Surgically repaired posttraumatic CSF rhinorrhea: An institutional experience and review of literature

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ABSTRACT

Introduction: Posttraumatic cerebrospinal fluid (CSF) rhinorrhea frequently complicates anterior skull base fracture. Although skull base fracture is present in only about 7% cases of head injury, CSF rhinorrhea develops in 30% of cases with basal fracture. **Materials and Methods:** A total of 43 cases admitted in our Institute (SGPGI Lucknow) from January 2000 to June 2011with history of head trauma followed by CSF rhinorrhea. Forty one cases were included in this study as two patients refused surgery. **Result:** Out of forty one cases, 26 cases (63%) were admitted with history of recurrent meningitis, 21 cases (51%) with loss of smell, 26 cases (63%) with delayed onset CSF rhinorrhea, 3 cases (7%) with early onset rhinorrhea which did not improve after trauma, 12 cases (30%) with early onset rhinorrhea which improved but reappeared after some time. Twenty cases (48.8%) were repaired by extradural approach, 10 cases (24.4%) were repaired by intradural approach and 11 cases (26.8%) were repaired by endoscopic approach. 12 cases (29.0%) required re-surgery for persistent or recurrence of CSF rhinorrhea. **Conclusion:** Although posttraumatic CSF rhinorrhea usually resolves with conservative management, its persistence makes an individual prone for further complications like meningitis, brain abscess and septicaemia. Timely surgical intervention usually gives promising results. Endoscopic repair was better than transcranial repair.

Key words: Endoscopic repair, posttraumatic CSF rhinorrhea, transcranial repair

INTRODUCTION

The rhinorrhea usually commences within 48 h of head trauma, but in some cases, it may be delayed for months or even years. Although basal skull fractures were present in only 7% of all head injury cases, cerebrospinal fluid (CSF) rhinorrhea developed in 30% of the cases with basal fracture. It usually begins as a bloody discharge and then become clear. There is usually a breach in the bone, dural or arachnoid meningeal layers.[1] Anosmia is common and other evidence that suggests the presence of a CSF leak, such as fluid level in paranasal sinus, pneumocephalus, periorbital oedema or accompanying neurological deficit secondary to damage of contiguous structures such as visual pathways. CSF rhinorrhea carries significant mortality and morbidity when inadequately treated. In one series pyogenic meningitis occurred in up to 25% of untreated patients. Usually the leakage spontaneously ceases within 1 week of conservative treatment including bed rest, serial lumbar puncture or permanent spinal fluid lumbar drainage. It may, however, persist in 5 to 10% of cases, which require operative intervention. In the present study, 41 cases of posttraumatic CSF rhinorrhea were analysed and outcome of surgical repair by transcranial and transnasal endoscopic approach was compared.

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MATERIALS AND METHODS

A total of 43 cases admitted in Department of Neurosurgery at Sanjay Gandhi Institute of Medical Sciences, Lucknow from January 2000 to June 2011with history of head trauma followed by persistent CSF rhinorrhea were selected. Forty one cases were included in this study as two patients refused surgery. Data regarding the patient's demographical history, mode of head trauma, type of rhinorrhea, history of meningitis, preoperative radiology, type of repair and postoperative complications were retrieved from hospital information system and database files of the department of neurosurgery and analyzed retrospectively. CSF rhinorrhea was divided into three types, Type – 1: CSF leak that starts just after trauma and persists throughout, Type – 2: CSF leak starts just after

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trauma, improves by conservative treatment but again recurs and persists. Type – 3: CSF leak starts more than 2 weeks after trauma and persists. CSF leak was confirmed by glucose level in fluid and visualization of a ring or halo sign which is a very sensitive but less specific test. Patients were underwent imagings like computed tomography (CT) cisternography and magnetic resonance imaging (MRI) cranium with heavy T2 sagittal and coronal cuts to localize the site of leak. If site of leak was not localized even with above investigations, nasal endoscopy was done after intrathecal fluorescin infusion to locate the site of leak.

Meningitis was ruled out on clinical ground and when in doubt, lumbar puncture for CSF examination (routine and microscopy) and culture sensitivity was done. Patients admitted with posttraumatic CSF rhinorrhea with active meningitis were managed, meanwhile with broad-spectrum antibiotics. CSF was sent for culture sensitivity and antibiotics were changed according to sensitivity report.

All patients with persistent CSF rhinorrhea were managed surgically. Operative approaches were of two types – transcranial and endonasal. An approach adopted by each surgeon was based on his/her preference and experience. Transcranial procedure was further divided into intradural repair and extradural repair. Different materials were used for repair of defect which depended on the size of the defect [Table 1], for defect size > 2 cm, autologus bone was used [Figure 1a-d].

RESULTS

There was a male preponderance with 34 males (83.0%) and 7 females (17.0%). The age group ranged from 2 to 49 years with a mean age of 19.78 years [Figure 2]. Fall from height was the most common mode of head injury present in 18 cases (43.9%), road traffic accident present in 15 cases (36.6%) and injury with hard object was present in 8 cases (19.5%). An early onset rhinorrhea which persisted (type – 1) was present in 3 cases (7.3%), early onset rhinorrhea which improved on conservative management and again recurred and persisted (type – 2) was found in 12 cases (29.3%) and delayed onset rhinorrhea (type – 3) which is the most common type was present in 26 cases (63.9%) [Table 2]. History of recurrent meningitis was present in 16 cases (39.0%), single episode meningitis was present in 10 cases (24.4%) and 15 cases (36.6%) presented without any history of meningitis. Localization of CSF leak by CT cisternography were possible in 35 cases (85.0%) [Table 3]. Intra – operative pseudoencephalocele was present in 14 cases (34.1%).

Operative Techniques and Results

After complete preoperative work up and control of meningitis as required, patients underwent operative intervention. Total 30 cases (73.2%) were repaired by transcranial approach, out of which 20 cases (48.8%) were operated by total extradural approach, 10 cases (24.4%) were operated by intradural approach and 11

Table 1: Graft material used for different sizes of defects

Technique	Size of defect	Graft material
Overlay	<3mm	Composite with muco-perichondrial graft
Underlay	>3mm	Composite with local mucosal flap
Bath-plug	Up to 2cm	Fascia, fat, muscle
Reinforcement	>2 cm	Cartilage, bone

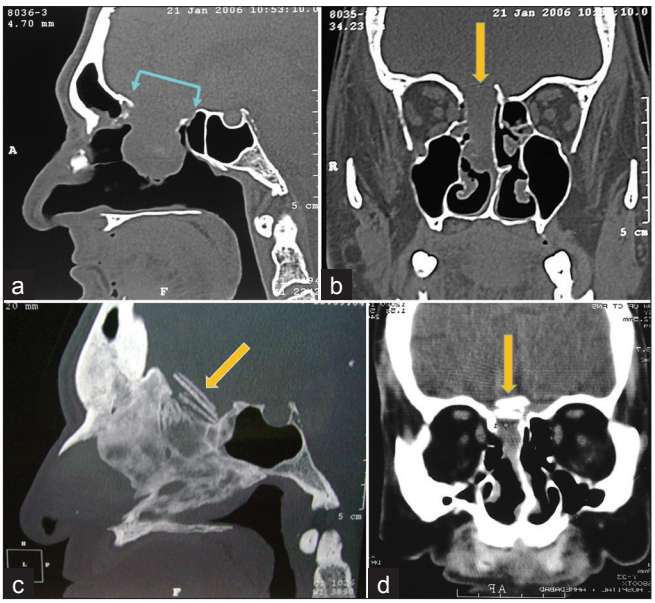

Figure 1: (a and b) Bilateral post traumatic CSF rhinorrhea site in anterior skull base with meningocele, (c and d) Use of bone graft for the repair (post operative)

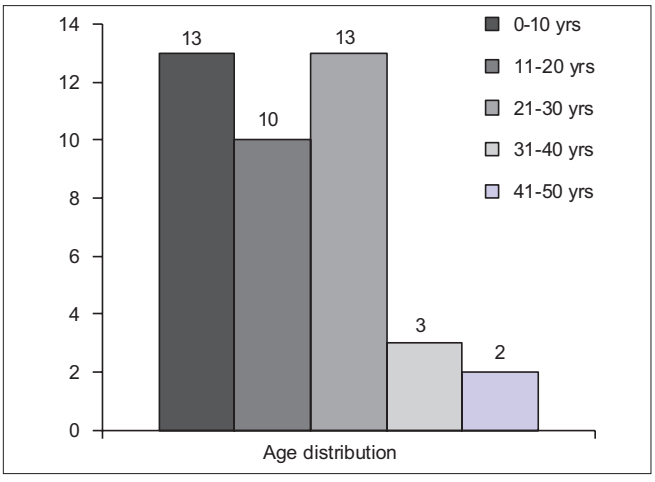

Figure 2: Age distribution of patient admitted with complain of persistent post traumatic CSF rhinorrhea manage surgically: Mean age – 19.78 yrs

Table 2: Mode of injury and type of rhinorrhea

Mode of injury	*n*=41 (%)	Type – 1 rhinorrhea *n*=3 (7.3 %)	Type – 2 rhinorrhea *n*=12 (29.3 %)	Type – 3 rhinorrhea *n*=26 (63.4 %)
Fall from height	18 (43.9)	2 (4.9)	5 (12.3)	11 (26.8)
Road traffic accident	15 (36.6)	1 (2.4)	6 (14.6)	8 (19.5)
Fall of hard object	8 (19.5)	0 (0.0)	1 (2.4)	7 (17.1)

Type – 1 rhinorrhea: CSF leak that started just after trauma and persist throughout; Type – 2 rhinorrhea: CSF leak starts just after trauma, improves by conservative treatment but again recurs and persist; Type – 3 rhinorrhea: CSF leak starts more than 2 weeks after trauma and persist

Table 3: History of meningitis and site of leak localised by computed tomography cisternography

History of meningitis	*n*=41 (%)	Leak localised by CT cisternography *n*=35 (85.4 %)	Leak not localised by CT cisternography *n*=6 (14.6 %)
No meningitis	15 (36.6)	11 (26.8)	4 (9.8)
Single episode meningitis	10 (24.4)	9 (22.0)	1 (2.4)
Recurrent meningitis	16 (39.0)	15 (36.6)	1 (2.4)

CT – Computed tomography

cases (26.8%) were operated by endoscopic transnasal approach. Postoperatively recurrence of CSF rhinorrhea was seen in 10 cases (24.4%), managed by transcranial approach. All patients of recurrent leak were managed by serial lumbar drainage for 3 days, prophylactic antibiotics against meningitis and complete bed rest with head end elevated by 30 degrees. In 2 cases (7.0%) CSF leak improved, rest 8 cases (27.0%) required repeat operative intervention. Out of 6 cases (20.0%) which were improved by 2nd operation, 4 cases (13.0%) in which recurrence of CSF leaks were seen in initial postoperative period which were managed by re-exploration of craniotomy and repair by intradural approach. Two cases (7.0%) who presented late in postoperative period (1st after 2 month, 2nd after 9 month) with recurrence of CSF leak with meningitis were managed by transnasal endoscopic approach after adequately giving treatment for meningitis. Out of 2 cases (7.0%) which required 3rd operation for recurrence of CSF leak even after 2nd operation, one case improved after re-repair but another had operative site hematoma without significant mass effect with meningitis and was managed by conservative treatment but did not improve and developed respiratory failure and died.

Total 11 cases (26.8%) were managed by transnasal endoscopic approach. Postoperative recurrence of CSF rhinorrhea seen in 2 cases (18.0%), one was managed by transnasal endoscopy approach and another was managed by craniotomy and repair as the patient had large dural defect with bone loss. None required 3rd operation in transnasal endoscopic group. [Table 4]. Mean follow up period was 4.2 years (Range-1 month to 11 years).

DISCUSSION

In the present study, we describe 41 patients with posttraumatic CSF rhinorrhea who required operative repair. The initial evaluation of a patient presenting with CSF rhinorrhea begins with a good history and physical examination. The typical history is that of clear, watery discharge from nose after a head trauma. There may be an increase in postnasal drip in the supine position. It is highly suspicious when there is a previous history of meningitis while the leak has been present. There is a high risk of developing meningitis, with all the associated morbidity and potential mortality with reported rate varying between 5.6%[2] and 60%,[3] and the annual risk of developing meningitis of 9.8% per year has been estimated.[4] In the present study, out of 26 (63.4%) patients presented with meningitis, 10 (24.4%) with single episode and 16 (39.0%) were with recurrent episode, but Schick *et al.*[5] reported 61.9% patients had presented with meningitis, 7 (33.3%) with a single episode and 6 (28.6%) with recurrent episode, which is comparable to our study. In most cases, the physical examination is unremarkable except for CSF rhinorrhea that occurs on changing posture like forward bending or straining due to an increase in intracranial pressure. Simple test to determine the presence of CSF is the visualization of a ring or halo sign. When CSF is mixed with blood, it can be placed onto a piece of filter paper. The blood on the paper will separate out from the CSF (central blood with clear ring of CSF). This test is not specific. Dula *et al.*[6] found that the ring sign occurred when blood was mixed with water, saline and other mucus.

All patients of suspected CSF rhinorrhea should be submitted for high resolution CT scan to detect bony defect. It can also detect the presence of pneumocephalus, soft tissue masses and hydrocephalus. CT cisternography has nearly a 100% detection rate when CSF leak is active. However, with intermittent leaks the rate of detection drops to 60%. In the present study, out of 41cases, in 35 cases (85.0%) site of leak were localized by CT cisternography. Colquhoum[7] was able to identify the site

of the CSF leak in 17 out of 21 (81.0%) patients by CT cisternography. Eljamel *et al.*[8] reported the success rate of CT cisternography up to 92% in active and 40% in inactive CSF leak. MR Cisternography is helpful for detecting inactive fistula, soft tissue abnormality and distinguishing CSF from other fluid located in a sinus cavity as CSF has high signal intensity on T2 images. Wakhloo *et al.*[9] were able to visualize three traumatic CSF fistula and one meningoencephalocele in six patients of CSF rhinorrhea examined by MRI with T2 weighting. MRI is not as good as CT when it comes to detecting bony defects and is much more expensive. Precise location of the leak is prerequisite for surgical repair, without which the patients will continue to be at risk of potentially fatal meningitis.[5]

The treatment of CSF rhinorrhea can be classified into conservative management and operative management. The majority of posttraumatic CSF leak responds well to conservative management. Persistence of a CSF leak increases the risk of meningitis about 10-fold and therefore treatment is of utmost importance.

Conservative management involves around bed rest. The patient is placed on bed rest for 7 – 10 days with head of bed 15 to 30 degrees elevated. The patient is also informed not to strain, cough or perform heavy lifting. It is reported that with this type of management, 90 to 95% of all traumatic CSF leaks resolve spontaneously.

Currently there are three type of techniques used to repair CSF leaks: intracranial, extracranial and transnasal endoscopic repair.[10] The intracranial approach has the advantage of direct visualization of a leak from above and allows treatment of coexisting intracranial pathology. However, it affords poor visualization of fistula from the anterior skull base. Intracranial approach has significant morbidity including anosmia, intracerebral haemorrhage, cerebral oedema, seizures, frontal lobe dysfunction with memory loss, osteomyelitis of the frontal bone, and rarely even death. Success rate with intracranial approach vary from 50 to 73%.[10] In the present study success rate of intracranial repair after first operation is 22 of 30 (73.3%) but Scholsem *et al.*[11] reported 98 of 109 patients (90.0%) were cured. The better results may be because of larger series and more experience for intracranial repair.

Table 4: Result of operative repair in cases of post traumatic cerebrospinal fluid rhinorrhea

	Attempt successful		
	1st	2nd	3rd
Intracranial (*n*=30)	22	6	2
Endoscopic (*n*=11)	9	2	0

The extracranial approach utilized facial incisions to gain access to the site of CSF leak. The main disadvantage with this approach is facial scarring. However, success rate has been up to 80% closure in CSF leaks.[12] No case in our study was operated by this approach due to its main disadvantage of facial scar.

It is currently accepted that the endoscopic intranasal management of CSF rhinorrhea is the preferred method of surgical repair with higher success rate and lower morbidity than other approaches. Transnasal endoscopic approach has many advantages like higher success rate with lower morbidity, short hospital stay and preserved olfaction than transcranial approach.

In our study, 11 cases were operated by transnasal endoscopic approach. Success seen in our study was 9 of 11 (81.8%). This result was comparable with other published series [Table 5].

CONCLUSIONS

Posttraumatic CSF rhinorrhea requires special attention. Initial treatment is conservative, but persisting leak after 2 weeks requires surgical repair to avoid complication

Table 5: Compression of transnasal endoscopic repair results

Series	No. of cases	1st attempt successful	2nd attempt successful	Craniotomy
Papay *et al.*[13]	4	4 (100.0)	–	0
Mattox *et al.*[12]	7	6 (86.0)	7 (100.0)	0
Stan Kiewich[14]	6	6 (100.0)	–	0
Kelly *et al.*[7]	8	7 (83.0)	8 (100.0)	0
Burns *et al.*[1]	42	35 (83.0)	38 (90.0)	Not mentioned
Lanza *et al.*[8]	36	34 (94.0)	35 (97.0)	1
Mazhar Hussain *et al.*[15]	8	8 (100.0)	–	0
Rohit S *et al.*[16]	11	10 (90.0)	11 (100.0)	0
Bhalodiya[17]	20	17 (85.0)	19 (95.0)	Not mentioned
Singh D[3]	36	32 (90.0)	35 (97.0)	1
Present series	11	9 (82.0)	10 (91.0)	1

Figures in paranthesis are in percentage

like meningitis. Localization of leak site can be done with preoperative imaging like CT or MR cisternography which is very important for successful surgical repair. Intracranial repair can be used but endoscopic approach has a better outcome with minimal morbidity.

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