

## ORIGINAL ARTICLE

TRANSNASAL ENDOSCOPIC REPAIR OF CEREBROSPINAL FLUID  
RHINORRHOEA

Sajid Nazir Bhatti, Shahbaz Ali Khan, Rizwan Shah, Ahsan Aurangzeb, Ehtisham Ahmed,  
Farhat Rizvi\*, Khalid Khan Zadran, Nazir Alvi

Department of Neurosurgery, \*Department of Pathology, Ayub Medical College, Abbottabad, Pakistan

**Background:** Cerebrospinal fluid (CSF) leaks can arise as a complication of trauma, hydrocephalus, endoscopic sinus surgery or it may occur spontaneously without any identifiable cause. Surgical repair is recommended in patients who do not respond to the conservative management. In recent years transnasal endoscopic approach has become the preferred method for repairing the CSF leaks and better outcomes have been reported as compared to the intracranial approaches that were previously used. Objective of this study was to analyse the outcome of transnasal endoscopic repair of CSF rhinorrhoea. **Methods:** This prospective study was conducted in the Department of Neurosurgery, Ayub Medical College, Abbottabad, from March 2007 to March 2010. Twenty-one patients with CSF rhinorrhoea were included in study that were diagnosed on the basis of clinical evaluation, glucose concentration of nasal discharge, computed tomography (CT) and magnetic resonance imaging (MRI). These patients did not respond to conservative management and were operated transnasally using rigid endoscope. Patients were followed up for a mean duration of 9 months and the outcome was analysed. **Results:** The patients included in the study ranged in the age group of 12–55 years. Among the patients 13 (57%) were female and 8 (38%) were males. The cause of CSF rhinorrhoea was traumatic in 16 (76.19%), Idiopathic or spontaneous in 4 (19.04%) and 1 (4.7%) case was related to endoscopic surgery for pituitary macroadenoma. In 10 (47.6.8%) patients the site of leak was cribriform plate, 5 (23.8%) had from sphenoid, 4 (19.04%) from frontal sinus and in 2 (9.5%) Ethmoid was affected. Primary surgery was successful in 17 (80.95%) of cases. In 2 (9.5%) cases re-exploration had to be performed. In 1 patient re-exploration had to be done for the third time. Overall success rate was 95%. One patient presented with CSF leak and meningitis 1 month after surgery and unfortunately died. **Conclusion:** Transnasal endoscopic repair of CSF rhinorrhoea is highly successful, safe and less traumatic.

**Keywords:** Transnasal endoscopic repair, CSF Rhinorrhoea, CSF leak, transnasal endoscopic duroplasty

## INTRODUCTION

CSF rhinorrhoea results from the breakdown of all barriers that separate subarachnoid space from upper aerodigestive tract. This barrier constitutes the mucosa of nasal cavity or paranasal sinus, skull base (i.e., bone), dura matter and arachnoid membrane.<sup>1</sup> As a consequence there is abnormal release of CSF from the subarachnoid space into the extracranial compartments.<sup>2</sup> CSF leaks may arise as a complication of trauma, endoscopic sinus surgery, hydrocephalus or they may occur spontaneously without any identifiable cause.<sup>3</sup> So, CSF fistulas can be divided into traumatic and non-traumatic causes. Traumatic can be accidental or iatrogenic. The non-traumatic group is associated with brain tumours, skull base congenital defects and meningoceles or meningo-encephalocoeles. These fistulas must be repaired to avoid imminent life threatening complication like ascending meningitis and pneumocephalus.<sup>4,5</sup> Majority of cases respond to conservative treatment measures. These include bed rest with slight reverse-Trendelenburg position medical treatment, with or without placement of external lumbar drainage. Surgical repair is required in

the cases refractory to such therapy.<sup>6,7</sup> Aim of surgery is to provide a; (1) water tight dural seal; (2) provide a barrier between contaminated sinonasal space in the sterile subdural compartment; (3) prevent airflow into the intracranial space; and (4) maintain a functional sinonasal system. Hence avoiding the life threatening complications.<sup>8</sup>

In recent years the endoscopic endonasal approach has become popular among the neurosurgeons because of low morbidity and high success rates. More and more patients are subjected to endoscopic repair and previously used transcranial approach is used less frequently.<sup>9,10</sup>

Many different techniques have been proposed to repair dural defects and success rates of up to 95% have been documented.<sup>11</sup> The objective of this article is to analyse and evaluate the outcome of patients who underwent a purely endoscopic repair of CSF leaks in our unit.

## PATIENTS AND METHODS

This study was conducted in the Department of Neurosurgery, Ayub Medical College, Abbottabad

from March 2007 to March 2010. Twenty-one Patients with CSF rhinorrhoea were included in this study. Patients were thoroughly examined clinically and glucose concentration of the nasal discharge (CSF) was analysed as well. All had high glucose concentration.

High resolution CT–Scan was performed in 14 patients. All of the patients underwent MRI with T2-weighted images in prone position. Patients were observed during a 7–10 days period of bed rest in reverse–Trendelenburg position. Prophylactic broad spectrum antibiotics and acetazolamide were administered to all of the patients. External lumbar drains were tried in 17 patients. Three patients refused the lumbar drainage. After failure of conservative management, endoscopic repair was performed in all patients.

Procedure was performed under controlled hypotensive general anaesthesia. Patients were placed supine on the operating table in a 20–25 degree reverse-Trendelenburg position, head being in a slightly extended position. Prior to surgery nasal cavity was decongested with topical bupivacaine with adrenaline and nose was packed with antiseptic nasal packing. After ten minutes, rigid endoscope was carefully introduced into the nasal cavity. CSF leak site was identified and the adjacent mucosa was removed to expose the dural and, or the osseous defect. Valsalva manoeuvre was performed to confirm the leak in cases of uncertain leak site. Turbinate was partially removed to improve visualisation. The defect was then closed by five layers. First of all abdominal fat was placed, over which an absorbable knitted fabric Surgicel® was put. Both these were held together by a thin film of fibrin glue. Then a mucoperichondrial flap was raised and placed over the defect site. Again fibrin glue was used over the flap. Nasal packing consisting of gauze was done. Foley’s catheter Fr. 12 was placed in nasal cavity and inflated by 1.5 ml of normal saline. Nasal packing removed 24–48 hours after surgery. Lumbar drainage was used in 11 cases for a period of 1–5 days. Bed rest was enforced for first 48 hours after surgery. Patients were discharged after a mean duration of 6 days and instructed to refrain from blowing of nose, strenuous exercise and Valsalva manoeuvre. Patients were seen fortnightly for two months after surgery and later monthly. Mean duration of follow-up was 9 month.

**RESULTS**

Patients included in study ranged in age group of 12–55 years. Among them 13 (57%) were females and 8 (38%) were males. The cause of CSF leak was traumatic in 16 (76.19%), idiopathic in 4 (19.04%) and 1 (4.7%) case was related to endoscopic pituitary surgery that was performed in the same unit. In 14 (66.6%) cases CSF rhinorrhoea was from left nostril

and in 7 (33.3%) cases right side was affected. Out of 21 patients, CT was used in 14 patients, and in 8 (57.14%) cases it was conclusive. The MRI with T2 weighted images in prone was used in all cases and was conclusive in 17 (80%) cases. In 10 (47.6%) cases, site of leak was cribriform plate, 5 (23.8%) had from sphenoid, 4 (19.04%) from frontal sinus and in 2 (9.5 %) ethmoid was effected as shown in Table-1.

**Table-1: Sites of CSF leak**

| Site             | Number of Patients | Percentage |
|------------------|--------------------|------------|
| Cribriform Plate | 10                 | 47.6       |
| Sphenoid         | 5                  | 23.8       |
| Frontal          | 4                  | 19.04      |
| Ethmoid          | 2                  | 9.5        |

Primary surgery was successful in 17 (80.95%) of cases. In 2 (9.5%) cases re-exploration had to be performed once. In 1 patient re-exploration had to be done for the third time which was successful. Overall the success rate was 95%. One patient had a delayed CSF leak. He presented 10 days after developing CSF leak about one month after surgery. At presentation he had full blown meningitis. Unfortunately he did not respond to aggressive medical therapy and died 5 days after re-admission.

**DISCUSSION**

Factors such as trauma, either surgical or of another type; increased intracranial pressure because of tumours, trauma, or other causes and the presence of congenital or acquired skull base defects predispose a patient to develop CSF leak, still a lot many cases are idiopathic or spontaneous.<sup>1</sup> Dural defects though rare, and must be closed because of the risk of developing meningitis or pneumocephalus.<sup>11</sup> Detection of CSF leaks is not always simple. Detailed history and clinical examination can be augmented by laboratory tests of rhinorrhoea samples for B-2-transferrin detection or B-trace protein which is a highly sensitive technique.<sup>12</sup> In our study we mainly relied upon the high glucose content because these tests were not available. Skull radiograms are minimally helpful and not cost effective. They can show intracranial aerocele, an opacified sphenoid sinus, air fluid level or an enlarged sella turcica.<sup>13</sup> CT scan picked up the skull base defect in over 80% of cases.<sup>14</sup> But in our study the yield was 57.14% mainly because the facility lacked the proper coronal cuts. CT-cysternography, using intracranial metrizamide can be used when the site is not obvious on CT or endoscopy.<sup>14</sup> MRI T2 inversion recovery sequences with an inversion time for fluid suppression FLAIR (Fluid attended inversion recovery) is also very useful.<sup>11</sup> CSF leaks can be initially managed conservatively with bed rest in semi sitting position, repeated lumbar spinal taps or lumbar drain with advice to avoid nose blowing, leaning forward and straining.<sup>14,15</sup> Surgical management of

CSF leaks was first reported by Dandy, who repaired it by frontal craniotomy in 1926.<sup>16</sup> It went on for decades. However the need of craniotomy and brain retraction carried the risk of anosmia, postoperative intracranial haemorrhage and brain oedema.<sup>14</sup> The first purely endoscopic repair of CSF leak was described in 1981.<sup>17</sup> The evolution of endonasal endoscopic technique was initially reserved for sellar lesions through the sphenoid sinus cavity, but now over the past decade it has been successfully used for CSF leaks with documented success rates of up to 95%.<sup>18-20</sup>

Success rate of 80% in primary surgery and overall 95% including the re-do surgeries is quite compatible to the ones documented in literature. Various autologous and homologous materials such as middle turbinate bone or mucosa, fascia lata, septal mucoperichondrial graft, temporalis fascia, acellular dermal grafts, abdominal fat and recuts abdominal fascia can be used for repair. Fascia lata and middle turbinate mucoperiosteal grafts are most commonly advocated.<sup>14,21,22</sup> We used layer of abdominal fat followed by surgical, fibrin glue, mucoperichondrial flap and at last fibrin glue again. Several authors recommended lumbar drainage for 24–120 hours after surgery. In our study we used lumbar drain in 11 (52%) with good outcome. Similar or better results were achieved in other studies as well in which lumbar drainage procedures were not used in all of the cases.<sup>1,23</sup> So lumbar drainage procedures should be individualized for every case.

## CONCLUSION

Transnasal endoscopic repair of CSF rhinorrhoea is highly successful, safe and less traumatic. A multi layer technique using fat, surgical fibrin glue and mucoperichondrial flap can be used to plug the defect with high success rate.

## REFERENCES

1. Hegazy HM, Carrau RL, Snyderman CH, Kassam A, Zweig J. Transnasal endoscopic repair of cerebrospinal fluid rhinorrhea: a meta-analysis. *Laryngoscope* 2000;110:1166–72.
2. Komatsu M, Komatsu F, Cavallo LM, Solari D, Stagno V, Inoue T, *et al.* Purely endoscopic repair of traumatic cerebrospinal fluid rhinorrhea from the anterior skull base: case report. *Neurol Med Chir (Tokyo)* 2011;51:222–5.
3. Zweig JL, Carrau RL, Celin SE, Schaitkin BM, Pollice PA, Snyderman CH, *et al.* Endoscopic repair of cerebrospinal fluid leaks to the sinonasal tract: predictors of success. *Otolaryngol Head Neck Surg* 2000;123:195–201.
4. Landeiro JA, Flores MS, Lázaro BC, Melo MH. Surgical management of cerebrospinal fluid rhinorrhea under endoscopic control. *Arq Neuropsiquiatr* 2004;62(3B):827–31.
5. Bernal-Sprekelsen M, Bleda-Vázquez C, Carrau RL.

- Ascending meningitis secondary to traumatic cerebrospinal fluid leaks. *Am J Rhinol* 2000;14(4):257–9.
6. Scholsem M, Scholtes F, Collignon F, Robe P, Dubuisson A, Kaschten B, *et al.* Surgical management of anterior cranial base fractures with cerebrospinal fluid fistulae: a single-institution experience. *Neurosurgery* 2008;62(2):463–9.
7. Locatelli D, Rampa F, Acchiardi I, Bignami M, De Bernardi F, Castelnuovo P. Endoscopic endonasal approaches for repair of cerebrospinal fluid leaks: nine-year experience. *Neurosurgery* 2006;58(4 Suppl 2):246–56.
8. El-Banhawy OA, Halaka AN, Altuwajjri MA, Ayad H, El-Sharnoby MM. Long-term outcome of endonasal endoscopic skull base reconstruction with nasal turbinate graft. *Skull Base* 2008;18(5):297–308.
9. El-Banhawy OA, Halaka AN, El-Hafiz Shehab El-Dien A, Ayad H. Subcranial transnasal repair of cerebrospinal fluid rhinorrhea with free autologous grafts by the combined overlay and underlay techniques. *Minim Invasive Neurosurg* 2004;47(4):197–202.
10. Landeiro JA, Lázaro B, Melo MH. Endonasal endoscopic repair of cerebrospinal fluid rhinorrhea. *Minim Invasive Neurosurg* 2004;47(3):173–7.
11. Castelnuovo PG, Delú G, Locatelli D, Padoan G, Bernardi FD, Pistochini A, *et al.* Endonasal endoscopic duraplasty: our experience. *Skull Base* 2006;16(1):19–24.
12. Meco C, Oberascher G, Arrer E, Moser G, Albegger K. Beta-trace protein test: new guidelines for the reliable diagnosis of cerebrospinal fluid fistula. *Otolaryngol Head Neck Surg* 2003;129:508–17.
13. Tamakawa Y, Hanafee WN. Cerebrospinal fluid rhinorrhea: the significance of an air-fluid level in the sphenoid sinus. *Radiology* 1980;135(1):101–3.
14. Tosun F, Carrau RL, Snyderman CH, Kassam A, Celin S, Schaitkin B. Endonasal endoscopic repair of cerebrospinal fluid leaks of the sphenoid sinus. *Arch Otolaryngol Head Neck Surg* 2003;129(5):576–80.
15. Nachtigal D, Frenkiel S, Yoskovitch A, Mohr G. Endoscopic repair of cerebrospinal fluid rhinorrhea: is it the treatment of choice? *J Otolaryngol* 1999;28(3):129–33.
16. Dandy WD. Pneumocephalus (intracranial pneumocele or arocele). *Arch Surg* 1926;12:949–82
17. Wigand ME. Transnasal ethmoidectomy under endoscopic control. *Rhinology* 1981;19(1):7–15.
18. Cappabianca P, Cavallo LM, Esposito F, De Divitiis O, Messina A, De Divitiis E. Extended endoscopic endonasal approach to the midline skull base: the evolving role of transsphenoidal surgery. *Adv Tech Stand Neurosurg* 2008;33:151–99.
19. Sieskiewicz A, Lysoń T, Rogowski M, Mariak Z. Endoscopic management of cerebrospinal fluid rhinorrhea. *Otolaryngol Pol* 2009;63:343–7.
20. Locatelli D, Rampa F, Acchiardi I, Bignami M, De Bernardi F, Castelnuovo P. Endoscopic endonasal approaches for repair of cerebrospinal fluid leaks: nine-year experience. *Neurosurgery* 2006;58(4 Suppl 2):ONS-246–56.
21. Castillo L, Jaklis A, Paquis P, Haddad A, Santini J. Nasal endoscopic repair of cerebrospinal fluid rhinorrhea. *Rhinology* 1999;37(1):33–6.
22. Husain M, Jha D, Vatsal DK, Husain N, Gupta RK. Neuroendoscopic Transnasal Repair of Cerebrospinal Fluid Rhinorrhea. *Skull Base* 2003;13(2):73–8.
23. Casiano RR, Jassir D. Endoscopic cerebrospinal fluid rhinorrhea repair: is a lumbar drain necessary? *Otolaryngol Head Neck Surg* 1999;121(6):745–50.

## Address for Correspondence:

**Dr. Sajid Nazir Bhatti**, Department of Neurosurgery, Ayub Medical College, Abbottabad, Pakistan. **Cell:** +92-300-9111916  
**Email:** drshahbazali@gmail.com