EXPERIENCE OF ENDOSCOPIC REPAIR OF CEREBROSPINAL FLUID RHINORRHEA

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ABSTRACT

Objective: To make an estimate of magnitude of cerebrospinal fluid rhinorrhea patients presenting in Otorhinolaryngology department of CMH Lahore and further elaboration of our experience of different techniques of endonasal endoscopic repair of cerebrospinal fluid leak.

Study Design: Cross-sectional analytical study.

Place and Duration of Study: Combined Military Hospital Lahore, from Jan 2017 to Dec 2017.

Methodology: For this analytical study last one year's data of cerebrospinal fluid rhinorrhea patients as well as all endoscopic surgeries was collected retrospectively from ENT department registers. Both male and female patients of all ages undergoing functional endoscopic sinus surgery were included in study to calculate the magnitude of cerebrospinal fluid rhinorrhea.

Results: During the last one year, 832 ENT surgeries were performed out of which 234 (28%) were functional endoscopic sinus surgeries. Total 10 cerebrospinal fluid rhinorrhea patients presented in ENT department of CMH Lahore in the last one year and all these underwent endonasal endoscopic repair surgery in operation theatre. Out of these 3 were males and 7 females. Age range was 43 to 67 years (average age was 53.2 years). Out of 10 cases of cerebrospinal fluid rhinorrhea treated endoscopically, 4 (40%) were iatrogenic, 3 (30%) were traumatic and 3 (30%) had spontaneous cerebrospinal fluid leakage.

Conclusion: Cerebrospinal fluid leakage is quite rare happening and its surgical management is also difficult to master. In our study use of facialata (alone or with septal cartilage) to endoscopically repair the leak has proved to be successful in 90% of cases.

Keywords: Cerebrospinal fluid leakage, Cerebrospinal fluid repair, Endoscopic repair, Iatrogenic Cerebrospinal fluid leakage.

INTRODUCTION

The term cerebrospinal fluid (CSF) rhinorrhea has been described as the 'nasal discharge of CSF that may be caused by trauma, surgery, malformation, tumor or previous radiation therapy[1]. Spontaneous CSF rhinorrhea is uncommon[2]. Iatrogenic and traumatic CSF rhinorrhea is the most common cause of CSF leak through the nasal cavity. Repair is though difficult yet possible. Lines of lesser resistance within sphenoid bone may underlie CSF leak pathology together with intracranial hypertension. The endoscopic transnasal approach to the sphenoid sinus is an excellent alternative to standard transcranial procedures[3].

Intranasal endoscopic repair is among one of the most common surgeries performed for iatrogenic CSF leak. The potential leak sites include the cribriform plate, ethmoid, sphenoid and frontal sinus. Glucose estimation, although non-specific is one of the most popular methods of confirming CSF leak. Despite its etiology, most cases of CSF rhinorrhea resolve spontaneously or with conservative management. For those instances where the leak does not resolve, a large variety of drainage, packing, and obliteration procedures have been developed in an attempt to stop the CSF drainage and prevent the development of meningitis. Seven cases are reviewed that resulted in complete control of the leak with minimal morbidity[4]. In Pakistan little work has been published pertaining to repair of the above mentioned complication. The expertise of performing endoscopic repair of CSF leakage needs very long and tiring training. Mastering in endoscopic sinus and skull base surgery is the

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baseline towards attempting this challenging and result oriented surgery. Few cases are having this issue therefore only few surgeons get opportunity to learn this specific surgery.

The first intracranial approach to CSF leak repair was done by Dandy. According to Dr Tahir the primary success rate for the transnasal approach was 70% compared to 86% for the intracranial repair. Blood loss, special care unit (SCU) stay and total cost were found to be significantly less in the transnasal endoscopic group. Intracranial repair by craniotomy has resulted in 70% successful leak repairs[5]. The traditional approach had a privilege of direct visualization of the defect for repair.

The main objective of our study was to make an estimate of incidence of CSF rhinorrhea patients presenting in Otorhinolaryngology department of CMH Lahore, and further elaboration of our experience of different techniques of endonasal endoscopic repair of CSF leak.

METHODOLOGY

This cross-sectional analytical study was performed in ENT department CMH Lahore, from 1st January 2017 to 31st December 2017. Consecutive sampling technique was adopted. Permission was obtained from the ethics review committee in CMH Lahore. Last one year's data of CSF rhinorrhea patients as well as all endoscopic surgeries was collected retrospectively from ENT department registers. Both male and female patients of all ages undergoing functional endoscopic sinus surgery were included in study to calculate the incidence of CSF rhinorrhea. All cases were performed under general anesthesia after thorough pre operative workup of all known and potential comorbidities. Basic laboratory investigations including blood complete picture, clotting profile and hepatitis screening was performed in all patients. Before surgery detailed informed consent was obtained from all patients. Patients were informed about harvesting fascia lata and use of tissue glue during surgery. In order to repair the CSF leakage Facialata, Septal cartilage and fat were used alone or in a combination as a graft material, in single or multiple layers, with or without the aid of tissue glue. Graft materials were obtained per-operatively simultaneously.

Post operatively bed restrictions, anti-tussives, stool softeners, acetazolamide (Tablet AZM), injectable mannitol, broad spectrum antibiotics, were prescribed in every patient to reduce the risk of graft instability and post operative complications of CSF rhinorrhea. Lumber drain was placed in some patients depending upon the size of defect and intracranial pressure. Data was analyzed using SPSS version 19.

RESULTS

During the last one year, 832 ENT surgeries were performed out of which 234 (28%) were functional endoscopic sinus surgeries. Total 10 CSF rhinorrhea patients presented in ENT department of CMH Lahore in the last one year and all these underwent endonasal endoscopic repair surgery in operation theatre. As for as aetiology of CSF leakage is concerned only traumatic, iatrogenic and spontaneous CSF leakage presented. No patient with CSF rhinorrhea as a complication of primary nasal or intracranial pathology presented in ENT department. Out of total 10 cases, 3 were males and 7 females. Age range was 43 to 67 years (average age was 53.2 years). Out of 10 cases of CSF rhinorrhea treated endoscopically, 4 (40%) were iatrogenic, 3 (30%) were traumatic and 3 (30%) had spontaneous CSF leakage (table). Out of 4 iatrogenic aetiology patients, 2 were from our own hospital and 2 were referred from other hospitals. The CSF leaks were repaired endoscopically using facialata graft primarily and where needed supported by septal cartilage and fat. Lumbar drain was placed in 2 (20%) of the cases. Nine cases were treated successfully with mean length of hospital stay 11.6 days (SD=4.6) and in one patient CSF leakage did not stop after surgery and was lost to follow-up (Success rate 90%). Magnitude of major complications such as meningitis, subdural hematoma, and intracranial abscess was negligible. The overall magnitude of CSF rhinorrhea patients

presented in ENT operation theatre was 1.03% out of total ENT surgeries. This count makes it quite rare happening but mastering its endoscopic surgical repair was also difficult.

repair. In our experience with 7 patients of endoscopically treated CSF rhinorrhoea over the past year, the results of achieving closure was 100% with no resultant complications.

Table: Patients with cerebrospinal fluid rhinorhea.

Patients	Age (Years)	Gender	Aetiology	Defect site	Defect size	Repair
1	50	Female	Traumatic	Fronto-ethmoidal junction	<1cm	Fascia lata, septal cartilage
2	67	Male	Iatrogenic	Cribriform plate	>1cm	Fascia lata, septal cartilage
3	43	Female	Iatrogenic	Fronto-ethmoidal junction	<1cm	Facia lata, septal cartilage, fat,tissue glue
4	43	Male	Traumatic	Fronto-ethmoidal junction	>1cm	Facia lata, septalcartilage, fat, tissue glue
5	60	Female	Iatrogenic	Fronto-ethmoidal junction	>1cm	Facia lata, septal cartilage
6	67	Male	Traumatic	Fronto-ethmidal junction	>1cm	Fascia lata, septal cartilage, tissue glue
7	52	Female	Iatrogenic	Fronto-ethmoidal junction	>1cm	Facia lata, septalcartilage, fat
8	50	Female	Spontaneous	Fovea ethmoidalis	<1cm	Facia lata
9	52	Female	Spontaneous	Front-ethmoidal junction	<1cm	Facia lata, septal cartilage
10	48	Female	Spontaneous	Fovea ethmoidalis	<1cm	Facia lata

DISCUSSION

Cerebrospinal fluid (CSF) rhinorrhea may refer to the drainage of CSF through the nasal cavity. For this to occur, the bone, dura, and arachnoid membrane must all be breached by the offending process. Cerebrospinal fluid rhinorrhea may develop spontaneously or as a result of a variety of inciting factors, including craniofacial trauma, surgery, radiation, or medical treatment. Head injury and iatrogenic aetiology is more common. With the advent of Endoscopic nasal surgeries chances of iatrogenic CSF leakage has increased and also the same technique has provided this endoscopic approach repair of CSF leaks. This approach has no incision on skin so has less morbidity in older patients also as for as post-operative recovery in concerned. In our setup, being a tertiary care hospital patients are referred from many surrounding smaller cities hospitals. Cases of head injuries are also referred here because this tertiary care hospital has specialities of neruro-surgery as well as endoscopic endonasal surgery to repair CSF leaks.

If left untreated, CSF rhinorrhea may result in meningitis, pneumocephalus, and intracranial hypotension needing its quick and efficient

Use of Lumber Drains in endoscopic CSF leak repair was not associated with reduced recurrence rates or a significant increase in hospital length of stay. Although the use of perioperative Lumber Drains to monitor CSF dynamics may have some therapeutic and diagnostic advantages, it may not be associated with clinically significant improvements in patient outcomes or recurrence rates[2]. Any correlation of lumbar drainage, defect site, size or septal graft could not be established because of low incidence of the disease in CMH Lahore. Although literature review shows that the success rate of repairs using any of the reported techniques and materials was high and not statistically different. The incidence of major complications such a meningitis, subdural hematoma, and intracranial abscess was less than 1% for each complication[6].

According to study by Dr Sharmamost common site of CSF leak was the ethmoid roof/ cribriform plate region[7]. Traumatic CSF leak, in particular iatrogenic, is still the most common cause. Imaging with CT and MRI remains the gold standard for localization of CSF leaks. According to him, sphenoid sinus is the most common location for CSF leak repair failure.

Lumbar drains and antibiotics are used as adjuvant therapy to endoscopic repair, but their benefits are not clear; intrathecal fluorescein can be used to aid location of CSF leak, but should be reserved for more complex cases. He suggested further work into graft materials used and adjuvant treatment is needed to make any meaningful conclusions about their efficacy. In our study the use of septal cartilage with facialata and fat proved to be effective in almost all cases. Larger sample sizes with different graft materials used would be more beneficial to assess the efficacy of different grafts, keeping in view the size and site of leaks.

Chaaban *et al* performed five year prospective evaluation of spontaneous CSF leak repair by single otorhinolaryngologist[8]. His objective was to to assess outcomes regarding spontaneous CSF leaks focusing on premorbid factors, surgical technique, and management of intracranial pressure. He concluded that although spontaneous CSF leaks have the highest recurrence rate of any etiology, prospective evaluation demonstrates high success rates with control of intracranial hypertension. Our study also concluded that very few cases of spontaneous leaks were found and traumatic cases are more common. As for as traumatic cases are concerned road traffic accidents with head and base of skull injuries are more common. Endoscopic repair is now becoming common and open surgeries performed by neurosurgeons are being replaced by this new less traumatic technique.

In our setup intrathecal fluorescein facility to identify was not available and we performed CT scans and MRI to localize the defect. But in none of case, these techniques in the absence of intrathecal fluorescein could exactly pin point the leak site. Resultantly we had to localize the leak site per operatively by meticulously removing all the sinuses septa on the base of skull. Dr Banu M *et al* assessed the long-term outcomes of patients that underwent endoscopic endonasal repair of CSF leak using low-dose intrathecal fluorescein (ITF) and an etiology-based algorithm for multilayer graft closure[9]. They concluded that Low-dose Intrathecal fluorescein I (TF) is a safe and useful adjunct to endoscopic endonasal repair of CSF leaks with minimal complications and successful localization of the leak in approximately 80%. An etiology-based approach to graft choice and duration of lumbar drain placement in CSF leak repair may optimize closure rates. Dr Pressuti has concluded in his study that a free muco-perichondrial graft offered good results for cerebrospinal fluid leak repair and a high success rate can be achieved without the use of intrathecal fluorescein and lumbar drain[6].

Another interesting study about the risk factors of spontaneous CSF leak was done by Nelson *et al* in USA[10]. Their objective was to determine the national rates of spontaneous CSF leaks and to determine the association with risk factors. They concluded that the national (USA) rate of craniotomy for spontaneous CSF leak repair is rising. This condition is yet another public health problem related to the rising obesity epidemic. All patients with spontaneous CSF leaks should be evaluated for OSA. Although we did not work on risk factors of the patients but this aspect of risk factors in various countries must be probed deeply to adopt and recommend preventive aspects. Prevention is of utmost importance because its surgical repair is not only difficult but it's not without complications.

As the obesity epidemic grows in the United States, rhinorrhea and otorrhea from spontaneous cerebrospinal fluid (CSF) leaks secondary to untreated idiopathic intracranial hypertension are increasing in prevalence[11]. Recognition and repair of intraoperative CSF leaks reduces postoperative complications. Use of pedicled nasoseptal flaps improves outcomes in reconstructing defects at higher risk for postoperative leak[12]. While another study favours using the three-layer, sandwich-grafting technique of facialata. According to them it further adds more security to the sealing of CSF and augments the results of repair[13].

Whereas Melo Nada says that nasoseptal flaps are a valid option for repair of recurrent

CSF leaks, particularly in the lateral sphenoid sinus recess[14].

As for as the use of lumber drainage is concerned, there are different views. As per Ahmed *et al* there is insufficient evidence to support that adjunctive lumbar drainage significantly reduces postoperative CSF leak recurrence in patients undergoing endoscopic CSF leak repair[15]. Acetazolamide is the oral medicine to used to lower the intracranial pressure. Chabaan's study provides some of the first direct evidence of decreased intracranial pressure associated with the oral administration of acetazolamide. In combination with the excellent endoscopic repair outcomes noted in a high risk population, this evidence supports the routine use of acetazolamide in patients with high intracranial pressure CSF leaks[16].

Hydroxyapatitie cement is also being used for repair. As for as Craniotomy approach is concerned hydroxyapatite cement cranioplasty is a safe and effective technique for repair of retrosigmoid craniotomy defects[17]. However according to Luryi hydroxyapatite cement should not be applied transnasally for the treatment of an ethmoid region fistula owing to its high probability of extrusion. Correct patient selection and technical familiarity with hydroxylapatitie cement are necessary for successful application[18].

Various protocols have been followed at different centers. According to the study by Fathala a protocol that covers all the angles by a good multilayered repair (regardless of its type and materials) while diminishing the forces acting on both sides of the repair leads to a minimal rate of CSF leak. No principle alone is effective individually[14].

The transnasal endoscopic approach has excellent results in the treatment of CSF rhinorrhea in the hands of a skilled surgeon with very low incidence of complications. We recommend it as the optimum surgical approach for both primary and revision of surgical management of CSF rhinorrhea.

CONCLUSION

CSF leakage is quite rare happening and its surgical management is also difficult to master. In our study use of fascia lata (alone or with septal cartilage) to endoscopically repair the leak has proved to be successful in 90% of cases.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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