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A RETROSPECTIVE ANALYSIS OF ENDOSCOPIC MANAGEMENT OF CSF RHINORRHEA IN TERTIARY CARE CENTRE

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KN- Definition of intellectual content, Literature survey, Prepared first draft of manuscript, Implementation of study protocol, data collection, data analysis, manuscript preparation and submission of article, **SA-** Concept, design, clinical protocol, manuscript preparation, editing and revision **KVK-** Review manuscript, preparation of tables and graphs, Coordination and manuscript revision

ABSTRACT

Introduction: Transnasal endoscopic repair is now the preferred treatment for most defect in the anterior cranial and sphenoid sinus. This paper aims to assess the outcomes of endoscopic management in treating cerebrospinal fluid (CSF) rhinorrhea at a tertiary care centre in northern India.

Aims and Objectives : The goal of this study was to examine the outcomes of endoscopic management of cerebrospinal fluid (CSF) rhinorrhea through a collaborative effort between neurosurgeons and otorhinolaryngologists.

Materials and methods: A retrospective analysis was conducted on 30 consecutive patients who underwent endoscopic repair of cerebrospinal fluid (CSF) rhinorrhea between 2021 and 2023. The endoscopic procedure involved identifying the defect and removing the surrounding mucosa for 3-4 mm. Repair was carried out using materials such as septal cartilage, fascia lata, oxidized cellulose, and fibrin sealant. In selected cases, a lumbar drain was placed for 2-4 days. Patients with spontaneous CSF rhinorrhea and high opening lumbar CSF pressure received a lumbar peritoneal shunt.

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Results: Spontaneous cerebrospinal fluid (CSF) leaks were found to be more prevalent among middle-aged females, while posttraumatic CSF leaks were commonly observed in young adult males. Following the initial surgery, success rates for patients with posttraumatic, spontaneous, and postprocedural CSF leaks saw significant improvement to 100% after a second procedure. Recurrence of leaks was attributed to various factors, including technical failures, poor graft uptake due to radiation therapy, the location of the leak in the lateral sphenoid recess, malfunction of lumbar peritoneal shunts, and inadequate healing of skull base fractures.

Conclusions: Effective collaboration between neurosurgeons and otorhinolaryngologists is crucial for achieving a high success rate in endoscopic repair of cerebrospinal fluid (CSF) rhinorrhea. This teamwork involves meticulous attention to key steps, including identifying the site of the leak, preparing the graft bed, securely placing the graft, and providing comprehensive postoperative care. Such a coordinated approach enhances the overall success and outcomes of the endoscopic repair procedure for CSF rhinorrhea.

Keywords: Cerebrospinal fluid rhinorrhea, endoscopy, transnasal

INTRODUCTION

Cerebrospinal fluid (CSF) rhinorrhea occurs due to the breakdown of physiological barriers between the subarachnoid space and the nasal cavity. Surgical intervention is necessary to prevent potentially life-threatening complications, such as meningitis and brain abscess, which can be observed in 10-40% of patients during follow-up.[1]

The popularity of endoscopic repair has grown significantly since Wigand reported the first instance of endoscopic CSF leak repair in 1981.[2] This approach offers excellent illumination, a stereoscopic view of anatomical details of the skull base, and avoids the morbidity associated with craniotomy. Moreover, documented success rates exceeding 90% in expert hands have established transnasal endoscopic repair as the preferred procedure for most anterior cranial fossa and sphenoid sinus CSF leaks.[3]

Compared to the intracranial approach, the endoscopic method provides superior illumination, higher success rates, and involves minimal morbidity.[3-6] This has contributed to its widespread adoption in the management of CSF rhinorrhea, reflecting its efficacy in addressing these challenging conditions.

AIMS AND OBJECTIVES

The objective of this study was to analyze the results of endoscopic management of CSF rhinorrhea by a team of neurosurgeons in collaboration with otorhinolaryngologists.

MATERIAL AND METHODS

A retrospective analysis was conducted on 30 consecutive patients who underwent endoscopic management for cerebrospinal fluid (CSF) rhinorrhea between 2021 and 2023. The study collected details related to the CSF leak's etiology, clinical presentation, surgical

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procedure, and hospital stay. Patient follow-ups were conducted either in the outpatient department or via telephone after discharge.

The diagnosis of CSF rhinorrhea was confirmed by assessing glucose levels in the watery discharge. Additional evaluations, such as high-resolution computed tomography (CT) scans of paranasal sinuses or magnetic resonance (MR) cisternograms, were performed as deemed appropriate. Patients with contraindications for MRI underwent a CT cisternogram. Opening lumbar CSF pressure was measured in cases of spontaneous CSF rhinorrhea. Patients with traumatic CSF rhinorrhea presenting after 48 hours underwent CSF analysis to rule out meningitis. Those with meningitis received intravenous antibiotics for at least 5 days before surgery.

The initial stage of surgery was carried out by an otorhinolaryngologist. Under general anesthesia, nasal mucosa was decongested, and various sinus leaks were accessed through specific approaches. After identifying the defect, a neurosurgeon prepared the graft bed by removing surrounding normal mucosa and fibrous tissue. Repair materials included fat (harvested from the thigh), fascia lata, oxidized cellulose, and fibrin sealant. Nasal septal cartilage was used for covering bony defects larger than 1 cm. A nasal pack was placed at the end of the procedure.

Indications for lumbar drain placement included active CSF leak, multiple intraoperative CSF leak areas, dural defects, encephalocele, and skull base bone defects larger than 1 cm. Lumboperitoneal shunts were inserted in spontaneous CSF rhinorrhea cases with high opening CSF pressure. For traumatic CSF rhinorrhea cases, concurrent repair of frontal sinus was performed if the inner table of the frontal sinus was fractured and displaced.

Postoperatively, measures were taken to prevent elevated intracranial pressure, and patients were instructed not to blow their noses. Lumbar CSF drainage was performed until nasal packs were removed on postoperative day 3, after which the drain was clamped for the next 24 hours and removed if no CSF leak evidence was found. The first follow-up visit was scheduled between 2 and 4 weeks after discharge, with subsequent visits planned according to patient convenience. Telephonic interviews were conducted for patients not compliant with follow-up.

RESULTS

During the study period, a total of 30 patients underwent surgical repair for cerebrospinal fluid (CSF) rhinorrhea, categorized into traumatic (n = 18), spontaneous (n = 8), and postprocedural or iatrogenic (n = 6) cases. There was a male gender predilection observed in posttraumatic and postprocedural leaks, while spontaneous leaks were more common in female patients within the age group of 40-59 years. The highest incidence of traumatic CSF leaks was noted in young adult males (20-39 years).

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The most common presentation was a watery discharge from the nostril, and clinical signs consistent with meningitis were observed in five posttraumatic leaks, two postprocedural leaks, and one spontaneous leak. Postprocedural leaks occurred following transsphenoidal resection of pituitary adenoma, resection of clinoidal meningioma, and orbital adenoid cystic carcinoma.

The predominant site of leak in postprocedural CSF leaks was the sphenoid sinus, while cribriform and sphenoid were the most common sites for spontaneous CSF leaks, respectively. Posttraumatic CSF leaks often involved multiple sites, and a supraorbital frontal sinusotomy was performed for managing associated frontal sinus defects.

Concomitant lumbar thecoperitoneal shunts were placed in two patients with spontaneous CSF leaks, and lumbar peritoneal shunt placement occurred in one patient each from the posttraumatic and postprocedural groups. Two patients in the postprocedural group experienced CSF leaks following radiation therapy for the primary tumor.

Among the three failures in the posttraumatic group, two had recurrent leaks from the same site, while the third developed a leak from another large defect in the floor of the anterior cranial fossa. All recurrent leaks, except one, were successfully repaired with a second endoscopic approach. Among the seven failures, four patients exhibited CSF leaks during the primary admission, while the others became symptomatic 5, 17, and 23 months following the first surgical repair. No morbidity or mortality related to the surgical procedure was reported in the series.

Table 1: Gender Distribution

Gender	No. of patients
Male	20
Female	10

Table 2: Location of leak

LOCATION OF LEAK	NUMBER OF PATIENTS
CRIBRIFORM	**10**
ETHMOID	**5**
SPHENOID	**10**
MULTIPLE SITES	**5**

DISCUSSION

In this study, the occurrence of posttraumatic cerebrospinal fluid (CSF) leaks exceeded that of spontaneous and postprocedural leaks. This finding diverges from a meta-analysis where spontaneous leaks were reported to be more prevalent.[7,16] Posttraumatic CSF leaks exhibited a higher prevalence in males aged 20-39 years, whereas spontaneous leaks were more prevalent in females aged 40-59 years. Spontaneous leaks often occurred at the sphenoid and

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cribriform plate, while posttraumatic cases involved leaks from multiple sites, with cribriform plate and sphenoid being the most common locations.[7-15] Therefore, it is crucial to thoroughly examine all areas associated with skull base fractures to identify evidence of dural breach or cerebrospinal fluid (CSF) leak in patients with traumatic CSF rhinorrhea. The success of endoscopic transnasal surgical repair relies on precise preoperative localization of the leak site, careful preparation of the recipient bed, and accurate placement of the graft material.[3,6] In their meta-analysis, Hegazy et al., found no statistically significant difference among different grafting techniques and materials[16] In our study, we addressed the skull base defect through the use of fat, fascia lata, oxidized cellulose, and fibrin sealant for repair. Additionally, a nasal septal cartilage segment was employed to cover the sphenoid ostia after sinus packing with fat and fibrin glue. The effectiveness of fibrin glue in preventing cerebrospinal fluid (CSF) leaks remains a subject of debate. Despite histopathological studies suggesting that fibrin glue might induce an inflammatory response conducive to healing, various investigations have reported success rates ranging from 92% to 100% without the use of glue and up to 97% with its application.[11,12,16-19] Mohindra et al., evaluated CSF leaks in 27 pediatric patients and found no statistically significant difference in outcome of endoscopic repairs with or without fibrin glue[20] Rodney et al., suggested that if tissue adhesives are used, they must be applied conservatively because a thick layer of adhesive may prevent the graft material from coming in contact with the wound bed[21] Several authors have reported successful results with relatively consistent use of lumbar drain, whereas others have reported similar results without lumbar drain placement[22-24] Based on a meta-analysis involving 14 studies and encompassing 289 repairs of cerebrospinal fluid (CSF) fistulae, Hegazy et al. recommended the utilization of lumbar drains for a duration of 3-5 days. This recommendation was specifically directed towards cases of idiopathic leaks, posttraumatic leaks, leaks associated with large defects (>15mm), recurrent leaks, and leaks linked to a meningocele.[16] We justified the placement of a lumbar drain in 80% of our patients based on the criteria recommended by Hegazy et al. In a meta-analysis of 55 studies involving 1,778 repairs of fistulae, Psaltis et al. reported a success rate of 90.6% after the initial endoscopic repair for cerebrospinal fluid (CSF) rhinorrhea. This success rate increased to 96.6% following a second endoscopic procedure.[7] The success rate in the largest series of endoscopic repair of CSF leaks reported by Kirtane et al., was 96.63% following first surgery and 98.88% after revision surgery .[8] Castelnuovo et al. conducted a review of 286 endoscopic repairs for cerebrospinal fluid (CSF) leaks, identifying 28 cases of failure in the initial attempt. However, many authors did not specify the precise site of failure and provided limited details. Based on their experience with failures, it became evident that a meticulous technique, including accurate preparation of the margins and graft coverage of at least 5 mm from the margins, was crucial..[25]

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