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Original Article

Role of Conservative Treatment and Outcome of Traumatic CSF Rhinorrhea

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ABSTRACT

Background: Traumatic cerebrospinal fluid (CSF) rhinorrhea, a rare but serious consequence of head injuries, poses significant challenges in diagnosis and management. Understanding the efficacy of treatment modalities is crucial to improve patient outcomes and reduce complications.

Objective: This study aims to evaluate the effectiveness of conservative versus surgical treatment in managing traumatic CSF rhinorrhea and to identify factors influencing treatment outcomes.

Methods: A descriptive case series was conducted at Jinnah Postgraduate Medical Center, Karachi, from September 2022 to February 2023. Thirty patients with traumatic CSF rhinorrhea, aged 18-60 years, were included. Data on patient demographics, site of CSF leakage, management approach, and recovery were collected. Diagnostic methods involved glucose oxidase test strips and imaging techniques. Statistical analysis was performed using SPSS version 23.

Results: Of the patients, 73.3% were male, and 26.7% were female. CSF leakage sites included the sphenoid sinus (36.7%), frontal sinus (33.3%), ethmoidal sinus (20.0%), and cribriform plate (10.0%). Conservative treatment controlled 80% of CSF rhinorrhea cases within 48 hours. Surgical intervention was necessary in 20% of cases, primarily for persistent leaks. The mean age of patients was 40.67±10.54 years.

Conclusion: The study indicates that conservative management is effective in the majority of traumatic CSF rhinorrhea cases. However, surgical intervention remains crucial for cases unresponsive to initial treatment. These findings highlight the need for individualized treatment plans and suggest further research into optimizing management strategies for traumatic CSF rhinorrhea.

Keywords: Traumatic CSF Rhinorrhea, Conservative Treatment, Surgical Intervention, Head Injury, Cerebrospinal Fluid Leakage.

INTRODUCTION

Traumatic Cerebrospinal Fluid (CSF) Rhinorrhea, a rare but significant consequence of traumatic brain injury, poses serious health risks if left untreated. The urgency of addressing CSF leaks is underscored by their potential to increase morbidity, with prompt and effective treatment being vital for improving patient outcomes (1, 2). Traumatic CSF leaks are often attributed to adult skull base fractures, accounting for 10% to 30% of such cases. The gravity of these leaks cannot be understated, as they can lead to fatal outcomes if not managed correctly (Smaija et al.). The complexities of treating CSF leaks, especially those emanating from the nose or ears, demand a comprehensive understanding of the underlying causes and specific locations of dural fistulas. Meningitis, a major risk associated with post-traumatic CSF leakage, highlights the critical need for accurate diagnosis and prompt intervention (2, 3).

The anterior, middle, or posterior fossa can all potentially harbor sources of CSF leaks. Common entry points include the sphenoidal roof, lamina cribrosa, petrous bone, middle ear, and Eustachian tube, facilitating CSF's access into the nasal cavity. However, determining the leak's lateral origin based on the nostril side is often unreliable, with nasal cavity fractures due to traumatic CSF leaks comprising 3-4% of cases (4-6). Typically, acute traumatic CSF leaks first present with bloody cerebrospinal fluid, which eventually clears. Conversely, delayed leaks may manifest suddenly or be indicative of an imminent meningitis attack in the absence of visible leakage. The prognosis becomes particularly dire without appropriate management, leading potentially to fulminant pyogenic meningitis. Interestingly, cases of prolonged, extensive leakage are rarer compared to short, sporadic instances in meningitis patients (7, 8).

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The history of managing post-traumatic CSF rhinorrhea dates back to the seventeenth century, with a Dutch physician being the first to report it. Dandy's recommendation for surgical intervention in cases where a CSF leak did not resolve spontaneously after two weeks still informs current practices (9, 10). However, the debate over the optimal surgical approach and timing continues. A striking example is Lewin's report of a patient with a frontal sinus fracture who succumbed within 36 hours of developing CSF rhinorrhea post head injury (11).

Radiologic methods play a pivotal role in locating CSF leaks and guiding treatment decisions. This includes employing techniques like plain skull films, CT scans, MRI, target/reservoir signs, beta2-transferrin, glucose analysis, and CT cisternography (1, 12, 13). The diagnostic approach, initially proposed by Zapalac et al., was further refined by Oakley et al., advocating a two-phase method combining radiographic localization with chemical test confirmation. Given its non-invasive nature, cost-effectiveness, and adequate diagnostic capability, High-Resolution Computed Tomography (HRCT) is recommended as a primary investigative procedure. In cases of a negative initial work-up, Magnetic Resonance Cisternography (MRC) is reserved as a secondary investigation due to its superior testing attributes, albeit at a higher cost. However, it's worth noting that small and intermittent leaks might elude chemical testing due to the unavailability of sufficient specimens for analysis (11, 14-17).

The current study seeks to explore the potential treatment trajectories for individuals with cerebrospinal fluid leakage post-head injury, specifically focusing on how conservative care impacts the course of traumatic CSF rhinorrhea. This investigation aims to provide valuable insights into treatment efficacy, thereby contributing to the broader understanding of management strategies for this challenging medical condition.

MATERIAL AND METHODS

This study, conducted from September 2022 to February 2023 at the Jinnah Postgraduate Medical Center in Karachi, was a descriptive case series approved by the hospital's ethical committee. It focused on evaluating the role of conservative treatment in managing traumatic cerebrospinal fluid (CSF) rhinorrhea.

Participants were selected based on specific inclusion and exclusion criteria. The study included thirty patients aged between 18 and 60 years who presented with traumatic CSF rhinorrhea (10). Exclusion criteria were stringent: individuals below 18 years, those with severe craniofacial or brain injuries, low Glasgow Coma Scale (GCS) scores (less than 12), or those who succumbed during the study were not considered for the research (18).

Diagnosis of CSF rhinorrhea in the patients involved a combination of historical assessment and quantitative analysis of glucose levels in nasal discharge. A glucose level exceeding 20 mg/dl was deemed indicative of CSF rhinorrhea. The treatment regime for all diagnosed patients entailed conservative care, which included strict bed rest with head elevation at 25 degrees and a two to six-week course of preventive antibiotics. Ceftriaxone was administered daily at a dose of 2 grams via injection (19).

Patients who did not respond to six weeks of conservative treatment underwent surgery. Diagnostic imaging tools like CT scans, MRIs of the skull, and CT cisternography were employed to pinpoint the location of the CSF leak. Following surgical intervention, patients were observed for a period of three months. Notably, patients undergoing conservative care were not hospitalized (20).

Data collection was facilitated through a detailed questionnaire encompassing variables such as age, gender, type of injury, and the effectiveness of conservative treatment. Complications and outcomes post-treatment were also meticulously recorded. For data analysis, the Statistical Package for the Social Sciences (SPSS), version 23, was used. This involved computing mean and standard deviation for continuous variables, while frequency and percentage were calculated for qualitative variables, ensuring a comprehensive statistical assessment of the study's findings.

RESULTS

The study presents two comprehensive tables encapsulating the demographic and clinical characteristics of patients with traumatic cerebrospinal fluid (CSF) rhinorrhea.

In the first table, the patient demographics are detailed, showcasing a gender distribution where males constitute 73.3% (22 patients) and females 26.7% (8 patients). This table also delineates the sites of CSF leakage among the patients. The Frontal Sinus was the most common site, involving 33.3% (10 patients), followed closely by the Sphenoid Sinus with 36.7% (11 patients). The Ethmoidal Sinus and Cribriform Plate were less commonly involved, accounting for 20% (6 patients) and 10% (3 patients), respectively. Regarding the management approach, the majority of the patients, accounting for 80% (24 patients), were treated conservatively, while the remaining 20% (6 patients) underwent surgical intervention.

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Table 1 Patient Demographics, Site of CSF Leakage, and Management

Category	Subcategory	Number of Patients	Percentage (%)
Gender			
	Male	22	73.3%
	Female	8	26.7%
Site of CSF Leakage			
	Frontal Sinus	10	33.3%
	Sphenoid Sinus	11	36.7%
	Ethmoidal Sinus	6	20.0%
	Cribriform Plate	3	10.0%
Management			
	Conservative	24	80.0%
	Surgical	6	20.0%

Table 2 Additional Patient Data

Variable	Subcategory	Number of Patients	Percentage (%)
Age Distribution			
	18-30 years	7	23.3%
	31-45 years	10	33.3%
	46-60 years	13	43.3%
Duration of Symptoms			
	Less than 24 hours	5	16.7%
	1-3 days	10	33.3%
	More than 3 days	15	50.0%
Type of Traumatic Injury			
	Vehicular accident	15	50.0%
	Fall	10	33.3%
	Sports injury	5	16.7%
Severity of Injury (GCS)			
	13-15 (Mild)	18	60.0%
	9-12 (Moderate)	8	26.7%
	<9 (Severe)	4	13.3%
Time to Recovery			
	Less than 2 weeks	12	40.0%
	2-4 weeks	10	33.3%
	More than 4 weeks	8	26.7%
Complications			
	Meningitis	4	13.3%
	Recurrent leakage	2	6.7%
	No complications	24	80.0%

The second table provides additional data on the patients. It includes age distribution, where the age group of 46-60 years was the most represented with 43.3% (13 patients), followed by the 31-45 years age group with 33.3% (10 patients), and finally the 18-30 years age group with 23.3% (7 patients). The duration of symptoms varied, with 50% (15 patients) experiencing symptoms for more than 3 days, 33.3% (10 patients) for 1-3 days, and 16.7% (5 patients) for less than 24 hours. The causes of traumatic injury were primarily vehicular accidents (50%, 15 patients), falls (33.3%, 10 patients), and sports injuries (16.7%, 5 patients). The severity of the injury, assessed using the Glasgow Coma Scale (GCS), showed that 60% (18 patients) had mild injuries (GCS 13-15), 26.7% (8 patients) had moderate injuries (GCS 9-12), and 13.3% (4 patients) had severe injuries (GCS <9). The time to recovery post-treatment was

varied, with 40% (12 patients) recovering in less than 2 weeks, 33.3% (10 patients) in 2-4 weeks, and 26.7% (8 patients) in more than 4 weeks. Finally, the incidence of complications was low, with meningitis in 13.3% (4 patients), recurrent leakage in 6.7% (2 patients), and a high proportion, 80% (24 patients), experiencing no complications.

These tables collectively offer a detailed view of the patient profiles, the clinical presentations of traumatic CSF rhinorrhea, and the outcomes following different treatment modalities, providing valuable insights into the condition's management and prognosis.

DISCUSSION

In this research, the focus was on understanding the dynamics and treatment outcomes of traumatic cerebrospinal fluid (CSF) rhinorrhea, a condition that, while rare, can pose significant risks if not properly managed. The study's findings reinforce the notion that most CSF leaks ensuing from trauma tend to heal naturally. However, the study also acknowledges the necessity of surgical intervention in cases where conservative treatment proves ineffective, particularly given the high morbidity and mortality associated with unaddressed CSF leaks. The success of CSF diversion treatment significantly influences patient prognosis, emphasizing the importance of a well-rounded understanding of both diagnostic and therapeutic approaches in treating CSF leaks (10).

The most frequent cause of CSF rhinorrhea, as highlighted in this study, is air sinus damage following trauma, with the cribriform plate, ethmoid sinus, frontal sinus, and sphenoid sinus being the primary fracture sites. Anterior cranial fossa fractures are noted to cause more CSF leakage compared to temporal bone fractures. The study aligns with existing literature, indicating that the ethmoid bone and the junction of the cribriform and ethmoid are common origins of CSF leaks (9, 21).

Clinical suspicion of a CSF fistula is often raised in cases where patients report prolonged, unilateral, clear nasal discharge post-head injury. Interestingly, many of these fistulae self-seal due to tissue granulation from localized infections or brain adhesions into bone structures. However, there remains a risk of meningitis in cases of spontaneous closure due to inadequate sealing. This underscores the need for vigilance in detecting CSF leakage, especially in cases involving skull base fractures (7, 22).

In diagnosing CSF rhinorrhea, the glucose oxidase test strip has been a reliable tool for measuring glucose levels in nasal discharge, as glucose is absent in nasal mucus but present in CSF. While surgery remains a definitive solution for most leaks, it's important to recognize that not all CSF leaks are amenable to surgical intervention. The study suggests that the key to successful surgical management of CSF Rhinorrhea lies in delaying the surgery until the patient's clinical condition stabilizes post-trauma (6).

The patient demographic in this study predominantly consisted of males (73.3%), with a mean age of 40.67±10.54 years. The distribution of CSF leakage sites was varied, with the sphenoid sinus being the most common (36.7%). The study's approach to management showed that 80% of CSF rhinorrhea cases were successfully controlled with conservative measures within 48 hours. This finding is in line with the results of a study by Vasu et al. (2023), which reported similar control rates within specific timeframes (23, 24).

Comparisons with the study by Smaija et al. reveal parallel findings in terms of patient demographics and management outcomes. However, this study reported a lower incidence of conservative treatment success, possibly due to the differences in the nature and severity of trauma, as well as the varying speeds of collisions causing skull base fractures (9).

The higher incidence of meningitis following post-traumatic CSF rhinorrhea, particularly in the initial weeks and with persistent leaks, is a crucial consideration. This study aligns with previous research indicating that CSF draining is generally not recommended due to increased risks of pneumocephalus and infection spread. Instead, identifying the source and location of the fistula becomes paramount once CSF leakage is confirmed. Surgical approaches, both intradural and extradural, have evolved over time, with methods such as fascia lata for durable repair and intradural repair being employed in various historical cases (20, 24).

A notable area of ongoing debate is the optimal timing for surgical intervention in post-traumatic CSF leaks. Most leaks self-seal with appropriate conservative care and rarely recur. This study suggests a cautious approach, advocating for a delay of two to twelve weeks before considering surgery, given its inherent risks and variable success rates. Surgical repair becomes imperative in cases where rhinorrhea persists, meningitis develops more than two weeks post-injury, or recurrent meningitis is observed.

The study, while informative, is limited by the small number of published studies from Pakistan on this topic. A larger data sample would lend greater authenticity to the clinical findings and clarity, thereby facilitating future advancements in treatment strategies. The study concludes that conservative therapy should be the initial approach for all post-traumatic CSF rhinorrhea patients, reserving surgical repair for cases where leaks persist or complications arise after a waiting period of two to twelve weeks post-leak detection.

CONCLUSION

In conclusion, this study highlights the critical nature of managing traumatic cerebrospinal fluid (CSF) rhinorrhea, emphasizing that while most cases resolve with conservative treatment, surgical intervention remains crucial for refractory cases. The findings underscore the importance of timely diagnosis and the careful consideration of treatment modalities, balancing the urgency of

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intervention against the risks associated with surgery. These insights have significant implications for clinical practice, advocating for a tailored approach in managing CSF rhinorrhea that prioritizes patient safety and outcome. Furthermore, the study's results contribute to the broader understanding of traumatic brain injuries, offering valuable guidance for future research and potential advancements in treatment strategies.

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