# SIZE OF INTRACEREBRAL HAEMORRHAGE AS PREDICTORS FOR OUTCOME OF HAEMORRHAGIC STROKE

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## ABSTRACT

Stroke caused by intracerebral haemorrhage (ICH) is one of the main complications of hypertension. It results in neurological disabilities of various degrees. The aim of this audit is to study the relationship between the size of intracerebral haemorrhage and the functional outcome of patients at discharge. The research is conducted by measuring the maximum dimension of haematoma in the patient's primary computed tomography (CT) scan. The degree of disability of patients is measured twice; at admission and at discharge using Glasgow Coma Scale (GCS). Patients who have had a history of intracerebral haemorrhage were excluded from this audit. It is found that the volume of blood clot showed no significance in predicting the outcome of the patients with intracerebral haemorrhage. The operative removal of blood clot was proven to only increase the lifespan of patients rather than improving their condition. Future studies are needed to enhance the accuracy of prediction of haemorrhagic stroke outcome.

**KEYWORDS**: *Stroke, haemorrhage, recovery*

## INTRODUCTION

According to a study conducted by the American Heart Association, each year, approximately 795,000 people experience stroke. Although the number of stroke deaths fell by 23.0% from 1999 to 2009, the fact that approximately one person will die of stroke every 4 minutes is still distressing (Go et al. 2013).

Stroke arises when blood flow to the brain stops. Intracerebral haemorrhage (ICH), which is the focus of this study, develops from blood leakage in the brain when a dead blood vessel within it bursts. The pressure elevation within the brain leads to brain cell damage, and stroke occurs due to oxygen deprivation in the brain. This in turn results in either unconsciousness or death (Fewel et al. 2003).

Complications of ICH include haematoma expansion, perihaematomal oedema with increased intracranial pressure, intraventricular extension of haemorrhage with hydrocephalus, seizures, venous thrombotic events, hyperglycaemia, rise in blood pressure, fever and infections (Balami & Buchan 2012). The same article also mentioned that management of ICH is aimed at preventing complications that will further worsen the condition of the already fatal disease.

ICH can be diagnosed by using computed tomography (CT) scan, magnetic resonance imaging (MRI), and angiogram.

Our goal was to determine the volume of blood clot in the brain as an important predictor in the outcome of haemorrhagic stroke. With additional validation, the findings of this study can be useful in selecting patients for surgical removal of haematomas or to devise the best treatment plan for each patient.

## LITERATURE REVIEW

Intracerebral haemorrhage (ICH) has been established as one of the most lethal and least treatable form of stroke despite the progression in medical knowledge (Dennis 2003). Age, haematoma volume and localization (Davis et al. 2006), anticoagulant use and level of consciousness have been detected as the predictive factors for patients' outcomes and mortality (Togha & Bakhtavar 2004).

ICH has been diagnosed more frequently and with greater accuracy after computed tomography (CT) was introduced (Helweg-Larsen et al. 1984). As haematoma volume is one of the relevant predictors of patients' outcomes, many researches have been conducted to observe the relationship between those two variables among patients with ICH based on the CT scan findings. Poor outcomes were seen in 18% of patients with lower haemorrhage volume and 62.5% of patients with larger haemorrhage volume after 30 days (Jordan et al. 2009).

This shows a clear relationship between volume of blood clot (haematoma) and the mortality level. Previous research by Börü et al. in 2009 has shown that all the patients who have hematoma volume of over 60 $cm^3$ died within 30 days. The research also proved a correlation between haematoma volume and both 30-day and one-year mortality rates and that the poor prognosis can be predicted by volume of haematoma.

Patients with higher conscious level, especially with Glasgow Coma Scale score of 9-12 benefit very highly from surgery (Al-Shahi & Whittle 2012). Furthermore, patients with ICH diameter larger than 3 cm had positive outcomes after haematoma removal compared to patients treated medically whereas patients with haematoma diameter less than 3 cm showed reasonable outcomes without surgery (Morioka et al. 2006). As surgery has yet been proven as

the best solution to ICH, new efforts exercising minimal invasive surgical techniques without extreme damages caused by more invasive procedures, as well as new treatments to dissolve and drain intraventricular blood, are currently being studied (Morgenstern et al. 2010).

Deciding for the best plan for patients with intracerebral haemorrhage is very challenging because outcomes in the patient population are generally poor (Kelly et al. 2013). The authors also suggest that patients or their surrogate decision maker must take the benefit of improved survival and the risk of often severe functional disability into consideration before deciding for or against surgery.

In general, previous studies showed that higher volume of hematoma will lead to worse outcome. However, the morbidity percentage differed in each study as the demographic of the patients and the place of study are different. Many studies have been conducted to observe the outcome of patients who underwent operative removal of haematoma. For now, surgery has only been proven to improve the outcome within certain limited conditions. More studies and findings are required to find the best treatment for ICH.

## METHODOLOGY

Patients with intracerebral haemorrhage admitted to Hospital Universiti Kebangsaan Malaysia (HUKM) were chosen for the purpose of this research. Patients who have had a history of brain haemorrhage were excluded. The abstracted clinical data and all available computed tomography (CT) scans for each case were evaluated. Total Glasgow Coma Scale (GCS) score at admission was used as an immediate outcome after ICH.

Using the formula *ABC/2*, where *A* is the greatest haemorrhage diameter by CT, *B* is the diameter 90° to *A*, and *C* is the thickness of haemorrhage, the total volume of haemorrhage is estimated. According to Luby et al. (2012), the ABC/2 method is the most sensitive, reliable and accurate of all.

Glasgow Coma Scale (GCS) was used to measure the neurological function the patients. The patients' GCS at admission and at discharge were noted. Another data extracted from the medical record was whether the patients received any surgery for the removal of blood clot. Using the blood volume as the independent variable, univariate logistic regression analysis was performed on Glasgow Coma Scale as the dependent variable whereas multivariate logistic regression analysis was performed on both dependent variables: Glasgow Coma Scale and operation (0=no, 1=yes). Values of $P \leq .05$ (two-tailed) were considered significant.

## RESULTS

For haemorrhage volumes of less than 30 $cm^3$, only 2 out of 27 (7%) had a GCS score of less than 9 while the rest, 93%, were admitted with a GCS score of 9 or more. Notably, all of the patients with haemorrhage volumes of more than 60 $cm^3$ scored a GCS of 9 or more, which is considerably high. In total, 15 out of 29 (52%) patients had a full GCS score at admission, 5 out of 29 (17%) had a score of 13-14, 8 out of 29 (28%) had a score of 12-9 while only 1 out of 29 (3%) had a score of 3-8. At discharge, 20 out of 29 (69%) patients had a full GCS score, 4 out of 29 (14%) with a score of 13-14, 3 out of 29 (10%) with a score of 9-12, and 2 out of 29 (7%) with a score of 3-8.

There was an overall increase in the GCS score of patients at discharge compared to their score at admission as shown in Figure 2. However, 7% of the patients showed a decrease in their GCS score. In univariate logistic regression analysis, volume of intracerebral haemorrhage ($P$=.310) was not a significant predictor for the outcome of haemorrhagic stroke.

Of all the patients who underwent surgery, 2 out of 4 (50%) showed improvement in their GCS score, 25% had a decrease while the other 25% showed no difference. On the other hand, 31% of patients without surgery improved their score, 3% decreased while the rest remained constant.

Although the operative removal was associated with increased GCS score, there was no significance in patients who underwent the operation and those who did not. As a matter of fact, in multiple regression analysis, both volume of intracerebral haemorrhage ($P$>.05) and operative removal of haemorrhage ($P$>.05) were not significant predictors of the GCS score of patients.

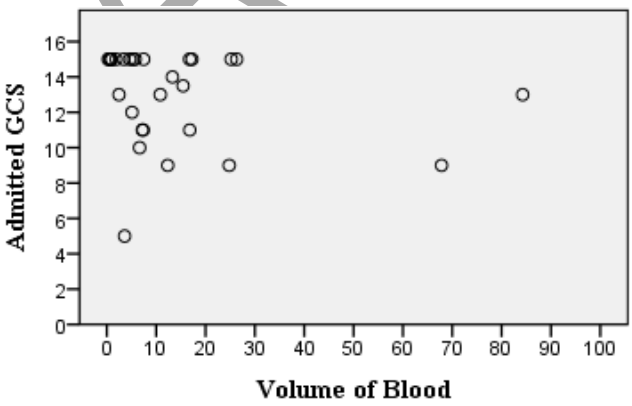


Figure 1 GCS score of patients when they were first admitted according to volume of intracerebral haemorrhage

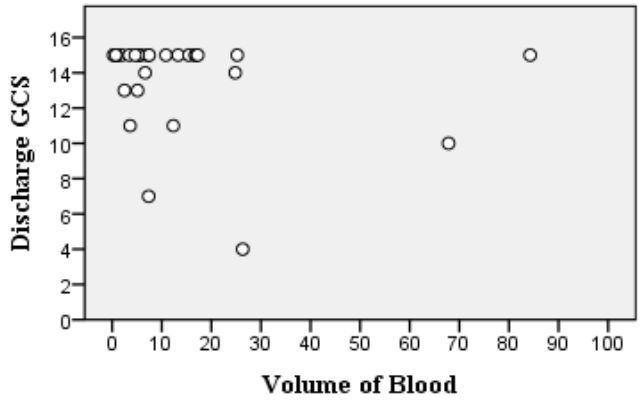


Figure 2 GCS score of patients when they were discharged according to volume of intracerebral haemorrhage

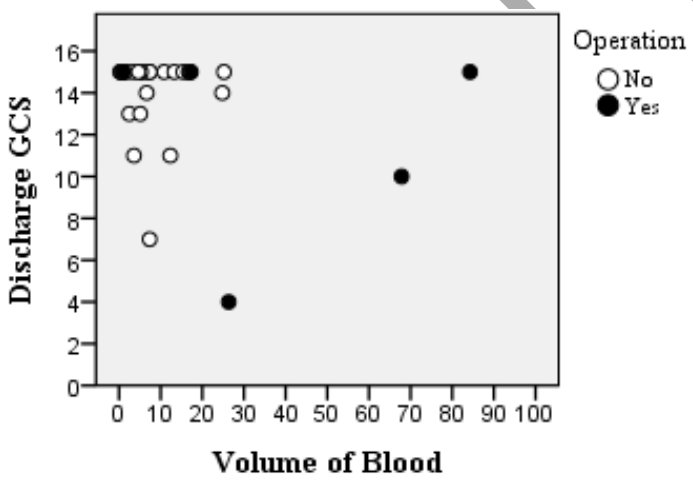


Figure 3 GCS score of patients during discharge according to volume of blood and presence of operative removal of haematoma

**DISCUSSION**

Our present findings demonstrate that there is no relationship between the volume of blood clot in the brain and the GCS score of the patients at admission. Similarly, the GCS scores of patients at discharge also show no apparent difference between those with larger clots and those with smaller clots.

Only 14% had their blood clot removed through surgery. This audit also revealed to us that surgery was performed to save a patient's life rather than to improve quality of living. Although a patient who underwent surgery had a longer lifespan, they did not show much increase in their GCS score compared to patients who took medications without surgery. Overall GCS score of patients during discharge were not significantly different in patients who underwent operation compared to those who did not.

Future cohort studies should focus on other possibilities of various factors that can affect the outcome of patients with ICH. The location of haematoma into should be taken into account, studying the correlation between the location (deep, cerebellar, pontine and lobar) and the outcome of haemorrhagic stroke. The outcome of ICH may also differ according to age, sex, race, and other factors regardless of the size of blood clot.

Haematoma expansion and delayed intraventricular haemorrhage independently predicts poor outcome in ICH (Dowlatshahi et al. 2011; Maas et al. 2013) while age, intraventricular spread of haemorrhage were independent predictors of outcome at 6 months (Daverat et al. 1991).

In 2013, Fan et al. also discovered that blood pressure can be highly associated with early neurological deterioration in patients with intracerebral haemorrhage. Another study suggests that hyperglycemia on presentation in non-diabetic patients can be an independent predictor of early fatality and worse functional outcome in patients with intracerebral haemorrhage (Stead et al. 2010).

Treatments for patients who have intracerebral haemorrhage have yet been discovered. Due to the rapid and severe outcome of the intracerebral haemorrhage, more treatment innovations should be developed and evaluated. For now, treatment remains primarily supportive.

## CONCLUSION

Surgery for patients with large volumes of hematoma is unnecessary since the surgical removal would minimally improve the patients' lifestyle quality. Apart from the volume of blood clot, other possible factors such as age, sex and location of blood clot should be measured as predictors for outcome in haemorrhagic stroke.

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