

Management of Patient with Post Operative Thoracoabdominal Aneurysm Repair

Spinal cord ischemia with high level paraplegia is an important complication of thoracoabdominal aneurysm repair. The use of lumbar drains carries a risk for intracranial bleeding. This protocol has been developed to minimize the risk for both of these complications.

Lumbar CSF fluid pressure monitoring provides a way to detect developing cord ischemia. It also enables drainage of CSF as a means of reducing the pressure around the cord when indicated.

Drainage of CSF must be done carefully. Over drainage carries the import risk of intracranial hemorrhage.

The following protocol has been developed in order to promptly detect spinal cord ischemia and prevent both paraplegia and intracranial hemorrhage.

KEY POINTS:

- Use fentanyl for pain management (morphine and hydromorphone have been shown in animal studies to constrict spinal arteries)
- Maintain higher BP targets as ordered
- Keep Hb > 100
- Keep HOB flat when drain is open to prevent over drainage and cerebral bleeding
- Perform and document spinal cord with sensory testing Q1H for a minimum of 48 hours after drain removal (until discontinued by Vascular Surgery); decreased sensation to pin or inability to lift the legs off the bed may be the earliest sign of spinal cord ischemia
- Patients should be able to lift legs off bed (one at a time)
- Note the correct drain position (13.6 cmH₂O = 10 mmHg); both levels are recorded on the Codman drain. **Zero the drain to the Phlebostatic Axis.**
- Accurate fluid filled pressure monitoring requires **the transducer to be level (Phlebostatic Axis)** and the drain to be “off” to drainage during measurement.
- **This is different than when using the Codman Microsensors(TM)**

LUMBAR CSF PRESSURE MONITORING:

1. The head of bed must be **maintained flat at all times while the drain is in place.** The bed should not be placed in reverse Trendelenburg or Trendelenburg position. The bed can be elevated only **when the drain is clamped** in anticipation of removal, if the patient remains asymptomatic.
2. Level the pressure transducer to the Phlebostatic Axis. **Note:** this is a change from the previous placement of iliac crest – the level will be almost the same.
3. The patient should arrive from the Operating Room with drainage being collected into a Codman drainage collection unit. Do not lay the drainage unit flat.

Level the “Zero” reference on the Codman drain to the Phlebostatic Axis.

4. Position the drain at 13.6 cmH₂O of water (which is 10 mmHg). The Codman drainage unit displays both units of measurement.
5. Unlike the Codman Microsensor catheters that we use for ICP monitoring, ICP is being measured through a fluid filled circuit. Accurate pressure measurements require the pressure transducer to be level with the Phlebostatic axis **and** the patient stopcock must be turned off to drainage and open to pressure monitoring only.

6. With the drain at 13.6 cmH₂O/10 mmHg, drainage should occur if the drain is opened and the pressure on the bedside monitor exceeds 10 mmHg. If the pressure displayed on the bedside monitor is higher than the set level of the drainage collecting unit (in mmHg), and there is no CSF drainage, suspect either a patency problem within the catheter/circuit or the development of spinal cord edema.

ASSESSMENT AND MONITORING:

1. Upon admission, initiate the spinal cord testing assessment field under Neuromuscular Assessment. Select all 4 limbs and FULL SENSORY assessment.
2. Perform spinal cord testing every hour for a MINIMUM of 48 hours after removal of the drain. Delayed paralysis can occur.
3. Sensory assessment to pin prick is extremely important and may be the first indication of spinal cord ischemia. This can indicate an anterior cord injury and may precede motor weakness.
4. With hourly spinal cord testing, the patient should be able to lift each leg off the bed (assess one leg at a time). Document ability to lift legs off bed every hour.
5. The use of analgesics should be minimized to facilitate early and ongoing spinal cord testing (sedatives should not be ordered unless surgery is complicated by the need for mechanical ventilation and respiratory instability).
6. Do not administer morphine or hydromorphone. Administer fentanyl bolus PRN for pain control. The goal is to keep the patient comfortable but awake, and able to participate in spinal cord testing.
7. Do not initiate fentanyl infusion unless **the patient requires 3 or more boluses of fentanyl per hour for more than 2 hours.**

PRESSURE MONITORING AND DRAINAGE:

1. The patient stopcock must be closed to drainage to obtain an accurate pressure.
2. Keep drain closed to continuous pressure monitoring for the first 30 minutes of each hour.
3. Open the drain for the second 30 minutes of every hour. Allow up to 20 ml of CSF drainage; if more than at 20 ml of CSF drains, close the drain and continue pressure monitoring.
4. Notify vascular surgery if ICP exceeds 15 mmHg and review drainage targets
5. If blood is noted in CSF, or the patient develops a headache, decrease in LOC or any focal findings, close the drain and notify Vascular Surgery STAT. A STAT CT should be ordered.
6. If pressure remains < 10 mmHg and there has been no drainage for 24 hours, drain clamping may be ordered by Vascular Surgery

BLOOD PRESSURE TARGET:

MAP > 90 as long as SBP < 160 (if unable to keep SBP < 160 contact Vascular Surgery for direction)

HR < 90

Maintain for 48 hours or until spinal drain has been removed (whichever is longer).

MEDICATIONS:

1. Narcan infusion for free radical scavenging – 1 mcg/kg/hr infusion for 48 hours post-operatively (or longer if cord ischemia develops).

2. Do not use morphine or hydromorphone; administer fentanyl for pain management.
3. Avoid sedatives (unless unstable and mechanically ventilated). Use fentanyl for pain control; use lowest possible dose to enable spinal cord testing.

CRITICAL FINDINGS AND INTERVENTIONS:

1. Contact Vascular Surgery and document for any of the following findings (calls should be made to the Senior or Consultant).
 - Decrease in pin prick response
 - Decrease in limb strength or ability to lift one or both legs off the bed
 - CSF pressure > 10 mmHg that does not decrease with drainage as per protocol
2. Contact CCTC provider for BP < target

OTHER CARE PROTOCOLS:

1. Hold pharmacological DVT prophylaxis for 12 hours before and after drain removal. Initiate sequential compression stockings until pharmacological intervention is started.
2. Use Crit Care Intensive Insulin Protocol to maintain normoglycemia. Monitor closely to prevent hypoglycemia.
3. Keep HOB flat at all times during period when drain is being intermittently opened. The head must remain flat until the drain is consistently closed.
4. Request daily POC ultrasound for fluid and cardiovascular assessment.
5. Maintain hemoglobin target > 100 for first 5 post-operative days, or until drain is out and patient has been asymptomatic for 5 days. Blood Transfusion Lab is aware.

DELAYED ONSET PARAPARESIS (PARTIAL PARALYSIS) OR PARAPLEGIA (COMPLETE PARAPLEGIA):

RESCUE PROCEDURE

- Delayed-onset refers to a decline in neurological function consistent with ischemic injury causing anterior cord syndrome – any decrease in *pinprick/temperature sensation with accompanying motor dysfunction*
- Notify Vascular Surgery STAT for changes in brain or spinal cord neurovascular change (pulse or neurologic change).
- Document leg lift bilaterally – legs must be lifted off the bed (test one leg at a time)
- If drain is not in place, Vascular Surgery to arrange for immediate drain insertion
- For rescue drainage, position drain to 6.8 cm H₂O/5 mmHg or as ordered (drainage should occur as long as pressure on bedside monitor remains > 5 mmHg at this level)
- For rescue drainage, do not drain more than 40 mL/hr of CSF unless specifically requested by Vascular Surgery or Anaesthesia
- STAT CBC, Transfuse to Hgb > 100
- Give Mannitol 12.5 gm IV over 15 minutes as ordered
- Give Methylprednisolone 30 mg/kg IV over 30 minutes as ordered
- Target MAP > 100, CI > 2.1 (if known)– administer fluid and vasoactive medications as necessary to achieve this goal
- Begin Narcan infusion at 1mcg/kg/hr if not already started