International Journal of Surgery and Surgical Research
Online ISSN: 2664-9179, Print ISSN: 2664-9160
Received: 02-11-2018; Accepted: 04-12-2018; Published: 02-01-2019
www.surgeryjournals.net
Volume 1; Issue 1; 2019; Page No. 07-10

Endoscopic management of CSF rhinorrhea: Is it a successful technique

Ahmed Gaber Hassanein MD[1*], Mostafa Eltaher MD[2], Khalid Nasser Fadle MD[3]

[1] Assistant Professor of Maxillofacial and Plastic Surgery, Maxillofacial Surgery Unit, Faculty of Medicine, Sohag University, Sohag, Egypt.

[1] Assistant Professor of Maxillofacial Surgery, Faculty of Dentistry, Al-Baha University, Kingdom of Saudi Arabia.

[2] Lecturer of Otolaryngology, Otolaryngology Department, Faculty of Medicine, Sohag University, Sohag, Egypt.

[3] Lecturer of Neurosurgery, Neurosurgery Department, Faculty of Medicine, Sohag University, Sohag, Egypt

Abstract
Endoscopic management of CSF rhinorrhea provides accurate repair and least morbidity. In this study, free tissue grafts in two layers were used for closure of skull base defect. The study included 8 cases: Four spontaneous CSF leakage, three iatrogenic trauma and one accidental trauma. Seven patients had repair using double layers of graft material while one patient had one overlay mucoperiosteal graft. Underlay grafts were septal cartilage in four cases and ear lobule fibro-fat in three cases. In one case we could not use underlay graft. On lay grafts were fascia lata in one case, nasal septal mucopericondrium in one case and lateral nasal wall mucoperiosteum in 6 cases. Follow-up revealed complete cure. Endonasal endoscopic repair of CSF rhinorrhea was a successful technique, with a low failure rate and minimal morbidity for both traumatic and spontaneous CSF leaks. Two-layer reconstruction of skull base defects could cure majority of leaks.

Keywords: endoscopic management, CSF rhinorrhea, spontaneous CSF leakage, double layers repair.

1. Introduction

Endoscopic approach for management of CSF rhinorrhea is known to provide accurate repair and least operative morbidity; however, several factors including the site, size, and cause of the leak together with overall medical condition may affect the results and prognosis [1]. Endoscopic Skull base surgeon may be confronted with many challenges during repair of CSF leak; localizing the leakage site may be difficult even for experienced surgeons, dealing with large defects, operating in anatomically difficult to reach areas while keeping patency of sinus drainage and managing pediatric patients [2-5]. Controversies are present as regard safety of intrathecal fluorescein, management of associated benign intracranial hypertension if present, and number of graft layers needed for efficient repair [5-8].

In this study we present our strategy for endoscopic treatment of CSF leakage using the simplest and least sophisticated steps as regard localizing the leakage site, grafting the defect and measures to control intracranial hypertension in either simple or anatomically challenging cases.

Patients and Methods

This is a prospective study done at the in ENT department and the Maxillofacial Surgery Sohag University Hospital, Sohag, Egypt. It included all patients with CSF who were managed between July 2015 and June 2018. This study was conducted after approval by the by the Institutional Review Board. Informed consent was signed by the patient if he was an adult or by the patient's parent or guardian in case of being below age of 18 years, regarding surgery and inclusion in the study.

The details of the patient were recorded using a proforma. These included the following data: age at presentation, sex, etiology, clinical presentation, duration of complaint, ENT and detailed rhinologic examination, imaging study, surgical procedures, surgical complications, duration of follow up, and complications.

The diagnosis was done depending on clinical history taking, ENT and detailed rhinologic examination, chemical analysis of the discharged fluid and imaging studies in the form of high resolution CT and MRI. After careful analysis of clinical data and imaging findings, all patients underwent endoscopic repair of CSF rhinorrhea under general anesthesia. Intraoperative endoscopic exploration for localizing the site of the leak with fluorescein available for topical use in case of difficult identification of the defect.[9]

Free tissue grafts in two layers (underlay graft between the dura and skull base and another overlay graft underneath the skull base) were used for closure of the skull base defect. Polymeric silicon sheet was used for stenting the frontal sinus ostium to keep its patency when the sinus drainage is compromised by surgical steps (figures 1, 2, and 3).

Postoperative Intravenous antibiotic was given to all cases (3rd generation cephalosporin) for seven days starting from day of surgery. Patients and their guardians were instructed against straining or nose blowing for a minimum period of one month and measures to decrease intracranial tension were followed especially in patients with diagnosed benign intracranial hypertension.

Postoperative follow-up using nasal endoscopy was carried out on regularly increasing intervals till the first year then every year. Radiological follow up would be done if new events are encountered.

Results

This study included 8 patients; 4 females and 4 males. The age range was 4 - 50 years with a mean age of 32.5 years. The etiology of CSF rhinorrhea was spontaneous CSF leakage in four cases, iatrogenic trauma (during endoscopic sinus surgery for allergic fungal sinusitis) in three cases and accidental trauma (history of falling from height) in one case.

Meningoencephaloceles were encountered in three cases with spontaneous CSF rhinorrhea and in one case of accidental trauma. Two cases with spontaneous CSF rhinorrhea (associated with frontoethmoid Meningoencephaloceles) showed skull base defect extending to involve the posterior table of the frontal sinus.

Three cases had CSF rhinorrhea due to surgical trauma during endoscopic sinus surgery, the leak was identified intraoperative and corrected in the same setting without attempting the usual preoperative steps.

Free tissue grafts in two layers (underlay graft between the dura and skull base and another overlay graft underneath the skull base) were used for closure of the skull base defect; the type of tissue graft differed according to the size of the defect.

Seven patients had repair using double layers of graft material while one patient with spontaneous leak that was managed by one overlay mucoperiosteal graft. Underlay graft (between the dura and skull base): cartilage was used in 4 cases while fibro fat from the lobule of the ear applied through path plug technique was used in three cases with defect diameter less than 5 mm, in one case we could not apply an underlay graft because of very narrow size of the defect. On lay graft (applied to the nasal side of the skull bones): fascia lata was used in one case, mucoperichondrium from the nasal septum in one case and mucoperiosteum from the lateral nasal wall anterior to the middle turbinate in 6 cases (figures 1, 2, and 3).

Intrathecal fluorescein injection was not used in our cases and we used careful analysis of imaging data together with intraoperative endoscopic exploration for localizing the site of the leak with fluorescein available for topical use in case of difficult identification of the defect.

We considered no need for radiological follow up as long as no new events are encountered. Follow up endoscopic examination for one year revealed complete cure of all patients with patent frontal sinus ostia in cases with frontal sinus defect.

Data about age, sex, etiology, site and size of the defect, and graft material used for repair are illustrated in table (1).

Table 1: data of the patients underwent endoscopic repair of CSF leak

No.	Age (years)	Sex	Cause	Anatomical site	Size (mm)	Graft material
1	25	Male	Iatrogenic	Whole fovea ethmoidalis	12×6	- Cartilage - Fascia lata
2	37	Male	Iatrogenic	Lateral lamella	6×4	-Cartilage -Nasal mucoperiosteum
3	40	Male	Iatrogenic	Anterior ethmoid	4×3	-Cartilage -Nasal mucoperiosteum
4	4	Male	Accidental trauma (fall from height)	Cribriform plate opposite to posterior ethmoid	5×4	-Fibrofat from lobule of the ear -Nasal mucoperiosteum
5	38	Female	Spontaneous	Fronto ethmoid	4×5	-Fibrofat from lobule of the ear -Nasal mucoperiosteum
6	28	Female	Spontaneous	front ethmoid & posterior table of the frontal sinus	6×4	-Fibrofat from lobule of the ear -Nasal mucoperiosteum
7	38	Female	Spontaneous	front ethmoid & posterior table of the frontal sinus	12×10	-Cartilage -Nasal mucopericondrium
8	50	Female	Spontaneous	front ethmoid (foramen caecum)	2×1	-Nasal mucoperiosteum (only on lay graft)

Fig 1: endoscopic view for Case no 1: (A) The defect is marked with blue dots; black arrow points to dura. (B) Cartilage graft applied between dura and bone, white arrow. (C) On lay fascia lata graft, yellow arrow.

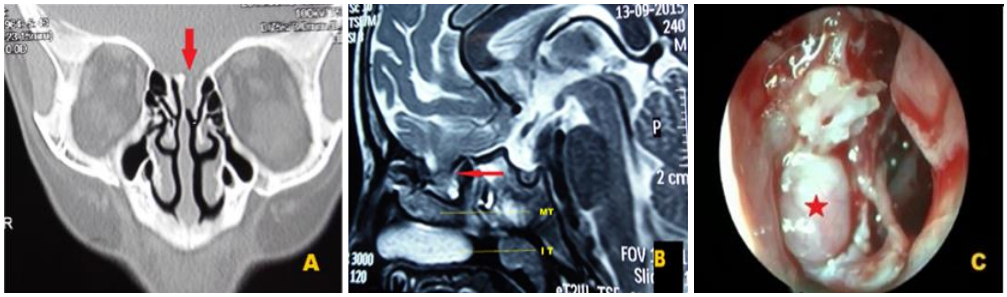

Fig 2: CT, MRI and endoscopic views of case no 4: (A) Coronal CT shows defect in the CP opposite to superior turbinate and grey shadow passing through the defect. (B) T2 weighted MRI image in the sagittal plane showing Meningoencephalocele. (C) Endoscopic view showing the defect after resection of the Meningoencephalocele, the superior turbinate was also resected for better exposure. Red arrow: defect site, MT: Middle turbinate, IT: inferior turbinate, red asterix: dura

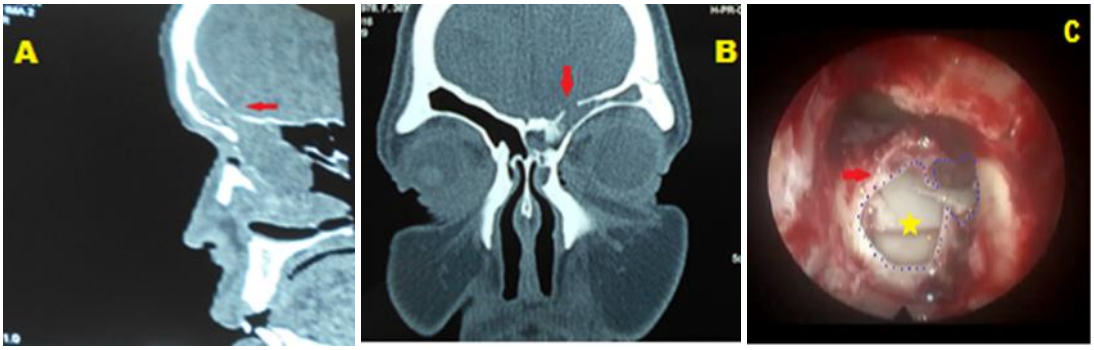

Fig 3: CT and endoscopic views of case no 7: (A) and B)- sagittal and coronal views of CT scan nose and paranasal sinuses showing defect in the posterior table of the frontal sinus "red arrow". (C) Endoscopic view (45o endoscope) showing defect "marked by blue dots" in the posterior table of the frontal sinus "red arrow" underlay cartilage graft appears through the defect "asterix".

Discussion

Endoscopic management of cerebrospinal rhinorrhea has proved to be efficient method with decreased operative and postoperative morbidity. Identification of the leakage site is considered the most important step for successful management. Many authors attempted to use intraoperative intrathecal fluorescein which is elicited endoscopically from the site of the leak [1, 10].

Reported complications associated with intrathecal fluorescein included headache, lower limb paresis/ numbness, cranial nerve palsies, opisthotonus, convulsions and even death. Although many studies provided certain criteria for safe use of intrathecal fluorescein, it appears that there is still no guarantee for avoiding such complications [11, 12, 10]. Not only the safety but also the efficacy of intrathecal fluorescein is debated. In addition to lengthening the operative time and the need for special anesthetic considerations, limitations in detecting the defect and false negative results of the fluorescein test were reported in literature. Topical application of fluorescein was recently introduced as method for safe localization of the defect [5, 13-15].

In our cases we relied on preoperative imaging studies in the form of high resolution CT scans and MRI for localizing the defect site with topical fluorescein prepared for use when needed. We were able to perfectly localize the defect in all cases without use of either intrathecal or topical fluorescein.

It is reported that most cases of spontaneous CSF leak are associated with idiopathic intracranial hypertension (IIH). Frequent recurrences following surgical repair of spontaneous CSF leak is a challenging problem and controversies in the literature are present as regard early and long term management of the increased intracranial pressure. Some authors recommended the use of lumbar drains for 3–5 days in cases of idiopathic leaks, posttraumatic leaks, and with large meningoceles. Others have advocated acetazolamide to decrease CSF production. Recurrence in such cases was claimed to occur late after 14 months, El-Fiky and her colleagues in 2015 argued that long-term management through CSF diversion is needed in patients with diagnosed IIH [16-19].

In this study we had 4 patients with spontaneous CSF leak; two of them had strong clinical and radiological evidence of IIH (obese middle aged females with BMI ≥ 35 and imaging evidence of empty sella) [17]. All cases were managed by Acetazolamide for one month following the operation and no long-term management through CSF diversion was attempted. We avoided lumber drains for their potential complications and the need for prolonged hospital stay. No recurrence was detected in any case even after 14 months period (Time passed since operations for the 4 cases is 15, 16, 22, and 30 months).

Another challenging problem is the diagnosis and repair of posttraumatic CSF leaks in pediatric population. The only presentation may be recurrent attacks of meningitis which should raise the suspicion for diagnosis. The narrow nasal fossa and limited surgical field in pediatric patients add to the technical difficulty of endoscopic CSF repair.[20] In this study a 4 years old child patient presented by recurrent attacks of meningitis and one-year past history of falling from height was diagnosed to have posttraumatic meningoencephalocele with skull base defect located in the posterior half of the cribriform plate; the patient was successfully managed through an endoscopic approach.

Defects involving the frontal sinus or frontal recess are not common but when present they need efficient anatomical knowledge and surgical skills for their endoscopic repair and simultaneously keeping patency of the sinus drainage

pathway [2]. This study involved two cases of frontoethmoid Meningoencephalocele with defect extending to the posterior table of the frontal sinus; endoscopic approach was successful as regard defect repair and preserved sinus patency.

Some authors described multilayer repair and using five layers of graft materials they assume this promotes better healing in the postoperative period and mimic to the natural barriers intervening between the nasal cavity and the cranial cavity [2]. We preferred using only two layers in order to decrease donor site morbidity and preserve anatomical structure of the compromised nasal region.

Based on supporting literature evidence and previous authors' experiences, the results obtained in this study allowed us to develop our own strategy for managing CSF rhinorrhea and avoid many controversial measures which may be time consuming, or even hazardous.

Conclusion

Endonasal endoscopic repair of CSF rhinorrhea was a successful technique, with a low failure rate and minimal morbidity. It can be used for both traumatic and spontaneous CSF leaks, and a two-layer reconstruction technique of the skull base defects could heal the majority of leaks.

Disclosure

Fund: no fund was obtained for this work.
Conflicts of Interest: no conflict of interest.

References

1. Locatelli D, Rampa F, Acchiardi I, Bignami M, Bernardi FD, Castelnuovo P. Endoscopic endonasal approaches for repair of cerebrospinal fluid leaks: nine-year experience. Operative Neurosurgery. 2006; 58(suppl_4):ONS-246-ONS-57.
2. Becker SS, Duncavage JA, Russell PT. Endoscopic endonasal repair of difficult-to-access cerebrospinal fluid leaks of the frontal sinus. American journal of rhinology & allergy. 2009; 23(2):181-4.
3. Friedberg SA, Galloway TC. LX Spontaneous Cerebrospinal Rhinorrhea. Annals of Otology, Rhinology & Laryngology. 1938; 47(3):792-4.
4. Ma J, Huang Q, Li X, Huang D, Xian J, Cui S. *et al*. Endoscopic transnasal repair of cerebrospinal fluid leaks with and without an encephalocele in pediatric patients: from infants to children. Child's Nervous System. 2015; 31(9):1493-8.
5. Seth R, Rajasekaran K, Benninger MS, Batra PS. The utility of intrathecal fluorescein in cerebrospinal fluid leak repair. Otolaryngology—Head and Neck Surgery. 2010; 143(5):626-32.
6. Steven R, Rothera M, Tang V, Bruce I. An unusual cause of nasal airway obstruction in a neonate: trans-sellar, trans-sphenoidal cephalocoele. The Journal of Laryngology & Otology. 2011; 125(10):1075-8.
7. Schlosser RJ, Woodworth BA, Wilensky EM, Grady MS, Bolger WE. Spontaneous cerebrospinal fluid leaks: a variant of benign intracranial hypertension. Annals of Otology, Rhinology & Laryngology. 2006; 115(7):495-500.
8. Chaaban MR, Illing E, Riley KO, Woodworth BA. Spontaneous cerebrospinal fluid leak repair: a five-year prospective evaluation. The Laryngoscope. 2014; 124(1):70-5.
9. Jones ME, Reino T, Gnoy A, Guillory S, Wackym P, Lawson W. Identification of intranasal cerebrospinal fluid leaks by topical application with fluorescein dye. American journal of rhinology. 2000; 14(2):93-6.
10. Keerl R, Weber RK, Draf W, Wienke A, Schaefer SD. Use of sodium fluorescein solution for detection of cerebrospinal fluid fistulas: an analysis of 420 administrations and reported complications in Europe and the United States. The Laryngoscope. 2004; 114(2):266-72.
11. Felisati G, Bianchi A, Lozza P, Portaleone S. Italian multicentre study on intrathecal fluorescein for craniosinusal fistulae. Acta Otorhinolaryngologica Italica. 2008; 28(4):159.
12. Wallace JD, Weintraub MI, Mattson RH, Rosnagle R. Status epilepticus as a complication of intrathecal fluorescein: Case report. Journal of neurosurgery. 1972; 36(5):659-60.
13. Schlosser RJ, Bolger WE. Nasal cerebrospinal fluid leaks: critical review and surgical considerations. The Laryngoscope. 2004; 114(2):255-65.
14. Moseley JI, Carton CA, Stern WE. Spectrum of complications in the use of intrathecal fluorescein. Journal of neurosurgery. 1978; 48(5):765-7.
15. Saafan ME, Ragab SM, Albirmawy OA. Topical intranasal fluorescein: the missing partner in algorithms of cerebrospinal fluid fistula detection. The Laryngoscope. 2006; 116(7):1158-61.
16. Woodworth BA, Palmer JN. Spontaneous cerebrospinal fluid leaks. Current opinion in otolaryngology & head and neck surgery. 2009; 17(1):59-65.
17. Hegazy HM, Carrau RL, Snyderman CH, Kassam A, Zweig J. Transnasal endoscopic repair of cerebrospinal fluid rhinorrhea: a meta-analysis. The Laryngoscope. 2000; 110(7):1166-72.
18. Schlosser RJ, Wilensky EM, Grady MS, Palmer JN, Kennedy DW, Bolger WE. Cerebrospinal fluid pressure monitoring after repair of cerebrospinal fluid leaks. Otolaryngology—Head and Neck Surgery. 2004; 130(4):443-8.
19. El Fiky L, Kotb A, Mostafa BE. A Unified Management for Spontaneous CSF Leak. International Journal of Otolaryngology and Head & Neck Surgery. 2015; 4(02):141.
20. Ibrahim AA, Magdy EA, Eid M. Endoscopic endonasal multilayer repair of traumatic ethmoidal roof cerebrospinal fluid rhinorrhea in children. International journal of pediatric otorhinolaryngology. 2012; 76(4):523-9.