



## ANALYSIS OF POST TRAUMATIC CSF RHINORRHEA

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**ABSTRACT**

CSF rhinorrhea is one of the cause for increased morbidity and mortality in Head Injury patients.

**Aim:** The aim of the study is to analyze about Mode of Injury, Time of Onset of Rhinorrhea, Site of Leak, Size of defects, Incidence of Meningitis, Incidence of Pneumocephalus, Anosmia, Visual Disturbance, Periorbital hematoma, all management modalities both conservative and surgical intervention and outcomes.

**Materials and Methods:** This is a retrospective and prospective study.

56 Patients who developed Posttraumatic CSF Rhinorrhea following RTA, fall, assault and GCS > 12 were admitted and included in the study. CT Brain(1 mm cuts) and CSF biochemical analysis were done for all patients.

**Statistical Analysis** Statistical analysis done using SPSS software to assess the multi factorial causes of complications and outcomes.

**Conclusion:** The Most Common Mode of Injury in our study group is Road Traffic Accidents, the most common time of Onset of CSF Rhinorrhea is Early Onset (< 48 hours) and the most common Site of Leak is in Ethmoid and the most common Size of defects is Small size (<1.5 cm). Meningitis and Pneumocephalus developed in 1/3rd of patients. More than 50% of patients were successfully treated conservatively with drugs alone. Meningitis is high in Late onset CSF Rhinorrhea and associated Pneumocephalus. Hence Prophylactic Antibiotic is essential. Early onset CSF Rhinorrhea favours spontaneous closure. Late onset requires surgical intervention

**KEYWORDS :** CSF Rhinorrhea Anterior Cranial Fossa Repair. Endoscopic Repair of CSF Rhinorrhea, Lumbar drain.

**INTRODUCTION**

As excision of Adam's rib was a divine surgical intervention and can't be labeled as "manual" surgery, the identities of the first ever surgery done on man by man will always remain a mystery. But, the first surgery on man by man for which there is evidence can be stated with certainty. As of now, Trephination is the most ancient procedure on human with material evidence. Trephination was quite common. Nearly one third (40 out of 120) prehistoric skulls dating around 6500 BC at a French burial site had trephination holes.

From the days of trephination (to extract the stone of madness) to the present era of Neuronavigation-Microneurosurgical procedures on aneurysms of cerebral vessels-Functional neurosurgery, Neurosurgery has evolved leaps and bounds. One of the important reasons behind the march of this discipline is the accumulation of fresh, detailed and accurate knowledge

Post traumatic CSF Rhinorrhea is most often caused by fractures of frontal, ethmoidal and sphenoidal bones. Dura is firmly adherent to the thin bone of anterior cranial fossa. CSF Rhinorrhea presents either early onset or delayed onset. CSF Rhinorrhea carries ascending infection and causes meningitis. It is managed conservatively. If not controlled treated by surgical interventions either endoscopic repair or by craniotomy and anterior cranial fossa repair.

**1. OBJECTIVES OF THE STUDY**

- To study the Parameters, Clinical Signs and Symptoms associated with Post Traumatic CSF Rhinorrhea
- Mode of Injury – RTA/Assault / Fall
- Time of Onset of Rhinorrhea – Early / Late
- Site of Leak – Frontal / Ethmoid / Sphenoid / Combined / Not found
- Size of defects
- Incidence of Meningitis
- Incidence of Pneumocephalus
- Clinical Features – Anosmia / Visual Disturbance / Periorbital Hematoma (Raccoon's Eye)
- Conservative Treatment with Drugs Alone
- Treatment with CSF Drain
- Treatment with Surgery
- Mode of Surgical Intervention
- Recurrence with Endoscopic Repair and Recurrence with ACF Repair

**MATERIALS AND METHODS**

The study was done at Institute of Neurosurgery, Madras Medical

College & Rajiv Gandhi Government General Hospital, Chennai – 600003 between October 2012 to January 2015.

**Method**

- This is a retrospective and prospective study.
- Patients who are admitted following head injury with CSF Rhinorrhea from October 2012 to January 2014 will be included in the study subject to the following criteria.
- Inclusion Criteria**
- All patients who developed post traumatic CSF Rhinorrhea following RTA, fall, assault.
- GCS > 12
- Exclusion Criteria**
- Patients who had undergone any procedure for CSF Rhinorrhea prior coming to our hospital.
- Patients not willing to participate in this study.
- GCS < 13
- CT Brain with fine cut bone window (1 mm cuts) with axial, coronal and 3D Reconstruction done for all patients with CSF Rhinorrhea.
- We confirm CSF with CSF glucose and chloride levels since Beta2 Transferrin assay for CSF is not available in our Institution.
- These patient details will be collected from the discharge summary which is available with the records department at the Institute of Neurology
- These patients will be followed for a period of minimum 1 year duration to ascertain complications due to the procedure and the outcome of the procedure.
- Statistical analysis will be done using SPSS software to assess the multi factorial causes of complications and outcomes.

**(I) Mode of Injury**

- We look for the following modes of injury
- RTA
- Assault
- Fall

**(II) Time of Onset**

- We classify a Leak as
- Early if it occurs within 48 hours of injury
- Late if it occurs after 48 hours of injury

**(III) Site of Leak**

- We look for the site of leak and mention the bone in which there is leak
- Leak in Cribriform Plate are included under Ethmoid

**(IV) Size of Defect**

- We consider defects smaller than 1.5 cm as Small and those larger than 1.5 cm as Large.
- We have taken this cut off since early ACF Repair is advocated for defects larger than 1.5 cm

**(V) Incidence of Meningitis**

- The following features were taken as signs of Meningitis
- Fever with Neck Rigidity
- Positive Culture in CSF

**(VI) Incidence of Pneumocephalous**

- Pneumocephalous was diagnosed in CT

**(VII) Incidence of Anosmia, Visual Disturbance, Periorbital Hematoma**

- Anosmia was detected by Clinical Examination
- Visual Disturbance was detected by Bedside Clinical Examination
- Periorbital hematoma was visually observed

**(VIII) Conservative Treatment with Drugs Alone**

- Patients who had total resolution of CSF Rhinorrhea were considered to have been cured with Conservative treatment with drugs alone
- The following treatment protocol was followed
- Bed Rest
- Head End Elevation 30°
- Avoidance of Nose Blowing
- Avoidance of Straining at Stools
- Avoidance of Cough
- Intravenous Antibiotics and Acetazolamide

**(IX) Treatment with CSF Drain**

- Continuous / Intermittent Lumbar Sub Arachnoid Drain was done for Patients who were not cured with the above regimen

**(X) Treatment with Surgery**

- Surgery was done for those
- 1. Who failed to respond to above methods
- 2. Who had meningitis (Surgery was done after Meningitis was resolved)
- 3. Who had large defects

**(XI) Mode of Surgery**

- Both Endoscopic Repair and Intracranial ACF Repair was done

**(XII) Recurrence with Endoscopic Repair and ACF Repair**

- We followed patient for one year and looked for recurrence

**OBSERVATIONS AND RESULTS**

The overall results of this study are as show below

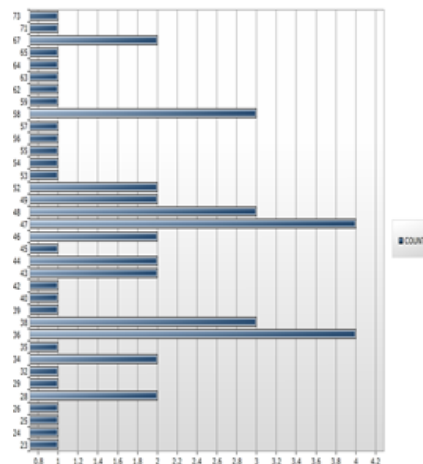
**Epidemiology : Age Distribution**

The patients were distributed from 23 years to 73 years

AGE	Frequency	Percent
23	1	1.79%
24	1	1.79%
25	1	1.79%
26	1	1.79%
28	2	3.57%
29	1	1.79%
32	1	1.79%
34	2	3.57%
35	1	1.79%
36	4	7.14%
38	3	5.36%
39	1	1.79%
40	1	1.79%
42	1	1.79%
43	2	3.57%
44	2	3.57%
45	1	1.79%
46	2	3.57%
47	4	7.14%
48	3	5.36%
49	2	3.57%
52	2	3.57%
53	1	1.79%
54	1	1.79%

55	1	1.79%
56	1	1.79%
57	1	1.79%
58	3	5.36%
59	1	1.79%
62	1	1.79%
63	1	1.79%
64	1	1.79%
65	1	1.79%
67	2	3.57%
71	1	1.79%
73	1	1.79%
<b>Total</b>	<b>56</b>	<b>100.00%</b>

We find more patients in fourth and fifth decade



Out of 56 patients 37 were males and 19 females. Lowest age was 23 and the highest was 73, with more patients between 40 to 50 years.

**Epidemiology : Sex Distribution**

SEX	Frequency	Percent
F	19	33.93%
M	37	66.07%
<b>Total</b>	<b>56</b>	<b>100.00%</b>

There was a Male : Female Ratio of 2:1

**(I) Mode of Injury**

MODE	Frequency	Percent
ASSAULT	5	8.93%
FALL	12	21.43%
RTA	39	69.64%
<b>Total</b>	<b>56</b>	<b>100.00%</b>

The Most Common Mode of Injury in our study group is Road Traffic Accidents

**(II) Time of Onset**

ONSET	Frequency	Percent
Delayed	13	23.21%
Early	43	76.79%
<b>Total</b>	<b>56</b>	<b>100.00%</b>

The most common time of Onset of CSF Rhinorrhea in our study group is Early Onset (< 48 hours)

**(III) Site of Leak**

The most common Site of Leak in our study group is in Ethmoid.

FRONTAL	Frequency	Percent
Fracture in Frontal	23	41.07%
No Fracture in Frontal	33	58.93%
<b>Total</b>	<b>56</b>	<b>100.00%</b>

ETHMOID	Frequency	Percent
Fracture in Ethmoid	47	83.93%
No Fracture in Ethmoid	9	16.07%
<b>Total</b>	<b>56</b>	<b>100.00%</b>

SPHENOID	Frequency	Percent
Fracture in Sphenoid	7	12.50%
No Fracture in Sphenoid	49	87.50%
Total	56	100.00%

**(IV) Size of Defect**

SIZE OF DEFECT	Frequency	Percent
Less than 1.5 cm	54	96.43%
More than 1.5 cm	2	3.57%
Total	56	100.00%

The most common Size of defects in our study group is Small size (<1.5 cm)

**(V) Incidence of Meningitis**

MENINGITIS	Frequency	Percent
Meningitis	18	32.14%
No Meningitis	38	67.86%
Total	56	100.00%

Meningitis developed in 32.14% of patients

**(VI) Incidence of Pneumocephalus**

PNEUMOCEPHALUS	Frequency	Percent
Pneumocephalus	19	33.93%
No Pneumocephalus	37	66.07%
Total	56	100.00%

Pneumocephalus developed in 33.93% of patients

**(VII) Incidence of Anosmia, Visual Disturbance, Periorbital Hematoma (Raccoon's Eye)**

The incidence of Anosmia, Visual Disturbance, Periorbital contusions are 7.14%, 5.36%, 28.57%, percent respectively

ANOSMIA	Frequency	Percent
Anosmia	4	7.14%
No Anosmia	52	92.86%
Total	56	100.00%

VISUAL DISTURBANCE	Frequency	Percent
Visual Disturbance	3	5.36%
No Visual Disturbance	53	94.64%
Total	56	100.00%

PERIORBITAL CONTUSION	Frequency	Percent
Periorbital Contusion	16	28.57%
No Periorbital Contusion	40	71.43%
Total	56	100.00%

**(VIII) Conservative Treatment with Drugs Alone**

DRUGS ALONE	Frequency	Percent
Conservative Management Only	30	53.57%
Conservative Management Not Enough	26	46.43%
Total	56	100.00%

53.57% of patients were treated successfully with drugs alone

**(IX) Treatment with CSF Drain**

LUMBAR DRAIN DONE OR NOT	Frequency	Percent
Lumbar CSF Drain Done	24	42.86%
Lumbar CSF Drain Not Done	32	57.14%
Total	56	100.00%

42.86% of patients required Lumbar CSF Drain

LUMBAR DRAIN EFFECTIVE OR NOT	Frequency	Percent
Lumbar CSF Drain Effective	11	19.64%
Lumbar CSF Drain Not Effective & surgery required	13	23.21%
Lumbar CSF Drain not done and Patient Taken for Early Surgery	2	3.57%
Lumbar CSF Drain not done and patient managed conservatively with drugs	30	53.57%
Total	56	100.00%

**(X) Treatment with Surgery**

PROCEDURE DONE OR NOT	Frequency	Percent
Surgical Procedures Done	15	26.79%
Surgical Procedures Not Done	41	73.21%
Total	56	100.00%

26.78% of patients required Surgery

**(XI) Mode of Surgery**

WHAT PROCEDURE	Frequency	Percent
Endoscopic Repair Done	11	19.64%
ACF Repair Done	4	7.14%
No Surgery	41	73.21%
Total	56	100.00%

Of this, 11 patients (19.64%) were treated endoscopically and 4 patients (7.14%) were treated via ACF Repair

**(XII) Recurrence with Endoscopic Repair**

- Of the patient treated surgically with endoscopy, there was 9.09% recurrence
- Of the patient treated surgically with ACF Repair, there was no recurrence

What procedure	Recurrence or not		
	What procedure	Recurrence	Total
ACF Repair Done	4	0	4
Endoscopic Repair Done	10	1	11
TOTAL	14	1	56

	Frequency	Percent
No Recurrence	14	25.00%
Recurrence	1	1.79%
No Surgery	41	73.21%
Total	56	100.00%

**ANALYSIS AND DISCUSSION**

This study is a retrospective and prospective study. 56 Patients are included in the study who are admitted with History of Trauma and CSF Rhinorrhea.

**(I) Mode of Injury**

RTA is the commonest mode of injury (69.64%) followed by fall (21.43) and assault (8.93).

Study	RTA	Fall	Assault
Aurangzeb A et al <sup>3</sup>	85%	11%	4%
Spangenberg P et al <sup>4</sup>	55%	35%	
Our Study	69.64%	21.43%	8.93%

**(II) Time of Onset**

Most common time of onset of CSF Rhinorrhea is early onset (<48 hours since injury) – 76.78% and delayed onset (>48 hours since injury) – 23.21%.

Delayed onset CSF Rhinorrhea patients are not amenable to conservative management and these patients had meningitis and are taken up for surgical intervention.

**(III) Site of Leak**

Among 56 patients, 53 patients had either isolated or combined fractures of frontal, ethmoid and sphenoid bones, involving the air sinuses.

We have included the fracture of cribriform plate along with ethmoid fracture as anatomically it is a part of ethmoid bone.

Common sites of CSF leak is through fractures involving ethmoid bone (47/56 patients).

Isolated bone fractures involving ethmoid - 26, frontal - 3 and sphenoid - nil.

Fractures involving combination of these bones are 24

No identifiable bony fracture are 3

Study	Ethmoid	Frontal	Sphenoid	Combined
Manelfe C <sup>9</sup> et al <sup>3</sup>	9		2	8 (7 fronto ethmoidal, sphenoid ethmoidal)
Our Study	26	3	-	24

**(IV) Size of Defect**

The most common Size of defects in our study group is Small size (<1.5 cm) (96.43%). Mateo Ziu et al<sup>6</sup> and McMains et al<sup>7</sup> noted that in patients in whom the endoscopic repair had failed, the defects were larger than 1.5 cm.

**(V) Incidence of Meningitis**

In our study Meningitis developed in 32.14% of patients

Study	Incidence of Meningitis
Bernal-Sprekelsen M et al <sup>8</sup>	29%
Eljamel MS et al <sup>9</sup>	30.6% (15/49)
Park JI et al <sup>10</sup>	31%
Schick B et al <sup>11</sup>	5/8
Our Study	32.14%(18/49)

Occurrence of meningitis is CSF Rhinorrhea is through ascending infection from nasal cavity. In our institution all patients with CSF Fistula are given prophylactic antibiotics. Meningitis is more severe in Diabetic patients with CSF Rhinorrhea.

Meningitis is confirmed by CSF culture taken from lumbar puncture. Most common organism being Streptococcus pneumonia, controlled with Ceftriaxone and crystalline penicillin. After controlling meningitis patients are taken up for surgical intervention.

**(VI) Incidence of Pneumocephalus**

Pneumocephalus is common in skull base fractures and CSF fistula. Pneumocephalus is a predisposing factor for meningitis.

Pneumocephalus developed in 33.93% of patients and it subsided spontaneously or after closing the dural defect.

Study	Incidence of Pneumocephalus
Incidence of Pneumocephalus <sup>12</sup>	31% ( /42)
Our Study	33.93%(19/56)

**(VII) Incidence of Anosmia, Visual Disturbance, Periorbital Hematoma (Raccoon's Eye)**

Anosmia is seen in 7.14% patients with CSF Rhinorrhea.

Study	Incidence of Anosmia
Jimenez DF et al <sup>13</sup>	7%
Haxel BR et al <sup>14</sup>	12%
Our Study	7.14%

Visual disturbance occurred in 5.36% of patients in the form of decreased visual acuity. Patients were evaluated by Neuro Ophthalmologist to rule out local/Optic nerve injuries. No structural lesions were identified. Patients improved after steroid therapy.

Study	Incidence of Visual Disturbance
Karabekir HS et al <sup>15</sup>	1
Kawai K et al <sup>16</sup>	1
Kim DW et al <sup>17</sup>	1
Swati Phuljhele et al <sup>18</sup>	5 cases
Our Study	5.36%(2/56)

28.57% had periorbital lesions such as contusion, hematoma (raccoon eyes) associated with craniofacial injury. These injuries normally resolved spontaneously in 2 to 3 weeks.

Study	Incidence of Periorbital hematoma
Spangenberg P et al	63%
Herbella FA et al	48%
Our Study	28.57%

All patients having CSF Rhinorrhea are initially subjected to conservative management, which includes bed rest, 15 to 30 degree head end elevation and avoidance of straining and nose blowing.

Patients who had large bony defects with or without encephalocele are subjected to early surgically intervention

Conservative management is further subdivided into

1. Drug(Acetazolamide) alone
2. Acetazolamide with Lumbar CSF drainage

The protocol followed in our Institute is to treat the patients with CSF Rhinorrhea with conservative management with drugs alone for 3-5 days. If not controlled Lumbar CSF drainage done for 7-10 days with prophylactic antibiotics.

**(VIII) Conservative Treatment with Drugs Alone**

53.57% of patients were treated successfully with drugs alone

Study	Treatment with Drugs Alone
Dalgic A et al	26/46 (60.4%)
Our Study	30/56(53.57%)

**(IX) Treatment with CSF Drain**

42.86 % of patients required Lumbar CSF Drain. CSF leak controlled with Lumbar CSF drainage is 19.64%.

Study	Requirement of Lumbar Drain
Dalgic A et al <sup>22</sup>	17/46 cases 15/17 success
Shapiro SA et al <sup>23</sup>	101/109
Our Study	24/56 (42.86%)

**(XI) Treatment with Surgery**

Patients not responding to conservative management with drugs and Lumbar CSF drainage are subjected to surgical intervention, either endoscopic repair or intracranial repair. Intracranial repair is done with intra dural and extra dural flaps. 26.78% of patients required Surgery

Study	Treatment with Surgery
Scholsem M et al <sup>24</sup>	98/109(90% cure)
Eljamel MS et al <sup>25</sup>	144/160 (90%)
Our Study	15/56 (26.78%)

**(XI) Mode of Surgery**

26.78% of patients required Surgery Of this, 73.33% were treated endoscopically and were treated 26.67% via ACF Repair

Sty	Treatment with Endoscopic repair	ACF Repair	Combined
Tahir MZ et al <sup>26</sup>	10(70% success)	22(86% success)	
Our Study	11(90.9%)	11(90.9%)	

**(XII) Recurrence with Endoscopic Repair and ACF Repair**

Of the patient treated surgically with endoscopy, there was 9.1% recurrence

Study	Recurrence after Endoscopic repair
Banks CA et al <sup>27</sup>	9% (166 operated)
Tahir MZ et al <sup>28</sup>	30%(10 operated)
Our Study	9.1%(11 operated)

Of the patient treated surgically with ACF Repair, there was no recurrence

Study	Recurrence after ACF Repair
Aurangzeb A et al <sup>29</sup>	26/27
Sherif C et al <sup>30</sup>	76 operated 1.9% rec
Scholsem M et al <sup>31</sup>	11/109(10%)
Tahir MZ et al <sup>32</sup>	3/22(14%)
Our Study	4/4(0%)

**CONCLUSION**

- (I) The Most Common Mode of Injury in our study group is Road Traffic Accidents, (II) The most common time of Onset of CSF Rhinorrhea in our study group is Early Onset (< 48 hours) and (III) The most common Site of Leak in our study group is in Ethmoid and (IV) The most common Size of defects in our study group is Small size (<1.5 cm)
- (V) Meningitis developed in 32.14 % of patients while (VI) Pneumocephalus developed in 33.93 % of patients and (VII) The incidence of Anosmia, Visual Disturbance, Periorbital Hematoma (Raccoon's Eye) are 7.14, 5.36, 28.37 percentage respectively
- (VIII) 53.57% of patients were successfully treated conservatively with drugs alone while and 3.57% patients were taken for Early Surgery without Lumbar CSF Drain
- (IX) 42.86% of patients required Lumbar CSF Drain and in this group Lumbar CSF Drain was Effective in 19.64% and Lumbar CSF Drain was Not Effective and surgery was required in 23.21%
- (X) 26.78% of patients required Surgery, 23.21% after Lumbar CSF Drain was Not Effective and 3.57% were taken for early surgery
- (XI) Of this, 19.64% were treated endoscopically and 7.14% were treated via ACF Repair. (XII) Of the patient treated surgically with endoscopy, there was 9.1% recurrence. Of the patient treated surgically with ACF Repair, there was nil recurrence.
- Meningitis is high in Late onset CSF Rhinorrhea and associated Pneumocephalus. Hence Prophylactic Antibiotic is essential. Early onset CSF Rhinorrhea favours spontaneous closure. Late onset requires surgical intervention.

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