

Retrospective examination of the trans-nasal endoscopic correction of cerebrospinal fluid rhinorrhoea

Badal Kumar¹, Jitendra Kumar²

¹Senior Resident, Department of ENT, AIIMS, Raipur, Chhatisgarh, India.

²Senior Resident, Department of ENT, Jannayak Karpoori Thakur Medical College and Hospital, Madhepura, Bihar, India

Received: 09-06-2021 / Revised: 28-07-2021 / Accepted: 24-08-2021

Corresponding author: Dr. Jitendra Kumar

Conflict of interest: Nil

Abstract

Aim: The aim of this study to evaluate the trans-nasal endoscopic repair of cerebrospinal fluid rhinorrhoea. **Methods:** The retrospective study was conducted in the Department of ENT, Jannayak Karpoori Thakur Medical College and Hospital, Madhepura, Bihar, India for 1 year, On the basis of medical records of 20 patients (13 males and 7 females) who had CSF rhinorrhoea and underwent trans-nasal endoscopic repair in Department of ENT. Patients were assessed for demographic profile, etiology of CSF leak and its duration, endoscopic findings, radiographic findings, location of leak, surgical repair and post-operative outcome. Retrieved data was represented in frequency and proportion in tabulated form for evaluation of results. Patients with defect size less than 1.5 cms; cases involving cribriform, ethmoid, sphenoid or frontal recess region of skull base were included in this study. **Results:** Etiological factor for CSF leak was found to be accidental trauma in 65% cases. In 3 patient causes was iatrogenic resulting from polypectomy. Spontaneous rhinorrhoea was observed in 20% subjects. Majority of patients (70%) presented with intermittent leaks whereas 30% were suffering from continuous type of leakage. Radiographic examination revealed bony defects in all these cases with concurrent meningocele and Meningo-encephalocele in 10 % and 55% cases respectively. Most common location of defect in this cohort was cribriform plate of ethmoid (80%) whereas it was fovea ethmoidalis in 20% patients. Cysternography was carried out in 30% patients to delineate the defect because of doubts in defining the lesion by HRCT/MRI in these cases. Fat, middle turbinate (MT) mucosa and septal bone were used as graft to fill the defects in 55% cases. 10 % of patients were treated by fat, MT mucosa and inferior turbinate mucosa. Fat, MT mucosa and septal cartilage were used in 10% and in 25% cases fat, septal mucosa and fibrin glue were used as grafts to seal the dehiscence. Post-operatively, lumbar drain was used in 38% cases only. **Conclusion:** The endo-nasal endoscopic closure is a safe and effective technique for repair of CSF rhinorrhoea. There is minimal intranasal trauma. An overall rate of successful repair was 100%.

Keywords: Rhinorrhoea, Endoscopy, Intranasal Trauma.

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Cerebrospinal fluid (CSF) is a clear, colorless fluid present in ventricles, cisterns, and subarachnoid space around the brain and spinal cord. An average of 500 ml/day is produced mainly by choroid plexus and absorbed back through arachnoid villi[1] any mismatch paranasal sinus leading between production and absorption leads to increased intracranial pressure and CSF pressure. CSF rhinorrhea occurs when an osseous defect in the skull base with a disruption of dura mater and arachnoid resulting a communication of subarachnoid space to nose and paranasal sinus, leading to CSF leak[2]. CSF leak can be categorized into spontaneous (idiopathic), traumatic, and non-traumatic. Traumatic may be accidental or iatrogenic. Non- traumatic can be due to hydrocephalus, tumors, congenital defects, etc. About 70–80% of CSF rhinorrhea is caused by accidental trauma[3]. Due to adherence of dura mater to bone in the region of anterior skull base, fracture often results in dural tear and CSF leak, mostly in fovea ethmoidalis, and posterior wall of frontal sinus. Common sites of leak after sinus surgeries are cribriform plate and fovea ethmoidalis[4]. The postulations regarding spontaneous leak are focal atrophy,1 persistence of embryonic lumen in the cribriform area, and intracranial hypertension. Hyperpneumatization of paranasal sinuses has a risk of spontaneous leak, particularly in lateral recess of sphenoid sinus[5]. Spontaneous healing of dura mater is interfered by herniation of meninges (meningocele) or with brain (Meningo encephalocele). Most traumatic leaks heal within 7–10 days with conservative measures such as bed rest, head end elevation, avoidance of straining, nose- blowing, and use of laxative[6]. Antibiotics were also given to prevent meningitis and facilitate healing. CSF rhinorrhea developing few days or weeks after a trauma and spontaneous leaks is less likely to heal, so surgical closure is mandatory. Surgical management of CSF rhinorrhea can be intracranial or extra cranial approaches.

Endoscopic trans nasal approach is an extra cranial approach which has the advantage of being less invasive, no external scar, excellent site localization with preservation of the surrounding anatomy, and shorter hospital stay. Excessive mobilization and injury of brain and dura mater are avoided and offer wide and site-specific view through a smaller exposure than that achieved through a microscope.

Material and Methods

The retrospective study was conducted in the Department of ENT, Jannayak Karpooori Thakur Medical College and Hospital, Madhepura, Bihar, India for 1 year, after taking the approval of the protocol review committee and institutional ethics committee. The medical records of 20 patients (13 males and 7 females) who had CSF rhinorrhoea and underwent trans-nasal endoscopic repair in the department were assessed.

Methodology

Patients were assessed for demographic profile, etiology of CSF leak and its duration, endoscopic findings, radiographic findings, location of leak, surgical repair and post-operative outcome. Retrieved data was represented in frequency and proportion in tabulated form for evaluation of results.

Patients with defect size less than 1.5 cms; cases involving cribriform, ethmoid, sphenoid or frontal recess region of skull base were included in this study.

patients with CSF leaks with duration less than two weeks; defect size more than 1.5 cms; cases involving posterior table of frontal sinus; leaks associated with multiple skull base fractures; leaks associated with tumor were excluded from this study.

Procedure

All surgical procedures were done under general anesthesia, with patient lying supine and head end elevated 30 degrees. Left thigh was prepared to harvest fat and fascia graft when required. Nasal decongestion was achieved with 4% xylocaine with adrenaline

1:30000 packs. Middle turbinate was lateralized or resected to gain access to the cribriform area in case of leaks from the cribriform area. In case of defect in the fovea ethmoidalis, complete ethmoidectomy was done. Site of leak was visualized and confirmed by Valsalva manouvere. Nasal mucosa around the site of leak was partially removed.

Meningocele/Meningoencephalocele was cauterized at the stump and removed. Fat plug was placed in all cases by bath plug method and placed in underlay manner. Further, layered reconstruction was done with a combination of cartilage, fibrin glue, septal bone, middle turbinate mucosa, septal mucosa or fibrin glue. Bilateral nasal packs were placed which were removed on 3rd

postoperative day. Lumbar drain was placed in cases with larger defects and/or increased intracranial pressure. Patients were put on acetazolamide 250 mg 8 hourly for 1 week postoperatively.

Results

In present study 20 patients (13 males and 7 females) were assessed. Mean age of patients was 30 years with range of 10-52 years (Table 1). Etiological factor for CSF leak was found to be accidental trauma in 65% cases. In 3 patients the reason was iatrogenic resulting from polypectomy. Spontaneous rhinorrhoea was observed in 20% subjects. Majority of patients (70%) presented with intermittent leaks whereas 30% were suffering from continuous type of leakage. (Table 2).

Table 1: Demographic profile of patients

| Variables | Frequency | Percentage (%) |
|-----------------------|-----------|----------------|
| Age (in years) | | |
| Below 20 | 4 | 20 |
| 20-40 | 12 | 60 |
| Above 40 | 4 | 20 |
| Gender | | |
| Males | 13 | 65 |
| Females | 7 | 35 |

Table 2: Clinical characteristics

| Variables | Frequency | Percentage (%) |
|---|-----------|----------------|
| Etiology of leak | | |
| Traumatic | | |
| Accidental | 13 | 65 |
| Iatrogenic | 3 | 15 |
| Spontaneous | 4 | 20 |
| Nature of leak | | |
| Intermittent | 14 | 70 |
| Continuous | 6 | 30 |
| Pre-operative episodes of meningitis | | |
| Present | 6 | 30 |
| Absent | 14 | 70 |

Radiographic examination revealed bony defects in all these cases with concurrent meningocele and meningoencephalocele in 10% and 55% cases respectively. Most common

location of defect in this cohort was cribriform plate of ethmoid (80%) whereas it was fovea ethmoidalis in 20% patients. Cysternography was carried out in 30% patients to delineate the

defect because of doubts in defining the lesion by HRCT/MRI in these cases (Table 3). All leaks were repaired with an underlay multilayered technique to restore the original anatomy layer by layer. Fat, middle turbinate (MT) mucosa and septal bone were used as graft to fill the defects in 55% cases. 10 % of patients were treated by fat, MT mucosa and inferior turbinate mucosa. Fat, MT mucosa and septal cartilage were used in 10% and in 25%

cases fat, septal mucosa and fibrin glue were used as grafts to seal the dehiscence. Post-operatively, lumbar drain was used in 38% cases only. No post-surgical complications were encountered in this study. Hospital stay in most of the cases (80%) was less than 2 weeks and in 20% of patients it was up to 4 weeks (Table 4). Mean follow up period was 12 months.

Table 3: Investigative procedures and observations

| Variables | Frequency | Percentage (%) |
|--------------------------|-----------|----------------|
| HRCT/MRI findings | | |
| Bony defects | 20 | 100 |
| Meningocele | 2 | 10 |
| Meningo-encephalocele | 11 | 55 |
| Cysternography required | 6 | 30 |
| Site of CSF leak | | |
| Cribriform plate | 16 | 80 |
| Fovea ethmoidalis | 4 | 20 |
| Sphenoid | 00 | 00 |

Table 4: Surgical repair and post-operative outcomes

| Variables | Frequency | Percentage (%) |
|--------------------------------------|-----------|----------------|
| Graft used for repair | | |
| Fat, MT* mucosa, septal bone | 11 | 55 |
| Fat, MT mucosa, Inf turbinate mucosa | 2 | 10 |
| Fat, MT mucosa and septal cartilage | 2 | 10 |
| Fat, septal mucosa and fibrin glue | 5 | 25 |
| Post-operative lumbar drain | | |
| Yes | 8 | 40 |
| No | 12 | 60 |
| Post-operative complications | | |
| No complication | 20 | 100 |
| Successful surgery | | |
| Yes | 20 | 100 |
| No | 00 | 00 |
| Hospital stay (weeks) | | |
| 0-2 | 16 | 80 |
| 3-4 | 4 | 20 |
| Follow up period (months) | | |
| 0-6 | 2 | 10 |
| >6 | 18 | 90 |

*MT: Middle turbinate

Discussion

Extra cranial approach for CSF leak was initiated by Dohlman in 1948 using nasofrontal incision which offered success rate of 60-80% with considerable reduction in risk of complications[7,8]. It was not until 1981 that Wigand described endoscopic repair of CSF rhinorrhoea which led to success rate of 90%[7]. Since then, this technique has gained popularity. It has been suggested that endoscopic repair be limited to gaps less than 1.5 cms in size but other authors have found no correlation between the success rate and size of the defect[9]. Recent studies have reported success rate of 93% at first and 100% at second surgery[10]. In present study, mean age of patients was found to be 30 years which is lower than the results presented by some authors[11]. Lower mean age is related to the fact that majority of patients had traumatic leaks resulting from road traffic accidents and assaults which tend to involve the younger demographic[10]. Preponderance of males over females has been observed in the present series. Traumatic leaks outnumber the non-traumatic leakages similar to the results presented by Safavi et al.[11] An important aspect of success in such cases is identification of the exact site of CSF leak[12,13]. HRCT plays an essential role in identifying even the smallest defect and provides important information about the anatomical variations and guiding the surgeon in planning surgical repairs. MRI scanning was done to detect co-existing meningocele or Meningo-encephalocele in cases where causative factor was trauma. In present study 55% patients had Meningo-encephalocele and 10% had meningocele. These figures are higher than those observed by Ismail et al.[9] Cysternography was done only in those cases where there was doubt in defining defect on CT/MRI scan. Commonest site of anatomical defect in majority (80%) of cases in our study was cribriform plate of ethmoid bone because of its inherent weakness due to presence of

sieve-like apertures for passage of olfactory nerve fibers. A variety of graft material was used ranging from fat, fascia lata, MT mucosa, septal cartilage or bone and fibrin glue depending upon the aetiology of leak, location and dimensions of bony dehiscence. Post-operative lumbar drain was used in cases that had larger defects and those with raised intracranial pressure. No post-operative complication was observed in any of patients in our study. These results are in concurrence with the earlier reports discussed in literature[7,9,11,14]. Success rate of 100% was recorded in this study similar to the results published by Ismail et al.[9] Hospital stay was less than 2 weeks in majority of cases. Mean follow up period was 12 months with no recurrence in any of these cases.

Conclusion

Endo-nasal endoscopic closure is a safe and effective technique for repair of CSF rhinorrhoea. There is minimal intranasal trauma. An overall rate of successful repair was 100%. No surgical complications were encountered in present series. Etiology of leak and size of defect did not have any adverse effect on surgical outcome.

Reference

1. Ommaya AK, Di Chiro G, Baldwin M, Pennybacker JB. Non-traumatic cerebrospinal fluid rhinorrhoea. *J Neurol Neurosurg Psychiatry* 1968; 31:214- 25.
2. Virk JS, Elmiyeh B, Saleh HA. Endoscopic management of cerebrospinal fluid rhinorrhea: The Charing Cross experience. *J Neurol Surg B Skull Base* 2013; 74:61-7.
3. Ismail AS, Costantino PD, Sen C. Transnasal transsphenoidal endoscopic repair of CSF leakage using multilayer acellular dermis. *Skull Base* 2007; 17:125-32.
4. Psaltis AJ, Schlosser RJ, Banks CA, Yawn J, Soler ZM. A systematic review of the endoscopic repair of cerebrospinal fluid

- leaks. *Otolaryngol Head Neck Surg* 2012; 147:196-203.
5. Schlosser RJ, Bolger WE. Nasal cerebrospinal fluid leaks: Critical review and surgical considerations. *Laryngoscope* 2004; 114:255-65.
 6. Hegazy HM, Carrau RL, Snyderman CH, Kassam A, Zweig J. Transnasal endoscopic repair of cerebrospinal fluid rhinorrhea: A meta-analysis. *Laryngoscope* 2000; 110:1166-72.
 7. Presutti L, Mattioli F, Villari D, Marchioni D, Alicandri-Ciufelli M. Transnasal endoscopic treatment of cerebrospinal fluid leak: 17 years' experience. *Acta Otorhinolaryngol Ital.* 2009;29(4):191-6.
 8. Chappity P, Thakar A, Verma R. Endonasal endoscopic approach in management of paediatric CSF rhinorrhoea cases. *Ind J Otolaryngol Head Neck Surg.* 2015;67(1):88-92.
 9. Ismail AS, Costantino PD and Sen C. Transnasal altranssphenoidal endoscopic repair of CSF leakage using multilayer acellular dermis. *Skull Base.* 2007;17(2):125-32.
 10. Virk JS, Elmiyeh, Saleh HA. Endoscopic management of cerebrospinal fluid rhinorrhea: The Charing cross experience. *J Neurol Surg B Skull Base.* 2013;74(2):61-7.
 11. Safavi A, Safavi AA, Jafari R. An empirical approach to the diagnosis and treatment of cerebrospinal fluid rhinorrhoea: An optimized method for developing countries. *Malays J Med Sci.* 2014;21(5):37-43.
 12. Mishra SK, Mathew GA, Paul RR, Asif SK, John M, Vaghese AM, et al. Endoscopic repair of CSF rhinorrhoea: An Institutional Experience. *Iran J Otorhinolaryngol.* 2016;28(84):39-43.
 13. Lee DH, Lim SC, Joo YE. Treatment outcomes of endoscopic repairs of sinonasal cerebrospinal leak. *J Craniofac Surg.* 2011;22(4):1266-70.
 14. Husain M, Jha D, Vatsal DK, Husain N, Gupta RK. Neuroendoscopic transnasal repair of cerebrospinal fluid rhinorrhoea. *Skull Base.* 2003;13(2):73-8.