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Endoscopic Ventricular Lavage in Management of Intraventricular Hemorrhage

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ORIGINAL STUDY

Endoscopic Ventricular Lavage in the Management of Intraventricular Hemorrhage

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Abstract

Objective: **The present study was conducted to evaluate the effect of neuroendoscopic evacuation of intraventricular hematoma (IVH; primary or secondary).**

Background: **IVH is one of the serious central nervous system hemorrhagic diseases with an acute onset, rapid progress, and a higher mortality rate of up to 80%. With the continuous progression of medical science and technology, neuroendoscopy combined with intraventricular lavage can effectively shorten the operation time with effective hematoma removal and less trauma to the brain.**

Patients and methods: **Twenty patients with IVH who were admitted to Neurosurgery Department, Menoufia University Hospital, during the period between January 2022 and January 2023, were included in this study. They underwent neuroendoscopic hematoma evacuation combined with intraventricular lavage and insertion of external ventricular drain. The patients were followed up for 3 months postoperatively.**

Results: **There were 14 males and six females. The mean age was 48.13 ± 3.9 years. Thirty-five percent of patients presented with deep coma, 30% presented with impaired consciousness, 20% had manifestations of stroke, and 15% presented with severe headache. Predisposing factors included hypertension in 45%, diabetes in 25%, smoking in 10%, and antiplatelet use in 10%. Mean systolic blood pressure was 158.19 ± 28.6 mmHg, the mean diastolic blood pressure was 95.22 ± 17 mm Hg, the mean platelet count was 205 ± 71.5/ml, and the mean international normalized ratio was 1.02 ± 0.11.**

Conclusion: **Endoscopic ventricular lavage seems to be an effective method for treating patients with IVH. It can improve the perioperative condition, improve hematoma clearance, and improve clinical outcome.**

Keywords: Graeb score, Intraventricular hemorrhage, Intraventricular lavage, Neuroendoscopic lavage

1. Introduction

The current study aims to evaluate the efficacy and safety of neuroendoscopy hematoma lavage in patients with intraventricular hemorrhage (IVH).

IVH is one of the common severe conditions in neurosurgery with acute onset, rapid progress, high disability, and mortality. IVH can cause serious complications like hydrocephalus, intracranial hypertension, or ventriculitis [1].

The typical clinical presentation of IVH included disturbance of water and electrolyte balance, limb dysfunction, myotonia, disturbed consciousness and high disability and mortality rate. The mortality rate in patients with severe IVH is as high as 80% [2].

The most important part of treating patients with severe IVH is to remove IVH as soon as possible, restore cerebrospinal fluid (CSF) circulation, prevent intracranial hypertension, and minimize secondary brain damage [3].

Intracranial pressure associated with IVH is usually treated both medically and surgically. External ventricular drainage (EVD), either alone or combined with thrombolytic agents, is widely used. However, prolonged catheterization and injection may cause rebleeding and intracranial infection [4].

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Therefore, it is always necessary to find a safe and effective treatment for patients with IVH in order to quickly eliminate ventricular hemorrhage and prevent recurrent rebleeding.

2. Patients and methods

This prospective study included 20 patients suffering from IVH who were admitted to the Neurosurgery Department, Menoufia University Hospital, during the period between January 2022 and January 2023. These patients were treated by neuroendoscopic ventricular lavage with the insertion of EVD. These patients were followed for 3 months postoperatively. The study was approved by the Institutional Review Board of Menoufia Faculty of Medicine. Inclusion criteria included patients with age between 18 and 70 years old, clinical manifestations of increased intracranial pressure, condition starting within 24–48 h, stable vital signs, and computed tomography (CT) brain showing IVH with hematoma volume less than 30 ml. Exclusion criteria included a previous history of cerebral infarction, vascular malformations, or tumors complicated by hemorrhage, incomplete clinical data, important organ dysfunction, and CT brain showing cerebellar or brain stem hemorrhage. An informed consent was taken by family members of the patients. Technique of neuroendoscopy: the patient was placed in the supine position. Neuroendoscopy was performed using a rigid endoscope (Storze), and the side with more hemorrhage was taken as the surgical side. Transverse incision about 3 cm in length was performed 1–2 cm in front of coronal suture and 2–3 cm beside the midline. A bone window of 3 cm diameter (Bur hole) and a dural cross incision were made. The endoscope was inserted into the lateral ventricle (the side of hematoma). Decompression of the hematoma was done by repeated irrigation and aspiration. Blood clots were removed by grasping forceps and if there was bleeding; bipolar coagulation was used to stop bleeding. The ventricular catheter was then inserted in the surgical side and lastly, the dura and the skin were closed in a routine manner. Patients were followed postoperatively both clinically [conscious level through Glasgow coma scale (GCS)] and radiologically with immediate CT to assess residual hematoma, subsequent CT brain after 24 h, and any other radiology guided by patient condition. If CT brain after 24 h showed a significant reduction in the hematoma size and unobstructed CSF circulation, the catheter was clamped for 24 h. If there was no increase in intracranial pressure, the catheter was removed.

2.1. Statistical analysis

The raw data and score of each item were collected and put in a word Excel sheet to be analyzed by specialists in statistics. The statistical tests used included the mean, SD, Student t test, χ^2 test, Mann–Whitney by Data were analyzed using SPSS Statistics, Version 21 (IBM Corp., Armonk, NY, USA).

3. Results

Out of 20 patients, 14 (70%) were males and six (30%) were females. The mean age was 48 ± 14.8 years. Predisposing factors included hypertension in nine (45%) patients, diabetes in five (25%) patients, smoking in one (5%) patient, and antiplatelet use in three (15%) patients. Presenting pictures included deep coma in seven (35%) patients, impaired consciousness in six (30%) patients, manifestations of stroke in four (20%) patients, and severe headache in three (15%) patients. The mean hematoma volume was 21 ± 1.47. Patient demographics and clinical data (Table 1).

The mean GCS was 9.6 ± 1.8. The mean operative time (h) was 3.01 ± 0.66. The mean ICU stay was 6.5 ± 1.9 days. The mean hospitalization time (days) was 21 ± 5.31. The mean GCS at the end of 3 months was 13.9 ± 1.8. The mortality rate at the end of 3 months was 25% (5/20), while 50% (10/20) of patients had residual disabilities and 25% (5/20) had complete recovery. The perioperative and postoperative data (Table 2).

There were complications related to the procedure as catheter rebleeding in five (25%) patients, catheter occlusion in six (30%) patients, ventriculitis in three (15%) patients, chronic hydrocephalus in four (20%) patients, and brain herniation in two (10%) patients (Table 3).

Table 1. Patients' demographics and clinical data.

Parameters	Mean ± SD	Value % (n = 20)
Age (years)	48 ± 14.8	
Sex		
Males	14	70
Females	6	30
Predisposing factors		
Hypertension	9	45
Diabetes	5	25
Smoking	1	5
Antiplatelet use	3	15
Presenting picture		
Deep coma	7	35
Impaired consciousness	6	30
Stroke	4	20
Severe headache	3	15
Graeb score	9.57 ± 1.27	
Hematoma volume	21 ± 1.47	

Table 2. Perioperative and postoperative data.

Parameters	Mean ± SD	Value % ($n = 20$)
GCS preoperative	9.6 ± 1.8	
Operative time (h)	3.01 ± 1.66	
Hospital stay (days)	21 ± 5.31	
ICU stay (days)	6.5 ± 1.9	
Glasgow coma score	13.9 ± 1.86	
Mortality rate		25 (5/20)
Residual disability		50 (10/20)
Complete recovery		25 (5/20)

Table 3. Complications to technique.

Complications	Number of patients (%)
Catheter occlusion	6 (30)
Catheter rebleeding	5 (25)
Ventriculitis	3 (15)
Chronic hydrocephalus	4 (20)
Brain herniation	2 (10)

Table 4. Comparison between preoperative and postoperative Glasgow coma scale and hematoma volume.

	Preoperative	Postoperative
GCS	9.6 ± 1.8	13.9 ± 1.86
Hematoma volume	21.89 ± 4.89	19.05 ± 8.13

Comparison between preoperative and postoperative GCS and hematoma volume (Table 4).

4. Discussion

IVH is a clinicopathologic condition with a dismal prognosis, which is influenced by several factors. The severity of neurological presentation (GCS), patient age, intraventricular hematoma volume, and increased ICP are indicators of a worse prognosis [5].

The sudden rise in ICP associated with initial bleeding may cause a significant reduction in cerebral blood flow, potentially leading to ischemia [6].

The obstruction of normal CSF flow combined with the mass effect caused by IVH can cause further deterioration. Thus, the primary goal should be an evacuation of intraventricular hematoma, reversal of ventricular dilatation, and restoration of normal ICP [6].

Management of IVH with hydrocephalus includes nonsurgical measures like mannitol infusion [5], using recombinant factor VIIa for control of bleeding [7], and surgical technique like placement of one or more EVD to drain blood and CSF and maintain an ICP below 20 mmHg with or without fibrinolysis [8]. However, EVD is easily blocked by blood clots. Also, repeated administration of drugs in the ventricles may increase the risk of rebleeding and intracranial infection [9]. Other minimally invasive techniques like neuroendoscopic hematoma evacuation and stereotactic CT-guided aspiration and thrombolysis have been used [10].

All goals can be achieved by neuroendoscopic procedure with reduction of the complications that are encountered with other therapeutic modalities [6].

In this study, the most common predisposing factor was hypertension (45%) followed by diabetes (25%), which is comparable to that reported by Ding *et al.* [11], where hypertension was found in 41% and diabetes in 27% of their patients.

In this study, the mean preoperative GCS was 9.6 ± 1.8 while the mean postoperative GCS score was 13.9 ± 1.86 and the difference was statistically significant ($P < 0.05$). This consistent with that reported by Ding *et al.* [11], who reported significant improvement in GCS in patients with IVH treated by neuroendoscopy.

In this study, the hematoma clearance rate at 3 months was 70% (15/20). Ding *et al.* [11] demonstrated a hematoma clearance rate of 89.47% (34/38), the difference may be due to a small number in our study [11].

The mortality rate in this study was 25% (5/20). Residual disability occurred in 50% (10/20) of patients, while complete recovery occurred in 25% (5/20). The final outcome depended mainly on the initial GCS. Our results are in agreement with previous studies, which reported the main predictive parameter to be the severity of neurologic presentation [12].

Procedure-related complications included catheter occlusion in 30% of patients which was treated by repeated irrigation and aspiration with normal saline solution. Catheter rebleeding occurred in 25% of patients which was treated by frequent irrigation with normal saline and controlling the blood pressure.

Ventriculitis occurred in 15% of patients which was treated by parenteral antibiotics. Chronic hydrocephalus occurred in 20% of patients which was treated by ventriculoperitoneal shunt. Brain herniation occurred in two (10%) patients with immediate death of the patient.

Horvath *et al.* [15] demonstrated that an endoscopic removal of blood clots together with ventriculostomy offers a more adequate treatment option than EVD in patients with IVH. A ventriculostomy helps in the physiological clearance of clots, even in cases of incomplete evacuation.

In 2009, Oertel *et al.* [13] did a study to define the role of neuroendoscopy and endoscopic third ventriculostomy in IVH and found that endoscopic third ventriculostomy represents a safe treatment option for patients with IVH-related obstructive hydrocephalus yielding similar results to EVD but

with less risk of infection and very low subsequent shunt placement rate [13].

The use of a flexible endoscope and free hand technique, albeit offering a narrower operating channel, allows more complete cleaning of the third ventricle and navigation down to the fourth ventricle through the aqueduct. The persistence of blood in the fourth ventricle is related to poor outcomes in patients with IVH [14].

4.1. Conclusion

Depending on our study results, we found that there was a statistically significant benefit for patients who underwent Neuroendoscopic ventricular lavage together with the insertion of EVD, which can be a safe and effective measure for treating IVH. However, disadvantages such as limited visual field, difficulty in securing hemostasis, and persistent increase in ICP may still be present.

4.2. Limitations of the study

Limited visual field.
Difficulty in securing hemostasis.
Persistent increase in ICP may still be present.
Small study group.

4.3. Future aspects

Improvement in instrumentation and surgical techniques, in particular flexible instrumentation.
Appropriate case selection.
Further studies on a larger number of patients should be done to confirm the efficacy of neuroendoscopy in the management of patients with IVH.
Increasing learning curve.

Ethics information

Ethical approval: 5/2022 SURG 41.

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Conflicts of interest

There are no conflicts of interest.

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References

[1] Amuluru K, Al-Mufti F, Romero CE, Gandhi CD. Isolated intraventricular hemorrhage associated with cerebral vasospasm and delayed cerebral ischemia following arteriovenous malformation rupture. Interv Neurol 2018;7:479–89.
[2] Weinstein R, Ess K, Sirdar B, Song S, Cutting S. Primary intraventricular hemorrhage: clinical characteristics and outcomes. J Stroke Cerebrovasc Dis 2017;26:995–9.
[3] Song P, Duan FL, Cai Q, Wu JL, Chen XB, Wang Y, et al. Endoscopic surgery versus external ventricular drainage surgery for severe intraventricular hemorrhage. Curr Med Sci 2018;38:880–7.
[4] Baker AD, Rivera Perla KM, Yu Z, Dlugash R, Avadhani R, Mould WA, et al. Fibrinolytic for treatment of intraventricular hemorrhage: a meta-analysis and systematic review. Int J Stroke 2018;13:11–23.
[5] Hemphill IIIJC, Bonovich DC, Besmertis L, Manley GT, Johnston SC. The ICH score: a simple, reliable grading scale for intracerebral hemorrhage. Stroke 2001;32:891–7.
[6] Longatti PL, Martinuzzi A, Fiorindi A, Maistrello L, Carteri A. Neuroendoscopic management of intraventricular hemorrhage. Stroke 2004;35:e35–8.
[7] Aitken M. Recombinant factor VIIa. Emerg Med Australas 2004;16:446–55.
[8] Yadav YR, Mukerji G, Shenoy R, Basoor A, Jain G, Nelson A. Endoscopic management of hypertensive intraventricular haemorrhage with obstructive hydrocephalus. BMC Neurol 2007;7:1–9.
[9] Muralidharan R. External ventricular drains: management and complications. Surg Neurol Int 2015;6(Suppl 6):S271.
[10] Montes JM, Wong JH, Fayad PB, Awad IA. Stereotactic computed tomographic-guided aspiration and thrombolysis of intracerebral hematoma: protocol and preliminary experience. Stroke 2000;31:834–40.
[11] Ding HT, Han Y, Sun DK, Nie QM. Efficacy and safety profile of neuroendoscopic hematoma evacuation combined with intraventricular lavage in severe intraventricular hemorrhage patients. Brain Behav 2020;10:e01756.
[12] Longatti P, Fiorindi A, Martinuzzi A. Neuroendoscopic aspiration of hematocephalus totalis. Operat Neurosurg 2005;57. ONS-E409.
[13] Oertel JM, Mondorf Y, Baldauf J, Schroeder HW, Gaab MR. Endoscopic third ventriculostomy for obstructive hydrocephalus due to intracranial hemorrhage with intraventricular extension. J Neurosurg 2009;111:1119–26.
[14] Basaldella L, Marton E, Fiorindi A, Scarpa B, Badreddine H, Longatti P. External ventricular drainage alone versus endoscopic surgery for severe intraventricular hemorrhage: a comparative retrospective analysis on outcome and shunt dependency. Neurosurg Focus 2012;32:E4.
[15] Horvath Z, Veto F, Balas I, Kover F, Doczi T. Biportal endoscopic removal of a primary intraventricular hematoma: case report. Minim Invasive Neurosurg 2000;43(1):4–8.