

A Hospital Based Study to Assess the Management of Cerebrospinal Fluid Rhinorrhea: An Observational Study**Gaurav Srivastava****Consultant, Department of Neurosurgery, Kashi Neuron Multispeciality Hospital, Ramnagar, Varanasi UP, India****Received: 22-10-2023 Revised: 18-11-2023 / Accepted: 10-01-2024****Corresponding Author: Dr. Gaurav Srivastava****Conflict of interest: Nil****Abstract****Aim:** The aim of the present study was to assess the management of Cerebrospinal Fluid Rhinorrhea.**Methods:** The present study was an observational study conducted at Kashi Neuron Multispeciality Hospital Ramnagar Varanasi UP, India, in Department of Neurosurgery for the period of 12 months. Oral and written consent was taken from all the participants and they will inform that they can leave the study at any time during the study. Total 50 cases came to Kashi Neuron Multispeciality Hospital, Ramnagar, Varanasi UP, India.**Results:** Out of 50 patients, 32 were female and 18 patients are male. Out of 50 patients, 48 patients were adult and 2 patients were child. Out of 50 patients, 36 patients were spontaneous in nature and 14 patients were traumatic in nature. Out of 50 cases, 31 patients had defect at Cribriform plate, 14 patients had defect at fovea ethmoidalis, 3 patient had defect at junction of posterior ethmoid and sphenoid, 2 patients had defect at lateral recess. Out of 31 patients of cribriform plate defect, 11 patients had defect at anterior portion of cribriform plate, 7 patients had defect at posterior part of cribriform plate and 6 patients had defect at lateral lamella. Out of 50 patients, 21 patients had circular defect, 18 patients had horizontal defect and 11 patients had pinpoint defect. Out of 50 patients, 29 patients were treated with fat, surgical, fascia and fibrin glue, 11 patients treated with fat surgical, fascia, flap and fibrin glue and 10 patients treated with fat surgical fascia, fibrin glue and cartilage.**Conclusion:** Most of CSF leak are spontaneous in nature, Most of patients had defect in cribriform plate & that too in anterior portion of the plate, almost all patients were adults, More Females had defect than males, Circular defects are slightly more common than Horizontal ones, and Most of the patients didn't need flap or cartilage during surgery.**Keywords:** CSF, CSF rhinorrhea, trauma, intracranial, extra cranial

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Introduction

Cerebrospinal fluid (CSF) rhinorrhea was first described in the second century AD by Galen, and his theory was that the CSF leaked into the nose through the pituitary and ethmoid regions. The correlation of posttraumatic rhinorrhea with leakage of CSF was made in the 17th century by Dutch surgeon, Bidloo the Elder. [1] Dura mater of the brain is an important barrier for any infection to ascend intracranially. Any transdural event can cause breach in its integrity, causing leak of the cerebrospinal CSF, as evident from watery nasal discharge. Transdural event can be due to trauma, nasal surgery, tumors invading skull base, or may be spontaneous.

CSF rhinorrhea ensues when the breach involves the nasal mucosa, periosteum, the bone forming the skull base in the region of nose and paranasal sinuses (PNS), endosteum, dura mater, and arachnoid mater. In each of these cases, the outcome is the same—CSF leak from the site of injury to dura and ascending

infection through the defect, causing meningitis and related complications. [2] CSF fistula is a serious and potentially fatal condition whose successful management requires a fundamental multidisciplinary approach. Until recently, the management of this condition was almost exclusively neurosurgical. [3]

CSF leaks are generally classified as traumatic, iatrogenic, and spontaneous/idiopathic. Traumatic causes include both blunt and penetrating facial injuries. Iatrogenic causes include neurosurgical and otolaryngologic approaches to neoplastic disease as well as functional endoscopic sinus surgery (FESS). Most spontaneous, or primary, causes of CSF rhinorrhea are now thought actually to be secondary to elevations in intracranial pressure (ICP) that might be seen in patients with idiopathic intracranial hypertension (IIH). Congenital skull base defects and certain tumors can also lead to CSF rhinorrhea. [4] Surgical repair of CSF leak site can be either

through an intracranial or an extracranial approach. Endoscopic approach is a type of extracranial approach which has the advantage of being less invasive, no external surgical scar, excellent site localization with preservation of the surrounding anatomy, and shorter hospital stay. Over the past decade, functional endoscopic sinus surgery has contributed considerably to the surgical armamentarium, and the endoscopic approach is considered by some of those surgeons to have become the standard of care, especially in CSF leaks of the anterior and middle skull base. [5]

CSF rhinorrhea may present spontaneously or following trauma and if untreated may lead to ascending meningitis and other complications. Management often requires the collaborative care of multiple clinicians. Although CSF rhinorrhea has been traditionally treated with open surgical procedures, the introduction of the rigid endoscope for minimally invasive endonasal procedures has revolutionized treatment for many patients. The aim of the present study was to assess the management of Cerebrospinal Fluid Rhinorrhea.

Materials and Methods

The present study was an observational study conducted at department of Neurosurgery, Kashi Neuron Multispeciality Hospital, Ramnagar, Varanasi UP, India, in Department of Neurosurgery for the period of 12 months. Oral and written consent was taken from all the participants and they will inform that they can leave the study at any time during the study. Total 50 cases came to Kashi Neuron Multispeciality Hospital, Ramnagar, Varanasi UP, India.

Inclusion Criteria

Inclusion criteria were; Patient of any age group with confirmed CSF leakage/ bony defect found in CT/MR study suffering from ANY of the following: Patient presented with traumatic head injury and has CSF rhinorrhea. Patient had past history of head trauma and presented with CSF rhinorrhea. Patient with spontaneous CSF rhinorrhea. Patient previously operated for other pathology and presented with postoperative CSF rhinorrhea.

Exclusion Criteria

Patients with no CSF leakage or bony defect found in CT/MR study.

Patients were evaluated, diagnosed, and classified using the following methods:

- History.
- Clinical examination.
- Biochemical and microbiological analysis of CSF.
- CT brain.
- CT PNS—axial and coronal cuts.

CT cisternogram/MR cisternogram.

All patients were investigated for CBS, renal and liver function, coagulation profile, viral marker of HIV, HBsAg, and blood grouping. Routine chest X-ray, USG chest and abdomen, and ECG were done. Patients with specific medical comorbidity were evaluated accordingly. Patients with spontaneous rhinorrhea underwent fundus examination and CSF manometry.

Leak site were classified into the following five locations:

- Anterior ethmoid roof.
- Posterior ethmoid roof.
- Sphenoid sinus.
- Cribriform plate.
- Frontal sinus.

All patients were given intravenous (IV) broad-spectrum antibiotics and oral antibiotic afterward. In conservative treatment, patients were kept in supine position, given stool softener, and advised to avoid unnecessary staining. All patients were given acetazolamide 250 mg tid dosage. Patients were evaluated for routine vitals and signs of meningitis. Patients were observed for 7 days. In operative treatment, for intracranial approach, bicoronal skin flap and elevation of depressed fracture were done if necessary. CSF leak site was confirmed and fascia lata, temporalis fascia, or pericranium was used to repair leak. Dural substitutes were sutured in watertight fashion by silk 4–0. In our Department of Neurosurgery, we took complete history, complete Ear, Nose, Throat and Head and Neck examination, Endoscopic examination of nasal cavity followed by Radiological test in the form of MR Cisternography. Depending upon the site of leak CSF leak repair done via endoscopic method of overlay and underlay and with the help of fascia, fat, surgical, flap, fibrin glue and cartilage.

Results

Table 1: Baseline characteristics

Gender	N	%
Male	18	36
Female	32	64
Age group		
Adult	48	96
Child	2	4
Nature of defect		
Spontaneous	36	72
Traumatic	14	28
Site of leak		
Cribriform plate	31	62
Fovea ethmoidalis	14	28
Lateral Recess	2	4
At junction of posterior ethmoid and sphenoid	3	6

Out of 50 patients, 32 were female and 18 patients are female. Out of 50 patients, 48 patients were adult and 2 patients was child. Out of 50 patients, 36 patients were spontaneous in nature and 14 patients were traumatic in nature. Out of 50 cases, 31 patients

had defect at Cribriform plate, 14 patients had defect at fovea ethmoidalis, 3 patient had defect at junction of posterior ethmoid and sphenoid, 2 patients had defect at lateral recess.

Table 2: Exact site in cribriform plate defect

Site in cribriform plate defect	N	%
Anterior portion of cribriform plate	18	58.07
Posterior portion of cribriform plate	7	22.58
Lateral lamella	6	19.35

Out of 31 patients of cribriform plate defect, 11 patients had defect at anterior portion of cribriform plate, 7 patients had defect at posterior part of cribriform plate and 6 patients had defect at lateral lamella.

Table 3: Shape of defect and type of closure

Shape of defect	N	%
Circular	21	42
Horizontal	18	36
Pinpoint	11	22
Type of closure		
Fat, surgical, fascia and fibrin glue	29	58
Fat surgical, fascia, flap and fibrin glue	11	22
Fat surgical fascia, fibrin glue and cartilage	10	20

Out of 50 patients, 21 patients had circular defect, 18 patients had horizontal defect and 11 patients had pinpoint defect. Out of 50 patients, 29 patients were treated with fat, surgical, fascia and fibrin glue, 11 patients treated with fat surgical, fascia, flap and fibrin glue and 10 patients treated with fat surgical fascia, fibrin glue and cartilage.

Discussion

Anterior cranial fossa cerebrospinal fluid (CSF) rhinorrhea presents complex challenges for management and repair because of the diverse etiologies, including blunt or penetrating head trauma and surgery for inflammatory or neoplastic sinonasal disease. In addition, CSF leaks may develop spontaneously in some cases. [6,7] Numerous techniques are described for the

management of CSF rhinorrhea, ranging from bed rest, with or without lumbar drain (LD) placement, to surgical management. Surgical management offers a variety of approaches for successfully closing a CSF fistula. The first successful intracranial repair of a CSF leak using a bifrontal craniotomy was reported by Dandy [8] in 1926. Advantages of the transcranial approach include direct visualization of the dural tear, the opportunity to address any associated brain injury, and the ability to use a pericranial flap in the repair. Disadvantages include the morbidity of the craniotomy and the associated permanent anosmia caused by manipulation of the olfactory bulbs. Repairs involving craniotomy have been reported to be successful in up to 80% of cases. [9]

As in this era of sedentary lifestyle, spontaneous CSF leak is known to be new entity to the world. As Minute injuries to Major inadvertent trauma over head and neck can also lead to CSF leak. [10] The cerebrospinal fluid (CSF) is a vital fluid that surrounds and protects the brain and spinal cord. It plays a crucial role in maintaining the optimal functioning of the central nervous system (CNS) by providing mechanical support, buoyancy, and metabolic exchange. [11] Under normal circumstances, CSF is contained within the protective layers of the meninges, but sometimes, due to various factors, a breach in this protective barrier can occur, leading to a CSF leak. [12] CSF leaks can be defined as abnormal communications between the subarachnoid space, where CSF circulates, and the extracranial or spinal spaces. These leaks can manifest through various sites, such as the skull base, spine, or middle ear, and can result from traumatic injuries, congenital malformations, surgical complications, or underlying medical conditions. [13,14] Out of 50 patients, 32 were female and 18 patients are male. Lindstrom et al [15] study in Wisconsin medical college had 53 patients, 28 were females and 25 were men. Out of 50 patients, 48 patients were adult and 2 patients were child. Out of 50 patients, 36 patients were spontaneous in nature and 14 patients were traumatic in nature. Spontaneous CSF rhinorrhea occurs in patients with high intracranial pressure, resulting in remodeling and thinning of the bones at the skull base, and also causing leak which actually acts as a safety valve. An intracranial neoplasm, hydrocephalus or the benign intracranial hypertension act on the prolongation of arachnoid sleeves around the olfactory fibers. The dura at this area ruptures and lets out the CSF to decrease the intracranial pressure.

Out of 50 cases, 31 patients had defect at Cribriform plate, 14 patients had defect at fovea ethmoidalis, 3 patient had defect at junction of posterior ethmoid and sphenoid, 2 patients had defect at lateral recess. Out of 31 patients of cribriform plate defect, 11 patients had defect at anterior portion of cribriform plate, 7 patients had defect at posterior part of cribriform plate and 6 patients had defect at lateral lamella. Out of 50 patients, 21 patients had circular defect, 18 patients had horizontal defect and 11 patients had pinpoint defect. Out of 50 patients, 29 patients were treated with fat, surgical, fascia and fibrin glue, 11 patients treated with fat surgical, fascia, flap and fibrin glue and 10 patients treated with fat surgical fascia, fibrin glue and cartilage. Multiple factors influence the success of CSF leak repairs. Studies support the importance of distinguishing between low-flow and high-flow CSF leaks before treatment plans are developed. [16] Large dural defects have more successful rates of CSF leak closure when a vascularized reconstructive

approach is used compared to free graft reconstruction. [17]

Conclusion

Most of CSF leak are spontaneous in nature, Most of patients had defect in cribriform plate & that too in anterior portion of the plate, almost all patients were adults, More Females had defect than males, Circular defects are slightly more common than Horizontal ones, and Most of the patients didn't need flap or cartilage during surgery.

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