

# Endoscopic Surgical Approach to CSF Rhinorrhoea-Analysis of 30 Cases

Rajesh Vishwakarma<sup>1</sup>, Kalpesh Patel<sup>2</sup>, Dipesh Darji<sup>3</sup>, Zeenat Ekkiswala<sup>4</sup>, Divya Agrawal<sup>5</sup>

<sup>1</sup>Gujarat University, Professor and Head, Department of E.N.T., Civil Hospital, Asarwa, Ahmedabad, Gujarat, India

<sup>2</sup>Gujarat University, Assistant Professor, Department of E.N.T., Civil Hospital, Asarwa, Ahmedabad, Gujarat, India

<sup>3</sup>Gujarat University, Assistant Professor, Department of E.N.T., Civil Hospital, Asarwa, Ahmedabad, Gujarat, India

<sup>4</sup>Gujarat University, Third year Resident, Department of E.N.T., Civil Hospital, Asarwa, Ahmedabad, Gujarat, India

<sup>5</sup>Gujarat University, Third year Resident, Department of E.N.T., Civil Hospital, Asarwa, Ahmedabad, Gujarat, India

**Abstract:** *Endoscopic endonasal surgery is a minimally invasive surgical technique and is gaining popularity for csf leak repair. The aim of our study was to study the cases of csf rhinorrhoea treated at our institution and evaluate the outcomes of endoscopic endonasal csf rhinorrhoea repair of the anterior and middle skull base.*

**Keywords:** CSF, Rhinorrhoea, Endoscopic, facia lata, bath-plug.

## 1. Introduction

CSF rhinorrhoea is the leakage of cerebrospinal fluid from subarachnoid space into the nasal cavity due to defect in the dura, bone and mucosa. CSF is formed in the choroid plexuses of the third and fourth ventricles. It flows from the lateral ventricle into the third ventricle through the foramen of Monroe then into the fourth ventricle through the aqueduct of Sylvius and then into the subarachnoid space through the foramen of Magendie and foramen of Luschka.

CSF leaks of the anterior skull base present one of the more difficult challenges in Endonasal endoscopic surgery (EES), involving an area that is anatomically complicated and technically demanding to access. The challenge is to recreate the barrier between the cranial vault and the nasal cavity to prevent and eliminate cerebrospinal fluid (CSF) leaks and protect the brain from exposure to infectious sources. Approximately 90% of CSF leaks at the anterior skull base manifests as rhinorrhea and can become life-threatening condition [1, 2]. CSF leak bears the risk of meningeal or intracranial infection and complication [3]. And any persistent CSF leak should be repaired [1]. Evaluation of the endoscopic repair of sinonasal CSF leaks has shown high success rates of 90% for first attempts at repair and up to 97% following a second endoscopic repair [1-3].

EES is a minimally invasive surgical technique, which provided a direct short-cut access to anterior and middle skull base without traversing any major neurovascular structures, which until recently accounted for a significant morbidity and a high-risk surgery [4] and CSF fistula is now one of its well-established indications. CSF leaks can have many etiologies including spontaneous, tumor-related, traumatic (accidental or iatrogenic), or congenital leaks. Etiology affects the risk of recurrence and thus the method of repair by having an impact on the defect size, location, degree of dural involvement, the likelihood of elevated intracranial pressure (ICP), and the possibility of meningoencephalocele protrusion [5-7]. The aim of this

article is to consider our experience and to evaluate the outcomes in patients who underwent a purely endoscopic repair of CSF leaks of the anterior skull base.

## 2. Aims and Objectives

1. To evaluate the outcome of endoscopic repair of csf rhinorrhoea
2. To study the techniques adopted for endoscopic repair and various graft materials used.

### 2.1 Study Design

Retrospective case analysis.

### 2.2 Materials and Method

Retrospective study was done of thirty patients treated for csf leaks of the anterior skull base presenting to our department of ENT, Civil hospital, Ahmedabad between June 2011 till March 2013. Data were collected according to the patient's characteristics, CSF fistula, surgical techniques, materials used to repair the defect, and complications.

#### 2.2.1 Inclusion Criteria

- Defects less than 1.5 cm in size
- Defects of cribriform, ethmoid, sphenoid and frontal recess area.

#### 2.2.2 Exclusion Criteria

- Defects greater than 1.5 cm
- Defect of posterior wall of frontal sinus
- Multiple skull base fractures
- Tumours with increased ICP

Patients presented with watery (clear) nasal discharge which was Intermittent or continuous and Increased on leaning forward. Patients had headache and there was history of recurrent meningitis, head injury or previous surgery in few cases.

### 3. Preoperative Evaluation

Preoperatively patients underwent various evaluations to confirm CSF leak and location, including thorough history and physical examination with nasal endoscopy and testing including magnetic resonance imaging (MRI), computed tomography (CT),  $\beta$ -2 transferrin testing for confirmation of CSF rhinorrhea (a protein found almost exclusive in CSF). MRI was preferred due to less exposure to radiation and being noninvasive.

### 4. Treatment Adopted

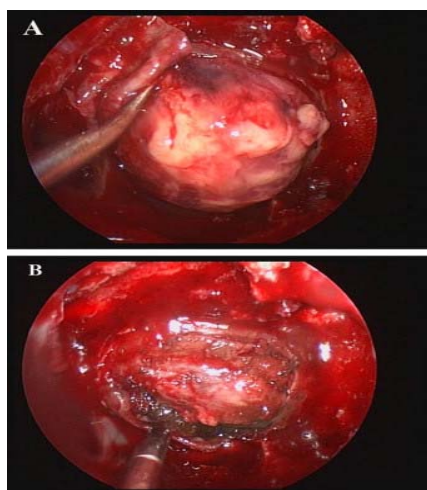
- Observation and medical management
- Transnasal Endoscopic Repair for spontaneous rhinorrhoea cases and 2 of 6 traumatic cases that did not respond to conservative management.

**Conservative measures** were used in traumatic cases **included** strict bed rest, head end elevation, avoiding strain, anti-tussives, laxatives, oral diuretics: Acetazolamide, lumbar drain (+/-) and prophylactic antibiotics.

**Surgical steps** used were used which include intrathecal dye (Flourescin dye) was used preoperatively in few cases which was injected through lumbar puncture. 0.25 ml of 5% flourescin was used. On endoscopy csf leak appeared to be bright yellow green coloured

### 5. Endoscopic Repair: Technique Used

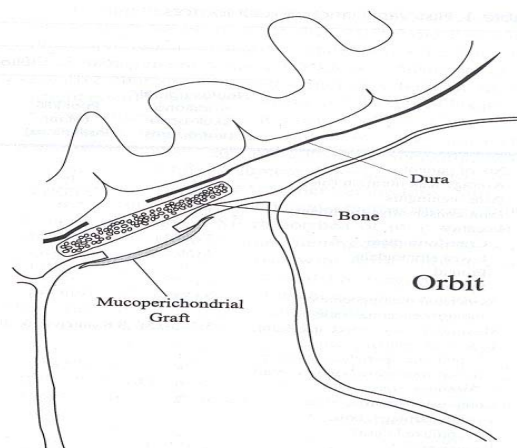
Adequate exposure of defect by complete ethmoidectomy / maxillary sinustomy/ frontal sinustomy/ sphenoidotomy/ middle/superior turbinectomy as required. Mucosa surrounding the defect site about 5 mm was stripped away. Encephaloceles were reduced by bipolar electrocautery at the stalk. Then graft was placed followed by fibrin glue. In all cases we used fibrin glue to improve adherence of the graft, and the graft was supported in place with layers of Surgicel, to separate the graft from the packing material, to prevent avulsion of the graft or flap during its removal. Absorbable nasal packing was placed adjacent to the grafts followed by nonabsorbable packing.



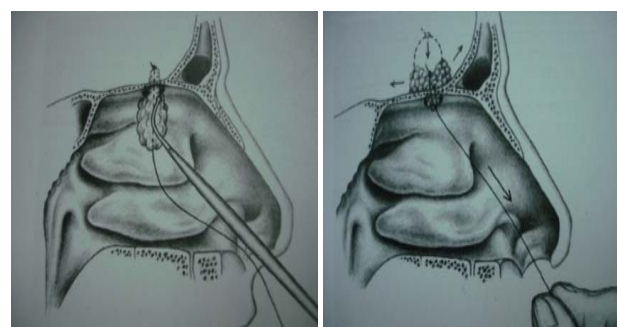
**Figure (1) A:** Fat placement at site of leak followed by  
**Figure (1) B:** Facia lata graft and fibrin glue.

Graft materials used for repair were fat, facia lata, nasal septal mucoperichondrial flap, middle turbinate flap and septal cartilage. Technique used for graft placement:

- Overlay technique when size of defect is <3mm
- Underlay technique when size of defect is >3mm
- Bath plug technique when size of defect is up to 2 cm.



**Figure 2:** Combined (overlay and underlay grafting)



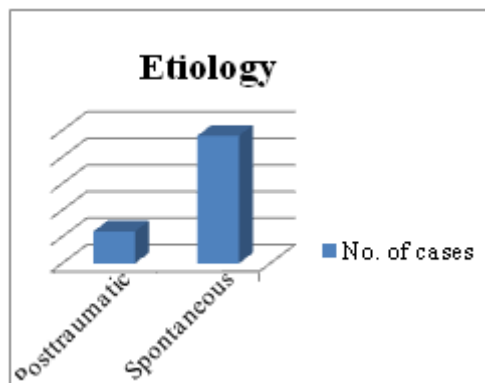
**Figure 3:** Bath Plug technique.

### 6. Preoperative Management

- Use of a lumbar drain in 8 patients.
- Average duration for keeping lumbar drain was 4 days
- Intravenous antibiotics used for 5 days followed by oral antibiotics for 2-3 weeks.
- Patients were instructed to avoid strain.

### 7. Observation and Results

From the etiological point of view, dural defects were classified into two groups: Six cases were posttraumatic while twenty four cases were spontaneous csf leaks.



Graph 1: Etiology of csf rhinorrhoea

The most frequent site of the anterior skull base defect was the cribriform plate, followed by the ethmoids and sphenoids. There was associated encephalocele in two cases.

Table 1: Showing site and size of csf leak.

Sites of leak	Associated encephalocele	Size of defect
Defect in cribriform plate on both sides	-	3.6 mm
Left lateral wall of sphenoid sinus	-	2.3 mm
Rt side cribriform plate	-	3.4 mm
Left cribriform plate	-	4.7 mm
Left cribriform plate	-	4.0 mm
Rt side cribriform plate	-	14 mm
Rt side cribriform plate & anterior ethmoids	Yes	4.4 mm
Left side cribriform plate	-	5.4 mm
Left side ethmoids	-	-
Left cribriform plate	-	3.4 mm
Rt cribriform plate	-	2 mm
Rt cribriform plate	-	2.6 mm
Left cribriform plate	-	15 mm
Rt side cribriform plate & anterior ethmoid	Yes	4.4 mm
Lateral wall of sphenoid	-	3.2 mm



Figure 4: Preop CT scan showing defect in lateral wall of sphenoid.



Figure 5: Postop CT scan of same patient.

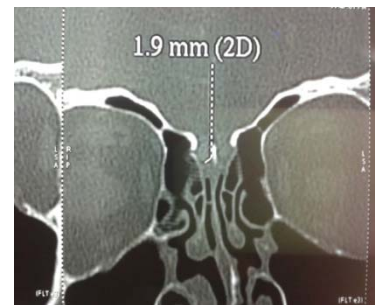


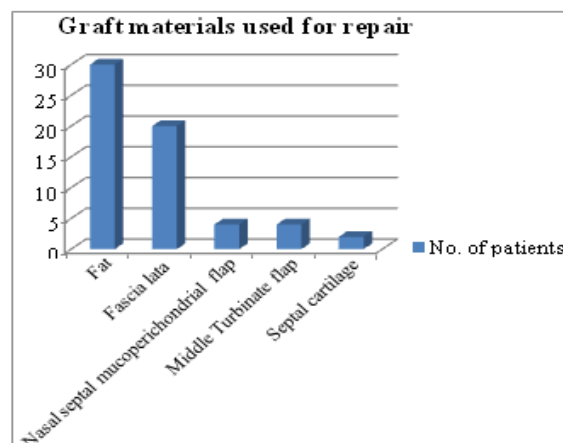
Figure 6: Preop CT scan showing defect in cribriform plate



Figure 7: Postop CT scan of same patient

## 8. Results

The closure technique used depended on the size and location of the fistula. The most frequently used graft was fat combined with facia lata.



Graph 2: Graft materials used for repair

The success rate was (93.34%) at the first attempt; only one patients (6.6%) required a second surgical procedure, and none of it was necessary to use a craniotomy for closure. Follow-up periods ranged from 4 months to 2 years. The radiological diagnosis by CT cisternography confirmed the CSF leaks and location the defect in 15/15 (100%) patients. Three of the traumatic csf leaks responded well to conservative management, rest were surgically repaired. No patients had any complications following endoscopic csf leak repair except one recurrence.



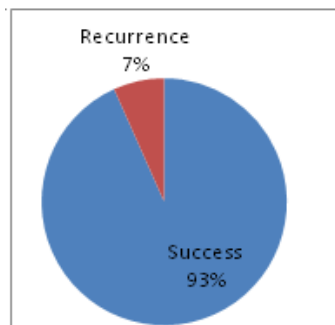


Figure 8

## 9. Discussion

In recent years we have seen the establishment of the ESS as a technique of choice for closure of CSF leak, seen as a less invasive technique with less morbidity and mortality, excellent view of the surgical field, and a higher success rate (about 95%), replacing the usual techniques, such as transcranial and extracranial interventions that had a success rate of 70% with significant morbidity (anosmia was permanent sequel) [8]. The presence of CSF rhinorrhea entails a significant risk to the patient's life [3]. The clinical confirmation should be performed by nasal inspection and determination of CSF markers such as  $\beta$ 2-transferrin, which has high specificity and sensitivity [10]. A CSF fistula entails a risk of bacterial meningitis in the long term, approximately 40% [10], situation may worsen when the healing of the repair is insufficient, when you leave a lumbar drain, or the administration of prophylactic antibiotics that increase the bacterial resistance and promote infection [3].

The identification of the site is necessary for successful surgical repair. CT, with and without contrast, and nasal endoscopic exploration are the most common form of locating the fistula, and when not displayed properly, CT cisternography is a helpful test. Combined use of fat and facia lata is effective in csf leak repair. Analysis of nasal fluid is problematic because simple testing such as observing how the drainage dries on paper (known as a ring sign) or measuring the sugar content (reflecting the elevated glucose content of CSF) may not be valid (Dula, 1993). Whereas, the presence of the enzyme  $\beta$ 2-transferrinase is only found in CSF, but requires the collection of several milliliters of fluid to be sent for highly specialized laboratory testing.

The use of intrathecal fluorescein should be avoided for serious complications that can arise. Lumbar drainage may increase morbidity and hospital stay. To observe the leak during surgery, increased intracranial pressure by increasing the pressure at the abdomen allows us to locate the CSF leak as a stream of clear liquid and transparent. Lumbar drainage should be reserved for patients with elevated intracranial pressure and the conservative measures, such as bed rest, elevation of the head, avoidance of straining activities is sufficient to ensure the sealing of the leak.

## 10. Conclusion

- ESS have made procedures minimally invasive, and CSF fistula is now one of its well-established indications with low morbidity and high success rate, with one restriction

for fistulas of the posterior wall of the frontal sinus that should be repaired in conjunction with open techniques.

- Identifying the size, site, and etiology of the CSF fistula remains the most important factor in the surgical success.
- The risk of bacterial meningitis, with a significant mortality rate, is high enough to consider surgical closure of the fistula. Endoscopic repair provides excellent results, and allows us to address a problem that until recently was a serious medical conflict.

## References

- [1] Kim E, Russell PT: Prevention and management of skull base injury. *Otolaryngol Clin North Am* 2010, 43(4):809
- [2] Wigand ME: Transnasal ethmoidectomy under endoscopic control. *Rhinology* 1981, 19(1):715.
- [3] Bernal-Sprekelsen M, Alobid I, Mullol J, Trobat F, Tomás-Barberán M: Closure of cerebrospinal fluid leaks prevents ascending bacterial meningitis. *Rhinology* 2005, 43(4):277-81.
- [4] Hegazy HM, Carrau RL, Snyderman CH, Kassam A, Zweig J: Transnasal endoscopic repair of cerebrospinal fluid rhinorrhea: a meta-analysis. *Laryngoscope* 2000, 110:116-117
- [5] Schlosser RJ, Wilensky EM, Grady MS, Bolger WE: Elevated intracranial pressures in spontaneous cerebrospinal fluid leaks. *Am J Rhinol* 2003, 17:191-195.
- [6] Carrau RL, Snyderman CH, Kassam AB: The management of cerebrospinal fluid leaks in patients at risk for high-pressure hydrocephalus. *Laryngoscope* 2005, 115(2):205-12.
- [7] Senior BA, Jafri K, Benninger M: Safety and efficacy of endoscopic repair of CSF leaks and encephaloceles: a Survey of the members of the American Rhinologic Society.
- [8] *Am J Rhinol* 2001, 15:21-25. PubMed Abstract
- [9] Schnipper D, Spiegel JH: Management of intracranial complications of sinus surgery. *Otolaryngol Clin North Am* 2004, 37(2)
- [10] Woodworth BA, Prince A, Chiu AG, Cohen NA, Schlosser RJ, Bolger WE, Kennedy DW, Palmer JN: Spontaneous CSF leaks: a paradigm for definitive repair and management of intracranial hypertension.
- [11] *Otolaryngol Head Neck Surg* 2008, 138(6):715-20.
- [12] Park JI, Strelzow VV: Friedman WH Current management of cerebrospinal fluid rhinorrhea. *Laryngoscope* 1983, 93(10):1294-300.

## Author Profile



**Dr. Rajesh Vishwakarma** received his M.S (D.L.O) Degree from Gujarat University. He is in Field of Teaching and Research enrolled in Govt. of Gujarat since 18 years. He is Professor and Head of Department at B.J Medical College, Civil Hospital, Ahmedabad. He is an established Cochlear Implant Surgeon who had done around 350 implant surgeries and an active member of Cochlear Implant Group of India.



**Dr. Kalpesh Patel, M.S. (D.L.O)**, passed from Gujarat University in 2000 and is Assistant Professor at B.J Medical College, Civil Hospital, Ahmedabad with an experience of more than 11 years. He has keen interest

in endoscopic skull base and cochlear implant surgeries.

**Dr Dipesh Darji** M.S passed from Gujarat University in 2011 and is Assistant Professor at B.J Medical College, Civil Hospital Ahmadabad with an experience of 2 years

**Dr. Zeenat M Ekkiswala** is a third year resident in B.J Medical College, Civil Hospital Ahmadabad, under Dr. Rajesh Vishwakarma

**Dr. Divya Agrawal** is a third year resident in B.J Medical College, Civil Hospital Ahmadabad, under Dr. Rajesh Vishwakarma.