**Management Guidelines for Patients Undergoing Lumbar Drain Placement for**

**Endovascular Repair of Thoracoabdominal Aortic Aneurysm (TAAA)**

**I.          Introduction**

Paraplegia related to spinal cord ischemia is a known complication of thoracoabdominal aneurysm repair with either an open or endovascular stent graft approach. Risk factors for developing spinal cord ischemia include previous aortic surgery, preoperative renal function, age, aortic cross clamp time, and emergency repair.

Increased cerebrospinal fluid (CSF) pressure contributes to cord ischemia by decreasing spinal cord perfusion pressure and therefore blood flow to the spinal cord. Systemic hypotension can also contribute to spinal cord ischemia. In the post-operative period, the onset of neurological events may be (1) immediate, upon waking from anesthesia or (2) delayed, occurring anywhere from 1 to 21 days.

The two main post-operative management strategies to prevent spinal cord ischemia are:

(1) CSF pressure monitoring and drainage.

Lumbar drains allow for both CSF pressure monitoring and for intra- and post-operative CSF drainage to maintain an adequate CSF pressure. A CSF pressure of 10mmHg is the goal for adequate spinal cord protection. Prior to surgery, the surgical team will assess the patient’s risk for spinal cord ischemia to determine if a lumbar drain is required.

(2) Maintenance of an adequate mean arterial blood pressure.

MAP should be maintained between 80-90mmHg. Higher MAPs may be necessary if the patient exhibits neurological symptoms.

II.         Lumbar Drain Management

 Key Administrative Points:

* Patients undergoing lumbar drain placement for endovascular TAAA repair will have the drain placed the day of surgery in the preop area by an anesthesiologist. This management differs from the management of patients who are having open TAAA repair with full heparinization for CPB – those patients have their drain placed the day prior to surgery.
* Patients will be admitted to surgical ICU postoperatively and will remain in ICU until the drain is removed.
* Postop management:
* All clinical issues should be directed to the vascular surgery (Mannick) resident on call. Orders for postop management of the lumbar drain will be placed by this service.
* All issues related to the function or placement of the lumbar drain should be directed to the anesthesiologist who placed the drain, or if this person is not immediately available, to the on-call (OC-1) anesthesiologist. The call team can be asked to manage urgent issues or to contact the cardiac anesthesiologist on call for management guidance.

Nursing Guidelines

* Please refer to the on-line nursing policy, N.C.P.M. NEU-00, “Cerebrospinal Fluid (CSF) Drainage with a Lumbar Catheter” for information regarding drain placement, drain management, and management of potential complications.
* The lumbar drain is to be leveled to the right atrium, mid axillary line (phlebostatic axis).  Please mark the site for consistency.
* Post operative lumbar drain orders will include:
* Site of leveling: right atrium, mid-axillary line (phlebostatic axis)
* Level of drainage chamber: 10cmH2O (sometimes referred to as the “pop off” pressure)
* Type of drainage: usually continuous drainage
* Volume of drainage: notify Mannick resident on call if CSF volume exceeds 20mL in an hour
* MAP goal:  80-90 mmHg
* Goal CSF pressure: not to exceed 10mmHg (drain will be transduced)
* Complete neurological assessment q1H
* Patient position: FLAT, until specifically ordered otherwise
* One exception: HOB may be elevated for x-ray without an order, but drain must be OFF to drainage chamber during this.

***Note*:**  These parameters may change at the discretion of the attending physician, based on the patient’s clinical circumstance.

* The bed controls for the patient’s bed should be turned OFF.
* An order is needed to elevate HOB (except for X-rays).
* The drainage chamber must remain upright. Do not place on bed.
* The orange/red bar to the left of the top of the drainage chamber is to coincide with level ordered for the drainage chamber (e.g. 10cmH2O).
* There are two scales on the drainage system (green and blue). The green scale on the right  (cmH2O) is to be used to measure CSF pressure.
* Empty the CSF drainage chamber into the collecting bag each hour.  Remember to turn the stopcock between the chamber and the collecting bag back to the correct position.

     Refer to the on-line nursing practice manual for specific directions for

     changing the collection bag (N.C.P.M. NEU-00, pg. 10).

* Ensure that all stopcocks are in the correct position. Never have stopcock OFF to monitoring system.
* Mark the injection port and stopcock on the lumbar drain tubing with a red caution sticker to alert others that these should NOT be used.
* Continuously monitor the lumbar drain for patency and placement.  Even if there is no CSF drainage, the CSF fluid in the drain line (from the patient to the drainage chamber) should show some fluctuation or movement in the tubing.  If there is any question that the line is out or not functioning properly, notify the responsible anesthesiologist.
* Place lumbar drain precaution sign at the head of the patient’s bed.  The sign can be obtained from the Lumbar Drain Reference Book or from the on-line policy N.C.P.M NEU-00, pg. 12.
* Remember to ensure that the lumbar drain is OFF to the drainage chamber (but open to monitoring):
* When traveling
* During any activity that may trigger Valsalva maneuver (e.g.

suctioning, continuous coughing spell, lifting on and off bed pan, attempting to have a BM)

* When turning or repositioning
* When lifting patient for an X-ray (HOB can be elevated for the X-ray—make sure stopcock is OFF to drainage chamber. Return patient to flat position, and return stopcock to correct position at end of procedure

**III.        TAAA: Clinical Assessment and Management**

Goal: To prevent and reverse delayed-onset paraplegia

* Maintain MAP 80-90mmHg.
* If MAP <80mmHg for greater than 5 minutes, notify Mannick resident on call. Hypotension can lead to hypoperfusion and ischemia of the spinal cord with resultant neurological changes.
* If patient experiences signs of cord ischemia (e.g. new weakness/loss of sensation in lower extremities) in the setting of an adequate MAP, MAP goal may be increased to increase spinal cord perfusion.
* If the patient is hypertensive, nitrates (nitroglycerine, nitroprusside) should be avoided.
* A complete neurological assessment is to be done every hour until MD orders state otherwise.
* Assessment should include LOC, orientation, response to pain, pupil size and response, extremity strength and sensation, facial symmetry.
* Any change should be reported to the Mannick resident immediately.
* Ensure that the drain is leveled appropriately to maintain CSF pressure of 10mmHg or as otherwise ordered. Inaccurate leveling can lead to over- or under-drainage.
* Under-drainage: The body makes approximately 20 ml/hr of CSF. However patients undergoing TAAA repair can have increased CSF pressure/edema from surgery. Increased CSF may lead to decreased spinal cord perfusion and spinal cord ischemia.
* Over-drainage:  Can result in possible subdural hematoma or herniation.  Patient complaint of a headache can be a sign of over-drainage of CSF.
* Check the lumbar drain dressing site frequently to ensure:
* it is intact
* there is no CSF drainage
* there is no evidence that the line has moved
* there is no redness or drainage at insertion site
* Notify Mannick Resident for:
* Lumbar pressure > than goal (usually 10mmHg)
* MAP < goal for longer than 5 minutes (usually 80mmHg)
* Any change in neurological status
* Excessive CSF drainage (>20 mL/hour, usually this would prompt a change in the level of the drainage pressure and the CSF pressure goal to 15 cm H2O)
* Signs of meningeal irritation (e.g. headache and stiff neck when patients puts chin to chest)
* Signs of nerve root irritation (e.g. back pain radiating down back of leg or around front of thigh)
* Change in quality of CSF(from either clear to cloudy or bloody)
* Redness or purulent drainage at insertion site
* Notify Anesthesiologist (see above) for drain function/placement issues:
* Any issues with line function
* Any question that line may be out (e.g. no drainage, no fluctuation in tubing leading to drainage chamber, no wave form fluctuation seen on monitor)

IV.       Criteria for Discontinuation of Lumbar Drain

* In the absence of neurological symptoms, the lumbar drain will be clamped 24 hours post operatively. If no neurological symptoms develop while the drain is off, it will be removed 48 hours post operatively
* Drain will be removed by the anesthesiologist who placed the drain or their designee. A simple dressing will be placed over the drain site.
* When capped, patient will be allowed to sit up in bed
* Order morning PT/PTT/platelets and hold SC heparin on morning of the drain pull.

**V.        Post-drain pull management**

* Lie flat for 2 hours after pull, then OOB to chair (sitting) for 2 hours, then activity per primary team
* Neuro checks q2 hours for 8 hours, then q8 hours for two more checks
* Resume SC heparin 1 hour after drain pull

**VI.       Nursing Documentation**

* The following should be documented every hour on nursing flow sheet:
* Neurological assessment
* CSF pressure
* Amount of drainage
* Confirmation that the line is patent
* Indicate drain leveled, zeroed, and site of level at start of shift
* Indicate drain re-leveled after subsequent position changes

Patient/Family Teaching

* Prior to insertion, the patient should be instructed on the purpose of the drain as well as what to expect during insertion.
* Instruct family and visitors not to change the bed position.
* If patient is alert, instruct her/him to notify the nurse or doctor if they experience     significant symptoms (numbness/weakness in LEs, headache, nausea).

APPENDIX

POST-OPERATIVE LUMBAR DRAIN ORDERS AFTER ENDOVASCULAR TAAA REPAIR

Lumber drain orders should be written by a member of the Vascular Surgery team. The orders listed below are guidelines and may be adjusted by the Vascular Surgery or Anesthesia attending based on the patient’s clinical situation.

* Level the lumbar drain at the right atrium, mid-axillary line (phlebostatic axis)
* Keep drainage chamber upright on pole; do not place on bed
* Turn bed controls OFF
* Continuous drainage
* Level drainage chamber at 10cmH2O
* Transduce CSF presure with goal CSF pressure of 10mmHg
* Empty collection chamber into drainage bag q hour and record volume
* Neuro checks q1H
* Keep patient in flat position
* Okay to raise HOB briefly for x-ray with drain OFF to drainage bag during this
* Maintain MAP 80 to 90 mmHg
* Turn drain OFF to drainage bag for:
* Traveling
* Any activity that may trigger Valsalva (suctioning, coughing spell, bed pan usage, bowel movement)
* Turning or repositioning
* Lifting patient for x-ray
* Notify physician (Mannick service resident on call) for:
* CSF drainage >20mL in an hour, or no output for an hour
* MAP <80 for >5 minutes
* Change in neurological status
* Change in quality of CSF (from clear to cloudy or bloody)
* Redness or purulence at insertion site
* Headache, stiff neck, radiating back/leg pain