

## ORIGINAL ARTICLE

## OUTCOME OF TRANSCRANIAL REPAIR OF TRAUMATIC CSF RHINORRHEA

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**Background:** Traumatic brain injury represents a significant cause of mortality and permanent disability in the adult population. Posttraumatic CSF rhinorrhea is one of the conditions most strongly associated with severe brain injury. Knowledge on the natural history of the illness and the outcomes of patients with transcranial subfrontal approach for posttraumatic CSF rhinorrhea approach may help the neurosurgeon in the decision-making process. This study was conducted to analyse the outcome of trans-cranial sub-frontal approach for traumatic CSF rhinorrhea, with duroplasty and fibrin glue. **Methods:** This study was carried out in the Department of Neurosurgery, Ayub Medical College, Abbottabad from Jan 2007 to Jun 2011. All patients undergoing trans-cranial sub-frontal repair of traumatic CSF fistulas were included. Where possible primary dural repair was performed under hypotensive general anaesthesia and in the cases where it was not possible, graft was used. This was followed by application of fibrin glue at the repaired site. Graft materials used in this study were taken from fascia lata, pericranium, and temporalis fascia. **Results:** Out of 27 patients 21 were men and 6 were women. Age of the patients ranged from 17 to 56 (34.5±4.6) years. Main causes of trauma were road traffic accidents (23, 85%), fall from height (3, 11%), and assaults (1, 4%). In 23 (85%) cases no CSF leak was observed in immediate postoperative period as well as during the follow-up visits while in 3 (11%) cases additional lumbar punctures were required to augment the repair. One patient failed to respond to surgery and lumbar drainage. **Conclusion:** The CSF rhinorrhea is commonly seen in patients with anterior skull fractures secondary to head injury. Initially conservative trial should be given to the patients, if it fails then on-lay dural technique followed by fibrin glue application through transcranial approach has good outcome with less chances of complications.

**Keywords:** CSF Rhinorrhea, posttraumatic, repair

### INTRODUCTION

Cerebrospinal fluid (CSF) rhinorrhea occurs when there is a fistula between the dura and the skull base and discharge of CSF from the nose. It results from the breakdown of all barriers separating the sterile subarachnoid space from upper aerodigestive tract. This barrier includes the mucosa of nasal cavity or paranasal sinus, skull base (i.e., bone), dura matter and arachnoid membrane.<sup>1</sup> A spinal fluid leak from the intracranial space to the nasal respiratory tract is potentially very serious because of the risk of an ascending infection which could produce fulminant meningitis.<sup>1</sup>

The CSF fistulas can be divided into traumatic and non-traumatic causes. Traumatic can be accidental or iatrogenic. Non-traumatic group is associated with brain tumours, skull base congenital defects and meningoceles or meningo-encephalocoeles CSF leaks may arise as a complication of trauma, endoscopic sinus surgery, hydrocephalus or they may occur spontaneously without any identifiable cause.<sup>2,3</sup> The CSF rhinorrhea commonly occurs following head trauma with fronto-basal skull fractures, as a result of intracranial surgery, or destructive lesions leading to spontaneous CSF leak.<sup>4,5</sup> Since these fistulas expose the sterile subarachnoid space to the upper aerodigestive tract, these must be repaired to avoid imminent life threatening complication like ascending meningitis and pneumocephalus.<sup>6</sup> Due to long lasting symptoms and

development of life threatening complications, treatment should promptly be started. The management of posttraumatic CSF rhinorrhea remains a controversial issue for skull base surgeons. Management plan of posttraumatic CSF rhinorrhea includes an approach of conservative measures for sufficient length of time. Most of the patients do respond to the conservative measures. When conservative treatment fails, surgical treatment is warranted as a potential life saving measure.<sup>7</sup>

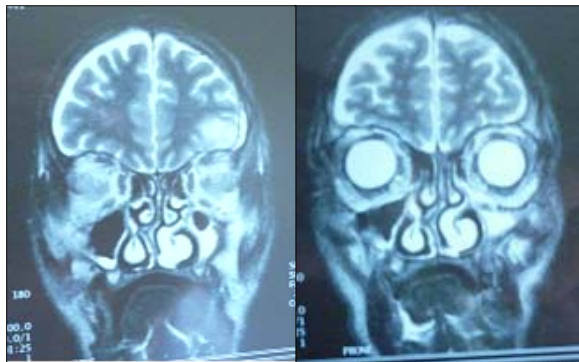
Surgical treatment has two types of approaches, i.e., trans-nasal endoscopic technique in which site of leak is approached trans-nasally and the site of leak packed and the trans-cranial sub-frontal approach. More and more patients are subjected to the newer endoscopic method.<sup>8</sup> However, anterior skull base fractures are often accompanied by craniofacial fractures or fracture of the naso-frontal segment. This pose a problem in establishing the correct diagnosis and identify the exact site of leak.<sup>9</sup> Additionally trans-cranial approach is implied in cases which fail to respond to the endoscopic approach and the centres which lack the endoscopic facilities also rely on the trans-cranial approach.

This study was conducted to analyse the outcome of trans-cranial sub-frontal approach for traumatic CSF rhinorrhea, with duroplasty and fibrin glue.

**MATERIAL AND METHODS**

This prospective observational study was carried out in the Department of Neurosurgery, Ayub Medical College, Abbottabad from January 2007 to June 2011. All patients undergoing trans-cranial sub-frontal repair of traumatic CSF fistulas were included. Approval of the study was taken from the Hospital’s Ethical Committee and informed consent was taken from all patients.

Patients were thoroughly examined clinically and glucose concentration of the nasal discharge (CSF) was analysed as well. High resolution CT-Scan was performed in all patients and selected patients underwent MRI with T2-weighted images in prone position (Figure-1). Patients were observed during 7–10 days period of bed rest in reverse-Trendelenburg position. Prophylactic broad spectrum antibiotics and acetazolamide were administered to all patients. Frontal craniotomies were done in all cases. Primary dural repair was performed under hypotensive general anaesthesia. Where possible, and in the cases where it was not possible, graft was used. This was followed by application of Fibrin Glue at the repaired site. Graft materials used in this study were taken from Fascia lata, pericranium, and temporalis fascia. Patients were observed postoperatively for any persistent and recurrent CSF leakage. Lumbar drainage was used in 4 (14.8%) 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 5 days and instructed to refrain from strenuous exercise and Valsalva manoeuvre. Patients were seen fortnightly for two months after surgery and later monthly. Mortality due to the procedure itself and any other complications like loss of smell, wound infection and occurrence of seizures were noted and documented.



**Figure-1: MRI showing hyperintense signals in ethmoid sinuses depicting CSF leak**

**RESULTS**

A total of 27 patients with posttraumatic CSF rhinorrhea, undergoing trans-cranial, sub-frontal surgical repair were included in this study. There

were 21 males and 6 females. Age of the patients ranged from 17 to 56 years; their mean age was 34.5±4.6 years. Main causes of trauma were road traffic accidents (23, 85.2%), fall from height (3, 11.1%), and assaults (1, 3.7%). X-ray skull and CT scan were done in all 27 cases whereas MRI was done in 5 (19%) cases only. Fracture of the frontal bone, orbital, and ethmoid air sinuses were seen in 6 (22.2%) cases.

In all 27 patients repair was accomplished via trans-cranial approach. In 15 (55.5%) patients repair was done with duroplasty by grafts material taken from fascia lata, while in 8 (29.6%) cases graft was taken from pericranium and temporalis fascia. In only 4 (14.8%) cases primary dural closure was possible. In all cases fibrin glue was applied at the repair site. In 23 (85%) cases no CSF leak was observed in immediate postoperative period as well as during the follow up visits while in 3 (11%) cases additional lumbar punctures were required to augment the repair. In 1 (3.7%) case the leak failed to stop and presented with recurrent CSF leak.

**Table-1: Surgical outcome of CSF leak repair (n=27)**

Outcome of CSF leak	Cases	Percentage
Stopped without lumbar puncture	23	85.2
Stopped with lumbar puncture	3	11.1
Did not stop	1	3.7

There was no operative mortality, but 1 (3.7%) case developed meningitis, and 4 (15%) cases developed anosmia. None of the patients developed wound infection and seizures (Table-2).

**Table-2: Postoperative complications (n=27)**

Type of complication	Cases	Percentage
Failure to stop leakage	1	3.7
Anosmia	4	15
Meningitis	1	3.7
Wound infection	0	0
Per-operative mortality	0	0

**DISCUSSION**

Patients with CSF rhinorrhea have always been a diagnostic and therapeutic challenge for neurosurgical and ENT colleagues. Successful management in refractory cases often involves a combination of observation, CSF diversion, and/or extracranial and intracranial procedures.<sup>6</sup> Posttraumatic CSF rhinorrhea mostly resolve spontaneously with conservative treatment within 7–10 days.<sup>10,11</sup> Absolute bed rest, keeping head elevated, avoiding coughing and straining during defecation and lumbar drain for few days are effective measures in conservative management. The selection of surgical procedure, timing of surgical intervention and role of antibiotics are debatable.

Even if the CSF leakage is stopped there is a chance of developing meningitis because delayed recurrent rhinorrhea occurs when dural defect is not

properly sealed. The objective of surgical intervention should be dural repair rather than stopping the CSF leakage as it reduces the risk of meningitis from 85–87%.<sup>6</sup>

In our study of 27 cases there was no operative mortality which is comparable to those of international studies. CSF leakage stopped in 23 (85%) cases immediately, while in 3 (11%) cases additional lumbar punctures were done to facilitate dural repair. One patient presented with recurrent CSF leakage after 6 weeks. This observation is in close proximity to the results of other studies conducted internationally. No patient developed wound infection, but 1 (3.7%) case developed meningitis. In literature it has been reported in 3–5% of cases.<sup>8</sup> Loss of smell was noted in 4 (15%) of cases, which could be due the reason that long term follow up was difficult as the patients don't come back for follow up once their CSF leakage stops.<sup>9–11</sup>

Only dural graft was used in all these cases followed by fibrin glue application. Transnasal endoscopic technique is practiced in selected cases especially where site of CSF leak can be precisely identified, and dural defect less than 3 Cm can be managed with free mucoperichondrial on-lay graft endoscopically.<sup>12,13</sup>

In emergency surgical intervention in posttraumatic CSF rhinorrhea cannot be done due to oedematous brain and brain parenchyma is more vulnerable to injury due to severe oedema.<sup>14</sup>

Type of surgical intervention to be chosen for the treatment of posttraumatic CSF rhinorrhea secondary to fractures of the anterior skull base varies according to location, the dimension of the bone fracture, and the experience of the operating surgeon. Massive CSF leakage with the destruction of the paranasal air sinuses and large obvious fractures are the indications for craniotomy.<sup>15,16</sup>

## CONCLUSION

Cerebrospinal fluid rhinorrhea is commonly seen in patients with anterior skull fractures secondary to head injury. Initially conservative trial should be given to the patients, if it fails then on-lay dural technique followed by fibrin glue application through

transcranial approach has good outcome with less chances of complications.

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