Correlation of Haematoma Volume with Early Outcome in Surgically Treated Spontaneous Primary Supratentorial Intra-Cerebral Haematomas

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Abstract

Introduction: Spontaneous intracerebral hemorrhage (ICH) comprises 10-15% of all strokes.

Aim: To assess the relationship between the haematoma volume and early surgical outcome of patients with spontaneous primary supratentorial intracerebral hemorrhage by Glasgow Outcome Scale at the 30th post ictus day.

Methods: This prospective study was done from April 2014 to March 2016 in Department of Neurosurgery, Combined Military Hospital (CMH), Dhaka. Forty seven cases were selected by set down criteria. Glasgow Coma Scale (GCS) score was recorded on admission, haematoma volume was calculated from the CT scan immediately after admission by Modified Ellipsoid Method and the surgical outcome of ICH patients was determined by Glasgow Outcome Scale (GOS) by face to face interview or by structured interview over phone at their 30th post ictus day. Correlation between the haematoma volume and the surgical outcome of ICH was done by Chi-square test. Again the correlations of three variables (haematoma volume, admission GCS and ICH score) with GOS was compared by Spearman's correlation coefficient test.

Results: Patients with haematoma volume of 30cc or more were found to have worst outcome.

Conclusion: Relationship between haematoma volume and surgical outcome was found statistically very significant. Risk stratification of the patients with spontaneous primary supratentorial intracerebral hematomas basing on hematoma volume may be used to improve standardization of treatment protocols and clinical research studies.

Key-words: Haematoma, Spontaneous intracerebral hemorrhage, Glasgow Coma Scale.

Introduction

Spontaneous primary intra-cerebral haematoma is defined as haemorrhage into the brain parenchyma in the absence of causal trauma or a structural disease process on a macroscopic level, such as a tumour, aneurysm, vascular malformation, or arteriovenous fistula[1]. ICH accounts for 10-15% of all strokes in the United States and Europe and 20-30% in Asian populations[2]. It is the commonest neurosurgical emergency in Bangladesh Armed Forces. The incidence of mortality and severe morbidity after primary ICH is higher than that of other subtypes of stroke. From another point of view, the frequent need for intensive care services and the high incidence of disability contribute disproportionately to the high costs of stroke treatment[3]. The surgical removal of all types of ICH has resulted in disappointing overall prognosis[4]. Several clinical and radiological factors such as age of the patient, level of consciousness, hypertension, volume of the haematoma, volume of peri-lesional oedema, midline shift on initial computed tomography (CT), and intraventricular spread of the bleeding appear to be markers of poor prognosis after spontaneous ICH[3,5]. Early mortality, generally defined as that in the first 30 days post-ictus, is higher in ICH than in ischaemic stroke[6]. Recent studies with CT confirmation of all cases of ICH indicate that ICH has a 30 day mortality rate between 34 and 50%[7]. Although it is not possible to predict individual patient outcome with complete accuracy, some knowledge of the relevant prognostic indicators is desirable, as the probability for a meaningful recovery invariably dictates future management. The two most significant predictors of mortality are haematoma volume and level of consciousness at admission[6]. A rating system known as the ICH score has been developed. It is based on GCS, age, haematoma volume, location and presence of intraventricular blood[8]. But it is very cumbersome and time consuming to calculate ICH score at bed side in an emergency setting and not so easy for the patients/relatives to assimilate while they are being counselled. Outcome prediction basing on haematoma volume is relatively straightforward and reasonably accurate. There are limited numbers of studies regarding the predictability of outcome of ICH patients depending solely on ICH volume. The aim of this study is to evaluate the relationship between haematoma volume and early outcome in surgically treated spontaneous primary supratentorial ICH patients.

Materials and Methods

Intra-cerebral Haemorrhage (ICH) patients who underwent surgical evacuation of their clot from April 2014 to March 2016 in Neurosurgery Department, Combined Military Hospital, Dhaka were prospectively studied. Clinical data of 47 cases of ICH patients was purposefully incorporated in this study. Posterior

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fossa ICH, ICH with ventricular extension, ICH due to secondary cause were excluded. Detail neurological status (GCS) (Table-I) and haematoma volume from (Table-II) CT scan were recorded on admission. Other clinical and laboratory data were also collected from the history sheet and recorded in preformed data collection sheet. Follow-up was done for each patient during their admission period in the ward (if he/she was discharged after 30 days post ictus), at outpatient department or by structured questionare with the patient/relatives over telephone (if the patient was discharged before 30 days post ictus). Outcome at 30 days post-ictus was measured using GOS (Glasgow Outcome Scale)[9]. The patients were categorized on the basis of haematoma volume into two groups: <30 cc and ≥ 30 cc groups and on the basis of GOS into two categories- favourable (GOS 4 & 5) and unfavourable outcome (GOS 1 to 3). According to their ICH score patients were also divided into two groups- Lower Risk Group (ICH score=0 to 1) and Higher Risk Group (ICH scoe= 2 to 6) (Table-III)[8]. The volume of the haematoma was approximated (Figure-1) by 'Modified Ellipsoid Method' using the formula ABC/2; when A is the greatest haematoma diameter on CT scan, B the greatest diameter perpendicular to A and C the total number of slices of CT scan showing the haematoma, divided by slice thickness[10] in cm. 'IBM SPSS Statistics Version 20' (IBM Corp.) was used for data analysis. Spearman's Rank Correlation Coefficient (Spearman's rho) was used to see the relationship between variables (Table-IV). In this study, level of significance was found to be 1% (i.e. p value <0.01) (99% statistical significance).

Results

Table-I: Surgical outcome of patients in relation to presenting GCS

Presenting GCS	Surgical Outcome		χ2 value	P value
	Favourable	Unfavourable		
	(n=14)	(n=33)		
3-4	0(0)	2(6.1%)	10.848	0.004*
5-12	10(71.4%)	31(93.9%)		
13-15	4(28.6%)	0(0)		

Chi square test* significant at P<0.01

Above table shows that GCS has significant (P<0.01) effect on surgical outcome.

Table-II: Surgical outcome of patients in relation to volume of haematoma

Volume of Haematoma	Surgical Outcome		χ2 value	P value
	Favourable	Unfavourable		
	(n=14)	(n=33)		
<30cc	4(28.6%)	1(3.0%)	6.745	0.009*
≥30cc	10(71.4%)	32(97.0%)		

Chi square test* significant at P<0.01

Above table shows that effect of volume of haematoma was statistically significant (P<0.01) on surgical outcome.

Table-III: Distribution of patients by risk group in relation to GOS

Risk group	Surgical Outcome			p value
	ICH Score	Favourable (n=14)	Unfavourable (n=33)	
Low risk group	0-1	6(42.9%)	1(3.0%)	0.002*
High risk group	2-6	8(57.1%)	32(97.0%)	

Fisher's exact test* Significant at P<0.01

Above table shows the relationship between ICH score (risk group) and GOS was statistically significant (P<0.01).

Table-IV: Correlation with GOS

Independent variable	Dependable variable	r value	p value
Size of haematoma	GOS	-0.581	0.0001 *
GCS on admission	GOS	+0.403	0.005 †
ICH score	GOS	-0.481	0.001 †

Spearman's correlation coefficient (r) test *Significant at P<0.001, †Significant at P<0.01

In above table, size of haematoma showed negative (r = 0.581) and significant relationship (P<0.001), GCS on admission showed positive (r = +0.403) and significant relationship (P<0.01), ICH score showed negative (r = 0.481) and significant relationship (P<0.01) with GOS.
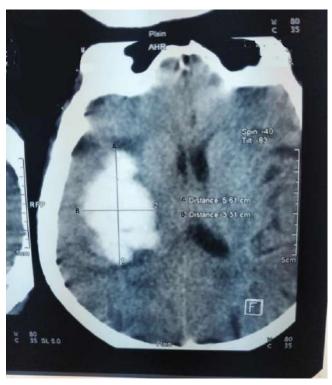

Figure-1: Measurement of haematoma volume from CT scan

Discussion

Spontaneous intracerebral haemorrhage (ICH) comprises 10-15% of all strokes and remains without a proven beneficial medical or

surgical treatment[11]. Although general guidelines exist to manage ICH, there remains great heterogeneity regarding the application of various surgical and medical therapies for ICH treatment[12]. A better understanding of prognosis and associated factors in ICH could reduce variability in clinical trials and in clinical management by allowing more effective targeting of therapies. To provide a simple clinical grading scale for ICH, the ICH score was developed, which is comprised of several factors associated with outcome. But it is very cumbersome to calculate ICH score at the bed-side in emergency setting. On the other hand, ICH volume can be calculated by any doctor/medical staff just by measuring the 3 diameters of haematoma from the CT scan. This study is intended to see the correlation between haematoma volume and early surgical outcome of spontaneous primary supratentorial intracerebral haemorrhage.

The age range was 25 to 83 years. The Mean (±SD) age was 58.2±11.8 years. The peak age incidence was 50-59 years (38.3%). In 2001, Hemphill et al found the mean age 66±15 years (range, 22 to 91 years) and 78% patients in their study had age < 80 years and 22% patients had age ≥ 80 years[8]. In this study, 8.5% patients had age ≥ 80 years. Age above or below 80 years was not found to have significant relationship with the surgical outcome of spontaneous primary supratentorial intracerebral haematomas (p=1.000). Possible reason was that number of patients ≥ 80 years was small and they presented by low GCS.

This study had male predominance. Out of 47 patients, 33(70.2%) were male and 14(29.8%) were female. The male female ratio was 1:0.42. GCS score is an important predictor of outcome in ICH patients. In 2001 Hemphill et al[8] found that 1 of 35(2.9%) patients with a presenting GCS score of 3 or 4 survived to 30 days and only 5 of 60(8.3%) patients with a presenting GCS score of 13 to l5 died, whereas 29 of 57(50.8%) patients with a GCS score of 5 to 12 died within 30 days. In this study, there were 2 patients presenting with GCS score of 3 to 4(4.3%) and all (100%) died. Among 41(87.2%) patients with a GCS score of 5 to 12 where 10 had favourable outcome and 31(93.9%) had unfavourable outcome. All 4(28.6%) patients with a GCS score of 13 to 15 had favourable outcome. GCS was found to have significant relationship (p<0.01) with the surgical outcome of spontaneous primary supratentorial intracerebral haematomas. Volume of haematoma is another very important factor in management of ICH patient. In this study the volume of haematoma ranged from 24 cc to 124 cc. Five (10.6%) patients had haematoma volume <30cc and 42(89.9%) patients had haematoma volume ≥ 30cc. Volume of the haematoma was found to have significant (p<0.01) relationship with the surgical outcome. In 2001, Hemphill et al[8] also found that volume of haematoma also had statistical significance (p=0.047). In this study, 2(4.3%), 5(10.6%), 36(76.6%), 3(6.4%), 1(2.1%) patients had ICH score 0, 1, 2, 3, 4 respectively. None of the patient in present study had

ICH scores 5 or 6. In 2002, Fernandes et al[13] found 88(22%), 97(25%), 116(30%), 74(19%), 17(4%), I(<I%) patients had ICH score 0, I, 2, 3, 4, and 5 respectively and none had score 6. In their study they had more patients with ICH score 0 and I than this study as they had good referral system than us, that's why they had good outcome compared to us.

In this study 14(29.8%) patients had favourable outcome and 33(70.2) patients had unfavourable outcome. Two (100%) patient of ICH score 0 and 4 patients out of 5(80%) of ICH score 1 were independent at their 30th post ictus day. In 2002, Fernandes et al[13] found that 70% patients of ICH score 0 and 30% of ICH score 1 were independent at their hospital discharge. We had better outcome as our sample size was smaller than Fernandes et al.

Limitations: The weakness of our study is the small sample size and short study period. Moreover in this study, there was no patient with thalamic ICH, who underwent operative treatment. Otherwise the outcome could have been little worse but more representative of the actual outcome of supratentorial ICH patients.

Conclusion

As the correlation between haematoma volume and early surgical outcome of patients with spontaneous primary supratentorial intracerebral haematomas was found statistically very significant, haematoma volume can be used with confidence in preoperative counselling for the purpose of predicting outcome in this group of patients.

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