Case Report

Minimally invasive surgery for bilateral large basal ganglia hemorrhage: a rare case report and insights from literature

Thi Chi Lan Le[1], Quang Hung Nguyen[1], Hai Dang Huynh[2], Thi Ngoc Tuyen Nguyen[1], Duy Linh Nguyen[3]^

[1]Department of Neurosurgery, Can Tho S.I.S General Hospital, Can Tho, Vietnam; [2]Department of Neurosurgery, Can Tho Central General Hospital, Can Tho, Vietnam; [3]Neurosurgical Division, Department of Surgery, Can Tho University of Medicine and Pharmacy, Can Tho, Vietnam

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Correspondence to: Duy Linh Nguyen, MD. Neurosurgical Division, Department of Surgery, Can Tho University of Medicine and Pharmacy, 179 Nguyen Van Cu Street, Can Tho 900000, Vietnam. Email: ndlinh@ctump.edu.vn.

Background: Acute bilateral basal ganglia hemorrhage is a rare and life-threatening condition, often associated with high morbidity and mortality. Timely diagnosis and intervention are crucial to improving outcomes. This report presents a case successfully managed with minimally invasive surgery (MIS).

Case Description: A 44-year-old male, previously independent in daily activities with a medical history of hypertension, presented to the emergency department with severely altered consciousness [Glasgow Coma Scale (GCS) score 6]. Immediate intubation and admission to the intensive care unit (ICU) were initiated. Computed tomography (CT) angiography confirmed no evidence of vascular abnormalities or aneurysms. Tubular retractor-assisted microsurgical evacuation was performed to remove the hematoma and reduce intracranial pressure (ICP). The patient demonstrated neurological improvement, including spontaneous eye opening by postoperative day 3 and discharge from the ICU on day 10, highlighting the effectiveness of the intervention. He was subsequently discharged from the hospital on day 15 and transferred to a rehabilitation center for further recovery. Bilateral basal ganglia hemorrhage is rare, and its management often poses challenges due to high morbidity and mortality rates.

Conclusions: This case underscores the importance of prompt diagnosis and intervention in bilateral basal ganglia hemorrhage. MIS offers a viable therapeutic option that may enhance recovery while reducing surgical risks.

Keywords: Bilateral; basal ganglia hemorrhage; minimally invasive surgery (MIS); hematoma evacuation; case report

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Introduction

Background

Intracerebral hemorrhage (ICH) is the second most common cause of stroke, accounting for 28% of all strokes (1), and remains the most lethal subtype. The condition arises from the rupture of abnormal cerebral blood vessels, often due to chronic hypertension or vascular malformations (2). The resulting hemorrhage triggers a cascade of events, including the release of toxic substances from dying blood cells within the hematoma, which exacerbates neuronal damage in the surrounding brain tissue. In addition, the accumulation

^ ORCID: 0000-0001-8283-9237.

of blood elevates intracranial pressure (ICP), potentially leading to further brain tissue injury and poor clinical outcomes (3).

Rationale and knowledge gap

In recent years, minimally invasive surgery (MIS) has emerged as a promising alternative to traditional medical management or open craniotomy for selected cases of supratentorial ICHs and intraventricular hemorrhages. MIS techniques allow for effective hematoma evacuation while minimizing surgical trauma to surrounding brain structures (4). Studies have shown that MIS can be feasible and safe, warranting further exploration (5-7).

The majority of patients with ICH are managed through decompressive craniectomy and hematoma evacuation. However, access to MIS remains limited to a small number of advanced neurosurgical centers, reflecting significant disparities in healthcare resources (8). The decision to perform surgery becomes even more challenging in rare and complex cases, such as large bilateral basal ganglia hemorrhages, where the risks and benefits of intervention must be carefully balanced. This report presents a challenging case managed with MIS, highlighting its potential role in treating bilateral basal ganglia hemorrhages.

Objective

This report aims to present a rare case of large bilateral basal ganglia hemorrhage treated with MIS and to provide insights from relevant literature regarding its surgical management. We present this case in accordance with the CARE reporting checklist (9) (available at https://acr.amegroups.com/article/view/10.21037/acr-25-17/rc).

Highlight box

Key findings

- Tubular retractor-assisted microsurgical evacuation successfully treated a rare case of acute bilateral basal ganglia hemorrhage, resulting in significant neurological improvement.
- A multidisciplinary approach with timely intervention and early rehabilitation contributed to the patient's positive functional recovery.

What is known and what is new?

- Bilateral basal ganglia hemorrhage is a rare clinical entity, often associated with poor prognosis and limited surgical interventions.
- This case demonstrates the application of tubular retractor-assisted microsurgical evacuation in a patient with simultaneous bilateral basal ganglia hemorrhage.

What is the implication, and what should change now?

- Minimally invasive surgery could be considered a viable option for specific cases of bilateral basal ganglia hemorrhage.

Case presentation

A 44-year-old male patient was brought to the hospital by his family after experiencing a sudden loss of consciousness. On examination, his Glasgow Coma Scale (GCS) score was 6 (E1V1M4). Clinical findings included bilaterally equal pupils, 2.5 mm in diameter, reactive to light. The patient exhibited hemiparesis on the left side with no response to painful stimuli, while the right side showed limited movement with muscle strength graded as 1/5 according to the Medical Research Council (MRC) scale (10). The National Institutes of Health Stroke Scale (NIHSS) score was recorded at 29.

The patient had a history of uncontrolled hypertension for three years and presented with severely elevated blood pressure at 180/120 mmHg upon admission, requiring immediate administration of nicardipine for control. A cranial computed tomography (CT) scan revealed a large, bilateral basal ganglia hemorrhage (*Figure 1A*), with the calculated hematoma volumes being 45 mL on the right and 30 mL on the left, as estimated by the Coniglobus formula. CT angiography (CTA) showed no vascular abnormalities.

After receiving their consent, minimally invasive surgery was performed using bilateral frontal craniotomies measuring approximately 3×3 cm^2. A tubular retractor and navigation system were employed to evacuate the hematomas effectively (*Figure 1B*). We used a cylindrical, self-retaining tubular retractor (disposable dual lumen brain tissue dilator, TianXinFu Medical Company, Beijing, China; diameter 15 mm, length 65 mm), which allows atraumatic cortical and subcortical access while maintaining a stable working corridor. The procedure was performed under microscopic visualization without the use of endoscopy. Then the brain demonstrated reduced tension, and the surgical site was closed with cranioplasty without a drainage.

The patient showed a slight improvement in his level of consciousness by the tenth postoperative day, achieving a GCS score of 9 (E2V2M5). A postoperative CT scan confirmed the complete resolution of the hematoma, with no remaining blood collection and a reduction in ventricular compression (*Figure 1C*). After 14 days of hospitalization,

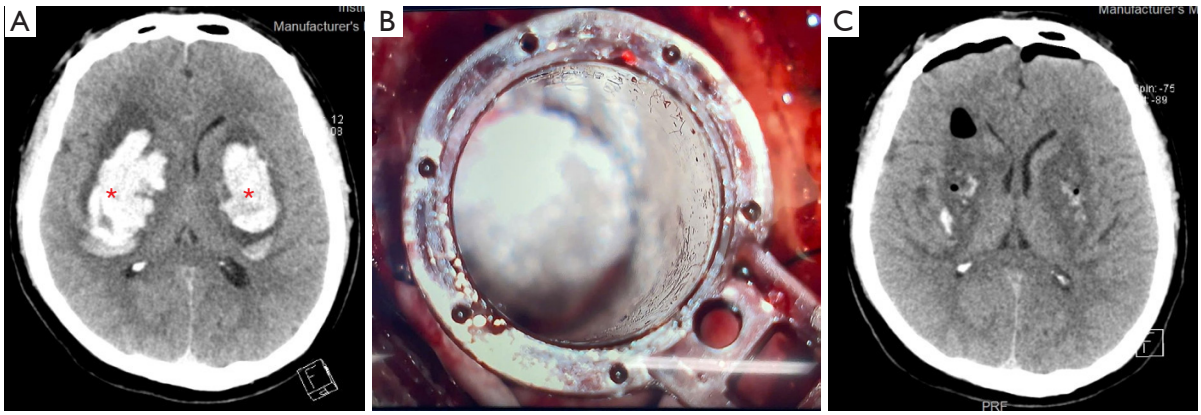

Figure 1 Minimally invasive surgical management of bilateral basal ganglia hemorrhage. (A) The preoperative cranial CT scan reveals bilateral large basal ganglia hemorrhage (red stars). (B) Intraoperative photograph shows a tubular retractor under microscope. (C) The postoperative CT scan shows successful removal of the hematoma. CT, computed tomography.

his motor recovery showed variability: the right limb demonstrated muscle strength graded at 3/5, the left lower limb at 1/5, and the left upper limb at 0/5. Following his discharge from the hospital, the patient was transferred to a rehabilitation center for further recovery. At discharge, the patient had a modified Rankin Scale (mRS) score of 5 and a Barthel Index of 15/100, indicating severe disability and complete dependence in daily activities. After three months of rehabilitation, only slight improvement was observed, with the Barthel Index increasing to 20/100 while the mRS remained unchanged at 5.

All procedures performed in this study were in accordance with the ethical standards of the institutional and national research committees, and with the Helsinki Declaration and its subsequent amendments. Written informed consent was obtained from the patient's family member for the publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

Discussion

Key findings

Bilateral basal ganglia hemorrhage is a rare and severe condition often associated with high morbidity and mortality. This includes potential contributing factors such as severe hypertension, impaired cerebral autoregulation, and small vessel disease, with references to relevant studies (11,12). This case highlights the effectiveness of MIS in managing large bilateral basal ganglia hemorrhages. The patient presented with a low GCS score, and the intervention successfully reduced ICP while facilitating significant neurological improvement and early functional recovery.

Strengths and limitations

The strengths of this report include the successful use of MIS for a rare and complex bilateral basal ganglia hemorrhage and the implementation of a comprehensive multidisciplinary approach, including early rehabilitation with speech and motor functional therapies. However, the limitations must be acknowledged. This report describes a single case, limiting the generalizability of the findings. Additionally, the follow-up period was short, and long-term functional outcomes remain uncertain. Furthermore, no direct comparison was made with other surgical approaches, such as decompressive craniectomy or open craniotomy, which could have provided further context for the effectiveness of MIS.

Comparison with similar researches

The basal ganglia are critical structures involved in motor control, and hemorrhages in these areas can lead to severe neurological deficits, including altered consciousness, hemiparesis, and impairments in cognitive and speech functions. The management of such cases, requires careful consideration of both medical and surgical options. A case report by Sheikh Hassan *et al.* was a patient with bilateral traumatic hemorrhage of the basal ganglia, emphasizing

Table 1 Case reports of spontaneous bilateral large basal ganglia hemorrhage management

Authors	Year	No. of cases	BP (mmHg)	GCS at admission	Size of bilateral hematomas	Treatment	Outcome
Kabuto *et al.* (15)	1995	2	–	Coma	Max diameter 7 cm	Conservative	Died
Cha *et al.* (16)	2012	1	69/43	3	Massive	Conservative	Died
Xu *et al.* (4)	2024	1	144/104	9	14 mL; 18 mL	Thrombolysis*	Good
Kayastha *et al.* (17)	2022	1	200/100	12	28 mL; 13 mL	conservative	Good
Zhang *et al.* (18)	2020	1	180/100	6	27 mL; 18 mL	Thrombolysis*	mRS =3 (90 days)
Sheikh Hassan *et al.* (13)	2022	1	220/120	8	5 cm × 3 cm; 3 cm × 1 cm	Conservative	Good, referred to the rehabilitation department
Jiang *et al.* (14)	2024	1	Max 200	6	40 mL; 5 mL	Endoscopic hematoma evacuation (one side)	GCS 10, muscle strength 2/5

*, local thrombolysis. BP, blood pressure; GCS, Glasgow Coma Scale; mRS, modified Rankin Scale.

the rarity of such cases and the importance of prompt diagnosis and management (13). Jiang *et al.* also reported bilateral simultaneous basal ganglia hemorrhage with neuroendoscopic hematoma evacuation to improve patient outcomes (14). We conducted a review of previously published case reports and studies on bilateral basal ganglia hemorrhage using databases such as PubMed and Google Scholar. The search was performed using keywords including "bilateral basal ganglia hemorrhage", "minimally invasive surgery", "bilateral hematoma evacuation", and "thrombolysis". Inclusion criteria focused on reports documenting cases of spontaneous bilateral hemorrhages with detailed treatment modalities and outcomes. From the reviewed literature, we identified only a limited number of cases describing surgical interventions, with most involving conservative management or thrombolysis. The findings are summarized in *Table 1* to highlight the rarity of MIS for bilateral hematoma evacuation.

This case highlights the potential of MIS in the treatment of large bilateral basal ganglia hemorrhages. MIS was chosen due to the large hematoma volume, significant mass effect, and the patient's deteriorating neurological status (GCS 6), which indicated the need for hematoma evacuation to prevent further deterioration. Although traditionally, decompressive craniectomy and open craniotomy have been the standard approaches, recent evidence supports the use of MIS for selected patients, particularly those with significant hematoma volumes and in the context of poor clinical status. MIS offers the advantages of reduced surgical injuries, lower complication rates, and potentially faster recovery, making it an attractive option even in resource-constrained settings (4). In Watanabe's systematic review, only 6 out of 64 case reports involved bilateral external ventricular drainage surgery, and no other MIS-based surgical methods were reported (19).

In line with the 2022 American Heart Association/American Stroke Association guidelines for managing spontaneous ICH, surgical intervention was considered appropriate for basal ganglia hemorrhages >20–30 mL with GCS scores of 5–12 (20). Additionally, the findings from the recent Early Neurointervention for Hemorrhagic Stroke (ENRICH) trial provide further support for the early use of MIS for hematoma evacuation. The ENRICH trial demonstrated that early surgery with MIS for spontaneous ICH, including basal ganglia hemorrhages, significantly improved neurological outcomes compared to the use of local thrombolysis alone (21). This is particularly relevant in the context of bilateral hemorrhages, where the potential for brain tissue damage due to increased ICP is high. Local thrombolysis, while beneficial in certain intraventricular hemorrhage, has not shown similar benefits in patients with large intracerebral hematomas or significant brain swelling (6,21).

Explanations of findings

The patient in this case had a GCS score of 6 at presentation, indicating a severe level of consciousness impairment, with additional findings of hemiparesis and markedly reduced motor strength on the left side. Despite these challenges, the use of MIS allowed for effective hematoma evacuation, significantly reducing ICP and contributing to

the patient's improvement. For cases of large basal ganglia hemorrhages, medical management often results in poor outcomes. Surgical intervention is essential to evacuate the hematoma and reduce ICP. Compared to medical treatment, minimally invasive surgery has demonstrated effectiveness in reducing in-hospital mortality rates (22). The prognosis for bilateral ICH is generally poor due to severe neurological deficits, including altered consciousness, quadriparesis, and pseudobulbar palsy (23), underscoring the importance of timely and effective interventions such as MIS.

The variability in the patient's recovery, particularly the muscle strength differences between limbs, is not uncommon in cases of basal ganglia hemorrhage (24). The basal ganglia are involved in fine motor control, and damage to these structures can lead to partial or complete loss of motor function on the contralateral side. In this case, the patient's recovery trajectory was aided by a multidisciplinary approach, including motor functional rehabilitation, speech-language pathologists for cognitive and swallowing functions. Previous studies have suggested that a higher evacuation rate (>70%) (25,26), which aligns with our findings. Although MIS has been associated with lower in-hospital mortality and more favorable discharge disposition, previous studies have not consistently demonstrated a significant impact on long-term functional outcomes or ambulatory status (26,27).

Implications and actions needed

This case emphasizes the importance of early intervention and the role of early MIS in improving outcomes for patients with severe ICH. While the patient's motor recovery will require ongoing rehabilitation, the initial postoperative success and transfer to a rehabilitation center reflect the potential for functional recovery in such challenging cases. Further studies are needed to better understand the long-term outcomes of MIS in large bilateral basal ganglia hemorrhages and to refine patient selection criteria for this approach.

Conclusions

This case demonstrates the effectiveness of MIS in the management of large bilateral basal ganglia hemorrhages. The patient's improvement in neurological function following MIS highlights the potential benefits of this approach, including reduced surgical trauma, faster recovery, and improved outcomes compared to traditional methods.

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Footnote

Reporting Checklist: The authors have completed the CARE reporting checklist. Available at https://acr.amegroups.com/article/view/10.21037/acr-25-17/rc

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and national research committees, and with the Helsinki Declaration and its subsequent amendments. Written informed consent was obtained from the patient's family member for the publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

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