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Endoscopic cerebrospinal fluid leak repair: how we do it

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ABSTRACT

Background: Cerebrospinal fluid (CSF) rhinorrhoea is characterized by a defect in the barriers which separate the subarachnoid space from sinonasal tract resulting in the leakage of watery fluid from the nose. Management of CSF rhinorrhoea is by both conservative and/or surgical approach. Transnasal endoscopic method has become the preferred surgical method for the repair of CSF leak because of less complication as compared to the open approach. To evaluate the results of patients who underwent endoscopic repair of CSF rhinorrhoea over a period of 5 years at BJ Medical College, Civil Hospital, Ahmedabad.
Methods: 118 patients were included in this retrospective study who underwent CSF leak repair by nasal endoscopy over a period of 5 years between 2011-2016 in the department of ENT at BJ Medical College, Civil Hospital, Ahmedabad. As per review of the records, these patients were diagnosed with CSF leak on the basis of their history, clinical examination, and radiological investigations. Materials used for the repair were fat, fascia lata, fibrin sealant, and/or vascular flap.
Results: Primary surgery was successful in 110 (93%) of cases. In 8 (7%) cases, there was a recurrence of leak which was managed by either conservative management (5 cases, 4%) or by re-exploration (3 cases, 3%).
Conclusions: Transnasal endoscope is an important tool for the evaluation and subsequent treatment of CSF rhinorrhoea. Endoscopic repair of CSF rhinorrhoea is safe, effective, has a low complication rate and has almost completely replaced the open technique.

Keywords: CSF, Rhinorrhoea, Nasal endoscopy, Retrospective

INTRODUCTION

Cerebrospinal fluid (CSF) rhinorrhoea results from a direct communication between the CSF-containing subarachnoid space and the sino-nasal tract. The most common cause is trauma, followed by iatrogenic trauma and tumors. Miller published the first known case of CSF rhinorrhoea which was non-traumatic type, caused by hydrocephalus.[1] Neurosurgical treatment of such dural leaks began with Dandy performing the bifrontal craniotomy in 1929. Dohlman introduced the first intracranial approach in 1948 using a naso-orbital incision that could repair the defect through the cribriform plate with a septal and middle turbinate flap.[2] Wigand performed the first nasal endoscopic CSF leak repair in 1981.[3] The etiologic classification of CSF leak was developed by Ommaya et al.[4-6] He classified CSF rhinorrhea into traumatic and nontraumatic, subdividing the latter into nontraumatic with normal pressure and nontraumatic with CSF hypertension.

The objective of the study was to evaluate the results of patients who underwent endoscopic repair of CSF rhinorrhoea over a period of 5 years at BJ Medical College, Civil Hospital, Ahmedabad.

METHODS

Retrospective study was undertaken of 118 patients treated for CSF leaks of the anterior skull base presenting

to our department of ENT, between March 2011 till March 2016.

Inclusion criteria

Patients with defects of size upto 2.5 cm on radiological findings and those involving the anterior skull base were included in the study

Exclusion criteria

Patients with defects >2.5 cm or involving the posterior wall of frontal sinus or having multiple skull base fractures were excluded from the study.

From the review of medical records of the past 5 years, a total of 118 cases were selected. In these patients, following a detailed otorhinolaryngo scopic examination and nasal endoscopic examination, a confirmation of CSF rhinorrhea was made by estimating the glucose levels in the discharge. Further evaluation included radiological examination by CT cisternography and/or MRI cisterno-graphy. The patients underwent endonasal endoscopic leak repair by multilayered autograft technique using fat, fibrin glue and fascia lata graft.[7] In cases with a bony defect of more than 1.5 cm, a Hadad flap was used for providing further support to the graft. Out of 118 patients selected 60 patients had defects of size <1.5 cm were treated by simple multilayered technique and 58 had defects >1.5 cm and required additional Hadad flap.

A rigid Hopkins endoscope of 0 degree with a 4-mm diameter was used for the procedure. Under general anaesthesia, nasal mucosa was decongested with infiltration 1:10,000 adrenaline solution. Nasal septal flap was infiltrated and Hadad flap elevated and pushed into the nasopharynx (Figure 1A).

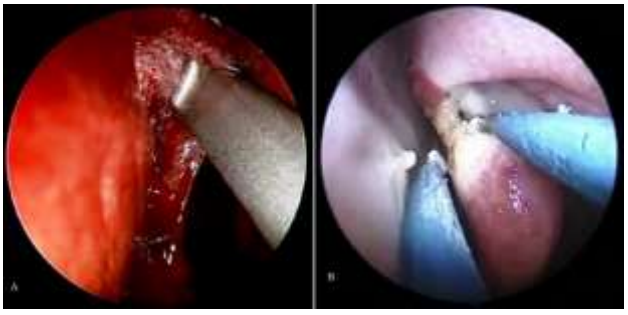

Figure 1: Elevation of septal flap and middle turbinectomy.

The cribriform region defects were approached by middle turbinectomy (Figure 1B), ethmoid sinus leaks by an ethmoidectomy, and sphenoid sinus through a transethmoidal pterygoidalsphenoidal approach.

After identifying the defect, the graft bed was prepared by removing a cuff of normal mucosa and tissue off the bone for 3-4 mm surrounding the defect. In cases of herniation of brain tissue through the defect, bipolar cautery was used to reduce the outpouching (Figure 2A). With the help of a ball probe, the brain tissue was mobilized from the edges around the defect to create a circumferential space known as undermining (Figure 2B).

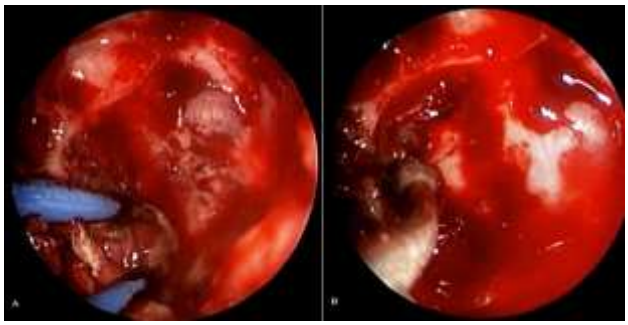

Figure 2: Reduction of encephalocele and undermining.

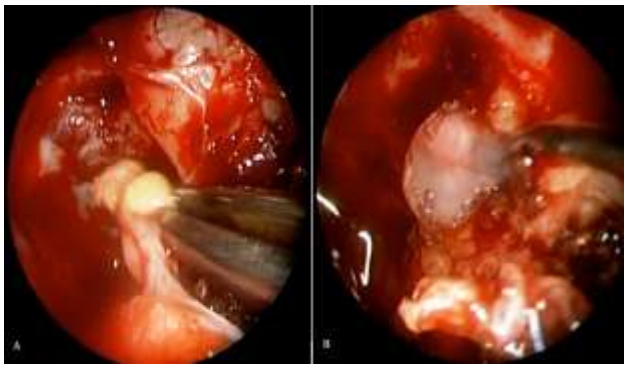

Figure 3: Fat plugged in the defect and covered with fibrin glue.

Fascia lata graft was harvested through a small incision in the lateral aspect of the thigh. The repair of the bony defect was done using fat (harvested from thigh) which was plugged into the defect (Figure 3A). A layer of fibrin sealant is applied over it and it is covered with fascia lata graft (Figure 3B).

In cases where the defect was >1.5 cm in size, the vascular pedicle flap (Hadad flap) is used to cover the graft and another thin layer of fibrin sealant is applied between the graft and the flap. This was further supported by absorbable (surgical) and non-absorbable nasal packing.

Post operatively the patient was advised bed rest with head end elevation for 48–72 hours. IV antibiotics were given for 7 days followed by oral antibiotics for 21 days along with stool softeners and antitussives for 2 weeks to decrease pressure on graft site. The non-absorbable nasal packing was removed after 4 days. Patients were instructed to avoid strenuous activities for minimum of 6 months. Regular endoscopic debridement was done weekly for 4 weeks to avoid crusting. Patients were followed up at 1, 3 and 6 months.

RESULTS

Patients included in study ranged in age group of 18–65 years. Out of 118 patients, 62 (52%) were males and 56 (47%) were females. The cause of CSF leak was traumatic in 61 (52%), iatrogenic due to endoscopic nasal surgery in 27 (23%), idiopathic in 22 (19%) and due to an intracranial tumor in 8 (6%). Size of defect by pre-op radiological methods was found to be <0.5 cm in 8 cases (6.7%), 0.6-1.0 cm in 19 cases (16.2%), 1.1-1.5 cm in 33 cases (28%), 1.6-2.0 cm in 37 cases (31.3%) and 2.1-2.5 cm in 21 cases (17.7%). The site of leak was found to be from the cribriform plate in 48 cases (41%), followed by sphenoid in 37 cases (31%), from the frontal sinus in 23 cases (19%) and from the ethmoid sinus in 10 cases (9%). Primary surgery was successful in 110 cases (93%) (Table 1). 8 patients had recurrence of leak. From the post traumatic group, 2 had recurrence from the same site, from the group of patients with spontaneous leak, 3 had recurrence. 3 patients had CSF leak manifested following radiation therapy for primary tumor. 5 of these 8 patients were managed conservatively and the 3 patients who developed a leak following radiation therapy required a re-exploration.

Table 1: Characteristics of patients.

Parameter	Post-traumatic (n=61)	Spontaneous (n=22)	Post-procedural (n=27)	Tumour (n=8)
Gender				
Male	32	10	15	5
Female	29	12	12	3
Age distribution (in years)				
<20	15	0	1	0
21-40	33	2	8	0
41-60	11	15	10	5
>60	02	5	8	3
Location of leak				
Cribriform	25	10	9	4
Sphenoid	15	7	12	3
Frontal	13	3	6	1
Ethmoid	8	2	0	0
Size of defect (cms)				
<0.5	2	3	2	1
0.6-1.0	7	5	5	2
1.1-1.5	21	4	6	2
1.6-2.0	19	7	9	2
2.1-2.5	12	3	5	1
Success rate				
After 1st procedure	59 (97%)	19 (86%)	27 (100%)	5 (62%)

Table 2: Comparison with other similar studies.

S. no.	Study	Number of patients	Study period	Success rate after endoscopic repair		
			(in years)	1st surgery	2nd surgery	3rd surgery
1	Kirtane et al[12]	267	13	96.30%	98.88%	-
2	Locatelli et al[13]	135	9	93.30%	98.50%	100%
3	Mc Mains et al[14]	92	12	85%	92%	-
4	Mirza et al[15]	72	10	90%	97%	99%
5	Ye et al[16]	69	8	89%	-	-
6	Our study	118	5	93%	100%	-

DISCUSSION

Recent years has seen the establishment of the endoscopic technique as the procedure of choice for CSF leak repairs due to less morbidity and mortality rates, better magnified view of the surgical field and a higher success rate compared to the open surgical techniques that had a success rate of about 70% and were associated with significant morbidity.[8] A presence of CSF rhinorrhoea is a serious risk to the life of the patient.[9] Correct identification of the defect site is a prerequisite for successful repair of CSF leak. CT scan, with or without contrast and exploration by nasal endoscopy are most common methods for locating the fistula. To

observe the leak during surgery, increasing the intracranial pressure by applying positive pressure at the abdomen allows in locating the CSF leak as a stream of clear transparent fluid.

Our study describes a 5 year experience of our center with the endoscopic surgical closure of CSF leak. Defects of size up to 2.5 cm can be safely repaired by the endonasal endoscopic technique. The success rate was 93% after the first attempt, rising to 100% after the second attempt (Table 2).

Defects which are more than 1.5 cm in size require additional support with a pedicle vascular flap so as to prevent the recurrence of leak. Hegazy et al has found no statistically significant difference in between different grafting techniques and materials.[10] As the majority of acute post-traumatic CSF leaks resolve spontaneously within 10–14 days, the initial treatment is always conservative, consisting of bed rest, fluid restriction, antihistamines, diuretics, stool softeners. Surgery is necessary only when the leak persists. Prophylactic antibiotics should be administered to patients with a record of meningitis. The endoscopic procedure has been found to shorten hospitalization time and reduce morbidity compared with open procedures.

CONCLUSION

Transnasal endoscopy is an important tool for the evaluation and subsequent treatment of CSF rhinorrhoea. Necessity of brain retraction during intracranial repair of CSF leaks is associated with risk of brain edema, anosmia and post-op intracranial hemorrhage. Endoscopic repair of CSF rhinorrhoea is safe, effective, has a low complication rate and has almost completely replaced the open technique. The key to successful endoscopic transnasal surgical repair is the accurate pre-op localization of site leak, preparation of the bed and accurate graft placement.

Endoscopic technique provides a better field of vision with enhanced illumination, magnification and the advantage of placement of graft at the site of defect under vision.

Excellent illumination, visualization of skull base and lack of morbidity have made it the procedure of choice in anterior cranial fossa and sphenoid sinus leaks.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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