ABSTRACT

Objective: To describe our experience and outcome of transnasal endoscopic CSF leak repair in 400 patients.

Materials and methods: It was a retrospective study of 400 cases operated over a period of 19 years.

Results: 400 patients were reviewed. Of this, 62% had spontaneous leaks and the rest of patients were found to have leak secondary to trauma. 6 cases were congenital. Age of the patients was between 30-50 years except congenital cases where majority were less than 10 years. CT Cisternography was our choice of radiological imaging, which had a success rate of 95% in detecting the defect. Most common CSF leak in our study was cribriform plate and the least was lateral recess or Sternberg’s canal (1.5%). Our success rate in defect closure was 98% in the first attempt and 100% during the second attempt. Mean hospital stay was found to be 0.75 days. No major complications were encountered following the surgery.

Conclusion: Our experience of endoscopic transnasal repair of CSF leaks is very good. Multi-layered closure is advocated. Hadad Bassagasteguy flap has been observed to be a good graft material. We urge the use of endoscopic repair due to better outcome and less morbidity.

Keywords: Endoscopic repair. Transnasal. Cerebrospinal fluid rhinorrhea.

INTRODUCTION

Cerebrospinal fluid rhinorrhea is the leakage of CSF from the subarachnoid space into the nasal cavity due to a defect in the dura, bone and mucosa[1]. Nearly 80% of CSF leaks occur as a result of accidental trauma, 16% are iatrogenic and only 4% due spontaneous leaks. The defects may be located in cribriform plate fovea ethmoidalis, sphenoid bone or posterior table of frontal sinus[2].

The majority of patients will present with intermittent or continuous rhinorrhea. This is usually unilateral, but may be bilateral with change in head position. There is often a history of previous surgery or a head injury. Rarely, recurrent meningitis may be the only indication. Up to 40 per cent of patients complain of headache[3].

CSF rhinorrhea was first reported in the 17th century[4]. In the early 20th century, Dandy[5] reported the first successful repair, which used a bifrontal craniotomy for placement of a fascia lata graft. Endoscopic approaches were introduced in the 1980s and early 1990s. Both Wigand[6] and Stankiewicz[7] described closure of incidental CSF leaks during endoscopic sinus surgery. In 1989, Papay and colleagues[8] introduced rigid transnasal endoscopy for the endonasal repair of CSF rhinorrhea. Since then, numerous series have been published, and endoscopic repair has emerged as a mainstay of surgical management.

The diagnosis of CSF rhinorrhea is typically a two-step process: First, the presence of a CSF leak must
be confirmed through the documentation of objective evidence of extra cranial CSF. Second, the position of the skull base defect or defects through which the CSF is draining must be determined. Nasoendoscopic examination should be performed in the outpatient clinic. This alone may identify the site of the leak in 36 per cent\(^9\) or may identify the cause, such as an encephalocele. The only test used to determine if a sample is CSF or not is immunofixation of beta-2 transferrin. The sensitivity of this test is 100 per cent with a specificity of 95 per cent\(^10\). Some authors favour computerized tomography (CT) Cisternography. High resolution coronal CT scans (l-2-mm slices) can offer detection in up to 84 per cent of cases in a large series\(^11\). A T 2-weighted MRI is the preferred imaging modality of some authors and rates of detection of 100 per cent are claimed\(^12\).

Over the past two decades, the optimal treatment strategy has undergone significant evolution as minimally invasive, endoscopic techniques have gained acceptance and supplanted more traditional techniques requiring external incisions or craniotomy. There were studies of large series of endoscopically treated patients where high success rates were reported, approaching 95% at the first closure attempt\(^13\).

The aim of our study is to share our experiences and outcome of Endoscopic transnasal CSF leak repair in 400 patients over a period of 19 years.

**PATIENTS AND METHODS**

The study consists of 400 patients who were operated from 1997 till March 2016. The case files were reviewed and the investigations, procedure, outcome and postoperative period noted.

**PREOPERATIVE WORK-UP**

The patients were first clinically assessed and checked for a positive reservoir sign. The collected fluid was sent for CSF analysis mainly glucose.

Endoscopic examination was done to identify the site of the leak. CT/ Cisternography was done as radiological investigation (Pictures 1-5). Intrathecal fluorescein dye was never used in our case series due to risk of complications.

Traumatic cases which did not respond to the initial conservative management of bed rest, head end elevation, avoidance of strenuous activities are taken for surgery after a waiting period of 15 days.
SURGICAL TECHNIQUE

All cases were operated under general anaesthesia with 0 and 30 degree rigid endoscope. The nasal cavity infiltrated with lidocaine and 1:1,00,000 adrenaline. Septoplasty is done if the visualisation is hampered, maxillary antrostomy; adequate exposure of the defect is done by ethmoidectomy, sphenoidotomy or middle/superior turbinectomy.

For defect in the posterior table of frontal sinus, a modified Lothrop approach is taken and leak from the lateral recess/ Sternberg’s canal is reached through transpterygoid route. If the leak is not well visualised during intra operative period, valsalva manoeuvre is performed. After identifying the defect, about 5mm of mucosa is removed surrounding the defect to make expose the bone and dural defect. Associated encephalocele is reduced by bipolar cauterisation. Rest of the brain tissue is mobilised from the dural edges. Graft is then placed covering the defect. Finally, surgicel and tissue glue are applied to keep the graft in position (Pictures 6-10).

Fig.-5 Iatrogenic Trauma Defect

Fig.-6: Meningoencephalocoele

Fig.-7: Closure with Septal Cartilage Middle

Fig.-8 Turbinate Flap

Fig.-9: Hadad Flap

Fig.-10: Operative Picture
The choice of grafts has evolved over time. Initially free septal flap, fat and fascia lata were used for defect closure. Now that has been changed to pedicled nasoseptal Hadad Bassagasteguy flap, the results of which are found to be very promising. If defect requires more tensile strength, fascia lata is used. Large defects more than 5-6 mm are given additional support with either middle turbinate flap or septal cartilage.

POSTOPERATIVE MANAGEMENT
The patients are discharged the next postoperative day. Postoperative antibiotics, stool softeners are given for a week. Patients are asked to avoid blowing the nose, sneezing or do strenuous activities which are likely to increase intracranial tension. Lumbar drains are placed for patients who have high pressure leaks or large defects more than 5-6mm for a day or two. Nasal pack is removed in 4-7 days. Patients are followed up weekly for four weeks.

RESULTS
We reviewed 400 cases which were operated during the time period of 1997 to March 2016. Of the 400 cases, 248 cases were spontaneous leak, 146 were traumatic including iatrogenic trauma and 6 congenital cases.

Majority of the patients were between the group of 30-50. The only exceptions were congenital Meningoencephalocoele which accounted for 6 of our cases with 5 of them less than 10 years of age.

The investigations which we do are CSF analysis and CT Cisternography. Only glucose is tested to confirm CSF. CT Cisternography was used to identify the site of the defect. The success rate with this radiological investigation was around 95% in our study.

Most common site of leak was found to be from area of cribriform plate. The least common site was the lateral recess/ Sternberg’s canal. For congenital Meningoencephalocoele, the defect was found anterior to middle turbinate in all the cases. Defect in the posterior table of frontal sinus were seen in cases of RTA. During surgery the defect was detected in 99% of the cases. For those who had a positive reservoir sign but no active leak intraoperatively, graft was placed over the whole of skull base.

The success rate for us in the repair of CSF rhinorrhea was 98% in the first attempt. The rest 2% of failure cases were corrected successfully in the second attempt. None of the patients required more than 2 attempts for defect closure.

Mean hospital stay was around 0.75 days. Maximum period of hospital stay was 2 days. Nasal pack was removed from 4th to the 7th day. The thigh sutures for harvesting fascia lata were removed on 7th day. No major complications were encountered in the group except for transient headache which resolved spontaneously.

DISCUSSION
This study reviews 400 cases which were operated over a period of 19 years. All the surgeries were performed by the main author. Due to panoramic visualisation and also lesser morbidity and mortality, endoscopes were used by the author since 1997. The success rates were 98% with the first attempt and 100% with the second attempt. None of the patients required a craniotomy approach.

Craniotomy and subsequent brain retraction is associated with significant morbidity including anosmia, intracranial haemorrhage, postoperative brain oedema etc. Moreover the accessibility is poor due to adjacent neurovascular structures. The failure rate of craniotomy is as high as 20-40%[14].

In our study, spontaneous leaks were found to be more (86%) which were supported by few studies[15, 16, 17]. The traumatic cases including the iatrogenic leaks accounted for the remaining.

A patient presenting with unilateral nasal discharge was sent through a diagnostic algorithm. A positive reservoir sign/ drip test, corroborated with an

<table>
<thead>
<tr>
<th>Site of leak</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cribiform plate</td>
<td>345</td>
</tr>
<tr>
<td>Fovea ethmoidalis</td>
<td>33</td>
</tr>
<tr>
<td>Posterior frontal sinus</td>
<td>16</td>
</tr>
<tr>
<td>Lateral Recess/Sternberg’s canal</td>
<td>6</td>
</tr>
</tbody>
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endoscopic examination to visualise the leak, CSF analysis for glucose of the collected specimen and CT Cisternography were done. Intraoperatively the leak was visualised with endoscope. Inactive leak were demonstrated with Valsalva manoeuvre. Intrathecal fluorescein was never administered due to associated neurological risks.

Cribiform plate was the most common site of leak which accounted for about 86% similar to many other articles[16,19,20, 21, 22]. The least common site of defect was lateral recess/ Sternberg’s canal which amounted to 1.5% of all the cases. 6 cases of congenital Meningoencephalocele treated during this time period had the defect anterior to the middle turbinate.

Many graft materials have been proposed for CSF leak repair in the literature. Fascia lata is the flap of choice in many[3,16]. We usually perform a 2-3 layer repair and our first choice of preference is Hadad flap. Additional Septal cartilage/ Middle turbinate flap are applied. Long standing and large defects are closed with fascia lata. Recently, for a defect of 1.5cm, a 5 layer closure was done using two layers of fascia lata, septal cartilage, Hadad flap and middle turbinate flap. Tissue glue is used to support the graft in all our cases[18].

Many authors advocate continuous lumbar drainage after defect closure[14]. But we have observed that lumbar drain is required only for a high pressure leaks. This observation is supported by[18].

We achieved a 98% success rate in the first attempt of defect closure. Many studies have had more than 90% success rates in the first attempt[16, 17, 20, 23]. The rest 2% were high pressure leaks, all of which were successfully closed in the second attempt[16, 17, 18].

The duration of hospital stay has reduced with the endoscopic management. The mean hospital stay for our patients is 0.75 days. Most of the literature advises 5-6 days of hospital stay[3]. The pack is removed after 4-7 days.

The use of prophylactic antibiotic is always a matter of controversy with few in favour of it[14,18,19] and few against it. We advocate prophylactic antibiotic for all the patients.

CONCLUSION

Transnasal endoscopic repair offers the highest success rate with minimal morbidity for a patient with cerebrospinal fluid leak. It gives excellent visualisation with precise graft placement. Our study of 400 cases is one of the largest studies regarding the subject. All the defects including those in the lateral recess as well as posterior table of frontal sinus can be operated on using endoscope. In our experience, Hadad flap gives very good results in defect closure. Multi-layered closure is advocated. Lumbar drain is required only for patients with high pressure leak. Our success rate of 98% in the first attempt and 100% in second attempt emphasises the effectiveness of this approach. Postoperative care is a very important factor in determining the outcome.

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c) Funding - None
d) Written consent of patient - taken
e) Animal rights-Not applicable.

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REFERENCES


