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Clinical Effect of Hematoma Volume and Intracranial Haemorrhage Score on Outcome of Primary Spontaneous Intracranial Haemorrhage

[1]Dr. Aamir Ahmad Kant, [2]Dr Omar Farooq, [3]Dr. Samia Rashid

[1]PG Student, Medicine, [2]Associate Professor, Medicine, [3]Professor and Head, Medicine

Government Medical College, Srinagar

Corresponding Author: Dr Omar Farooq**,** Associate Professor Govt Medical College Srinagar J&K India

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Abstract

Background: Intracerebral hemorrhage (ICH) constitutes 10% to 15% of all strokes and has a higher risk of morbidity and mortality than cerebral infarction or subarachnoid hemorrhage (SAH). Intracranial haemorrhage (ICH) accounts for approximately 10% of all strokes, and about 35-45% of patients die within the first month. Incidence rates are particularly high in Asians blacks.

Objectives: To study the clinical effect of hematoma volume and ICH score in the outcome of ICH in terms of 30 day mortality.

Methods: The present observational study was carried out in the Postgraduate Department of Medicine, Government Medical College, Srinagar. All raw data was calculated and ICH score and hematoma volume was calculated. The ICH score is a simple clinical grading scale that allows risk stratification on presentation with ICH.

Results: The mean age of patients in our study was 68.3 years, there were 55.8% males and 44.2% females. Intraventricular extension was seen in 58.3%, supratentorial ICH in 78.5% patients and infratentorial ICH in 21.5% patients. 22.7% patients were observed to have ICH score 3, followed by 19.6% with ICH score 1, 18.4% with ICH score 0, 17.8% with ICH score 4, 17.2% with ICH score 2 and 4.3% patients with ICH score 5.

Conclusion: Improved standardization of clinical assessment with the use of a grading scale such as the ICH Score is likely to provide more consistency in clinical care and clinical research for ICH.

Introduction

Despite advances in the treatment of cerebral infarction and SAH, there remains no therapy of proven benefit in improving outcome after ICH[1]. Studies of surgical hematoma evacuation in ICH using a variety of methods have yielded either negative or inconclusive results[2-6]. Likewise, no medical treatment has been shown conclusively to benefit patients with ICH[7-10]. Hypertensive ICH usually results from spontaneous rupture of a small penetrating artery deep in the brain. The most common sites are the basal ganglian [especially the putamen], thalamus, cerebellum, and

pons. The small arteries in these areas seem most prone to hypertension-induced vascular injury[11].

Intracranial haemorrhage (ICH) generally presents as the abrupt onset of a focal neurologic deficit. Seizures are uncommon. Although clinical symptoms may be maximal at onset, commonly the focal deficit worsens over 30–90 min and is associated with a diminishing level of consciousness and signs of increased ICP such as headache and vomiting[11].

Patients should have routine blood chemistries and hematologic studies. Specific attention to the platelet count and PT/PTT/INR is important to identify coagulopathy. CT imaging reliably detects acute focal hemorrhages in the supratentorial space. Rarely very small pontine or medullary hemorrhages may not be well delineated because of motion and bone-induced artifact that obscure structures in the posterior fossa[11].

The ICH Score[11]

Age	< 80 Years	Score 0	≥ 80 years	Score 1		
Hematoma Volume	<30 cc	0	≥30 cc	1		
Intraventricular Hemorrhage Present	No	0	Yes	1		
Infratentorial Origin of Hemorrhage	No	0	Yes	1		
Glasgow Coma Scale Score	13-15	0	5-12	1	3–4	2

Clinical grading scales play an important role in the evaluation and management of patients with acute neurological disorders, especially traumatic brain injury and various types of stroke. Examples of widely used clinical grading scales include the GCS for traumatic brain injury (and other disorders), the Hunt-Hess and World Federation of Neurological Surgeons (WFNS) scales for aneurysmal SAH, the National Institutes of Health Stroke Scale (NIHSS) for ischemic stroke, and the Spetzler-Martin scale for arteriovenous malformations.[12-16] However, despite the common occurrence and high morbidity of ICH, there remains no widely used clinical grading scale for ICH.

Objectives

To study the clinical effect of hematoma volume and ICH score in the outcome of ICH in terms of 30 day mortality.

Material and Methods

After obtaining the ethical clearance from the Institutional Ethical Committee, the present observational study was carried out in the Postgraduate Department of Medicine, Government Medical College, Srinagar. It was conducted over a period of 18 months from December 2017 to February 2019.

Inclusion Criteria

1. Patients with age more than or equal to 18 years.
2. Patients with spontaneous ICH of non-traumatic origin detected on CT/MRI.

Exclusion Criteria

1 Patients less than 18 years.

2 Patients with history of trauma.

3 Patients with acute ischemic stroke.

All raw data was calculated and ICH score and hematoma volume was calculated. The ICH score is a simple clinical grading scale that allows risk stratification on presentation with ICH.

Total sum of each Score

ICH Score Total	% Mortality at 30 Days
0	0 (0- 13)
1	13 (4-29)
2	26 (11–46)
3	72 (53–86)
4	97 (82–100)
5	100 (54–100)

ICH Volume is measured by ABC/2 formula [Ellipsoid method], where A=longest diameter, B=diameter perpendicular to A, and C=number of slices multiplied by their thickness.

Statistical Methods

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as Mean±SD and categorical variables were summarized as frequencies and percentages. Graphically the data was presented by bar and pie diagrams. Chi-square test was employed for comparing 30-Day mortality with respect to various factors. For multivariate analysis of significant independent predictors of 30-Day mortality, logistic regression was applied. A P-value of less than 0.05 was considered statistically significant. All P-values were two tailed.

Results and Observations

The mean age of patients in our study was 68.3 years with youngest patients 45 years and eldest being 90 years. There were 55.8% male patients and 44.2% female patients. Hematoma volume of ≥30cc was found in 54.6% patients and 45.4% patients had <30cc hematoma volume. Presence of intraventricular extension was seen in 95 (58.3%) patients in our study. Supratentorial ICH was seen in 78.5% patients and infratentorial ICH in 21.5% patients. 22.7% patients were observed to have ICH score 3, followed by 19.6% with ICH score 1, 18.4% with ICH score 0, 17.8% with ICH score 4, 17.2% with ICH score 2 and 4.3% patients with ICH score 5. About half of patients (47.2%) were observed to have 30-day mortality in our study. Out of a total of 163 patients, 121 were aged <80 years in which 38.8% had 30-day mortality. Patients aged ≥80 years were 42 in our study and 30-day mortality was observed in 71.4%. When 30-day mortality was seen as per gender it was observed that 41 (45.1%) out of 91 males and 36 (50%) of the 76 females had 30-day mortality. When 30-day mortality was seen as per hematoma volume it was observed that 73% patients with hematoma volume of ≥30cc had 30-day mortality as compared to 16.2% patients with hematoma volume of <30cc. When 30-day mortality was seen as per presence of IVH it was observed that 68.4% patients with presence of IVH had 30 day mortality as compared to 17.6% patients who did not have presence of IVH. When 30-day mortality was seen as per site of ICH it was observed that 51.4% patients with infratentorial ICH site had 30 day mortality as compared to 46.1% patients whose site of ICH was supratentorial. When 30-day mortality was seen as per site of ICH score, it was observed that 100% patients with ICH score 5 had 30 day mortality followed by 96.6% patients with ICH score 4, 78.6% patients with ICH score 3, 28.6% patients with ICH score 2 and 5 (15.6%) patients with ICH score 1 had 30-day mortality. The 30 day mortality observed as per ICH

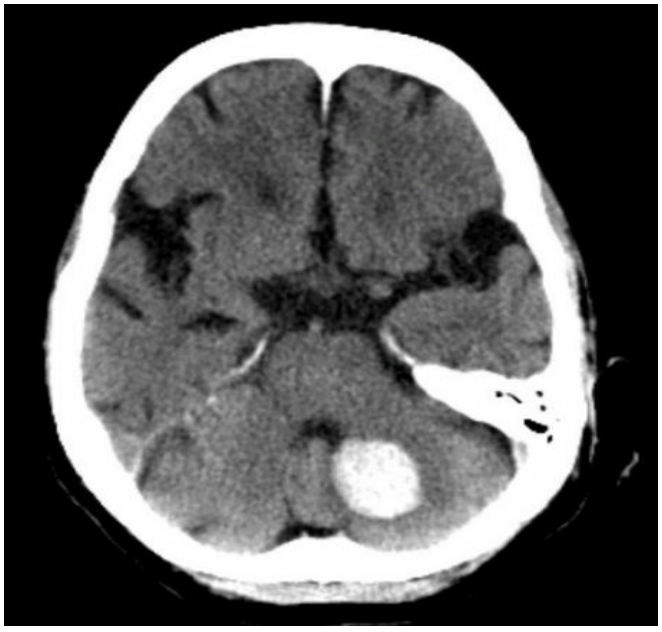
score in our study approximately correlated with the original JC Hemphil results.

Basic Data			
		Frequency	Percentage
Age (Years)	< 50	3	1.8
	50-59	12	7.4
	60-69	59	36.2
	70-79	47	28.8
	≥ 80	42	25.8
	Mean±SD 68.3±10.76		
Gender	Male	91	55.8
	Female	72	44.2
Hematoma Volume (cc)	< 30 cc	74	45.4
	≥ 30 cc	89	54.6
Presence of IVH	Yes	95	58.3
	No	68	41.7
Site of ICH	Supratentorial	128	78.5
	Infratentorial	35	21.5

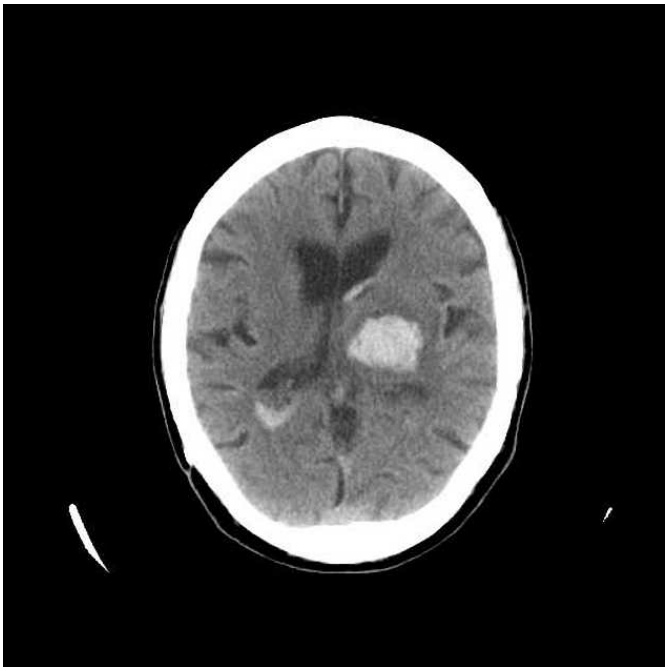
ICH and GCS Scoring			
Scoring		Frequency	Percentage
ICH Score	Score 0	30	18.4
	Score 1	32	19.6
	Score 2	28	17.2
	Score 3	37	22.7
	Score 4	29	17.8
	Score 5	7	4.3
GCS Score	3-4	4	2.5
	5-12	82	50.3
	13-15	77	47.2

30-day mortality of study patients		
Mortality	Frequency	Percentage
Yes	77	47.2
No	86	52.8
Total	163	100

30-day mortality as per various parameters					
		N	30 Day Mortality		P-value
			No.	%age	
Age (Years)	< 80	121	47	38.8	0.003*
	≥ 80	42	30	71.4	
Gender	Male	91	41	45.1	0.531
	Female	72	36	50.0	
Hematoma Volume (cc)	< 30 cc	74	12	16.2	<0.001*
	≥ 30 cc	89	65	73.0	
Presence of IVH	Yes	95	65	68.4	<0.001*
	No	68	12	17.6	
Site of ICH	Supratentorial	128	59	46.1	0.576
	Infratentorial	35	18	51.4	
ICH Score	Score 0	30	0	0.0	<0.001*
	Score 1	32	5	15.6	
	Score 2	28	8	28.6	
	Score 3	37	29	78.4	
	Score 4	29	28	96.6	
	Score 5	7	7	100	



Left Cerebellar Hemisphere Bleed



Left basal ganglia bleed with IV extension.

Discussion

In our study a total of 163 patients were studied in which 59 (36.2%) belonged to age group of 60-69 years followed by 47 (28.8%) patients who belonged to 70-79 years of age, 42 (25.8%) patients were aged ≥80 years, 12 (7.4%) were aged 50-59 years while as only 3 (1.8%) patients were aged <50 years. The mean age of patients in our study was 68.3 years with youngest patients 45 years and eldest being 90 years. Our results are comparable with the findings of **Ojha P et al (2019)**[17] who studied a total of 120 patients with mean age of 66.9 years. Mean age at ICH was 66 years (range, 22 to 91 years) in a study done by **Hemphill JC et al (2001)**[18]. There were 91 (55.8%) male patients in our study as compared to 72 (44.2%) female patients. Our study observations are confirmed by a study done by **Hemphill JC et al (2001)**[18] in which 53% were male patients and 47% were female patients. **Ahmed F et al (2016)**[19] conducted a study in which 52 (54.17%) patients were male and 44 (45.83%) were female patients. When patients were distributed as per hematoma volume, it was found that 89 (54.6%) patients were having ≥30cc hematoma volume while as 74 (45.4%) patients were having <30cc hematoma volume. Presence of intraventricular extension was seen in 95 (58.3%) patients in our study. Site of ICH was supratentorial in majority of patients i.e. 128 (78.5%) and infratentorial site was observed in 35 (21.5%) patients. Our results are comparable with the observations of **Hemphill JC et al (2001)**[18] where site of ICH was supratentorial in 122 (80%) out of which 52 (43%) had 30-day mortality. Infratentorial lesion was found in 30 (20%) of patients in our study in which 16 (53%) had 30-day mortality. **Ojha P et al (2019)**[17] studied 120 patients of ICH in which infratentorial lesion were seen in 108 patients and 12 supratenorial.

Patients were distributed as per ICH score and 37 (22.7%) patients were observed to have score 3, 32 (19.6%) had score 1, 30 (18.4%) had score 0, 29 (17.8%) had score 4, 28 (17.2%) had score 2 and 7 (4.3%) patients had ICH score 5. Out of a total of 163 patients studied, 82 (50.3%) patients had GCS score of 5-12 followed by 13-15 GCS score in 77 (47.2%) patients and 4 (2.5%) patients were observed to have GCS score of 3-4. **Hemphill JC et al (2001)**[18] conducted a retrospective review of medical records of patients with non-traumatic ICH treated at the University of California, San Francisco (UCSF). The GCS was divided into 3 subgroups (GCS scores of 3 to 4, 5 to 12, and 13 to 15) to more accurately reflect the very strong influence of GCS score on outcome. Of note, in the UCSF ICH cohort, only 1 of 35 patients with a presenting GCS score of 3 or 4 survived to 30 days, and only 5 of 60 patients with a presenting GCS score of 13 to 15 died, whereas 29 of 57 patients with a GCS score of 5 to 12 died within 30 days. Thirty-day mortality rates for patients with ICH Scores of 1, 2, 3,

and 4 were 13%, 26%, 72%, and 97%, respectively. No patient in the UCSF ICH cohort had an ICH Score of 6 because no patient with an infratentorial ICH had a hematoma volume 30 cm3. **Ojha P et al (2019)**[17] prospectively evaluated the predictive utility of ICH score in patients presenting with Acute ICH on discharge, 30 days and 60 days follow-up period. In their study 72 patients survived and 48 expired. Of these 72 survived patients mean GCS score was 13.5 and of the 48 patients who expired mean GCS score was 4.5. Mean ICH score in patients who survived and those who expired were 1.1 and 3.3, respectively. As observed in previous studies, mean ICH and ICH scores were significantly higher in patients who died in their present cohort. The mortality rates observed with individual ICH scores were as follows: 0 (16.7%), 1 (0%), 2 (30%), 3 (57.2%), 4 (62.5%), 5 (100%) and 6 (100%).

In a study, **Lisk et al,**[12] concluded that the most important predictors of prognosis in these patients were bleeding volume, age, ventricular expansion, and patient's GCS. In another study, **Juvela**[13] reported factors including low GCS, hypertension, smoking, intraventricular hemorrhage, surgery, cerebral hematoma, age, and the amount of alcohol consumed in a week prior to hemorrhage as the most important predictors. **Fric-Shamji, et al,**[14] found no relationship between the volume of primary ICH and mortality, while other studies such as the present one showed a relationship between the volume of primary ICH and the spread of hemorrhage to cerebral ventricles with outcome in patients with ICH; mortality rate was related to volume of hemorrhage or ventricular hemorrhage as well.[15-16,18]

About half of patients (77, 47.2%) were observed to have 30-day mortality in our study. Out of a total of 163 patients, 121 were aged <80 years in which 47 (38.8%) had 30-day mortality. Patients aged ≥80 years 42 in our study and 30-day mortality was observed in 30 (71.4%) of them. When 30-day mortality was seen as per gender it was observed that 41 (45.1%) out of 91 males and 36 (50%) of the 76 females had 30-day mortality. When 30-day mortality was seen as per hematoma volume it was observed that 73% patients with hematoma volume of ≥30cc had 30-day mortality as compared to 16.2% patients with hematoma volume of <30cc. When 30-day mortality was seen as per presence of IVH it was observed that 68.4% patients with presence of IVH had 30 day mortality as compared to 17.6% patients who did not have presence of IVH. When 30-day mortality was seen as per site of ICH it was observed that 51.4% patients with infratentorial ICH site had 30 day mortality as compared to 46.1% patients whose site of ICH was supratentorial. When 30-day mortality was seen as per site of ICH score, it was observed that 100% patients with ICH score 5 had 30 day mortality followed by 96.6% patients with ICH score 4, 78.6% patients with ICH score 3, 28.6% patients with ICH score 2 and 5 (15.6%) patients with ICH score 1 had 30-day mortality.

The 30-day mortality from ICH in various studies has been found to vary from 35 to 52%, with one-half of these deaths occurring within the first 2 days.[14-16] In a study conducted by Rohit Bhatia et al, the in-hospital mortality was found to be 32.7%.13 In our study, 48 (40%) patients died during hospitalisation. The ICH score is the most commonly used clinical grading scale in predicting the 30-day mortality as well as the short-term and long-term functional outcome of ICH[15,16,18,20-23]. Currently, it has been widely recognized by the academic community as a useful prognostic evaluation

scale[4,24]. Many revisions of the ICH score have been developed by investigators worldwide to try to improve the accuracy of the model. Among them, ICH-GS received more attention for its better accuracy in predicting the in-hospital and 30-day mortality as well as the 30-day favorable prognosis in patients with primary ICH[4]. The ICH score and ICH-GS score are easy to use and can be steadily obtained during the patient's first visit at most modern medical facilities[4].

Conclusion

Improved standardization of clinical assessment with the use of a grading scale such as the ICH Score is likely to provide more consistency in clinical care and clinical research for ICH, just as similar assessment scales have provided consistency in traumatic brain injury, aneurysmal SAH, and ischemic stroke. This in turn could provide an important step in developing new treatments for ICH, a disease with no current treatment of proven benefit.

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