

Efficacy of Therapeutic CSF Drainage in Sub Arachnoid Hemorrhage Patients with Severe Headache in Tertiary Care Hospital

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ABSTRACT

Objective: This study was carried out with an aim of determining the effectiveness of the therapeutic cerebrospinal fluid (CSF) drainage in the reduction of severe headache in patients who had aneurysmal subarachnoid hemorrhage (SAH).

Study Design: Cross-sectional study

Place and Duration of Study: This study was conducted at the Department of Neurology at the Pak Emirates Military Hospital, Rawalpindi from 16 November 2025 till 16 May 2026.

Methods: 90 patients aged 18-70 years with non-traumatic aneurysmal SAH who present themselves with severe headache (Visual Analog Scale 7 or more) were selected using consecutive non-probability sampling.

Results: A total of 90 patients were included, with 52 males (57.8%) and 38 females (42.2%), and a mean age of 52.4 ± 10.8 years. Baseline headache severity was high (VAS 8.6 ± 0.9), with WFNS grades I–II observed in 38 patients (42.2%) and grades III–V in 52 patients (57.8%). Therapeutic CSF drainage led to progressive reductions in headache intensity, with mean VAS scores of 6.1 ± 1.3 at 24 hours, 5.2 ± 1.4 at 48 hours, and 5.0 ± 1.5 at 72 hours. By 48 hours, 63 patients (70.0%) achieved $\geq 30\%$ reduction in VAS scores. Safety outcomes were acceptable, with 65 patients (72.2%) experiencing no complications.

Conclusion: It was found that therapeutic cerebrospinal fluid (CSF) drainage is a safe and efficacious intervention that can be applied to the reduction of the severity of headache in patients with aneurysmal subarachnoid hemorrhage, leading to the achievement of crucial changes in the severity of pain and overall clinical outcomes.

Key Words: Subarachnoid hemorrhage, Cerebrospinal fluid drainage, Severe headache, Lumbar drainage

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INTRODUCTION

Subarachnoid haemorrhage (SAH) is an emergency condition with life-threatening consequences that is caused by bleeding into the subarachnoid space between the arachnoid and pia mater¹. It represents a small proportion of strokes (5–10%), but has a disproportionately large burden of mortality and disability².

Most spontaneous SAH are caused by an aneurysmal rupture, and despite great progress in imaging, neurosurgery and intensive care, prognosis is still dismal and early mortality and long-term neurological deterioration remain significant³. Severe sudden headache is one of the most common presenting symptoms of SAH and is often referred to as the “worst headache of life”⁴. This is a thunderclap headache that typically peaks in intensity within seconds or minutes and can be accompanied by vomiting, headache sensitivity to light, neck stiffness, and altered consciousness⁵. The pain is due to the irritation of meninges by the blood in the cerebrospinal fluid (CSF) and activation of nociceptive pathways, inflammatory mediators and elevated ICP⁶. Blood products can also block the flow and absorption of CSF and lead to hydrocephalus, seen in 15-30% of SAH patients and which adds to the severity of the headache⁷. The main treatment is to repair the aneurysm early with either a clip or a coil, to prevent rebleeding⁸. Even after treatment of an aneurysm, however, sometimes the headache remains severe and can be poorly responsive to routine analgesics like acetaminophen, opioids and adjunctive medications⁹. Therapeutic CSF drainage

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may thus be of some importance for symptom control. External ventricular drainage is routinely performed in those with hydrocephalus or elevated ICP, and lumbar drainage is sometimes used to obtain CSF with blood in it from the subarachnoid space¹⁰.

By reducing ICP, improving CSF circulation and clearing inflammatory blood breakdown products, CSF drainage may decrease meningeal irritation, headache intensity and headache duration¹¹. There is, however, little evidence that has specifically assessed its efficacy for the relief of severe headache in SAH patients. Further study should thus be conducted in tertiary care settings¹². Recent research has explored the role of cerebrospinal fluid (CSF) drainage in patients with aneurysmal subarachnoid hemorrhage (SAH), particularly regarding headache management and long-term complications. Zhou et al¹¹ demonstrated that the method of CSF drainage used during the acute phase can influence the risk of chronic hydrocephalus, highlighting the importance of careful CSF management in SAH patients. Likewise, Maciel et al¹² conducted a survey of acute headache management in international healthcare providers, which revealed significant differences in management, with a need for standardisation to enhance pain control¹³.

METHODS

This study was a cross-sectional study to assess the effectiveness of therapeutic CSF (tCSF) drainage in severe headaches caused by subarachnoid hemorrhage (SAH). The study was conducted in the department of Neurology at Pak Emirates Military Hospital (PEMH), Rawalpindi, a tertiary care hospital with neurological and neurosurgical services. The study was conducted from 16 November 2025 till 16 May 2026, after an ethical approval from the College of Physicians and Surgeons Pakistan and institutional review board for four months. The study involved a total of 90 patients. The sample size was estimated using one proportion formula with a 10% margin of error and a 95% confidence interval, assuming about 70% of patients would obtain a therapeutic CSF drainage at least 30% reduction in headache severity. To account for possible 10% drop out, a final sample of 90 patients was planned [9]. All eligible patients attending the Emergency or Neurology Departments on a first come-first-served basis during the study period were sampled using non-probability consecutive sampling.

The study included adults (18-70 years) who had had non-traumatic aneurysmal SAH and severe headache (study criterion: Visual Analog Scale (VAS) score of 7 or above). Patients who had either external ventricular drainage (EVD) or external lumbar drainage (ELD) were only included. Exclusion criteria for lumbar drainage were contraindications, coagulopathy, thrombocytopenia, compressed basal cisterns, active infection, pregnancy, inability to give consent, or being

enrolled in another interventional trial. Data collection included screening of patients at admission for diagnosis of SAH and for baseline headache severity. Post-procedure assessment of headache intensity was performed 24–48 hours following CSF drainage; the primary outcome was the average change in VAS scores, and the percentage of patients that had a headache reduction $\geq 30\%$. Other information on WFNS grade, drainage method, drainage volume and the time of the intervention were also collected. Safety outcomes were assessed until discharge such as meningitis, rebleed, neurological impairments, and other complications. Demographic, clinical, procedural and outcome data were collected on standardized proformas.

The data was analyzed with SPSS 27.0. Data for continuous variables (age, VAS scores) were described as mean $\pm$ SD or median (IQR) as appropriate based on distribution. Categorical variables are presented as frequencies and percentages with 95% confidence interval. The VAS scores before and after drainage were compared using paired t tests and Wilcoxon signed-rank tests and the number of patients who reported significant headache reduction was compared using chi-square tests. Univariate analysis and multivariate logistic regression, adjusted for age, sex, WFNS grade, and baseline headache severity, were used to determine predictors of efficacy. Differential effects were evaluated in the subgroup analyses based on WFNS grade and drainage method.

RESULTS

A total of 90 respondents were included in the study, as summarized in Table 1, comprising 52 males (57.8%) and 38 females (42.2%), with a mean age of 52.4 ± 10.8 years. Baseline headache severity was very high (mean VAS 8.6 ± 0.9).

Table No.1: Baseline demographic and clinical characteristics

Variable	Category / Measure	Result
Age	Mean $\pm$ SD	52.4 $\pm$ 10.8 years
Sex	Male	52 (57.8%)
Sex	Female	38 (42.2%)
Baseline VAS score	Mean $\pm$ SD	8.6 $\pm$ 0.9
WFNS grade I–II	—	38 (42.2%)
WFNS grade III–V	—	52 (57.8%)
Hypertension	Yes	48 (53.3%)
Diabetes mellitus	Yes	19 (21.1%)
Smoking	Yes	27 (30.0%)

Thirty-eight respondents (42.2%) had WFNS grades I-II, while 52 respondents (57.8%) had WFNS grades III-V. Table 2 shows progressive reduction in headache severity following CSF drainage, with mean VAS scores decreasing to 6.1 ± 1.3 at 24 hours, 5.2 ± 1.4 at 48 hours, and 5.0 ± 1.5 at 72 hours. Table 3 shows that 70.0% (63/90) of the respondents reported $\geq 30\%$ reduction in VAS by 48 hours.

Table No. 3. Comparison of pre- and post-drainage VAS scores / Efficacy

Comparison	Mean difference	95% CI	p-value	Responders $\geq 30\%$ VAS reduction	n (%)
Baseline vs 24 hours	2.5	2.1–2.8	<0.001	—	—
Baseline vs 48 hours	3.4	3.0–3.8	0.002	63/90 (70.0%)	70%
Baseline vs 72 hours	3.6	3.1–4.0	<0.001	—	—

DISCUSSION

This study examined the use of therapeutic CSF drainage in patients with aneurysmal subarachnoid hemorrhage (SAH) who had severe headache. The results showed that CSF drainage was associated with a significant decrease in the severity of headaches. Baseline Visual Analog Scale (VAS) scores were 8.6 ± 0.9 , indicating a very high level of headache. Mean VAS scores also were found to be reduced to 6.1, 5.2 and 5.0 at 24, 48 and 72 hours after CSF drainage, respectively, which suggested a progressive decrease in headache intensity. The difference was statistically significant at all follow-up time points ($p < 0.001$); of 90 patients, 63 (69%) achieved a clinically significant improvement of $\geq 30\%$ in headache severity. Based on these observations, it can be concluded that CSF removal of blood-contaminated CSF and ICP reduction are important therapeutic principles in relieving symptoms.

Demographic characteristics were consistent with past SAH studies. Patients had a mean age of 52.4 ± 10.8 years, with 57.8% being male. Similarly, vascular risk factors, such as hypertension (53.3%) and smoking history (30%) were present, reflecting previous observations that these factors play a role in the incidence of SAH and rupture of aneurysms [14,15]. The reduction in the severity of the headache as observed confirms previous research. Wolf et al. [16] found that CSF drainage from the lumbar increased CSF flow, increased clearance of subarachnoid blood and lowered ICP with a better clinical outcome. In this study, Lee et al. [17] performed a systematic review and meta-analysis with lumbar CSF drainage demonstrating that CSF drainage is beneficial for clinical outcomes and helps to reduce complications like delayed cerebral ischemia and hydrocephalus, and that CSF dynamics in the brain are improved, supporting the favourable symptomatic relief observed in this study [18].

While these were some significant results, there were a number of limitations to the study. It was carried out at one tertiary care center that has a relatively small

Table No.2. Headache severity before and after therapeutic CSF drainage

Time point	Mean $\pm$ SD	Median (IQR)
Baseline	8.6 ± 0.9	9 (8–9)
24 hours	6.1 ± 1.3	6 (5–7)
48 hours	5.2 ± 1.4	5 (4–6)
72 hours	5.0 ± 1.5	5 (4–6)

sample, thus limiting the ability to generalize the results. Furthermore, patients followed for a long period of time were not included in the cross-sectional study to obtain information on chronic headache or delayed neurological complications. The future studies should incorporate multicenter prospective studies with long follow-ups to assess again on the long term outcome of therapeutic CSF drainage and safety and the best time of administering therapeutic CSF in patients with subarachnoid hemorrhage.

CONCLUSION

This clinical trial found out that therapeutic cerebrospinal fluid (CSF) drainage is a viable treatment method in alleviating severe headache in patients with aneurysmal subarachnoid hemorrhage (SAH). These findings showed that the drainage of CSF was effective in reducing the severity of headache significantly and provided relief from the headache in most of the patients. The procedure allowed to improve the dynamics in the intracranial environment and enhance the comfort of patients by contributing to the elimination of blood-tinged CSF and decreasing the intracranial pressure. Furthermore, the safety of the intervention was good, and the level of complications was also relatively small. These findings underscore the possibility of CSF drainage as a significant supportive therapy measure in the management of SAH-related headache and could lead to higher overall clinical results in patients with this condition.

Author's Contribution:

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