Med. J. Cairo Univ., Vol. 93, No. 2, Accepted 16/2/2025
DOI: 10.22608/MJCU. 619-624, June 2025
www.medicaljournalofcairouniversity.net

Prognostic Factors Affecting Surgical Outcome of Spontaneous Cerebellar Hemorrhage

YASSER A. ABDALRAHEEM, M.D.; MOHAMED A. HEWEDY, M.D. and HANY MOHAILABA, M.D.

The Department of Neurosurgery, Faculty of Medicine, Beni-Suef University

Abstract

Background: Spontaneous cerebellar hemorrhage (SCH) is associated with higher rates of morbidity and mortality worldwide. This is because the posterior fossa space is very constrained; meaning that even a small amount of bleeding can put pressure on the brainstem and cause serious complications.

Aim of Study: To identify potential predictors of surgical success in SCH patients by analyzing their prognostic characteristics.

Patients and Methods: Twenty individuals diagnosed with SCH and undergoing surgery at Beni-Suef University Hospitals' Neurosurgery Department were the subjects of this retrospective study. Age, sex, maximum diameter and volume of hemorrhage, affiliated intraventricular hemorrhage (IVH), compression of the fourth ventricle, associated hydrocephalus, and compression of the brainstem were among the prognostic variables evaluated in the patients. We used the Glasgow Outcome Scale (GOS) to assess the outcomes.

Results: The participants'median age was 60.20±4.36 years, according to the results. Seventy percent were men and thirty percent were women. The following variables were found to be significantly correlated with poor outcomes as measured by the GOS: Patient age (p=0.004), GCS (p<0.001), hematoma size (p<0.001), presence of pre-interventional IVH (p<0.001), brain stem compression (p=0.019), delayed intervention time (p=0.001), performance of cerebrospinal fluid (CSF) diversion (p=0.001), and occurrence of complications (p=0.004).

Conclusion: The level of consciousness when admitted, delayed surgical intervention, IVH, brainstem compression, significant fourth ventricular compression with hydrocephalic changes are all factors that predict a poor outcome of surgical treatment.

Key Words: Cerebellar – Hemorrhage – Brain stem – GOS.

Correspondence to: Dr. Yasser A. Abdalraheem,
The Department of Neurosurgery, Faculty of Medicine,
Beni-Suef University

Introduction

HEMORRHAGE inside the cerebellum, known as a spontaneous cerebellar hematoma (SCH), is a serious condition that accounts for 6.3% to 16.4% of all intracranial hemorrhages. The formation of a spontaneous cerebellar hematoma is most often caused by uncontrolled hypertension, but minor vascular diseases may also play a role. People in their middle years and later in life are more likely to experience it **[1]**. Because the posterior fossa space is so small, even a little bleed may compress the brainstem, leading to rapid clinical deterioration and serious consequences, SCH is associated with higher death and morbidity rates worldwide **[2]**. Patients with cerebellar hemorrhage often need surgical evacuation more often than those with supratentorial intracerebral hemorrhage **[3,4,5]**. Timely diagnosis and adequate treatment are crucial for lowering mortality and morbidity rates **[6,7]**. Despite these data, some still advocate for conservative treatment, ventricular drainage, and direct or stereotactic clot evacuation as methods for treating SCH **[8,9]**. In order to improve patient outcomes, clarify treatment plans, and uncover factors impacting prognosis, we have examined our cases in this study.

Patients and Methods

This study presents a retrospective analysis involving 20 patients diagnosed with spontaneous cerebellar hematoma who underwent surgical evacuation at the Neurosurgery Department of Beni-Suef University Hospitals from May 2022 to June 2024.

The evaluation of the patient encompassed the analysis of various prognostic variables:

- Age.
- Sex.
- Medical condition of the patients as, hypertension, DM.

- Usage of antiplatelet, or anticoagulant drugs.
- Conscious level at time of administration using GCS.
- Volume of the hematoma.

All patients underwent clinical and radiological follow-up following their surgical procedures.

The inclusion criteria encompassed all instances of SCH, whereas patients with secondary posterior fossa hematomas due to tumoral bleeding, arteriovenous malformations-related SCH, cerebral aneurysm rupture, hemorrhagic transformation of a cerebellar infarct, or traumatic cerebellar hemorrhage were not considered.

All patients underwent a pre-operative CT scan for the assessment of volume and maximal diameter of the cerebellar hematoma, evaluation of any compression on the 4^{th} ventricle or brain stem, and determination of the presence or absence of hydrocephalus and IVH. Imaging studies, such as MRI with contrast or CT cerebral angiography, were performed exclusively on patients suspected of having tumor apoplexy or vascular anomalies.

Patients exhibiting neurological deterioration were advised to undergo surgery if the maximum hematoma diameter exceeded 3cm or if the cerebellar hematoma volume surpassed 10mL. In cases of elevated intracranial pressure, the option of surgical hematoma evacuation was given significant consideration. Ventriculo sub galeal drainage (VSD) was conducted in patients presenting with small hematomas and progressive mental deterioration linked to hydrocephalus resulting from IVH or 4^{th} ventricle obliteration. Surgeries were conducted with patients positioned prone, and hematomas were excised through suboccipital craniotomy and external ventricular drainage. The outcomes of the treatment were evaluated through the Glasgow Coma Scale (GCS). The results were subsequently analyzed in relation to several clinical factors.

Ethical consideration:

Approval was secured from the Research Ethics Committee at the Faculty of Medicine, Beni-Suef University. The patients' data was obtained from the archive and database of the Neurosurgery Department at Beni-Suef University, thus waiving the need for informed consent. Approval number is (FMB-SUREC/05012025/Abdulraheem).

Statistical analysis:

IBM Corp., Armonk, NY, encoded and imported data using SPSS version 28. Case count and relative frequency (percentages) are categorical variables, whereas mean and standard deviation are quantitative variables. We compared groups using unpaired *t*-tests. To compare categorical data, we used the Chi-square (χ^2) test. Expected frequency less than 5 required the exact test. Logistic regression revealed independent negative outcome factors. Notable *p*-values were less than 0.05.

Results

Among 20 patients included in our study, 14 patients were males (70%) and 6 were females (30%), with a median age of 60.20±4.36 years (range 51–66 years). Level of consciousness on admission, according to admission GCS; 3 patients (15%) had scores of 14–15, 14 patients (70%) had scores of 9–13, and 3 patients (15%) had scores of ≤8 (Table 1).

Table (1): Demographic and clinical presentation data of the studied group.

Sex (n,%):	
Female	6 (30.0%)
Male	14 (70.0%)
Age (years):	
Mean ± SD	60.20±4.36
Range	51.00-66.00
Level of consciousness on admission (GCS) (n,%):	
14–15	3 (15%)
9–13	14 (70.0%)
≤8	3 (15%)

In Table (2): All patients (100%) had posterior fossa hematoma. The size of the hematoma was determined by its diameter, with a mean largest diameter of 3.40±0.45 cm. Among the patients, 10 (50%) had hematoma size equal or greater than 3.5cm, while 10 (50%) had hematomas smaller than 3.5cm. Interventricular hemorrhage was detected in 13 patients (65.0%), while in 7 patients (35.0%), it was absent. Hydrocephalus was diagnosed using the admission CT scan in 18 patients (90.0%), while 2 patients (10.0%) showed no hydrocephalic changes. Brain stem compression was found in 12 individuals (60.0%), while 8 patients (40.0%) did not exhibit this compression. The intervention was done in less than 24 hours in 11 patients (55.0%), while 9 patients (45.0%) waited more than 24 hours to receive any kind of intervention. All patients had hematoma evacuation, while 13 patients (65.0%) had CSF diversion too.

After management of all spontaneous posterior fossa hematoma patients, 15 patients (75.0%) faced complications. The mean post intervention Glasgow outcome scalewas 2.70±1.49, ranging from 1.00 to 5.00. According to GOS, 40.0% of patients had good outcome, while 12 patients (60.0%) had poor outcome.

In Table (4): There were statistical significant correlations between ages of patients, (p=0.004), GCS (p<0.001), hematoma Size (p<0.001), presence

of pre interventional intraventricular hemorrhage (p<0.001) or brain stem compression (p=0.019), delayed time of intervention (p=0.001), performing CSF diversion (p<0.001), and occurrence of complications (p=0.004) with poor out comes as by GOS.

Logistic regression analysis was conducted to assess predictors of bad outcome in spontaneous posterior fossa haematoma patients; presences of brain stem compression in pre intervention CT, was the only significant predictor as shown in Table (5).

Table (2): Pre intervention radiologic criteria and intervention data of the patients.

Site of hematoma (n, %):	
Cerebellar	20 (100%)
Hematoma size (cm):	
Mean ± SD	3.40±0.45
≥3.5	10 (50%)
<3.5	10 (50%)
Intraventricular hemorrhage (n, %):	
Yes	13 (65.0%)
No	7 (35.0%)
Hydrocephalus (n, %):	
Yes	18 (90.0%)
No	2 (10.0%)
Brain stem compression (n, %):	
Yes	12 (60.0%)
No	8 (40.0%)
Time of intervention:	
Less than 24	11 (55.0%)
More than 24	9 (45.0%)
Evacuation (n, %):	
Done	20 (100.0%)
CSF diversion (n, %):	
Yes	13 (65.0%)
No	7 (35.0%)

Table (3): Post intervention outcome assesment of the patients.

Complications (n, %):	
Yes	15 (75.0%)
No	5 (25.0%)
Glasgow outcome scale (n, %):	
Mean ± SD	2.70±1.49
Range	1.00-5.00
Good outcome	8 (40.0%)
Poor outcome	12 (60.0%)

Table (4): Correlation of basic, clinical, radiologic and intervention data of the patients with patient outcome (Glascow outcome scale).

	Glascow outcome scale				*p*-value
	Good outcome		Poor outcome		
	Count	%	Count	%	
Sex:					
Female	3	37.5	3	25.0	0.642
Male	5	62.5	9	75.0	
Age:					
Mean ± SD	57.00	4.07	62.33	3.14	0.004
GCS:					
Mean ± SD	13.25	0.71	9.33	1.23	<0.001
Hematoma Size (cm):					
Mean ± SD	3.00	0.00	3.67	0.39	<0.001
Intraventricular hemorrhage:					
Yes	1	12.5	12	100.0	<0.001
No	7	87.5	0	0.0	
Hydrocephalus:					
Yes	6	75.0	12	100.0	0.147
No	2	25.0	0	0.0	
Brain stem compression:					
Yes	2	25.0	10	83.3	0.019
No	6	75.0	2	16.7	
Time of intervention:					
More than 24	0	0.0	9	75.0	0.001
Less than 24	8	100.0	3	25.0	
CSF diversion:					
Yes	1	12.5	12	100.0	<0.001
No	7	87.5	0	0.0	
Complications:					
Yes	3	37.5	12	100.0	0.004
No	5	62.5	0	0.0	

Table (5): Logistic regression for prediction of bad outcome.

	p-value	QR	95% C.I.	
			Lower	Upper
Bad outcome:				
Brain stem compression	0.016	15	1.652	136.1772

Discussion

A serious complication that makes about 10-15% of all neurovascular events is SCH. It is associated with higher incidence of death and illness. Even though there have been major developments in surgical and diagnostic procedures, people are still debating who should have surgery *[9,10,11]*. The purpose of this study was to improve treatment methods and patient outcomes after SCH by clarifying the relationship between clinical and radiological data in SCH prediction.

Radiographic observations including hematoma diameter, brain stem compression, hydrocephalus presence, and concurrent intraventricular hemorrhage were among the numerous prognostic indicators that we investigated and evaluated. According to studies done by Saad et al. *[1]* and Wu et al. *[5]*, the most important elements to consider are the patient's age, the severity and length of their symptoms, and their neurological status prior to surgery.

The study had 20 participants, with a median age of 60.20±4.36 years (ranging from 51-66 years), with 14 males (70%) and 6 females (30%) making up the study. This is in line with the findings of the 22-patient study by Han et al. *[2]*, which showed that males in their 60s and 70s had the highest frequency of cerebellar hemorrhage. The results of Moon et al. *[13]* and Dolderer et al. *[12]* also support this conclusion. According to Saad et al. *[1]*, the majority of the participants in their study were female. Contrary to our findings, Saad et al. *[1]* found no statistically significant correlation between age and clinical outcomes, which is in line with many case series, including that of Dammann et al. *[14]*. We found a statistically significant correlation between patient age (p=0.004) and poor outcomes. Regarding the prognosis of spontaneous posterior fossa hematoma, Dammann et al. *[14]* pointed out that the patient's initial degree of awareness is significant. According to studies conducted by Louis et al. *[3]* and Wu et al. *[5]*, a Glasgow Coma Scale score below 8, together with the presence of hydrocephalus and IVH, is associated with an increased risk of early mortality. According to Cho et al. *[15]*, there are several factors that might predict a poor prognosis for spontaneous cerebellar hemorrhage. These include an initial GCS score below 10, a hematoma volume exceeding 15mL, obstruction of the quadrigeminal cistern, hydrocephalus, and IVH. Evidence from this study shows that factors such as a low GCS upon admission, significant thickness and volume of hemorrhage, hydrocephalus, IVH, compression of the brainstem, postponement of surgical intervention, and total blockage of the fourth ventricle are associated with a poor prognosis of SCH. A poorer result was associated with these characteristics. Although surgical evacuation is the main method for treating cerebellar hemorrhages, the criteria for this procedure are still up for debate. Surgical indications have been defined by many studies as follows: A hematoma larger than 3cm, blockage of the quadrigeminal cistern, and compression of the fourth ventricle or brainstem *[16,17,18]*. Surgery is considered necessary when the maximum hematoma diameter is more than 3cm or the hematoma volume is more than 15mL, according to certain research *[15,16]*. We argue that the size and location of hematomas shouldn't be the only criteria for surgery; other factors that should be considered include level of consciousness upon admission, brain CT findings of intraventricular hemorrhage, hydrocephalus, degree of compression in the fourth ventricle, and other similar factors.

Results showed that cases where the hematoma size was less than 3 cm and the GCS score was more than 10 had good results after surgery, while cases where the hematoma size was greater than 3cm and the GCS score was less than 10 had bad outcomes. The location of the hematoma, the existence of hydrocephalus, the degree of brain stem compression, and the presence of IVH were factors that determined the prognosis for patients with hematomas exceeding 3cm and a GCS score over 9. Out of 20 patients analyzed, 40.0% had positive results; all of these patients had an initial GCS greater than 10 and had surgical evacuation performed early. On the other hand, 12 patients (60.0%) had adverse results due to a GCS below 10 during surgery. This announcement is in line with what Luparello and Canavero *[19]* and Han et al. *[2]* found in their studies.

In order to get positive results, it is essential to promptly remove SCH during surgery. This allows for the rapid relief of pressure on the brainstem and ventricles, which helps to avoid permanent damage. But, pre-operative management of certain medical issues, such as malignant hypertension or an aberrant coagulation profile, may make early intervention impossible.

The tiny sample size and retrospective methodology are the main limitations of this study.

Conclusion:

The success of surgical evacuation after spontaneous cerebellar bleeding depends on a number of factors. A low first GCS score, a long wait before operation, quadrigeminal cistern and fourth ventricle compression, considerable intraventricular hemorrhage, hydrocephalus, and brainstem compression are all factors that might lead to a negative result. Prompt surgical intervention and a good state of consciousness at admission are connected with a positive outcome.

Conflict of interest:

None.

References

1- SAAD M., ALI H., MOWAFY A.A., BADRAN M., TAHA A.N. and AMEN M.M.: Surgical management of spontaneous posterior fossa hematoma: Predictors of the neurological outcome. Egyptian Journal of Neurosurgery, Apr 2; 39 (1): 16, 2024.

2- HAN J., LEE H.K., CHO T.G., MOON J.G. and KIM C.H.: Management and outcome of spontaneous cerebellar hemorrhage. Journal of Cerebrovascular and Endovascular Neurosurgery, Sep 1; 17 (3): 185-93, 2015.

3- LOUIS E.K., WIJDICKS E.F., LI H. and ATKINSON J.D.: Predictors of poor outcome in patients with a spontaneous cerebellar hematoma. Canadian journal of neurological sciences, Feb. 27 (1): 32-6, 2000.

4- YANAKA K., MEGURO K., FUJITA K., NARUSHIMA K. and NOSE T.: Immediate surgery reduces mortality in deeply comatose patients with spontaneous cerebellar hemorrhage. Neurologia medico-chirurgica, 40 (6): 295-300, 2000.

5- WU Y.T., LI T.Y., CHIANG S.L., CHU H.Y., CHANG S.T. and CHEN L.C.: Predictors of first-week mortality in patients with acute spontaneous cerebellar hemorrhage. The Cerebellum, Apr. 12: 165-70, 2013.

6- SALVATI M., CERVONI L, RACO A. and DELFINI R.: Spontaneous cerebellar hemorrhage: Clinical remarks on 50 cases. Surgical Neurology, Mar 1; 55 (3): 156-61, 2001.

7- AL SAFATLI D., GUENTHER A., MCLEAN A.L., WASCHKE A., KALFF R. and EWALD C.: Prediction of 30-day mortality in spontaneous cerebellar hemorrhage. Surgical neurology international, 8, 2017.

8- SVIRI G.E., HAYEK S. and PALDOR I.: Spontaneous cerebellar hemorrhage carries a grim prognosis in both operated and unoperated patients. Journal of Clinical Neuroscience, Aug 1; (78): 121-7, 2020.

9- KURAMATSU J.B., BIFFI A., GERNER S.T., SEMBILL J.A., SPRÜGEL M.I., LEASURE A., SANSING L., MATOUK C., FALCONE G.J., ENDRES M. and HAEUSLER K.G.: Association of surgical hematoma evacuation vs conservative treatment with functional outcome in patients with cerebellar intracerebral hemorrhage. JAMA, Oct 8; 322 (14): 1392-403, 2019.

10- PATEL V.D., GARCIA R.M., SWOR D.E., LIOTTA E.M., MAAS M.B. and NAIDECH A.: Natural history of infratentorial intracerebral hemorrhages: Two subgroups with distinct presentations and outcomes. Journal of Stroke and Cerebrovascular Diseases, Aug 1; 29 (8): 104920, 2020.

11- LEE T.H., HUANG Y.H., SU T.M., CHEN C.F., LU C.H., LEE H.L., TSAI H.P., SUNG W.W. and KWAN A.L.: Predictive factors of 2-year postoperative outcomes in patients with spontaneous cerebellar hemorrhage. Journal of clinical medicine, Jun. 8; 8 (6): 818, 2019.

12- DOLDERER S., KALLENBERG K., ASCHOFF A., SCHWAB S. and SCHWARZ S.: Long-term outcome after spontaneous cerebellar haemorrhage. European Neurology, Sep 15; 52 (2): 112-9, 2004.

13- MOON K.S., PARK H.K., YOON S.M., BAE H.G., YUN I.G. and CHOI S.K.: Outcomes in the management of spontaneous cerebellar hemorrhage. Journal of Korean Neurosurgical Society, 40 (4): 234-8, 2006.

14- DAMMANN P., ASGARI S., BASSIOUNI H., GASSER T., PANAGIOTOPOULOS V., GIZEWSKI E.R., STOLKE D., SURE U. and SANDALCIOGLU I.E.: Spontaneous cerebellar hemorrhage-experience with 57 surgically treated patients and review of the literature. Neurosurgical review, Jan. 34: 77-86, 2011.

15- CHO S.M., HU C., PYEN J.S., WHANG K., KIM H.J., HAN Y.P. and HONG S.K.: Predictors of Outcome of Spontaneous Cerebellar Hemorrhage. Journal of Korean Neurosurgical Society, Oct 1; 26 (10): 1395-400, 1997.

16- COHEN Z.R., RAM Z., KNOLLER N., PELES E. and HADANI M.: Management and outcome of non-traumatic cerebellar haemorrhage. Cerebrovascular Diseases, Oct 25; 14 (3-4): 207-13, 2002.

17- DAHDALEH N.S., DLOUHY B.J., VILJOEN S.V., CAPUANO A.W., KUNG D.K., TORNER J.C., HASAN D.M. and HOWARD 3rd M.A.: Clinical and radiographic predictors of neurological outcome following posterior fossa decompression for spontaneous cerebellar hemorrhage. Journal of Clinical Neuroscience, Sep. 1; 19 (9): 1236-41, 2012.

18- KIROLLOS R.W., TYAGI A.K., ROSS S.A., VAN HILLE P.T. and MARKS P.V.: Management of spontaneous cerebellar hematomas: A prospective treatment protocol. Neurosurgery, Dec. 1; 49 (6): 1378-87, 2001.

19- LUPARELLO V. and CANAVERO S.: Treatment of hypertensive cerebellar hemorrhage–surgical or conservative management?. Neurosurgery, Sep. 1; 37 (3): 552-3, 1995.

العوامل التنبؤية المؤثرة على النتيجة الجراحية لإخراج النزيف المخيخى العفوى

الخلفية: يرتبط النزيف المخيخى العفوى بمعدلات أعلى من الإصابة والوفيات فى جميع أنحاء العالم. وذلك لأن مساحة الحفرة الخلفية مقيدة للغاية؛ مما يعنى أن حتى كمية صغيرة من النزيف يمكن أن تضغط على جذع الدماغ وتسبب مضاعفات خطيرة.

الأهداف: تحديد المتنبئين المحتملين لنجاح الجراحة فى مرضى النزيف المخيخى العفوى من خلال تحليل خصائصهم التشخيصية.

الطرق: تم إجراء هذه الدراسة الاستعادية على عشرين فردًا تم تشخيصهم بالنزيف المخيخى العفوى وخضعوا لعملية جراحية فى قسم جراحة المخ والأعصاب بمستشفيات جامعة بني سويف. وكان العمر والجنس وأقصى قطر وحجم للنزيف والنزيف داخل البطين المرتبط به وانضغاط البطين الرابع واستسقاء الرأس المرتبط به وانضغاط جذع الدماغ من بين المتغيرات التشخيصية التى تم تقييمها لدى المرضى. استخدمنا مقياس غلاسكو للنتائج لتقييم النتائج.

النتائج: كان متوسط عمر المشاركين ٦٠,٢٠ ± ٤,٣٦ سنة، وفقًا للنتائج. وكان سبعون بالمائة من الرجال وثلاثون بالمائة من النساء. وُجِد أن المتغيرات التالية مرتبطة بشكل كبير بالنتائج السيئة كما تم قياسها بواسطة مقياس جلاسكو:

(وجود نزيف داخل البطين $p<0.001$) حجم الورم الدموى، ($p<0.001$)، GCS ($p<0.001$) عمر المريض، ($p<0.004$) أداء تحويل السائل النخاعى ($p<0.001$)، وقت التدخل المتأخر ($p<0.001$) ضغط جذع الدماغ ($p<0.019$).

الخلاصة: مستوى الوعى عند القبول، والتدخل الجراحى المتأخر، ونزيف داخل البطين، وضغط جذع الدماغ، وضغط البطين الرابع الكبير مع التغيرات الاستسقاء الرأسى كلها عامل تتنبأ بنتيجة سيئة للعلاج الجراحى.