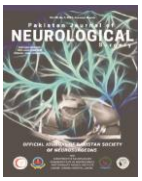

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Original Article (BRAIN)

Management Options of Post Traumatic Cerebrospinal Fluid Rhinorrhea

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ABSTRACT

Objective: A study was performed for establishing the management options for cerebrospinal fluid leakage in patients with a head injury. The study aimed to determine management options for traumatic CSF rhinorrhea and develop a better option.

Material and Methods: This study was conducted at the Neurosurgery ward, Bahawal Victoria Hospital Bahawalpur. Patients presented in the neurosurgery ward with head trauma having CSF rhinorrhea.

Results: Out of all patients who presented with a head injury, 80 patients had cerebrospinal fluid (CSF) rhinorrhea. The ages of the patients were between 20 and 50 years. CSF leakage was stopped in 70 patients with conservative management. In 10 patients, the cerebrospinal fluid rhinorrhea continued after the conservative management of 2 – 6 weeks, and surgical repair of dural tear at the base of the skull was done in these patients. The site of CSF rhinorrhea leakage was located in these patients with the help of a CT scan and MRI skull. In all these patients dural tears were repaired with fascia Lata graft or periosteum, pasted on the defect with fibrin glue.

Conclusion: We concluded that all post-traumatic C.S.F rhinorrhea cases should be managed conservatively because most of the C.S.F leaks stop spontaneously with proper conservative management. So surgical repair should be delayed for 2 – 12 weeks after a leak has been identified.

Keywords: Head Injuries, Surgery**,** Cerebrospinal Fluid rhinorrhea.

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INTRODUCTION

Cerebrospinal fluid (CSF) rhinorrhea is one of the common complications after traumatic brain injuries (TBI).[1] The risks of CSF leaks can be detrimental to the outcomes of the patients. Early diagnosis and proper management are necessary as it is associated with a better long-term prognosis for the patients.[2] Traumatic CSF leak are reported to be approximately 10% to 30% of

the skull base fractures in adults.[3] CSF rhinorrhea is a potentially fatal condition without proper treatment. Management of CSF leakage from the nose or ear requires an obvious concept for the causes and site of Duralfistulae.[4]

Dura matter is thin and adherent to the bone at the base of the skull. Fracture of the skull bone at the base results in Dural injury CSF rhinorrhea. This cerebrospinal leakage through the nasal cavity is called CSF rhinorrhea. Leakage is facilitated when intracranial pressure is elevated from any cause. The traumatic cerebrospinal fluid leakage has not been linked to gender or age. Meningitis is the main danger in post-traumatic cerebrospinal fluid leaks.

Possible leaking sites may be numerous and may occur in the anterior, middle, and posterior fossa. Most commonly, CSF gets to the nasal cavity through frontal air sinuses, the lamina cribrosa, the sphenoidal roof, or the petrous bone, through the middle ear and the Eustachian tube. Lateralization of the leak as per the nostril side is not reliable. In acute traumatic cerebrospinal leaks, the cerebrospinal fluid invariably is bloody initially, then becomes clear. Delayed leaks may present with a fairly sudden copious gush or as an obvious attack of meningitis without an obvious leak. If cerebrospinal fluid leaks after trauma are not treated properly, the patient can go under fulminant pyogenic meningitis, and fate is known very well. Copious, continuous leakage is less common with meningitis as compared to intermittent and little leakage.

The incidence of CSF leaks with meningitis in head injuries is around 0.2 to 0.5%.[5] A Dutch surgeon first recorded post-traumatic C.S.F rhinorrhea in the 17th century.[6] In 1944, Dandy supported the surgical repair of any C.S.F leak which does not has healed spontaneously in two weeks. There is as yet no consensus on the time of surgery and the most successful operative route. Cerebrospinal fluid leaks after trauma produce a risk of meningitis which on occasions is dangerous in onset. Lewin reported one patient with a fracture involving the frontal sinus who died within 36 hours after C.S.F rhinorrhea following head injury.[7]

Biochemical Analysis of Nasal Discharge

Double Ring Sign: CSF mixed with blood or nasal discharge forms two rings because CSF being a watery fluid invades linen more than blood called the double-ring sign, halo sign, or Target sign.

Hanker Chief Test: CSF is clear and non-sticky while nasal discharge contains mucus so it is sticky and unclear.

Diagnosis of CSF Fistula Site

Radiologic modalities are important to diagnose leaking sites so that decisions can be made for the treatment of the patient with CSF rhinorrhea. The radiologic modalities will include plain films of the skull, computed tomography (CT), and magnetic resonance imaging (MRI) brain and skull.

CT Scan Skull: skull base structures are best observed with a CT scan of the skull. Fractures of anterior and middle cranial fossae are shown on 3-D images with thin sections (1 – 2 mm). CSF leaking site can be diagnosed easily.

MRI Brain and Skull: CSF leaking can be detected by MRI scan in multiple planes. Active CSF rhinorrhea is diagnosed with a sensitivity of 90%. CT scan is useful to show the bony details of fractures, MRI scan is useful for showing the site of bony defect from where brain and arachnoid herniate and CSF leaking occurs.[8-12]

MATERIALS AND METHODS

Study Design and Setting

A descriptive case series was conducted at the Neurosurgery ward, Bahawal Victoria Hospital Bahawalpur. This study involved 80 patients aged between 20 – and 55 years of both genders diagnosed with CSF rhinorrhea presented with trauma.

Inclusion Criteria

Head injury patients included those who presented with CSF leakage having age between 20 – 55 years of any gender.

Exclusion Criteria

Trauma patients of GCS below 20 years of age were not included in the study.

Data Collection

Consent was taken from all the patients included in the study. Biodata like age, sex, mode of injury, and response to conservative management was entered in a questionnaire. Successful surgical repair of the dural defect .postoperative course, type of graft, and complications were recorded on a proforma.

Data Analysis

SPSS version 25 was used to analyze the collected data. collected data. Biodata and management data are divided into categorical and numerical variables. Numerical variables such as age are presented by mean SD. Data is presented by frequency and percentages.

Clinical & Surgical Management

The Neurosurgery Department of Bahawal-Victoria Hospital (BVH) was the place for this study and we evaluated the options for management of post-traumatic CSF rhinorrhea from August 2016 to December 2018. Out of 2000 patients admitted with a head injury, 80 patients had CSF rhinorrhea.

Diagnosis of CSF rhinorrhea was confirmed by history, clinical examination, and quantitative estimation of glucose in the discharge from the nose.

All these patients were managed conservatively which include strict bed rest with the raised head side at 25 degrees and prophylactic antibiotics for 2-6 weeks. Most of the patients were given injectable Ceftriaxone 2g once a day.

Surgical intervention was carried out in those patients in whom C.S.F rhinorrhea was not stopped after 6 weeks of conservative management. The site of C.S.F leakage was confirmed with the help of a CT scan and MRI skull.

RESULTS

Age Distribution

Age distribution found 20 patients between ages 12 – 25 and 60 patients between 26 – 50 (Table 1).

Table 1: Age distribution.

Age – Years	12 – 25	26 – 50
Mean age	20	60
Minimum	12	26
Maximum	25	50

Gender Distribution

Gender distribution was found to be 65 males and 15 females.

Site of CSF Leakages

All cases with CSF rhinorrhea in this series had GCS above 12 – 15. These patients were managed conservatively for 2 – 6 weeks with strict bed rest, raised head side of the patient at 35 degrees, and

prophylactic antibiotics. In these patients, we tried to locate the site of CSF leakage by CT scan and MRI skull. In four patients' leakage was located. In 3 patients' leakage was at the Cribriform plate on the right side and 1 had fracture and leakage through the frontal ear sinus. According to the site of CSF leakage frontal sinus was the most common site that is 35 patients, sphenoid sinus in 24 patients, ethmoid sinus in 14, and cribriform plate found in 7 patients (Table 2).

Table 2: Site of CSF leakage

Frontal sinus	35
Sphenoid sinus	24
Ethmoidal sinus	14
Cribriform plate	07

The most common fracture sites leading to CSF leaks occur mostly through air sinus injury following trauma. CSF rhinorrhea is caused by Frontal sinus (30.8%), Sphenoid sinus (11.4 – 30.8%), Ethmoid (15.4 – 19.1%), cribriform plate (7.7%), frontoethmoidal (7.7%), and Sphenoethmoidal (7.7%) fractures.

Anterior cranial fossa fractures cause more CSF leakage than temporal bone fractures. Fractures of ethmoid bone and junction between cribriform and ethmoid were the most common cause of CSF leakage.

Out of these 80 patients in 70 patients, CSF leakage through the nose was stopped with conservative management within 3 – 6 weeks and discharged from the hospital with instructions to immediately report to Neurosurgery Department if at any time patient notices the watery discharge from the nose.

Treatments

10 patients did not respond to conservative management and CSF rhinorrhea continued despite proper conservative management for 6 weeks (Table 3).

Table 3: Mode of treatment.

Conservative	Surgical
70	10

In one patient leakage was not located properly and he underwent bifrontal craniotomy. Leakage was located by gentle retraction of the frontal lobes of the brain from the base of the skull.

The dural tear was repaired with a piece of fascia lata pasted at the site of the tear with fibrin glue. Postoperatively one patient developed meningitis and recovered with a maximum dose of Ceftriaxone. Mortality is found in 19% of patients with continuous leakage of CSF.

Ceftriaxone and cefepime were mostly used for prophylaxis but the rate of incidence of meningitis is not changed by the use of any antibiotics. Further management can be decided only after three days of strict bed rest for lumbar drainage or surgical repair is taken.

DISCUSSION

Post-traumatic CSF. leakage through the base of the skull and nose is a serious condition that results in fulminating pyogenic meningitis and serious complications if not treated properly.[13] For its precise management, the exact anatomy of the base of the skull is essential to know. Fractures of the skull base can rupture the dura and can cause CSF leakage. Such a fistula provides an open portal of entry for microorganisms through the nasopharynx and paranasal sinuses, so this is not surprising that these patients are at high risk for acute bacterial meningitis. New imaging techniques have made it possible to pinpoint the anatomical defect causing the CSF fistula.[14]

Recurrent episodes of meningitis are strongly associated with a head injury and CSF rhinorrhea. The presence of C.S.F fistula is readily suspected if

a patient complains of a persistent, clear unilateral discharge from the nose after a head injury. The spontaneous closer of such fistulae happens by adhesions of the brain into bony services or by granulation tissue in response to local infection. The quality of closure is often not enough and the threat of meningitis may remain in some cases of spontaneous closure. It is imperative to search for evidence of CSF leakage in every case with a head injury, particularly those with fractures of the skull base.[16]

The diagnosis of CSF rhinorrhea can be confirmed very simply by using a glucose oxidase test strip to demonstrate glucose in nasal discharge. Unlike nasal mucus, the CSF contains glucose.[17] Most leaks discontinue spontaneously whereas surgical repairs do not guarantee stoppage of all likely CSF leaks. Patience is key to success and waiting for the clinical status of the patient to become stable following the trauma to manage CSF Rhinorrhea surgically.

In a series by Mincy et al, CSF rhinorrhea stopped inside 24 hours in 35%, 48 hours in 68%, and 7 days in 85% of cases. In our series, only 50 patients had CSF leakage from the nose out of 2000 patients with a head injury.

This low percentage may be due to low-speed accidents or blunt injuries leading to fewer skull base fractures extending into the paranasal air sinuses.[18] The conservative measures while waiting for any intervention should be complete bed rest, head up to 25 – 30 degrees to decrease intracranial pressure, culture from nose and throat, and antibiotics.[19]

The CSF drainage is not recommended as it increases the risk of pneumocephalus and causes infection. Identification of CSF in terms of leaking fluid should pave the way to demonstrate the origins as well as the site of the fistula to localize. Biochemical findings of the collected fluid should exhibit values for sugar > 30 mg/dl to be conclusive. A total of 3 surgically treated cases of traumatic CSF rhinorrhea were documented by Cushing in 1927. Surgical options include extradural and intradural repair of dural defects. Claims published the 1st case series in 1937 treated by a transcranial extra Dural repair by fascia Lata. The intradural repair technique was used by Taylor that is now the most widely used method as mentioned by Edan in 1941.

The intracranial, intradural approach is recommended for traumatic CSF leaks which do not heal with conservative measures, Surgical repair of the fistula is done by applying a patch of abdominal fat and fascia Lata

There is continuing debate about the timing of surgical management of post-traumatic CSF leakage through the nose because most CSF leaks close spontaneously with proper conservative management and never reoccur. Surgery is not always successful and carries it is on risks so surgical repair is often delayed for 2-12 weeks after a leak has been identified. In most traumatic cases more than 50%of cases of CSF rhinorrhea stop in1 a week and mostly within 6 months.

Surgical repair of a dural tear is indicated when rhinorrhea persists, when a patient develops meningitis more than two weeks after a head injury and when a patient has recurrent episodes of meningitis after the head injury.

CONCLUSION

We concluded that all post-traumatic C.S.F rhinorrhea cases should be managed conservatively because most of the C.S.F leaks stop spontaneously with proper conservative management. So surgical repair should be delayed for 2 – 12 weeks after a leak has been identified.

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Additional Information

Disclosures: Authors report no conflict of interest.
Ethical Review Board Approval: The study was conformed to the ethical review board requirements.
Human Subjects: Consent was obtained by all patients/participants in this study.
Conflicts of Interest:
In compliance with the ICMJE uniform disclosure form, all authors declare the following:
Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.
Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Muhammad Shahid Smaija	1. Study design and methodology.
2.	Noor Fatima	2. Paper writing and data calculations.
3.	Luqman Shahid	3. Data collection and calculations.
4.	Asifa Shahid	4. Analysis of data and interpretation of results etc.