



Original Article

Correlation of Glasgow outcome scale (GOS) and Haematoma Volume during Surgical and Conservative Management of Spontaneous Supratentorial Intracerebral Hemorrhage Patients

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Abstract

Background: Haematoma volume is an important issue for the management of spontaneous supratentorial intracerebral hemorrhage patients. **Objective:** The purpose of the present study was to correlate the Glasgow outcome scale (GOS) and haematoma volume during surgical and conservative management of spontaneous supratentorial intracerebral hemorrhage patients. **Methodology:** This randomized control trial which was conducted in the Department of Neurosurgery at Dhaka Medical College and Hospital from January 2010 to October 2011 for a period of one year and ten months. All hypertensive patients with spontaneous supratentorial intracerebral hemorrhage who were admitted within 48 hours of stroke in Neurosurgery Department during the study period were considered as a study population. Patients underwent surgery was considered as group I and patients those who did not give the consent for operation were treated conservatively was considered as group II. Surgery and conservative groups were matched in age, GCS, GOS, hematoma location and volume of hematoma. **Result:** A total of 31 patients were enrolled in this study of which 14 patients underwent surgical evacuation and 17 cases were selected for conservative therapy. Significant negative correlation was found between GCS on admission with hematoma volume in surgery group ($r=-0.631$; $P=0.016$) and conservative group ($r=-0.854$; $p=0.001$). A negative but not significant correlation ($r=-0.426$; $P=0.129$) between GOS with hematoma volume in group I, where negative significant correlation ($r=-0.503$; $P=0.039$) in conservative group II. **Conclusion:** In conclusion Glasgow outcome scale (GOS) is positively correlated with the haematoma volume during surgical and conservative management of spontaneous supratentorial intracerebral hemorrhage patients. [*Journal of Science Foundation* 2019;17(1):9-14]

Keywords: Haematoma Volume; Spontaneous; Supratentorial; Intracerebral Hemorrhage

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Introduction

Spontaneous intracerebral hemorrhage (ICH) accounts for approximately 4.0 to 14% of all strokes and is associated with a high mortality and morbidity (Bamford et al., 1990). Hematoma is a principal cause of early neurological deterioration. Studies show that up to 38.0% hematoma expansion is noted within three hours of onset and that hematoma volume is an important predictor of 30 day mortality (Gebel et al., 2002; McKinley et al., 1999).

Large volume ICH is commonly associated with high ICP and brain tissue shifts. An intravenous sedative should be given to the agitated patient to attain a motionless state. If ICP does not respond to sedation and cerebral perfusion management, osmotic agents and hyperventilation should be considered (Nau 2000). Mannitol is commonly used because it is renally metabolized, has a half-life up to 4 hours, and achieves intermediate concentrations within the CSF (Weiner and Cooper 1992). All these patients are followed closely in the intensive care unit with continuous cardiovascular monitoring (Jha 1996).

Proper timing of surgical intervention is also very important. Small hematomas whether superficial or deep are preferably treated best by wait and watch policy (Qureshi et al., 2005). Infratentorial hemorrhages seem to benefit from early surgery. Most neurosurgeons believe cerebellar hemorrhages greater than 3 centimeters benefit from early surgical intervention because of the significant risk of brainstem compression and obstructive hydrocephalus within 24 hours (Broderick et al., 1993).

The single most important factor guiding the management of patients with spontaneous ICH is the pre-operative level of consciousness. The majority of studies during the past 20 years have clearly shown that surgical intervention is superior to conservative treatment if GCS scores 6 to 12 and volume of haematoma (20 to 80 ml) in both mortality and functional outcome (Weiner and Cooper 1992). Therefore this present study was undertaken to correlate the Glasgow outcome scale (GOS) and haematoma volume during surgical and conservative management of spontaneous supratentorial intracerebral hemorrhage patients.

Methodology

Study Population and Settings: This was a single centered, parallel pragmatic randomized control trial which was conducted in the Department of Neurosurgery at Dhaka Medical College and Hospital from January 2010 to October 2011 for a period of one year and ten months. All hypertensive patients with spontaneous supratentorial intracerebral hemorrhage who were admitted within 48 hours of stroke in Neurosurgery Department during the study period were considered as a study population.

Randomization and Blinding: The study population was divided into two groups designated as group A who were treated with surgical management and group B who were treated conservatively. Patients who didn't give consent for operation were selected for conservative therapy. Prior to commencement of this study, the research protocol was approved by ethical committee. The inclusion criteria of study population were patient admitted within 48 hours of ictus, CT-scan evidence of spontaneous supratentorial ICH, only lobar hematoma was included in this study; in addition hematoma volume more than 30 ml in CT-scan, hematoma causing mass effect like midline shift, GCS score 6 to 12, age 40 to 70 years and only hypertensive cases were included in this study. The exclusion criteria of study population were patient after 48 hours of ictus, ICH other than spontaneous, posterior fossa (cerebellum) and deep seated (thalamus, putamen) hematoma, hematoma with ventricular extension, GCS score <6 and >12, patient with co morbid disease as diabetes, ischemic heart disease, COPD and patient taking any anticoagulant (as warfarin) and drugs that inhibit platelet aggregation (as aspirin).

Study Procedure: This study was done on admitted patients with a brain CT scan confirmed spontaneous supratentorial ICH fulfilling all selection criteria. All these patients were evaluated on the basis of detailed history and clinical examination. Clinical evaluation of the conscious level by Glasgow Coma Score (GCS) was performed at the time of admission and seven days after treatment. Glasgow outcome scale (GOS) was recorded one month after treatment. The baseline volume of ICH was measured according to a bedside method of measuring CT ICH volume. The Broderick's formula $(Ax \times B \times C)/2$ was used (Mourad et al., 2011). Laboratory testing was performed like complete blood count, blood sugar level and ECG.

Surgical treatment: After giving the consent, patients selected for surgical treatment were taken to the operating room as soon as possible. All surgical cases underwent either decompressive craniotomy or craniectomy under general anesthesia. **Medical treatment:** Medical treatment included osmotherapy, blood pressure control, seizure prophylaxis, deep venous thrombosis prophylaxis, intravenous fluids, H₂ blockers and early nutritional support (Tarikul 2011).

Follow up and Outcome Measures: Among them 14 patients were operated and 17 patients those did not give consent for operation were treated conservatively, then continuously followed up by observing the GCS score at 7th day and 30 days Glasgow outcome scale (GOS). A check list was prepared by the researcher considering the variables such as age, volume of haematoma, GCS and GOS. The check list was tested first in the department of Neurosurgery of Dhaka Medical College and Hospital and then finalized. The data was collected by the researcher himself. On admission, detailed history from the attendants was taken. General and neurological examination of patients was done. Findings of CT scan were recorded carefully. GCS and GOS were also recorded.

Statistical Analysis: Data was collected and edited manually. A master sheet was prepared and data was analyzed by SPSS (Statistical package for social science). Unpaired t-test, paired t-test, correlation and Chi square (χ^2) test were performed. The level of significance considered p value <0.05. The summarized data was then presented in tabulated form.

Results

A total of 60 patients having stroke within 48 hours with spontaneous supratentorial ICH were selected. Out of these 29 patients were not included in the study due to unable to fulfill the selection criteria. Fourteen (14) patients underwent surgical evacuation while seventeen (17) patients those who didn't give consent for operation were selected for conservative therapy. Therefore a total of 31 patients were enrolled in this study.

The mean±SD age were 53.29±6.92 years and 52.47±7.51 years in surgery and conservative patients respectively. Mean age difference was not statistically significant (p>0.05) (Table 1).

Table 1: Age Distribution of the Study Patients (n=31)

| Age Group | Group A | Group B | P value |
|-----------------|------------|------------|---------------------|
| Mean ± SD | 53.29±6.92 | 52.47±7.51 | 0.758 ^{ns} |
| Range (min-max) | 45 to 65 | 40 to 65 | |

ns = not significant; P value reached from unpaired t-test

Maximum hematoma volume was found of 31 to 60 ml in both surgery and conservative patients. Mean hematoma volume was 50.5±11.59 ml ranging from 35 to 70 ml in surgery patients. Mean hematoma volume was 44±10.75 ml ranging from 30 to 64 ml in conservative patients. Mean hematoma volume difference was not significant (p>0.05) (Table 2).

Table 2: Distribution of the Study Patients According to Hematoma Volume (n=31)

| Hematoma volume | Group A | Group B | P value |
|-----------------|------------|----------|---------------------|
| ≤30 | 1(0.0) | 2(11.8) | 0.117 ^{ns} |
| 31-60 | 11(78.6) | 14(82.4) | |
| >60 | 2(14.3) | 1(5.9) | |
| Mean±SD | 50.5±11.59 | 44±10.75 | |
| Range (min-max) | 35 to 70 | 30 to 64 | |

ns = not significant; P value reached from unpaired t-test

The association between hematoma volumes with GOS at 30 days were recorded. One patient (7.1%) in surgery and one patient (5.9%) in conservative group had good recovery in hematoma volume ≤30 ml. One patient (5.9%) recovered with moderate disability in same volume of hematoma.

More than one third 5(35.7%) and 9(52.9%) patients were dead in surgery and conservative group respectively in hematoma volume 31 to 60 ml.

Table 3: Association between Hematoma Volume with GOS at 30 days (n=31)

| Glasgow Outcome Score (GOS) | Hematoma volume (ml) | |
|--|----------------------|----------|
| | Group A | Group B |
| Hematoma volume (≤ 30 ml) | | |
| • Dead | 0(0.0%) | 0(0.0%) |
| • Severe disabled | 0(0.0%) | 0(0.0%) |
| • Moderate disabled | 0(0.0%) | 1(5.9%) |
| • Good recovery | 1(7.1%) | 1(5.9%) |
| Hematoma volume (31 to 60 ml) | | |
| • Dead | 5(35.7%) | 9(52.9%) |
| • Severe disabled | 1(7.1%) | 3(17.6%) |
| • Moderate disabled | 2(14.3%) | 0(0.0%) |
| • Good recovery | 3(21.4%) | 2(11.8%) |
| Hematoma volume (>60ml) | | |
| • Dead | 1(7.1%) | 1(5.9%) |
| • Severe disabled | 1(7.1%) | 0(0.0%) |
| • Moderate disabled | 0(0.0%) | 0(0.0%) |
| • Good recovery | 0(0.0%) | 0(0.0%) |

Discussion

This comparative study was carried out with an aim to compare the outcome of surgery in relation to conservative management of spontaneous supratentorial intracerebral hemorrhage.

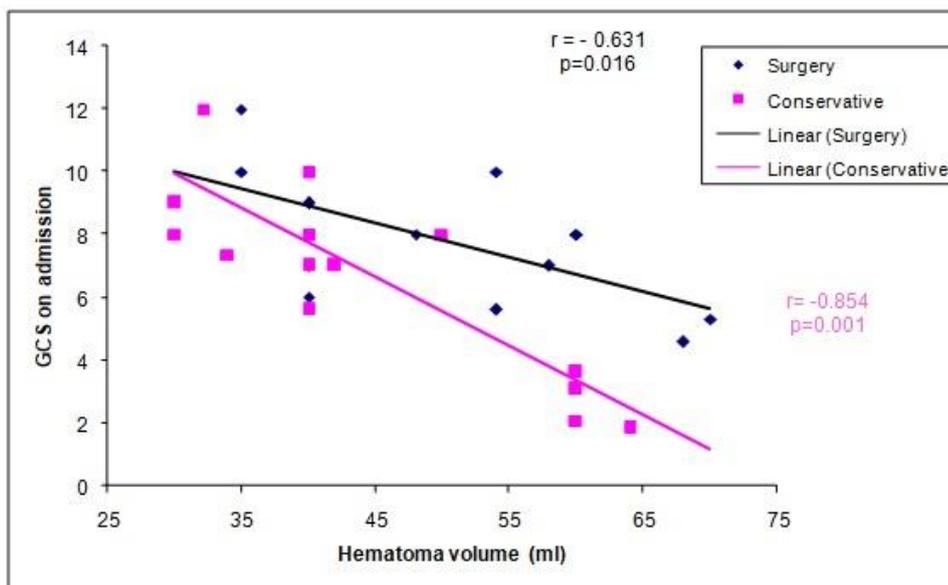


Figure 1: Scatter diagram showing significant negative correlation ($r=-0.631$; $P=0.016$) between GCS on admission with hematoma volume in surgery patients and significant negative correlation ($r=-0.854$; $P=0.001$) between GCS on admission with hematoma volume in conservative patients

A total of 31 patients with spontaneous supratentorial ICH, evaluated by brain CT scan were included in the study, in the Department of Neurosurgery of Dhaka Medical College and Hospital, Dhaka during January 2010 to October 2011. Fourteen patients underwent surgery was considered as group I and 17 patients those

who did not give consent for operation were treated conservatively was considered as group II and subsequently followed up by monitoring the GCS 7th day and GOS at 30 days.

In this present study it was observed that the mean±SD age was 53.29±6.92 years and 52.47±7.51 years in surgery and conservative group respectively, which was almost similar between two groups, no statistical significant ($p>0.05$) difference was observed. A half (50.0%) of the surgery patients were in 5th decade. Besides, in conservative group maximum (41.2%) patients were found in 5th and 6th decade. Similarly, Mourad et al (2011) have observed the mean age of the patients having spontaneous supratentorial ICH was 56.65±11.47 years in surgery group and 49.60±15.28 years in conservative group and the difference was not statistically significant ($p>0.05$), thus support the present study. Whereas in Bangladesh, Tarikul (2011) has shown mean age was 55.70 years and in Pakistan, Ahmed et al (2001) have shown the mean age was 58.8 years in patients having spontaneous intracerebral hemorrhage, which is comparable with the current study.

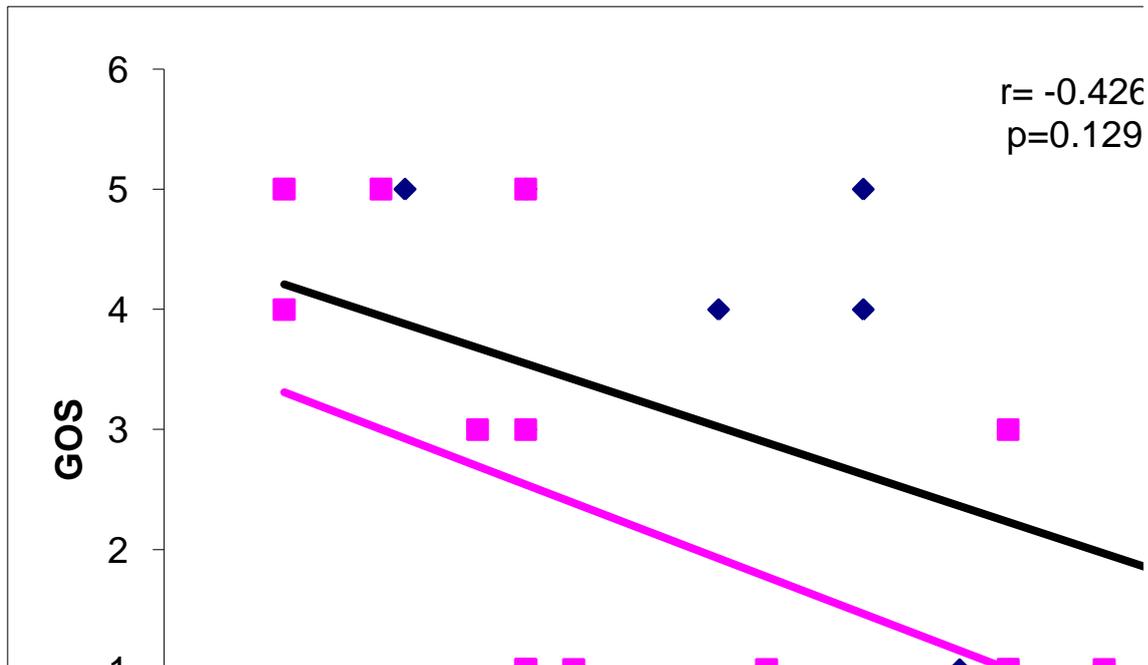


Figure 2: Scatter diagram showing negative but not significant correlation ($r=-0.426$; $P=0.129$) between GOS with hematoma volume in surgery patients and negative significant correlation ($r=-0.503$; $P=0.039$) between GOS with hematoma volume in conservative patients

In this current series it was observed that majority of the study patients had hematoma volume within 31 to 60 ml, which were 78.6% and 82.4% in surgery and conservative group respectively. The mean hematoma volume was 50.5±11.59 (ml) ranging from 30 to 70 (ml) in patient who underwent surgery and 44±10.75 (ml) ranging from 30 to 64 (ml) in patients who received conservative treatment. No significant ($p>0.05$) differences in baseline hemorrhage size among both groups. Similar findings were made by Barkatullah (2001) where 60.0% and 55.5% in surgery and conservative treatment group respectively having hematoma volume between 31 to 60 ml.

As regards to the outcome of spontaneous supratentorial ICH it was correlating with hematoma volume in this current study. According to hematoma volume 31–60 ml more than one third (35.7%) of the patients were dead and 42.8% were alive, 7.1% with severe disabled, 14.3% moderate disable and 21.4% with good recovery in surgery group. In conservative group more than a half (52.9%) of the patients were dead and only 29.4% were alive, 17.6% with sever disable and 11.8% with good recovery. The result obtained in this current study that the recovery was higher in surgery group, whereas mortality was more in conservative groups. Similarly, there was a strong significant difference in the group of lobar haematomas (>50 ml) in favors of the surgical group (mortality 24.3% vs. 60.2% $p<0.05$) was observed by Sampron et al (2010) and (10.5% vs. 20%) by Cho et al (2008) in patients with ICH volume of at least 30 ml. On the other hand Metaanalizi et al (2011) showed Surgery was superior to medical treatment in cases with hematoma volume >40ml, and GCS ≥ 6 , which supports the current study. Barkatullah (2001) has reported that good result after

surgery when ICH volume <50 ml by ultrasound guided endoscopic evacuation. In another study, Mourad et al (2011) showed improved GOS in surgery patients with hematoma volume 30–79 ml compared with conservative groups, which is comparable with the current study.

Volume of haematoma had been found to correlate with an individual's level of consciousness⁵. In this series it was observed that significant negative correlation were found between GCS on admission with hematoma volume in surgery group ($r=-0.631$; $p=0.016$) and conservative group ($r=-0.854$; $p=0.001$). However, Mourad et al (2011) showed significant negative correlation between hemorrhage size and baseline GCS ($r=-0.517$, $p=0.02$) in surgical group. On the other hand, patients received conservative treatment, there was a highly statistically significant negative correlation between size of hemorrhage and baseline GCS ($r=-0.765$, $p=0.001$), which is well correspond with the current study.

In this present study it was observed that negative but not significant correlation ($r=-0.426$; $p=0.129$) between GOS with hematoma volume in surgery group, where negative significant correlation ($r=-0.503$; $P=0.039$) in conservative group. This resembles with Tarikul (2011), where investigator found significant negative correlation his study ($r=-0.571$, $p=0.0001$). However Mourad et al (2011) showed a positive significant correlation ($r=0.473$, $p=0.035$) between hemorrhage size GOS after 30 days in surgical group. This may be due to large hematoma evacuated in progressively deteriorating patient, which is comparable with the current study although the correlation was not significant in surgery group but the correlation value was almost reliable.

Conclusion

It has been concluded that Glasgow outcome scale (GOS) is positively correlated with the haematoma volume. This has been found during the comparison between surgical and conservative management of spontaneous supratentorial intracerebral hemorrhage patients. Thus the decision of whether or not to surgically evacuate supratentorial ICH should depend on a combination of hematoma size and initial GCS.

References

- Ahmed R, Shakir AH, Moizuddin SS, Haleem A, Ali S, Durrani K, Khan A, Baig S. Predictors of in-hospital mortality for intracerebral hemorrhage: a hospital-based study in Pakistani adults. *Journal of Stroke and Cerebrovascular Diseases*. 2001;10(3):122-7
- Bamford J, Sandercock PA, Dennis M, Burn J, Warlow C. A prospective study of acute cerebrovascular disease in the community: the Oxfordshire Community Stroke Project--1981-86. 2. Incidence, case fatality rates and overall outcome at one year of cerebral infarction, primary intracerebral and subarachnoid haemorrhage. *Journal of Neurology, Neurosurgery & Psychiatry*. 1990;53(1):16-22
- Barkatullah AM. Role of surgery in the management of primary spontaneous intracerebral hemorrhage in adult patient. [MS Neurosurgery Thesis]. University of Dhaka, 2001
- Broderick JP, Brodt TG, Duldner JE, Tomsick T, Huster G. Volume of intracerebral hemorrhage. A powerful and easy-to-use predictor of 30-day mortality. *Stroke*. 1993;24(7):987-93
- Cho DY, Chen CC, Lee HC, Lee WY, Lin HL. Glasgow Coma Scale and hematoma volume as criteria for treatment of putaminal and thalamic intracerebral hemorrhage. *Surgical neurology*. 2008;70(6):628-33
- Gebel JM, Jauch EC, Brodt TG, Khoury J, Sauerbeck L, Salisbury S, Spilker J, Tomsick TA, Duldner J, Broderick JP. Relative edema volume is a predictor of outcome in patients with hyperacute spontaneous intracerebral hemorrhage. *Stroke*. 2002;33(11):2636-41
- Jha AN. Spontaneous intracerebral hemorrhage. In: Ramamurti B, Tandon PN, *Textbook of Neurosurgery*. 2nd ed. New Delhi: Churchill Livingstone; 1996:695–705
- McKinley BA, Parmley CL, Tonneson AS. Standardized management of intracranial pressure: a preliminary clinical trial. *Journal of Trauma and Acute Care Surgery*. 1999;46(2):271-9
- Metaanalizi İH. Meta-analyses of intracerebral hematoma treatment. *Turkish neurosurgery*. 2011;21(1):6-14
- Mourad HS, Enab AA, Abdelalim AM. Early outcome of Conservative versus Surgical Treatment of Spontaneous Supratentorial Intracerebral Hemorrhage. *Egypt J Neurol Psychiat Neurosurg*. 2011;48:85-92
- Nau R. Osmotherapy for elevated intracranial pressure. *Clinical pharmacokinetics*. 2000;38(1):23-40
- Qureshi AI, Mohammad YM, Yahia AM, Suarez JJ, Siddiqui AM, Kirmani JF, Suri MF, Kolb J, Zaidat OO. A prospective multicenter study to evaluate the feasibility and safety of aggressive antihypertensive treatment in patients with acute intracerebral hemorrhage. *Journal of intensive care medicine*. 2005;20(1):34-42
- Samprón N, Urculo E, Mendia A, Azkarate B, Alberdi F, Arrazola M. Early mortality in spontaneous supratentorial intracerebral haemorrhage. *Neurocirugía*. 2010;21(2):93-8
- Tarikul I. Analysis of early outcome of surgery in spontaneous primary intracerebral haemorrhage in relation to preoperative Glasgow coma scale, [MS Neurosurgery Thesis], University of Dhaka, 2011
- Weiner HL, Cooper PR. The Management of Spontaneous Intracerebral Hemorrhage. *Contemporary Neurosurgery*. 1992;14(21):1