in 5EB.

7. The order specimens are drawn in is not critical when drawing from the Catheter.

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

**TROUBLESHOOTING THE ICP CODMAN DEVICE**

1. Display will not turn on: verify power cord is plugged into a live AC power source.

2. Low battery indicator WILL illuminate ON THE ICP CODMAN DEVICE operates on battery: FOR 4- HOURS

3. Verify all cables are secure.

4. YOU CAN CHANGE CABLES THAT ARE ATTACHED
TO THE ICP CODMAN DEVICE AS LONG AS YOU VERIFY REFERENCE NUMBER.

5. ONLY SLAVE CABLES TO PHILIPS BEDSIDE MONITOR CAN BE CHANGED FOR TROUBLESHOOTING.

6. ICP Codman MUST remain plugged in at all times except during transport.

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.

NOTE: The Codman Monitor displays the true ICP number, this is the ICP number that should be documented in the EMR

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 than 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)

If, after discontinuation of the ventricular catheter, drainage is noted at the site.

REFERENCE:


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