



## DILEMMAS IN MANAGEMENT OF CEREBELLAR HEMORRHAGIC STROKE: A PROSPECTIVE STUDY

**Dr. Molleti Mahesh Kumar\***

Mch Neurosurgery Resident, Department of Neuro Surgery, Guntur Medical College, Guntur, Andhra Pradesh, India. \*Corresponding Author

**Dr. Rohit Reddy A**

Consultant Neurosurgeon

**Dr. K. V. V. Satyanarayana Murthy**

Professor and HOD, Department of Neuro Surgery, Guntur Medical College, Guntur, Andhra Pradesh, India.

### ABSTRACT

Spontaneous cerebellar hemorrhage remains a neurosurgical emergency with high mortality and uncertain treatment guidelines. This prospective study of 30 patients (October 2023–October 2025) evaluated clinical and radiological factors influencing management and outcomes at a tertiary center. Fourth-ventricle compression, clot size, hematoma volume, hydrocephalus, and GCS guided treatment decisions. Grade II compression was most common (60%), and hydrocephalus occurred in 40%. Conservative management, surgical evacuation (SE), EVD, or combined SE + EVD were performed as appropriate. No deaths occurred among patients treated conservatively, with SE, or with combined therapy. In contrast, all patients who underwent EVD alone died, all presenting with poor GCS and intraventricular hemorrhage (IVH), identifying IVH as the strongest predictor of mortality. Patients with Grade I compression had uniformly good outcomes. Tailored intervention based on neurological status, ventricular compression, and hydrocephalus improves survival, but larger studies are needed to refine management guidelines.

**KEYWORDS :** Cerebellar Hemorrhage, Hydrocephalus; Intraventricular Hemorrhage; Surgical Evacuation.

### INTRODUCTION

Cerebellar hemorrhages which are of spontaneous in origin account to about 5 to 13% of all intra cranial bleeds. According to the data available the surgical mortality remains 20-50% in spontaneous cerebellar hemorrhage<sup>1</sup>. Management strategies for patients with good and poor neurological status are clear, but for the category between these two extreme groups remain speculative.

The reason for management of cerebellar hematomas being dubious is, insufficiency of available literature on management of cerebellar hemorrhages specifically. Although literature is available on this issue, the reports collectively do not suggest surgical intervention straightforward and the controversy of managing spontaneous cerebellar hematomas still persist between initial medical management or immediate surgical intervention.

The present study focuses on reviewing the available literature on management of spontaneous cerebellar hematomas and comparing the data available with the present study to endeavor framing management guidelines for cerebellar hemorrhagic stroke in the institute.

### MATERIAL AND METHODS

This prospective observational study was conducted at Guntur Government General Hospital from October 2023 to October 2025. Thirty patients with spontaneous cerebellar hemorrhage confirmed on NCCT were included. Exclusion criteria included GCS 3 with bilaterally non-reactive pupils, severe comorbidities, unstable vitals, traumatic bleeds, or hemorrhages due to AVMs, aneurysms, or tumors

### Initial Evaluation

All patients underwent emergency stabilization and neurological assessment using GCS. NCCT brain was performed in all cases. Radiological parameters included Hematoma size and location, hematoma volume is calculated by using ABC/2 formula. Presence of hydrocephalus or IVH, fourth ventricle compression was graded per Kirillov et al<sup>2</sup>

grade 1- normal or minimally compressed  
grade 2- moderately compressed  
grade 3- severely compressed or obliterated

### Management Modalities

Treatment allocation was based on GCS, 4th-ventricle grade, clot size, and hydrocephalus. Conservative management: Included neuro-ICU monitoring, BP control, and ICP management following AHA/ASA recommendations. This was preferred for GCS 13–15 with Grade I–II compression without hydrocephalus. Surgical Evacuation. (SE): Standard midline suboccipital craniectomy and hematoma evacuation per established neurosurgical protocols. CSF Drainage (EVD): Used in patients with acute hydrocephalus and neurological decline<sup>[4,14]</sup>. Combined (EVD + SE): Performed in patients with mass effect plus hydrocephalus

### Outcome Assessment

Patients were followed at 15 days, 1 month, 3 months, and 6 months. primary outcomes were mortality and functional status, as measured by the Glasgow Outcome Scale (GOS) at discharge. A GOS of 4 (Moderate Disability) or 5 (Good Recovery) was considered a "good outcome."

### RESULTS

A total of 30 patients met the inclusion criteria. The cohort had a male preponderance (60%, n=18). The most common age group was 51-60 years (40%, n=12). Hypertension was the most common comorbidity, present in 40% (n=12) of patients. Headache (60%) and loss of consciousness (40%) were the most frequent presenting symptoms. At admission, 14 patients (46.66%) had a GCS of 13-15, 11 (36.66%) had a GCS of 9-12, and 5 (16.66%) had a GCS of 3-8. On NCCT, 18 patients (60%) had a clot size >3 cm, and 12 patients (40%) had a clot volume >15 ml. Associated hydrocephalus was present in 12 patients (40%). Out of 30 patients in this study, 4(13.33%) patients belonged to grade I, 18(60%) patients belonged to grade II and 8(26.66%) patients belonged to grade III 4<sup>th</sup> ventricle compression. Among 4 patients grouped under grade I the mean clot volume is 7ml and mean clot diameter is 2.40 cm. In 18 patients grouped under grade II the mean clot volume is 16 ml and mean clot diameter is 4.20 cm. In 3 patients grouped under grade III the mean clot volume is 27 ml and mean clot diameter is 5.30 cm.

In this study, 4 patients who are grouped under grade I are treated conservatively, among 18 patients who are grouped under grade II 6 patients are treated conservatively, 8 patients are treated with suboccipital craniectomy and evacuation of hematoma, 2 patients are treated with CSF drainage alone and 2 patients are treated with CSF drainage and surgical evacuation of hematoma. Among 8 patients who are grouped under grade III, 5 patients are treated with suboccipital craniectomy and evacuation of hematoma, 2 patients are treated with CSF drainage alone (CSF-D) and 1 patient is treated with CSF drainage and suboccipital craniectomy and evacuation of hematoma.

There is no mortality recorded in grade I and in grade II, 2 out of 18 patients and 2 out of 8 patients in grade III expired. There is no mortality recorded in patients who are managed conservatively, with surgical evacuation of hematoma and with combined CSF drainage and surgical evacuation of hematoma (CSF-D+SE) procedure. Whereas 100% mortality is noted in patients who underwent CSF drainage. Further analysis showed that these 4 patients who died all presented with a poor GCS and had associated IVH. The deaths were distributed as 2 patients from Grade II and 2 from Grade III.

## DISCUSSION

The age group of patients in this study ranged from 29 years to 75 years, the frequent age group of patients were between 51 to 60 years. This observation was consistent with other studies such as Parmenion P et al.<sup>3</sup> The presentation of clinical features is variable in different patients, headache being the most common presentation symptom accounting for 60% of patients followed by loss of consciousness which was noted in 40% of patients, Fischer CM et al.<sup>4</sup>, and Lui TN et al.<sup>5</sup>, in their studies noted unpredictable rapid deterioration of conscious levels in patients, majority of patients who presented with acute onset of symptoms, who are otherwise conscious, deteriorated in conscious levels within 72 hours after acute onset of symptoms. Acute presentation is correlated to poor outcome.

The NCCT brain variables such as 4th ventricle status, clot size, clot volume, and hydrocephalus are corresponded with each other to establish a management protocol according to the results obtained. Other features in CT scan are compared with the 4th ventricle degree of compression. In Kobayashi et al.<sup>6</sup>, and Zieger et al.<sup>7</sup>, studies the size and clot volume had significant influence in outcome of the patient. A diameter of more than 3 to 4 cm or a volume of more than 15 ml for a cerebellar hematoma has been considered by many surgeons to be an indication for surgical evacuation of the hematoma. The degree of cerebellar atrophy should be evaluated. A large hematoma may not exert significant brainstem compression in the presence of cerebellar atrophy. Furthermore, estimation of the size of the hematoma on the basis of CT scans could be both difficult and inaccurate, because of the nebulous margins at the interface between the hematoma and the surrounding cerebellum. The mass effect produced by areas of surrounding edema could be underestimated. These factors may explain the controversial findings in the literature regarding the value of size estimations in the treatment of cerebellar hematomas. In our management protocol, we selected the degree of fourth ventricular compression, rather than the size of the hematoma, as a measure of mass effect. Therefore, 53% of patients with Grade I or II compression were treated with ventricular drainage or observation only, without hematoma evacuation, despite the presence of hematomas of more than 3 cm in diameter. The outcomes were good in 66% of cases.

In a series of Taneda et al.<sup>8</sup> the presence of hydrocephalus played a key role in adapting for surgical intervention. In a study of Shenkin and Zavala et al.<sup>9</sup>, it is determined that surgical treatment was unnecessary, and treatment should be

directed towards the relieving of hydrocephalus. In a study of Mathew et al.<sup>10</sup>, presence of hydrocephalus invariably resulted in brainstem compression and so it was indicated that in the presence of hydrocephalus a posterior fossa craniectomy and evacuation of hematoma is to be done.

In the present study, the presence of intra ventricular hemorrhage determined the outcome of patient, where all the patients who had intra ventricular hemorrhage expired in spite of combined CSF drainage and surgical evacuation of hematoma. The patients who had GCS score <13 depending on presence or absence of hydrocephalus they were subjected to various treatment modalities. If the patient had hydrocephalus external ventricular drainage is performed and if the patient improves EVD is converted to VP shunt and in patients who did not improve surgical evacuation of hematoma was done; if after surgical evacuation of hematoma, the patient deteriorates because of hydrocephalus ventriculo-peritoneal shunt is done. If the clot size >3cm and / or >15 ml surgical evacuation of hematoma was performed irrespective of GCS. The importance of the location is related to brainstem compression. In the present study, the location of the hematoma was well correlated with the grade of fourth ventricular compression. Midline hematomas were associated with greater degrees of fourth ventricular compression.

In the present study the outcome was measured using grade of 4th ventricular compression in CT brain, glassgow outcome scale, glassgow coma scale and hematoma diameter.

According to grading of the patients of the 4(13.33%) patients belonged to grade I in whom the mean clot size is 2.4cm, the mean clot volume is 7ml, all 4 patients GCS were between 13 and 15, everybody in grade I were treated conservatively the GOS was 4 in 2 patients and 5 in 2 patients during discharge, and no mortality is noted in grade I even after 6 months follow up.

18(60%) patients belonged to grade II, mean clot diameter is 4.2cm, mean clot volume is 16 ml, among them 6 patients who had clot volume < 15ml, clot size < 3cm, no hydrocephalus and GCS between 13 and 15 underwent conservative management and during discharge GOS was 4 or 5 and all these 6 patients are alive after 6 months follow up. 7 among 18 patients in this group are treated with surgical evacuation of hematoma in whom the GCS was below 13, these 7 patients did not have hydrocephalus, clot size was > 3cm in all 7 patients and clot volume was >15ml in all 7 patients, among these 7 patients 4 patients were discharged with GOS 4 or 5 and 3 patients were discharged with GOS <4, among these 7 patients 6 patients were on follow up for 6 months and were alive, 1 patient was on follow up for 3 months and lost the follow up after 3 months. 2 among 18 patients had intraventricular hemorrhage, with GCS 3 and 4, on emergency basis external ventricular drainage was done in these 2 patients, both the patients expired within 48 hours of admission. 2 among 18 patients who had grade II 4th ventricular compression had clot volume <15ml, clot size <3cm with GCS <13 and had hydrocephalus, these 2 patients underwent external ventricular drainage after which they did not improve after 48 hours so, surgical evacuation of hematoma was performed following which patients improved and were discharged with GOS <4 and these 2 patients were alive with mild deficits with 6 months follow up. 1 among 18 patients in grade II 4th ventricular compression had clot size >3cm without hydrocephalus, initially the patient underwent surgical evacuation of hematoma, on 10th postoperative day patient developed hydrocephalus and deteriorated for which ventriculo-peritoneal shunt was done and patient improved to GCS 15 and was discharged with GOS 5.

Among 8 patients who are grouped under grade III 4th

ventricular compression 5 patients underwent surgical evacuation of hematoma in whom the clot size is >3cm and or clot volume >15ml, among these 5 patients no deaths are noted and GOS during discharge was <4, 1 patient who had hydrocephalus external ventricular drainage was done on emergency basis and as the patient did not improve after 48 hours surgical evacuation of hematoma was done following which patient improved and was discharged with GOS <4, the patient is alive after 6 months of follow up. 2 among the 8 patients who are grouped under grade III of 4th ventricular compression presented with GCS 3 but pupils were reactive to light bilaterally on admission, on CT brain intraventricular bleed was noted with cerebellar hematoma also compressing the brainstem, external ventricular drainage was done on emergency but the 2 patients did not improve and expired within 48 hours.

## CONCLUSION

The dilemmas in indications for surgical intervention in spontaneous cerebellar hematomas still persist because of inadequate literature and data available. A series of collected data, randomized trials and correlation of data available may outline the management protocol, but this study does not focus on promoting significance.

The commonest age group of presentation with spontaneous cerebellar hematomas is 51-60 years, with male predilection (60% being males and 40% being females). The commonest complaint with patients presented was headache (60%). As the center is tertiary hospital, most of the patients will be referred from primary health centers delay in presentation after acute onset of symptoms was noted i.e. 60% patients presented after 24 hours of acute onset of symptoms. 46.66% patients presented with GCS between 13 and 15. 60% of patients had grade II of 4th ventricular compression with clot size >3cm, clot volume <15ml and not associated with hydrocephalus.

The mean clot volume and clot diameter though did not have any significance in influencing the decision of treatment, it was noted for data purpose, which is 7ml, 16ml, 27ml in grade I, II, III of 4th ventricular compression respectively. Majority (43.33%) patients had surgical evacuation of hematoma. There are no mortalities recorded in patients who are treated by conservative management, by surgical evacuation of hematoma or by combined CSF drainage and surgical evacuation of hematoma. But, 100% mortality is noted in patients who underwent CSF drainage alone (all the patients expired had intraventricular hemorrhage) suggesting probably intraventricular hemorrhage is associated with poor outcome. In the present study clot size, clot volume, GCS score of patient during presentation and grade of 4th ventricular compression and presence of intraventricular hemorrhage influenced the decision on treatment choice.

**Sources of Funding:** NIL

**Conflicts of Interest:** NIL

## REFERENCES

1. Farid, A. M. (2013). Neurosurgical Department, Tanta Faculty of Medicine, Tanta ARE. *Tanta Medical Journal*, 41(4), 358–363.
2. Kirillos, R. W., Tyagi, A. K., Ross, S. A., van Hille, P. T., & Marks, P. V. (2001). Management of spontaneous cerebellar hematomas: A prospective treatment protocol. *Neurosurgery*, 49, 1378–1387.
3. Tsitsopoulos, P. P., Tobieson, L., Enblad, P., & Marklund, N. (2012). Prognostic factors and long-term outcome following surgical treatment of 76 patients with spontaneous cerebellar haematoma. *Acta Neurochirurgica*. <https://doi.org/10.1007/s00701-012-1372>
4. Fischer, C. M., Picard, E. H., Palak, A., & Daddal, A. (1965). Acute hypertensive cerebellar hemorrhage: Diagnosis and surgical treatment. *Journal of Nervous and Mental Disease*, 140, 38–47.
5. Lui, T. N., Fairholm, D. J., Shu, T. F., Chang, C. N., Lee, S. T., & Chen, H. R. (1985). Surgical treatment of spontaneous cerebellar hemorrhage. *Surgical Neurology*, 23, 555–558.
6. Kobayashi, S., Sato, A., Kageyama, Y., Nakamura, H., Watanabe, Y., & Yamaura, A. (1994). Treatment of hypertensive cerebellar hemorrhage: Surgical or conservative management? *Neurosurgery*, 34, 246–251.
7. Zieger, A., Vonoifakos, D., Steudel, W. I., & Dusterbehn, G. (1984). Nontraumatic intracerebellar hematomas: Prognostic value of volumetric evaluation by computed tomography. *Surgical Neurology*, 22, 491–494.

8. Taneda, M., Hayakawa, T., & Mogami, H. (1987). Primary cerebellar hemorrhage: Quadrigeminal cistern obliteration on CT scan as a predictor of outcome. *Journal of Neurosurgery*, 67, 545–552.
9. Shenkin, H. A., & Zavala, M. (1982). Cerebellar strokes: Mortality, surgical indications, and results of ventricular drainage. *The Lancet*, 2, 429–432.
10. Mathew, P., Teasdale, G., Bannan, A., & Oluoch-Olunya, D. (1995). Neurosurgical management of cerebellar haematoma and infarct. *Journal of Neurology, Neurosurgery & Psychiatry*, 59, 287–292.