Scientific Research Publishing

World Journal of Neuroscience, 2026, 16(1), 25-32
https://www.scirp.org/journal/wjns
ISSN Online: 2162-2019
ISSN Print: 2162-2000

Brainstem Hemorrhage Stereotactic Aspiration in Mali: About the First Two Cases in West Africa

Mahamadou Dama[1*], Daouda Sissoko[1], Oumar Coulibaly[1], Alpha Singuepire[2], Kalilou Sangho[3], Amadou Drame[3], Mody Camara[4], Drissa Kanikomo[5], Oumar Diallo[1]

[1]Department of Neurosurgery, Mali Hospital, Bamako, Mali
[2]Neurosurgeon Department, Nianancoro FOMBA Hospital, Bamako, Mali
[3]Anesthesiologist-Intensivist Department, Mali Hospital, Bamako, Mali
[4]Department of Radiology and Imaging Medical, Mali Hospital, Bamako, Mali
[5]Department of Neurosurgery, Gabriel Touré Hospital, Bamako, Mali
Email: *damasmaha@yahoo.fr

How to cite this paper: Dama, M., Sissoko, D., Coulibaly, O., Singuepire, A., Sangho, K., Drame, A., Camara, M., Kanikomo, D. and Diallo, O. (2026) Brainstem Hemorrhage Stereotactic Aspiration in Mali: About the First Two Cases in West Africa. *World Journal of Neuroscience*, **16**, 25-32.
https://doi.org/10.4236/wjns.2026.161003

Received: July 18, 2025
Accepted: December 23, 2025
Published: December 26, 2025

Abstract

Background: Primary brainstem hemorrhage (PBH) is a type of spontaneous brainstem hemorrhage that is not associated with definite lesions. Currently, it is being debated whether to manage brainstem hemorrhage with conservative or surgical approaches, with some researchers suggesting conservative therapy, while others advocate for surgical treatment. The aim of this work is to present the first two cases operated on in Mali. **Case Presentations:** These were two cases selected according to the criteria defined by our team and were aged under 40 years, with a volume and Glasgow scale, operated on stereotactically with a frame. The calculation of the coordinates was manual. At 30 days post-operation, we had a 100% survival rate. **Conclusion:** Stereotactic evacuation of brainstem hematomas is possible in Mali; our results are encouraging, but a larger study is necessary.

Keywords

Brainstem, Hemorrhage, Stereotactic, Mali, West Africa

1. Introduction

Primary brainstem hemorrhage (PBH) is a type of spontaneous brainstem hemorrhage that is not associated with definite or objective lesions such as cavernomas and arteriovenous malformations [1]. Hypertensive brainstem hemorrhage denotes a catastrophic event with an extremely poor outcome [2] [3]. The rate of

incidence of primary brainstem hemorrhage is 2% - 4% in 100,000 people every year, accounting for up to 10% of the cases of intracerebral hemorrhage, and the most common type is pontine hemorrhage with a mortality rate ranging from 40% to 50% [4]. Brainstem hemorrhage usually leads to serious consciousness disturbance, motor, and respiratory damage. Currently, it is being debated whether to manage brainstem hemorrhage with conservative or surgical approaches, with some researchers suggesting conservative therapy [5] while others advocate for surgical treatment because recent advances in microsurgery and neuroimaging techniques, intraprocedural neurophysiological monitoring, and neuronavigation have allowed for improvements in the outcomes of patients with primary brainstem hemorrhage [6]. Evacuation can be performed by craniotomy [7]. The patient's surgical position and approach are determined by experienced neurosurgeons in the surgical center. In general, suboccipital, subtemporal, retrosigmoid, or transcerebellar-middle cerebellar peduncle approach will be used depending on the hematoma location. The hematoma is evacuated with the help of a microscope. Neuroendoscopy is another method of evacuation, but neurosurgeons will make the surgical plan based on the neuronavigational results. In Asia, especially in China, stereotactic evacuation seems to have risen above the two previous methods. The optimal stereotactic puncture route will be determined by the results of neuronavigation [8]. In West Africa, the treatment was medical and in the vast majority of cases in services that were not suitable, such as emergency rooms for days, medical wards, or even cardiology. Mali, not being an exception to this rule, we decided to adopt another approach in order to reduce mortality related to this entity by improving our technical facilities. We chose stereotactic evacuation because of the availability of the frame in the department, but also because of our training in this technique in China. In 2017, Huang *et al*. developed and validated a brainstem hemorrhage score based on the Glasgow score and hematoma volume [9]. This score allowed us to use it as a reference and, taking into account our working conditions, including intensive care, to make the choice of patients.

The aim of this work is to present the first two cases operated on in Mali.

2. Methods

The selection criteria chosen by our team were age under 40, volume between 5 and 15 mL, and a GCS between 7 and 10 points without coagulation disorder and without anticoagulant or antiplatelet treatment.

The patients were operated on between 6 and 72 hours after the stroke under general anesthesia, and the calculation of the X, Y, Z coordinates, as well as the arc and the ring were done manually.

The patients were operated on in the prone position, and the incision was infratentorial occipital. The hole had a diameter of 5 mm and the suction cannula had a diameter of 4 mm.

Eighty percent or more of the initial volume evacuated was considered satisfactory.

2.1. Case Study 1

A 37-year-old male patient with a relatively unremarkable medical history presented with sudden-onset headaches. He arrived at the hospital 3 hours after the event. On admission, he was drowsy with a GCS of 14 points. The blood pressure was 170/80 mmHg with a heart rate of 70 beats per minute, and the breathing was steady. He had tetraplegia. The diagnosis of hemorrhagic stroke was strongly suspected. The brain CT scan in emergency revealed a bulbopontine hemorrhage (**Figure 1**). The volume of the hematoma measured on the scanner was 6 mL. Six hours after the stroke, the patient was still tetraplegic, with a GCS of 7 points. We decided to intubate the patient to perform a follow-up CT scan, and the volume of the hematoma was 6.08 mL. The patient had a brainstem hematoma score (BHS) of 2 according to Huang *et al*. After obtaining the family's consent, we proceeded with the stereotactic evacuation under general anesthesia. Intraoperatively, the patient remained relatively hypertensive, and we evacuated 6 mL of hematoma. The patient was then transferred to the intensive care unit, and 72 hours postoperatively, we performed a follow-up CT scan (**Figure 2**) before beginning the patient's awakening. Upon waking, the patient was paretic in the upper limbs and paraplegic in the lower limbs but conscious. The extubation attempt failed, and we performed a tracheotomy on the tenth day after surgery. One month after the surgery, he developed a lung infection and passed away on the forty-fifth day.

2.2. Case Study 2

This second case was a 39-year-old known hypertensive man who suddenly experienced a loss of consciousness. He was transported two hours after the stroke. Upon admission, the Glasgow score was 11 points with a blood pressure of 200/110 mmHg, and he was put on nicardipine via an auto-injector syringe. He presented with right-sided hemiplegia. The performed scan revealed a brainstem hematoma (**Figure 3**), and the calculated volume was 8.12 mL. Six hours after the stroke, the GCS was 9, and the volume was still the same. Evacuative surgery by stereotaxis was decided with the family's consent, and the postoperative day 3 scan showed satisfactory evacuation (**Figure 4**); the BHS was 1. The patient was extubated on the fourth day and, as before surgery, had a right hemiplegia. He stayed 15 days in the intensive care unit, including 7 days with a nasogastric tube due to swallowing disorders, then was transferred to the neurosurgery department, where he spent a week before being discharged home with a prescription for physiotherapy.

3. Discussion

This study is the first of its kind conducted in West Africa because, traditionally, brainstem hematomas were treated exclusively with medical therapy. The evacuation of intraparenchymal hematomas in general, and particularly of the brainstem, is commonly practiced, especially in Asia [1] [3] [5] [7] [9].

Figure 1. Bulbopontine hematoma.

Figure 2. Follow-up CT scan.

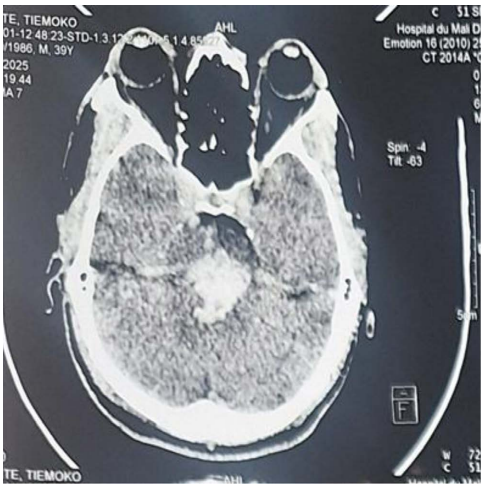

Figure 3. The CT scan revealed a hematoma in the brainstem.

Figure 4. Postoperative scan on day 3.

Since primary brainstem hemorrhage (PBH) has the worst prognosis of all types of ICH, previous studies have investigated prognostic factors such as age, coma, blood glucose, GCS, hemorrhage size, location, and extent of hemorrhage [10]. According to the anatomical region, the medulla oblongata type is the most serious type and may cause ataxic respiration and rapid death [11]. There are also several classifications based on the CT scan appearance [12]-[15], and it was demonstrated that small amounts of dorsal hemorrhage had a good prognosis, while ventral and massive hematoma have higher mortality [16]. The Second Affiliated Hospital of Zhejiang University School of Medicine in China introduced four types of hematoma classification based on the maximum cross-section of CT and showed surgical treatment according to different classifications [17].

In order to improve decision-making, several scoring systems have been developed, but only the score by Huang *et al*. has been validated to predict 30-day and 90-day mortality [9]. The 30-day mortality rates for patients with a total score of 0, 1, 2, 3, and 4 were 2.7%, 31.6%, 42.7%, 81.8%, and 100%, respectively. We used this scoring system to choose our patients. The first one had 2 and the second had 1. According to Huang *et al*., patients with a score of 0 have a 97.3% chance of survival, while those with a score of 4 have a 0% chance of survival, so we excluded the two extremes.

Surgical treatment of PBH is controversial; however, the purpose of surgical treatment is to remove or reduce the hematoma, decompress the brainstem, prevent secondary damage, and be sensitive to the brainstem. Certainly, the belief in and the concept of destiny are strongly rooted in Africans, but in a way, we have almost completely copied the results of studies conducted by Europe and America. Added to this is the lack of financial resources for purchasing equipment and conducting our own studies, which sometimes makes us accept our conditions. Even though age is not a contraindication [10], we chose patients under 40 years old with a volume between 5 and 15 mL, and all our patients are operated on in the prone position (**Figure 5**, **Figure 6**). The *X*, *Y*, *Z* coordinates as well as the arc and

the ring are calculated manually, because surgery is not recommended for patients with bleeding greater than 15 mL, a severe irreversible damage source, and extremely unstable basic vital signs. According to the formula,

$$X = X' + 5$$

$$Y = Y' + 40$$

$$Z = \left(Z' + Z''\right)/2 + 37$$

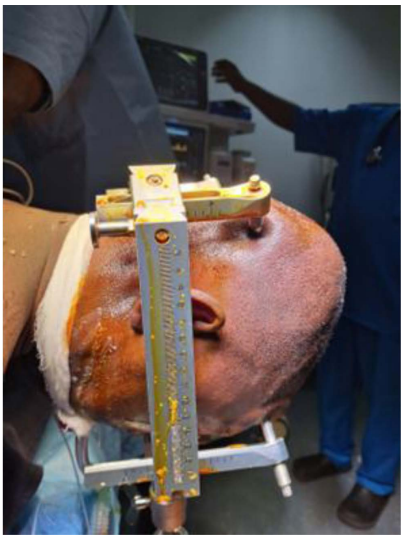

Figure 5. Prone position.

Figure 6. Image showing the choice of the bow and the ring.

Our patients are not operated on before 6 hours to allow the clot to stabilize, but they are not operated on after 72 hours because the blood degradation process will have begun, like the Chinese recommendation between 6 - 24 h after bleeding. Our surgical option was only stereotactic frame evacuation without drain or alteplase. We reported 100% survival at 30 days post-surgery, even though there is

a selection bias. Among the biases, we were both under 40 years old, but we also excluded those who had a collapsed GCS. We included patients with an HBS score of 1, whereas other authors had chosen scores of 2 and 3 [18]. One patient died 45 days postoperatively due to a pulmonary infection, while the second patient is still alive with hemiplegia.

4. Conclusion

Stereotactic evacuation of brainstem hematomas is possible in Mali. The calculation of the coordinates is performed manually, and our results are encouraging. A larger study, comparing it with conservative treatment, is necessary.

Conflicts of Interest

There are no conflicts of interest.

References

[1] Chen, D., Tang, Y., Nie, H., Zhang, P., Wang, W., Dong, Q., *et al.* (2021) Primary Brainstem Hemorrhage: A Review of Prognostic Factors and Surgical Management. *Frontiers in Neurology*, **12**, Article 727962. https://doi.org/10.3389/fneur.2021.727962

[2] Shrestha, B.K., Ma, L., Lan, Z., Li, H. and You, C. (2015) Surgical Management of Spontaneous Hypertensive Brainstem Hemorrhage. *Interdisciplinary Neurosurgery*, **2**, 145-148. https://doi.org/10.1016/j.inat.2015.06.005

[3] Ichimura, S., Bertalanffy, H., Nakaya, M., Mochizuki, Y., Moriwaki, G., Sakamoto, R., *et al.* (2018) Surgical Treatment for Primary Brainstem Hemorrhage to Improve Postoperative Functional Outcomes. *World Neurosurgery*, **120**, e1289-e1294. https://doi.org/10.1016/j.wneu.2018.09.055

[4] Takeuchi, S., Suzuki, G., Takasato, Y., Masaoka, H., Hayakawa, T., Otani, N., *et al.* (2013) Prognostic Factors in Patients with Primary Brainstem Hemorrhage. *Clinical Neurology and Neurosurgery*, **115**, 732-735. https://doi.org/10.1016/j.clineuro.2012.08.022

[5] Manno, E.M., Atkinson, J.L.D., Fulgham, J.R. and Wijdicks, E.F.M. (2005) Emerging Medical and Surgical Management Strategies in the Evaluation and Treatment of Intracerebral Hemorrhage. *Mayo Clinic Proceedings*, **80**, 420-433. https://doi.org/10.4065/80.3.420

[6] Takahama, H., Morii, K., Sato, M., Sekiguchi, K. and Sato, S. (1989) Stereotactic Aspiration in Hypertensive Pontine Hemorrhage: Comparative Study with Conservative Therapy. *No Shinkei Geka*, **17**, 733-739.

[7] Zheng, J., Li, H., Guo, R., Lin, S., Hu, X., Dong, W., *et al.* (2014) Minimally Invasive Surgery Treatment for the Patients with Spontaneous Supratentorial Intracerebral Hemorrhage (MISTICH): Protocol of a Multi-Center Randomized Controlled Trial. *BMC Neurology*, **14**, Article No. 206. https://doi.org/10.1186/s12883-014-0206-z

[8] He, Q., Wang, J., Ma, L., Li, H., Tao, C. and You, C. (2022) Safety of Surgical Treatment in Severe Primary Pontine Haemorrhage Evacuation (STIPE): Study Protocol for a Multi-Centre, Randomised, Controlled, Open-Label Trial. *BMJ Open*, **12**, e062233. https://doi.org/10.1136/bmjopen-2022-062233

[9] Huang, K., Ji, Z., Sun, L., Gao, X., Lin, S., Liu, T., *et al.* (2017) Development and Validation of a Grading Scale for Primary Pontine Hemorrhage. *Stroke*, **48**, 63-69.

https://doi.org/10.1161/strokeaha.116.015326

[10] Chen, P., Yao, H., Tang, X., Wang, Y., Zhang, Q., Liu, Y., *et al.* (2022) Management of Primary Brainstem Hemorrhage: A Review of Outcome Prediction, Surgical Treatment, and Animal Model. *Disease Markers*, **2022**, Article ID: 4293590. https://doi.org/10.1155/2022/4293590

[11] Kwon, H., Park, J., Lee, J. and Yoon, B. (2005) Primary Medullary Hemorrhage Associated with Hypertension. *Journal of Clinical Neurology*, **1**, 177-179. https://doi.org/10.3988/jcn.2005.1.2.177

[12] Russell, B., Rengachary, S.S. and McGregor, D. (1986) Primary Pontine Hematoma Presenting as a Cerebellopontine Angle Mass. *Neurosurgery*, **19**, 129-133. https://doi.org/10.1227/00006123-198607000-00023

[13] Chung, C. and Park, C. (1992) Primary Pontine Hemorrhage: A New CT Classification. *Neurology*, **42**, 830-830. https://doi.org/10.1212/wnl.42.4.830

[14] Nishizaki, T., Ikeda, N., Nakano, S., Sakakura, T., Abiko, M. and Okamura, T. (2012) Factors Determining the Outcome of Pontine Hemorrhage in the Absence of Surgical Intervention. *Open Journal of Modern Neurosurgery*, **2**, 17-20. https://doi.org/10.4236/ojmn.2012.22004

[15] Wessels, T., Moller-Hartmann, W., Noth, J. and Klotzsch, C. (2004) CT Findings and Clinical Features as Markers for Patient Outcome in Primary Pontine Hemorrhage. *AJNR American Journal of Neuroradiology*, **25**, 257-260.

[16] Jang, J.H., Song, Y.G. and Kim, Y.Z. (2011) Predictors of 30-Day Mortality and 90-Day Functional Recovery after Primary Pontine Hemorrhage. *Journal of Korean Medical Science*, **26**, 100-107. https://doi.org/10.3346/jkms.2011.26.1.100

[17] Liu, F., Wang, Z.F. and Yu, X.B. (2019) Efficiency and Influencing Factors of Stereotactic Precision Aspiration in the Treatment of Primary Brainstem Hemorrhage. *Chinese Journal of Neurosurgery*, **35**, 1094-1098.

[18] Chen, L., Chen, T., Mao, G., Chen, B., Li, M., Zhang, H., *et al.* (2020) Clinical Neurorestorative Therapeutic Guideline for Brainstem Hemorrhage (2020 China Version). *Journal of Neurorestoratology*, **8**, 232-240. https://doi.org/10.26599/jnr.2020.9040024