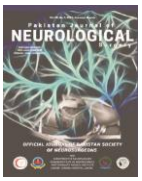

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Original Article (BRAIN)

The Frequency of Early Post Traumatic Cerebrospinal Fluid Rhinorrhea in Patients with Head Trauma

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ABSTRACT

Objective: To determine the frequency of early post-traumatic CSF (cerebrospinal fluid) rhinorrhea in patients with head trauma.

Materials and Methods: A prospective study was conducted in the Department of Neurosurgery, Jinnah Postgraduate Medical Centre, Karachi from 13th December 2019 to 12th December 2020. This study comprised 155 patients who had suffered head trauma. All patients were followed for one week. If patients developed clear, watery discharge from the nose, this was documented as being CSF rhinorrhea. The frequency was then further divided into immediate and early.

Results: The ages of the patients were 34.28 ± 14.20 years on average. The prevalence of CSF rhinorrhea was observed in 3.2% (5/155) patients. In all the patients, the CSF leak presented within the first 48 hours i.e. it was immediate.

Conclusion: Although rare, this post-traumatic complication continues to be a challenge in terms of morbidity and subsequent mortality.

Key Words: Cerebrospinal fluid, Rhinorrhea, Head Trauma.

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INTRODUCTION

Annually, an estimated 10 million people suffer from traumatic brain injury worldwide.[1] CSF leakage complicates 2% of these head injuries and CSF leaks in 80% to 90% of adults are a consequence of head trauma.[2,3,4] This frequency in children is less than 1% of closed head injuries. CSF leaks are uncommon in the pediatric population younger than 2 years of age with the adults to children ratio being 10:1. Traumatic CSF fistulas are the result of tearing of the dura and arachnoid mater with concurrent anatomical

discontinuation which results in the discharge of CSF through the paranasal sinuses, the nasal cavity, or the middle ear.[5,6]

Craniofacial trauma is responsible for 80% of the leaks.[7] 11 to 45% of the patients presenting with skull fractures develop CSF rhinorrhea.[7,8] However, these fractures may also occur in patients with Le Fort III fractures without an associated skull fracture. It has been reported that 84% of the patients developing a CSF fistula had fractures of the frontal sinus, with the orbital and petrous bones following suit.[9] Hence, the anterior skull base is the fossa most frequently involved.[2] Another weak point is the junction of the ethmoid bone with the cribriform plate and the ethmoid bone itself.[10] Because the dura is tightly adherent at these spots, the roof of the sphenoid sinus and the posterior wall of the frontal sinus are next.[11,12]

Most CSF leaks occur either immediately after the trauma or in the following days or weeks.[13] More than half of these will show up during the first 48 hours, 70% within seven days, and nearly all within three months.[14] Approximately 68% of these lesions heal spontaneously in the first 48 hours if the lesion is small and 85% close in the first week. CSF leaks are divided into early and delayed onset. Patients having post-traumatic CSF leak within the first 48 hours are considered to be in the early onset group.[9] Delayed CSF rhinorrhea can be due to the resolution of a clot or a decrease in cerebral edema.

CSF leaks that last longer than 7 – 10 days increase the risk of developing meningitis by about 25%.[15] The incidence of meningitis in early CSF leaks is from 6% to 20% whereas it is 57% in delayed leaks.[16]

CSF is best recognized by assessing the β-2 transferrin levels in the watery discharge. For detecting CSF leaks, this assay is 100% sensitive and has a specificity of 71%. This assay has a sensitivity of 100% and a specificity of 71% for the detection of CSF leaks.[17] CT scan is probably the best tool to locate the CSF fistula and to predict whether spontaneous healing will occur or not. A thin multislice CT scan (0.6 to 1mm) is the standard. An MRI may help distinguish between a mucopurulent discharge and CSF.

The treatment of traumatic CSF rhinorrhea is still debatable and very varied.[18] Spontaneous closure occurs in up to 85% of traumatic CSF leaks with conservative management.[25] with a significant number resolving in the first 24 – 48 hours.[15] Therefore, strict bed rest should be advised in these patients with elevating the head end upt0 30°. Avoidance of sneezing, coughing, blowing the nose, and straining while defecating should be advocated.[15] When indicated, laxatives, antitussives, and antiemetics should be added to the regimen. However, if the rhinorrhea doesn't resolve after 3 – 7 days of medical management, surgical management should be considered.[7,19,20] A CSF diversion procedure, usually a lumbar drain can be passed for 7 – 10 days.[7,20] Continuous CSF drainage can be hazardous and caution is warranted. Early surgical intervention is indicated in penetrating injuries or severe traumatic brain injuries in need of an intervention. In CSF leaks persisting for more than 10 days or delayed recurrence (after 10 days), surgical intervention is the better option. The options include transcranial, extracranial, transnasal, and endoscopic endonasal approaches.

In our part of the world, there is very limited data available due to an inadequate number of locoregional studies. The goal of this study is to calculate the frequency of CSF rhinorrhea in patients presenting with head trauma so that we can initiate proper and early management in our patients once the burden is known.

MATERIAL AND METHODS

Study Design and Setting

A Descriptive study was conducted at the Department of Neurosurgery, Jinnah Postgraduate Medical Centre, Karachi, for 1 year.

Inclusion Criteria

All Adult head trauma patients that were admitted to our neurotrauma unit (Ages 18 years to 60 years) were included.

Exclusion Criteria

All head injury patients requiring frontal skull base surgery were not a part of the study. If the patients had a previous history of brain trauma or head or nasal surgery were also excluded. Patients who expired within 7 days of admission were also not taken as a part of the study.

Data Collection and Clinical Management

The study comprised all patients who presented to the emergency department during the study period and met the inclusion criteria. Before patients were enrolled, they gave their informed consent.

Data was collected on a predesigned proforma. Patient demographics including age and gender were recorded. The major parameter to be assessed in this study is the incidence of CSF rhinorrhea in head trauma patients in the early post-traumatic period. The following additional parameters were also assessed in this study: The mode of trauma, GCS of the patients at the time of admission, additional head injury according to radiological findings on CT scan with the presence of fractures and their location. The patient who was lost to follow-up in the subsequent 7 days after head trauma was not included.

Data Analysis

SPSS version 22 was used to analyze the data. For quantitative variables such as age, mean and standard deviations were determined. Qualitative variables i.e. GCS, mode of injury, gender, and type of trauma, were analyzed by determining the frequencies and percentages. A Chi-square test was used to test the results. The significance level was considered at 0.05.

RESULTS

A total of 155 patients were included in our study and these patients were followed for 7 days.

Gender Distribution

Out of 155 patients, 129 (83.2%) were males and 26 (16.8%) were females.

Age Distribution

The ages of the patients were subdivided into three groups (from 18 – 30, 31 – 45, and 46 – 60 years of age). Frequency of patients in 18 – 30 group was 77 (49.7%), in 31 – 45 was 44 (28.4%) and 46 – 60 was 34 (21.9%). The mean ages were 34.28 ± 14.20 years.

Severity of Injury

Our study showed that 69 (44.5%) had a mild injury, 61 (39.4%) had moderate and 25 (16.1%) had severe. 152 of the 155 patients had a blunt head injury, whereas three had penetrating trauma.

Mode of Injury

The majority of patients had a history of road traffic accident i.e. 133 (85.8%), 16 (10.3%) patients presented after falling from a height while 3 (1.9%) had a history of assault and other 3 (1.9%) had other causes of trauma (Table 1).

Table 1: Mode of Trauma.

Mode of Trauma	Percentage
RTA	133 (85.80%)
Fall	16 (10.30%)
Assault	3 (1.90%)
Other	3 (1.90%)

Associated Injuries

Overall, the majority of the head trauma patients (63.2%) did not have any associated skull or facial fractures. In the study, 47 (30.3%) had skull fractures only, whereas 9 (5.8%) had involvement of both the bones of the skull and face. One patient had an isolated facial fracture. Out of the 56 patients who had a skull fracture, 23 (41.0%) had involvement of the frontal bone. This was followed by temporal fractures which were present in 12 (21.4%) patients. Occipital fractures were seen in 8 (14.2%) while the parietal bone was fractured in 6 (10.7%) patients. Multiple bone fractures were seen in 9 (16%) patients. Anterior skull base was the cranial fossa most commonly involved that is in 21 (13.5%) patients followed by the middle skull base fracture in 9 (5.8%) patients. Only 2 patients (1.3%) had fractured their posterior fossa. Out of the 155 patients in our study, isolated extradural hematoma or a brain contusion was the most common brain injury pattern, found in 28 (24.5%) patients each. 12 (7.7%) patients had an acute subdural hematoma. A combination of the hematoma was seen in 19 patients.

CSF Rhinorrhea

Only 5 patients out of 155 had CSF rhinorrhea making the frequency of CSF rhinorrhea to be 3.2% (Table 2). All of the patients, who developed rhinorrhea, did so on an immediate basis that is within 48 hours of the trauma.

Table 2: Frequency of CSF Rhinorrhea

CSF Rhinorrhea	
Absent	**Present**
150 (96.80%)	5 (3.2%)

Table 3: Age distribution of CSF rhinorrhea (n = 5).

	Frequency	
18 – 30 years	4	P-value 0.427 (Insignificant result)
31 – 45 years	1	
Above 45 years	0	

Table 4: Gender distribution of CSF rhinorrhea (n = 5).

Gender	Frequency	
Male	4	P-value0.606 (Insignificant result)
Female	1	

Table 5: Mode of trauma seen in patients with CSF rhinorrhea (n = 5).

Mode of Trauma	Frequency	
RTA	4	P-value0.876 (insignificant result)
Fall	1	

Table 6: CSF rhinorrhea with associated skull fractures.

Skull Bone Fractures	Frequency	
Frontal	4	P-value 0.003 (significant result)
Parietal	0	
Temporal	1	
Occipital	0	

All of the patients with rhinorrhea had skull fractures, with two having additional facial fractures. Frontal bone was the most commonly fractured as four out of five presented with it (80%) and one patient had a temporal base fracture (20%), the p-value is significant. There was no identifiable fracture in one patient, whereas 3 had anterior skull base and 1 had a middle cranial fossa fracture. There were associated intracranial injuries in 3 patients, while 1 patient had a concomitant extradural hematoma and one had a contusion.

DISCUSSION

Approximately 80% of CSF leaks present as a squeal of head trauma. In comparison, 16 percent of leaks occur as a consequence of surgical intervention, and 4% occur secondary to nontraumatic causes. Traumatic CSF leaks are prevalent in young males, and they exacerbate 2% of all head trauma including basilar skull fractures 12 to 30% of the time.[21] Males were

predominantly involved according to Adoga and colleagues.[22] We report comparable results since young males are more vulnerable to trauma due to their outdoor activities and occupational exposure. Hardman et al found that TBI was most common in young adults aged 15 – 24 years.[23] Similarly, the majority of the patients in our study (49.2%) were between 18 – 30 years of age and 28.4% were between 30 – 45 years of age. In the age group above 45, 21.9% had head trauma.

In our setting, the majority of the admissions were due to a history of blunt injury (98.1%), with road traffic accidents being the predominant cause in 85.8% of persons, followed by a history of falls in 10.3% of patients. According to Tagliaferri et al., RTA-related TBI accounts for up to 60% of all TBI. The proportions reported by Butcher et al were even greater, ranging from 53 percent to > 75 percent of total cases in the examined trials.[25] This adds to the growing body of evidence that RTA is a major cause of serious TBI around the world.

Tseng et al described that 46.7% of the patients admitted with head trauma had an associated skull fracture.[26] Similarly in our study, out of those patients who had a fracture on admission, the frontal bone was involved in 41.0% of the patients, the temporal bone in 21.4%, and more than 2 bones involved in 16.0% of the fractures. In one large recent study, sphenoid bone was the more commonly involved site (32%) followed by ethmoid (31%).[27] Linear fractures are most prevalent in the frontal and temporal regions, according to Yavuz et al.[28] Because it is the thickest of the cranial bones, the occipital bone was more resistant to injury. However, in those patients who developed CSF rhinorrhea, frontal bone was fractured in 4 out of 5, which is a significant value inferring that patients having fractures of this bone are more prone to developing CSF rhinorrhea. Another study found the junction of ethmoid bone with the cribriform plate to be a potential weak site leading to this complication.[10] According to Friedman and colleagues, the frontal bone is the most commonly involved anterior skull base bone followed by the temporal bone and orbital bone leading to rhinorrhea.[6]

There was no skull base involvement in 78.7% (122/155) of the cases; the Anterior cranial fossa was involved in 13.5% (21/155) of the cases, the middle fossa in 5.8% (9/155), and the posterior fossa in only 1.3% (2/155). Following that Mokolane et al[29] observed the prevalence of basilar skull fracture in 15.2% of the cases. However, the MCF was the most commonly broken intracranial fossa in their study, tailed by the ACF, with the PCF having the fewest fractures. In our study, out of the five patients who had CSF rhinorrhea, 3 had anterior cranial fossa fractures while 1 had fractured their middle fossa, one patient didn't have any visible skull base involvement, however occult fracture not visible on CT scan can't be ruled out.

The overall frequency of CSF rhinorrhea that was found in our study was 3.2% (5/155). Bell and colleagues found it to be 4.6%.[30] Brodie et al reported it to be present in 2% of cases of head trauma.[2] The leak was evident within the first 48 hours in all the patients who developed this complication. More than half of the traumatic leaks are visible during the first two days, 70% within the initial week, and practically all in the subsequent three months.[31] In all of these patients, the CSF leak closed on conservative management within the first 48 hours. When conservative treatment was performed for three days, the overall incidence of cessation was approximately 39.5%. It increased to 85% when continued for 7 days.[30]

LIMITATIONS

The main limitation of this study was the small sample size relative to the low frequency of CSF rhinorrhea. Another important limitation is the very broad inclusion criteria, however, to determine the actual burden of CSF rhinorrhea in

trauma patients and certain injury patterns that might somewhat help in predicting the occurrence of CSF rhinorrhea, all types of head trauma injuries were included so that timely management can be employed. Larger and comparative series are required to determine the true prevalence of these post-traumatic complications in patients sustaining head injury as this can prove to be debilitating in a modest number of patients, affecting their quality of life.

CONCLUSION

In this study, we aimed to ascertain the prevalence of CSF rhinorrhea in patients with head trauma. Although road traffic accidents leading to head injury is fairly common in this part of the world, only a small proportion of the patients develop the post-traumatic complication of CSF rhinorrhea. In such cases, the CSF leak spontaneously closes within the first 48 hours of trauma. Large sample sizes, long-term follow-up, and well-designed studies are required in the future.

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Additional Information

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AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Rabail Akbar Qazi	1. Study design and methodology.
2.	Rabail Akbar Qazi	2. Paper writing.
3.	Rabail Akbar, Tanweer Ahmed	3. Data collection and calculations.
4.	Rabail Akbar, Sana Akbar	4. Analysis of data and interpretation of results.
5.	Tanweer Ahmed, Sana Akbar	5. Literature review and referencing.
6.	Lal Rehman, Ali Afzal	6. Editing and quality insurer.