CSF RHINORRHOEA

WHAT IS CSF

- Normal CSF pressure 60 – 150 mmH₂O (low in neonates)
- Secreted at a rate of 35-0.4 mL per minute, 500cc per day, turnover 3 times per day
- Lateral (paired) → foramen of Monroe → Third ventricle (unpaired) → Aqueduct of Sylvius → 4th ventricle (LituAX) (Total 4 ventricles Paired lateral and 3rd and 4th ventricle)
- 4th ventricle communicates to central canal of spinal cord. CSF to Subarachnoid space (due to arterial pulsations) via 3 forams, Single Foramen of Monfendie in roof and paired lateral foramen of Luschka. Absorption via arachnoid villi and arachnoid granulations in close relation to Dural venous sinuses.
- Functions of CSF:
  - It cushions the brain and spinal cord against trauma
  - It nourishes the brain tissue.
  - It removes waste materials.
- Present in subarachnoid space

DEFINITION

- CSF discharging from the nose is known as CSF rhinorrhoea.
- Cerebrospinal fluid is a clear colourless fluid that bathes the brain and spinal cord, cushioning them against trauma.
- In fact in literal terms the brain and spinal cord floats in the cerebrospinal fluid. The specific gravity of brain is only 4% of that of CSF, hence it could float easily in the CSF.

COMMUNICATION OF CSF to NOSE

- Anterior Cranial Fossa – MC Cribriform plate
- Middle or posterior cranial fossa – Mastoid cavity → middle ear → Eustachian tube

CAUSES

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Causes of CSF rhinorrhoea.
TYPES OF CSF RHINORRHOEA:

I. Traumatic

II. Non traumatic (spontaneous) –

a. High pressure leaks (always associated with concomitant hydrocephalus)
   - Encountered in the cribiform area. This is due to the fagility and unique anatomy in this area
   - The leak during these conditions functions as a safety valve alleviating the increased intracranial pressure.
   - These high pressure leaks are associated with slow growing tumors and 1/4 of them have hydrocephalus.
   - Pituitary neoplasms (MC) > Posterior cranial fossa lesions.
   - Closure of these leaks may worsen the condition of the patient if the causative lesion is left untreated.

b. Normal pressure leaks –
   - These leaks are associated with congenital dehiscence or thin bone along the skull base.
   - Commonly this type of leaks occur in the ethmoidal sinus adjacent to the cribiform plate.
   - Potential leak pathways include the prolongation of the subarachnoid space along the olfactory nerves and stalk of the hypophysis.
   - Cerebrospinal leaks needs to be treated because of the impending threat of meningeal infections

SPONTANEOUS CSF RHINORRHOEA

- True spontaneous leaks are really rare. There is almost always some antecedent traumatic event.
- NUSS postulated the various causes of spontaneous CSF rhinorrhoea. He named them as “4 P’s”.
  1. Increased intracranial pressure
  2. Brain pulsations which continuously occur along the skull base
  3. Degree of pneumatisation of the paranasal sinuses
  4. Arachnoid pits / villi exist normally along the skull base. Continued transmission of pulsation, erodes the bone until the arachnoid communicates with a pneumatised space with the potential to develop fistula.

DIAGNOSIS

- History – surgeries, accident, unilateral, watery, intermittent, associated features like headache, positional variation, asso with anosmia or hyposmia etc.

BEDSITE TESTS FOR DETECTING CSF RHINORRHOEA

QUECKENSTEDT’S TEST – pressure on b/l jugular veins increases rhinorrhoea.

RESERVOIR SIGN – This test is ideally performed immediately on rising from the bed. The patient is asked to place the chin over their chest. The patient must stay in that position for one full minute. Clear fluid dripping from the nose is CSF.

HALO / DOUBLE RING SIGN – If rhinorrhoea associated with blood. Clear ring surrounds blood.

But false negative in tear and saliva.
**Handkerchief test**: Discharge from the nose is blown into a handkerchief and is allowed to dry. If the discharge is CSF the handkerchief will not stiffen, if the discharge is secretions from the nose the handkerchief stiffens due to the presence of mucin in the nasal secretions.

**LABORATORY TEST**

- **Glucose oxidase test** – Glucose oxidase strips show colour change on detection of glucose. (high false negative so abandoned)
- **β2 transferrin** in the nasal secretions. In CSF Beta 2 transferrin is present, and it is absent in normal nasal secretions. (100% Sensitivity and 95% specificity)
- **βTrace Protein** – 100% sensitive and specific
- **Intrathecal radionucleotide test** – Most Specific
- Tests that help to localise the CSF leak:
- **MR Cysternography**
- **CT Cysternography (Contraindicated in active meningitis or High ICP)**
- **Intra thecal administration of non ionic contrast with high resolution CT scan**. Intra thecal administration of low quantities of Fluorescein can also be used.
- If the leak is present it can be viewed in the nasal cavity with a 490 nm light generated by a special optical filter. Dye injection is done using **Barbolage technique** in which 1 - 2 drops of 5% Fluorescein is diluted with the patients own CSF, and then injected partially, then CSF is withdrawn further diluting the dye and then reinjecting the dye.

**MANAGEMENT**

**INDICATIONS FOR CONSERVATIVE MANAGEMENT**

- Immediate post traumatic leak within 48hrs
- Small leaks after surgery
- No indication for intracranial exploration
- Older and high risk patients for surgery

**MEDICAL** (for 14 days)

1. Bed rest
2. Elevation of the head end of the bed
3. Stool softeners
4. Short course of Azetazolamide
5. Continuous / daily intermittent lumbar spinal drainage helps to reduce the fistula
6. Antibiotic prophylaxis to prevent meningitis.

**SURGICAL MANAGEMENT**:

- CSF leaks into the nose can be approached by two routes:
  1. Intracranial repair
  2. Extracranial repair

**INTRACRANIAL REPAIR**:

- Till recently this was the commonest approach adopted to repair CSF rhinorrhoea.
- Leaks from the anterior defects can be repaired by **Frontal anterior fossa craniotomy**. A middle cranial fossa craniotomy or posterior fossa craniotomy can be used to manage leaks from these
areas. **Leaks from the sphenoid sinus area are difficult to approach via the intracranial route**. The repair techniques involve use of a *pedicled periosteal or dural flaps*, *muscle plugs can be used to plug the defects*, mobilised portions of falx cerebri or other facial grafts can be utilised. Fibrin glue can be used to stabilise the grafts used in case of large leaks.

- **Advantages** of this approach are
  1. The adjacent brain tissue can be directly inspected
  2. Direct visualisation of the dural defect
  3. The repair can also be done even under conditions of increased intracranial tension
  4. Even if efforts to localise the leak fails blind repair is possible in this approach. The areas covered with grafts must include the cribriform plate and the sphenoid sinus.

- **Disadvantages** of this approach:
  1. Increased morbidity
  2. Increased risk of permanent anosmia
  3. Trauma related to brain retraction (hematoma, oedema, seizures, cognitive dysfunction)
  4. Longer hospital stay

**EXTRACRANIAL REPAIR:**

- This can be divided into external approaches and endoscopic techniques

**EXTERNAL APPROACH:**

- This include **Anterior Osteoplastic approach** via bicoronal or eyebrow incision, external ethmoidectomy, transeptal sphenoidectomy, and transeptal sphenoidectomy.
- Graft materials used could range from *fascia lata, temporoalis fascia, septal cartilage, turbinate mucosa, muscle and fat.*
- For cribriform plate, or fovea leaks a transnasal ethmoidectomy is performed. For sphenoid leaks sphenoidectomy is performed.

**DISADVANTAGES OF THIS PROCEDURE INCLUDE:**

- Inability to repair associated intracranial abnormalities
- Ineffective in repairing high pressure leaks
- Ineffective in repairing frontal and sphenoid sinus leaks when they have prominent lateral extensions

**ENDOSCOPIC TECHNIQUES:**

**ADVANTAGES**

- Less morbidity
- Better visualisation and magnification.
- Accurate positioning of the graft to plug the leak.
- There is no threat of anosmia, and this procedure has low morbidity.
- No brain retraction
- No external incision

- **GRAFT – Underlay and Overlay**
- Technique
- < 1cm only soft tissue graft
- >1cm cartilage / bone with soft tissue
- **TOBACCO POUCH TECHNIQUE** – Circular piece of graft folded, filled with fibrin sponge / fat and placed on defect with glue.
- **BATH PLUG TECHNIQUE** – prolene thread passed through fat, placed in defect, thread pulled forms plug.
- **Underlay** – Btw Dura and cribriform plate

![Diagram of bath plug technique](image1)

- **Overlay** – Over the cribriform plate directly without undermining

![Diagram of sandwich technique](image2)