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The Relationship Between Onset Time and Outcome Patients Intra Cerebral Ganglia Basalis EC Stroke Hemorrhagic Operations at Dr. Mohammad Hoesin General Hospital Palembang

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Abstract

Background: Spontaneous intracerebral hemorrhage is the second most common stroke subtype defined as non-traumatic hemorrhage to the brain parenchyma, which can extend to the ventricles and into the subarachnoid space. Advances in innovations in the field of surgical intervention compared to conservative therapy are more beneficial in preventing disability in patients. The surgical methods that are often used in nontraumatic intra cerebral bleeding interventions are craniotomy and craniectomy. Many factors influence postoperative patient outcome. The level of patient awareness, the extent of the hematoma are the main predictive factors for patient outcome. Glasgow Outcome Scale is often used to measure the outcome of intracranial bleeding patient care.

Methods: The study is a case series studies which was conducted by tracing 70 medical records of patients with intra-cerebral ganglia basal hemorrhage due to stroke hemorrhagic who had met the study inclusion criteria from January 2018 to December 2020 who were operated on at the Neurosurgery Installation of RSUP Dr. Mohammad Hoesin Palembang.

Results: The mean ICH age in the study was 40 - 60 years (54.23 ± 13.09), male gender were 41 samples (58.6%), mean GCS was 10.93 ± 2.48 (3-15), pressure systolic blood 171.33 ± 24.09 (120 - 240), diastolic blood pressure 98.8 ± 13.46 (70 - 140), most patients ICH with a history of hypertension 68 people (97.1%), 60 people (85.7%) without a history of DM, 57.1% with craniotomy, 59 people with a bleeding volume of 30-60 cc (84.3%), surgery onset ≥ 8 hours (68.6%), uncal herniation (57.1%).

Craniotomy and craniectomy were not significantly associated with the prognostic assessment of GOS on ICH (p value = 0.502). Uncal herniation was significantly associated with the incidence of ICH (p value = 0.000). The correlation was strong between time of onset and patient prognosis (p 0.000).

Conclusion: There was a significant relationship between onset time and patient outcomes, meaning that the correlation between onset time and patient outcomes was quite strong. The longer the onset time, the more likely it is to have a bad outcome (GOS score 4-5), whereas the faster the onset time, the more likely it is to have a good outcome (GOS score 1-3).

Keywords: intra cerebral hemorrhage, onset, outcome, GOS score

1. Introduction

In developed countries, stroke is the third leading cause of death after heart disease and cancer, and is the most common cause of morbidity and disability. Stroke is classified into hemorrhagic and ischemic strokes.[1,2] Research describes various clinical findings, especially neurological signs and symptoms to differentiate the type of stroke based on clinical evaluation. The signs and symptoms of ischemic stroke can develop slowly, and can develop over several hours of varying severity. Various manifestations can occur as a result of an ischemic stroke, including paresis, ataxia, paralysis, vomiting, and eye vision, but where these signs occur depends on the area of the brain supplied by the occluded blood vessels. Hemorrhagic stroke has a wide spectrum of clinical manifestations, acute headache, vomiting and increased blood pressure are the most common signs and symptoms, leading to local neurological signs and developing within minutes.[2]

Intracerebral hemorrhage is the second most common stroke subtype, accounting for 10-50% of all stroke cases. Non-traumatic intra cerebral hemorrhage is the leading cause of death and disability in the world. The spontaneous rupture of blood vessels in the brain is generally caused by hypertension and degenerative changes in the walls of the blood vessels. About 10-30 cases per 100,000 population, which means that worldwide there are 15 million cases each year.[1] The basal ganglia are the most common sites of intra-cerebral hemorrhage (50% -70%). Mortality at day 30 post-onset was 33.5% to 50.6%, while 41% of patients who survived had multiple disabilities.[2] Surgical intervention when compared with conservative therapy may be of greater benefit for intracerebral hemorrhages that are more profound, such as in the basal ganglia. The most commonly used surgical methods for

nontraumatic intracerebral hemorrhage are craniotomy and craniectomy. This surgical method is able to reduce intracranial pressure immediately and prevent negative pathogenetic mechanisms such as perihematomal edema that leads to herniation and death.[3]

Many factors influence postoperative patient outcome. The patient's level of consciousness and the extent of the hematoma were the main predictors of the outcome of intracerebral hemorrhage. Based on further analysis it was found that a hemorrhage of 1 cm from the surface of the cortex showed better outcome with surgical intervention. Patients with a GCS $\leq$ 8 show a worse prognosis.[4,5,6] In addition, various studies have also shown that patients with increased intracranial pressure and mass pressure effects due to intracranial hemorrhage have better outcomes when decompressive craniectomy (DC) is performed for hematoma evacuation. A meta-analysis study showed better outcomes if surgery was performed within 8 hours of onset. Craniectomy very early (within 4 hours after onset) was associated with an increased risk of rebleeding. One of the assessment of the patient's prognosis can be through the assessment of the Glasgow Outcome Scale (GOS). The Glasgow Outcome Scale (GOS) is one of the most frequently used scoring systems for measuring outcome after brain injury and is now frequently used to measure the outcome of intracranial hemorrhage patient care.[7]

The high incidence of intracerebral hemorrhage, high morbidity and mortality, and the variety of research results regarding time of action with postoperative patient outcomes are the reasons for this study. The purpose of this study was to determine the mean time of disease onset and its relationship with the outcome of patients with intracerebral basal ganglia hemorrhage who underwent surgery at Dr. Mohammad Hoesin General Hospital Palembang in 2009-2020.

2. Methods

The type of research used is a case series study which aims to determine the relationship between the time of onset of the disease and the outcome of postoperative patients with basal intracerebral ganglia hemorrhage caused by hemorrhagic stroke from January 2018 to December 2020 which was carried out surgery at the Neurosurgery Installation of Dr. Mohammad Hoesin General Hospital Palembang.

The subjects of this study were all medical records of patients with intracerebral ganglia basal hemorrhage ec hemorrhagic stroke who underwent surgery that met the inclusion criteria.

The inclusion criteria were. Patients with a primary diagnosis of intra cerebral ganglia basal hemorrhage ec hemorrhagic stroke and patients with intra cerebral ganglia basal hemorrhage ec hemorrhagic stroke who underwent surgery at Dr. Mohammad Hoesin General Hospital Palembang in 2018-2020. The exclusion criteria were. Basal ganglia intra cerebral hemorrhage patients due to trauma and intra cerebal basal ganglia bleeding patients who did not undergo surgery.

There were 70 subjects in this study. The independent variable was the onset time. The dependent variable was the operation. The sociodemographic characteristics were age and gender, along with the clinical characteristics which have the preoperative blood pressure, preoperative GCS, history of hypertension and diabetes mellitus, pre-herniation and bleeding volume.

Data processing will be carried out in several stages. The first stage, the data obtained will be grouped based on the purpose and type of data. Furthermore, testing will be carried out with the appropriate analysis. Univariate analysis was used to describe data characteristics such as frequency distribution, mean and coverage. This analysis will explain the characteristics of the demographic and clinical data (all variables). The bivariate analysis used the Chi square (X2) test with a 95% confidence level, to assess the relationship between categorical variables and patient outcomes. Analysis using Spearman with a correlation measure assessed a range of 0 to 1. A value close to zero means that there is no more correlation and a value of 1 means perfect correlation. To determine the relationship between onset time and postoperative patient outcome.

3. Results

Demographic characteristics of the research sample

Demographic characteristics can be seen in Table 4. In this study, the mean age of the sample of patients with intracerebral ganglia basal hemorrhage ec hemorrhagic stroke was 54.23 ± 13.09 years with an age range of 18 to 81 years. The majority of the age range was 40 - 60 years (54.3%) and the majority of the sample were male (58.6%). The research results are presented in table 1.

Table 1. Demographic characteristics of research samples

Characteristics	Total	Percentage (%)
Mean ± (min-max)	54.23 ± 13.09 (18 – 81)	
Age (years)		
• < 40 years old	9	12.9
• 40 – 60 years old	38	54.3
• 61 – 80 years old	22	31.4
• > 80 years old	1	1.4
Gender		
• Male	41	58.6
• Female	9	41.4

Clinical characteristics of study samples

In this study, the mean GCS in the sample of patients with intracerebral ganglia basal hemorrhage ec hemorrhagic stroke was 10.93 ± 2.48 with a GCS range of 3 to 15. The mean systolic blood pressure was 171.33 ± 24.09 mmHg with a range of 120 to 240 mmHg whereas. The mean diastolic blood pressure was 98.8 ± 13.46 mmHg with a range of 70 to 140 mmHg. 97.1% of patients with intracerebral basal ganglia hemorrhage ec hemorrhagic stroke had a history of hypertension but only 14.3% of patients had a history of diabetes mellitus. The most common type of surgery performed in patients with intracerebral ganglia basal hemorrhage ec hemorrhagic stroke is craniotomy (57.1%) with a mean bleeding volume of 44.15 ± 15.38 cc and the largest range of bleeding is 30-60 cc (84.35%). Most surgery onset was ≥ 8 hours (68.6%) with a mean of 27.3 ± 26.12 hours and an onset range of 1 to 96 hours mmHg. Uncal herniation occurred in 57.1% of the study sample. The research results are presented in table 2.

Table 2. Demographic characteristics of research samples

Characteristics	Total	Percentage (%)
GCS, mean ± SD (min-max)	10.93 ± 2.48 (3 – 15)	
Systolic blood pressure (mmHg), mean ± SD (min-max)	171.33 ± 24.09 (120 – 240)	
Diastolic blood pressure (mmHg), Mean ± SD (min-max)	98.8 ± 13.46 (70 – 140)	
History of hypertension		
• Yes	68	97.1
• No	2	2.9
History of diabetes mellitus		
• Yes	10	14.3
• No	60	85.7
Type of operation		
• Craniotomy	40	57.1
• Craniectomy	30	42.9
Bleeding volume (cc), mean ± SD (min-max)	44.15 ± 15.38 (30 - 80)	
Bleeding volume		
• 30 – 60 cc	59	84.3
• > 60 cc	11	15.7
Onset (hours), mean ± SD (min-max)	27.3 ± 26.11 (1 - 96)	
The onset of surgery		
• ≥ 8 hours	48	68.6
• < 8 hours	22	31.4
Uncal herniation		
• Yes	40	57.1
• No	30	42.9

Demographic Characteristics based on the GOS Outcome

In this study the outcomes based on GOS were divided into good (GOS scores 4 and 5) and bad (GOS scores 1 - 3). There were 52 patients with bad outcome (74.3%) and 18 patients (25.7%) with good outcome. Patients with good GOS had a mean age of 45.39 ± 8.61 years with a majority age range of 40 - 60 years (72.2%) while patients with bad GOS had a mean age of 57.29 ± 13.03 years with a majority age range of 40 - 60 years (48.1%). By statistical analysis, it was found that there were

differences in age (p = 0.000) and the age range of patients (p = 0.004) between patients with good and bad outcomes.

The majority of patients with good outcomes were male (59.6%) as well as patients with poor outcomes, the majority were male (55.6%). By statistical analysis, it was found that there was no gender difference (p = 0.981) between patients with good and bad outcomes. The research results are presented in table 3.

Table 3. Demographic characteristics based on gos outcomes

Characteristics	Outcome		P value
	Bad (GOS 1-3)	Good (GOS 4-5)	
Mean ± SD (min - max)	57.29 ± 13.03 (18 – 81)	45.39 ± 8.61 (22 - 55)	0.000[a]
Age, n (%)			
• < 40 years old	4 (7.7)	5 (27.8)	0.004[b]
• 40 – 60 years old	25 (48.1)	13 (72.2)	
• 61 – 80 years old	22 (42.3)	0 (0.0)	
• > 80 years old	1 (1.9)	0 (0.0)	
Gender, n (%)			
• Male	31 (59.6)	10 (55.6)	0.981[c]
• Female	21 (40.4)	8 (44.4)	

[a]Independent T test, p = 0.05
[b]Pearson Chi Square, p = 0.05
[c]Chi Square test, p = 0.05

Clinical characteristics based on the GOS outcome

In this study, patients with good outcomes had a mean GCS of 10.81 ± 2.48 with a range of 3-15, mean systolic blood pressure of 171.92 ± 23.74 with a range of 130-240 and a mean diastolic blood pressure of 99. 15 ± 12.96 with a range of 70 - 140 while patients with poor outcomes had a mean GCS of 11.28 ± 2.52 with a range of 7-15, mean systolic blood pressure was 172.22 ± 25.79 with a range of 120-230 and mean diastolic blood pressure of 97.78 ± 15.17 with a range of 70 - 140. By statistical analysis, it was found that there was no difference in GCS (p = 0.573), systolic blood pressure (p = 0.739) and diastolic blood pressure (p = 0.977) between patients with good and bad outcomes.

Both in the group of patients with bad and good outcomes, the majority had a history of hypertension and had no history of DM. By statistical analysis, it was found that there was no difference in history of hypertension (p = 0.451) and history of DM (p = 1,000) between patients with good and bad outcomes. The majority of the type of surgery in both outcome groups was craniotomy. By statistical analysis, it was found that there was no difference in the type of surgery (p = 0.502) between patients

with good and bad outcomes.

In this study, patients with good outcomes had a mean bleeding volume of 46.28 ± 14.74 cc with a majority range of 30-60 cc (82.7%) while patients with poor outcomes had a mean bleeding volume of 37.99 ± 15. 96 cc with the majority of the range 30-60 cc (88.9%). By statistical analysis, it was found that there was a difference in bleeding volume (p = 0.002) between patients with good and bad outcomes but there was no difference in the range of bleeding volume (p = 0.716). The results of the study are presented in table 4.

Table 4. Clinical characteristics based on the GOS outcome

Characteristics	Outcome		P value
	Bad (GOS 1-3)	Good (GOS 4-5)	
GCS, mean ± SD (min-max)	10.81 ± 2.48 (3 – 15)	11.28 ± 2.52 (7 – 15)	0.573[a]
Systolic blood pressure (mmHg), mean ± SD (min-max)	171.02 ± 23.74 (130 – 240)	172.22 ± 25.79 (120 – 230)	0.739[a]
Diastolic blood pressure (mmHg), mean ± SD (min-max)	99.15 ± 12.96 (70 – 140)	97.78 ± 15.17 (70 – 140)	0.977[a]
History of hypertension, n (%)			
• Yes	51 (98.1)	17 (94.4)	0.451[b]
• No	1 (1.9)	1 (5.6)	
History of diabetes mellitus, n (%)			
• Yes	8 (15.4)	2 (11.1)	1.000[b]
• No	44 (84.6)	16 (88.9)	
Type of operation, n (%)			
• Craniotomy	28 (53.8)	12 (66.7)	0.502[c]
• Craniectomy	24 (46.2)	6 (33.3)	
Bleeding volume (cc), mean ± SD (min-max)	46.28 ± 14.74 (30 – 80)	37.99 ± 15.96 (30 – 80)	0.001[a]
Bleeding volume			
• 30 – 60 cc	43 (82.7)	16 (88.9)	0.716[b]
• > 60 cc	9 (17.3)	2 (11.1)	
Uncal herniation			
• Yes	40 (76.9)	0 (0.0)	0.000[b]
• No	12 (23.1)	18 (100)	

[a] Mann Whitney test, p = 0.05
[b] Fisher Exact test, p = 0.05
[c] Chi-square test, p = 0.05

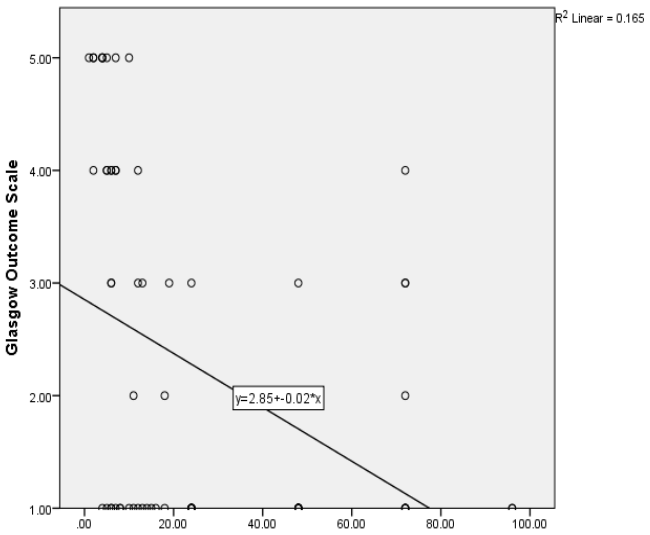
Relationship of onset time and glasgow outcome scale

The variables assessed were onset before surgery and outcome after surgery based on the Glasgow Outcome Scale (GOS). With the correlation test, it was found that there was a significant negative correlation between onset and GOS. Patients with intracerebral basal ganglia hemorrhage ec hemorrhagic stroke with a longer onset were correlated with a significant reduction in GOS (r = -0.545; p = 0.000). The results of the analysis are presented in table 5.

Table 5. Relationship between onset time and glasglow outcome scale

Characteristics	Onset (hours)	Glasgow outcome scale	R	P value
• Mean ± SD	27.30 ± 26.12	2.20 ± 1.54	-	0.000
• Median (min-max)	15.5 (1 – 96)	1 (1 – 5)	0.545	

Spearman Rho's, p = 0.05



Onset time

In this study, out of 48 patients with onset ≥ 8 hours, 45 patients (93.8%) had poor GOS outcome, whereas of 22 patients with onset <8 hours, only 7 patients (31.8%) had a bad GOS outcome. By statistical analysis, it was found that there was a significant difference in onset between patients with bad and good outcomes (p = 0.000). The results of the analysis are presented in table 6.

Table 6. Relationship between onset time and glasglow outcome scale

Characteristics	Outcome		P value
	Bad (GOS 1-3)	Good (GOS 4-5)	
Onset time, n (%)			
• ≥ 8 hours	45 (93.8)	3 (6.3)	0.000
• < 8 hours	7 (31.8)	15 (68.2)	

Fisher Exact Test, p = 0.05

4. Discussion

Distribution of frequency by age group, the results of this study are similar to research (Yang et al., 2017) where the mean age is 51.47 years. The results of this study are slightly different from that of Kim, et al. (2020) that cases of ICH increase with age. Age-related degenerative changes in cerebral arteries increase the risk of rupture (Naval et al., 2015).[9]

Based on the frequency distribution of sex in the study, the dominant gender was found to be similar to the results of the study by Kim, et al. (2020), which states that the annual incidence rate per 100,000 people is higher in men than women in all age categories. The annual incidence rate per 100,000 people is higher in men than in women.9 Estrogen reduces cardiovascular risk by a protective mechanism against atherosclerosis (Naval et al., 2015).[10]

The history of hypertension in the study subjects was dominated by study subjects who had a history of hypertension. Hypertension is the most important risk factor for ICH, especially deep ICH rather than lobe ICH (Kim et al., 2020). A history of hypertension has a 2 times greater risk of developing ICH.[9] Hypertension causes high pressure in the Willisi circulus which results in smooth cell proliferation followed by smooth muscle cell apoptosis, so that as the reason hypertension-related ICH is often located deep in the basal ganglia (Sahni, 2007).[11]

In the history of diabetes mellitus, the majority of study subjects did not have a history of diabetes mellitus. A similar study with the study of Herzig et al., (2007), as many as 70.0% of patients with comorbid diabetes were found in ICH. Diabetes mellitus is associated with thickening of the basement membrane of cerebellum vessels and endothelium proliferation, as well as with increased platelet aggregation, coagulability, and plasminogen activator inhibitors, and decreased fibrinolytics (Herzig et al., 2007).[12]

The results of the analysis showed that of the 70 study subjects most of the patients had an onset of ICH at ≥ 8 hours. The benefit of early surgery (within 12 hours) on ICH was first observed by Morgenstern et al. In 1998 and later reconfirmed by STICH II (within 21 hours). The meta-analysis found that surgery improved outcome when performed within 8 hours of onset. However, craniotomy too early (within 4 hours after onset) on the other hand was found to be associated with an increased risk of re-bleeding.[1]

The frequency distribution based on preoperative blood pressure showed that most of the subjects were diagnosed with stage II hypertension. Hypertension was a major risk factor for intracerebral hemorrhage identified in 71.4% of the total 70 cases (Ahammed et al. 2017).[13] Elevated blood pressure is associated with life-threatening comorbidities including ischemic heart disease, heart failure, kidney problems, and cerebrovascular disease. Although the incidence of these complications can be reduced by effective blood pressure management, achieving good blood pressure control at the population level remains a challenge. European Society of Cardiology / European Society of Anaesthesiology guidelines state that preoperative hypertension is a concern in perioperative management and is more susceptible to perioperative myocardial ischemia. European guidelines suggest that postponement of surgery for further assessment should be considered in patients with a blood pressure greater than 180 mmHg systolic or 110 mmHg diastolic. (Howell et al. 2018). Most of the bleeding in ICH associated with hypertension occurs at or near the bifurcation of the penetrating small arteries originating from the basilar artery or the anterior, media, or posterior cerebral arteries.[14]

Surgical intervention in the form of research according to the research of Hayes et al. (2013), the proportion of surgery in 26 patients obtained more data as much as craniotomy than decompression craniectomy. In the case of deep basal ganglia hemorrhage, decompression craniectomy can further optimize the outcome. In principle, craniotomy should be performed to avoid further injury to the brain area (Hayes et al., 2013).[14] Surgical action in general in cases of ICH through craniotomy (75%).[15]

The frequency distribution based on the volume of bleeding was mostly found in the 30-60 cc group. Blood volume is one of the factors that can determine the prognosis of patients with intracerebral hemorrhage. Intracerebral hemorrhage volume is a strong and easy-to-use predictor of 30-day mortality in patients with spontaneous intracerebral hemorrhage. The mean volume of bleeding in patient mortality was 36.32 and the median was 33.80. The mean volume of bleeding in patients alive was 15.77 and the median was 11.84. Among 70 patients, 14 patients had a bleeding volume of ≥ 30 ml. A larger blood volume was associated with a very statistically significant increase in mortality. Patients

with a blood volume of ≥ 30 ml had a time risk of more than 7,222 times compared with patients who had a blood volume of <30 ml in relation to 30-day mortality.[17] Each increase in mL of bleeding volume is associated with an increased risk of death by 1% (Hedge et al., 2020).[16]

The results of the distribution of the GOS outcomes based on the assessment of baseline GCS, volume, action, and uncal herniation in the study, regardless of the degree of GOS, there were more patients with initial GCS > 8, bleeding volume 30-60 cc, craniotomy. Uncal herniation was only found in the GOS 1 and GOS 2 outcome distributions. These results are consistent with the study of Khallaf et al. (2019), obtained 30 out of 66 patients, mostly with hematoma volume before 30-60 ml. Assessment of patient magnitude based on GCS score was mostly with GCS score> 8, namely 30 (45.5%) patients with GCS 9-12 and and 15 (22.7%) patients with GCS 13-15. In this study, we found a statistically significant correlation of level of awareness (GCS) to outcome (p value 0.000). In 21 patients with GCS 5-8, only three (14.3%) patients had good results while 18 (85.7%) had poor results. In 30 patients with GCS 9-12, 21 (70%) patients had a good outcome while nine (30%) had a poor outcome. In 15 patients with GCS 13-15, 13 (86.7%) had a good outcome while two (13.3%) had a poor outcome. Hematoma volume is one of the most important parameters for evaluating the severity of the condition, whereas a hematoma volume> 85 ml indicates a very poor outcome. With extensive hematoma (> 90 ml), most of the patients, 15 (78.9%), had poor outcome. Craniotomy is a standard surgical procedure in ICH cases especially for hematoma volumes greater than 30 ml. Early evacuation of the hematoma can reduce the toxic effects of blood products and plasma, reduce surrounding edema and ischemia, and prevent expansion of the hematoma. The initial craniotomy can lead to a decrease in intracranial pressure and an increase in local blood circulation. Craniotomy also has several other advantages such as a good outlook and thorough cleaning of the hematoma, easy hemostasis, which helps in the outcome and decreases mortality and improves prognosis. Uncal herniation results in thinning of the lateral suprasellar cisterns, dilatation of the ipsilateral and lateral pontine cisterns, resulting in midbrain decompression. Compression of the posterior cerebral arteries can cause infarction, resulting in poor patient outcome (GOS 1 and 2).[17]

The relationship between onset time and patient outcome of postoperative basal ganglia intracerebral hemorrhage caused by hemorrhagic stroke in Neurosurgery, RSMH Palembang. Based on the table above, the Pearson Chi-Square significance score is 0.000, which means that there is a significant relationship between onset time and patient outcome. In the analysis, it can also be determined the strength of the correlation (r value) with a value of -0.545, which means that the correlation test between the two variables is considered quite strong because the value is close to number

1. The longer the onset time, the more potential to experience death, while the faster the onset time will be greater. the possibility of a full recovery. The observation that substantial sustained bleeding occurs in patients with ICH and is associated with neurologic deterioration, especially during the first 3 to 4 hours after onset, dramatically changes the prospects for effective treatment for ICH. A similar study in Broderick et al. (2007) stated that the action intervention within 4 hours after onset, after monitoring for 6 months, found that 7 people died (7%), 15 (15%) recovered completely, and 35 (35%) lived independently at home. so the prognosis is mostly good. However, data differ from other studies suggesting "ultra-premature" surgery in 4 out of 11 people experiencing recurrent acute bleeding as many as 75% died. Craniotomy within 12 hours of onset resulted in a mortality rate of only 18%. However, the results did not improve much. In a small study of 20 subjects who underwent surgery for a mean of 8 hours and 25 minutes since symptom onset there was no significant difference in mortality seen at 3 months. In a prospective 24-hour trial in 34 patients with basal ganglia hemorrhage, eight patients died (47%), and no statistical difference was seen in patient survival. During 6 months of follow-up, 12 patients (46%) had died, and only 1 patient (4%) was living independently at home. There was no statistically significant difference in mortality and morbidity. Symptom onset to surgery was 30 hours (range 16 to 49 hours) and the mean time was only 16% (74 of 465 patients) less than 12 hours.[18,19]

5. Conclusion

There was a significant relationship between onset time and patient outcomes, meaning that the correlation between onset time and patient outcomes was quite strong. The longer the onset time, the more likely it is to have a bad outcome (GOS score 4-5), whereas the faster the onset time, the more likely it is to have a good outcome (GOS score 1-3).

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