IJMA

International Journal of Medical Arts

Volume 6, Issue 10, October 2024

P- ISSN: 2636-4174
E- ISSN: 2682-3780

Available online at Journal Website
https://ijma.journals.ekb.eg/
Main Subject [Neurosurgery]

Original Article

Impact of Volume and Locations of Spontaneous Intracerebral Haemorrhage on "In – Hospital Mortality and Outcome": A Single Centre Analysis

Palanisamy Seerangan [*1]; KS, Vinodh Kumar [1]; L, Sankar [1]; Sanoop Kumar Sherin Sabu [2]; M, Manjula [3]

[1] Department of Neurosurgery, Government Mohan Kumaramangalam Medical College Hospital, Salem, Tamil Nadu-636002, India.

[2] Department of Medical Gastroenterology, GEM Hospital Chennai, Tamil Nadu-636002, India.

[3] Department of General Medicine, Government Mohan Kumaramangalam Medical College Hospital, Salem, Tamil Nadu - 636002 India.

Article information

Received: 10-08-2024

Accepted: 26-10-2024

DOI: 10.21608/ijma.2024.311231.2018

***Corresponding author**

Email: drpalanisamy32@gmail.com

Citation: Seerangan P, Vinodh Kumar KS, Sankar L, Sherin Sabu SK, Manjula M. Impact of Volume and Locations of Spontaneous Intracerebral Haemorrhage on "In – Hospital Mortality and Outcome": A Single Centre Analysis. IJMA 2024; October; 6 [10]: 5003-5009. DOI: 10.21608/ijma.2024.311231.2018

ABSTRACT

Background: Spontaneous Intracerebral Hemorrhage [SICH] is the second most common cause of stroke and accounts for 7.5−30% of all strokes. In India, there still exist places where CT brain is unheard of, stroke care centers unimaginable, and supply almost always short of demand. Our analysis on potential indirect noninvasive markers and scoring systems for predicting early regarding mortality of ICH cases helps taking decision on ICH management early in clinical practice.

Aim and Objective: This study aims to determine the Influence of Spontaneous ICH volume and its anatomical location on "In-Hospital Mortality". In addition to assess the Significance of calculating the volume of ICH at various locations and their impact on the Outcome.

Results: The NIHS Score at admission and the anatomical location on comparison was found to have infratentorial locations [32.7%] and deep location [32.3] to have severe NIHS score on admission. There was significant relation between the variation in NIHSS and anatomical location prevalence. Outcome mRS and anatomical location of SICH was found to have poor outcome scores among infratentorial location [59%]. Among the 84 cases who underwent surgical intervention 45 [53.5%] Survived while 39[46.4%] succumbed to death. The mean ICH volume among the dead was 20.25 [SD-14.53] and among survived was 18.9. [SD-12.14] with a p value of 0.38 by student T test. Among the 47 cases [55.95 % of total cases], 57.4% of the cases had poor outcome [death] and among them patients with Intra-ventricular extension of hemorrhage had very poor outcome.

Conclusion: There was significant correlation in the distribution pattern of anatomical location of SICH and immediate in hospital outcome of the patients. There was significant relation between the NIHSS, Presenting Glasgow score, clinical profile among different anatomical location. Higher ICH volume in different anatomical location was found to have higher mortality rates.

Keywords: Spontaneous Intracerebral Hemorrhage; NIHSS; Infratentorial; Stroke; Glasgow Coma Scale

This is an open-access article registered under the Creative Commons, ShareAlike 4.0 International license [CC BY-SA 4.0] [https://creativecommons.org/licenses/by-sa/4.0/legalcode.

INTRODUCTION

Spontaneous Intracerebral Hemorrhage [SICH] is the second most common cause of stroke and accounts for 7.5−30% of all strokes. Incidence of Intracerebral Hemorrhage [ICH] in India is higher and in younger age compared to the western developed world [1].

The most important risk factors for ICH is Systemic-hypertension [SHTN], Primary cause like cerebral amyloid angiopathy [CAA]. Systemic hypertension related ICH is increasingly seen in deep structures like putamen, basal ganglia. CAA-related ICH is commonly seen in advanced age, and are usually seen in lobar regions. In India, there still exist places where CT brain is unheard of, stroke care centers unimaginable, and supply almost always short of demand [2].

Although the mortality of ICH is strongly dependent on HEMATOMA SIZE and to a lesser extent, LOCATION, the overall mortality rate varies between 25% and 60% [3,4].

Our analysis on potential indirect noninvasive markers and scoring systems for predicting early regarding mortality of ICH cases helps taking decision on ICH management early in clinical practice.

THE AIM OF THE WORK

This study aims to determine the Influence of Spontaneous ICH volume and its anatomical location on "In-Hospital Mortality". In addition to assess the Significance of calculating the volume of ICH at various locations and their impact on the Outcome.

PATIENTS AND METHODS

A Prospective Single Center Study. Sample Size: 84 cases. Inclusion criteria: Age of the patient > 18 years. Spontaneous Intracerebral Hemorrhage on Brain Imaging-Non-Contrast CT. Exclusion criteria: Age of the patient < 18 years. Traumatic ICH, Subarachnoid hemorrhage, hemorrhage secondary to brain tumors, aneurysmal or vascular mal-formations were excluded. There is no single score or scale which related specifically on the anatomical location of SICH and outcome. Therefore, this study on the detailed localization of anatomical location and in hospital mortality would provide better light on the hidden. Variables analyzed are Demographic data like age, sex, educational status, presenting clinical features, comorbidities, Drug and medication history, Glasgow coma score [GCS] on admission, mRS on admission, mRS at outcome, Radiological features- based on site, Intraventricular extension, Midline shift, ICH Score. The NIH Stroke Scale [NIHSS] is a standardized assessment tool used by clinicians to objectively evaluate stroke-induced neurological impairments. It measures the severity of deficits across multiple domains, including level of consciousness, visual fields, motor function, sensory perception, language, and coordination. Each domain is scored from 0, indicating no impairment, to higher values reflecting increasing dysfunction, with a total score range of 0 to 42. Elevated NIHSS scores correlate with greater neurological injury, making it a valuable instrument for initial stroke assessment, monitoring clinical evaluation and predicting patient outcomes. In-Hospital outcome- Survived/ died. All patients who presented with features suggestive of CVA, after applying NIHS scale, SICH was confirmed with plain CT Brain. Detailed history was collected and further evaluated with clinical scoring and radiological scoring systems. Standard treatment based on decisions made by a team of neurologist and neurosurgeon. All the patients were followed up till the in-hospital outcome- either discharge or death. Discharge mRS was calculated. Periodically data were entered and documented. After the end of study, the data was analyzed statistically based on the above outlined aims and objectives.

RESULTS

Age and sex distribution: The Mean age of presentation was 56 years with SD 11.8. Youngest age of presentation was 30 years male with lobar ICH and the oldest patient was 87-year-old female with deep ICH involving the basal ganglia with intraventricular extension of bleed. There was no statistically significant [0=0.91] difference in anatomical location of SICH among different sex distribution. 57.1 % [n=48] were males, 42.9% [n=36] females.

Arrival time in ED After ICTUS: Most patients [25%] presented to the emergency department within 6 to 12 hours [Figure 1]

Arrival to hospital vs GCS at admission: The value of p was <0.001. When arrival to Emergency department and the presenting Glasgow Coma Scale was compared it was found that later presentation was with poor GCS with statistically significant results [Table 1].

ICH score vs outcome MRS: Pearson correlation factor 0.636, with p value= <0.001. On evaluating the ICH Score and mRS Score it was to have a Positive Pearson correlation coefficient with a significant p value [GRAPH [1].

NIHSS score at admission:28% [n-24] had a severe NIHSS Score at presentation while few had an NIHSS score as mild [n-8, 10%] and very severe [n-9, 11%].

Anatomical location of SICH: In this study of 84 intracerebral hemorrhage [ICH] cases, 40.4% were located in deep brain regions, 27.4% in lobar regions, and 26.2% in infra-tentorial areas. A smaller proportion, 6.0%, involved multiple non-lobar regions. These findings highlight the varied anatomical distribution of ICH [Table [2.1]].

Different deep locations: In this study of 34 cases of intracerebral haemorrhage located in deep brain structures, the most common sites involved were the thalamus and internal capsule, either alone or in combination, totalling 5 cases. Putaminal haemorrhage, often associated with other regions like the caudate, Globus Pallidus, or thalamus, was observed in multiple combinations, accounting for the majority of cases. Specifically, putaminal haemorrhage with involvement of the caudate, Globus Pallidus, or thalamus was seen in 14 cases. Isolated haemorrhages in the caudate, Globus Pallidus, and other deep structures were less frequent. This data emphasizes the complexity and varied patterns of haemorrhage in deep brain locations [Table [2.2]].

Different infratentorial location: Among the infra-tentorial locations, cerebellum was the commonest one while in the brainstem locations midbrain was common. In this study of 22 cases of intracerebral haemorrhage in the infra-tentorial region, the cerebellum was the most commonly affected area, with 10 cases. Haemorrhages in the brainstem were also observed, including 4 cases in the midbrain and 3 in the pons. Additionally, there were 2 cases in the medulla, highlighting the distribution of haemorrhages within the lower brain structures [TABLE [2.3]]. [Figure.[2]].

Relationship between total ICH score and Glasgow Coma Scale at admission: The value of P-<0.001 [Chi-square test]. 33.3% [n=28] patients had favorable GCS [13 to 15] at presentation and they also had lower Total ICH Score at presentation. There was significant correlation between the GCS and presenting ICH Score. While it was found that patients with GCS 8 to 12 had higher total ICH Score at presentation [Table 3].

Anatomical location of SICH and presenting NIHSS: The NIHS Score at admission and the anatomical location on comparison was found to have infratentorial locations [32.7%] and deep location [32.3] to have severe NIHS score on admission. There was significant relation between the variation in NIHSS and anatomical location prevalence [Table.4.1].

Anatomical location of SICH and outcome MRS of SICH: Outcome mRS and anatomical location of SICH was found to have poor outcome scores among infratentorial location [59%]. There was significant correlation in the distribution pattern of outcome mRS and anatomical location [Table.4.2.].

Anatomical Location of SICH and clinical outcome of SICH: It was found to have poor outcome [death] among infratentorial location [59%]. There was significant correlation in the distribution pattern of outcome and anatomical location of SICH. [Table.4.3].

Anatomical location of SICH and treatment given: Among 84 cases who were surgically managed most of them were 41% [n-34] were deep SICH cases who underwent Decompression Craniectomy for features of raised ICT. It was followed by lobar location 27% [n- 23] [Figure [3]].

Treatment given and outcome: Among the 84 cases who underwent surgical intervention 45 [53.5%] Survived while 39[46.4%] succumbed to death [TABLE .5.1]. Among the SICH involving the infratentorial locations, Cerebellar ICH had very poor outcome of a case mortality rate of more than 60%. There was significant correlation between the distribution of sites and outcome [TABLE.5.2].

Clinical outcome of patient and volume of SICH: The mean ICH volume among the dead was 20.25 [SD-14.53] and among survived was 18.9. [SD-12.14] with a p value of 0.38 by student T test [TABLE.5.3].

Clinical outcome and complicated SICH: In this study, we examined the outcomes of patients with spontaneous intracerebral haemorrhage [SICH] based on the presence of hydrocephalus and intraventricular extension of haemorrhage [IVH]. Out of 47 patients, 27 did not survive, while 20 survived. Hydrocephalus was observed in 6 patients, of whom 2 died and 4 survived, showing a significant association with better survival outcomes [$p < 0.001$]. However, among the 4 patients with both hydrocephalus and IVH, none survived. In patients with isolated IVH, 21 died and 16 survived. These findings suggest that while hydrocephalus alone may be associated with better survival, the presence of IVH, especially when combined with hydrocephalus, correlates with higher mortality [Table:5.4, Figure. 5].

Overall, the results highlight that larger volumes of haemorrhage, especially more than 30ml, and complications like hydrocephalus and intraventricular extension are significantly associated with higher mortality rates. Additionally, decompressive craniectomy was associated with better survival outcomes compared to external ventricular drainage.

Table [1]: Arrival to hospital vs GCS at admission

p=<0.001		Glasgow Coma Scale at admission 13-15	8 to 12	less than 8	Total
Arrival time in ED after ICTUS	1/2 hrs	0	1	1	2
	1-2 hr	3	1	6	10
	2—3 hrs	4	4	6	14
	3—6 hrs	4	5	10	19
	6—12 hrs	8	1	12	21
	12—24 hrs	3	2	4	9
	24—48hrs	1	1	2	4
	After 2 days	1	1	3	5
Total		24	16	44	84

Table [2]. Based on anatomical location

Table [2.1]. Anatomical location of SICH		
	N	Percentage
Deep Location	34	40.4
Infra-tentorial	22	26.2
Lobar	23	27.4
Multiple Non lobar ICH	5	6.0
Total	84	
Table [2.2]. Anatomical different deep locations		
Caudate	1	
Caudate, Globus Pallidus	2	
Caudate, Thalamic, Internal capsule	2	
Globus Pallidus	1	
Globus Pallidus, Thalamic	3	
Internal capsule	3	
Putaminal hemorrhage	3	
Putaminal hemorrhage, Caudate	3	
Putaminal hemorrhage, Caudate, Globus Pallidus	3	
Putaminal hemorrhage, Caudate, Globus Pallidus, Thalamic	1	
Putaminal hemorrhage, Caudate, Globus Pallidus, Thalamic, Internal capsule	1	
Putaminal hemorrhage, Caudate, Internal capsule	1	
Putaminal hemorrhage, Caudate, Thalamic	1	
Putaminal hemorrhage, Caudate, Thalamic, Internal capsule	2	
Putaminal hemorrhage, Globus Pallidus	1	
Putaminal hemorrhage, Thalamic, Internal capsule	1	
Table [2.3]: Anatomical different infratentorial location		
Cerebellum	10	
Medulla	2	
Medulla, Cerebellum	1	
Midbrain	4	
Midbrain, Pons	1	
Pons	3	
Pons, Cerebellum	1	
Total	22	

Table [3] Relationship between total ICH score and Glasgow Coma Scale At Admission

		Total ICH score						Total
		0	1	2	3	4	5	
Glasgow Coma Scale At admission	13-15	13	14	1	0	0	0	28
	8 to 12	0	0	3	6	4	3	16
	Less than 8	1	13	18	7	1	0	40
Total		14	27	22	13	5	3	84

Table [4]: Based on anatomical location of ICSH

Table [4.1]: Anatomical location of SICH and presenting NIHSS					
	Deep	Infra-tentorial	Lobar	Multiple Non lobar ICH	Total
Mild = </= 6	2	4	2	0	8
Moderate = 7-10	8	4	9	2	23
Moderately Severe =11–15	10	3	6	1	20
Severe = 16 – 22	11	7	4	2	24
Very severe = >/= 23	3	4	2	0	9
Total	**34**	**22**	**23**	**5**	**84**
Table [4.2]: Anatomical location of SICH and outcome mRS of SICH					
	Deep	Infra- tentorial	Lobar	Multiple Non lobar ICH	Total
Outcome mRS	0	0	0	1	0
	1	2	3	1	0
	2	7	5	13	1
	3	7	0	0	1
	4	1	1	1	0
	5	4	0	1	0
	6= dead	13	13	6	2
Total	34	22	23	5	84
Table [4.3]: Anatomical location of SICH and clinical outcome of SICH					
	Deep	Infratentorial	Lobar	Multiple Non lobar ICH	Total
Dead	13	13	6	2	34
Discharged	21	9	17	3	50
Total	34	22	23	5	84

TABLE [5]: Based on treatment given

Table [5.1]: Treatment given and outcome				
Treatment Given	Dead	Survived	Total	
Decompressive Craniectomy	22	32	54	
External Ventricular Drainage	17	13	30	
Total	39	45	84	
Table [5.2]: Treatment given sites and outcome				
Treatment given sites	Dead	Survived	Total	P valve
Cerebellum	6	4	10	<0.001
Medulla	2	1	3	
Medulla, Cerebellum	1	0	1	
Midbrain	0	2	2	
Midbrain, Pons	1	0	1	
Pons	2	2	4	
Pons, Cerebellum	1	0	1	
Total	13	9	22	
Table [5.3]: Clinical table outcome of patient and volume of SICH				
Volume of ICH	DEAD	SURVIVED	TOTAL	p value
Less than 10ml	8	11	19	<0.001
11 to 20ml	13	20	33	
21 to 30ml	6	14	20	
More than 30ml	7	5	12	
Total	34	50	84	
Table [5.4]: Clinical outcome in complicated SICH				
SICH with	Dead	Survived	Total	p Value
Hydrocephalus	2	4	6	<0.001
Hydrocephalus + Intra-ventricular extension of haemorrhage	4	0	4	
Intra-ventricular extension of haemorrhage	21	16	37	
Total	27	20	47	

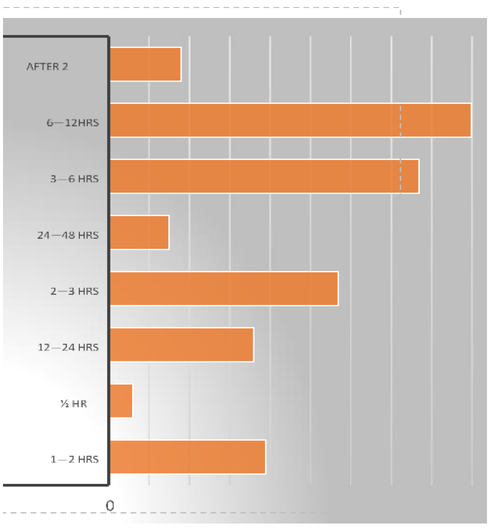
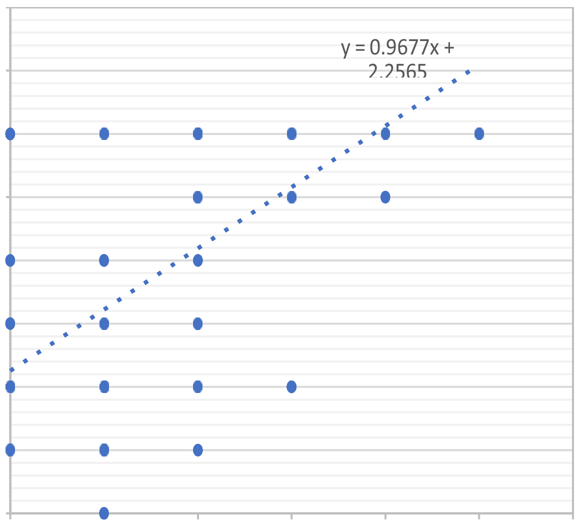


Figure [1]: Horizontal bar diagram showing arrival time to hospital



Graph [1]: Correlation analysis chart showing relation between ICH score and outcome MRS

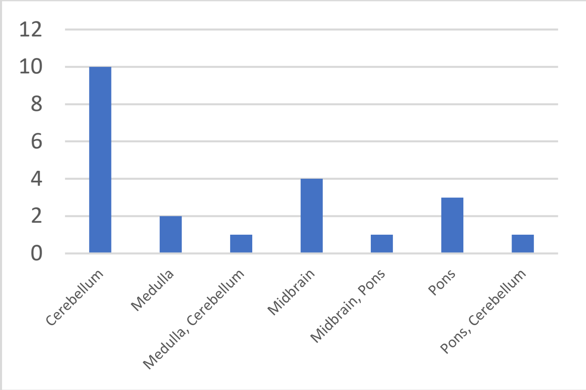


Figure [2]: Different Infratentorial SICH Locations

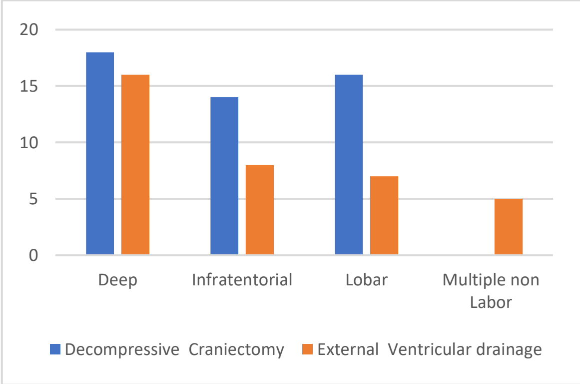


Figure [3]: Anatomical Location of SICH and Treatment Given

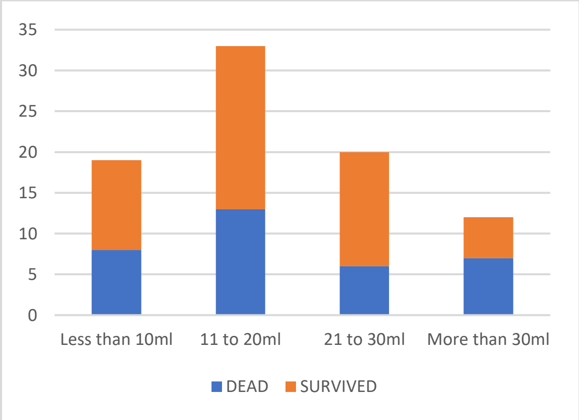


Figure [4]: Clinical Outcome and Volume of ICH

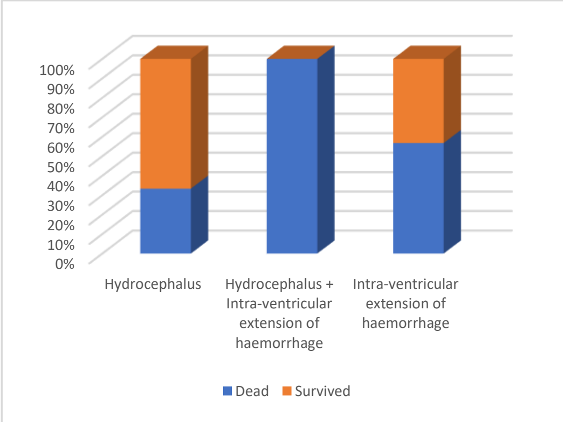


Figure [5]: Clinical outcome and complicated SICH

DISCUSSION

The study verifies that the age range of presentation is consistent with findings by Foschi et al. and that there is no gender-based variation in the anatomical site of spontaneous intracerebral hemorrhage. These findings support the demographic tendencies in ICH that remain consistent across research [5].

Our findings, showing that 25% of patients presented to the emergency department within 6 to 12 hours, are consistent with **Luzzi *et al.*'s** observations of similar presentation timing for spontaneous intracerebral hemorrhage. This alignment underscores the reliability of these temporal patterns in ICH presentation [6].

According to our research, patients with a p-value of less than 0.001 typically have lower Glasgow Coma Scale scores when they arrive at the emergency department later. This result validates the discovery made by Huttner et al. of a comparable relationship between delayed arrival and poor initial evaluations [7].

The study reveals that Pearson correlation factor of 0.636 between the ICH Score and mRS, with a significant p-value of <0.001, is consistent with the results of **Sreekrishnan *et al.*** who also identified a strong positive correlation between these variables [8].

Our study found that 40.4% of intracerebral hemorrhage cases were in deep brain regions, 27.4% in lobar regions, and 26.2% in infra-tentorial areas. These results are similar to **Hallevi *et al.*'s** findings, which also reported similar distributions of hemorrhage across these locations [9].

The research suggests that the significant correlation between Glasgow Coma Scale scores and the presenting ICH Score, with lower ICH Scores in patients with favourable GCS and higher ICH Scores in those with lower GCS, is consistent with the results reported by **Rashid *et al.*** [10].

Our study's observation of poorer mRS outcomes, particularly in infratentorial locations [59%], and the significant correlation between outcome and anatomical location, is consistent with the findings reported by **Teo *et al.*** who also identified similar patterns in their analysis of SICH outcomes [11].

The results of our investigation, which show a strong correlation between outcome and anatomical location and a high mortality rate [59%] linked to infratentorial SICH, closely resemble those of **Rost *et al.*,** who also found comparable relationships in their analysis [12].

In their examination of surgical care for intracerebral hemorrhage, de Oliveira **Manoel *et al.*** revealed similar outcomes, which are consistent with our study's 53.5% survival rate and 46.4% death rate among 84 surgical intervention patients [13].

The results of our study, which show that hydrocephalus alone may be linked to better survival outcomes in patients with spontaneous intracerebral hemorrhage [SICH] while the presence of both hydrocephalus and intraventricular hemorrhage [IVH] correlates with higher mortality, are consistent with the findings of Bhattathiri et al., who also found that IVH significantly reduces survival, particularly when combined with hydrocephalus [14].

The relationship between anatomical location and outcomes in Spontaneous Intracerebral Hemorrhage [SICH], several confounding factors should be considered, including pre-existing conditions [e.g., hypertension, diabetes], age, initial severity and hemorrhage volume. The presence of intraventricular extension [IVE] may also significantly impact mortality, potentially overshadowing the effects of location. Additionally, the timing of surgical interventions and access to quality rehabilitation services are crucial for recovery. Adjusting for these factors will enhance the understanding of prognosis and improve clinical decision-making.

Conclusion:

Our study demonstrates a significant correlation between the anatomical location of spontaneous intracerebral hemorrhage [SICH] and both immediate in-hospital outcomes and clinical profiles of patients. We observed that the location of the hemorrhage significantly influences the National Institutes of Health Stroke Scale [NIHSS] scores, presenting Glasgow Coma Scale [GCS] scores, and overall clinical profile of patients. Notably, hemorrhages located in certain anatomical regions were associated with poorer outcomes and higher mortality rates. Additionally, the volume of the intracerebral hemorrhage [ICH] further exacerbates these outcomes, with larger hemorrhage volumes correlating with increased mortality rates across different anatomical locations. These findings underline the importance of considering both the location and size of SICH when assessing prognosis and guiding treatment strategies. Our results highlight the need for targeted management approaches based on haemorrhage location and volume, which could potentially improve patient outcomes. Future research should focus on validating these findings and exploring therapeutic interventions tailored to specific hemorrhage characteristics.

Disclosure: None to be disclosed

REFERENCES

1. Hegde A, Menon G, Kumar V, Lakshmi Prasad G, Kongwad LI, Nair R, Nayak R. Clinical Profile and Predictors of Outcome in Spontaneous Intracerebral Hemorrhage from a Tertiary Care Centre in South India. Stroke Res Treat. 2020 Jan 27;2020:2192709. doi: 10.1155/2020/2192709.

2. An SJ, Kim TJ, Yoon BW. Epidemiology, Risk Factors, and Clinical Features of Intracerebral Hemorrhage: An Update. J Stroke. 2017 Jan;19[1]:3-10. doi: 10.5853/jos.2016.00864.

3. Hegde A, Menon G. Modifying the Intracerebral Hemorrhage Score to Suit the Needs of the Developing World. Ann Indian Acad Neurol. 2018 Oct-Dec; 21 [4]: 270-274. doi: 10.4103/aian.AIAN_419_17.

4. Pinho J, Costa AS, Araújo JM, Amorim JM, Ferreira C. Intracerebral hemorrhage outcome: A comprehensive update. J Neurol Sci. 2019 Mar 15;398:54-66. doi: 10.1016/j.jns.2019.01.013.

5. Foschi M, D'Anna L, Gabriele C, Conversi F, Gabriele F, De Santis F, Orlandi B, De Santis F, Ornello R, Sacco S. Sex Differences in the Epidemiology of Intracerebral Hemorrhage Over 10 Years in a Population-Based Stroke Registry. J Am Heart Assoc. 2024 Mar 5;13[5]:e032595. doi: 10.1161/JAHA.123.032595.

6. Luzzi S, Elia A, Del Maestro M, Morotti A, Elbabaa SK, Cavallini A, Galzio R. Indication, Timing, and Surgical Treatment of Spontaneous Intracerebral Hemorrhage: Systematic Review and Proposal of a Management Algorithm. World Neurosurg. 2019 Apr;124:e769-e778. doi: 10.1016/j.wneu.2019.01.016.

7. Huttner HB, Kohrmann M, Tognoni E, Juttler E, Richter G, Dorfler A, Reulbach U, Bassemir T, Staykov D, Bardutzky J, Schellinger PD, Schwab S. Clinical severity predicts time to hospital admission in patients with spontaneous intracerebral hemorrhage. Cerebrovasc Dis. 2008;25[6]:533-8. doi: 10.1159/000131671.

8. Sreekrishnan A, Dearborn JL, Greer DM, Shi FD, Hwang DY, Leasure AC, Zhou SE, Gilmore EJ, Matouk CC, Petersen NH, Sansing LH, Sheth KN. Intracerebral Hemorrhage Location and Functional Outcomes of Patients: A Systematic Literature Review and Meta-Analysis. Neurocrit Care. 2016 Dec;25[3]:384-391. doi: 10.1007/s12028-016-0276-4.

9. Hallevi H, Albright KC, Aronowski J, Barreto AD, Martin-Schild S, Khaja AM, Gonzales NR, Illoh K, Noser EA, Grotta JC. Intraventricular hemorrhage: Anatomic relationships and clinical implications. Neurology. 2008 Mar 11;70[11]:848-52. doi: 10.1212/01.wnl.0000304930.47751.75.

10. Rashid HU, Amin R, Rahman A, Islam MR, Hossain M, Barua KK, Hossain MA. Correlation between intracerebral hemorrhage score and surgical outcome of spontaneous intracerebral hemorrhage. Bangladesh Med Res Counc Bull. 2013 Apr; 39 [1]:1-5. doi: 10.3329/bmrcb.v39i1.15789.

11. Teo KC, Fong SM, Leung WCY, Leung IYH, Wong YK, et al. Location-Specific Hematoma Volume Cutoff and Clinical Outcomes in Intracerebral Hemorrhage. Stroke. 2023; 54[6]:1548-1557. doi: 10.1161/STROKEAHA.122.041246.

12. Rost NS, Smith EE, Chang Y, Snider RW, Chanderraj R, Schwab K, FitzMaurice E, Wendell L, Goldstein JN, Greenberg SM, Rosand J. Prediction of functional outcome in patients with primary intracerebral hemorrhage: the FUNC score. Stroke. 2008 Aug;39[8]:2304-9. doi: 10.1161/STROKEAHA.107.512202.

13. de de Oliveira Manoel AL. Surgery for spontaneous intracerebral hemorrhage. Crit Care. 2020 Feb 7;24[1]:45. doi: 10.1186/s13054-020-2749-2.

14. Bhattathiri PS, Gregson B, Prasad KS, Mendelow AD; STICH Investigators. Intraventricular hemorrhage and hydrocephalus after spontaneous intracerebral hemorrhage: results from the STICH trial. Acta Neurochir Suppl. 2006;96:65-8. doi: 10.1007/3-211-30714-1_16.

IJMA

International Journal of Medical Arts

Volume 6, Issue 10, October 2024

P- ISSN: 2636-4174
E- ISSN: 2682-3780