

Main Article

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Cerebrospinal fluid rhinorrhoea: does fibrin glue change the surgical outcome?

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Abstract

Objective. Cerebrospinal fluid rhinorrhoea takes place when there is a breakdown of the barriers separating the nasal cavity from the subarachnoid space. The aim of this study was to assess the surgical outcomes of endoscopic transnasal cerebrospinal fluid leak repair with and without fibrin glue.

Method. There were 43 patients with cerebrospinal fluid rhinorrhoea who underwent surgery for cerebrospinal fluid leak repair between 2014 and 2018. Patients were divided into group A, where fibrin glue was used, and group B, where fibrin glue was not used.

Results. It was found that 74.4 per cent of cases were due to spontaneous cerebrospinal fluid leak. The most common site of a leak was the cribriform plate (65 per cent). There was a success rate of 96.1 per cent (25 of 26) in group A and 83 per cent (15 of 17) in group B. There was no statistically significant difference between the results of the two groups (chi-square test: $p = 0.31$).

Conclusion. There was no statistically significant difference in the results of cerebrospinal fluid leak repair with and without fibrin glue.

Introduction

Cerebrospinal fluid (CSF) rhinorrhoea occurs when there is a breakdown of all the barriers separating the nasal cavity from the subarachnoid space. These barriers are the mucosa of the sinonasal cavity, the skull base, the dura mater and the arachnoid membrane. The aetiology of CSF rhinorrhoea can be broadly classified into traumatic and atraumatic causes. Traumatic cases can be further classified into accidental and iatrogenic causes. The incidence of CSF leak following endoscopic sinus surgery is noted only in about 0.3–3 per cent of patients undergoing surgery.¹ In patients with a head injury, the incidence of CSF leak is about 2 per cent.² The pathophysiology of a CSF leak in atraumatic cases is proposed to be caused by increased intracranial pressure (ICP). Thus, CSF leak is noted in conditions that increase the ICP, such as intracranial tumours, benign post-traumatic intracranial hypertension and post-infectious hydrocephalus.

The majority of cases of CSF rhinorrhoea resolve with conservative treatment, such as strict bed rest with elevation of the head, avoidance of strenuous activity and medical management of increased ICP. If patients do not respond to conservative treatment, they may require surgical correction with either transcranial surgery or endoscopic transnasal surgery. The closure of the defect is usually carried out in a multi-layered technique. When a multi-layered closure is used, the use of fibrin glue has been shown to give the added benefit of reduced recurrence. The purpose of this study was to assess the surgical outcome of endoscopic transnasal CSF leak repair with and without fibrin glue.

Materials and methods

This was a retrospective study that was carried out in the Department of Otorhinolaryngology and Head and Neck surgery in a tertiary care hospital. Patients who were diagnosed with CSF rhinorrhoea and who underwent endoscopic assisted transnasal CSF leak repair between January 2014 and January 2018 were included in the study. Forty-three cases of CSF rhinorrhoea were included in the study.

All patients were evaluated thoroughly, starting with a detailed patient history, including history of rhinorrhoea, history of trauma or previous nasal surgery, history of headache and fever, and previous hospital admission. The nasal fluid samples were subjected to biochemical, cytological and beta-2 transferrin analysis.

Clinical assessment was completed for all patients, and the probable site of the leak was analysed with diagnostic nasal endoscopy. Furthermore, the patients were subjected to radiological imaging, which comprised of plain computed tomography (CT) and CT cisternography to rule out intracranial space occupying lesions and to assess the location of the leak site, respectively (Figure 1 and 2).

Once the diagnosis and leak site were confirmed, all 43 patients underwent endoscopic assisted transnasal CSF leak repair after written informed consent for the procedure was obtained. The procedure was conducted under general anaesthesia, using 4 mm diameter endoscopes of 0 and 45 degrees. The leak site was identified intra-operatively (Figure 3),

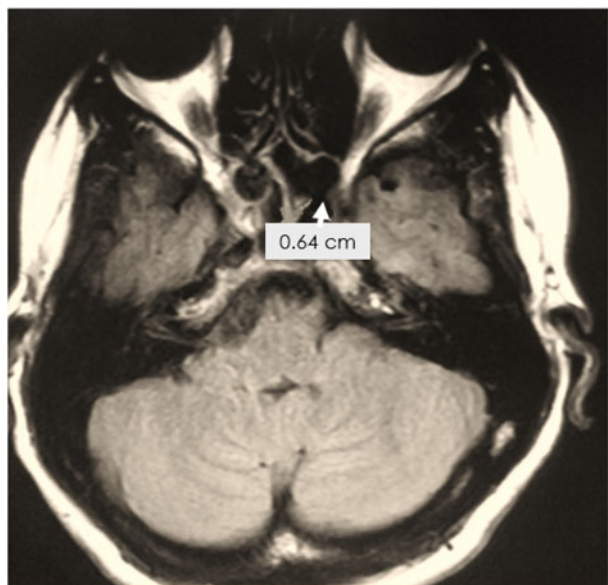


Fig. 1. Axial plane T2-weighted magnetic resonance image showing a defect in the lateral recess of the sphenoid.

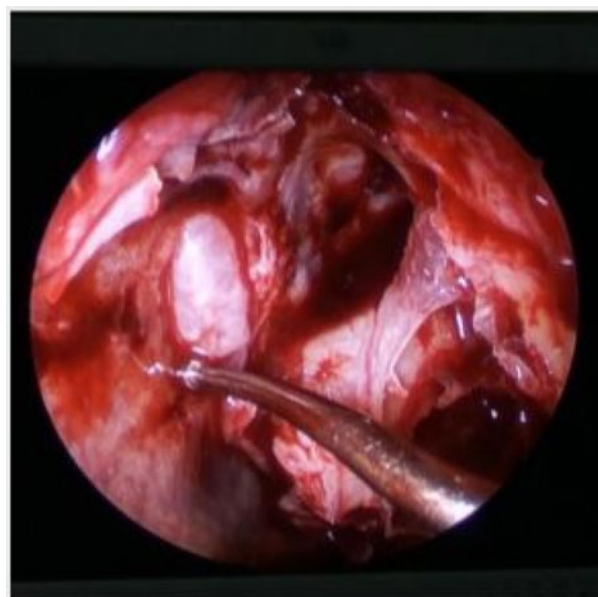


Fig. 3. Image showing a defect in the cribriform plate.



Fig. 2. Coronal plane computed tomography image showing a defect in the cribriform plate measuring 0.20 cm.

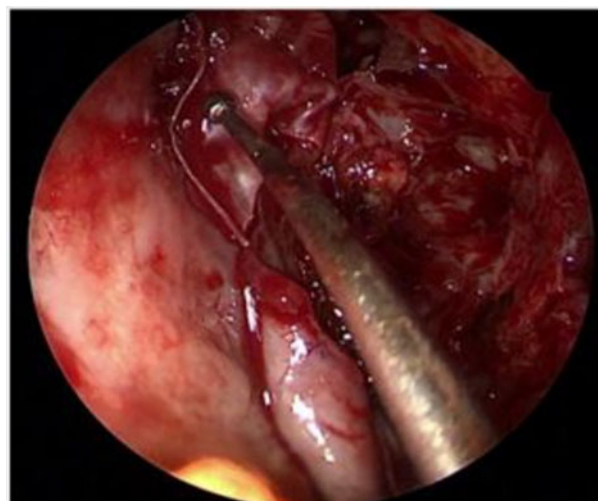


Fig. 4. Image showing placement of fascia graft.

and the mucosal lining surrounding the leak site was stripped completely to facilitate the graft uptake. If encephaloceles were encountered, they were reduced with the help of bipolar cautery.

Multi-layered closure was done in all cases using fascia (Figure 4), adipose tissue and a free middle turbinate mucosal flap. The first layer consisted of a fat plug in the defect, and then the fascia lata was tucked. This was followed by a free mucosal flap harvested from the ipsilateral middle turbinate as needed in individual cases. Departmental protocol states that fibrin glue should be used in all CSF leaks, but strict adherence to this protocol was not possible due to some families having financial constraints. This allowed us to group the patients into two groups: group A (26 of 43), where fibrin glue was used (Figure 5); and group B (17 of 43), where fibrin glue was not used. Furthermore, the graft and closure were stabilised using absorbable gel forms. Finally, Merocel® was used for nasal packing.



Fig. 5. Image showing fibrin glue instilled over the graft material.

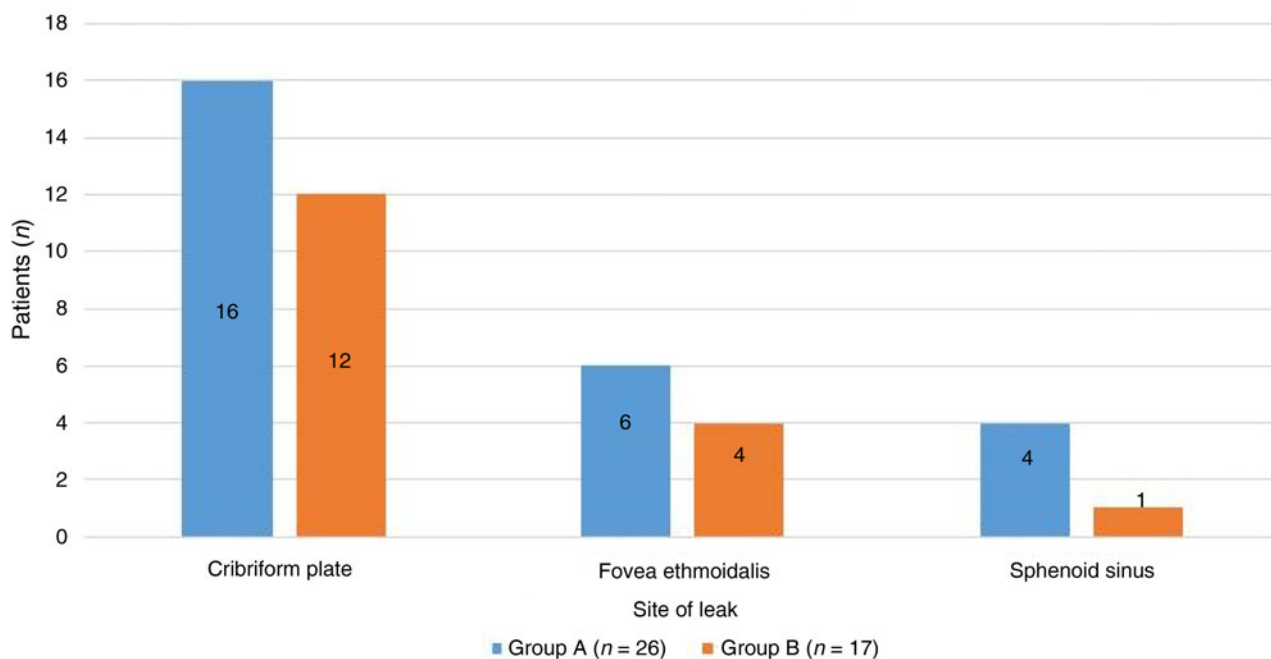


Fig. 6. Graph showing the incidence of cerebrospinal fluid leak at different sites in group A and B.

Post-operative care

All patients were advised to follow strict bed rest with head elevation at a 30-degree angle. The patients were told to avoid strenuous activity. All patients were given intravenous antibiotics for 5 days, oral antibiotics for another 10 days and oral acetazolamide for 6 weeks. Merocel nasal packing was removed on post-operative day 3. Patients who were diagnosed with benign intracranial hypertension had a lumbar drain for a time period of 3–5 days post-operatively.

Cough suppressants and stool softeners were advised to patients that needed them. At the time of discharge, all patients were given strict orders not to lift any heavy objects or do strenuous activity until further orders. Nasal endoscopy was performed for all patients during the follow up at two weeks, two months and six months.

Results

Among the patients who underwent surgery for CSF leak, 22 patients were male and 21 were female, with a group age range from 27–70 years. Out of 43 cases, there were 32 cases of spontaneous CSF leak, 9 cases with a history of head injury preceding the CSF leak and 2 cases with a history of nasal surgery in the recent past. Two cases had a history of recurrent hospital admission following meningitis. Forty-one cases underwent CT cisternography. Two referred patients had undergone magnetic resonance cisternography from other institutes. Encephaloceles were encountered in 12 cases. All the patients were subjected to CSF analysis and were confirmed to have CSF rhinorrhoea.

The leak site was noted in the cribriform plate (28 of 43), the fovea ethmoidalis or roof of the ethmoids (10/43), and the sphenoid sinus (5 of 43) (Figure 6).

Defect size ranged from 2 to 9 mm in size. Six cases were diagnosed with benign intracranial hypertension with papilloedema at the time of diagnosis. These cases were treated conservatively in the pre- and post-operative period, with oral

acetazolamide and a lumbar drain in the post-operative period for 3–5 days.

All 43 patients underwent endoscopic transnasal CSF leak repair. In all patients, the multi-layered overlay method of defect closure was used. The grafts that were used for closure were fat and fascia lata harvested from the thigh.

Group A consisted of the 26 patients where fibrin glue was used to repair the CSF leak, and group B consisted of the 17 patients where fibrin glue was not used. There were no criteria used for selecting patients in whom fibrin glue would or would not be used. All patients were given the option of fibrin glue for the surgery, and 17 patients declined because of their financial constraints.

Two patients developed meningitis in the first post-operative week and were managed medically with no mortality. Five cases developed minor synechiae formation in the post-operative period, and these patients were managed on an out-patient basis. One patient complained of anosmia which did not recover during the follow-up period.

There was a success rate of 96.1 per cent (25 of 26) in cases where fibrin glue was used. The success rate was 83 per cent (15 of 17) in cases where fibrin glue was not used. There was no statistically significant difference between results of endoscopic closure of CSF leak with fibrin glue and without fibrin glue ($p = 0.31$).

Discussion

With advances in the technology, there has been quite a revolution in the field of otorhinolaryngology. We have witnessed a major shift in the paradigm of treatment of CSF rhinorrhoea. Endoscopic assisted transnasal repair of CSF leak has become the preferred modality of surgical treatment of CSF leaks.

Based on aetiology, CSF rhinorrhoea can be classified into traumatic and atraumatic. Traumatic CSF rhinorrhoea is further sub-classified as iatrogenic and accidental.

The most common cause of CSF leak is accidental trauma followed by iatrogenic causes. The anterior skull base is prone

to trauma from both accidental as well as iatrogenic causes. In addition, injury to the anterior skull base is associated with CSF leaks because the dura is adherent to the bone in this region. Cerebrospinal fluid leaks following trauma often resolve spontaneously. If the dural defects persist, surgical closure is mandatory in order to prevent complications such as meningitis and pneumocephalus.³

Endoscopic CSF leak repair can be performed using multi-layered closure. Autologous grafts such as muscle, fat and fascia are used in layers for the closure of the defect. Grafting can be performed using either the inlay or onlay method. In our study, the onlay method of closure was used for all cases. Each layer of grafting can be done using fibrin sealants, Vaseline® gel or haemostatic sponges. Fibrin glue simulates the final phase of the coagulation cascade, via the interaction of thrombin and fibrinogen. There are several studies in the literature that have been carried out to assess the efficacy of fibrin glue in CSF leak repair.^{4–6}

In our study, 43 cases of CSF rhinorrhoea underwent endoscopic transnasal CSF leak repair, with an age group ranging from 27–70 years. The male to female ratio was 1.04:1, which is similar to that of other studies.^{7–9} The diagnosis of CSF rhinorrhoea could be ascertained in a majority of cases from the clinical history of watery nasal discharge, history of head injury, nasal fluid cytology and biochemical analysis.

The localised site of the leak was assessed with rigid endoscopic diagnostic nasal evaluation. Forty-one patients underwent plain CT imaging to rule out any space occupying lesions followed by CT cisternography, and two patients underwent magnetic resonance cisternography (referred from another hospital). In seven cases, encephaloceles were encountered. The beta-2 transferrin or beta-trace protein tests used for assessing nasal fluid for evidence of CSF leak fluid are very sensitive tests. All subjects underwent these two tests to confirm the diagnosis of CSF rhinorrhoea. Two cases had a history of recurrent meningitis requiring hospital admission.

Spontaneous cases of CSF rhinorrhoea (32 of 43) were the most common cause in our study. This finding is in accordance with some authors³ but in contrast with other authors.^{7,8,10} The most common leak site was the cribriform plate (28 of 43) as found in the literature.^{3,11} Other leak sites were the fovea ethmoidalis or roof of ethmoids (10 or 43), and the sphenoid sinus (5 of 43).

- Cerebrospinal fluid (CSF) rhinorrhoea of spontaneous aetiology is more common than traumatic CSF rhinorrhoea
- The cribriform plate was the most common site of CSF leaks
- Endoscopic endonasal repair of CSF leaks is an excellent surgical approach with good surgical outcomes, less post-operative recovery time and is more cosmetically appealing
- The use of fibrin glue did not show any advantage on surgical outcome

The closure rate of CSF leak in group A, where fibrin glue was used, was 96.1 per cent (25 of 26), and the closure rate of

CSF leak in group B, where fibrin glue was not used, was 83.1 per cent (15 of 17). There are various studies that show closure rates of 97 per cent with fibrin glue and 92–100 per cent without glue.^{9,12–14} 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.¹⁵

Conclusion

Endoscopic transnasal CSF leak repair is an excellent surgical technique for CSF rhinorrhoea. Spontaneous CSF rhinorrhoea is more common than traumatic CSF rhinorrhoea. There was no statistically significant difference in results of CSF leak repair with fibrin glue and without fibrin glue.

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Competing interests. None declared

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