ORIGINAL ARTICLE

Endoscopic Endonasal Repair of CSF Rhinorrhea: Sixteen-Year Experience

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Abstract

Objectives: To describe the surgical endoscopic experience of a tertiary referral center in the repair of CSF rhinorrhea, with a long-term follow-up. Study design: Retrospective chart review with follow-up of the patients. Materials and Methods: A total of 24 patients presented with CSF rhinorrhea (12 spontaneous, 4 traumatic, 8 iatrogenic) over a period of 16 years and were managed endoscopically by the same surgeon. The ratio of male to female patients was 11:13. The age ranged from 4 to 64 years. The leak was more commonly seen on the right side. Pre-operative CT with intrathecal metrizamide was obtained in 20 patients. Temporalis muscle, fascia, and fibrin glue were used in all patients.

Results: The location of the defect was most commonly found in the cribriform plate (50 %). Other locations included the fovea ethmoidalis, and lateral wall of the sphenoid. A lumbar drain was used in 6 patients. The follow-up period ranged from 1 month to 16 years. Successful repair was obtained in 22 patients with recurrence of leak in 2 patients (8.3 %). No major complications were encountered.

Conclusion: The endoscopic endonasal approach is a safe and effective method of treatment in patients with CSF rhinorrhea, sparing them the morbidity of the extra-cranial approach. Our results are comparable to those in the literature. CT scan with intrathecal metrizamide can enhance pre-operative diagnosis and aid in determining the site of *leak.*

Key words: CSF rhinorrhea, endoscopic repair, fibrin glue, fluorescein.

Introduction

Cerebrospinal fluid (CSF) rhinorrhea is a condition whereby CSF leaks into the nasal cavity through a defect in the base of skull. Various etiologies include spontaneous, traumatic, and iatrogenic, with the latter becoming a leading cause of CSF rhinorrhea due to the increased application of endoscopic sinonasal surgery. Diagnosis is confirmed by demonstrating the presence of β2-transferrin or β-trace proteins in the suspect fluid retrieved from the nose. Localizing the leaking site is achieved with the help of imaging studies, mainly high-resolution computed tomography (HRCT), MRI, and/or with the use intrathecal fluorescein. We report our experience of CSF rhinorrhea treated endoscopically over a period of 16 years with long-term postoperative follow-up. The use of HRCT with intrathecal metrizamide was the mainstay for localizing the base of skull defect in our series, in addition to a suggestive history and physical exam.

Materials and Methods:

A total of 24 patients presented with CSF rhinorrhea to the American University of Beirut Medical Center over a period of 16 years. They were all managed endoscopically by the same surgeon. The ratio of male to female patients was 11:13, and the age ranged from 4 to 64 years. Pre-operative CT with intrathecal metrizamide was obtained in 20 of our 24 patients. Temporalis muscle, fascia, and fibrin glue were used in all patients.

Results:

The pathogenesis of CSF rhinorrhea was divided equally between spontaneous (50%) and traumatic (50%). The traumatic etiologies were further classified into iatrogenic (33%) versus accidental (17%). The side of the defect was also determined, and a right sided predominance (58%) was detected. Defects of left side and one bilateral defect occurred at a frequency of 38% and 4%, respectively. The only case that had bilateral defects was a patient that had sustained head trauma with resultant bilateral cribriform plate cracks.

CT scan with intrathecal metrizamide was done on 20 of 24 patients, and positive localization of the defect was determined in 19 of them (95%). The remaining four patients in whom no CT with metrizamide was obtained belonged to the iatrogenic group and had direct intraoperative visualization of the CSF leak. Thus, they

did not require any imaging modality to confirm or localize the defect, and the leak was repaired directly.

	No. of Patients
Trauma	12
Non-iatrogenic	4 (17%)
Iatrogenic	8 (33%)
Spontaneous	12 (50%)

Table1. Pathogenesis of CSF Rhinorrhea in 24 Patients

MRI was obtained on 10 of the 24 patients (42%) and resulted in accurate localization of the defect in seven patients (70%). These were patients who were suspected to have an encephalocele on fiberoptic exam, and MRI was of great benefit in depicting the soft tissue mass accurately.

Concerning fluid studies, only 3 of our patients had nasal fluid samples sent for testing. β2-transferrin, a protein present only in CSF, perilymph, and aqueous humor, was requested just for two of our patients. Despite the high reported sensitivity and specificity of this test to detect CSF in suspect nasal fluid, it was not obtained because of its unavailability at our institution and thus, it's resultant high cost. Another patient had his nasal fluid sample sent for glucose testing, however, this was one of the earlier cases, and since then, this test has almost been abandoned because of its low sensitivity and specificity (1).

The use of intrathecal fluorescein for intra-operative localization of the defect was applied on 3 of our 24 patients. Eventhough it's still highly recommended in many centers, we tend to shy away from using it since it's not FDA approved for use in this indication, and because of it's reported neurological complications (2).

As for the site of the base of skull defect, our results showed a 50% predominance of bony defects at the level of the cribriform plate. The rest of the cases were equally distributed between the fovea ethmoidalis and the sphenoid sinus. Out of six sphenoid sinus leaks, 2 were in the lateral wall of the sinus and 4 had a roof defect.

The types of materials used in the surgeries included temporalis fascia and muscle, surgicel, and fibrin glue, and these were used in all patients. To obtain some tissue bulk when packing the sphenoid sinus after surgery, a large piece of abdominal fat was harvested and tucked in the cavity. In defects that were large enough to perform an underlay repair, nasal septal bone and/or cartilage was used. They provided excellent support to reconstructed area and are proved to have been durable.

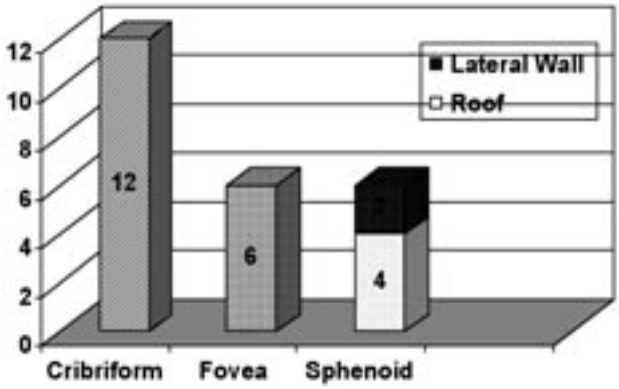

Figure 1: Site of defect localization

Post-operative lumbar puncture drains were used on 6 of 24 patients (25%). These patients presented with spontaneous CSF leaks and were postulated to have high intracranial pressure. The success rate was 92%, with only 2 patients returning with a recurrence.

Discussion:

The first report of CSF rhinorrhea repair was via an intracranial approach reported by Dandy et al. in 1926. He performed a bifrontal craniotomy, and this remained the gold standard of treatment until the extracranial nonendoscopic approach was described by Dohlman (1948) through a nasofrontal incision. This in turn paved the way for the evolution of CSF repair surgery which climaxed with the evolution of the endoscope and the application of this technology to the field, first reported by Wigand in 1981. The endoscope allows for better visualization of the base of skull area, and this, in addition to the evolution of instrumentation to complement the endoscope, has lead to the increased application of the endoscopic technique (3).

The cribriform area is reported to be the most common site of the base of skull defect (4), and our results reflect this fact. Most of the cases could be traced back to a traumatic incident as a possible cause, making it the most common etiology. Sinus surgery was also a common cause of CSF rhinorrhea in our series. This was found to cause defects larger than those attributed to either spontaneous or traumatic causes.

Preoperative work-up consisted of computed tomography scanning of the sinuses with intrathecal metrizamide. Only those that had iatrogenic obvious leak were repaired in the same setting without the need to have an imaging study. Thin cuts with reconstruction in the three planes were used to localize the defect and showed the defect 95% of the time. Intrathecal flurosceine injection was not requested in our institution due to its unavailability, and secondary, due to its

off-label use intrathecally and the many resultant side effects including epileptic crises (status epilepticus), grand mal seizure, opisthotonus, and peripheral nerve palsy. These complications were mainly related to errors in dosages, and the lack of premedication. Recent reports recommend premedication with dexamethasone and diphenhydramine to significantly reduce the risk of complications (5).

Most of the cases were repaired endoscopically in an overlay fashion, however, when defects were large at area fovea ethmoidalis or sphenoid sinus, they were repaired with a combined endoscopic underlay-overlay manner. The overall success rate was 92%, with only 2 patients with recurrent disease. This result is comparable to results previously reported in the literature. One of the 2 recurrences had successful repair of a sphenoid sinus lateral wall leak until she sustained major head trauma three years following her surgery, and had to undergo a Bifrontal Craniotomy to close the defect.

In small defects, the underlay technique has proven to be more than sufficient. Schlosser and Bolger report they do not attempt to insert fascia or fat plugs in an underlay technique in cases of small defects for various reasons mainly the risk of causing an increase in the size of the bony defect. They believe that the graft acts as a scaffold for overlying fibrous growth through osteoneogenesis of the bony borders, as evidenced by previous studies (6).

Fibrin glue was used in all patients conservatively. The excessive application of this glue can cause a thick layer, interfering in the close contact needed between the graft and the underlying bone.

A lumbar drain was used only in selected cases (25%), mainly in some of the patients who had a spontaneous leak and who were hypothesized to have high intracranial pressures. The primary author believes, by his experience, that the use of lumbar drains does not add to the success of the repair. A clear indication is the use of lumbar drains directly in the post-traumatic setting as a means of conservative treatment (7).

Concerning graft material, most of the repairs in our series were done using temporalis muscle and fascia. On rare occasions bone was used, mainly in cases of large defects. Different materials have reportedly been used over the years including but not limited to temporalis fascia, turbinate mucosa with or without bone, alloplastic collagen material, and fat. The advantage of these materials is that they are readily available near or in the surgical field, and are easy to harvest with little donor site morbidity. Studies have failed to show a difference between the various grafting materials used, with no one material having superior results than another.

In our experience Surgicel packing was applied in two to three layers followed by layered Merocel packing cut in strips that were progressively removed over the week after the surgery. A Foley catheter was used for packing repairs of sphenoid sinus defects, and it was gradually deflated over the following two to three days. No complications attributable to the packing material were noted, and it was found that they provided support to the closure and reinforced it. Care must be taken when applying the packing material not to obstruct the nasofrontal outflow tract as this can lead to complications of postoperative frontal sinusitis.

In conclusion, Endoscopic repair of CSF Fistulas shows very high success rates (92%). CT scan with Metrizamide is an excellent diagnostic tool and is extremely valuable in localizing the site of the defect. The use of Fluorescein was not standardized in our series due to its possible neurological complications. Large skull base defects require the use of septal bone or cartilage grafts, and fat is added in patients with sphenoid sinus involvement. Lumbar drain is not to be used except in individualized cases.

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