Original Article

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Correlation of Intracerebral Hemorrhage Score and 30-Day Mortality in Hemorrhagic Stroke

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Abstract

Background: Hemorrhagic Stroke (HS) is a devastating subtype of stroke with high mortality. The Intracerebral Hemorrhage Score (ICH Score) is a globally accepted prognostic tool for predicting 30-day mortality. To determine correlation between ICH Score and 30-day mortality in patients with HS at Neurosurgery Department of a tertiary hospital in Bangladesh.

Materials and methods: A prospective observational study was conducted over 18 months, enrolling 288 adults with HS. The ICH Score was calculated at the time of admission. Patients were followed-up at 30-day by Glasgow Outcome Scale (GOS). Spearman's correlation analysis was performed to determine correlation between ICH score and 30-day mortality.

Results: The patients mean age was 59.6 years and 27 (9.5%) underwent surgical intervention. 30-day mortality rate was 42.25%. Strong positive correlation of ICH score was found with 30-day mortality (rho=0.984) and negative correlation was found with GOS score at 30-day (rho= -0.583). Mortality escalated with higher scores: 2.9% (Score 0), 27.1% (Score 1), 33.7% (Score 2), 72.9% (Score 3), 89.5% (Score 4) and 100% (Scores 5).

Conclusions: TheICH score had positive correlation with 30-day mortality and acceptable in predicting 30-day mortality in HS.

Keywords: Hemorrhagic stroke; ICH Score; 30-day mortality.

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Introduction

Hemorrhagic Stroke (HS) is a major contributor to global mortality and long-term disability. Over the past 30 years, the worldwide incidence of hemorrhagic stroke has risen significantly, Low and Middle Income Countries (LMICs) like Bangladesh bearing this burden. This affects physical, emotional and socioeconomic condition of stroke survivors, their families and healthcare systems.[1-3] The case fatality rate for hemorrhagic stroke is 25% to 30% in High Income Countries (HICs) while it is 30% to 48% in LMICs, with survivors often facing severe neurological deficits.[4]

The 30-day mortality rate of hemorrhagic stroke was 22.11% in a study from Bangladesh, 30-day mortality rate of hemorrhagic stroke was 44% in another study from Bangladesh and a study conducted in United states found that the 30-day mortality rate for hemorrhagic stroke was approximately 36%.[5-7] These variations in the mortality rates are attributable to factors such as the severity of the stroke, the patient's age and the quality of medical care available.[4]

Due to poor outcomes associated with hemorrhagic stroke, clinicians must balance medical and ethical factors when shaping treatment strategies. Prognostication in acute hemorrhagic stroke plays a vital role in guiding clinical decisions, optimizing resource allocation and facilitating communication with patients and families about prognosis and care. This Prognostication is needed timely for accurate medical interventions.[8]

The Intracerebral Hemorrhage (ICH) Score, a validated clinical-radiological grading system, developed based on factors like Glasgow Coma Scale (GCS) score, hematoma volume, ventricular extension of hemorrhage, location of origin of hemorrhage and age.[9] The ICH score ranges between 0-6. In the original validation study, no

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patient with an ICH Score of 0 died, whereas all patients with an ICH Score of 5 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. There were no patient with ICH scores 6.[9] Globally, ICH score has been widely adopted to predict 30-day mortality.[7,10,11] However, its applicability in diverse healthcare settings particularly in low resource environments remains understudied.[5,12]

Chittagong Medical College Hospital (CMCH) the second largest tertiary level hospital in Bangladesh, serves a population of over 30 million in the Chittagong Division. Despite its critical role, CMCH combat with resource limitation, delayed patient presentation, overcrowding, limited neurocritical care infrastructure and socioeconomic barriers to post discharge follow-up. A prior Bangladeshi study validated the ICH Score's utility in Chattogram, but did not specifically assess its correlation with 30-day mortality. Existing studies in similar settings highlight discrepancies in prognostic accuracy due to variations in patient populations and healthcare delivery.[5-6]

The present study was conducted to guide clinicians in resource poor settings like CMCH in optimizing acute HS management and provide a foundation for future research on context specific prognostic models in Bangladesh.

Materials and methods

This was a descriptive type of prospective observational study conducted at the department of Neurosurgery, Chittagong Medical College Hospital, Chattogram, Bangladesh, during the period from September 2023 to February 2025.
Patients admitted to the Department of Neurosurgery of CMCH with a diagnosis of hemorrhagic stroke during the study period, with consecutive sampling.

Inclusion criteria:

- Patients with a CT evidence of spontaneous hemorrhagic stroke.
- Age> 18 years.

Exclusion criteria:

- Patients with SAH, aneurysmal hematomas, and vascular malformations.
- Patients having hemorrhagic stroke secondary to a brain tumor, trauma.
- Patients having hemorrhagic transformation of a cerebral infarct.
- Patients having other comorbid fatal conditions like end-stage renal disease, ischemic heart disease, malignancy, chronic liver disease and sepsis.
- Patient having history previous hemorrhagic stroke.

Prior approval was taken befoe commence the study (Approval letter no-59.27.0000.013. 19.PG.009.2024/1046 dt. 08.01.2024).

Results

A total of 299 patients were screened, and 288 were found to fulfill the study's eligibility criteria. Four patients were lost to follow-up and the remaining 284 patients were included in the final analysis. The present study's results and observations are described in the following tables and charts.

Table I Distribution of patients by their demographic, clinical, radiological findings and therapeutic measures (n=284)

Characteristics	Mean ±SD or n (%) or Median (Range)
Age	59.6 ± 14.6
Gender	
Male	146 (51.4)
Female	138 (48.6)
GCS	9.8 ± 3.2
Hematoma volume, ml	26.8 (0.90-117.00)
Location of hematoma	
Supratentorial	266 (93.7)
Infratentorial	18 (6.3)
Ventricular extension	144 (50.7)
Treatment	
Conservative	257 (90.5)
Surgical	27 (9.5)

In this cohort of 284 patients with ICH, the median ICH score was 2 (range 0-5). ICH score of 2 was the most frequent (101/284, 35.56%) followed by score 3 (70/284, 24.65%) score 1 (59/284, 20.77%) score 0 (34/284, 11.97%), score 4 (19/284, 6.69%) and score 5 (1/284, 0.35%) (Figure 1).

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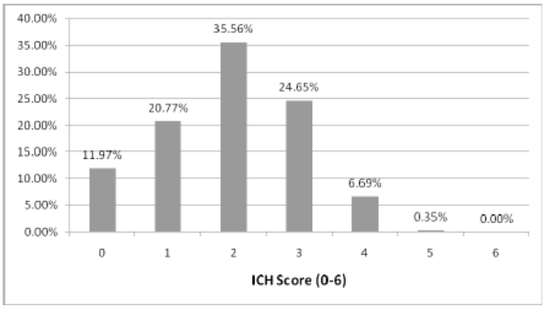

Figure 1 Distribution of the patients by their ICH score score (n=284)

Out of 284 analyzed patients with hemorrhagic stroke, 164 (57.75%) survived at least 30 days post ictus and 30-day mortality rate was 42.25% (Figure 2).

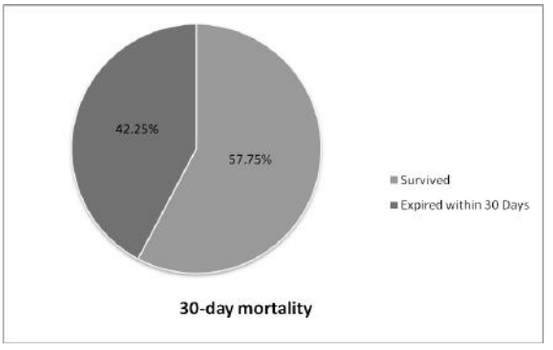

Figure 2 Distribution of the patients based on their 30-day mortality

At 30 days post-ictus, out of 284 patients, 25 (8.8%) had a GOS score of 5 (Indicating good recovery) and 70 (24.65%) had a GOS score of 4 indicating recovery with moderate disability. Other than 120 (42.25%) patients who expired (GOS score 1) before the 30-day follow-up, another 69 (24.3%) patients were found to have a GOS score of 3 (severe disability), No patient was found with GOS score 2 (Figure 3).

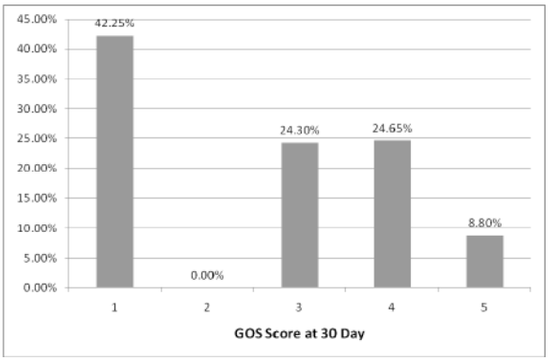

Figure 3 Distribution of the patients based on their 30-day GOS score

Table II shows that 30-day mortality increases in accordance with increases in the ICH score's values. Only one patient with an ICH Score of 0 died (2.9%) whereas 27.1%, 33.7%, 72.9%, 89.5% and 100% of the patients expired with ICH scores of 1, 2, 3, 4 and 5 respectively.

Table II 30-days mortality rate for the entire cohort of 284 patients with hemorrhagic stroke and stratified by ICH Score

ICH score	N	Mortality rate at 30 day, n (%)
0	34	1 (2.9)
1	59	16 (27.1)
2	101	34 (33.7)
3	70	51 (72.9)
4	19	17 (89.5)
5	1	1 (100)
Entire cohort	284	120 (42.3)

Table III Shows that age ≥80 years, Low GCS on admission, Hematoma volume ≥30ml, presence of ventricular extension of hemorrhage was responsible for significantly higher 30-day mortality. Infratentorial hemorrhage was responsible for higher mortality than supratentorial hemorrhage. But is statically not significant because p value >0.05.

Table III Association between variables of ICH score and 30-day mortality

Variables		30-day mortality		
	Number of patients	Survived (n=164)	Dead n=120	p value
Age				
<80 years	252	155 (61.5)	97 (38.5)	0.001*
≥80 years	32	9 (28.1)	23 (71.9)	
GCS				
3-4	15	0 (0)	15 (100)	
5-12	197	99 (50.3)	98 (49.7)	<0.001*
13-15	72	65 (90.3)	7 (9.7)	
Volume of				
<30ml	151	106 (70.2)	45 (29.8)	<0.001*
≥30ml	133	58 (43.6)	75 (56.4)	
Location				
Supratentorial	266	157 (59.0)	109 (41.0)	0.094*
Infratentorial	18	7 (38.9)	11 (61.1)	
IVH				
Absent	140	97 (69.3)	43 (30.7)	<0.001*
Present	144	67 (46.5)	77 (53.5)	

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Discussion

Hemorrhagic stroke is severe burden for Low and Middle Income Countries (LMIC) compared to High Income Countries (HIC). As the most lethal form of acute stroke, hemorrhagic stroke is characterized by high mortality and morbidity, with minimal improvement in outcomes over recent decades. Despite advancements in stroke care, therapeutic options for hemorrhagic stroke remain limited.[13] The present study examined the correlation between ICH score and 30-day mortality in hemorrhagic stroke admitted to a tertiary-level hospital in Bangladesh. This study reveals the ICH Score as a good predictor of 30-day mortality in hemorrhagic stroke patients at CMCH, aligning with global and regional evidence.[10]

The pattern and demography of hemorrhagic stroke in Bangladesh is different from the western world but quite similar to our neighboring country India. The mean age of the patients in the present study was 59.6 years, which is predominantly younger in comparison to the western population where the mean age was 70–79 years.[9,14,15] However, most of the available studies from Bangladesh and India report mean ages of 55-65 years.[5,6,16-19] Only 32 patients out of 284 (11.26%) were equal or above the age of 80 in the present study. The World Health Organization report states that the average life expectancy of an Bangladeshi at birth is 73.1 years.[20] Thus most of the present study population fails to live beyond the age of 80. This was evident from observation that only one patient in this study had ICH score of 5.

In the present study male to female representation was almost equal (51.4% versus 48.6%). Several other studies also observed such non-significant gender differences.[11,21]

The 30 day mortality of patients with hemorrhagic stroke has been reported as ranging from 22.1% to 52%.[5,6,17-19,22] The high mortality rate (42.25%) in the present study mirrors trends in low-resource settings.

Concerning the 30-day functional outcome 8.8% had good recovery and 24.65% had recovery with moderate disability. In a meta analysis, Van Asch et al. presented a functional outcome with independency rates of between 12% and 39% corresponding to the findings of present study.[23] Present study results agreed with the studies of Bhatia et al. and Hegde et al. where most of the survivors were disabled at the time of discharge and at the 30-day follow-up[18,22].

The primary objective of the present study was to determine the correlation between ICH score and 30-day mortality, Spearman's correlation coefficient (r) = 0.984, indicating a strong positive correlation between ICH score and 30-day mortality. Present study results agreed with the study of Safatli et al. where the correlation coefficient between ICH score and 30-day mortality was 0.986.[21] The strong correlation between ICH Scores and 30-day mortality supports its utility in triaging high-risk patients for aggressive monitoring or palliative care at CMCH.

In this study it was evident that each increase in the ICH Score was associated with a progressive increase in 30-day mortality. 30 days mortality rates for ICH score of 0,1,2,3,4 and 5 was 2.9%, 27.1%, 33.7%, 72.9%, 89.5%, 100% respectively. In this study the relation between ICH score and 30-day outcome of hemorrhagic stroke patients was found highly significant ($p<0.001$) and they had inverse relation with GOS score. Different studies have found 30 days mortality rates for ICH score of 0,1,2,3, and 4 to be ranging from 0%-17%, 2.9% – 19.4%, 22% - 32.4%, 61.1% - 80.0% and 68% - 100% respectively.[9,12,21] Present study revealed higher mortality rates for mid-range scores (Scores 1–2) than reported in high-income countries reflecting systemic challenges such as overcrowding, scarcity of neuro ICU, inadequate neuro rehabilitation and delayed arrival for hospital admission.[9,21]

The Hemphill ICH Score has been validated numerous times, with a pooled area under a ROC curve of 0.80 in an international meta analysis.[24] In the present study the areas under ROC curve for the original ICH score was 0.779.

In the present study, the GCS score was found strong 30-day mortality predictor of hemorrhagic stroke. For admission GCS 3-4 mortality rate was 100%, GCS 5-12 mortality rate 49.7%, GCS 13-15 mortality rate was 9.7%. In this study all patients with GCS 6 and below (n=40) died within 30 days. Previous study showed GCS alone a good outcome predictor of hemorrhagic stroke, AUC 0.874.[14]

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Volume of ICH is a powerful predictor of 30-day mortality in patients with hemorrhagic stroke. In the original ICH score, ICH volume cut-off level was 30 ml. In the present study 30-day mortality was 56.4% having hematoma volume ≥30 ml Vs. 29.8% for volume <30 ml, p value <0.001. In a previous study from Bangladesh 100% of the patients with hemorrhagic stroke with >60ml of ICH volume expired within 30-days of ictus.[25]

Ventricular extension of hemorrhage is an independent predictor of 30-Day mortality in hemorrhagic stroke. In this study 30- day mortality rate was 53.5% who had ventricular extension of Hemorrhage vs. 30.7% where ventricular extension absent. Previous study by Al Mamun et al. found 61.17% mortality in ventricular extension group vs. 21.65% in without ventricular extension group.[16]

The ICH Score is a vital tool for triage and prognostication in Bangladeshi population. Its strong correlation with mortality supports its integration into clinical workflows at CMCH and similar institutions, enabling risk-based resource allocation and palliative counseling.

Limitations

- Patients were selected from a single center and it is only generalizable to those who came to receive hospital care.
- For all critical patients, providing neuro-critical care support was not possibledue to limited ICU in CMCH.
- Post discharge care access and post discharge medication adherence were notassessed.

Conclusion

In conclusion, the present study has demonstrated that the ICH score is a strong prognostic indicator of 30-days mortality in hemorrhagic stroke patients. Higher ICH Scores correlate strongly with higher 30-day mortality. However, the disproportionate mortality burden among patients with mid-range scores underscores the impact of management limitations such as delayed care, inadequate neuro-critical and neuro-rehabilitation infrastructure.

Recommendation

These findings advocate for the integration of the ICH Score into hospital triage protocols. These findings indicate neuro-critical care support all for salvageable patients (Scores 1–2). Palliative care for high risk cases that managed conservatively and quick surgical intervention in indicated patient (Scores 3). Palliative care for extreme high risk cases (Score 4 and more). Multi-center studies are required to validate the ICH Score across diverse Bangladeshi populations, including surgical cohorts.

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Contribution of authors

MA-Conception, design, acquisition of data, data analysis, data interpretation, drafting & final approval.

MIH-Conception, design, data analysis, drafting, critical revision & final approval.

SMM-Conception, design, acquisition of data, drafting, critical revision & final approval.

MSA-Design, data interpretation, drafting & final approval.

MS-Conception, data analysis, data interpretation, critical revision & final approval.

MO-Acquisition of data, data analysis, drafting & final approval.

OF-Acquisition of data, data interpretation & final approval.

MRK-Conception, data analysis, critical revision & final approval.

AHMTR-Design, acquisition of data, data analysis & final approval.

Disclosure

All the authors declared no conflict of interest.

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