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Volume of Intracerebral Hemorrhage: A Powerful Predictor of 30-Day Mortality

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ABSTRACT

Cerebrovascular diseases have recently emerged as a major health problem affecting the elderly population. Volume of the blood is one factor which can determine the prognosis of the patient with intracerebral hemorrhage. A prospective observational study was done at Neurology ward of Chittagong Medical College Hospital (CMCH). The aim of this study was to determine the 30-day mortality of intracerebral hemorrhage in a hospital population and to determine the most important predictor of 30-day outcome. Seventy cases of spontaneous intracerebral hemorrhage were analyzed and followed up for 30 days in hospital and house where necessary. Statistical analyses were performed to see the outcome in relation with blood volume by SPSS-18. In this study, 50(71.42%) patients had hypertension. Diabetes mellitus was found among 6(8.57%). aphasia was found 40(57.1%) patients, dysarthria was in 11(15.7%), motor deficit in 65(92.9%) patients, 48(68.6%) patients had cranial nerve involvement and 32(45.7%) patients had abnormal fundoscopic findings. Regarding analysis of volume of hemorrhage, <5 ml was found in 9(12.9%) patients, 5-15 ml was found in 32(45.7%) patients, >15-30 ml was found in 15(21.4%) patients, >30-60 ml was found in 10(14.3%) patients and >60 ml was in 4(5.7%) of patients. Among all patients, no of death was 9(12.8%) within 30 day and rest 61(87.2%) were alive. After analysis, it was found that fatal outcome is more with increased volume of hemorrhage ($p<0.05$). It was 100% with >60ml of hemorrhage. Volume of intracerebral hemorrhage is a powerful and easy-to-use predictor of 30-day mortality in patients with spontaneous intracerebral hemorrhage.

Keywords: Stroke, Intracerebral hemorrhage, Volume

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INTRODUCTION

Stroke is the clinical designation for a rapidly developing loss of brain function due to a disturbance of cerebral blood vessels. This phenomenon can be due to ischemia (lack of blood supply) caused by thrombosis or embolism or due to a hemorrhage [1]. Intracerebral hemorrhage is the extravasation of blood into the parenchyma and it is most common in elderly and its incidence is more in those receiving anticoagulant therapy [2]. The mortality rate was changed based on the volume of blood, severity of bleeding and location of blood inside the brain parenchyma [3]. Hypertension and amyloid angiopathy are the primary causes while coagulopathy, trauma, intracranial neoplasm, drugs are the secondary causes for intracranial hemorrhage [4].

Volume of blood in CT scan has the potential diagnostic capability to find the mortality rate in intracerebral hemorrhage cases [5]. The CT scan imaging of the brain is the standard radiological investigation to detect the presence or absence of intracerebral hemorrhage and it is more sensitive than MRI for the detection of acute heamatoma. [6].

The population studies reported 30 days mortality of 44% -51% in Computed Tomographic era [7]. Advances in medical treatment and the spectrum of surgical interventions in recent years have altered the prognosis of patients with cerebral infarction and subarachnoid hemorrhage [8, 9]. However, spontaneous intracerebral hemorrhage (ICH), which accounts for 10–20% of all strokes, is still the deadliest, most disabling and least treatable type of stroke [10-12]. At present, there is no proven therapy for improving the outcome after ICH. Previous studies showed that surgical evaluation in ICH yielded negative or inconclusive results [13-16]. Similarly, no current medical treatment has been shown to provide benefit to patients with ICH [17-19]. Given the limited therapeutic options for these patients, risk-stratification models, based on pre-operative patient and disease characteristics, are useful for providing patients with an insight into the potential risk of complications and mortality. These models ultimately aid in the clinical decision for surgical versus non-surgical therapy, and are useful in comparing the quality of care between different surgeons and hospitals.

A number of prognostic models for patients with ICH have been proposed [13, 20-28]. These models include neurological conditions, clinical parameters, laboratory results and neuroimaging findings. However, most of the models require complex algebraic calculations and are not user-friendly. Hemphill *et al.* [28] first proposed the grading scale for predicting mortality in ICH patients, known as the ICH score. It is an additive rating scale and can be easily and quickly determined in patients with ICH. Since that time, several multifactorial risk scores were developed to predict outcomes after ICH [26-27, 29-30].

The mortality of patient is depending more on the volume of hemorrhage, lesser extent on consciousness and other factors [31]. If intracerebral hemorrhage increases in size after hospital admission, it may worse the outcome of the condition. Studies have been conducted correlating the volume of blood and mortality [32]. In hemorrhagic stroke volume of blood has a relation with 30-days mortality. We can calculate it from the imaging and apply it in our country at resource poor setting to predict the outcome like morbidity and mortality. The present study was undertaken to measure the volume of intracerebral blood and correlate the same with 30-day mortality in our Bangladesh.

MATERIALS AND METHOD

This prospective observational study was conducted at neurology ward of Chittagong Medical College Hospital (CMCH), Chittagong, Bangladesh from November, 2013 to May, 2014. Proper ethical permission was obtained from the ethical committee of Chittagong Medical College. Study populations were selected after fulfilling the selection criteria on the basis of history, and physical examination and investigation. Inclusion criteria was radiologically (C.T scan of Head) documented hemorrhagic stroke and occurrence of stroke within 3 days. Exclusion criteria were H/O previous stroke patients having intraventricular extension of the blood, infratentorial origin of hemorrhage, Presence of aspiration pneumonia or sepsis at the time of presentation or during the course of stay in the hospital, Presence of concurrent subdural, extradural and subarachnoid hemorrhage, Use of antiplatelet medication (Aspirin), anticoagulant medication (Warfarin),Acute or chronic kidney diseases, hepatic pathology, decompensated chronic pulmonary diseases, any coagulopathies, Glasgow Coma Scale less than 7 and Uncontrolled diabetes mellitus. All patients/guardians were informed about the treatment options and written witnessed consent was taken from them. Volume of intracerebral hemorrhage was calculated on initial head CT scan by using ABC/2 method. Then patients was followed up and observed for next 30 days to see the mortality outcome. No surgical treatment was given. If patient were discharged from the hospital he/she were followed up by telephone call with the guardian or home visit by the researcher himself .For communication mobile phone/telephone number of the patient or guardian was preserved for further communication..

.Data analysis

All the data was checked and edited after collection. Data processed and analysed by using windows based computer software devised with SPSS -18. All data was evaluated by using statistical methods-Chi-square test, T-test, Logistic regression. The results were presented in tables and figures. Statistical significance was set at $p<0.05$ and confidence interval set at 95% level.

RESULTS AND DISCUSSION

In these study 70 patients was selected. This study showed that majority of patients were male that came upto 60% and female constituted 32%. Two different age group were included. < 70 years of patient was 82.9% and ≥ 70 years of patient was 17.1%. Most of patients were from rural area, which was 80% and rest of them were 20%. Majority of patients were doing sedentary works (91.4%). Different types of occupation was found in the study patients but maximum were doing nonspecific works. Socioeconomic conditions of most of the patients were lower middle class (61.4%).

Hypertension which is major risk factor for intracerebral hemorrhage was identified in 71.4% of total 70 cases, Hypertension diabetes and cigarette smoking had no significant role on outcome in statistical point. Different examination findings were analyzed, where aphasia was found in 57.1% patients, dysarthria was in 15.7%, motor deficit was found in 92.9% patients, 68.6% patients had cranial nerve involvement and 45.7% patients had abnormal fundoscopic findings.

Among 70 patients of intracerebral hemorrhage 30 day mortality was 12.86% and rest 87.2% were alive. Regarding level of consciousness, mean GCS score of death patients were 12 and median of that were 11. In alive patients mean GCS score were 13.85 and median of that were 15. In statistical point of view it was significant. (P<.05)

Among 70 patients, 52 patients had >12 GCS score. Out of 52 patients having GCS score >12, 4 patients was death. Out of 18 patients having GCS score <12 .5 patients was death. It is statistically significant that decreased GCS is associated with increased mortality. Mean volume of hemorrhage of death patients was 36.32 and median of that was 33.80.Mean volume of hemorrhage of alive patients was 15.77 and median of that was 11.84.Result was statistically highly significant (p<.oo1).according to outcome.

Among 70 patients, 14 patients had ≥ 30 ml volume of hemorrhage .Out of 14 patents, 5 patients were death. 56 patients had <30 ml volumes of hemorrhage .Out of 56 patents, 4 patients were death. Larger volume of blood was associated with increased mortality which was statistically highly significant (p=.004Results of study indicated that increased volume of blood was related to decreased GCS score. It was statistically significant (p<.01). Regarding relationship between intra-cerebral blood volume and length of survival in days among patients who died within 30 days of the event, there is a weak negative correlation between the two variable (r = -0.329) and the regression line for Length of survival (in days) = 15.914 ─ 0.114 × intra cerebral blood volume.

In univariate logistic analysis patient having ≥ 70 years of age had more than 1.457 time risk than patient having <70 years of age in relation to outcome. In case of level of consciousness

GCS score >12 had 217 times risk of mortality than GCS score ≤ 12. Patient having ≥ 30 ml of volume of blood had more than 7.222 time risk than patient having <30 ml of volume of blood in relation to 30 day mortality. In stepwise multivariate logistic regression volume of intracerebral hemorrhage, GCS score were significant independent predictor factor for 30 days mortality.

Stroke has recently emerged as a major health problem affecting the population. Its incidence has increased many folds with the emergence of several risk factors like coronary artery diseases, diabetes mellitus, hypertension, dyslipidemia. Hypertension and amyloid angiopathy are the primary causes while coagulopathy, trauma, intracranial neoplasm, drugs are the secondary causes for intracranial hemorrhage The study was done in the Neurology department of Chittagong medical College Hospital. Among 70 patients of intracerebral hemorrhage we evaluate the 30 day mortality in relation with volume of the hematoma.

In the present study, male was more than female as expected, as male got more preference to female in the present socioeconomic and social status of Bangladesh. In this study two different age group were included. Patients having< 70 year of age was 82.9% and patients having ≥ 70 year of age was 17.1%. Different types of occupation were found in the study patients but maximum were doing nonspecific jobs. Patients from middle class and poor families were more in the present study. Sedentary workers and patients from urban community are more common in this study. Most women were housewives and 61% were from lower middle class family. Among the study patients, hypertension was found among 50 (71.42%) patients In this study among 70 patients, 8.6% patients were diabetic mellitus. Different examination findings were analyzed, where aphasia was found in 40(57.1%) patients, dysarthria was in 11(15.7%), motor deficit was found in 65(92.9%) patients, 48(68.6%) patients had cranial nerve involvement and 32(45.7%) patients had abnormal fundoscopic findings. In present study 74.3% cases had GCS more 12 and 25.7% cases had less than or equal to 12 . Average GCS score was 13.61.

This study was conducted to analyze the relationship between blood volume and 30 day mortality outcome. It also shows that among 70 study patients, death was 9(12.8%) and rest 61(87.2%) were alive. Regarding analysis of volume of hemorrhage,<5 ml was found in 9(12.9%) patients, 5-15 ml was found in 32(45.7%) patients, >15-30 ml was found in 15(21.4%) patients, >30-60 ml was found in 10(14.3%) patients and >60 ml was in 4(5.7%) of patients. More percentage of death was observed in 60ml (100%). In a similar study, <5ml was found in 0(0%), 5-15ml was 24(21%), 15-30ml was 68(56.67%), 30-60 ml was 14(11%) and >60ml was 14(11.67%) More percentage of death was observed in >60ml (85%) 33. Present study also showed that a 60 ml of blood volume is almost always fatal (100%) to the

patient. Thus volume of blood is one factor which can determine the fate of the patient.

In our study it was found that there was negative correlation with volume of intracerebral hemorrhage with Glasgow coma scale. In present study where the significant variables associated with 30 day mortality were Glasgow Coma Scale and ICH volume and nonsignificant variables were age, hypertension, cigarette smoking and diabetes mellitus.

We found significant correlation between blood volume and mortality rate. These results are at par with similar published studies [33, 34].This is a single-center hospital study and the results may or may not reflect the cross section of the population. For more consistent results large multi-center studies have to planned and executed in order to determine relationship between blood volume and mortality rate.

There are no proven definitive treatments that have an intracerebral hemorrhage. Because of the rapid and severe devastation associated with intracerebral hemorrhage, innovative treatments need to be developed and evaluated. Bedside estimation of the volume of parenchymal hemorrhage can be a powerful tool for selection and stratification of patients in the future treatment strategy.

Table 1: Distribution of risk factors among the study patients according to outcome (with X^2 test significance)

Risk Factors		**Outcome**				**Total**		X^2 Test Significance
		Death(n = 9)		**Alive(n = 61)**		**(n = 70)**		
		N	%	N	%	n	%	
Hypertension	Present	5	55.6	45	73.8	50	71.4	$X^2 = 1.275$
	Absent	4	44.4	16	26.2	20	28.6	$P = 0.259^{NS}$
Diabetes	Present	2	22.2	4	6.6	6	8.6	$X^2 = 2.456$
Mellitus	Absent	7	77.8	57	93.4	64	91.4	$P = 0.117^{NS}$
Cigarette	Present	2	22.2	7	11.5	9	12.9	$X^2 = 0.808$
Smoking	Absent	7	77.8	54	88.5	61	87.1	$P = 0.369^{NS}$

***** NS = Not Significant (P > 0.05)

This table showed hypertension was main risk factor for hemorrhagic stroke

Table 2: Distribution of the neurological findings among the stroke patients (n = 70)

Neurological Findings		***Frequency***	***Percentage (%)***
Speech	Normal	19	27.1
	Aphasia	40	57.2
	Dysarthria	11	15.7
Motor Deficit in the Limbs	Present	65	92.9
	Absent	5	7.1
Cranial Nerve Involvement	Present	48	68.6
	Absent	22	31.4
Fundoscopy	Normal	38	54.3
	Abnormal	32	45.7
Total		70	100.0

Table 3 showing main neurological findings of study population were aphasia, motor deficit in limbs, cranial nerve involvement, and abnormal fundoscopic findings.

Age Group	≥ 70 Years	2	22.2	10	16.4	12	17.1	$X^2 = 0.188$
	< 70 Years	7	77.8	51	83.6	58	82.9	$P = 0.665^{NS}$
GCS Grades	> 12	4	44.4	48	78.7	52	74.3	$X^2 = 4.815$
	≤ 12	5	55.6	13	21.3	18	25.7	$P = 0.028^{S}$
Volume	≥ 30 ml	5	55.6	9	14.8	14	20.0	$X^2 = 8.160$
Grades	< 30 ml	4	44.4	52	85.2	56	80.0	$P = 0.004^{HS}$

***** NS = Not Significant (P > 0.05); S = Significant (P < 0.05); HS = Highly Significant (P < 0.01)

Table 4: Distribution of predictive factors among the study patients according to outcome (with X^2 test significance)

Predictive Risk Factors		**Outcome**				**Total (n = 70)**		X^2 Test Significance
		Death(n = 9)		**Alive(n = 61)**				
		N	%	N	%	n	%	
Age Group	≥ 70 Years	2	22.2	10	16.4	12	17.1	$X^2 = 0.188$
	< 70 Years	7	77.8	51	83.6	58	82.9	$P = 0.665^{NS}$
GCS Grades	> 12	4	44.4	48	78.7	52	74.3	$X^2 = 4.815$
	≤ 12	5	55.6	13	21.3	18	25.7	$P = 0.028^{S}$
Volume	≥ 30 ml	5	55.6	9	14.8	14	20.0	$X^2 = 8.160$
Grades	< 30 ml	4	44.4	52	85.2	56	80.0	$P = 0.004^{HS}$

***** NS = Not Significant (P > 0.05); S = Significant (P < 0.05); HS = Highly Significant (P < 0.01)

Table 4 showing different predictive factors of hemorrhagic stroke where age had no significant but GCS score and volume of blood had more significant GCS score ≤ 12. ≥ 30 ml of volume of blood had more than risk than <30 ml of volume of blood in relation to 30 day mortality

CONCLUSION

Upon analyzing the mortality pattern on the basis of blood volume, we could observe that increased volume of the intracerebral blood was associated with poor outcome. Further it was observed and statistically proved that more than 60 ml of blood volume is almost always fatal (100%) to the patient. This study gives an idea regarding the relationship between blood volume and mortality rate.

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