Endoscopic Surgery for Intraventricular Hemorrhage (IVH) Caused by Thalamic Hemorrhage: Comparisons of Endoscopic Surgery and External Ventricular Drainage (EVD) Surgery

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Key words
- Endoscopic surgery
- External ventricular drainage
- Intraventricular hemorrhage
- Thalamic hemorrhage

Abbreviations and Acronyms
CSF: Cerebrospinal fluid
ETV: Endoscopic third ventriculostomy
EVD: External ventricular drainage
GCS: Glasgow Coma Scale
ICU: Intensive care unit
ICH: Intracerebral hemorrhage
IVF: Intraventricular fibrinolysis
IVH: Intraventricular hemorrhage
VP: Ventriculoperitoneal

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BACKGROUND: **Intraventricular hemorrhage (IVH) caused by thalamic hemorrhage has high mortality and morbidity. The aim of this study was to investigate the efficacy and the results of endoscopic surgery for the evacuation of IVH caused by thalamic hemorrhage compared with that of external ventricular drainage (EVD) surgery.**

METHODS: **From January 2006 to December 2008, 48 patients with IVH caused by thalamic hemorrhage were enrolled and treated in our department. Patients with IVH caused by thalamic hemorrhage who also resulted in acute hydrocephalus were indicated for surgery; the patients who were included were randomly divided into an EVD group and an endoscopic surgery group. The clinical evaluation data included the Glasgow Coma Scale, length of intensive care unit (ICU) stay, age, intracerebral hemorrhage volume, and severity of IVH. Outcome was measured using the 30-day and 90-day mortality rate, ventriculoperitoneal (VP) shunt dependent rate, and Glasgow Outcome Scale after three months.**

RESULTS: **The clinical features of the 24 patients in each group showed no significant differences in age or Glasgow Coma Scale assessment on admission. There was also no significant difference in intracerebral hemorrhage volume or Graeb score between the endoscopic group and the EVD group. The length of ICU stay was 11 ± 5 days in the endoscopic surgery group and 18 ± 7 days in the EVD group. The endoscopic surgery group had a shorter ICU stay ($P = 0.04$) compared with the EVD group. The 30-day and 90-day mortality rates were 12.5% and 20.8% in the endoscopic surgery group and 12.5% and 16.6% in the EVD group, respectively. The mean Glasgow Outcome Scale score was 3.08 ± 1.38 in the endoscopic surgery group and 3.33 ± 1.40 in the EVD group. Outcome significantly correlated with initial consciousness level; the severity of IVH did not influence the outcome in all of the cases. There was no significant difference in mortality rate or outcome between the endoscopic group and the EVD group. The VP shunt rates were 47.62% in the endoscopic surgery group and 90.48% in the EVD group. Endoscopic surgery group had a significant lower VP shunt rate ($P = 0.002$; odds rate = 9.8) compared with the EVD group.**

CONCLUSIONS: **Endoscopic surgery was found to have significantly lower shunt-dependent hydrocephalus, and the ICU stay was shorter compared with EVD surgery. This can decrease the need for permanent VP shunts in patients with IVH caused by thalamic hemorrhage.**

INTRODUCTION

Hypertensive intracerebral hemorrhage (ICH) is a neurosurgical emergency frequently encountered in clinical practice. Approximately 10% to 15% of cases of ICH involve thalamic hemorrhage (1, 22). Evacuation of a thalamic hematoma by craniotomy is generally considered controversial because of the high rates of mortality and morbidity observed after this procedure. Thalamic hemorrhages are clinically significant as they are located close to the internal capsule and the ventricular system. They have been classified into medial, posterolateral, anterior and dorsal types according to the vessel involved and subsequent clinical picture (10). Many studies had found that ICH volume, intraventricular hemorrhage (IVH), hydrocephalus, Glasgow Coma Scale (GCS) and age are the best predictors for mortality and functional outcome after thalamic ICH (10, 11, 15, 20). IVH caused by thalamic hemorrhage is generally treated with external ventricular drainage (EVD) (2). However, although appropriate treatment is offered, the clinical response to EVD is not known in detail. We used endoscopy to evacuate IVH caused by thalamic hemorrhage (3). The results were promising with

Table 1. Clinical Data for the Patients with Thalamic ICH with IVH

Data	EVD (n = 24)	Endoscopic (n = 24)	*P* Value
Age	62.17 ± 10.74	65.54 ± 11.70	0.30
Initial GCS (range)	9.83 ± 3.09 (4–13)	8.54 ± 2.78 (4–12)	0.13
ICH volume (mL)	11.5 ± 9.56 (4–20)	10.5 ± 10.74 (4–25)	0.42
Graeb Score	4.54 ± 3.11 (2–8)	6.9 ± 2.98 (2–10)	0.47
ICU length of stay	18 ± 7	11 ± 5	0.04

EVD, external ventricular drainage; GCS, Glasgow Coma Scale; ICH, intracerebral hemorrhage; ICU, intensive care unit; IVH, intraventricular hemorrhage.

respect to the prevention of shunt-dependent hydrocephalus. The aim of this study was to investigate the efficacy and the results of endoscopic surgery for IVH from thalamic hemorrhage and compare them with those from EVD surgery.

MATERIAL AND METHODS

Patients

From January 2006 to December 2008, 72 patients with thalamic hemorrhage were treated in our department. All patients were screened and the surgical indication was patients with IVH from thalamic hemorrhage that caused acute hydrocephalus. Patients with thalamic hemorrhage not associated with IVH, patients with bleeding tendency, or secondary parenchymal hemorrhage were excluded. This study was prospective and randomized. The selected patients were randomly divided into two groups: an EVD group and an endoscopic surgery group.

Operation

In the EVD group, traditional EVDs were performed on patients in the supine position under local anesthesia. Patients with ventricular blood received continuous drainage at 10 cm H_2O until there was no further reduction in cerebrospinal fluid (CSF) blood content. The EVD catheter was then sequentially weaned in daily increments of 5 cm H_2O and removed. Patients were considered as having failed catheter "weaning" if they developed hydrocephalus, or if their level of conscious worsened as a result of the weaning process. Permanent ventriculoperitoneal (VP) shunt surgery was performed if patients failed EVD weaning. No intraventricular injection of an anticoagulant (eg, urokinase) was given during the procedure.

In the endoscopic surgery group, the surgical procedure was performed with the patient in the supine position with a pillow under the shoulder and the head turned approximately 60° away, while under general anesthesia. A 3-cm incision was made in the parietal-occipital scalp ipsilateral to IVH and the thalamic hematoma. A burr hole (1 cm in diameter) was drilled using the navigator system guide. A transcortical transventricular puncture was made with a 7-mm rigid endoscope sheath. When the ventricle was reached, the stylet was removed and a 2.7-mm, 0° endoscope (Storz) and a suction tube were inserted through this tube, permitting the simultaneous removal of intraventricular and thalamic hematomas. When a bleeding vessel was encountered, the suction tube was replaced with a 3-mm unipolar suction, coagulation tube to cauterize the vessel. When all procedures were complete, an EVD was left in the ventricle for 3 ± 2 days until there was no further reduction in CSF blood content after which it was removed. Permanent VP shunt surgery was performed if patients failed the "weaning" of the EVD. No urokinase was given during this procedure.

Clinical Evaluation

The clinical evaluation data included the Glasgow Coma Scale (GCS), age, ICH volume, length of ICU stay, and severity of IVH. The volume of ICH was calculated using the simplified equation $1/2A \times B \times C$, where A is the maximum width measured, B is the length, and C is the height (9). Severity of IVH was graded according to the amount of blood in each ventricle using the Graeb score of 0 to 12, which is the sum of the score in each ventricle; 4 is the maximum in each lateral ventricle, and 2 is the maximum in the third and fourth ventricles (6). The clinical data of the patients with thalamic ICH with IVH are listed in **Table 1**.

Outcome Analysis

A telephone interview was conducted with all surviving patients at the time of the study, and the outcome at 90 days after onset of the disease was determined. Patient function was evaluated using the Glasgow Outcome Scale. The 30-day and 90-day mortality rate and 90-day VP shunt dependent rates were also evaluated.

Statistical Analysis

All statistical analyses were performed using the SPSS 16.0 Statistics program. A probability value of less than 0.05 was considered statistically significant. Normally distributed data are expressed as the means ± the standard deviations and were compared using the unpaired *t* test.

Illustrative Case

A 71-year-old woman was admitted to our hospital because of an altered level of consciousness and left hemiparesis. On admission, she was drowsy (GCS score, 9). A computed tomographic scan revealed a right-sided thalamic hemorrhage with rupture into the ventricle and acute hydrocephalus (**Figure 1**). The volume of the hematoma was estimated to be 40 mL. As

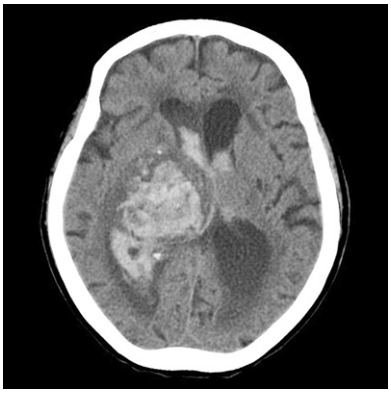

Figure 1. Preoperative axial computed tomographic scan revealing the rupture of a thalamic hematoma into the ventricle.