

Technical aspects of ICP monitoring and EVD placement

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Practice parameters

- Procedures carried out in the ICU, U112, and the ER
- Procedures
 - External ventricular drains
 - Placement of ICP and other intracranial monitors
 - Bur holes for subdural hematomas

Determination of urgency

- Based on clinical and imaging assessment in consultation with neurosurgical staff
- Assign a time priority to the patient (i.e. E0, E1, E4, E6, E12, E24...)
- Communicate urgency to Admitting department (ICU or 112 step down)
- If unable to transfer E0-E4 then book emergency OR.
- If delay would result in catastrophic outcome procedure may be performed in the FMC ER

Consent

- Appropriately signed consent should be in patient's chart prior to initiating the procedure
- For E1-E6 to be performed by House Staff and Fellows without delay, it is appropriate for consent to be signed by staff Neurosurgeon within a few hours of the procedures.
 - House staff should document in patient's chart that case and urgency has been discussed with staff
 - Notify appropriate family members and document in chart

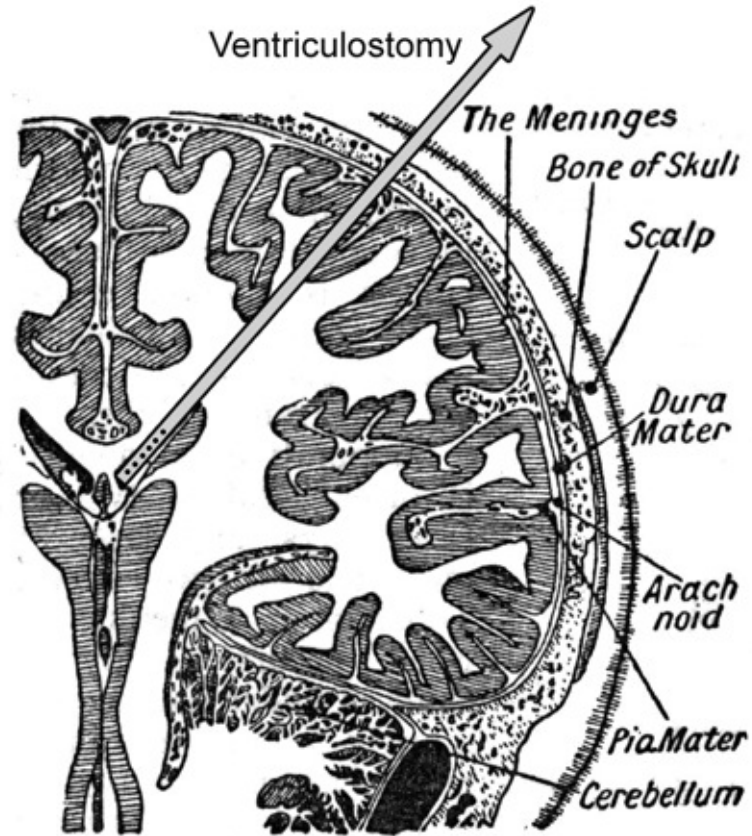
Performance of bedside procedure

- May be performed independently by PGY-3 or higher Residents assuming that they have obtained adequate supervised experience in the past
- PGY-1 and PGY-2 require direct supervision of more Senior Resident, Fellow, or attending Neurosurgeon
- Surgeon needs to perform a “time out process” before initiating the procedure
 - Verify correct identity of the patient, correct site, and correct side with the bedside nurse or another (assisting) physician before initiating the procedure

Documentation of Bedside Procedure

- A brief OR note should be dictated (#44444, work type #10)
- The OR note must identify the admitting/attending staff Neurosurgeon and house staff. Copies of the OR note must be sent to the staff neurosurgeon and yourself in care of Patti Sullivan, Residency training Program Coordinator
- The OR note must state the diagnosis, the procedure done as well as the date and the approximate time the procedure was carried out.
- The OR note should contain a brief section outlining the clinical indication and a second brief section indicating the procedure performed including the main finding of the procedure.

External ventricular drains



- An External Ventricular Drainage (EVD) is the temporary drainage of CSF from the lateral ventricles to a closed collection system outside the body
- Indications
 - To divert the flow of CSF to treat acute hydrocephalus (e.g. shunt failure, tumor, or hemorrhage)
 - To divert bloodstained CSF (e.g. following neurosurgery, haemorrhage)
 - To divert infected CSF (e.g. shunt infection)
 - To monitor ICP (e.g. usually GCS= ≤ 8 and either abnormal CT or normal CT with risk factors)
 - To relieve raised ICP (e.g. Trauma)

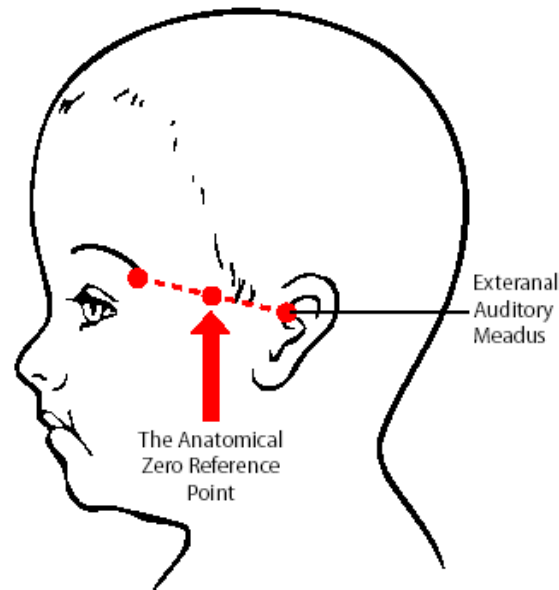
- Kocher's point
 - Places catheter in frontal horn
 - Right side usually used
 - Entry site 2-3 cm from midline which is approximately the mid-pupillary line, 1 cm anterior to the coronal suture
 - Incision oriented in the sagittal plane in case it needs to be incorporated in flap
 - Drill bit or bur hole
 - Trajectory perpendicular to the surface of the skull, aim towards medial canthus of the ipsilateral eye and in the AP plane towards the EAM
 - Advance with stylet until CSF obtained. Usually 4-5 cm (no more than 7 cm). Get CSF at 3-4 cm with ventricular enlargement

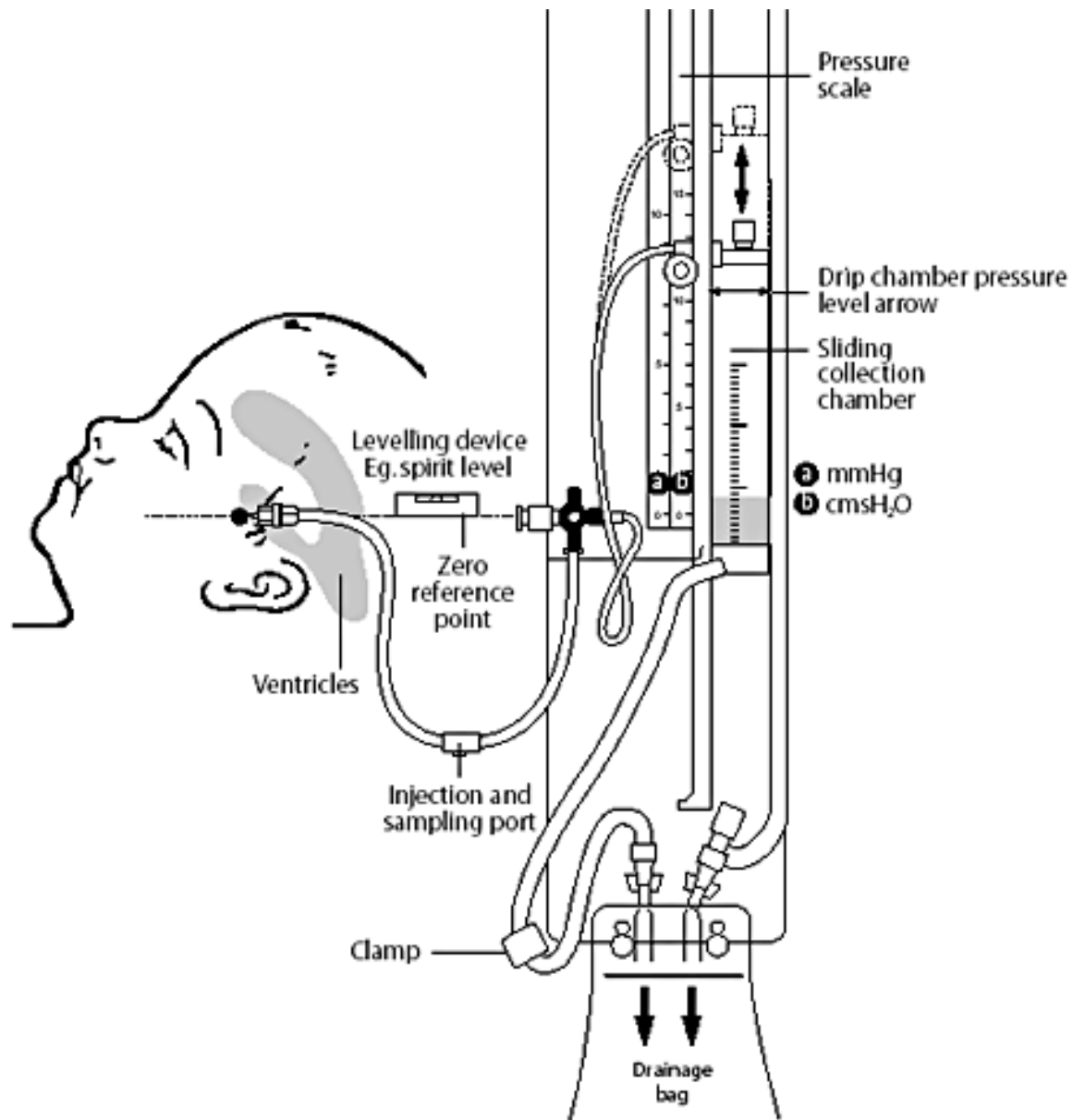
- The catheter is tunnelled under the scalp and brought out 3 cm away.
- Use a 3-Ethilon running suture for drain site and 2-Silk purse string for exit site
- Connected to
 - A self-sealing sampling & injection port.
 - An anti reflux drip/collection chamber.
 - A pressure scale mounting panel or a tape measure.
 - A drainage bag.
- An initial assessment of CSF drainage should be made
- Subsequently checks should be made of
 - Amount of drainage
 - Colour of CSF
 - Exit site
 - The position of the EVD

- Position of drain

- Prescribe a drain height post-operatively

- Can be left open (10 to 20 cm)
 - Or left closed and intermittently opened to drain a certain amount of CSF an hour or above a critical ICP (open to drain 10 cc q15m when $ICP > 20$)





- Advantages
 - Low cost
 - Allows ICP monitoring and therapeutic CSF drainage
 - Easily recalibrated to reduce drift
- Disadvantages
 - Difficult to insert into tight or displaced ventricles
 - Obstruction may cause inaccurate readings
 - May flush distally ad lib but proximally with 1-2 cc normal saline (no preservative)
 - Labour intensive (transducer must be maintained at fixed reference point, must close when moving patient)

Codman ICP monitors

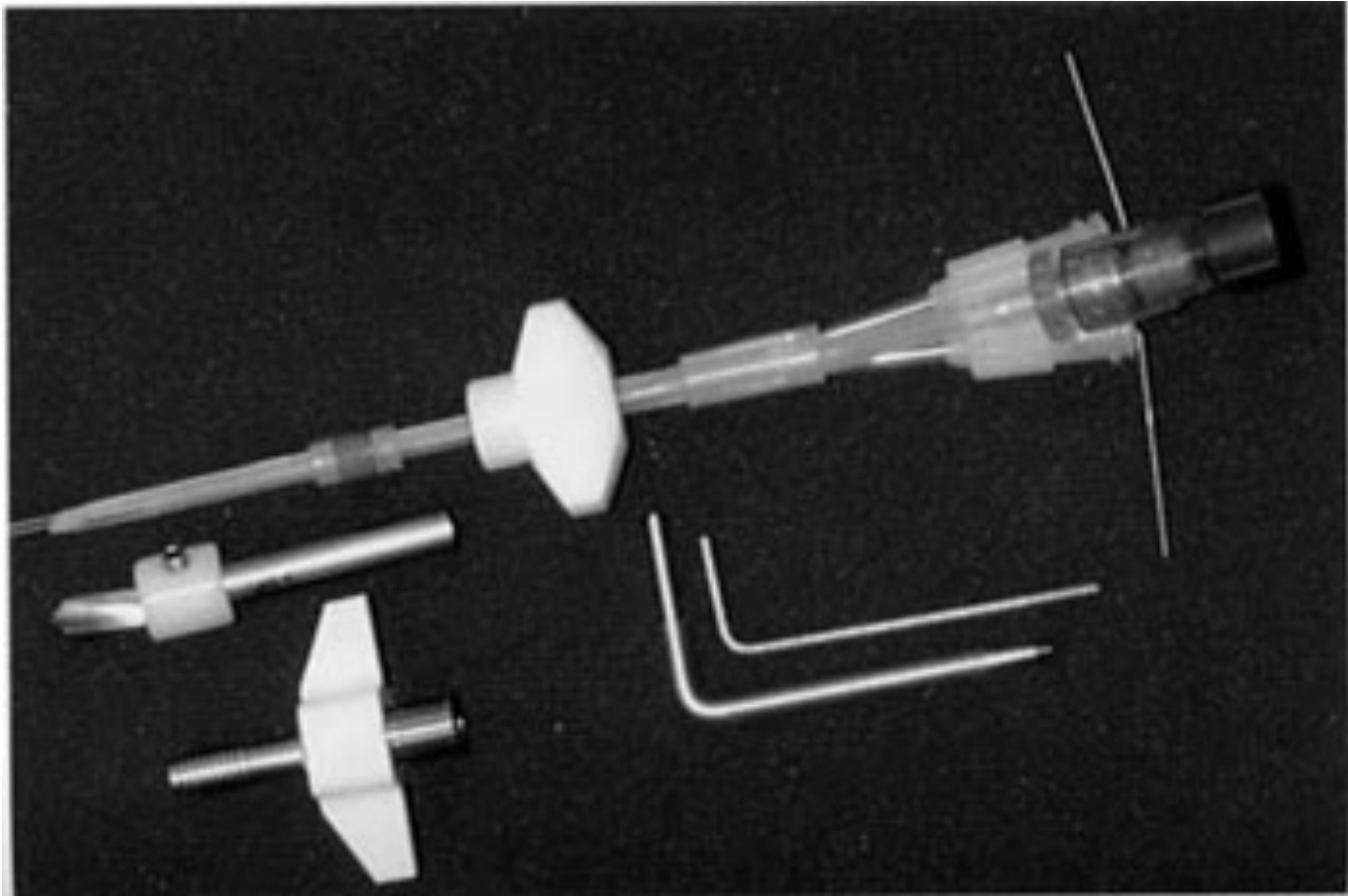
Thin (1 mm in diameter)



- Monitor placed in parenchyma or fluid space
 - Usually former
- Same location as EVD in bedside procedure
 - Drill bit hole
 - Tunnel guide goes from incision to exit site
- Connect monitor to Codman ICP EXPRESS
 - Detect monitors
 - Zero in normal saline, hit blue ZERO button
 - Record reference number
- Can bend monitor 90 degrees
- Insert to 2.5 cm from outer cortex of skull
- Tunnel 3 cm away and suture incision and purse string
- Connect back to Codman ICP EXPRESS then to nursing monitors

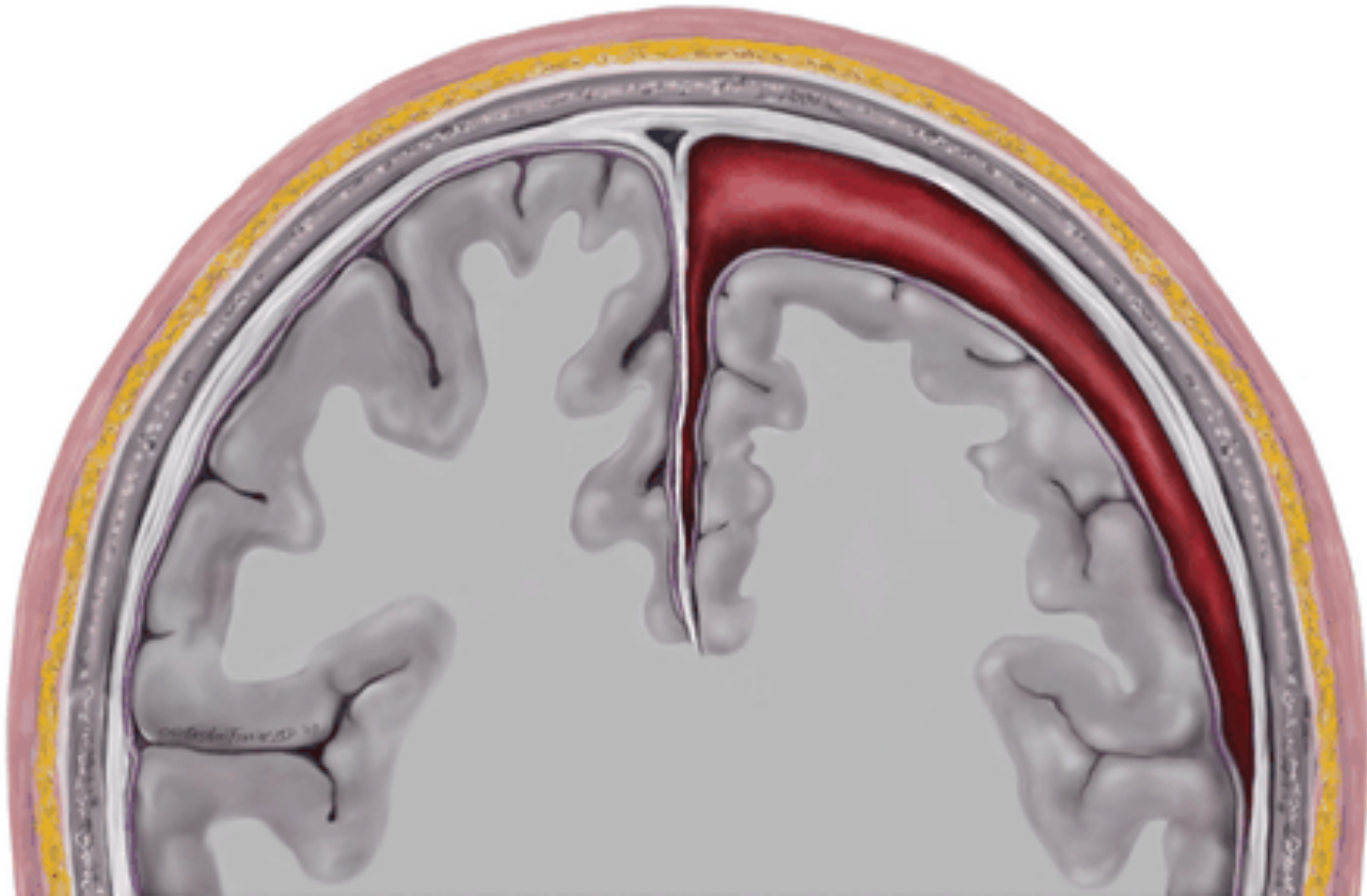
- Advantages
 - Easy to insert
 - Less invasive than and EVD
- Disadvantages
 - Higher cost
 - Only allows ICP monitoring
 - Cannot be recalibrated and subject to drift

Lycox bolts



- 3 Port system
 - PO2
 - Temperature
 - Port for Codman or microdialysis
- Same location as EVD
 - Place 1-2 cm anterior if EVD present
- Smaller incision
 - Big enough for drill bit (comes with set)
- Screw in bolt
- Use trochar to puncture dura
- Insert port system
- Place monitors
 - If placing Codman must use extra cap and predetermine depth

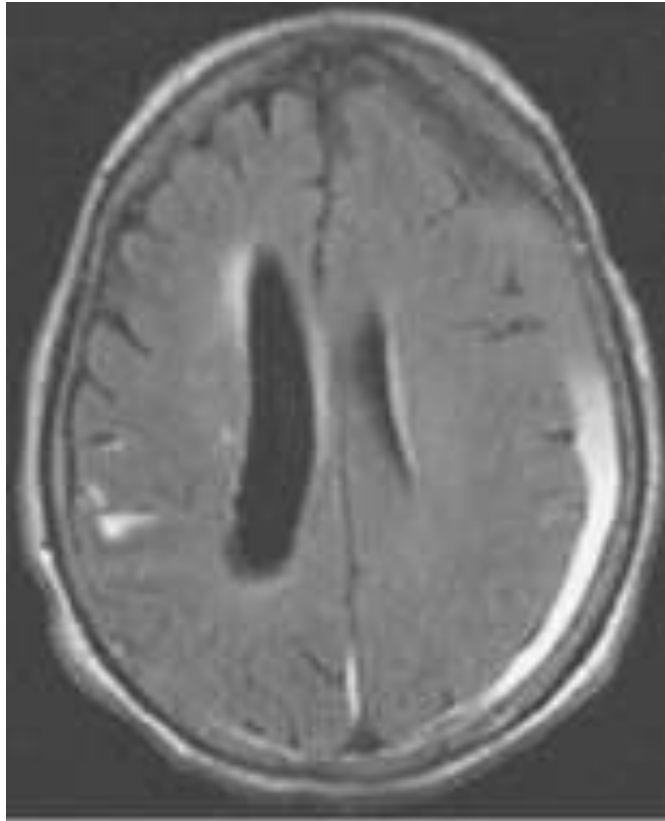
Subdural drains



- Insert where the subdural is located
 - Usually frontal (2 cm lateral to Kochers) or at parietal boss
 - Incorporate incision to a possible flap
 - Insert drain
 - Small dural opening to subdural space doesn't fill with air
 - Use a primed drain
 - Soft pass
 - Aim where the money is
- Drugs
 - Local anaesthetic with epinephrine
 - Fentanyl 50ug iv
 - Midazolam 2.5 mg iv

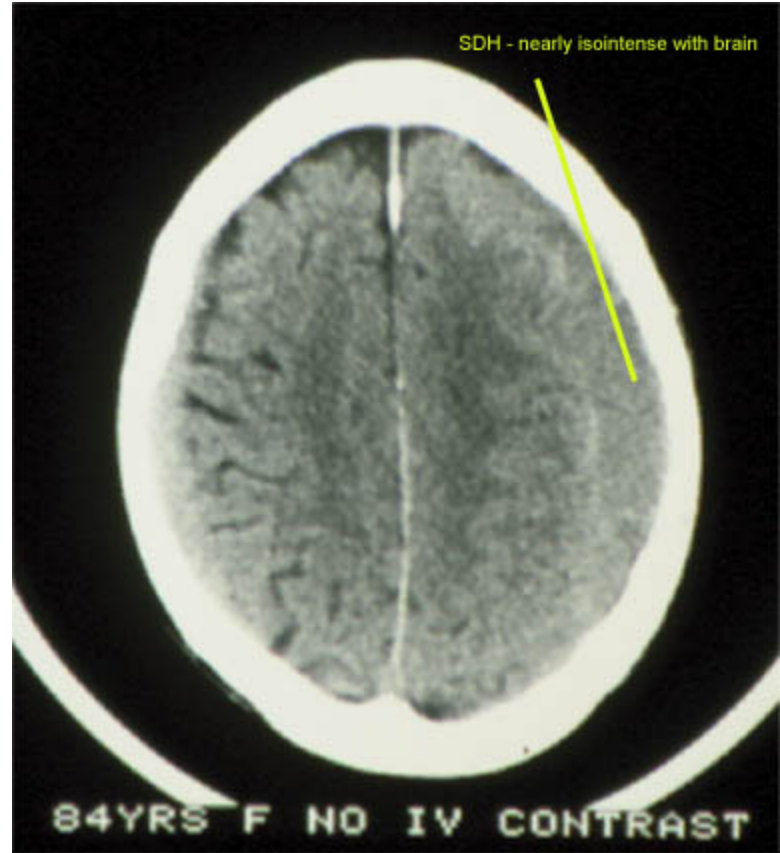
- Tunnel like EVD
 - Use purse strings to scalp
- An initial assessment of drainage should be made
 - Color and consistency should be noted
- Maintenance
 - Usually level to floor
 - Initially may drain a lot, so clamp for several hours if drain more than 75 cc then open and level to drain 10 cc per hour
- Imaging
 - CT scan the next day

- Indications
 - Chronic subdurals mass effect causing
 - Focal neurological deficits (e.g. drift)
 - Global neurological deficits (e.g decreased LOC)
 - Temporizing complex chronic and subacute SDH for possible definitive procedure
- Complications
 - Infections
 - Injury to brain
 - Acute bleeding



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SDH - nearly isointense with brain

84YRS F NO IV CONTRAST

