

ORIGINAL RESEARCH

A Study to Evaluate the Management of Traumatic Cerebrospinal Fluid Leaks and Associated Lesions

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ABSTRACT

Introduction: Cerebrospinal Fluid (CSF) leak is a serious complication in base of skull fractures with high probability of complications like meningitis. The objective of the study was to evaluate the traumatic management of cerebrospinal fluid leaks and associated lesions.

Materials and Methodology: Study commenced with 102 patients comprising of different ages between 15 and 80 years that include both the genders who were diagnosed to be CSF rhinorrhoea presented with trauma.

Results: There was a total of 102 subjects who had head injury as well as CT scan evidence of base of skull fracture. Maximum number of patients was in the age group 21-30 years (27 patients). Mean age of the patients was 41.47 and standard deviation was 15.79. There was a total of 81 (79.4%) males and 21 (20.6%) females. And in evaluating the mode of injury among the study subjects, road traffic accidents observed as the most common mode of injury, which occurred in 85 (83.4%) patients. A total of 11 (10.5%) patients had history of fall from height and assault accounted for 6 (6.1%) patients.

Conclusion: Early detection of CSF leak and starting of antibiotics according to culture and sensitivity and surgical repair in indicated patients can yield best results.

Keywords: CSF Rhinorrhoea, Anterior Cranial Fossa, Meningitis.

INTRODUCTION

High energy trauma has been reportedly identified as the sole reason for the fracture involving the base of skull. The most commonly calculated is that the force of more than 1000 lbs for 1 ms is promptly enough to generate a fracture.¹ Fractures involving the anterior region of the skull base mostly results in the tear of dural sheath because of the adherence of the dura to the underlying bone. Therefore, a communication is created between the subarachnoid space and the sinuses, resulting in CSF rhinorrhoea. Middle Cranial Fossa (MCF) and the posterior cranial fossa fractures and also the fracture involving the clivus can cause CSF

rhinorrhoea via the sphenoid sinus.² Fractures passing through the petrous bone, especially the longitudinal ones can also produce CSF leak due to its proximity to the middle ear. Almost around 80% of the reported traumatic CSF leaks are those involving the nasal pathways while 20% involves the aural pathways.³

Cerebrospinal fluid (CSF) rhinorrhoea is one of the most frequent complications after traumatic brain injuries (TBI).⁴ The risks of CSF leaks could possibly be detrimental to the clinical outcomes of the patients. Prompt early diagnosis and proper management are mandatory as it is associated with a better long-term prognosis for the patients.⁵ Traumatic CSF leak is a complication seen in 2% of all head injuries patients. And it occurs in 12-30% of the cases of basilar skull fractures. Out of the basilar skull fractures, those involving the frontal and ethmoidal sinuses first followed by longitudinal temporal bone fractures causing CSF leaks.⁶ CSF rhinorrhoea commonly occurs following head trauma (fronto-basal skull fractures) or as a result of intracranial surgery. Various other conditions that can cause CSF leakage is that paranasal sinuses along with osteomyelitis of the adjacent bone, congenital anomalies of the brain and its coverings such as meningoceles or meningoencephaloceles, and destructive lesions involving the skull base.⁷ Pituitary tumours cause erosion of the floor of sella turcica and are frequently associated with CSF rhinorrhoea.⁸

The linear fractures in the base of the skull mostly associated with a high risk of intracranial infection. The overall incidence of bacterial meningitis among post-traumatic CSF leak varies between 6-30% and the rate increases with increase in duration of CSF leak. The objective of the study was to evaluate the traumatic management of cerebrospinal fluid leaks and associated lesions.

MATERIALS AND METHODOLOGY

This study was adopted as a descriptive study which was conducted in the Department of Neurosurgery, Anugrah Narayan Magadh Medical College and Hospital (ANMMCH), Gaya, Bihar (India) and Department of Neurosurgery, Jawaharlal Nehru Medical College and Hospital (JLNMCH), Bhagalpur, Bihar, India. The study commenced with 102 patients comprising of different ages between 15 and 80 years that include both the genders who were diagnosed to be CSF rhinorrhoea presented with trauma.

Those patients reported with head injury presented with CSF leakage with the age group between 20 and 55 years were included in the study. And those patients with trauma observed with a poor GCS score and those below 20 years of age irrespective of gender were promptly excluded from the study. Basically, a proforma containing the demographical data of the patients were provided to all the study participants which was duly filled by the researcher. This questionnaire also included successful surgical repair of the dural defect, postoperative course, type of graft used, and its associated complications were promptly recorded.

In patients observed with the clinical evidence of meningitis, lumbar puncture was performed, and the CSF sample was sent to look for the type of organism and pattern of antibiotic sensitivity. And the most common organisms involved in causing meningitis in cases of post-traumatic CSF leak are observed to be *Streptococcus* and *H.influenza*⁹ and these patients were commenced with empirical antibiotics in-order to cover these organisms. Antibiotics like ceftriaxone and penicillin was the first choice of drug. Patients with penetrating injury, intracranial haematoma, large intracranial pneumocoel, herniation of brain tissue from nose and ear, low probability of natural dural repair, were considered for early surgery

PSS version 25 was used to analyse the collected data. collected data. Biodata and management data are divided into categorical and numerical variables. Numerical variables such as age are presented by mean SD. Data is presented by frequency and percentages.

RESULTS

There was a total of 102 subjects who had head injury as well as CT scan evidence of base of skull fracture. Maximum number of patients was in the age group 21-30 years (27 patients). Mean age of the patients was 41.47 and standard deviation was 15.79. There was a total of 81 (79.4%) males and 21 (20.6%) females.

And in evaluating the mode of injury among the study subjects, road traffic accidents observed as the most common mode of injury, which occurred in 85 (83.4%) patients. A total of 11 (10.5%) patients had history of fall from height and assault accounted for 6 (6.1%) patients [Table-2].

Among the total 102 patients, 63 (61.4%) patients had loss of consciousness soon after trauma. There were 63 (64.4%) patients who had raccoon eye. Of the 102 patients only 28 (27.3%) patients had postauricular haemorrhage (Battle sign) which was given in Table-3. Among the total 21 patients with CSF leak, 19 of them had CSF rhinorrhoea only, 9 patients had CSF otorrhoea only and 1 (2.85%) patient had both CSF rhinorrhoea and otorrhoea. And 52 (51.2%) patients had Anterior Cranial Fossa (ACF) fracture alone which was the most common among all the base of skull fractures in the study subjects. A combination of anterior and MCF fracture was seen in 27 (26.2%) patients. Fracture site in different patients in the study group identified from CT is given in [Table-4]

Patients were categorised into three groups depending on the duration of CSF leak. There were 18 patients who had only one day of CSF leak which came to 51.4% of the patients with CSF leak. In the study group, 10 patients had CSF leak with duration between 2-10 days which is 28.5% of those with CSF leak. A prolonged duration of CSF leak in spite of conservative management was noted in seven patients which is 20% of the total among those with CSF leak.

Of the 21 patients who had CSF leak, nine patients (25.7%) developed meningitis. CSF culture was done in nine patients, of whom two of the samples grew Streptococcus pneumonia, one grew resistant Klebsiella and other samples were sterile. In those patients in CSF culture, they grew Streptococcus pneumoniae, both were sensitive to penicillin. One patient with the resistant Klebsiella and another one with sterile CSF study succumbed to death. Among 21 patients with CSF Leak, 12 patients were managed conservatively and only seven patients had surgical interventions. Among 21 patients managed conservatively, three of them were managed with a lumbar drain. Only seven patients (20%) had a persistent leak lasting for more than 10 days.

Table 1: Age and sex distribution in patients

Age distribution	Males	Females	N	%
13 – 20	4	2	6	6.1
21 – 30	23	4	27	26.1
31 – 40	17	6	23	22.2
41 – 50	13	3	16	15.2
51 – 60	12	2	14	14.4
61 – 70	9	3	12	11.9
71 – 80	3	1	4	4.1
Total	81	21	102	100

Table 2: Mode of injury

Mode of injury	N	%
Road traffic accident	85	83.4
Fall from height	11	10.5
Assault	6	6.1

Total	102	100
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Table 3: Clinical picture at the time of presentation of fracture

Clinical picture	Number	%
Nose/ear bleed	81	79.8
Loss of consciousness	63	61.4
Subconjunctival haemorrhage	40	38.9
Raccoon eyes	66	64.8
Post auricular haemorrhage	28	27.3
CSF leak	21	20.9

Table 4: CT findings on site of skull fracture

CT scan	Frequency	%
ACF	52	51.2
MCF	8	7.9
PCF	1	1.3
ACF+MCF	27	26.2
ACF+MCF+PCF	6	5.9
ACF+PCF	5	4.6
MCF+PCF	3	2.9
Total	102	100

DISCUSSION

In the current study, the maximum number of patients who had traumatic CSF leaks was between 21-30 years, which constituted 26.1% and it was followed by those between 31- 40 years which was nearly 22.2%. This was particularly comparable with the results obtained by World Health Organization (WHO) statistics.¹⁰ Therefore in the current study, the majority contributed to the major share of the base of skull fractures in our study and it contributed to the mode of injury in 83.2% of patients. Road traffic accidents were found to be the most common aetiology in a study conducted by Sivanandapanicker J et al.¹¹ This response to predisposition at a younger age group and road traffic accidents might be due to inexperience, tendency to take risks and alcoholism. In this study, ACF fractures were the most frequent basal skull fractures. This constituted 51.2% of cases. This was eventually comparable with the results of studies by Waani AA et al and Emejulu JK and Malomo O.^{12,13} There are few studies in which they found MCF fractures as the most common site of fracture in patients with head injury.¹⁴ It was observed that 38.9% of the study subjects had subconjunctival haemorrhage and 64.8% of the patients had raccoon eyes. These are signs and symptoms of ACF fracture. 28 patients (27.3%) had post auricular ecchymosis or battle sign, which is a manifestation of MCF fracture.

Preto FL et al had clearly hypothesized that the importance of clinical signs in order to diagnose basal skull fractures in his study.¹⁵ There were 28 patients who had CSF leak in the form of rhinorrhoea or otorrhoea among the total study group. This accounted to about 20.9% of the total cases of basal skull fractures. Friedman JA et al had reported 12-30% incidence of CSF leak among patients with base of skull fractures.¹⁶ According to Lloyd MN et al the most common investigation done for diagnosis of basal skull fracture.¹⁷ The duration of CSF leak in each of the 35 patients were studied. There were 25 patients (51.42%) with duration of leak for 1 day and in them the leak resolved spontaneously. Of these 21 patients with duration of leak more than one day; nine patients developed clinical features of meningitis. CSF study

was done in them, and it was suggestive of meningitis. Therefore, 20.9% of the total 21 patients with CSF leak had meningitis in this study. In a 12-year prospective study conducted by Daudia A et al. it was observed that the incidence of meningitis in persistent CSF leak was 19%.¹⁸ The relatively increased incidence in this study may be attributed to small sample size. The CSF leak repair by intracranial intradural and intracranial extradural repair with fascia lata had a success rate of 100% with maximum follow-up period of 1 year and a minimum of 1 month. Similar results were obtained in study conducted by Lin DT.¹⁹

CONCLUSION

From this study, the cases of post-traumatic C.S.F rhinorrhoea cases should be managed conservatively because most of the C.S.F leaks stop spontaneously with proper conservative management. So surgical repair should be delayed for 2 – 12 weeks after a leak has been identified.

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