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**Original Research Article**

# Post traumatic cerebrospinal fluid rhinorrhea: a descriptive study

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## ABSTRACT

**Background:** Post-traumatic CSF rhinorrhea occurs following head trauma or after intracranial surgery. Traumatic CSF rhinorrhea can be detrimental with complications such as bacterial meningitis.
**Methods:** Retrospective review of hospital records of post-traumatic patients admitted under neurosurgery department from 2016-2021 was done. 66 patients with CSF rhinorrhea were identified. Their mode of trauma, management and radiological images were reviewed and recorded.
**Results:** Out of the 66 patients, 87.8% were males and average age group 20-30years. 41 resolved with conservative management. Frontal bone was most common site of rhinorrhea. In 61.8% (n=41) patients, fracture was seen in more than one bone/anatomical site. Incidence of post-traumatic CSF rhinorrhea in this study in 6.6%.
**Conclusions:** Early diagnosis and management are important to prevent complications. In majority of cases, the leak subsides with conservative management, hence early surgical intervention is not required.

**Keywords:** Cerebrospinal fluid, Post traumatic cerebrospinal fluid rhinorrhea, Traumatic CSF rhinorrhea

## INTRODUCTION

Cerebrospinal fluid (CSF) rhinorrhea is the leakage of cerebrospinal fluid into the nasal cavity due to a defect in dura mater, bone and mucosa. Post-traumatic CSF rhinorrhea occurs following head trauma or after intracranial surgery. Traumatic CSF rhinorrhea can be detrimental with complications such as bacterial meningitis. Early onset CSF leaks occur within 48 hours of trauma. Most of the leaks heal spontaneously. Spontaneous healing can be affected in case of large defects, comorbidities like diabetes mellitus and raised intracranial pressure.[1]

Delayed onset leaks usually occur within three months. But CSF leaks after 44 years of trauma has been reported. In 1957, Schneider and Thompson reported delayed onset CSF rhinorrhea with recurrent bouts of meningitis after 44 years of trauma.[2] Physical examination includes a complete rhinologic, otologic, head and neck and neurologic examinations. CSF drainage may be demonstrated on endoscopic examination by asking the patient to perform valsalva maneuver. Chemical diagnosis is done by various methods. First is based on glucose concentration, that is, concentration of glucose in CSF exceeds 50% of serum concentration except during meningitis, subarachnoid hemorrhage and some other unusual circumstances.[3] Beta-trace protein has a sensitivity of 92% and specificity of 100%. It is synthesized primarily in oligodendrocytes, arachnoid villi and choroid plexus in the CNS. But it is also seen in multiple sclerosis, renal failure, cerebral infarction and certain CNS tumors.[4] Beta2-transferrin is located only within the CSF, perilymph and aqueous humor. It has a high sensitivity and specificity.[5]

Radiology should be performed, for identifying the exact site of leak. HRCT is most commonly used. It has high

degree of accuracy and is easily available. Mostafa in 2004, a combination of HRCT and T2-weighted fat suppressed MRI was used, with a sensitivity of 89.74%.[6] CT cisternograms and Radionuclide cisternograms have been used to detect CSF leaks. Both the techniques involve intrathecal administration of fluorescein or radioactive markers and thus are invasive. The purpose of this study is to fine the incidence of post-traumatic CSF rhinorrhea, the diagnostic and treatment algorithms of post-traumatic CSF leaks and the treatment outcome of post traumatic CSF rhinorrhea.

## METHODS

### *Study design*

Retrospective review of hospital records of post-trauma patients admitted under neurosurgery department at Medical Trust Hospital, Ernakulam, a tertiary care centre from 2016-2021. Their mode of trauma, diagnostic and treatment modalities were obtained from hospital records. Radiological pictures were obtained from PACS available in hospital software system.

### *Sample size*

Sample size is 66. The software n master 2.0 is used here and the following formula has been used for sample size calculation.

### *Inclusion criteria*

Post traumatic CSF rhinorrhea patients of all ages and gender were included in the study.

### *Exclusion criteria*

Spontaneous and congenital leaks have been excluded.

### *Statistical analysis*

The statistical analysis has been carried out in the present study by IBM SPSS Statistics 20 version and Microsoft word, Microsoft Excel 2007 version have been used to generate graphs, tables etc. Categorical Variables has been described as frequency and percentage. Continues variables are presented on mean±S.D.

### *Ethical approval*

Ethical approval has been obtained from Institutional Ethics committee and Scientific Research committee.

## RESULTS

In this study, females outnumbered males by a ratio of A total of 66 cases were included in the study. Out of 66 patients, 12.1% (n=8) were female and 87.8% (n=58) were males. Male:female ratio was 1:0.137. The age of patients ranged from 5 to 70 years, with 47% (n=31) lying in the 21-30 age group. Out of the 66 patients in this study, in 84.8% (n=56) road traffic accident was the mechanism of trauma. Fall from height consisted 10.6% (n=7) and 4.5% (n=3) had other mechanisms of trauma like heavy blow on head, objects falling on head. The time interval for CSF leak to occur following trauma is in the range of 1-5days in 85% (n=56) patients. The time interval was 6-10 days in 6% (n=4) patients, 11-15 days 3% (n=2) patients and >15days in 6% (n=4) patients. Out of the 66 patients, 41 resolved with conservative management. The rest of the patients underwent surgical correction. 24.2% (n=16) underwent endoscopic management and 13.6%(n=9) underwent open surgical approach.

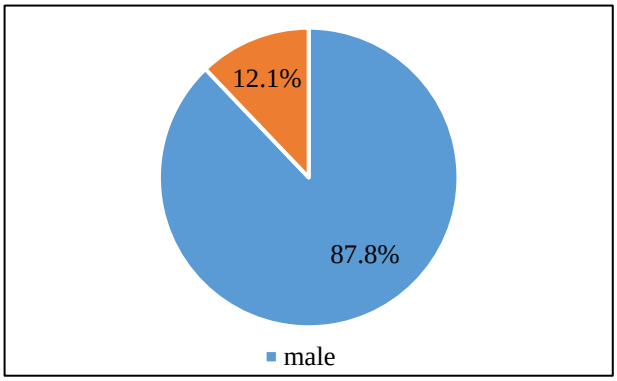


**Figure 1: Gender distribution of post traumatic CSF rhinorrhea.**

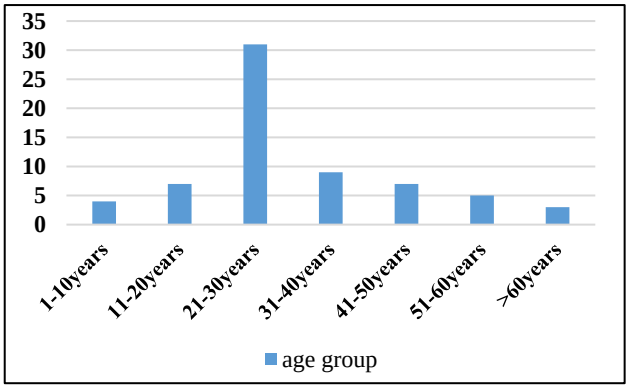


**Figure 2: Age distribution of patients with post traumatic CSF rhinorrhea.**

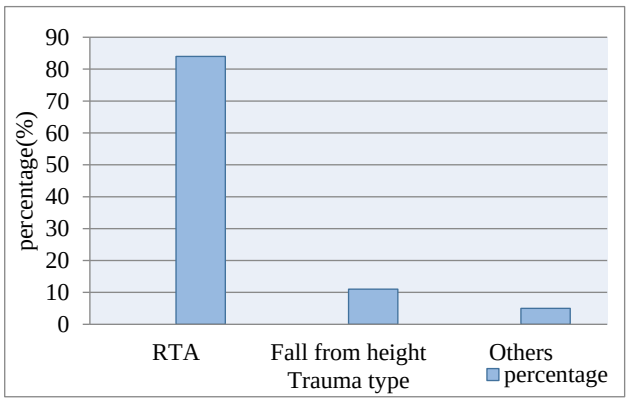

**Figure 3: Mechanism of trauma,**

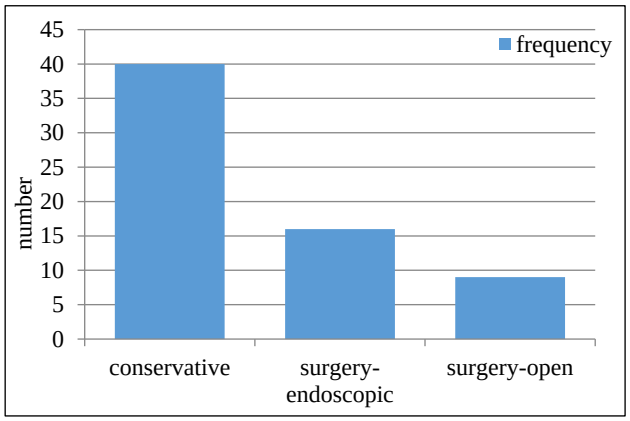


**Figure 4: Management.**

Conservative management was adequate in 41 patients. The leak subsided in one day in 12.1% (n=5) cases, two days in 34.1%(n=14), three days in 19.5% (n=8), four days in 19.5% (n=8), five days in 9.7% (n=4) and six days in 4.8% (n=2) cases. 16 cases were managed by endoscopic trans nasal CSF rhinorrhea repair. Out of the 16 cases, 25% had one defect, 68.75% had two defects and 6.25% had three radiological defects.

**Table 1: Number of days taken for leak to subside in conservative management.**

| No of days for leak to subside i conservative treatment | No. of cases | % |
|---|---|---|
| **1** | 5 | 12.10 |
| **2** | 14 | 34.10 |
| **3** | 8 | 19.50 |
| **4** | 8 | 19.50 |
| **5** | 4 | 9.70 |
| **6** | 2 | 4.80 |

**Table 2: Site of fracture.**

| Site | No. of cases | % |
|---|---|---|
| **Frontal bone** | 12 | 18.1 |
| **Sphenoid** | 5 | 7.5 |
| **Cribriform** | 6 | 9 |
| **Ethmoid** | 2 | 3 |
| **Frontal+cribriform** | 11 | 16.6 |
| **Frontal+sphenoid** | 9 | 13.6 |
| **Frontal+ethmoid** | 9 | 13.6 |
| **Frontal+sphenoid ethmoid** | 12 | 18.1 |

**Table 3: Outcome of surgical management.**

| Type of repair | No. of cases | Recurrence |
|---|---|---|
| **Endoscopic repair** | 16 | 0 |
| **Open repair** | 9 | 1 |

Out of the 16 patients, the defects correlated with the radiological findings in 93.75% (n=15) patients, whereas in 6.25% (n=1) case it did not correlate. In 61.8% (n=41) patients, fracture was seen in more than one bone/anatomical site. Out of the 66 patients, 10.6% (n=7) had meningitis. Out of this, 6 patients had meningitis before surgical correction. One patient had meningitis post open surgical correction and this patient underwent endoscopic CSF leak repair on POD8 of open surgical correction. Out of the 16 patients who underwent endoscopic CSF leak repair, there was no recurrence in any patients. There was one case of recurrence among the 9 patients who underwent open surgical repair.

## DISCUSSION

In the current study out of 66 patients with post trauamatic CSF rhinorrhea 87.8% (n=58) were male and 12.1% (n=8) were females. Male to female ratio is 1:0.137. In the study by Nasiru Jinjiri Ismail et al, out of the 20 cases of post traumatic CSF rhinorrhea, all the patients were male7. In the study by Mustafa Tajelsir et al, out of 16 cases of posttraumatic CSF rhinorrhea male:female ratio was 2.2:1 (1:0.45).[8]

The age range of the current study is 5-70years with a mean age of 25.5years. The maximum number of patients (47%) were in the age group of 21-30 years. In a study by R. Bryan Bell, the average age of post traumatic CSF leak was 28.2 with an age range of 2-80 years.[9]

In this study the mechanism of trauma was road traffic accident in 84.8% (n=56) patients. Fall from height was the mechanism of trauma in 10.6% (n=7) patients. Heavy blow to head, heavy objects falling on head were the mechanism in 3 patients. In the study by Nasiru Jinjiri Ismail et al, out of the 20 cases, all patients had road traffic accident as the etiological factor.[7] The time interval for CSF rhinorrhea to occur after trauma was 1-5 days in 85% of cases, 6-10 days in 6% cases, 11-15 days in 3% and >15days in 6% cases. This can be classified into early onset, delayed onset and very late onset CSF rhinorrhea. In a study by Friedman et al, 67% patients had an early onset CSF rhinorrhea 16% had delayed whereas 16% had very late onset CSF rhinorrhea.[10]

In this study, conservative management with strict bed rest and acetazolamide was adequate in 41 cases (62%). In the study by Jonathan A Friedman et al, spontaneous resolution occurred in 60% cases, whereas in the study by Broadie, out of 122 CSF leaks, 95% closed spontaneously within a week.[10,11] In majority of cases, 35% (n=14), the leak subsided in 48 hours. The average number of days taken for the leak to subside was 3.5 days in the study. In the study by Jonathan A Friedman et al, the average number of days for spontaneous resolution was 4-8 days.[10]

CSF rhinorrhea protocol, that is combined HRCT and MRI (patient prone) was done in all the cases who

underwent endoscopic CSF rhinorrhea leak repair. Of the 16 cases managed by endoscopic CSF leak repair, 10 had two defects, 4 had one defect and 2 had three defects radiologically. The radiological findings correlated clinically in 15 cases. That is, in 93.5% cases, both radiological findings and intra-op defects were correlating. In the one case where there was no radiological correlation, the radiological site of leak was at the cribriform plate, whereas intraoperative site of leak was from the sphenoid sinus.

Intrathecal fluorescein was used to detect the site of leak in all the 16 patients who underwent endoscopic repair. This is done pre-operatively. Patient is placed in lateral decubitus position. 1ml dye is mixed with 3 ml saline and 0.3 ml of that mixture taken. This is mixed with 8 ml CSF and injected into subarachnoid space. None of these patients reported any complications of intrathecal fluorescein. In the study by Badr Eldin Mostafa et al, the sensitivity of HRCT was 88.25%. Fat suppressed T2-weighted MRI detected CSF-like density with a sensitivity of 88.88%. Superimposing CTs and MRIs accurately localized the site of leakage in 17 out of 19 cases with a sensitivity of 89.74% .[6] In this study, using combined HRCT and MRI for detection of leak, sensitivity is 93.75%.

CSF rhinorrhea can occur due to defects in the skull base; in anterior, middle and posterior cranial fossae. In this study majority of cases had frontal bone fracture, n=55(83%). This was followed by sphenoid (n=29), ethmoid (n=20) and cribriform (n=16). In the study by Ji-Woong Oh et al, the most common fracture sites leading to CSF leaks following TBI are the frontal sinus (30.8%), sphenoid sinus (11.4-30.8%) ethmoid (15.4-19.1%), cribriform plate (7.7%), frontoethmoid and sphenoethmoid.[12,13] This is comparable to the present study. Meningitis is the most feared and severe complication of a CSF leak. In this study n=7 (10.6%) out of 66 patients had meningitis. Out of this, 6 patients had meningitis before surgical correction. One patient developed recurrence of leak and meningitis post open surgical correction and this patient underwent endoscopic CSF leak repair on POD8 of open surgical correction.

The closure techniques depend on size and location of the defect. The three forms of grafting are underlay, overlay or combined. In endoscopic repair of CSF rhinorrhea, the various materials used were fascia lata, fat, hadad flap, surgical (oxidised regenerated cellulose) and BIPP nasal packing. Fascia lata, fat, surgicel and BIPP packing were used in all the 16 patients who underwent endoscopic CSF leak repair. Fat and fascia lata underlay without raising hadad flap was the method of closure in 13 patients, whereas fat and fascia underlay with hadad flap was the method of closure in 3 patients. BIPP nasal packing was done in all the patients, which was removed on post-op day 5.

There are certain limitations in this study. In this study the confirmation of CSF leak was made only using glucose estimation, due to lack of availability of beta 2 transferrin study. Patients need to be followed up for longer time for ruling out late recurrences and this being a retrospective study, is subject to confounding.

## CONCLUSION

Incidence of post traumatic CSF rhinorrhea in this study in 6.6%. Post traumatic CSF rhinorrhea has male preponderance. Frontal bone is the most common site of fracture and leak. Most common mechanism of trauma was road traffic accident. Majority of patients can be managed conservatively. Recurrence rate after surgical repair, open/endoscopic, is low.

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*Ethical approval: The study was approved by the Institutional Ethics Committee*

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