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BAT versus BRAIN Score for Prediction of Hematoma Expansion in Spontaneous Intracerebral Hemorrhage: A Prospective Observational Study

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ABSTRACT

Background: Spontaneous intracerebral haemorrhage (ICH) is a major cause of mortality and morbidity globally, with hematoma expansion (HE) being a key predictor of poor outcomes. Identifying patients at high risk for HE is crucial to initiate timely interventions. The BRAIN and BAT scores are two scoring systems that predict HE, but their comparative effectiveness remains unclear.
Objective: This study aimed to evaluate and compare the predictability of hematoma expansion using the BRAIN and BAT scores in patients with spontaneous parenchymal ICH.
Methods: A cross-sectional observational study was conducted at the Department of Neurology, Government Medical College, Kota, from October 2023 to October 2024. A total of 90 patients with spontaneous parenchymal ICH who underwent a non-contrast CT (NCCT) head scan within 6 hours of symptom onset and a follow-up CT at 24 hours were included. Hematoma volume was calculated, and BRAIN and BAT scores were assessed. The relationship between hematoma expansion, clinical parameters, and imaging markers such as blend sign and hypodensities was analysed.
Results: Hematoma expansion occurred in 33 of 90 patients (36.7%), with a higher mean BAT score (2.15 ± 1.48) in patients with HE compared to those without (0.11 ± 0.32, $p<0.001$). The BAT score showed a stronger correlation with HE than the BRAIN score, which did not show a statistically significant difference between the groups ($p = 0.325$). Blend sign and hypodensities were strong predictors of HE, with 78.9% of patients with blend sign and 100% of those with hypodensities experiencing hematoma growth ($p<0.001$). Patients presenting within 2.5 hours of ictus showed a higher rate of HE.
Conclusion: The BAT score demonstrated superior predictive capability for hematoma expansion compared to the BRAIN score. Early identification of high-risk patients using the BAT score, along with recognition of key NCCT markers, may guide to improve clinical outcomes in ICH management.

Keywords*: Spontaneous Parenchymal ICH, Hematoma Expansion, BRAIN score, BAT score, Blend sign and Spot sign, Intraventricular Extension, Warfarin.*

INTRODUCTION

Gupta S, Singh S, Maheshwari D, Sardana V, Bhushan B. Analysis of various sleep architecture parameters using polysomnography among patients with recurrent stroke: A cross-sectional study at a tertiary care hospital in Rajasthan. Int J Med Pharm Res. 2025;6(5):1958-66.

Stroke is a significant global health problem and remains a major cause of mortality and morbidity in developed countries, with an increasing burden in low- and middle-income nations as well.[1,2] Spontaneous intracerebral hemorrhage

(sICH), which refers to bleeding into the brain parenchyma without any preceding trauma or surgical intervention, is a particularly severe form of stroke. The common causes of SICH include hypertension, coagulopathy, cerebral amyloid angiopathy, tumors, and vascular malformations. Among these, the most consistently identified major risk factors are advancing age and hypertension.[3] Hematoma expansion has been shown to be an independent predictor of unfavorable clinical outcomes in patients with spontaneous ICH[4] and is now considered a critical target for early therapeutic interventions.[5] Consequently, the early identification of patients at high risk of hematoma expansion is essential for timely and effective management.

Several clinical and radiological factors have been associated with outcomes following SICH, including patient age, baseline hematoma volume, hematoma expansion, the presence of a neurological deficit, intraventricular hemorrhage (IVH), and the anatomical location of the hematoma.[6] Among these, hematoma volume has consistently emerged as the strongest predictor of poor outcome, and up to half of patients experience early hematoma growth.[7] Since hematoma expansion is potentially modifiable, its early detection plays a crucial role in optimizing treatment strategies and improving patient outcomes.[8] Hematoma growth has been reported in approximately 30% of patients presenting within six hours of symptom onset and is an independent predictor of poor functional outcome.[9]

Recent research has highlighted several non-contrast CT (NCCT) markers that may help predict hematoma expansion. These imaging signs, such as the blend sign, island sign, and black hole sign, offer a widely available and practical alternative to CT angiography spot sign for identifying patients at risk.[10] NCCT remains the most accessible and routinely used imaging modality for acute stroke diagnosis across the globe. Hematoma growth, often defined as either a greater than 33% increase in hematoma volume or an absolute increase of more than 6 mL on follow-up imaging, is frequently observed in patients with spontaneous ICH. Imaging markers such as the island sign, blend sign, and black hole sign have been used to predict hematoma growth reliably.[11]

To aid clinicians in early risk stratification, scoring systems based on imaging and clinical features have been developed. The BAT score is a novel NCCT-based scoring system comprising the blend sign, hypodensities, and time from symptom onset to baseline CT. With a maximum score of 5, a score of 3 or more has been shown to predict a significant risk of hematoma expansion.[12] Similarly, the BRAIN score incorporates five independent predictors: baseline ICH volume, recurrent ICH, anticoagulation with warfarin, intraventricular extension, and time from symptom onset to CT. The total score ranges up to 24, with higher scores indicating greater risk of expansion.[13] Early prediction of hematoma expansion using such scoring systems enables prompt initiation of anti-edema measures, neuroprotective strategies, and, when necessary, early neurosurgical intervention.

AIM AND OBJECTIVES

The aim of this study was to determine and compare the utility of the BAT and BRAIN scores in predicting hematoma expansion in patients presenting with spontaneous parenchymal intracerebral hemorrhage. The objectives were to assess the predictability of hematoma expansion using the BRAIN score, evaluate the predictive performance of the BAT score, and compare the accuracy of both scoring systems in forecasting hematoma growth.

SUBJECTS AND METHODS

Study design and site: This cross-sectional observational study was conducted in the Department of Neurology at Government Medical College (GMC), Kota, Rajasthan, India and its associated group of hospitals.

Study population: It included patients with spontaneous parenchymal intracerebral hemorrhage (ICH) who presented to the Neurology Department and Emergency Department of GMC Kota. A total of 90 patients were enrolled after fulfilling the inclusion and exclusion criteria and providing written informed consent. Patients aged over 18 years with spontaneous ICH who underwent an initial non-contrast CT (NCCT) scan within 6 hours of symptom onset and a follow-up CT scan at approximately 24 hours were included. Exclusion criteria comprised of patients with non-ICH strokes, those who underwent surgical intervention before the follow-up CT, and cases of ICH secondary to trauma, brain tumors, hemorrhagic transformation, subarachnoid hemorrhage, subdural hemorrhage, or epidural hemorrhage.

Methodology: All enrolled patients underwent detailed clinical evaluation, including the recording of vital parameters such as heart rate, blood pressure, respiratory rate, and temperature. A comprehensive medical history and neurological examination were conducted, followed by appropriate laboratory investigations. NCCT of the head was performed for all patients at presentation. The hematoma volume was calculated using the ellipsoid method ($A \times B \times C \times ½$), where A represents width, B length, and C height determined by the number of CT slices with hematoma.[14] Hematoma volume was categorized as small (0–9.9 cm^3), medium (10–29.9 cm^3), large (30–59.9 cm^3), and very large (≥60 cm^3). The effects of various clinical and radiological parameters were examined, including age, hematoma volume, presence of subarachnoid and intraventricular hemorrhage (IVH), midline shift, and use of anticoagulant medications. The association between anticoagulant use and hematoma volume was also analyzed. All eligible patients were evaluated using both the BAT and BRAIN scores to assess the risk of hematoma expansion.

The BAT score is a 5-point scale derived from non-contrast CT features, including the presence of the blend sign (1 point), hypodensities (2 points), and the time interval between symptom onset and CT scan (2 points). A score of ≥3

indicates a high risk of hematoma expansion.[12] The blend sign was defined according to Li et al.[10], and hypodensities were assessed based on the criteria of Boulouis et al.[15] The BRAIN score comprises five components: baseline hematoma volume, recurrent ICH, warfarin use at onset, intraventricular extension, and time to CT from symptom onset, with a maximum possible score of 24.[13] Hematoma expansion was defined in accordance with the American Heart Association/American Stroke Association guidelines as fulfilling any one of the following: a relative hematoma growth >33%, an absolute hematoma growth >6 mL, development of new IVH on follow-up CT, or IVH expansion of ≥1 mL.[16] Follow-up NCCT was performed at approximately 24 hours from ictus or earlier if clinical deterioration occurred. Surgical evacuation was considered in patients with supratentorial hematoma volume >30 mL or midline shift >1 cm, and in those with posterior fossa cerebellar hematomas exceeding 3 cm in maximum diameter.[17]

All patients received standard care according to institutional ICH management protocols. Recombinant factor VII was not administered due to factors such as delayed presentation or cost constraints. Supportive care included administration of osmotic agents, antihypertensives, antiepileptic drugs, and insulin or other hypoglycemic agents as indicated. Surgical intervention and ventilatory support were provided when necessary. All CT scans were independently reviewed by neurologists to evaluate NCCT markers such as black hole sign, island sign, hypodensities, swirl sign, satellite sign, irregular hematoma margins, heterogeneous density, and presence of fluid levels. Any discrepancies in interpretation were resolved by consensus. The Spot sign on CT angiography, when performed, was defined as the presence of at least one contrast spot with attenuation >120 Hounsfield units within the hematoma, unrelated to adjacent vessels.[14]

Statistical Analysis

Statistical analysis was performed using SPSS version 25. Descriptive statistics were expressed as mean ± standard deviation. Frequency analysis, cross-tabulation, chi-square tests, and correlation analysis were conducted to evaluate the relationships between variables. A p-value of <0.05 was considered statistically significant. The sample size of 90 patients was calculated based on a 95% confidence interval, with a precision error of 2% and an estimated prevalence of 2.5% from previous literature.

RESULTS

Spontaneous parenchymal intracerebral hemorrhage predominantly affected middle-aged individuals (41-60 years) and older adults (≥61 years), with mean age of 59.37 years. The condition was relatively rare in younger adults (20-40 years).The study population of 90 patients with spontaneous parenchymal intracerebral hemorrhage showed a male preponderance, with 53 males (58.89%) and 37 females (41.11%). 61 (67.78%) patients resided in urban areas and 29 (32.22%) patients resided in rural areas. The study population's vital signs and laboratory parameters show a relatively stable profile, with mean values of 76.96±6.54 beats/min for heart rate, 13.77±0.98/min for respiratory rate, and 98.426±0.56°F for temperature. Laboratory parameters also showed normal ranges, with mean values of 11.79±1.01 g/dL for hemoglobin, 11680±2178.35 cells/µL for TLC, 5.48±0.27% for HbA1C, and 34.47±5.69 mg/dL for urea. Among 90 patients, 97.78% (88 patients) did not experience recurrent Intracerebral Hemorrhage (ICH), while 2.22% (2 patients) experienced recurrence. The BRAIN score distribution revealed that 68.89% of patients had a score of 5-10, indicating moderate risk of hematoma expansion, with a mean score of 8.17±2.976. The study found that 86.67% of patients had a BAT score of 0-2, indicating low risk of hematoma expansion, while 10% scored 2-4, and 3.33% scored more than 4. The mean BAT score was 0.86±1.36.The time from onset to NCCT showed that 9 patients (10%) underwent NCCT within 2.5 hours, while 81 patients (90%) underwent NCCT at or after 2.5 hours, with a mean time of 4.86 hours.

Table 1: Age Distribution

Age Group (years)	Number of Patients	Percent
20-40	2	2.22
41-60	48	53.33
61 & above	40	44.44
Mean ± SD	**59.37±10.67 years**	

Table 2: Correlation Matrix for Brain Score, BAT Score and ICH Volume around 24 Hours

Variables	Total BRAIN Score	BAT Score	ICH Volume Around 24 Hours
Total Brain Score	1	0.613	0.845
BAT Score	0.613	1	0.683
ICH Volume Around 24 Hours	0.845	0.683	1

Table 3: Comparison of ICH Volume Based on BAT Score-Time From Onset and Brain Score

	Number of Patients	Mean ICH Volume (mL)	Std. Dev.	p-value
BAT Score-Time from Onset				
< 2.5 hours	9	51.56	12.032	0.499
≥ 2.5 hours	81	26.35	13.825	

BRAIN Score Range				
> 5 hours	5	15.6	4.278	<0.001
1-2 hours	7	59.43	5.968	
2-3 hours	6	27	15.569	
3 to 4 hours	32	32.5	12.549	
4 to 5 hours	40	22.55	12.151	

Table 4: Blend Sign (Present/Absent) and Blood Pressure: Hematoma Expansion

Variables	Hematoma Expansion		P value
	No	**Yes**	
Blend sign (N=19)	4	15	<0.001
Any hypodensity (N=20)	0	20	<0.001
BAT score- < 2.5 hours (N=9)	1	8	0.001
BAT score - ≥ 2.5 hours (N=81)	56	25	
BRAIN Score 1-2 hours (N=7)	0	7	0.001
BRAIN Score - 2-3 hours (N=6)	4	2	
BRAIN Score - 3 to 4 (N=32)	17	15	
BRAIN Score - 4 to 5 (N=40)	31	9	
BRAIN Score - >5 (N=5)	0	5	
Blood Pressure			
Hypertension Stage 1 (N=33)	30	3	0.00036
Hypertension Stage 2 (N=57)	27	30	

Table 5: Hematoma Expansion with Various Parameters

Parameter	Hematoma Expansion		Total	P value
	(Yes)	**(No)**		
Baseline ICH Volume				
<10 ml	0	5	5	<0.001
10–20 ml	1	35	36	
>20 ml	32	17	49	
Recurrent ICH				
No	31	57	88	0.04
Yes	2	0	2	
Anticoagulation with Warfarin at Onset				
No	32	57	89	0.025
Yes	1	0	1	
IVE				
No	13	51	64	<0.001
Yes	20	6	26	
BRAIN Score				
>5 hours	0	5	5	0.001
1–2 hours	7	0	7	
2–3 hours	2	4	6	
3 to 4 hours	15	17	32	
4 to 5 hours	9	31	40	
Blend Sign (Present/Absent)				
No	18	53	71	<0.001
Yes	15	4	19	
Any Hypodensity (Present/Absent)				
No	13	57	70	<0.001
Yes	20	0	20	
BAT Score-Time from Onset to NCCT Head				
<2.5 hours	8	1	9	0.001
≥2.5 hours	25	56	81	
Hematoma Expansion				
No	0	57	57	<0.001
Yes	33	0	33	

Table 6: Comparative Study of Hematoma Expansion and Total BRAIN Score, BAT Score and ICH volume around 24 hours

Hematoma Expansion		N	Mean	Std. Deviation	P value
Total brain score	Yes	33	10.73	2.401	0.325
	No	57	6.68	2.164	
BAT score	Yes	33	2.15	1.482	0.001
	No	57	0.11	0.363	
ICH volume around 24 hours	Yes	33	45.36	11.637	0.002
	No	57	19.32	7.419	

Imaging features of patients with spontaneous parenchymal intracerebral hemorrhage showed that 19 patients (21.11%) had the blend sign, while 71 patients (78.89%) did not. Additionally, 20 patients (22.22%) had hypodensity, whereas 70 patients (77.78%) did not.The correlation matrix revealed significant positive correlations between Brain score, BAT score, and ICH volume around 24 hours, with a strong positive correlation between Brain score and BAT score ($r = 0.613$, $p < 0.01$) and between Brain score and ICH volume around 24 hours ($r = 0.845$, $p < 0.01$)The analysis revealed a significant relationship between the BAT score-time from onset and ICH volume, with patients having a time from onset to BAT score of <2.5 hours showing a mean ICH volume of 51.56±12.032 mL, whereas those with a time from onset to BAT score of ≥ 2.5 hours had a significantly lower mean ICH volume of 26.35±13.825 mL. The analysis revealed a significant relationship between the Brain score and ICH volume, with patients having a Brain score of > 5 showing a significantly lower mean ICH volume of 15.6±4.278 mL, whereas those with a Brain score range of 1-2 had a significantly higher mean ICH volume of 59.43±5.968 mL. Among patients with intracerebral hemorrhage, 9 patients (10%) had both blend sign and hypodensity present.

The study found that patients with hematoma expansion had a significantly higher average BRAIN score of 10.73±2.4, indicating a higher risk, and aBAT score of 2.15±1.48, indicating a higher risk. The difference in means between BRAIN and BAT scores was statistically significant (p-value < 0.0001). Hematoma expansion occurred in 33/90 patients (36.7%), with similar incidence rates between females (13/37, 35.1%) and males (20/53, 37.7%), indicating no significant gender difference.

The study found that blend sign and hypodensity were strong predictors of hematoma expansion in patients with intracerebral hemorrhage. Notably, 15 out of 19 patients (78.9%) with blend sign experienced hematoma expansion (p <0.001), and all 20 patients (100%) with any hypodensity experienced expansion (p <0.001). Additionally, patients with a BAT score-time from onset < 2.5 hours had a higher expansion rate (p=0.001), as did those with a BRAIN score of 1-2 hour duration (p=0.001).The analysis showed that patients with hypertension stage 2 had a higher rate of hematoma expansion (30/57, 52.6%) compared to those with hypertension stage 1 (3/33, 9.1%).

The analysis of hematoma expansion in patients with spontaneous parenchymal intracerebral hemorrhage revealed that the BAT score was a stronger predictor of expansion, with a mean score of 2.15 in patients with expansion vs 0.11 in those without (p<0.001). In contrast, the BRAIN score showed no significant difference (p=0.325). Additionally, ICH volume around 24 hours was significantly higher in patients with expansion (45.36 mL) vs those without (19.32 mL, p=0.002), highlighting the importance of BAT score and ICH volume in predicting hematoma expansion.

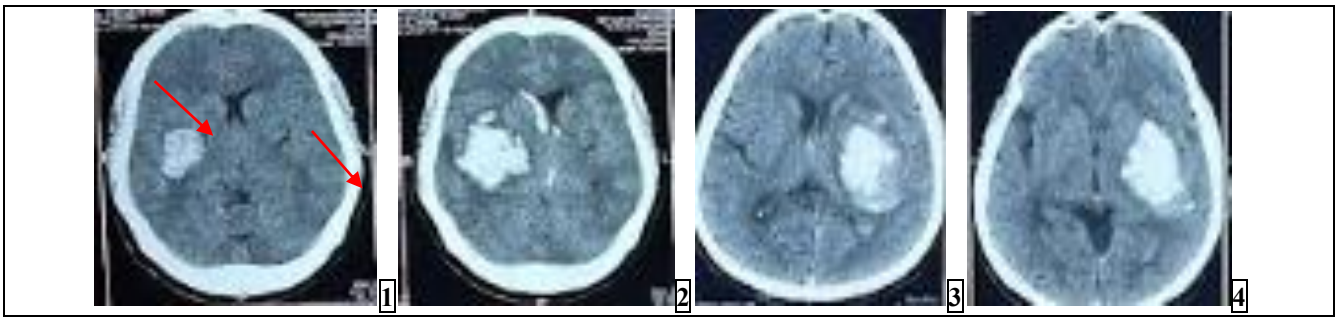

Fig. (1-4)*: (1) CT head of a patient within 6 hours of ictus showing hypodensity inside hyperdensity (arrow); (2) CT head of the same patient at around 24 hours from ictus showing significant increase in hematoma size with intraventricular extension; (3) First CT head of a patient showing blend sign;
(4) Follow up CT head at around 24 hours from the ictus showing hematoma expansion

**Informed written consent was obtained from the patients. The patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.*

DISCUSSION

Spontaneous IntraCerebral Hemorrhage (sICH) remains a critical neurological emergency characterized by high mortality and morbidity. Hematoma expansion (HE) is a well-established, strong, and independent predictor of poor clinical outcomes. Early identification of patients at risk for HE allows for timely implementation of therapeutic strategies such as stringent blood pressure control, reversal of anticoagulation, neurosurgical consultation, and intensive monitoring, all of which may help mitigate secondary brain injury. Several clinical and radiological scoring systems have been proposed to predict hematoma expansion, including the BAT and BRAIN scores. This study aimed to evaluate and compare the predictive utility of these two non-contrast CT (NCCT)-based scores for hematoma expansion in patients with spontaneous ICH.

The present study sought to analyze the clinical parameters and NCCT findings, along with the predictive accuracy of BAT and BRAIN scores. Our analysis revealed that the majority of patients (53.33%) belonged to the 41–60 years age group, with a mean age of 59.37 ± 10.67 years. A significant proportion of subjects (44.44%) were aged ≥61 years, while only 2.22% were between 20–40 years. This age distribution reflects the increasing incidence of sICH with advancing age. The age association with hematoma expansion was statistically significant ($p = 0.0002$), consistent with findings by Egila AAE et al. (2017)[18], who also reported a significant correlation between older age and hematoma expansion.

Patients who underwent NCCT within 2.5 hours of symptom onset exhibited significantly higher mean ICH volumes (51.56 ± 12.03 mL) compared to those imaged after 2.5 hours (26.35 ± 13.82 mL). Although our findings appear to contradict those of Morotti et al.[12], who reported a higher early imaging volume without statistical significance, the discrepancy can be explained by a few key factors. Patients with larger hematomas and more severe symptoms are more likely to present earlier, introducing a selection bias. Additionally, early imaging may capture the hematoma during its dynamic phase, especially in cases of ongoing bleeding. In contrast, patients presenting later may have smaller, stabilized hematomas. Differences in population characteristics and healthcare system responsiveness may also play a role.

Our findings are in line with studies by Vanderwerf J et al. (2018)[19] and Morotti A et al. (2018)[12], both of which reported significant associations between hematoma expansion and parameters incorporated in the BRAIN and BAT scores. Morotti et al.[12] emphasized the relevance of imaging markers such as the blend sign and hypodensities, as well as the timing of NCCT, in predicting HE. These imaging features likely reflect ongoing hemorrhage or unclotted blood within the hematoma, denoting instability and potential for expansion. The early timing of NCCT imaging captures hematoma dynamics more effectively, enabling detection of these markers. Our study reinforces the importance of early imaging for accurate risk stratification and prompt intervention.

Notably, our study found no significant association between blood pressure and hematoma expansion ($p = 0.391$), mirroring results from Li Q et al. (2017)[20] and Morotti A et al. (2018)[12], who reported non-significant p-values of 0.391 and 0.72, respectively. This finding underscores the complexity of the relationship between blood pressure and hematoma progression. Although elevated blood pressure is a well-recognized risk factor for the initial hemorrhagic event, its role in hematoma expansion is less clear. Acute elevations in blood pressure may reflect a physiological stress response to the hemorrhage, rather than a causative factor for ongoing bleeding. Variations in timing and technique of blood pressure measurement across studies may further confound this association. While blood pressure control remains integral to ICH management, it may not be a reliable standalone predictor of expansion.

Our analysis demonstrated a statistically significant correlation between the blend sign and hematoma expansion, supporting its utility as an imaging biomarker. This aligns with the findings of Helal HHAE et al. (2019)[21], who also observed a significant association ($p = 0.013$). The blend sign likely represents recent or active bleeding within the hematoma, reflecting vascular instability. Its reproducibility across multiple studies validates its use as a simple and effective marker for predicting HE on NCCT.[22]

Intraventricular extension (IVE) of hemorrhage was also significantly associated with hematoma expansion in our study ($p < 0.001$). Among patients with hematoma expansion, 60.6% had IVE, compared to only 10.5% of those without expansion. This observation is consistent with reports by Morotti et al.[12] and Boulouis et al.[23], both of whom found IVE to be a predictor of hematoma growth. IVE likely indicates a higher hemorrhagic burden and may signify rupture into the ventricular system, reflecting increased local pressure and a more aggressive bleeding phenotype. It may also serve as a surrogate marker for hematoma instability, warranting closer monitoring and more aggressive intervention.

Recurrent ICH was significantly associated with hematoma expansion ($p = 0.04$), although only two patients in our cohort had recurrent hemorrhage, both of whom experienced HE. While the sample size limits broad conclusions, this finding is supported by the literature. Al-Shahi Salman et al.[24] have shown that recurrent ICH is frequently linked to small vessel diseases such as hypertensive vasculopathy and cerebral amyloid angiopathy, conditions that predispose to fragile vasculature and greater expansion risk. Poon et al.[25] further observed that recurrent ICH often occurs in older individuals and is associated with lobar hemorrhages—factors already implicated in HE.

Lastly, we found a statistically significant association between warfarin use and hematoma expansion ($p = 0.025$), although this observation was based on a single patient. This result is consistent with the study by Wang X et al. (2015)[13],

which also demonstrated a significant association (p = 0.002). Warfarin impairs hemostasis and predisposes to ongoing bleeding. However, due to the limited number of anticoagulated patients in our study, particularly those on warfarin, this finding should be interpreted cautiously. Larger cohort studies are warranted to better assess the predictive value of anticoagulation status.

Limitation

There were some limitations in this study like Small Sample Size of the population, Lack of Long-Term Follow-Up of the enrolled patients and Exclusion Criteria May Introduce Selection Bias – Patients who underwent surgery before follow-up CT and those with secondary causes of ICH (e.g., trauma, tumors) were excluded, potentially limiting the applicability of the findings to real-world cases.

CONCLUSION

Spontaneous intracerebral hemorrhage (sICH) remains a critical neurological emergency with significant morbidity and mortality. Hematoma expansion (HE) is a major predictor of poor outcomes, and its early identification is vital for optimizing patient management. This study highlights that imaging markers such as blend sign, hypodensity, and intraventricular extension (IVE) on non-contrast CT (NCCT) are strong predictors of hematoma expansion. Among clinical scoring systems, the BAT score demonstrated superior predictive value over the BRAIN score in identifying patients at risk of hematoma growth. Furthermore, early imaging (within 2.5 hours of symptom onset), intraventricular extension, a history of recurrent ICH were also significantly associated with hematoma expansion. While blood pressure and anticoagulant use had variable predictive value in our cohort, their role should not be discounted in broader clinical decision-making These findings emphasize the need for rapid NCCT imaging and integration of these imaging-based scores into early triage protocols may enhance risk stratification and guide targeted therapeutic interventions in patients with sICH. Future studies with larger cohorts are warranted to further validate these predictors and refine early intervention strategies to mitigate secondary brain injury in sICH.

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