

External Ventricular Drainage & Lumbar Drainage Procedure and Care.

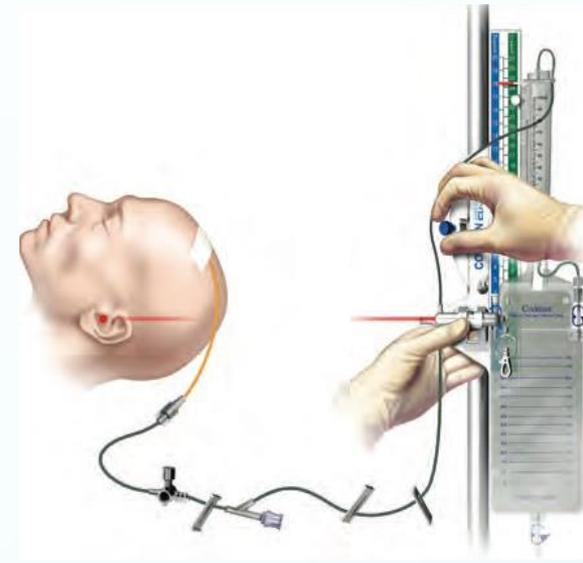
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External Ventricular Drain

- Indications:
 - Therapeutic (To relieve raised ICP).
 - Hydrocephalus (communicating and non-communicating)
 - Surgical Mass lesions.
 - Infections (pyogenic and tuberculous).
 - Chiari Malformations.
 - SAH resulting in acute hydrocephalus
 - Shunt failure due to mechanical disruption or infection
 - Brain relaxation in the OT, etc.
 - ICP monitoring

ICP monitoring and EVD

- Intraventricular catheters are considered the **gold standard** for measuring ICP.* (**Level 3**)
- An external ventricular device not only has **ICP monitoring capabilities**, but also can assist with controlling increased ICP by allowing for **therapeutic CSF drainage**.



*Czosnyka, M., & Pickard, J. D. (2004). Monitoring and interpretation of intracranial pressure. *Journal of Neurology, Neurosurgery, and Psychiatry*, 75, 813–821.

EVD System

1. Brain Cannula
2. Ventricular Catheter
3. Stylet
4. Connecting tube
5. Collecting Bag



Preparation

- Written informed consent
- Ask for history of bleeding tendency.
- Check Coagulogram
- **All ICP catheters should be inserted using sterile technique.**
 - Intracranial catheters inserted outside of the OR show a tendency toward higher infection rates.*

*Arabi, Y., Memish, Z., Balkhy, H., Francis, C., Ferayan, A., Shimemeri, A., et al. (2005). Ventriculostomy-associated infections: Incidence and risk factors. American Journal of Infection Control, 33, 137–43

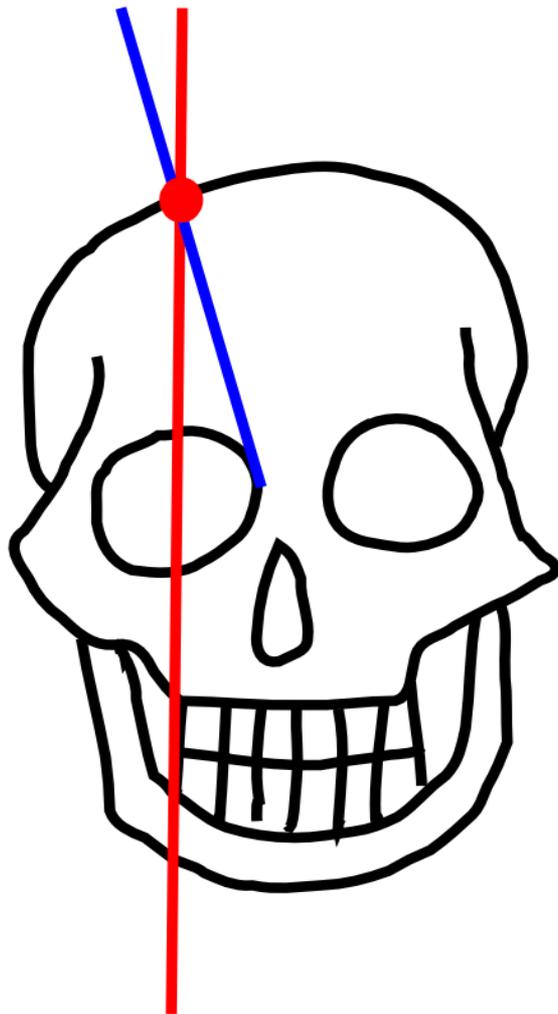
Preparation

- Position: 30⁰ head end elevation with head in neutral position.* (Level 2)
- Immobilize the head (Saline bottles on either side of the head).
- During insertion, continuously monitor heart rate, respiratory rate, and O₂ saturation
- Prepare site by shaving or clipping
 - Always the non-dominant side.
 - By rule – right side.

*Fan, J. Y. (2004). Effect of backrest position on intracranial pressure and cerebral perfusion pressure in individuals with brain injury: A systematic review. *Journal of Neuroscience Nursing*, 36 (5), 278–88.

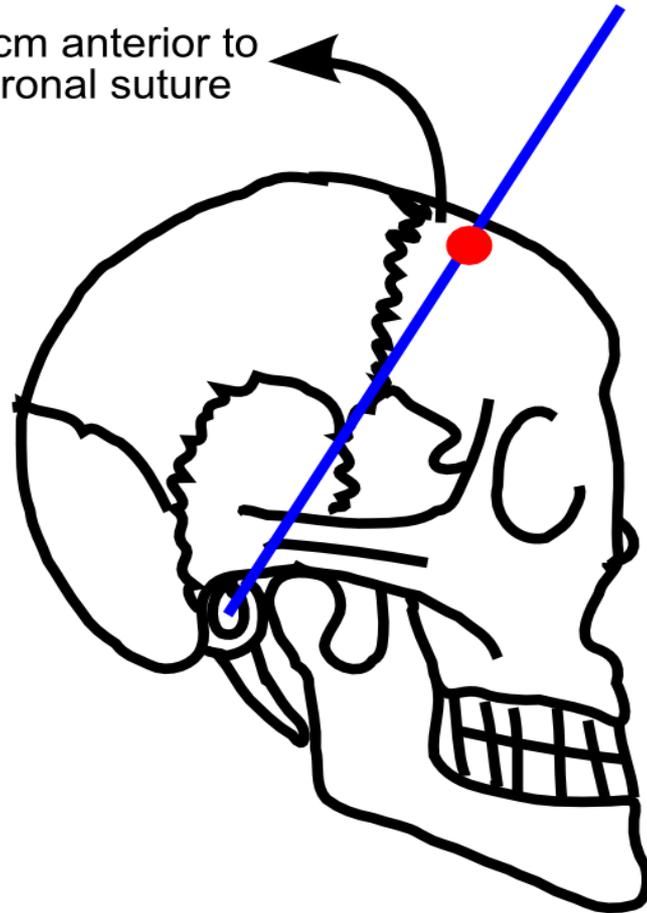
Procedure

- Markings:
 - Midline of the scalp by connecting nasion to inion.
 - Mid-pupillary line.
 - The coronal suture. Or draw a perpendicular line from mid-point of zygoma.
- Mark Kocher's point 1 cm anterior to coronal suture on mid-pupillary line.
- Clean site in circular motion with antiseptic solution.
 - Thrice with betadine and once with spirit.



2-3 cm from midline
(~mid-pupillary line with forward gaze)

1 cm anterior to
coronal suture



Kocher's Point

Procedure

- The scalp is infiltrated with lignocaine Adr soln.
 - Properly administered LA prevents scalp bleeding.
- With scalpel, a small (1 cm) bone-deep incision is made in the scalp
 - If it starts bleeding torrentially --- apply pressure for 2 min.
- Another incision (1 cm) is made 3-5cm behind this incision and subgaleal tunneling (with artery forceps) is performed between these incisions.

Procedure

Bone is drilled in the direction of the catheter placement (exactly perpendicular to the scalp).

- A guard is essential in preventing plunging of the drill tip. Approx 1.5 cm of the drill tip should be exposed beyond the guard.
- In our setting, **dura is to be punctured along with bone in a single thrust**
 - Gradual pressure on the dura may lead to stripping of the adjoining dura resulting in EDH

Twist Drill

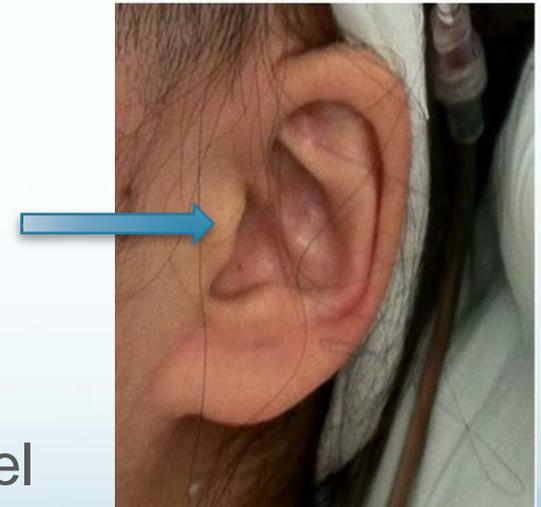


Procedure

- Ventricular puncture
 - Enter the brain perpendicular to skull at Kocher's point
 - Note the distance at which the ventricle is hit
 - Pre-measure the length of the catheter to be inserted
- The catheter is secured using a tunneling method through a separate incision and sutured
- A CT scan must be performed
 - to confirm catheter placement and
 - to rule out complications like EDH, SDH, ICH, IVH

Procedure Completion

- Dress insertion site by applying sterile dressing
- The tubing can be placed in a sterile manner in a camera cable cover to prevent contamination
- Must Dos:
 - Measure the ICP and document it
 - Take CSF for analysis
 - Establish the EVD system & set the level
 - Document the procedure and complications, if any



EVD Insertion



Complications of EVD

- **EVD Infections.**
 - This is the major complication with EVD.
 - The mean EVD-associated infection rate is 8%–9%.^{*}
 - The difficulty is with making the diagnosis
 - The inflammatory response to blood (aseptic or chemical meningitis) may mask the response to infection.
 - EVD-associated infection is defined by a positive CSF culture.^{**}

^{*}Fichtner, J., Güresir, E., Seifert, V., & Raabe, A. (2010). Efficacy of silver-bearing external ventricular drainage catheters: A retrospective analysis. *Journal of Neurosurgery*, 112(4), 840-846.

^{**}Lozier, A. P., Sciacca, R. R., Romagnoli, M. F., & Connolly, S. E. (2002). Ventriculostomy-related infections: A critical review of the literature. *Neurosurgery*, 51, 170–182.

Prevention is the Best Cure

- Strict adherence to **Aseptic Technique**
- **Prophylactic antibiotics** remain controversial due to the risk of selection for resistant organisms
- **Antibiotic-impregnated ventricular catheters** have been widely used after a randomized multicenter clinical trial showed evidence of their ability to reduce infections (Zambramski et al., 2002)
- **Tunneling** is a technique frequently used to decrease EVD infection (Dasic Hanna, Bonjanic, & Kerr, 2006; Lozier et al., 2002)
- For EVD-associated infection rates greater than 10%, it is recommended the institution should investigate its practices and EVD protocols (**Level 3**; Lozier et al.).

Complications of EVD

- Non-infectious Complications
 - **Aneurysmal re-bleeding and hemispheric shifts from reduction in ICP**
 - Set the level based on the indication for the EVD
 - **CSF overdrainage**
 - Monitor the CSF drainage (every 4th hourly)
 - Monitor the ICP frequently.
 - Set the level as per the ICP value.
 - **Hemorrhage and misplacement complications**
 - CT scan after EVD insertion
 - Call for help if first tap is dry.
 - 2 taps is the maximum limit.

Points to Remember

- Written Informed Consent
- Strict aseptic precautions
- Kocher's point
- Direction – Perpendicular to the skull
- Pre-measure length of the catheter to be inserted
- Tunnel the catheter
- Measure the ICP and document it
- Set the level
- Document the procedure

Removal of the EVD

- Close monitoring of the clinical status and the ICP of the patient.
- When the primary pathology has been dealt with.
- Slowly raise the height of the level at which the EVD is set for drainage. Monitor GCS and ICP. Periodic CT scans should be done.
- If patient responds well – Clamp EVD for 2 hours and then remove EVD in the clamped position.
- If ICP rises or patient's GCS deteriorates – open EVD --- Consider VP shunt.

Lumbar Drainage

- **Indications:**
 - Therapeutic.
 - CSF rhinorrhea after transsphenoidal surgery
 - CSF rhinorrhea/otorrhea after craniotomy
 - CSF leak from wound site
 - Wound bulge
 - to manage non-traumatic subarachnoid hemorrhage to prevent vasospasm
 - Prophylactic.
 - During transsphenoidal surgery.
 - During intracranial surgery to decrease brain bulge.

LD – Absolute Contraindications

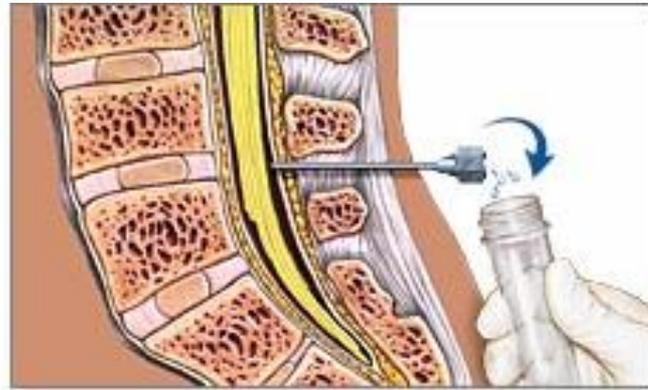
- Increased ICP (excludes documented pseudo-tumor cerebri patients)
- Unequal pressures between the supratentorial and infratentorial compartments as evidence by the following head CT findings:
 - midline shift
 - Loss of suprachiasmatic and basilar cisterns
 - posterior fossa mass
 - loss of the superior cerebellar cistern
 - loss of the quadrigeminal plate cistern
- Infected skin over the needle entry site
- Spinal epidural abscess
- Intracranial mass
- Obstructive non-communicating hydrocephalus
- Spinal arteriovenous malformation

LD – Relative Contraindications

- Coagulopathy, active bleeding, or severe thrombocytopenia
- Brain abscess
- History of prior lumbar spine surgery
- History of prior lumbar vertebral fracture

Preparation

- Written Informed Consent
- Patient positioning



Preparation

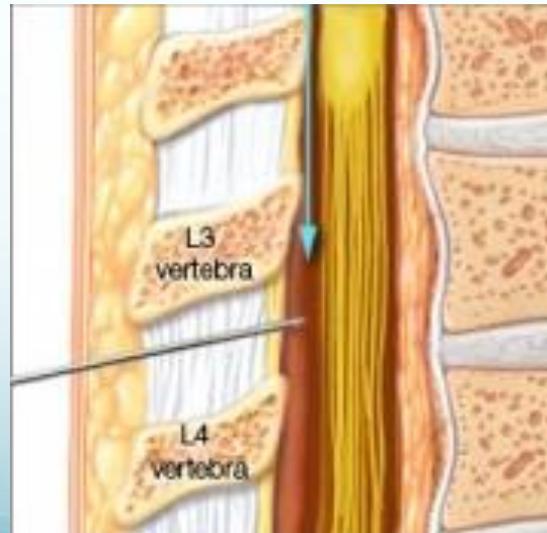


Preparation

- Identify interspaces and mark the puncture site at the L4 – L5 interspaces in a perpendicular line from the iliac crest
- Drape the patient with sterile drape.
- Recheck the landmarks.
- Infiltrate the skin and subcutaneous tissue with preservative-free 1% lidocaine with a 23-gauge needle.

Procedure

- Insert the Touhy needle into the midline of the interspace with bevel up. Direct the needle on a 10-degree angle toward the umbilicus
- Advance the needle slowly, removing the stylet every 2–3 millimeters to check for CSF flow

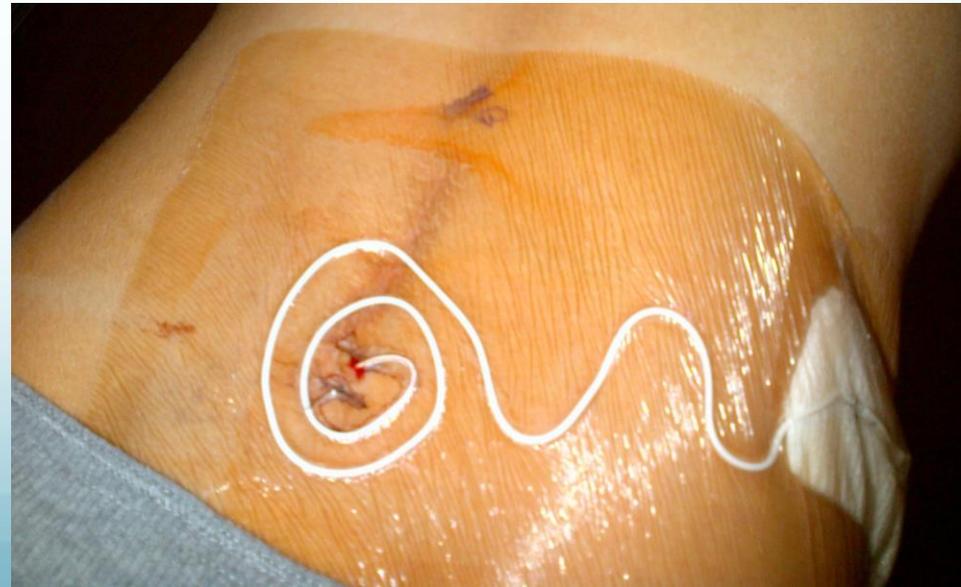


Procedure

- Once the dural sac is punctured and CSF flow established – Turn the needle 90 degree.
- Collect CSF for analysis.
- Thread the catheter through the needle and then remove the needle.

Procedure

- Connect the system.
- Set the level. 40mL every 4th hourly.
- Secure the LD catheter to the patient.
- Secure the system with steri-drape.



Maintenance

- Steri-drape over the entire area.
- Problem is always at the connector.
- While making changes to the patient's positioning, the LDD should be clamped so that overdrainage does not occur.
- The lumbar drain should be closed when patient is ambulatory.
- The level should be reset every time the patient changes her/his position.
- Daily electrolytes to look for imbalances. CSF – electrolyte rich.
- Good hydration to be maintained. Consider the CSF drainage in the input-output balance.

Removal of the LD.

- Once the indication has been taken care of.
- Clamp the drain.
- Look for CSF leak/wound bulge.
- If the problem has settled – remove the LD in the clamped position.
- If not --- consider shunt.

Complications

- Post-dural puncture headache
- Lumbar sacral nerve injury or paresthesias
- Cerebrospinal fluid leak
- Meningitis
- Insertion site infection
- Spinal or epidural hematoma
- Catheter fracture or catheter retention

Thank you