CEREBROSPINAL FLUID RHINORRHOEA & ITS MANAGEMENT

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Introduction

- **CSF rhinorrhea** refers to a **fistula** between the subarachnoid space and the **nasopharynx** – this may be direct via the anterior cranial fossa and PNS **or** indirect from the middle or posterior fossa via the eustachian tube with an intact tympanic membrane.
Historical Perspective

- First described by Galen, 200 B.C.
- Saintclair Thompson reported the first series of patients with spontaneous leakage in 1889
- The first well-succeeded surgical approach was attributed to Dandy in 1926, when he sutured the fascia lata over dural defect, on back of the posterior wall of the frontal sinus, by intracranial route
- In 1964, Vrabec and Hallberg described endonasal approach to repair a CSF leak in the cribriform lamina
Introduction

CSF rhinorrhoea

ACF
- Cribiform plate
- Frontal sinus
- Sphenoid sinus

PCF
- Petrous bone to middle ear

MCF
- Sphenoid sinus- lat extension
- Petrous bone to middle ear
Causes of CSF rhinorrhoea

- Traumatic
  - Surgical
  - Non-surgical
- Spontaneous
  - High Pressure
  - Low pressure

Acute

Delayed
Causes of CSF rhinorrhoea

- **Traumatic** –
  - **Acute / Early** – within 1 week
  - **Delayed** – month/year later
- **Non-surgical**-
  - Blunt trauma – Basilar skull fracture
  - Projectile trauma
- **Surgical / Iatrogenic / Post-operative leaks**-
  - Craniotomy
  - Paranasal sinus surgery
  - Skull base tumour ablation
  - Transsphenoidal surgery
Causes of CSF rhinorrhoea

- **Spontaneous / Non-traumatic** –
  - **High-Pressure Flow** -
    - Intracranial tumours
    - Hydrocephalus
  - **Low-Pressure Flow** –
    - Bony erosion, Osteomyelitis, Osteonecrosis
    - Sellar atrophy
    - Olfactory atrophy / Focal cerebral atrophy
    - Congenital defects of skull base
    - Pneumatized bone
    - Idiopathic
Traumatic CSF rhinorrhoea

- MC cause of CSF leak is head trauma, particularly, basilar skull fracture
- CSF leaks occur in approximately 3% of all head injuries & 12-30% of basilar skull fractures, depending upon the accelerative forces
- Typically begin within 48 hours, and 95% will manifest within 3 months of injury
Traumatic CSF rhinorrhoea

- Roofs of ethmoid & the cribriform plate MC site-
  - Thinnest area of the ethmoid roof
  - Dura tightly adherent to bone in this area
  - Natural dehiscence created by Anterior Ethmoidal Artery in the region of lateral cribriform plate
  - Prolongation of the subarachnoid space along the olfactory nerve rootlets with subsequent rupture
Traumatic CSF rhinorrhoea

- Delayed Post-traumatic CSF Leak –
  - Lysis of clot in the area of fracture
  - Resolution of soft tissue edema
  - Loss of vascularity with necrosis of soft tissue around the wound
  - Delayed increase in ICP after trauma
Post-operative CSF rhinorrhoea

- **Iatrogenic/Post-operative CSF rhinorrhoea**
  - Trans-sphenoidal hypophysectomy, Ethmoidectomy, Anterior skull base tumour ablation e.g. olfactory groove meningioma
  - May be compounded by altered post-operative CSF flow characteristics or unrecognized/untreated hydrocephalus
  - Less likely to resolve spontaneously compared to nonsurgical traumatic cases as the dural and bony defect is large
Spontaneous CSF rhinorrhea

- Leaks that are explained neither by trauma nor by any other cause
- Tumours and raised ICP are highly correlated with spontaneous CSF leak
- Pituitary tumours are the most common neoplastic cause of spontaneous CSF leak, due to sellar erosion
Complications of Untreated CSF fistula

- **Meningitis** – 3-11% risk within first three weeks after trauma, overall risk 25%, with 10% mortality, more with delayed CSF fistula, MC organism isolated is Pneumococcus
- **Pneumocephalus** – 20-30%, including life-threatening tension pneumocephalus → indicates open communication with significant risk of meningitis and encephalitis
- **Cerebral Abscess**
- **Encephalitis**
- **Headache**
Diagnostic Approach

CSF rhinorrhoea

- Confirming that the leaking fluid is CSF
- Delineating the site of CSF fistula
- Defining the mechanism of production of CSF fistula
Clinical evidence of CSF Leak

- Unilateral clear watery nasal discharge with a salty taste
- Dripping in the back of throat
- Headache –
  - High pressure – build up over time & relieved by sudden discharge of fluid
  - Low pressure – postural headache relieved by reclining
- Reservoir sign- Large volume of fluid flowing out of the nose during a change in head position – indicates that a CSF-filled sinus has drained at once
- Recurrent attacks of headache, fever and meningitis in a patient with history of head trauma → Look for CSF fistula
- Provocative Tests – Occult CSF leak can be made manifest with the aid of – Valsalva maneuver
  - Jugular venous compression
  - Flexing the neck in sitting position
Clinical evidence of CSF Leak

- **Target sign/Halo sign**: Pseudochromatographic pattern produced by differential diffusion of CSF admixed with blood or other serosanguinous fluid on filter paper – CSF produces a “Bull’s eye pattern “with blood in the center

- **Glucose**: CSF - >= 50-66 % serum concn.
  - Nasal secretion <= 10 mg%
  - Chloride concentration > 110 mEq/L → Most likely CSF

Qualitative spot test – Dextrostix
  - Not definitive
  - Negative test excludes the presence of CSF
Clinical evidence of CSF Leak

- **Immunological methods** –
  - Differentiates between proteins in CSF & those in nasopharyngeal secretions
  - **β₂-transferrin** –
    - Highly accurate way of determining presence of CSF; present only in CSF, aqueous humor & perilymph
    - Most sensitive & specific test available to date
  - **β-trace protein** (Prostaglandin β synthase)
Clinical evidence of CSF Leak

- **Other contributory evidence**: 
  - Unilateral/bilateral anosmia - defect or leak in the region of cribriform plate
  - Imbalance, dizziness, hearing loss, VII nerve dysfunction - temporal bone fracture
  - Optic nerve lesion – injury in the region of tuberculum sellae, sphenoid sinus and the posterior ethmoids
Neuroimaging

- Plain X ray Skull
  - Basilar skull fracture
  - Air-fluid level in the PNS
- CT with bone windows
- Fine-cut (3mm) CT in both coronal & axial planes with 3D reconstruction
  - Sphenoid, ethmoid & cribiform plate # best identified on coronal images
  - Can locate the fistula in more than 50 % cases
- CT cisternography
Neuroimaging- CT cisternography

- Water soluble contrast agents- iohexol, metrizamide

- Procedure-
  - Baseline CT head done
  - Contrast injected in subarachnoid space via a C1-C2 cisternal pucture, prone pt placed in Trendelenberg position for 4 min
  - Table is then made neutral, pt’s head extended slightly, and another CT head performed

- Active leaks-76-100%, Inactive leaks-60%
Neuroimaging

- MRI
- MRI with heavily T2W images & CISS sequences (MR Cisternography)
  - 3D evaluation is done using the CISS technique with 0.7-mm thickness in the sagittal and coronal planes.
  - Highly accurate in localising the site and extent of CSF fistula
  - Non-invasive, No contrast required
- Direct nasal endoscopy-visualization of fistula from ethmoid, sphenoid and cribiform plate
Neuroimaging-
Radionuclide cisternography

- Also called as ‘Nasal Pledget Staining’
- Useful for intermittent CSF fistula
- Tc$^{99}$ labelled albumin, In$^{111}$ labelled DTPA
- Placement of cotton-pledgets along areas thought to be harbouring a fistula
- Slow or intermittent leaks detected by leaving the pledgets in place for 6-48 hrs
- RI (Radioactivity Index) ratio = $\frac{\text{RI}_{\text{pledget}}}{\text{RI}_{1\text{ml of patients blood}}}$
- RI < 0.3 - Normal, > 1.5 - CSF leak
## Interpretation of Radionuclide cisternography (Nasal Pledget Staining)

<table>
<thead>
<tr>
<th>Location of stain</th>
<th>Probable site of fistula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior nasal</td>
<td>Cribriform plate or anterior ethmoidal roof</td>
</tr>
<tr>
<td>Posterior nasal or sphenoethmoidal</td>
<td>Posterior ethmoid or sphenoid sinus</td>
</tr>
<tr>
<td>Middle meatus</td>
<td>Frontal sinus</td>
</tr>
<tr>
<td>Below posterior end of inferior turbinate</td>
<td>Eustachian tube</td>
</tr>
<tr>
<td></td>
<td>( middle fossa )</td>
</tr>
</tbody>
</table>
Neuroimaging- Tracer study

- Useful for intraoperative localization of CSF fistula

- Principle- Ability to retrieve extracranially a tracer substance injected into the CSF

- Fluoroscein, Indigo-carmine
Management of Traumatic CSF rhinorrhea

Most traumatic CSF leaks stop on their own—

- 35% leaks stopped within 24 hours
- 68% within 48 hours
- 85% within 1 week

Conservative Management

Conservative management

- Position – elevate head 30-45° for cranial leaks
- Avoid sneezing, coughing, straining
- Monitor carefully for neurological deterioration- meningitis or pneumocephalus
- Antibiotics– for prevention of meningitis
- Pharmacological adjuvants – Diamox, Frusemide
Role of Lumbar CSF drainage

- Rationale – Granulation tissue can seal the fistula provided that the leak has stopped
- Indicated if positioning and diamox alone does not significantly decrease CSF leak within 24 hours
- CSF drainage to be continued for 3 – 5 days after stoppage of leak to allow healing
Role of Lumbar CSF drainage

Complications –
- Over drainage of CSF – pneumocephalus, intracranial haemorrhage
- High CSF protein concentration - Blockage
- Meningitis – incidence can be reduced by tunneling the external catheter and by prophylactic antibiotics
- Broken catheter tip
- Dural-cutaneous fistula -
  - Stitch
  - Epidural blood patch
Indications of Surgical Intervention

- Recurrent attacks of meningitis with continuing leak despite conservative management
- Patients with enlarging pneumocephalus (> 2 cc persistent intracranial air - significant) despite conservative treatment
- Acute traumatic or post-operative leaks that recur or persist after 10-13 days of conservative management including Lumbar CSF drainage
- Proven intermittent or delayed leaks
- High pressure leaks with hydrocephalus
Indications of Surgical Intervention

- Radiological appearances that indicate a low probability of natural dural repair:
  - Erosion, destruction or severe comminution of skull base or sinuses
  - Intracranial spikes of bone
  - Soft tissue between the bony edges

- Leaks associated with congenital dysplasia of brain, skull base; particularly after a bout of meningitis
Indications of Surgical Intervention

- Leaks caused by high-energy missile wounds
- High volume leaks through sella and petrous bone are particularly resistant to conservative management
General Principles

- Treat meningitis and rule out hydrocephalus before embarking on any surgical procedure
- Careful identification of the site and extent of the dural defect
- Dissection of the bony and dural defect
- Direct dural repair if possible
- Closure using a graft( ± glue), if direct dural repair is not possible
Surgical management of CSF rhinorrhoea

- Intracranial
  - Intradural
  - Extradural
  - Intradural -extradural

- Extracranial
  - Open
  - Endoscopic

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Intracranial approaches

- Position- Supine with head slightly extended to allow frontal lobes to fall backwards
- Head-end of table elevated by 15° to facilitate venous drainage
- Bicoronal skin flap
- Elevate the pericranium as a separate layer for subsequent anterior cranial fossa repair
- Care taken to preserve supraorbital nerves- conversion of foramen into a groove
Intracranial approaches

- Very important to fashion the bone flap very low to clearly visualize the floor of anterior cranial fossa & the site of leak
- Dealing the frontal sinus
- Extradural or Intradural
Intracranial, extradural exploration - Limitations

- Dural tears virtually inevitable in the course of dissection, makes identification of “original” traumatic CSF fistula more difficult
- Areas of cerebral tissue herniation into bony defects cannot be easily visualized
- Permanent dural repair is not reliably achieved
Intracranial, *intradural* exploration

- Excellent exposure of the entire anterior cranial fossa way back to the lateral aspects of sphenoid wings and posteriorly up to the planum & anterior clinoid processes
- Dura should be opened far anteriorly, which may require anterior third of SSS to be ligated and cut
- Falx must also be cut to provide full exposure
- Identification –
  - Areas of parenchymal brain contusion
  - Brain may be adherent to or herniated through the defect
  - Identification with the help of positive pressure ventilation
Intracranial, intradural exploration - Indications

- Once located, the fistula is to be packed with a plug of fat – to be reinforced with a dural patch graft from autologous pericranium, temporalis fascia or fascia lata + biological glue

- If a discrete fistula cannot be identified-
  - Cover the entire anterior cranial fossa floor with a large pericranial graft all the way upto plannum sphenoidale & cover both cribriform plates + biological glue

- The use of fibrin glue have improved the success of operative closure and is strongly recommended.
Management of Petrous # with CSF otorrhoea/otorhinorrhoea

- Longitudinal # rarely need repair
- Subtemporal craniotomy and extradural approach
- If mastoid air cells are opened, they are plugged with bone wax
- Repair of the defect with fascia and glue
CSF shunting (VP / TP shunt)

- Hydrocephalus must be excluded first in any case of CSF rhinorrhea, which fails to respond to conservative management.
- Carried out in conjunction with anatomic repair of a fistula or resection of a mass lesion in the face of hydrocephalus.
- Small leaks that cannot be identified.
Extracranial, \textit{extradural} approach (Open / Endoscopic)

- **Considered for-**
  - Sphenoid
  - Parasellar
  - Posterior wall of frontal sinus
  - Cribriform / ethmoid
  - Petrous
  - CSF fistula

- **Unsuitable for-**
  - Bilateral fistula
  - Where site of CSF leak is uncertain
  - Where intracranial debridement of brain and brain is necessary
Extracranial, extradural approach (Open / Endoscopic)

- Discrete, clearly defined normal pressure leaks from anterior cranial fossa including cribiform plate and adjacent ethmoid
- Post-operative CSF leak after Transsphenoidal surgery, not controlled by conservative management
- Fractures that abut on an air sinus, particularly when the bony defect is limited to the cranial wall of the sinus
Extracranial, **extradural** approach (Open / Endoscopic)

- **Advantages-**
  - No brain retraction
  - No additional risk of anosmia
  - Operation need not be delayed by brain swelling

- **Disadvantages-**
  - Localization of fistula must be very precise
  - Graft is placed extradurally and not tamponaded by the brain
Extracranial open approaches

- Trans-sphenoidal repair for CSF rhinorrhoea after pituitary surgery
  - Sublabial, transseptal or endonasal route
  - Sphenoid mucosa is stripped and repair is performed with fascia lata & secured with fibrin glue
  - Sphenoid sinus packed with fat and glue ± autologous bone/ cartilage to reinforce the opening of sphenoid sinus

Extracranial open approaches

- **External ethmoidectomy**
  - Most common extracranial approach to fistulas of the cribriform and ethmoid regions
  - Naso-orbital (Lynch-Howarth incision) midway between nasal dorsum and medial canthus along the curvature of nasofacial crease
  - Ethmoidectomy
  - Tracer to identify the site of leak
  - Repaired with fascia + glue + pedicled mucoperiosteal flap + supported by nasal packing

- **Transmastoid approach**
  - For # petrous bone involving tegmen tympani with intact hearing
Other extracranial techniques

- **Primary repair of facial fractures**
  (with sinus repair and ablation as necessary)

- **Frontal osteoplasticsinusotomy**
  (repair of posterior sinus wall or cranialization of sinus & packing - in case of simple fracture through posterior wall of frontal sinus without evidence of comminution of skull base or significant cerebral contusion)
Transnasal Endoscopic repair

- Clear anatomical exposure of the roof of the nasal and sinus cavities by the endoscope
- Excellent field of vision, allowing exact localization of the leak
- The ability to clean mucosa from the bony defect precisely.
- Accurate position of the graft material over the defect.
Transnasal Endoscopic repair

- Variety of options for techniques to repair the defect of the anterior skull base, but the principle concept is still the same: "water-tight closure".

- Mucoperiosteal flaps from various donor sites (especially the nasal septal) were rotated to the leak area to seal the defect, with a success rate of 95-100%
Transnasal Endoscopic repair

- Small sized defect (< 0.5 cm) - mucosal graft or flap
- Larger defect (> 0.5 cm) - bone or cartilage graft. Septal cartilage is better as a free graft because of its property of pliability, which makes it easier to insert through the skull base defect
- There is no limitation for endoscopic repair of sphenoid sinus fistula as regards to the size of the bony defect
- However, ethmoid roof defect > 1.5 cm is considered a relative contraindication to endoscopic repair
Transnasal Endoscopic repair-Sphenoid sinus

- Nasal cavities infiltrated with LA
- Endoscopic sphenoidotomy accomplished through transethmoid approach
- Identify the defect, remove any residual mucosa as it prevents adhesion of the graft
- Fascia lata with fat graft harvested
- Fascial graft placed over the defect + glue + fat graft
- Reinforced with surgicel gelfoam + nasal pack
Transnasal Endoscopic repair – Sphenoid sinus defect

Endoscopic approach to sphenoid sinus defect
Transnasal Endoscopic repair – Cribriform plate defect

- Approach same as for transnasal endoscopic sphenoid sinus repair
- Complete ethmoidectomy performed to expose defects of anterior skull base
- Identify the defect, remove any residual mucosa as it prevents adhesion of the graft
- Mucosal graft or a composite mucosa-turbinate graft harvested from opposite nasal cavity
- A free bone/turbinate graft may be placed on the intracranial side of the bony defect between dura & skull base (Underlay) or can be placed directly over the defect (Onlay) & secured with fibrin glue
Transnasal Endoscopic repair

- Success or failure depends upon
  - Surgeon’s experience
  - Correct localization of fistula pre and intraoperatively
  - Raised ICP

- No statistical difference in results based on
  - Type of graft (Free vs Pedicled, mucosa vs fascia, muscle vs fat)
  - Underlay or onlay graft
  - Use of lumbar drain post-operatively

Transnasal Endoscopic repair – Cribriform plate defect
Transnasal Endoscopic repair
Surgical approaches to skull base with inherently higher risk of developing post-operative CSF rhinorrhea

- Subfrontal approach with breach of frontal sinus
- Anterior skull base lesion (e.g. olfactory groove meningioma)
- Transsphenoidal
- Transtemporal or suboccipital approach to acoustic tumours
Prevention of CSF leaks

- Anterior cranial fossa:
  - Management of frontal sinus
  - Subfrontal approaches
- Middle cranial fossa:
  - Trans-sphenoidal
- Posterior cranial fossa:
  - Suboccipital or transtemporal approach to acoustic neuroma
Management of frontal sinus

Frontal sinus entered during pterional/frontal craniotomy

Mucosa not violated

- No further treatment is required

Mucosa entered

- Removal of all remaining mucosa
- Packing the sinus with antibiotic impregnated gelfoam
- Covering defect with pericranial graft sewn to dura
Subfrontal approaches

- Anterior skull base lesions such as meningioma or primary nasopharyngeal tumours may require resection of underlying dura or bone

- **Small defect** - Packing with fat/muscle and covering with fascia + biological glue

- **Large defect** - Extensive reconstruction with fascial graft + biological glue ± autologous bone graft / methylmethacrylate / tantalum mesh

- Elevate the periosteum as a separate flap at the start of procedure to create a periosteal flap layer for repair of skull base bony/dural defect
Trans-sphenoidal Approach

- Incidence of CSF leak - 1.4 to 6.4%

- Arachnoid violation during trans-sphenoidal procedures

- Fascia lata graft of proper size to be placed intradurally against the diaphragma sellae ± Marlex mesh to reinforce fascial graft

- Sphenoid sinus packed with fat and glue

- Valsalva maneuver
  - Posterior nasal pack against the sphenoid sinus
  - LP drain
Acoustic Neuroma surgery

- Incidence – 6-30 %
- Translabyrinthine, Suboccipital, Transsigmoid approach
- Well- pneumatized petrous bone may predispose to leakage during drilling of posterior wall of meatus

Diagram:
- Mastoid air cells
- Middle ear and Eustachian tube
- CSF rhinorrhoea
Acoustic Neuroma surgery

- Violation of mastoid air cells - Seal with bone wax and packing with fat & muscle
- Transmastoid approach for CSF leak localization
- Free adipose tissue autograft in the bone defect
- Careful closure of fascial, subcutaneous & skin layers
Controversies in Management - Routine Antibiotic prophylaxis

Post-traumatic CSF leak following Basilar skull fracture

Prophylactic Antibiotics

FOR
Prevention of Meningitis

AGAINST
Elimination of commensal flora of nasopharynx with subsequent infection by more virulent Gram neg. organisms
Controversies in Management - Routine Antibiotic Prophylaxis

FOR


2.5% (6/237) who received prophylactic antibiotics developed meningitis compared to 10% (9/87) who did not receive prophylactic antibiotics

Statistically significant reduction

AGAINST


Risk of meningitis was 7.6% (8/106) in the treated and 11.9% (13/109) in the untreated group

- Statistically non-significant reduction
- More cases of Gram-negative infection and of partially-treated meningitis in the treated group.
Controversies in Management - Routine Antibiotic Prophylaxis


  A total of 52 patients was studied, 26 in each treatment group. Meningitis developed in one patient in the placebo group.

  Statistically non-significant

**CURRENT RECOMMENDATION**
Routine prophylactic antibiotics are no longer recommended in Post-traumatic CSF leak
Controversies in Management -
CT Cisternography vs MR
Cisternography

- The sensitivity in detecting CSF fistulae with
  MR cisternography (CISS: 93.6 %) was
  higher than with CT cisternography (72.3 %).
  Although the localization of CSF fistulae
  always proved possible with MR
  cisternography, this could only be
  accomplished with CT in 70 % of cases.

(Eberhardt KE, Hollenbach HP, Deimling M, Tomandl BF, Huk
WJ. MR cisternography: a new method for the diagnosis of
Controversies in Management - CT Cisternography vs MR Cisternography

The sensitivity and specificity of the MR method- \( T_2^* \)-weighted 3D-CISS sequence (88.9% and 95.1%) is higher compared with CT cisternography (77.8% and 87.8%). **The MR method is superior to CT cisternography, is noninvasive, the administration of contrast agent is no longer necessary.**

Controversies in Management - Open/ Endoscopic Repair

- The conventional approaches for repairing to anterior skull base defect are the extracranial route (naso-orbital incision) or craniotomy with pericranial flap.
- These approaches to repair the defect of the anterior skull base have a variable success rate of 60 to 80 percent.
- The morbidity associated with craniotomy such as a loss in the ability to smell and prolonged hospitalization has made the endoscopic approach an alternative option.
- In the series of endoscopic repair, the success rate was 85.7% after the initial procedure and 100% after a second one.

(Mattox DE, Kennedy DW. Endoscopic management of cerebrospinal fluid leaks and encephaloceles. Laryngoscope 1990;100:858-62.)
Controversies in Management - Open/Endoscopic Repair

- The endoscopic approach should be considered as the preferred method if the skull base defect is endoscopically accessible.
- Endoscopy offers the advantage of reduced hospitalization and better visualization.
- Craniotomy approach is still the back-up procedure if the endoscopic one fails.
AIIMS Experience

- Retrospective analysis
- Study period - January 2001 to December 2006, spanning a period of 6 years.
- **Total no. of patients – 204,**
  CSF rhinorrhoea – 179
  CSF otorrhoea – 25
- Patients with minor traumatic CSF leaks which ceased spontaneously within first 48 hours were excluded.
CSF Rhinorrhoea

- Traumatic
- Spontaneous

CSF Otorrhoea

- Traumatic
- Post-operative

Post-operative
AIIMS Experience

Figure 1

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Otorrhoea</td>
<td>25</td>
</tr>
<tr>
<td>Traumatic Rhinorrhoea</td>
<td>79</td>
</tr>
<tr>
<td>Spontaneous Rhinorrhoea</td>
<td>35</td>
</tr>
<tr>
<td>Postop Rhinorrhoea</td>
<td>65</td>
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## AIIMS Experience

<table>
<thead>
<tr>
<th></th>
<th>Traumatic CSF Rhinorrhoea</th>
<th>Spontaneous CSF Rhinorrhoea</th>
<th>Post-op CSF Rhinorrhoea</th>
<th>CSF Otorrhoea</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number of patients</strong></td>
<td>79</td>
<td>35</td>
<td>65</td>
<td>25</td>
</tr>
<tr>
<td><strong>Mean Age</strong></td>
<td>26.3 Years</td>
<td>38.7 Years</td>
<td>36 Years</td>
<td>28.2 Years</td>
</tr>
<tr>
<td><strong>Sex ratio (M:F)</strong></td>
<td>6.1:1</td>
<td>0.52:1</td>
<td>0.9:1</td>
<td>2.1:1</td>
</tr>
<tr>
<td><strong>Unilateral / Bilateral</strong></td>
<td>62/17</td>
<td>28/7</td>
<td>20/45</td>
<td>25/0</td>
</tr>
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</table>
AIIMS Experience –

**Traumatic CSF rhinorrhoea**

- n=79
- Maximum number of patients [33(41.77%)] presented immediately after trauma, followed by 9(11.3%) patients who presented within first two weeks following trauma.
- 11 (13.9%) patients had history of meningitis.
AIIMS Experience – Traumatic CSF rhinorrhea

Radiological findings (Figure 8)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumocephalus</td>
<td>2</td>
</tr>
<tr>
<td>Mastoid # or Petrous Temporal bone #</td>
<td>5</td>
</tr>
<tr>
<td>Cribiform plate #</td>
<td>55</td>
</tr>
<tr>
<td>Frontal bone #/ACF #</td>
<td>15</td>
</tr>
<tr>
<td>Normal</td>
<td>2</td>
</tr>
</tbody>
</table>

Total: 79 patients
The patients were managed conservatively or surgically based upon the time of presentation, magnitude of leak, history of meningitis or history of recurrences.

Five (31.2%) patients were treated with bed rest, acetazolamide, and frusmide alone, while 11 (68.7%) patients were treated with additional lumbar CSF drain.
AIIMS Experience – Traumatic CSF rhinorrhoea

Surgical Treatment (Figure 11)

- Intradural repair: 28
- Extradural repair: 10
- Sandwich repair: 12
- Exteriorisation of Frontal sinus: 2
- Endoscopic repair: 1
- Transnasal Transsphenoidal packing of Sphenoid sinus: 1

n-63

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AIIMS Experience –
Traumatic CSF rhinorrhoea

- **Complications:** 12 (15.1%) patients developed postop meningitis
- **Follow-up and outcome:**
  - Mean follow up - 11 m (1 m-4 yrs)
  - 65 (82.27%) - no further leaks,
  - 6 (7.59%) - recurrence of CSF leak
    - {HCP was associated, 2/6 required re-surgery}
  - 1 (1.26%) patient died of fulminant post operative meningitis
AIIMS Experience –
Spontaneous CSF rhinorrhoea

- n=35
- Mean age = 38.7 Years
- M: F = 0.52:1
- 13 (37%) patients presented with history of meningitis
AIIMS Experience – Spontaneous CSF rhinorrhoea

Radiological findings (Figure 19)
n=35

- Cribiform plate defect: 24
- Sellar floor defect: 5
- Hydrocephalus: 4
- Normal: 2
AIIMS Experience –
Spontaneous CSF rhinorrhoea

- 3 patients managed conservatively, only 1 require LP drain
- First leaks and patients not having history of recurrent meningitis, responded well to conservative measures alone.
AIIMS Experience – Spontaneous CSF rhinorrhea

Surgical Management (Figure 21)
n-35

- Intradural repair: 19
- Extradural repair: 4
- Endoscopic repair: 5
- Transnasal transsphenoidal sellar packing: 2
- VP shunt/ Ommaya/ TP shunt, other CSF diversion procedures: 2
AIIMS Experience –
Spontaneous CSF rhinorrhoea

- **Complications:** 4(11.42%) patients developed postop meningitis
- **Follow-up and outcome:**
  - Mean follow up - 9 m (1 m-2.9 yrs)
  - 29(82.85%) - no further leaks,
  - 2(5.71%) - recurrence of CSF leak
    - {1/2 required surgery – TP shunt followed by Extradural repair}
  - 1(2.85%) patient died of fulminant post operative meningitis
AIIMS Experience –
Post-operative CSF rhinorrhoea

Primary Disease (Figure 26)
n-65

- Pituitary Adenoma: 40
- CP angle lesion: 7
- Frontal lesions: 18
AIIMS Experience – Post-operative CSF rhinorrhoea

Primary Surgery(Figure 27)
n-65
AIIMS Experience – Post-operative CSF rhinorrhoea

Treatment modality (Figure 28)

n-65

31 Surgical

34 Conservative
AIIMS Experience – Post-operative CSF rhinorrhoea

Conservative Management (Figure 29)

- Bed rest, Acetazolamide, Frusemide
- Lumbar CSF drain

n=34
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Surgical Management (Figure 30)

- Transnasal repair: 20
- Frontal sinus exteriorisation: 9
- Mastoid cells waxing with reexploration: 2

n-31

Saturday, September 20, 2008
AIIMS Experience – Post-operative CSF rhinorrhoea

- **Complications:** Nine (13.8%) patients developed complications.
  7(10.76%) - Postop meningitis, 2(3%) - Septicemia

- **Follow-up and outcome:**
  Mean follow up -10 m (1 m-4.4 yrs)
  46 (70.8%) - no further leaks,
  9(13.8 %) - recurrence of CSF leak
  4(6.1 %) patients died in post op. period
AIIMS Experience – Post-operative CSF rhinorrhoea

Management of Recurrence (Figure 32)
<table>
<thead>
<tr>
<th>CSF rhinorrhoea – The Way Ahead</th>
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<tbody>
<tr>
<td>- Improved flexible endoscopy</td>
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<tr>
<td>- Availability of biological glue</td>
</tr>
<tr>
<td>- Newer non-invasive 3-D imaging techniques for fistula localization</td>
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<tr>
<td>- Minimally invasive approach</td>
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</tbody>
</table>
Take Home message

- CSF rhinorrhea- potentially life threatening owing to risk of meningitis
- MC cause- trauma with Basilar skull #, though post-operative leaks are also on the rise
- MC site – Cribriform plate of ethmoid
- Diagnosis by a variety of Clinical & radiological techniques, though MR cisternography with heavily T2W and 3D CISS sequences being the modality of choice
- Conservative and surgical management depending on the cause, site and duration of CSF leak
- Variety of Intracranial/ Extracranial, open/ endoscopic approaches available
- Future trend is towards minimally invasive endoscopic approaches
Thank You