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Assessment of prognostic ability of intracerebral hemorrhage score with special reference to a tribal population

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ABSTRACT

Background: Stroke is the second leading cause of death worldwide. Intracerebral hemorrhage (ICH) accounts for 10% of all strokes, and about 35–45% of patients die within the 1st month. The scarcity of robust data on the validity and utility of the ICH score on the Indian population in a resource-poor health facility is a compelling factor for more study in this field, especially among the tribal population in this region. ICH score is a simple, easy-to-calculate prognostic indicator of hemorrhagic score. **Aims and Objectives:** The aim of this study is to estimate the prognostic significance of ICH score (both modified and the original) in hemorrhagic stroke in terms of mortality and morbidity and to analyze associated risk factors like mortality, morbidity, and motor recovery of hemorrhagic stroke in tribal and non-tribal population. **Materials and Methods:** The study was institution-based observational and prospective study of 120 new-onset hemorrhagic stroke cases diagnosed by clinical and radiological evaluation admitted in this medical college during the period of study. Along with history, clinical examination and CT scan brain guided ICH scoring is done, follow-up at the end of 1 week and at the 5th week including physical performance assessment and reviewing of records and certificates. $P<0.05$ was considered statistically significant. **Results:** The patients with modified ICH score 0 had 100% improvement whereas the improvement was seen in 54.84% of patients with scores 1 and 2. A total 50% of patients with scores 3 and 4 improved significantly. The incidence of hypertension was more in non-tribal population (70.45%) than total tribal population (56.25%) of study and Compared to non-tribal population (23.86%), tribals had more history of addiction (40.63%). **Conclusion:** Both the ICH Scores, modified and the original, were practical and valid predicting mortality in our setup. However, the modified one was more accurate and pragmatic in our study.

Key words: Intracerebral hemorrhage; Intracerebral haemorrhage score; Prognostic marker; Tribal and non-tribal groups

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INTRODUCTION

Intracerebral hemorrhage (ICH) is a major cause of death and disability, with an incidence rate of 24.6/100,000 person-years and a fatality rate of 40%.[1] Population-based studies show that most patients present with small ICHs that are readily survivable with good medical care.[2] Hypertension, coagulopathy, sympathomimetic drugs (cocaine, methamphetamine), and cerebral amyloid angiopathy cause most of these hemorrhages. As remarked earlier, it is of the hematoma, not simply its size that determines the clinical effects.[3] A clot 60 mL in volume is almost uniformly fatal if situated in the basal ganglia but may allow reasonably good outcome if located in the frontal or occipital lobe,[4] even small hemorrhages in the brainstem or cerebellum may have catastrophic consequences, making location, not size, and the more important predictor for infra-tentorial ICH. Hematoma

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shape was classified by Fujii et al., as either irregular or separated or round. Irregularly shaped hematomas have been associated with an increased risk of expansion during the first location 24 h of onset.[5] Perihematomal edema is also an independent prognostic factor for the death or dependency of ICH patients. Usually, the hematoma enlarges in 3–12 h but edema peaks initially at day 4–5, remains gradually elevated until day 14, then decreases.[6]

Several scoring systems that are intended to predict prognosis have been devised and validated. The ICH score grades ICH severity and subsequent 30-day mortality, thus helping to guide goals of care conversations with patients' families. This score is often used in conjunction with the functional outcome risk stratification scale (the FUNC score), which indicates the likelihood of a patient's functional independence 90 days after ICH.[7] The "ICH score" devised by Hemphill et al., uses GCS, volume, presence of intraventricular hemorrhage, the location—supra- or infra-tentorial, and age above or below 80 years. A score of 5 related well with a mortality of 100% and a score 0 with 0% mortality. Subsequent validity studies placed the ICH Score on solid standpoint.[8] Hegde and Menon conducted a study about the need of modification of ICH Score for the Indian sub-continent[9] and they propose a minor modification in the ICH score by reducing the age criteria by 10 years to prognosticate the disease better in our population." So a revised ICH scoring prefers the age limit of 70 years, instead of the original limit of 80 years to allot a score of 1. The score was 0–6, but only exceptional patients will have the maximal score of 6 from an infra-tentorial ICH plus an ICH volume 30 mL. In the article by Hemphill et al., 30-day mortality rates were 0%, 13%, 26%, 72%, 97%, and 100% for an original ICH Score of 0, 1, 2, 3, 4, and 5, respectively.[9] The management of ICH is largely supportive, with strategies aimed at the limitation of further brain injury and the prevention of associated complications, which add further detrimental effects to an already lethal disease and jeopardize clinical outcomes.[10]

Aims and objectives

1. To estimate prognostic ability (modified and the original ICH Score) of short-term outcome of hemorrhagic stroke in terms of mortality and morbidity
2. To analyze the risk factors associated with short-term outcomes in terms of mortality, morbidity, and motor recovery of hemorrhagic stroke between tribal and non-tribal population.

MATERIALS AND METHODS

This study was conducted at medicine ward and OPD of the Department of General Medicine of Bankura Sammilani Medical College and Hospital (catering districts of Bankura, Purulia, Birbhum, Burdwan, and West Midnapore) after getting due permission from the Institutional Ethics Committee (BSMC/Aca/08) and approval of The West Bengal University of Health Sciences. It was an institution-based observational and prospective study and study period was 18 months, from February 2018 to July 2019. The study was conducted on 60 males and an equal number of females (total cases 120) subjects admitted with hemorrhagic stroke to the medicine ward. A total of 88 non-tribal and 32 tribal subjects were selected for this study. The criterion followed for specification of tribal subjects are (i) group of people not yet exposed to or used to modern practices contemporarily prevalent (ii) distinctive culture, (iii) geographical isolation, (iv) shyness of contact with the community at large, and (v) backwardness. Non-tribal as in the present study refers to those patients which do not belong to any tribe or match any above criteria. This criterion is not spelt out in the Constitution but has become well established. All cases were diagnosed by clinical history and radiological evaluation.

Inclusion criteria

Inclusion criteria were new onset hemorrhagic stroke diagnosed by clinical and radiological evaluation admitted in this medical college during the study.

Exclusion criteria

There were some exclusion criteria like, patients with – (1) Unwilling patients/relatives History of psychiatric illness, (2) Hemorrhagic conversion of infarction, (3) Previous history of fracture or amputation, (4) Past history of any neurological disorder with residual deficit.

Proper written informed consent from each patient or his/her next to kin was asked after explaining the study procedure in their own language before study. We started the data collection once the synopsis was approved and completed the data collection and analysis within the stipulated time. Clinical examination and CT scan brain-guided ICH scoring was done. Following up at the end of 1 week and the 5th week including physical performance assessment and reviewing of records and certificates.

RESULTS

All variables used for outcome model development were abstracted from data available at the time of initial ICH evaluation as shown in Table 1.

A score of 5–6 related well with a mortality of 100% and a score 0 with 0% mortality. Subsequent validity studies placed the ICH Score on a solid standpoint.

The outcome was assessed as mortality after 30 days, for patients in whom 30-day outcome was not available from medical records (n31), Internet-based mortality records (California Death Records; Social Security Death Index) were searched. Patients who were alive at hospital discharge and did not have a recorded date of death in any of these records were assumed to have been alive at 30 days after ICH.

For analyses, overall frequencies or mean SD values of specific parameters (as appropriate) were compared by statistics for dichotomous variables. GCS, ICH volume, serum glucose level, and pulse pressure were considered continuous variables, with sex, site of ICH, presumed cause, and IVH as categorical variables. Because age was only associated with outcome for patients aged 80 years (patients aged 80, P0.41), age was considered a dichotomous categorical variable with a cut point at 80 years. Student's t-test was used to compare continuous variables, and the Wilcoxon rank sum test was used for categorical variables.

The parametric data were analyzed using unpaired t-test or Mann Whitney U-test (as applicable) and the non-parametric data were analyzed using Chi-square test. SPSS for Windows version 16.1 was used for statistical analysis and $P<0.05$ was considered statistically significant. Graph pad prism software and Microsoft Office were used for drawing the graph.

Out of 120 subjects, male and female sexes are equally distributed. The number of subjects of tribal origin is 32, which is 27.67% of the total study population. The original ICH Score includes a scoring for subjects with age more than 80 years and the number of such subjects in our study population is 11 which is roughly 9.17% of the total population. However, as per the requirement of modified ICH Score, the number of subjects with age more than 70 years is 40, which is 1/3rd of the total study population (Table 2).

We have studied common risk factors and in comparison with non-tribal population (70%) only 56% of total tribal population had a history of hypertension whereas only 9.38% of tribal subjects had a history of diabetes. Only 5.83% of the total study population had a history of stroke in the past. The tribal and non-tribal population had almost similar frequency. Compared to the non-tribal population (23.86%), tribals had more history of addiction (40.63%). Overall 15.83% of study subjects had a history of taking anti-platelet medication. Only 2 of such subjects were tribal. Only 2 (one tribal and another non-tribal) subjects were taking anti-coagulation drugs regularly. The presence of comorbidities was also analyzed and the distribution is almost similar for tribal and non-tribal populations.

The comparative numbers of patients who had a history of hypertension versus those who had hypertension at admission were also studied (Figure 1 and Table 3).

Our study shows various ICH Score (Original) groups and their outcome in terms of mortality after admission. A score 5/6 had a mortality outcome of 100%, whereas

Table 1: The ICH score

Component	ICH score points
GCS score	
3–4	2
5–12	1
13–15	0
ICH volume in cm^3	
≥30	1
<30	0
Intra ventricular hemorrhage	
Yes	1
No	0
Infratentorial origin of ICH	
Yes	1
No	0
Age in years	
≥80	1
<80	0
The total score is 0–6	

ICH: Intracerebral hemorrhage

Table 2: Distribution of study population (As required for Modified ICH score)

Age distribution	Age group (in years)		Grand total
	<70	≥70	
Male	43	17	60
Female	37	23	60
Grand total	80	40	120
Distribution of study population (as required for original ICH score)			
	<80	≥80	
Male	56	4	60
Female	53	7	60
Grand total	109	11	120

ICH: Intracerebral hemorrhage

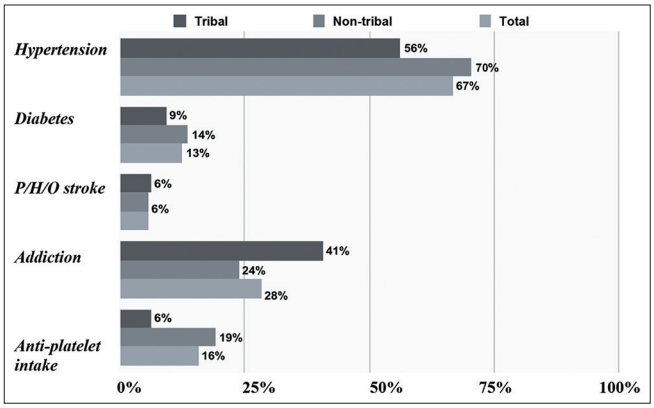

Figure 1: Presence of common risk factors in % of respective population

Table 3: Presence of hypertension at admission versus history of hypertension

Presence of hypertension at admission			Grand total	Patients with H/O hypertension		
Type of population	Hypertension at admission	Non-hypertensive at admission		H/O hypertension	Percentage of patients had hypertension at admission	Percentage of patients had H/O hypertension
Non-tribal	69	19	88	62	78.41	70.45
Tribal	25	7	32	18	78.13	56.25
Grand total	94	26	120	80	78.33	66.67

score 1/2 with mortality 25%. However, two subjects who, a score of 0 had died too (Table 4).

In a 4×2 contingency table, Chi-squared test of independence was applied and the relationship between outcome and the Original ICH Score group is statistically significant (P<0.05). Modified ICH Score groups and their outcome in terms of mortality, a score 5/6 had a mortality outcome of 100%, followed by a score of 3/4 with mortality of 83.33% and score 1/2 with mortality 22.5%. However, no mortality was associated with score 0 (Table 5).

Chi-squared test of independence was applied and the relationship between outcome and the Modified ICH Score group is statistically significant (P<0.05). The distribution of different morbidities (such as bed sore, infection, and aspiration) in the 1st week of admission was also analyzed. The most common form of morbidity associated within the 1st week was aspiration. Almost 1/3rd of study subjects were found to have it. Total 28.17% of patients who were alive at 5th week had some form of morbidity. Around 27% of the non-tribal population in comparison with 31.58% of tribal population had morbidities.

After 4 weeks, improvement of disability score had studied and tribal subjects (84.21%) had a significant degree of improvement in comparison with non-tribal subjects (Table 6).

The volume of hematoma, presence of intraventricular extension, localization of hematoma in the infra-tentorial region, and poor GCS could significantly predict the mortality outcome. The most common location for hematoma was basal ganglia (42%) and Thalamic (28%) followed by lobar (22%).

The objective of our study was to find the validity of the ICH Score in our setup and to find out the differences of risk factors and outcome in terms of mortality and morbidity between Tribal and non-tribal population. Aspiration was the most common form of morbidity present after the 1st week and the tribal group had slightly more incidence of morbidity than the non-tribal group. The distribution of mortality was almost similar in tribal and non-tribal groups. Both the ICH Scores, modified and the original, were practical and valid predicting mortality in our setup. However, the modified one was more accurate and pragmatic in our study. Motor recovery after 4 weeks, assessed by Fugl-Meyer Performance assessment scale for upper extremity was better in the tribal than non-tribal group. More significant improvements were seen in subjects with less ICH Score.

Table 4: Observed frequencies (original ICH score group/outcome)

Original ICH score group	Death	Alive	Total	Percentage
Score 0	2	43	45	4.44
Score (1–2) Gr 1	8	24	32	25.00
Score (3–4) Gr 2	37	4	41	90.24
Score (5–6) Gr 3	2	0	2	100.00
Total	49	71	120	40.83

ICH: Intracerebral hemorrhage

Table 5: Observed frequencies (modified ICH score group/outcome)

Modified ICH score group	Death	Alive	Total	Mortality (%)
Score 0	0	34	34	0
Score (1–2) Gr 1	9	31	40	22.5
Score (3–4) Gr 2	30	6	36	83.33
Score (5–6) Gr 3	10	0	10	100
Total	49	71	120	40.83

ICH: Intracerebral hemorrhage

DISCUSSION

During the study, a total of 120 patients (60 males and 60 females) were enrolled after considering the inclusion and exclusion criteria. A total of 32 (18 males and 14 females) subjects belong to the tribal population which is 27.67% of the study population. The actual age distribution of the patients could not be assessed. Most of our subjects belong to very poor socio-economic strata. Neither could they remember their actual age nor are they accustomed to the English calendar system. In our study, we took two types of categorical age-based data as per the requirement of ICH Score. We divided the patients into two groups, ones with age above 70 years and ones with age above 80 years, for the modified and original ICH Score.

Table 6: Improvement of disability score after 4 weeks

Row labels	Death	Improved	No improvement	Grand total	Percentage
Non-tribal	36	38	14	88	73.07
Tribal	13	16	3	32	84.21
Grand total	49	54	17	120	76.05

On-third of our subjects had age more than 70 years and only 11 patients had age more than 80 years.

About 2/3rd of our study subjects had a previous history of hypertension diagnosis. 70.45% of non-tribal had a history of anti-hypertensive intake at some point in their life, which is 14.2% more than the tribal. This can be explained by more indulgence to fast food and a sedentary life-style is observed in the non-tribal population. We did not take body weight or lipid profile data in this study. A further study on differences of the prevalence of hypertension and metabolic syndrome in tribal and non-tribal population can shed a light into this finding. However another concerning explanation could be the lack of affordable health care in tribal areas which can explain the concerning number of undiagnosed hypertensive patients.

In the original ICH Score study by Hemphill et al,[8] 74% of total study subjects had a history of hypertension, which is about 7.23% more than our number (66.67%). 9.38% of tribal subjects have a history of diabetes whereas the percentage goes higher (13.64%) for the non-tribal population. We calculated P-values for each of the risk factors but none of these risk factors could predict outcome significantly ($P<0.05$).

The most common morbidities associated with ICH found in our setup were aspiration, bed sore, and secondary infection. We relied on the presence of new-onset chest crepitation as the feature of aspiration. Although there are various other common causes of new-onset chest crepitation, we did not have adequate manpower and means to exclude them. About 34% of all study subjects had aspiration, the most common of the other three at the 1st week of admission. 6.8% and 10.25% of all patients had features of secondary infection and bed sore. While bed sore can be easily inspected, we relied on new-onset fever and the presence of leukocytosis as the marker of secondary infection. Overall 37.5% of study subjects (38.64% of non-tribals and 34.5% of tribals) had some form of morbidities in the 1st week. Bed sore (21.13%) was the most common type of morbidity at the end of 4th week; followed by secondary infection (14.08%) and aspiration (only 1). We have no provision for waterbeds in our set up and high floor admission are two major causes of high number of bed sore in our study. No Indian study could be found to corroborate this data.

We have grouped the ICH scores into three groups.[11] A score 5/6 (Group 3) had a mortality outcome of 100%, followed by a score of 3/4 (Group 2) with mortality of 90.24% and score 1/2 (Group 1) with mortality 25%. The calculated $P<0.00001$.[13] The original ICH Score is good at predicting mortality. A higher score predicted higher mortality. However, only 9.17% of total study subjects in our study (only 11 out of 120) had age more than 80 years, compared to 22% in the original study done by Hemphill et al. Two of our study subjects aged between 70 years and 80 years, who had ICH Score 0, died too. If we had lowered the age bar to 70 years, we could have predicted their poor outcome. The modified ICH Score: Similarly, A score 5/6 (Group 3) had a mortality outcome of 100%, followed by a score of 3/4 (Group 2) with mortality of 83.33% and score 1/2 (Group 3) with mortality 22.5%. However, no mortality was associated with score 0. The calculated $P<0.00001$. Qureshi et al.,[14] all have found several same characteristics associated with outcome, as measured by mortality and functional outcome. We used Fugl-Meyer Motor performance assessment scale for upper extremity to analyze the morbidity outcome. From past studies, the minimum improvement in score for motor recovery on a short-term basis (within 4 weeks) for upper extremity is 9. We divided our subjects in two groups, one who had significant improvement scores and one who did not and we applied Chi-square with the modified ICH Score. From our study, subjects with score 0 had 100% improvement whereas for score groups 1 and 2, 54.84% and 50% of patients improved significantly.[15] However, in group 3 (Having Modified ICH Score 5/6), none of the subjects survived. The overall significant motor improvement for upper extremity was seen in 76% of patients. We also found out that 84.21% of tribal subjects had a significant degree of improvement in comparison with 73.07% of non-tribal subjects. The difference of improvement can be attributed to the requirement of early mobility in tribal people to live by day to day as mostly they are wage earners and small-scale farmers by profession. However, we need further study to validate our assumption.

Limitations of the study

Our study was conducted in a resource-poor, peripheral medical college. Poor workforce, inadequate setup, absence of neurosurgical facility, and exclusive critical care unit made us compromise the treatment of our patients as per ideal guidelines. No data on the prevalence of hypertension

and diabetes in the tribal population were found on the internet. We also could not find any addiction-related data on the tribal population.

CONCLUSION

Both the ICH Scores, modified and the original, were practical and valid predicting mortality in our setup. However, the modified one was more accurate and pragmatic in our study. Motor recovery after 4 weeks, assessed by Fugl-Meyer Performance assessment scale for the upper extremity was better in tribal than non-tribal group. More significant improvements were seen in subjects with less ICH Score.

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Authors' Contributions:
AH- Concept and design of study, acquisition of data and prepared first draft of manuscript; **SS-** Acquisition of data revising it critically, interpreted the results; **SM-** Reviewed the literature and revision of the manuscript; **RMM-** Coordination, statistical analysis and interpretation.

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