

UConn HEALTH

CLINICAL PROCEDURE

Intracranial Pressure Monitoring / Cerebrospinal Fluid Drainage using the Codman ESD3 External Drainage System

A. EFFECTIVE DATE :

January 13, 2021

B. PURPOSE :

To outline the procedure for Intracranial Pressure (ICP) Monitoring in the ICU.

C. POLICY :

1. The Codman EDS3 CSF External Drainage System is utilized in the intensive care setting to allow for:
 - a) Monitoring ICP
 - b) The ability to decrease the pressure within the cranium by removing CSF
 - c) the ability to collect CSF specimens
 - d) CSF drainage into the drip chamber
2. Insertion and removal of all intracranial pressure monitoring devices must be performed by a neurosurgeon or a practitioner with clinical privileges.
3. Sterile gloves, mask, and hat will be worn when assisting with initial ventriculostomy catheter insertion and drainage system hook-up. Sterile gloves and mask will be worn when performing site care, replacing the drainage collection bag, or obtaining a sample of CSF.
4. Only a neurosurgeon or practitioner, under a neurosurgeon's guidance and with the privilege delineated may inject medication into the system or irrigate the ventriculostomy catheter. Administration of medication to the patient can be accomplished via the injection site on the Y-connector next to the Patient Line stopcock.
5. ICU RNs, upon approval of the neurosurgeon may flush the system from the patient line stopcock BACK to the drip chamber, transducer or collection bag. Sterility must be maintained and any solution must be flushed AWAY FROM the patient. Nurses should NEVER flush between the patient line stopcock and the patient catheter.
6. The following will be assessed upon initial insertion, Q12 hours (RN shift assessment), and PRN:
 - a) HOB is at the ordered height.
 - b) HOB control is *Locked Out*.
 - c) No air bubbles are noted in the system.
 - d) All connectors in the system are tight.
 - e) Position of the transducer is at the "Foramen of Monro".
 - f) Dressing for intactness and drainage
7. The following will be assessed and documented in the medical record:
 - a) Level of drainage system per orders
 - b) Color and character of CSF fluid every 12 hours and PRN.
 - c) ICP and CPP every 1- 2 hours as ordered by practitioner.
 - d) GCS and neuro assessment every 1 – 2 hours as ordered by practitioner.
 - e) Significant interventions and responses to interventions.

8. The following conditions will be reported to the neurosurgeon / practitioner:
- Any neurological deterioration.
 - Pupillary dilatation, bradycardia, hypertension. (Late sign of increased ICP.)
 - Changes in CSF (color/clarity/amount).
 - CSF suddenly becomes bloody. (Sign of re-bleeding.)
 - CSF leaking at catheter insertion site. (Increased risk of infection.)
 - Air bubbles or debris (tissue, blood clots) in the EDS tubing suspected to be inhibiting drainage or monitoring or any concern that the ventriculostomy catheter may be occluded.
 - Significant change in waveform, dampening of waveform or no waveform after troubleshooting
 - ICP catheter falling out. (If this happens, place a sterile dressing over site.)
 - Elevated ICP that does not respond to ordered therapy.
 - Elevated leukocyte count and/or temperature. (Sign of infection.)
 - Site swelling, CSF leakage, or signs infection after catheter removal

D. SCOPE :

UConn Health, John Dempsey Hospital, **Intensive Care Unit**

E. DEFINITIONS :

- CSF: cerebrospinal fluid
- MAP: mean arterial pressure
- CPP: cerebral perfusion pressure; $CPP = MAP - ICP$; Normal CPP is between 70 – 90mmHg
- ICP: intracranial pressure; Normal ICP is 9 – 14 mmHg.
- Null Position: The Codman EDS 3 drainage system uses 4-way stopcocks. The stopcock can be opened in 3 directions simultaneously. This is called the Null Position and is not recommended because it may result in inaccurate ICP readings.

F. MATERIAL(S) NEEDED :

- Codman EDS 3 CSF External Drainage System
- IV pole
- Codman EDS 3 Leveling Device (obtained from ICU Pyxis)
- Disposable transducer with “dead end” cap and stopcock
- (2) 10 ml luer-lok syringes
- Sterile preservative free saline solution
- Sterile needle-less injection cap
- 18 gauge needle

G. PROCEDURE : The RN will follow these steps related to set-up, monitoring and ICP monitoring system care:

1. **MOUNTING**

- Obtain Codman EDS 3 CSF External Drainage System and remove the product from its packaging, being careful not to drop extension pieces. Maintain sterile technique.
- Mount the EDS 3 to an IV pole with the Blue Screw.
- Place the cord over the IV pole and secure in place using the CORD-LOC Locking mechanism until it is tight against the pole. For extra security, knot the cord above the CORD-LOC.

2. **LEVELING**

- Leveling in Relationship to the Floor:
 - Insert Codman EDS 3 Leveling Device to the Codman EDS 3 CSF External Drainage System by sliding the securing tab over the slot on the EDS system (Laser should be pointing toward the patient.)
 - Level the Codman EDS 3 system to the floor with the grey screw. Bubble in center indicates level. Once leveled, tighten the grey screw.
- Leveling in Relationship to the Patient:

- i. Rotate the laser to emit laser beam toward the patient.
- ii. Loosen the blue screw and adjust the height of the EDS on the IV pole, centering the laser point to the patient's external auditory meatus. This represents the "zero" reference point.
- iii. Rotate the laser point until the laser is extinguished.

3. POSITIONING THE DRIP CHAMBER

- a) Obtain an order for the level of the drip chamber.
- b) Loosen the white screw and adjust the chamber until the black reference line is at the ordered level for drainage.
- c) Intracranial pressure is controlled by the height of the drip chamber relative to the patient. It is important that neither the drip chamber nor the patient be raised or lowered accidentally. Put sign above bed not to move bed. Apply "lockout" adjustment to head of bed.

4. PRIMING THE EDS 3

- a) Fill a 10 ml luer-lok syring with sterile preservative free saline solution.
- b) Place the patient line stopcock in the monitoring only position ("off" - prong points toward drip chamber).
- c) Remove cap from the monitoring port of the patient line stopcock
- d) Screw on syringe to the monitoring port.
- e) Remove the cap from the end of the tubing (proximal end of the patient line).
- f) Flush the length of the line until all air has been expelled between the patient line stopcock and the end of the tubing.
- g) Replace the cap at the end of the tubing.
- h) Turn the patient line stopcock to the "closed" position ("off" - prong points towards end of tubing (proximal end)).
- i) Flush the length of the line to the drip chamber; Verify that fluid flows freely into the drip chamber and into the collection bag. Verify absence of leaks.
- j) Turn the patient line stopcock to the "Drainage Only" position ("off" – prong points toward stopcock).
- k) Remove the syringe and replace the cap on the monitoring port of the patient line stopcock.

5. USING THE PATIENT LINE STOPCOCK

The Patient Line Stopcock controls the flow of CSF from the patient line to the parts of the EDS 3:

- a) **Drainage Position** – this position is for drainage of CSF and potentially for monitoring as well if system is hooked to a fluid coupled transducer at the system stopcock (recommended placement).
- b) **Monitoring Position** – this position stops the flow of CSF to the system stopcock. This is for monitoring ICP with a fluid coupled transducer attached to this port (alternative placement site for a transducer).
- c) **Closed Position** – stops the flow of CSF to the system stopcock and disables the monitoring port.
- d) **Null Position** – not recommended. May result in inaccurate ICP readings.

6. USING THE SYSTEM STOPCOCK

The System Stopcock regulates the flow of CSF to the drip chamber. It is also the port used to connect the FC transducer.

- a) **Drainage Only Position** – this position disables the monitoring port. This is for drainage of CSF.
- b) **Monitoring Only Position** – this position stops flow of CSF to the drip chamber. This is the position for monitoring ICP with a fluid coupled transducer.
- c) **Closed Position** – stops flow of CSF to the drip chamber and disables the monitoring port.
- d) **Null Position** – not recommended. May result in inaccurate ICP readings.

7. USING THE DRIP CHAMBER STOPCOCK

The Drip Chamber Stopcock controls whether CSF flows into the collection bag or accumulates in the drip chamber. It provides a port for CSF sampling.

- a) **Drainage Only Position** – the position disables the sampling port. This is for draining CSF into the collection bag.

- b) **Sampling Only Position** – This does not allow fluid to drain into the collection bag and allows sampling of collected CSF from the sampling port.
- c) **Drip Chamber Position** – stops flow of CSF to the collection bag and disables the sampling port. CSF collects in the drip chamber, but it cannot be sampled.
- d) **Null Position** – not recommended. May result in inaccurate ICP readings.

8. CONNECTING THE EDS 3 TO THE PATIENT CATHETER

Remove the LUER-LOK cap from the distal end of the ventricular catheter and attach the primed system via the patient connector to the patient line. Connection should always be a fluid to fluid interface.

9. DRAINING CSF INTO THE DRIP CHAMBER

- a) Obtain an MD/APRN order for whether the system is to remain open to drain, or will be intermittently drained to maintain a specified ICP.
- b) Obtain an MD/APRN order for the maximum amount of CSF drainage/hour. (Leaving the drainage system open to drain for a sustained period of time can result in collapsed ventricles resulting in false readings.)
- c) Obtain an MD/APRN order for the drip chamber level. (If the drainage system is not at the correct level it may result in over or under drainage.)
- d) If continual drainage is ordered:
 - i. Place Patient Line stopcock in the *Drainage Only* position.
 - ii. Place the System stopcock in the *Drainage Only* position.
 - iii. Place the Drip Chamber stopcock in the *Drip Chamber* position.
 - iv. Verify that CSF drains into the Drip Chamber.
- e) If intermittent drainage is desired;
 - i. Maintain the Patient Line stopcock in the *Drainage Only* position
 - ii. Maintain the System stopcock in the *Monitoring Only* position
 - iii. Turn the System stopcock to the *Drainage Only* position. Verify that CSF drains into the Drip Chamber and maintain this position until the specified level of ICP is reached.
 - iv. Place the System stopcock back to the *Monitoring Only* position when drainage is complete.
- f) Observe the color, clarity, and amount of CSF every hour.

10. DRAINING CSF FROM THE DRIP CHAMBER INTO THE COLLECTION BAG

- a) Turn System stopcock to *Closed* position. (Ensures accurate measure of the fluid contained in the Drip Chamber.)
- b) Turn Drip Chamber stopcock to *Drainage Only* position.
- c) Verify that CSF drains from the Drip Chamber into the collection bag.
- d) Return the System stopcock to its original position (*Monitoring only or Drainage only*).

11. SAMPLING CSF

- a) Verify MD/APRN order to collect sample.
- b) Apply mask and sterile gloves.
- c) Place Drip Chamber stopcock in the *Sampling Only* position. (This is the desired port to use for a fresh sample.)
- d) Cleanse the port with betadine stick and allow to dry for 1 minute.
- e) Withdraw sample with a 6 ml syringe, place sample in a sterile container, label properly and deliver to the lab immediately. (Usually CSF specimen is sent for culture and sensitivity, gram stain, and cell count. Glucose and protein may also be ordered.)
- f) Return Drip Chamber stopcock to previous position.
- g) Note: A sampling port is also located at the bottom of the collection bag, however this would not be the desired port for obtaining a fresh sample.
- h) Sampling of CSF may also be obtained from the port closest to the insertion site on the ventriculostomy drainage system. Sampling from this site is performed only by the neurosurgeon or practitioner.

12. MONITORING ICP

- a) Prime the transducer/stopcock with sterile preservative free saline solution using a 10 ml syringe. **NOTE: drip chamber attachment must be removed and a dead-end cap is applied to the transducer. NO FLUSH SYSTEM is to be attached.**
- b) Attach the transducer to the System stopcock (preferred site) and to the bedside monitor pressure cable. Configure the monitor to display ICP with the appropriate label / scale.
- c) Zero the system to atmospheric pressure by turning the Transducer stopcock off to the drainage system and opening it to air. Press “Zero” on the bedside monitor pressure module.
- d) Adjust the System stopcocks to the ***Monitoring Only*** position for ICP monitoring. (Patient stopcock will be in the *Drainage* position.)
- e) To obtain accurate ICP readings, wait at least 1 minute after adjusting stopcocks.
- f) **Note:** the *Null* position is not recommended for ICP monitoring, as pressure measured with the stopcock in the *Null* position will be a reflection of a blended pressure from both the patient and the drainage bag and will result in inaccurate ICP readings.

13. SITE AND SYSTEM CARE:

- a) Components of the ventriculostomy set up are changed only when a new ventriculostomy catheter is inserted, the system is malfunctioning (e.g., wet vent), or when ordered.
- b) Change ventriculostomy collection bag when full, system is changed, or prior to transporting a patient.
- c) Change head dressing every 72 hours or when no longer occlusive:
 - i. Apply sterile gloves and a mask
 - ii. Swab the site with a betadine stick in a circular motion, from the center outward, and allow to air dry for at least one minute.
 - iii. Apply sterile gauze dressing.
 - iv. Secure with tape or transparent dressing.

14. FLUSHING THE EDS SYSTEM – RN may do this only with approval of the Neurosurgeon

TO FLUSH THE SYSTEM FROM THE PATIENT LINE STOPCOCK BACK TO THE COLLECTION BAG:

- a) Turn Patient Line stopcock to *Closed* position.
- b) Turn System stopcock to *Drainage Only* position.
- c) Turn Drip Chamber stopcock to *Drainage Only* position.
- d) Open all slide clamps.
- e) Attach a 10 ml syringe with sterile preservative free saline solution to the Patient Line stopcock.
- f) Inject saline solution into the Patient Line stopcock monitoring port.
- g) When complete, turn stopcocks back to their original position and put a new sterile cap on the Patient Line stopcock.

15. IRRIGATING THE VENTRICULOSTOMY CATHETER - This is done only by a neurosurgeon or a practitioner, under the guidance of a neurosurgeon.

- a) If there is any question regarding patency of the ventriculostomy catheter, notify the neurosurgeon or practitioner as the ventriculostomy catheter may need to be irrigated or changed.
 - i. Monitor ICP waveform for dampening. The ICP waveform generally has 3 distinct components, P1, P2, and P3. If the waveform is dampened, the patency of the catheter or the drainage and monitoring system may be in question and the pressure values may be inaccurate.
 - ii. If there is no drainage of CSF or fluctuation with respirations the catheter may be occluded. Debris such as tissue or blood clots can obstruct the catheter and cause large increases in ICP which places the patient at greater risk for secondary brain injury.

16. TRANSPORTING A PATIENT CONNECTED TO THE EDS

- a) Place Patient Line stopcock to the *Closed* position.

- b) Drain Drip Chamber into drainage bag.
- c) Replace the collection bag if necessary.
- d) Place the Drip Chamber stopcock into the *Drip Chamber* position.
- e) Transport the patient with the ESD on the IV pole if possible. (It is recommended that the EDS 3 system be suspended, rather than allowed to lie flat on a surface during transport. If the microbial retentive atmospheric vent in the Drip Chamber becomes wet, the EDS 3 System should be changed. Wetting of the vent inside the collection bag by fluid for a prolonged period may cause air entrapment and reduce the capacity of the bag.)
- f) After transport completed, re-level the EDS 3 system to floor and the patient.
- g) Resume or verify Drip Chamber height settings.
- h) Resume drainage or monitoring by placing Patient Line stopcocks in their original positions

17. TROUBLESHOOTING ELEVATED PRESSURES

- a) The stopcock could be open to pressure monitoring but closed to drainage:
 - i. Check all stopcocks
 - ii. Ensure that all stopcocks are open to both the drainage unit and to the patient catheter
- b) The drainage unit could be positioned higher than the pressure in the patient's head:
 - i. Ensure that the zero on the Drip Chamber is positioned at the external auditory canal, and the arrow on the Drip Chamber is positioned at the correct position above the head
 - ii. Note that drainage occurs when the system is open and the ICP exceeds the level of the drainage unit.
 - iii. Ensure that ICP reading is taken when the stopcock is closed to drainage and open between pressure system and the patient catheter.
- c) The catheter may be blocked:
 - i. Lower the drainage chamber below the patient's head. If the catheter is patent, CSF drainage should occur.
 - ii. Evaluate the ICP waveform:
 - Selected an appropriate scale is to ensure good visibility of the waveform.
 - A crisp waveform should be present. The waveform should demonstrate pressure changes that correspond to the heart rhythm.
 - A flat waveform suggests catheter is not patent. Brain edema could obstruct the catheter tip and impair waveform transmission.
 - iii. The ICP elevation may be the result of severe brain swelling, but the ventricles are either empty or collapsed

18. REPLACING A COLLECTION BAG

- a) Maintain sterile technique when replacing the collection bag. Mask and sterile gloves are worn.
- b) Turn the Drip Chamber stopcock so that it is in the *Drip Chamber* position. (This stops the flow of CSF to the collection bag and allows the drainage bag to be changed.)
- c) Using the slide clamp on the drainage bag, occlude the tubing leading to the collection bag.
- d) Twist the connector on the bag counterclockwise to disengage.
- e) Dispose the collection bag as per hospital policy.
- f) Connect the new bag to the tubing and hang collection bag on built in hooks.
- g) Open slide clamp in the tubing.

19. REPLACING THE CODMAN EXTERNAL DRAINAGE SYSTEM

Maintain sterile technique during replacement of the external drainage system.

- a) Occlude catheter with rubber coated forceps.
- b) Disconnect the LUER-LOK between the intraventricular catheter and drainage line in counterclockwise motion
- c) Discard the old EDS 3 system
- d) Connect a new EDS 3 system that has been set-up/ primed as per steps 1-4 above.

20. REMOVAL OF THE INTRAVENTRICULAR CATHETER

The neurosurgeon will determine when the catheter will be removed.

a) Obtain supplies:

- i. sterile gloves
- ii. hat
- iii. mask
- iv. suture material
- v. 2 suture removal kits
- vi. 1% lidocaine and 5 cc syringe
- vii. sterile clamps
- viii. sterile towels
- ix. betadine ointment
- x. sterile 2 X 2 gauze dressing
- xi. large tegaderm dressing
- xii. sterile specimen cup

b) After removal of the catheter:

- i. Apply betadine ointment, 2 X 2 dressing, and tegaderm to site.
- ii. Culture intraventricular catheter if ordered.
- iii. Monitor site for swelling, CSF leakage, signs of infection.

H. ATTACHMENTS :

None

I. REFERENCES :

1. Bulger, E.M., Nathens, A.B., Rivara, F.P., et. al. Management of Severe Head Injury; Institutional Variations in Care and Effect on Outcome. *Critical Care Medicine*, 2002, 30: 1870.
2. Greenberg, M.S. (2001). Handbook of Neurosurgery (5th ed., rev.) Thieme: New York
3. Hickey, J. (2000). The Clinical Practice of Neurological and Neurosurgical Nursing (4th ed., rev.). J.B. Lippincott: Philadelphia, Pennsylvania.
4. Lynn-McHale, D.J and Carlson, K. K., (2001). AACN Procedure Manual for Critical Care, W.B. Saunders Co
5. Refer to the **CODMAN® EDS CSF External Drainage System with Ventricular Catheter**, **CODMAN® External Drainage System II Collection Bag**, and **CODMAN® EDS Leveling Device** package inserts for diagrams and additional information.

J. SEARCH WORDS :

Intracranial Pressure, ICP, Ventriculostomy, External Drainage System, EDS

K. ENFORCEMENT:

Violations of this policy or associated procedures may result in appropriate disciplinary measures in accordance with University By-Laws, General Rules of Conduct for All University Employees, applicable collective bargaining agreements, the University of Connecticut Student Code, other applicable University Policies, or as outlined in any procedures document related to this policy.

L. STAKEHOLDER APPROVALS :

On File

M. COMMITTEE APPROVALS :

Original Policy approved by: ICU Standards Committee & Nursing Standards Committee

N. FINAL APPROVAL :

- | | |
|--|--------------------------|
| 1. <u>Andrew Agwunobi, MD (Signed)</u>
Andrew Agwunobi, MD
UConn Health Chief Executive Officer | <u>1/14/2021</u>
Date |
| 2. <u>Anne Horbatuck (Signed)</u>
Anne D. Horbatuck, RN, BSN, MBA
Clinical Policy Committee Co-Chair | <u>1/13/2021</u>
Date |
| 3. <u>Scott Allen, MD (Signed)</u>
Scott Allen, MD
Clinical Policy Committee Co-Chair | <u>1/13/2021</u>
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| 4. <u>Caryl Ryan (Signed)</u>
Caryl Ryan MS, BSN, RN
VP Quality and Patient Service & Chief Nursing Officer | <u>1/13/2021</u>
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Date Issued: 4/2005

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