

# Hematoma Evacuation Outcome in Patients with Spontaneous Supratentorial Intracerebral Hemorrhage

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## Hematoma Evacuation Outcome in Patients with Spontaneous Supratentorial Intracerebral Hemorrhage

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### Abstract

The mortality rate of spontaneous supratentorial intracerebral hemorrhage evacuation is still high and varies in all neurosurgical centers. Currently, minimally invasive surgery to evacuate bleeding has become an option, but not all neurosurgical centers can perform the procedures due to limited resources. In addition, there are several guidelines for determining which patients will undergo a surgery. This study assessed the outcome of selected patients who were operated on using micro neurosurgical procedures or external ventricular drainage for intraventricular hemorrhage between 2016 and 2021. Patients included in this study were recruited from a hospital in Jakarta, Indonesia and selected based on the guideline of the 2015 American Heart Association/American Stroke Association (AHA/ASA). The outcome was assessed by a modified Rankin scale (mRS). There were 301 patients with hemorrhagic stroke but only fifty patients were matched the criteria in the guideline. Male patients constituted the majority of the patients (n=28, 56%) and hypertension has occurred in 37 (74%) patients. The hematoma was mostly located in the intracerebral with intraventricular extension (n=27, 54%) patients. The pre-operative Glasgow Coma Scale (GCS) of 23 (46%) patients were comatose and the other was 9-13. Postoperatively, there were 37 (74%) patients with a scale of 13-15, but 10 (20%) patients died. Pair t-test of the preoperative and postoperative scales showed a significant difference,  $p < 0.01$ . The outcome of 40 (80%) patients was good (modified Rankin scale of 0-3), and the Spearman's rank correlation coefficient was -0.739 with the Sig.2-tailed was  $< 0.01$ . The outcome of spontaneous supratentorial intracerebral hemorrhage evacuation is good when selecting patients following the 2015 AHA/ASA guideline and there is a strong correlation between postoperative GCS with 3-month mRS results.

**Keywords:** Intracerebral hemorrhage, guidelines, modified Rankin scale, outcome

### Introduction

The incidence of spontaneous intracerebral hemorrhage (SICH) ranges from 10-20% of all stroke patients around the world, but in Asia is higher, even up to 24%. One month's case fatality rate was 40% and increases to 54% in one year.<sup>1</sup> Therefore, efforts to improve the management of patients are needed and one of the medical measures is surgery. A randomized study of 61 patients with spontaneous supratentorial intracerebral hemorrhage (SSICH) by Bhaskar et al.<sup>2</sup> has been done to compare surgical evacuation and medical measures. The result was hematoma volume correlated with the mortality rate. The mortality rate was 56.4% in patients with the volume of 31-60 mL and 81% in patients with

a volume of 61-90 mL. The mortality rate in the surgical group was lower than the conservative group 35.7% vs 77.8%.

The American Heart Association/American Stroke Association (AHA/ASA) 2015 has provided guidance as a recommendation for surgery of SICH based on evidence-based medicine.<sup>3</sup> The recommendation includes: supratentorial hematoma evacuation in deteriorating patients might be considered as a life-saving measure (class IIb, level of evidence C); a policy of early hematoma evacuation is not beneficial compared with hematoma evacuation when patients deteriorate (class IIb, level of evidence A); and ventricular drainage as a treatment for hydrocephalus is reasonable, especially in patients with a decreased level of consciousness (class IIa, level of evidence B).

The minimally invasive endoscopic procedure has recently become the surgical of choice for evacuating hematoma, but not all neurosurgery centers can do this due to the limited resources.

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Likewise, the author has carried out the evacuation of SSICH with microsurgical procedures or external ventricular drainage for hydrocephalus due to intracerebral hemorrhage extended into intraventricular (IVH). The indication for surgery was based on the criteria according to the AHA/ASA guidelines 2015. Lack of data regarding clinical outcomes following surgical evacuation of patients with SSICH in Indonesia, hence it is needed to obtain the data for the improvement of health care and clinical judgment for patients with SSICH in Indonesia. Therefore, we investigate the outcomes of surgical evacuation in patients with SSICH in our center.

## Methods

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This study was done by collecting data from medical records of patients from 14 hospital in Jakarta between 2016–2021 and approved by the Health Research Ethic Committee, Faculty of Medicine, Universitas Kristen Indonesia number 22/Etik Penelitian/FK UKI/2021. The patients with SSICH who were operated on based on the AHA/ASA 2015 guideline were included in this study. Patients were included if they were adults (>18 years old), had a SSICH on CT scan with a volume of between 10 mL and 60.00 mL, and were within 48 h of ictus. They were excluded the hemorrhage was due to an aneurysm or angiographically proven arteriovenous malformation; was secondary to tumor or trauma; involved the thalamic, cerebellar, or brainstem regions. Patients were also excluded if they had any severe pre-existing physical or mental disabilities or comorbidities that could interfere with the assessment of the outcome.

All patients at the time of admission to the hospital lost consciousness, therefore the patient's family in charge had to sign the operating permit and fill out the consent form to be included in the study. The patients were operated on by microsurgical procedures or external ventricular drainage for intraventricular hemorrhage with hydrocephalus.

Data of sex, age, risk factor, and pre-operative Glasgow coma scale (GCS) and one week postoperatively were collected. The outcomes of patients were analyzed by a modified Rankin scale (mRS) three months after surgery. The best of mRS is no symptoms (0), no significant disability (1), slight disability (2), moderate disability (3), moderately severe disability (4), severe disability (5), and the worst is 6 (dead).<sup>4</sup>

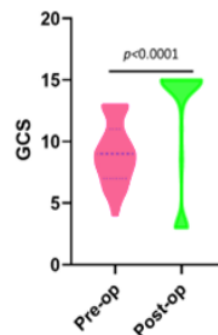


Figure 1 Comparison between Pre-Operative and Post-Operative GCS

GCS score was analyzed by using Wilcoxon paired rank test and the correlation between GCS with mRS was analyzed by the Spearman correlation test.

## Results

There 301 patients with hemorrhagic stroke were admitted to our center, and 50 patients of them have matched the inclusion and exclusion criteria. A description of the patient's sex, age, risk factor, location of hematoma, and GCS is presented in Table.

The majority of patients were male (70%) and were 41–60 years old (70%). Hypertension was a predominant risk factor for SSICH in this series, was noted in 37 (74%) patients, and the bleeding was commonly located deep-seated (basal

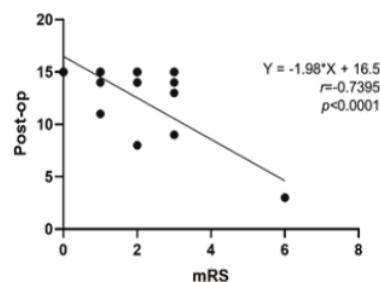


Figure 2 Correlation between post-Operative GCS with 3-month mRS

**Table Patients Characteristic**

Parameter	Results	%
Age (year)		
<40	8	16
41-50	17	34
51-60	18	36
61-70	6	12
>70	1	2
Sex		
Male	35	70
Female	15	30
Risk factor		
Hypertension	37	74
Diabetes	3	6
Hypertension & diabetes	8	16
Hypercholesterolemia	2	4
Location of hematoma		
Subcortical	10	20
Basal ganglia	13	26
Intraventricular	27	54
Pre-operative GCS		
4-8	23	46
9-12	21	42
13-15	6	12
Post-operative GCS		
3	10	20
4-8	1	2
9-12	2	4
13-15	37	74
mRs		
0	14	28
1	9	18
2	10	20
3	7	14
4	0	0
5	0	0
6	10	20

ganglia) with extension into intraventricular in 27 (54%) patients. The majority of patients (46%) were comatose before surgery. The GCS postoperatively was evaluated one week after surgery. There were 37 (74%) patients who had

GCS of 13-15, and 10 (20%) patients with GCS of 3 or died. Post-operative GCS was better than pre-operatively,  $p < 0.0001$  (Wilcoxon paired rank test, Figure 1).

The majority of patients had good outcomes

(mRS 0-3) while 10 of 50 (20%) patients died. The correlation between post-operative GCS with 3-month mRS was analyzed by the correlation Spearman test. The result was a negative correlation (-0.7395,  $p < 0.0001$ ) as shown in Figure 2.

## Discussion

This study included 50 patients who met the inclusion and exclusion criteria of the study and most of the patients were 41-60 years old. It was younger than previous studies by Kaya et al.<sup>5</sup> (56 years old) and Behle et al.<sup>6</sup> (73 years old). The patients in this study were younger because the majority of family elderly patients opted for non-surgical treatment. Hypertension is the main risk factor in this study, and it is consistent with previous studies.<sup>1-8</sup> Even though hypertension is a modifiable risk factor but remains an important issue for SICH incidence.<sup>1</sup>

The location of hematoma in this study was mostly in basal ganglia with extension into intraventricular. Extension of the hematoma into the intraventricular contributes to hydrocephalus and increased intracranial pressure. External ventricular drainage has been recommended for intraventricular hemorrhage with hydrocephalus to decrease the intracranial pressure.<sup>2</sup> This study demonstrated a good result for this group, 21 out of 27 (77.8%) patients survived.

Overall, the mortality rate of our patients was twenty percent. It was in the range of results of the study from Sweden by Farhlstrom et al.<sup>7</sup> They analyzed nationwide different neurosurgical centers in Sweden which treated patients with SICH. They noted 30-day mortality rates between 10 and 28%. Meanwhile, Sarkar et al.<sup>8</sup> had found a mortality rate of 29.16%, and Hansen et al.<sup>9</sup> had reported a 30-day mortality rate of 57% and a one-year mortality rate of 67%.

The mortality rate depends on many factors including age, complication after surgery, location and volume of the hematoma, GCS pre and postoperatively, and more importantly the indication or criteria for doing surgery or not. This study found that the majority of patients had favorable outcomes and correlate with post-operative GCS. Meanwhile, Hedge et al.<sup>10</sup> have revealed a favorable outcome of all location spontaneous intracerebral hemorrhage surgery was 24.26%.

Long-term outcomes were not carried out yet in this study, but Hessington et al.,<sup>11</sup> conducted a

study with a mean follows up time of 4.2 years, and the result was that 51% of patients have a good outcome and the proportion of good outcomes was 13.1% in lobar ICH.

At present minimally invasive procedures for evacuation of intracerebral dan intraventricular hemorrhage are developed. Minimal invasive surgery with thrombolysis in intracerebral hemorrhage evacuation (MISTIE) III trial has been reported by Han et al.<sup>12</sup> The procedure was performed on 255 patients aged 18 years or older with a total bleeding volume of at least 30 mL. Follow-up on day 365 and the good outcome was 44.2% (mRS 0-3).

Meanwhile, one study by De Haven et al.,<sup>13</sup> conducted a secondary analysis of MISTIE III by dividing patients into 4 classifications based on the remaining blood clots after the end of treatment ICH and IVH (ETIV) evacuation procedures. ETIV Score 3: less or 5mL, 2: 5-10 mL, 1: 10-20 mL, 0:  $\geq 20$  mL. Good outcome (mRS 0-3) was obtained in 73.3% of patients in the ETIV 3 group, ETIV 2: 49.2%, ETIV 1: 44%, and ETIV 0: 28.1%. A p-value of the chi-square test was 0.001. Residual intracerebral and intraventricular blood clots after minimally invasive procedures or craniotomy will affect patient outcomes.<sup>14</sup>

In conclusion, the study has shown a favorable outcome of SSICH evacuation by selecting the patients based on the AHA/ASA 2015 guidelines. Post-operative GCS level has A strong correlation with the 3-month mRS.

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