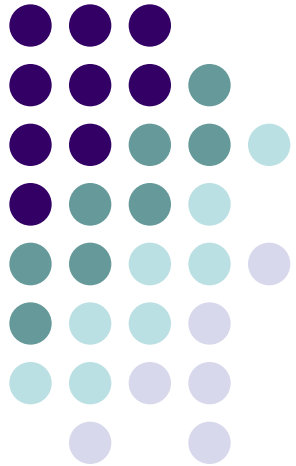
Sharing of Best Practices in Managing Lumbar CSF Drains

Karin Grant MS, RN, CNRN, ACNP-BC

Riverside Methodist Hospital

Columbus, OH



Disclosures

- While I work for the OhioHealth Corporation, the opinions expressed here are my own, and do not reflect an endorsement of any products or services by OhioHealth.
- I am a member of the Integra LifeSciences Corporation Speaker's Bureau

Objectives

- Describe scenarios where lumbar CSF drains are used, and the anticipated benefits of therapy
- List the potential complications of lumbar CSF drainage
- Discuss safe care concepts and interventions to prevent/mitigate complications

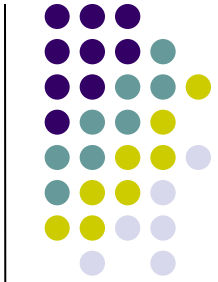
Purposes for Lumbar CSF Drainage[1,3,14,15]

- Treatment of cranial or spinal CSF leaks
- Evaluation of Normal Pressure Hydrocephalus
- Prevention of neurological deficits during/after Thoracoabdominal Aortic Aneurysm (TAA) repair
- Access for intrathecal medication administration, and/or CSF sampling.
- To reduce intracranial pressure during a craniotomy or transsphenoidal surgery

Placement of Lumbar CSF Drains[1,18]

- May be placed in the operating room, interventional radiology suite, or at bedside
- Is a sterile procedure- requires appropriate prep, masks, gloves, gowns
- Closed, sterile drainage system primed with patient's CSF or preservative free saline
- System set up to drain by pressure, level or volume.
- Volume drainage may be continuous or intermittent.

Continuous Drainage vs Intermittent Drainage



- Benefits: Similar to normal flow patterns
- Lower likelihood of reduced or non-flow
- Less need to access system to restore flow
- Less risk for infection due to above
- Risks: If non volume limiting drainage system used, there is a higher risk for over drainage with potential for severe headache, neural herniation, subdural/intracranial hemorrhage and pneumocephalus, when using continuous drainage.

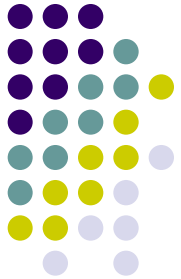
Volume Limiting and Non-Volume Limiting Systems

- Volume limiting systems improve safety due reduction of risk for pneumocephalus, herniation syndromes, or hemorrhage due to over drainage/too rapid drainage of CSF.

Patient Level of Care

- The location where patient safety is maintained (and frequent patient monitoring is performed) at the lowest charge to the patient is optimal.-AANN Care of the Patient with a Lumbar Drain 2007 page 12.[1]
- Critical Care Unit: When needed for other medical issues, if using a non volume limiting drainage system, patient requiring significant sedation
- Intermediate Unit: Volume limiting drainage system
- General Med/Surg Unit: Volume limiting drainage system, staff knowledgeable of care, patient/staff ratio sufficient for appropriate monitoring. Ideal for treating CSF leaks and evaluating for NPH if can be done safely.[1,8]

Costs Associated with Critical Care Unit Admissions[6]



- Medicare intensive care unit use: Analysis of incidence, cost and payment. CCM 2004 vol 32, No. 11. Cooper L.M. and Linde-Zwirble W.T.
- Intensive care unit patients cost nearly 3 times as much as “floor” patients ($14,135 vs $5,571) with 2/3 of the costs associated with the ICU portion of the stay.
- ICU cases were paid at a rate of only twice “floor” cases ($11,704 vs $5,835)
- Only 83% of costs were paid for intensive care unit patients, compared to 105% for “floor” patients.
- Generated a $5.8 billion loss to hospitals when ICU care is required.

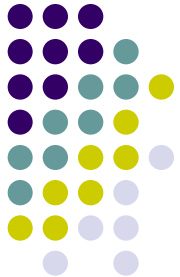
General Complications [1,18]

- Infection
- Pneumocephalus- overdrainge
- Herniation-overdrainge
- Subdural/Intracranial hemorrhage-over drainage
- Disruption of drain or drainage system
- Complications of immobility
  - DVT prophylaxis
  - Hypoxia/Hypercarbia
  - Constipation/Ileus
  - Urinary retention

Prevention of Complications [1,18]

- IV antibiotic coverage while drain in place
- Volume limiting drainage system, use of continuous flow of CSF.
- Assess system for integrity
- Keep system opening to a minimum
- Clear dressing at insertion site, maintain dressing integrity
- Evaluate patient tolerance
- Neurologic assessment
- Patient and family teaching

Scenarios for this Presentation



- Lumbar CSF diversion for CSF leaks
  - Specific Complications
- Lumbar CSF drainage for NPH evaluation
  - Specific Complications
- Lumbar CSF drainage for peri-operative spinal cord protection with repair of TAA
  - Peri-operative care
- General concepts
  - Assessment, patient care, sampling/medication instillation, trouble shooting
- Case Studies
  - Patient with NPH
  - Patient with CSF leak

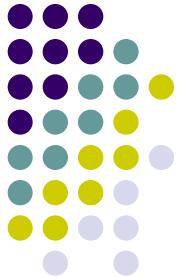
Use of Lumbar CSF Drain for CSF Leaks [2, 14, 18]

- May be used after surgery or as a sole treatment.
- Diverts CSF to reduce volume and pressure on area needing to heal.
- Generally uses the “volume” method of drainage.
- Cranial and cervical spine CSF leaks-HOB elevated.
- Lumbar CSF leaks- flat bedrest
- Drain for 3-5 days, then clamp, re-evaluate for symptoms

Specific Complications [1,9,18]

- If patient has cranial CSF leak, risk for pneumocephalus with overdrainage of CSF.
- Cranial and cervical positioning/activity- higher risk for overdrainage of CSF
- Lumbar- if recent postop may have ongoing pain control issues in addition to immobility complications. May have difficulty maintaing HOB flat, risk for overdrainage
- Volume limiting drainage systems provide protection from overdraining
- Avoidance of activities that promote “bearing down” crucial to prevent recurrent leakage.

Use of Lumbar CSF Drain for Normal Pressure Hydrocephalus [4,10,11]



- Considered most appropriate test to determine if patient will benefit from VP shunt placement. Ventricular size change not predictive.
- Requires coordination with several departments.
- OhioHealth protocol: Patient admitted to general Neuroscience floor, drain placed in IR, attached to volume limiting drainage system.
- Therapy eval prior to drain placement, then serial evaluations at 24, 48 and 72 hours
- Three trials each time, average calculated. May be videotaped
- Evaluation of cadence (steps/sec), velocity (meters/sec) and stride length (meters/step) and steps for 180 turn.
- Utilize continuous drainage 15-20cc/hour, clamp for OOB.

Use of Lumbar CSF Drain for Normal Pressure Hydrocephalus [12]

- Significant Improvement: >30% increase in velocity, >20% increase in stride length, decrease in number of steps for 180 turn, and PT reports significant subjective improvement in gait quality
- Non Significant Improvement: 10-30% increase in velocity, 10-20% increase in stride length, and PT reports subjective improvement in gait quality
- No Improvement: 0-10% increase in velocity, 0-10% increase in stride length and PT reports no subjective improvement in gait quality
- Results shared with Neurosurgeon to determine if patient can be expected to benefit from VP shunt placement.

Specific Complications [8]

- Level of dementia must be taken in to account to determine safety/efficacy of drainage trial.
- Doing trial outside of critical care unit may be more tolerable for a patient with dementia.
- Can be expected to not follow activity restrictions- use volume limiting drainage system, consider bed alarms, “sitter” or least invasive physical restraint.
- May try to take system apart,consider appropriate measures.

Use of Lumbar CSF Drains for Neurological Protection with TAA Repair [5,7,13]

- Paraplegia, secondary to spinal cord ischemia during aortic cross clamping during surgery, has been reported with frequencies ranging 6-40%
- Risk with endovascular stenting treatment reported at 8%.
- Lumbar CSF drainage during and after surgery has been shown to improve neurologic outcome and prevent the effects of cord ischemia.

Pathophysiology 2

- During aortic cross clamping circulation to the spinal cord is decreased due to reduction in blood flow.
- Endovascular repair also affects perfusion due to decreased collateral circulation during and after procedure.
- Spinal cord perfusion is lowered and a rise in CSF pressure further impairs circulation.
- Reperfusion injury can also occur.
- Clinical signs will depend on the vascular territory affected and may include paraparesis, tetraparesis, paraplegia, or loss of bowel/bladder control.

Prevention of Spinal Cord Injury [5, 13,1 6, 17]

- Lumbar CSF drain is placed prior to surgery
- Transducer placed at level of spinal cord, mid axillary line, or as directed
- May be combined with other therapies:
  - Intrathecal papaverine
  - Steroids
  - Hypothermia
  - Monitoring of SSEPs during surgery
  - Extracorporeal bypass
  - Epidural cooling

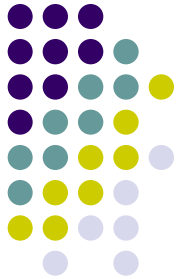
Peri-operative Care [2, 7]

- Starting CSF drainage prior to aortic clamping and continuing 24-72 hours post-op lowers the incidence of neurologic complications.
- CSF pressure is monitored and kept below 10mm Hg (15mm Hg), by draining CSF.
- Constant versus intermittent drainage, use of volume limiting drainage system
- Reduction of CSF pressure can help maintain a sufficient perfusion gradient between local spinal and venous pressures.
- CSF drainage also can permit a longer safe period for re-inclusion of vital arteries into a graft.

Lumbar CSF Drainage: Patient Assessment [1,18]

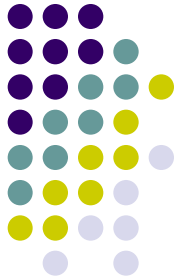
- Presence of headache, nausea
- If CSF leak- symptoms based on leak site
- Motor/sensory exam
- Vital signs
- Drain site
- Dressing/system integrity
- Need to change drainage bag?
- Learning needs

Lumbar CSF Drainage: Patient Care [1,18]



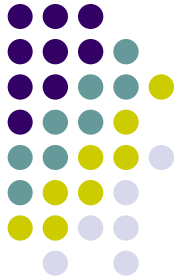
- Evaluate medications
- Prevention of complications of immobility
- If allowed OOB, assist with ADLs, etc
- Provide comfort, diversion
- Patient and family education
- All staff members should be aware that Lumbar CSF drainage is in use.
- Report changes in assessment findings

CSF Sampling/Medication Instillation [1, 18]



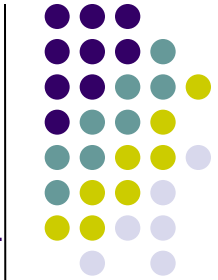
- Hospital protocol for who can obtain specimens or instill medication
- Sterile procedure- gloves and mask
- Prep site closest to patient per facility policies
- Withdraw slowly, stop if meet resistance.
- To instill medication, follow with small amount of preservative free saline to clear tubing. Clamp for appropriate time, then be sure to reopen system
- Monitor for any neurological change
- Dispose of items appropriately

Lumbar CSF Drainage: Trouble Shooting [1]



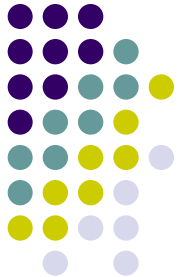
- Not draining enough CSF- reposition patient, assess tubing for kinks.
- If no change, lower collection chamber, raise bed.
- If no change, notify appropriate provider as system may need flushed.
- Flush toward drainage system first, patient last.
- Draining too much CSF-raise collection chamber, use volume limiting drainage system
- Radicular pain- steroids, gabapentin, slower drainage
- Neurologic change- CT scan/MRI, possible removal of drain
- Fever/confusion- evaluate for infection

Removal of Lumbar CSF Drain



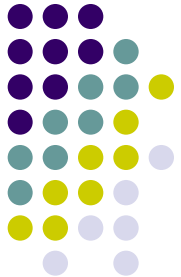
- Hold any Low Molecular Weight Heparin
- Pre-medicate if placing suture
- Clamp system
- Sterile prep- gloves, mask
- Have pt bend knees to stomach, gently remove catheter.
- Straighten legs, suture site depending on facility protocol. Have pt cough
- Dry sterile dressing. FBR for 1 hour. Neurologic assessment
- DC unneeded medications.

Case Study #1- NPH



- 70 y/o male with urinary incontinence, gait disturbance and early dementia. CT brain with greater that age appropriate ventricular size, + CSF flow MRI study. Admit to Brain/Stroke unit-gen/med unit
- Day #1- Initial PT eval, including cadence, velocity, stride length and 180 degree turn.
- Day #1- Lumbar CSF drain placed in IR, volume limiting drainage system attached, draining 15-20cc/hr. IV ATB, IS, bed alarm, stool softners, mechanical prophylaxis, IV ATB. HOB at 30 degrees, sit up for meals. Side rails up.
- Day #2- Repeat PT evaluation, trial of 3. Patient frequently sitting up on own, but does stay in bed. Up to bathroom with drain clamped.

Case Study #1- NPH

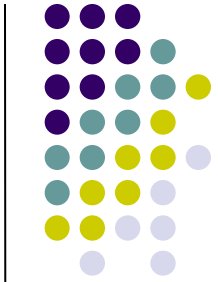


- Day #3- Repeat PT evaluation, then Lumbar CSF drain removed at bedside by NP, absorbable suture placed. IV ATB discontinued.
- Summary of evaluation: Cadence improved 25%, velocity improved 35%, stride length improved 40%, steps to turn 180 reduced from 8 to 4 and PT reported significant subjective improvement in gait quality.
- Report sent to neurosurgeon's office, will make plans for readmission for VP shunt placement.
- The efficacy evaluation for VPS was able to be safely done on a general med/surg unit due to utilization of a volume limiting drainage system.

Case Study #2: Lumbar CSF Leak

- 45 y/o female, with pseudomeningocele s/p L3-S1 FF. Has positional HA interfering with ADLS. Admit to Spine unit-med/surg unit.
- Lumbar CSF drain placed in IR, attached to volume limiting drainage system. Flat bedrest, set to drain 20cc/hour, IV ATB, LMW heparin, PPI, stool softners, foley, IS.
- Drain in place for 5 days. Patient assisted to turn, finger foods ordered, using lap top and TV, pain meds and muscle relaxants.
- Day #2- Develops left leg radiculopathy- steroids added. Area of pseudomeningocele now flat

Case Study #2: Lumbar CSF Leak



- Day #3- Restless, found sitting up by staff. Muscle relaxant changed to diazepam, re-educated on need for flat position
- Day #4- sits up on own when eating lunch. Order obtained for HOB for meals only.
- Day #5 drain clamped early am, LMW Heparin stopped,mobilizes, no recurrence of sx. Drain removed late after noon by NP, site sutured with absorbable suture. Radiculopathy resolved with drain removal. IV ATB discontinued
- Patient monitored overnight, continues to ambulate without recurrence of HA or psuedomeningocele. DC to home.
- Lumbar CSF leak was able to be safely managed on a med/surg unit due to usage of volume limiting drainage system

Summary

- Use of lumbar CSF drainage is a common therapeutic intervention for several neurological diagnoses.
- Lumbar CSF drainage is not without risks, which can be reduced by providing care at the appropriate level, using volume limiting drainage systems, preventing, evaluating and mitigating potential complications, and providing patient and family education to allow them to be partners in the process.

Contact Information

- Karin Grant, Acute Care NP-Neurosurgery
  - Riverside Methodist Hospital
  - 3535 Olentangy River Road
  - Columbus, Ohio 43214
  - 614 566-5000
- Karin.Grant@Ohiohealth.com

References

- 1. AANN Care of the Patient with a Lumbar Drain 2nd Ed. AANN Glenview IL 2007
- 2. Bethel SA Use of lumbar cerebrospinal fluid drainage in thoracoabdominal aortic aneurysm repairs. Journal of Vascular Nursing. Sept 1999;17(3): 53-58.
- 3. Chang P et al Continuous cerebrospinal fluid drainage using a lumbar subarachnoid catheter for cerebrospinal fluid rhinorrhea after functional endoscopic sinus surgery. Acta Anaesthesiol Sin. 2002; 40:97-99.
- 4. Chen IH, Huang CI, Liu HC, Chen KK Effectiveness of shunting in patients with normal pressure hydrocephalus predicted by temporary, controlled resistance, continuous lumbar drainage: a pilot study. J Neurol Neurosurg Psychiatry. 1994;56(11):1430
- 5. Connolly JE Prevention of spinal cord complications in aortic surgery. Am J Surg 1998;176(2):92
- 6. Cooper LM, LInde-Zwirbie Medicare intensive care use: Analysis of incidence, cost and paymenty. Crit Care Med 2004;32(11): 2247-2253.

References

- 7. Fedorow CA, Moon MC, Mutch AC, and Grocott HP Lumbar cerebrospinal fluid drainnage for thoracoabdominal aortic surgery: Rational and practical considerations for management. Anesth Analg 2010;111:46-58.
- 8. Governale LS, Fein N, Logsdon J, Black PM Techniques and complications of external lumbar drainage for normal pressure hydrocephalus. Neurosurgery 2008;63(Suppl 2):379-384
- 9. Graf CJ, Gross CE, Beck DW Complications of spinal drainage in the management of cerebrospinal fluid fistula. J Neurosurg 1981;54:392-395.
- 10. Haan J, Thomeer RT Predictive value of temporary external lumbar drainage in normal pressure hydrocephalus. Neurosurgery 1998;22(2):338.
- 11. Lenfeldt N, Hansson W, Larsson A, Brigander R, Eklund A, Malm J Three-day CSF drainage barely reduces ventricular size in normal pressure hydrocephalus. Neurology 2012;79(3):237-42.
- 12. Marmarou A,Young HF, Aygok GA, Sawauchi S, Tsuji O, Yamamota T, Dunbar J Diagnosis and management of idiopathic normal-pressure hydrocephalus: a prospective study in 151 patients. J. Neurosurg 2005;102:987-997.

References

- 13. McGarvey ML, Cheung AT, Szeto W, Messe SR Management of neurological complications of thoracic aortic surgery. J Clin Neuropsysiol 2007;24(4):336
- 14. Mehta GU and Oldfied EH Prevention of intraoperative cerebrospinal fluid leaks by lumbar cerebrospinal fluid drainage during surgery for pituitary microadenomas. J Neurosurg 2012;116:1299-1303.
- 15. Nam-Kyung Y, Gye CS, Chang-Jin K, Gil CL, Yong JJ, Bong-Jae L, and Yoo-Sam C The effectiveness of lumbar drainage in the conservative and surgical treatment of traumatic cerebrospinal fluid rhinorrhea. Acta Oto-Laryngologica 2013;133:82-90.
- 16. Robertazzi RR, Cunningham JN Jr Intraoperative adjuncts of spinal cord protection. Semin Thorac Cardiovasc Surg 1998;10(1):29.
- 17. Svensson LG, Hess KR< D'Agostino RS, Entrup MH, Hreib K, Kimmel WA, Nadolny E, Shahian DM Reduction in neurological injury after high-risk thoracoabdominal aortic operation. Ann Thorac Surg 1998;66(1):132
- 18. Thompson HJ Managing patients with lumbar drainage devices Critical Care Nurse 2000;20(5):59-69.