

ORIGINAL ARTICLE

COMPARISON OF LUMBAR DRAIN INSERTION AND CONSERVATIVE MANAGEMENT IN THE TREATMENT OF TRAUMATIC CSF RHINORRHOEA

Riffatullah Khan, Muhammad Sajjad*, Abdul Aziz Khan*, Bilal Ahmad*, Sohail Ahmad, Muhammad Mushtaq**, Saad Sultan*, Osama Iftikhar***

Department of Neurosurgery, Pakistan Institute of Medical Sciences Islamabad, Department of Neurosurgery, Ayub Teaching Hospital Abbottabad, **Ayub Medical College, Abbottabad, **District Headquarters Hospital Mansehra-Pakistan

Background: Conservative management of traumatic CSF rhinorrhoea is associated with a greater risk of developing meningitis in the presence of active CSF leak. Lumbar drains have been reported to be better than conservative management alone in stopping CSF leaks following traumatic brain injury. **Methods:** This randomized controlled trial enrolled 60 patients with CSF rhinorrhoea and divided them into two groups. One group was managed with conservative management plus a lumbar drain (group A) and the other was managed with conservative management alone (Group B). Length of CSF rhinorrhoea in days was estimated in both groups. **Results:** There was a statistically significant difference in mean length of CSF rhinorrhoea in both groups. In group A, mean Length of CSF rhinorrhoea was found to be 3.4 days \pm 1.1 SD, while in group B it was 6.75 days \pm 1.96 SD ($p=0.001$). Stratification with respect to gender, age, duration and type of trauma showed similar trend ($p<0.05$ in all cases). **Conclusions:** Patients who underwent lumbar drain insertion plus conservative management demonstrated significantly shorter length of CSF rhinorrhoea when compared to conservative management alone in the treatment of traumatic CSF rhinorrhoea.

Keywords: CSF rhinorrhoea; Traumatic brain injury; Lumbar drain; Conservative management, Cerebrospinal Fluid

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INTRODUCTION

The main functions of cerebrospinal fluid include protection of brain and maintenance of intra-cranial pressure.¹ From choroid plexus, where it is produced at a daily active volume of 140 ml, it circulates to the third and the fourth ventricles of brain from the lateral ventricles via the "aqueduct of Sylvius" and is reabsorbed into the dural venous sinuses through the arachnoid villi in the subarachnoid space.² CSF leaks are a well-known complication of traumatic brain injury and are associated with substantial mortality and morbidity.^{3,4} CSF Rhinorrhoea results from damage the anatomical barriers separating the nasal cavity from anterior and/or middle cranial fossae.⁵ CSF rhinorrhoea resulting from traumatic brain injury is seen in 9 out of every 10 cases of cerebrospinal fluid leak. It has been estimated that non-surgical traumatic brain injury is the culprit in 80% of cases of cerebrospinal fluid leaks while surgical procedures leading to cerebrospinal fluid leak are seen in about 16% of cases while only 4% of cerebrospinal fluid leaks are due to non-traumatic causes.⁶ Most cerebrospinal fluid leaks (up to 70%) present within days or weeks of trauma to brain, however some may take as late as 2-3 months to

appear.^{7,8} Conservative management of CSF leaks has been advocated and has been found to help in healing of CSF leaks over a period of 7-10 days, however, conservative management doesn't always succeed and sometimes CSF diversion through lumbar drains becomes necessary in case of conservative management failure.⁹⁻¹¹ Lumbar drainage of CSF leaks has been found to be a safe and effective method for treatment of cerebrospinal fluid leaks as well as prevention of cerebrospinal fluid fistula formation in certain groups of patients such as those with large meningeal layer tears or irradiated / debilitated patients.^{12,13} In a Recently, the use of lumbar drains earlier in the management of CSF leaks has drawn attention.¹⁴ The use of lumbar drains in the management of CSF leaks was found to be associated with a significantly reduced leak time ($p<0.0001$; in Lumbar drainage (Group A) the mean \pm SD CSF leak time was 4.83 \pm 1.88 days while in the conservative management group (Group B) the mean \pm SD CSF leak time was 7.03 \pm 2.02 days.)¹⁴ Interestingly, the use of lumbar drains was not associated with a statistically significant reduction in the occurrence of complications such as recurrent CSF leak or meningitis ($p>0.05$).¹⁴ The present study

was designed with a view to determine the efficacy of lumbar drains in management of CSF leaks in our setup. Since most CSF leaks heal with conservative management in a week or so, however the patients are exposed to a greater risk of meningitis owing to the active CSF leak. The use of lumbar drains in patients with CSF leaks due to traumatic brain injury should help decrease the risk of meningitis by decreasing the duration of leak. The rationale of this study was that adoption of this simple, cost-effective method will reduce the risk of fatal meningitis as well as recurrent leaks in patients with CSF rhinorrhoea secondary to traumatic brain injury in addition to reduction in duration of hospital stay.

MATERIAL AND METHOD

This randomized controlled trial was conducted at the department of Neurosurgery, Pakistan Institute of Medical Sciences, Islamabad from March to August 2017. Sixty patients who were later divided into two groups of thirty patients each through consecutive non-probability sampling technique were enrolled into this study. This sample size was arrived at keeping population variance at 3.8025^{14} , population standard deviation at 1.95 (SD of length of CSF leak in days)¹⁴, test value of population mean 4.83, and anticipated population mean to be 4.83 using a 5% level of significance with 90% power of test. All patients from both sexes aged 15–65 years who presented with CSF rhinorrhoea following a history of traumatic brain injury that occurred in the previous 8 weeks were enrolled in the study. In order to control bias, patients who had clinical evidence of systemic illnesses including meningitis, those with a history of severe cough, sneezing or nose blowing, or patients with spinal fistula, hydrocephalus, space occupying lesion in the brain eroding adjacent bone (confirmed on CT Scan brain) were excluded from the study as these factors could introduce bias into the study. The objective of this randomized controlled trial was to compare lumbar drain insertion plus conservative management and conservative management alone in the treatment of traumatic CSF rhinorrhoea in terms of mean length of CSF leak in days. Traumatic CSF rhinorrhoea was defined as clear, watery unilateral nasal discharge in patients with a recent history of traumatic head injury. Its presence was confirmed on visual inspection by demonstration of “reservoir sign” which would show a gush of fluid from nose following recumbency for a while. The “ring sign” which entails formation of a ring of cerebrospinal fluid around a central collection of blood in cases of blood-stained CSF rhinorrhoea was also used as a clinical evidence of CSF rhinorrhoea. Each study participant also underwent an HRCT of skull with axial, sagittal and coronal reconstruction to identify the site of CSF

leakage. The length of CSF rhinorrhoea was measured in days following hospitalization / enrolment in the study to stoppage of CSF leak confirmed by visual inspection. The null hypothesis for the study suggested that there is no significant difference in Length of CSF rhinorrhoea between lumbar drain insertion plus conservative management and conservative management alone in the treatment of post traumatic CSF leak while the alternate hypothesis was that there was a significant difference in Length of CSF rhinorrhoea between lumbar drain insertion plus conservative management and conservative management alone in the treatment of post traumatic CSF leak. Following permission and approval from the hospital ethics committee, study population was recruited from indoor patients at the department of Neurosurgery, PIMS Islamabad as per sample selection criteria. After obtaining an informed consent, the patients were allocated to either of the two groups via lottery method. Patients in Group A were managed by placement of a subarachnoid lumbar drain in addition to the conservative management for draining approximately 5–10 mL of CSF per hour while patients in Group B were managed only conservatively. Prophylactic antibiotics were administered to all study participants. Lumbar drain was inserted in the space between L3–L4 vertebra via a spinal needle under strict aseptic conditions. Conservative management of patients involved strict bed rest, elevation of head to 30°, advice to refrain from sneezing, coughing, blowing of nose, straining, particularly at stools and / or Valsalva manoeuvres. Patients were prescribed medicine for vomiting, cough or constipation where required and were monitored for blood pressure control. Patient were observed for CSF leakage for two weeks. After stoppage of leak, lumbar drain was clamped for 48 hours and patient were observed for recurrent leakage for another 3 days. Drain was removed before the patients were discharged in case of no further CSF leak. The data collected was entered into and analysed using SPSS 17. Quantitative variables such as age of the patient, length of CSF rhinorrhoea in days and duration of trauma were measured as mean±SD. Categorical variables were described as frequencies and percentages. Student’s *t*-test was used for comparison of length of CSF rhinorrhoea in both groups. Effect modifiers like age, gender, duration and type of trauma were controlled by stratification. Post stratification student *t*-test was applied and *p*-value less than 0.05 considered as significant.

RESULTS

Of the sixty study participants, an overwhelming majority was male (n=56; 93.33%). The gender distribution in both groups was similar, i.e., 28 (93.3%) males and 2 (6.7%) females in each group. Patients

managed with lumbar drain were older than those managed conservatively: their mean age was 28.5±10.2 years while the mean age of patients managed conservatively was 26.3±7.9 years.

Road traffic accidents were the most common cause of trauma in both the groups. Comprising 86.7% and 90% respectively of both Group A and Group B patients. The mean duration of trauma in hours was longer in patients managed with lumbar drain (23.5±4.2) than in patients managed conservatively (21.3±3.7). In group A (conservative plus lumbar drain), mean length of CSF rhinorrhoea was found to be 3.4 days±1.1SD, while in group B (conservative alone) mean Length of CSF rhinorrhoea was found to be 6.9 days±1.96SD (Table-1). Student's *t*-test was applied to assess the significance of difference between two means. *p*-value was found to be 0.001 implying significant difference between two groups with patients in group A (conservative plus lumbar drain) demonstrated significantly shorter length of CSF rhinorrhoea. Stratification with respect to gender (Table-2), age (Table-3), type of trauma (Table-4) and duration of trauma (Table-5) showed similar trends. *p*-value was found to be <0.05 in all cases implying patients in group A (CONSERVATIVE PLUS LUMBAR DRAIN) demonstrated significantly shorter length of CSF rhinorrhoea when stratified for effect modifiers (*p*<0.05).

Table-1: Mean CSF length in both treatment groups

Group	Mean (Days)	SD	<i>p</i> -value t-test
Group A Conservative plus lumbar drain	3.4	1.1	0.001
Group B Conservative only	6.9	2.1	

Table-2: Gender based stratification

Gender	Group	Mean	SD	<i>p</i> -value t-test
Males	Conservative plus lumbar drain	3.29	1.01	0.001
	Conservative only	6.75	1.96	
Females	Conservative plus lumbar drain	4.5	0.71	0.001
	Conservative only	9.5	0.71	

Table-3: Age based stratification

Age groups	Group	Mean	SD	<i>p</i> -value t-test
15–40 years	Conservative plus lumbar drain	3.2	0.9	0.001
	Conservative only	6.9	2.1	
>40 years	Conservative plus lumbar drain	4.3	0.9	0.001
	Conservative only	6.7	1.2	

Table-4: Stratification based on trauma type

Trauma type	Group	Mean	SD	<i>p</i> -value t-test
RTA	Conservative plus lumbar drain	3.35	1.06	0.001
	Conservative only	6.78	1.98	
Fall	Conservative plus lumbar drain	3.5	1.0	0.001
	Conservative only	8.33	2.08	

Table-5: Stratification based on trauma duration

Trauma duration	Group	Mean	SD	<i>p</i> -value t-test
Within 2 days	Conservative plus lumbar drain	3.3	1.1	0.001
	Conservative only	6.8	2.1	
More than 2 days	Conservative plus lumbar drain	3.4	0.9	0.001
	Conservative only	7.8	1.8	

DISCUSSION

There is a lack of consensus on the management of CSF rhinorrhoea with surgeon's preference playing an important role, i.e., endoscopic vs extra-cranial approach for management of CSF rhinorrhea.^{15,16} However, conservative management is the treatment of choice for most CSF leaks and operative management is only considered when, despite 4-6 weeks of conservative treatment CSF leak doesn't stop; when a spontaneous CSF fistula forms; in cases with intermittent CSF leaks or with delayed CSF leaks following trauma; meningitis with concomitant CSF leaks or "false CSF rhinorrhoea" from petrous skull bones through the mid-ear canal.¹⁷ CSF rhinorrhoea due to traumatic brain injury constitutes about 90% of cases with CSF leakage.

Meningitis is the most common cause of morbidity as well as mortality in patients with active CSF leaks.¹⁸ The use of lumbar drains in addition to conservative management of CSF rhinorrhoea is controversial.^{14,19-21} Despite the controversy surrounding placement of lumbar drains in patients with CSF Rhinorrhoea, a number of studies have reported their benefit over conservative management.^{14,21}

In this randomized controlled trial, we compared the benefit of lumbar drain insertion with conservative management of CSF leaks and the benefit was measured in terms of reduction in number of days of CSF leak. Our results show that in patients who had had a lumbar drain inserted had a significant reduction in the length of CSF rhinorrhoea in terms of days compared to conservative management alone (*p*=0.001). Similar trend was observed upon stratification of outcome by age of study population, gender, and type of trauma leading to CSF leaks (*p*<0.05 in all cases).

Similar results have been reported elsewhere. For example in a study by Albu and colleagues¹⁴, it was observed that the use of lumbar drains resulted in a significant reduction of the length of CSF leak.¹⁴ The results of their study are comparable to those in our study: In Group A CSF leak time was 4.83±1.88 days, a figure close to present study results (3.4 days ±1.1 SD) while in Group B was 7.03±2.02 days (6.75 days ±1.96 SD in the present study). In another study, no significant difference was observed between conservative

management of CSF leakage and the placement of a lumbar drain for CSF leakage in terms of recurrence of CSF leak, occurrence of meningitis during or after management of CSF rhinorrhoea or clinico-pathological factors affecting CSF rhinorrhea.²² However, a significant difference was observed in the duration of hospitalization between the treatment groups (15.3 vs 23.2 days, $p=0.03$).²² There are reports that addition of lumbar drainage to conservative management of CSF rhinorrhoea doesn't confer additional benefits.²³

A recent study by Ahmed and colleagues failed to find evidence for efficacy of peri-operative lumbar drainage in reduction of recurrent post-operative CSF leaks following endoscopic repair.²⁴

To sum up the findings of this study, use of lumbar drains resulted in a significantly shorter length of CSF rhinorrhoea compared to conservative management alone. However, in view of conflicting reports about efficacy of lumbar drains in the management of CSF rhinorrhoea in literature, it is recommended that further studies with a larger sample size be conducted to validate the use of lumbar drains in routine clinical practice since doing so would eventually lead to a shorter duration of hospital stay and reduced risk of developing complications such as meningitis.

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Address for Correspondence:

Dr Muhammad Sajjad, Male doctor hostel room DR-41 ayub medical college Abbottabad-Pakistan

Email: dr_sajjadasher@yahoo.com