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ORIGINAL ARTICLE

Prevalence of Cerebrospinal Fluid Leak in Traumatic Head Injury at a Tertiary Care Center

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ABSTRACT

Background: Cerebrospinal fluid circulates around the surface of brain and spinal cord and through the brain's ventricles. CSF leak is a condition that occurs when the CSF leaks through a defect in the dura or skull and out through the ear or nose. The most common causes of CSF leak include head injury, brain and sinus surgery. The objective of this study was to determine the frequencies of post-traumatic cerebrospinal fluid leak in traumatic head injury.

Material and Methods: A descriptive case series was carried out in the Department of Neurosurgery, Hayatabad Medical Complex, Peshawar for a period of 1 year, from 1st February 2016 to 31st January 2017. A total of 422 patients presenting within 48 hours of acute trauma to the head were included in a consecutive manner and followed up till 7th day to determine the CSF leak.

Results: The mean age group of our sample was 37.37 ± 12.3 years of which 79.6% were male patients and 20.4% female patients. Most of the patients (55.5%) were ≤ 40 years of age. CSF leak was observed in 5.2% of patients, with otorrhea seen in 2.1% patients and rhinorrhea in 3.1% patients, respectively.

Conclusion: CSF leak is quite common in our population after acute trauma to the head. The high prevalence may be due to high frequency of accidents in our society with high velocity impact and more commonly seen in the younger age group (≤ 40 years).

Key words: Craniocerebral trauma, CSF leak, Otorrhea, Rhinorrhea, Traumatic head injury

Authors' Contribution:
[1,2] Conception, synthesis, planning of research and manuscript writing Interpretation, discussion, [3] Active participations in data collection [4] Data analysis.

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Introduction

Traumatic brain injury is the fourth largest cause of fatal trauma worldwide.[1] The social and economic implications of traumatic brain injuries are immense whilst the physical and mental bearing upon the patient are devastating. Injury to the head results in a wide spectrum of anatomic and physiologic disruptions which frequently needs expert neurosurgical care.[1] Trauma to the head might result in leakage of cerebrospinal fluid (CSF) through dural tears in the skull base and at other fracture sites. The reported incidence of post-traumatic CSF leaks is 2% among the head trauma patients.[2] These leaks are frequently associated with basilar skull fractures and present as rhinorrhea, otorrhea and in rare cases as occulorrhoea.[1,2]

The CSF leak may be acute, chronic, spontaneous, iatrogenic, infection/inflammation and tumor associated. Acute or early CSF leaks present within 24 to 48 hours of trauma while the chronic or late leaks present in a delayed fashion such as weeks, months or years later.[3] Most of the cases of traumatic CSF leaks resolve spontaneously with simple conservative measures such as reclined bed position, blood pressure control, diuretics

and does not require repair of the dural and cranial defect.[4] Current guideline advises conservative treatment of posttraumatic CSF leaks for 10 to 14 days. If the leak does not respond to conservative measures in two weeks, then it is imperative to intervene invasively.[5-7]

The common investigations performed to detect skull fracture and hence the suspected dural tear area by the high-resolution CT scan is seen with coronal and sagittal cuts. MRI with T2 weighted images in prone position is also highly favored. Radionuclide cisternography, metrizamide contrast test and intrathecal fluorescein dye test are other tests to confirm CSF leaks. Beta transferrin of the leaking fluid and its glucose levels are also helpful in differentiation between CSF rhinorrhea from other causes. [7-9] Complications of posttraumatic CSF leaks include acute fulminant meningitis with a considerably higher mortality rate, repeated pneumocephalus with the possibility of tension pneumocephalus.[9-12] Bell et al[13] has conducted a review of posttraumatic CSF leaks and its management and has reported that these leaks are present in 4.6% of head trauma patients. However, the true prevalence is unknown because the CSF leaks may appear years after initial dural tear. Sometimes, patients may present with sudden onset acute meningitis which may appear months or years after the initial head injury.[13]

The rationale of this study was to observe frequency of early posttraumatic CSF leaks at our institute. Wide discrepancies exist in the observed frequencies of post traumatic CSF leaks in different studies. By determining the frequencies of post-traumatic cerebrospinal fluid leak in traumatic head injury at our institution, the present study will be helpful to overcome that difference in the observed studies. Furthermore, recording the associated morbidity will help us in delineating the management strategies according to our local expertise and availability of treatment options

Material and Methods

This study was conducted at Neurotrauma ward, Hayatabad Medical Complex Peshawar. Duration of the study was one year, from 1st February 2016 to 31st January 2017. The study design was descriptive case series in which non-probability consecutive technique was used for sample collection. Patients presenting within 48 hours after the initial head trauma, both male and female, with age ranging from 18 to 65 years were included, while patients who developed post-operative cerebrospinal fluid leaks, those who presented with spontaneous cerebrospinal fluid rhinorrhea or otorrhea or those who developed inflammatory type of cerebrospinal fluid discharge were excluded. Patients were divided into four different age groups (≤ 30 years, 31-40 years, 41-50 years and ≥ 51 years). All patients meeting inclusion criteria were included in the study through emergency and OPD. Detailed history, clinical examination and diagnosis was confirmed using high resolution CT and MRI of brain, skull base, temporal region followed by routine investigations. Patients were followed during their course of admission till the day of discharge and were assessed for the presence or resolution of the CSF leak. Post stratification was done through chi square test and p-value less than or equal to 0.05 was considered significant.

Results

The study was conducted on 422 patients presenting after acute trauma. The mean age of the sample was 37.4 ± 12.4 years (Table I). There were 79.6% male patients and 20.4% female patients (Table I). CSF leak was observed in 5.2% of patients (Table II). Looking at the type of outlet of CSF leak, we observed that 2.1% of patients had Otorrhea, while 3.1% patients had Rhinorrhea (Table II). We stratified the CSF leak with regards to different age groups and observed that the difference was statistically significant with a p value of 0.000. (Table III). CSF leak was also stratified with regards to gender however the difference was statistically insignificant (p = 0.793) (Table IV).

Table I: Frequency distribution of patients according to age groups (n = 422)

Age (years)	Frequency(n)	Percentage (%)
≤ 30	150	35.5
31 to 40	84	19.9
41 to 50	104	24.6
≥ 51	84	19.9
Total	422	
Mean ± SD	37.4 ±12.4	

Table II: Frequency distribution of types of CSF leak (n = 422)		
Type of CSF leak	**Frequency n**	**Percentage %**
Otorrhea	09	2.1
Rhinorrhea	13	3.1
Total CSF leaks	22	5.2

Table III: Age wise stratification of patients with CSF leak (n = 422)				
		CSF Leak		**Total**
		Yes n (%)	**No n (%)**	
Age Groups	≤ 30	7 (4.7)	143 (95.3)	150
	31 to 40	13(15.5)	71(84.5)	84
	41 to 50	1(1.0)	103(99.0)	104
	≥ 51	1(1.2)	83(98.8)	84
Total		22(5.2)	400(94.8)	422
P value		0.0001		

Table IV: Gender wise stratification of patients with CSF leak (n = 422)			
Gender	**CSF Leak**		
	Yes n (%)	**No n (%)**	**Total**
Male (79.6%)	18 (5.4)	318 (94.6)	336
Female (20.4%)	4(4.7)	82(95.3)	86
Total	22(5.2)	400(94.8)	422
P value	0.793		

Discussion

Nonsurgical trauma accounts for approximately 80% of CSF leaks. This is in sharp contrast to 16% of CSF leaks seen after surgical procedures and 4% due to nontraumatic causes. Of the traumatic leaks, more than 50% are evident within the first two days of trauma, 70% within the first week, and almost all present within three months.[14] CSF traumatic leaks occur commonly in young males and complicate 2% of all head injuries, and 12% to 30% of all basilar skull fractures.[11] Adoga and colleagues[15], in their study on otorhinolaryngological manifestations in head trauma found that majority of patients with head injury were male patients and the most affected population was below 40 years.[15] We report comparable results, as in our study also, most of the patients with head trauma (79.6%) and CSF leak (82%; 18/22) were male. Similarly, majority of the patients (54.4%) were below 40 years of age.

The common sites of CSF rhinorrhea in cases of accidental trauma are the frontal sinus (30%), sphenoid sinus (30%) and cribriform/ ethmoid (23%).[16] Identifying the site of lesion in cases of CSF leak is important and that can be done either through high resolution CT (HRCT) scan or a cisternogram. Localization of lesion is essential for appropriate management plan especially in cases of surgical intervention.[11] Ji-Woong et al[17] mentioned in his research article that for diagnosis, laboratory tests and radiological workup is mandatory, as physical examination is not reliable. Furthermore, they added that radiologic findings are important in identification of leaking point and further decision making for management. The radiologic investigations may include plain radiograph of skull bones, high resolution computed tomography (HRCT), CT cisternography, and magnetic resonance imaging (MRI) with intrathecal contrast or cisternography. Similarly, in a study by Oakley[18] and his colleagues, HRCT is recommended as the first-line study for localization of CSF leak while MR cisternography should be used for CSF leak identification as a second line for each of these if beta-2 transferrin is not available or if HRCT is not clear.[18] In our study, we also used these modalities to locate CSF leakage site i.e. HRCT, CT/ MRI cisternogram. CSF leaks will usually resolve without surgical intervention in cases of trauma. In refractory cases, successful management often involves a combination of observation, CSF diversion, and/ or extracranial and intracranial procedures.[13]

Unilateral watery nasal discharge is the most common presenting symptom in skull base trauma cases.[10] Adoga et al, in a study found that common otorhinolaryngological presentations of CSF leaks were rhinorrhea followed by otorrhea.[15] Contrary to this, Yellinek and his colleagues in their study reported that otorrhea is more frequent then rhinorrhea in cases of CSF leak secondary to traumatic brain injury.[19] In our study, 22 patients had CSF leaks out of total 422 patients i.e. 5.2% patients were diagnosed with CSF leak, out of which 2.1% had CSF otorrhea and 3.1% had rhinorrhea. Anatomical differences in the skull base bone and dural structures seems to be the reason for above discrepancy. Rhinorrhea is mostly associated with leaning forward or standing. Other nasal conditions, like allergic rhinitis, perennial rhinitis and vasomotor rhinitis, are common, and may mimic the signs and

symptoms of CSF rhinorrhea or may occur simultaneously with a CSF leak. If test is performed during the quiescent phase, there are chances of false-negative results on diagnostic testing. Repeat testing and further follow-up is required in cases of high clinical suspicion.[10,13]

Conclusion

CSF leak is common in our population after traumatic head injury. The high prevalence may be due to high number of accidents in our society with high velocity impact and more commonly seen in the age group less than 40 years.

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