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RESEARCH ARTICLE

Analysis of Clinical Profiles and Their Impact on Outcomes in Spontaneous Intracerebral Hemorrhage

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ABSTRACT

BACKGROUND: Spontaneous Intracerebral Hemorrhage (SICH) is a critical condition with significant mortality and morbidity. Early outcome assessment is crucial for optimizing treatment efforts. Spontaneous ICH, defined as intraparenchymal bleeding without trauma or surgery, constitutes about 10–20% of all strokes. The incidence of primary ICH varies globally and is influenced by factors such as age, sex, ethnicity, and seasonal changes. It is the second most prevalent type of stroke and a leading cause of death and disability worldwide, with a 30-day fatality rate around 40% and severe disability in most survivors. ICH is a medical emergency; over 20% of patients experience worsening consciousness levels shortly after the initial evaluation, and 15–23% suffer hematoma expansion and neurological decline within hours. Complications from ICH are key predictors of early mortality and adverse outcomes. Specialized neurocritical care centers are essential in delivering medical care and enhancing patient outcomes. This study aims to evaluate the clinical profile and its impact on the outcome of spontaneous intracerebral hemorrhage.

AIM: To assess the clinical profile and its effect on the outcome of spontaneous intracerebral hemorrhage and to determine the association between clinical, biochemical, and radiological parameters with mortality among these cases.

MATERIAL AND METHOD: This hospital-based, prospective, interventional study was carried out in the Department of General Medicine. Patients were monitored throughout their hospital stay and followed up after three months to evaluate outcomes. The study population consisted of adult patients admitted to the medicine department of the institute with a diagnosis of spontaneous intracerebral hemorrhage. Written informed consent was obtained from the patients or their relatives if the patients were unable to provide consent due to their medical condition. All patients underwent a follow-up CT scan within 24 hours of admission or earlier if there was clinical deterioration.

RESULTS: The mean age of the patients was 41.4±8.0 years, with 65.5% being male. A significant association was found between age and mortality, while the association with sex was not significant. Among the study subjects, 17 had a history of hypertension, 19 had diabetes, 14 were smokers, 16 had a history of irregular treatment, and 15% had a history of a previous stroke. Within the three-month follow-up period, 20 patients died. Hypertension, smoking, and a history of irregular treatment were significantly associated with mortality. Additionally, a Glasgow Coma Scale (GCS) score at admission and an ICH score of 4 or higher were linked to increased mortality.

CONCLUSION: In conclusion, intracerebral hemorrhage is linked to high mortality. Key factors contributing to increased mortality include hypertension, smoking, symptoms such as vomiting and altered sensorium at presentation, lower Glasgow Coma Scale (GCS) scores, high ICH scores, and adverse radiological features like midline shift, larger hematoma size, and infratentorial extension.

KEYWORDS: Clinical, Determinants, Intracerebral hemorrhage score, Prognosis and Radiological

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INTRODUCTION

Spontaneous intracerebral hemorrhage (ICH) is defined as a blood collection in the cerebral parenchyma not caused by trauma. It accounts for 10-15% of all stroke cases and results from the weakening of the cerebral vessel endothelial lining, often due to hypertension or other conditions. This leads to vessel rupture within the brain parenchyma, causing localized blood collection, or hematoma, which increases intracranial pressure and damages neurons, potentially resulting in death.[1] SICH is the second most common type of stroke, representing 7.5-30% of all stroke cases. Hemorrhagic stroke generally has higher morbidity and mortality rates than ischemic stroke, with only one-fourth of patients regaining functional

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independence after SICH, and between one-fourth to half succumbing to the bleeding.[2] The optimal management of SICH remains controversial, particularly regarding the role of surgery. In resource-constrained developing countries like India, treatment strategies must be adapted due to the high morbidity and mortality associated with SICH. There is limited published literature from India on SICH outcomes.[3,4]

SICH comprises approximately 4-14% of all strokes, with a higher incidence in Asian countries compared to the West. It is more common and more likely to result in death (44% 30-day mortality) or major disability compared to cerebral infarction or subarachnoid hemorrhage (SAH).[5] The American Heart Association/American Stroke Association (AHA/ASA) guidelines recommend using established severity assessment scores like the Glasgow Coma Scale (GCS) and ICH scores for effective communication among medical professionals and objective evaluation.[6] The National Institute of Health Stroke Scale (NIHSS) is the most widely used stroke deficit rating scale, while the modified Rankin Scale (mRS) measures neurological disability affecting daily activities in stroke or other neurological disease patients.[7,8,9]

Complications from ICH are significant predictors of early mortality and poor outcomes. Specialized neurocritical care centers are vital for providing medical care and improving patient outcomes.[10,11] Non-contrast computed tomography (CT) is the gold standard for initial brain imaging in acute stroke patients due to its availability and high sensitivity for detecting ICH.[12,13] It helps determine hematoma location, size, and associated intraventricular hemorrhage (IVH) and hydrocephalus, which are predictors of patient outcomes.[14,15]

Due to its poor prognosis, numerous researchers have investigated the relationship between clinical and radiological factors and outcomes in ICH cases. Ojha et al. observed that a large ICH volume, lower consciousness levels, intraventricular hemorrhage, infratentorial extension, and older age are linked to a higher risk of death or disability within 30 days.[16] The Intracerebral Hemorrhage (ICH) score, a composite measure introduced to predict 30-day mortality risk, is based on five factors: age over 80 years, GCS score, hematoma volume, location, and intraventricular extension. Computerized Tomography (CT) scanning is the preferred initial diagnostic tool for SICH, as it effectively distinguishes hemorrhagic from ischemic stroke. Magnetic Resonance Imaging (MRI) and angiography may be used when appropriate.[17,18] Therefore, this study aimed to identify the outcome patterns and associated factors in SICH patients from eastern India.

MATERIAL AND METHODS

This hospital-based, prospective, interventional study was carried out in the Department of General Medicine. Patients were monitored throughout their hospital stay and followed up after three months to evaluate outcomes. The study included adult patients admitted to the medicine department with a diagnosis of spontaneous intracerebral hemorrhage. Written informed consent was obtained from the patients or their relatives if the patients were unable to provide consent due to their medical condition. All patients underwent a follow-up CT scan within 24 hours of admission or sooner if there was clinical deterioration. Surgical evacuation was offered to all patients with supratentorial hematoma volumes greater than 30 ml or a midline shift greater than 1 cm. Surgical intervention was also offered for posterior fossa cerebellar hematomas with a maximum diameter greater than 3 cm.

Inclusion criteria

- Patients above 18 years of age report to the medical emergency of the institute and are diagnosed to be suffering from intracerebral hemorrhage by computerized tomography (CT).

Exclusion criteria

- Trauma to the head
- Arteriovenous malformations
- Aneurysms
- Space-occupying lesions with bleeding
- Cases in which consent could not be obtained.

Study Tools

Pre-tested proforma was used for data collection. It included questions related to the demographic profile of the study subjects, their clinical details, findings of the laboratory and radiological investigations, and the outcome at discharge and during three months follow-up period.

Data Collection Procedure

The study subjects were recruited from the institute's emergency department. Written consent was obtained from the patient or their guardian, depending on the patient's condition. A detailed history was taken regarding the current illness and pre-existing conditions. A physical examination was conducted to observe general signs and neurological status, including the Glasgow Coma Scale (GCS) score.

Investigations included CBC, blood sugar, lipid profile, liver function tests, and renal function tests. An electrocardiogram was performed to assess cardiac condition, and an echocardiogram was done in selected cases where cardiac abnormalities were suspected. Imaging involved a computerized tomographic angiogram (CTA) for all patients at admission, with repeats at one week and one month if necessary. Magnetic resonance imaging (MRI) was performed as needed. The volume of the hematoma was calculated using the ABC/2 formula: A is the longest diameter of the hematoma (in cm), B is the diameter perpendicular to A (in cm), and C is the product of the number of CT scan slices showing the hematoma and the slice thickness in cm. The hematoma's location, intraventricular extension, presence of hydrocephalus, and any midline shift were also recorded. The ICH score was calculated at admission.

Management followed hospital protocols, including administering hypoglycemic agents, antihypertensives, osmotic agents, and antiepileptic agents as needed. Surgery was performed if necessary. The outcomes measured were mortality and morbidity, with morbidity assessed using the modified Rankin Scale (mRS) at discharge. Patients were asked to return for a follow-up assessment using the mRS three months later. The mRS is a 6-point disability scale widely used to assess outcomes in stroke cases. Treatment was either medical conservative therapy or early surgical evacuation, performed within 72 hours of ICH diagnosis. The primary outcome was either death or survival during the hospital stay, and observations focused on short-term outcomes and short-term mortality.

STATISTICAL ANALYSIS

Data were entered in Microsoft Excel version 2013. It was cleaned, coded, and analyzed using Statistical Package for Social Sciences (SPSS) version 20. Categorical variables were summarized as frequency and percentage while numerical variables were summarized as mean and SD. Appropriate statistical tests were done to find the association between clinical and radiological factors with the outcome among these cases.

RESULT: -

In total, 100 patients with spontaneous ICH requiring hospitalization were identified within the study period. Based on our inclusion and exclusion criteria, 80 patients were included in the study. Twenty patients were lost to follow-up, and their mRS at 90 days could not be obtained.

Table 1: Showing background factors in relation to mortality of the cases.

Background Factor	Survived (n=60)	Died (n=20)
Age (yrs.)	41.4±8.0	47.6±10.2
Sex (Male)	31	13
Hypertension	17	6
Diabetes	19	3
Smoking	14	10
History of irregular treatment	16	14
History of stroke	15	12

The average age was 41.4±8.0 years, with 65.5% being male. There was a significant association between age and mortality, but not with sex. Seventeen of the study participants had a history of hypertension, while nineteen had diabetes. Among them, fourteen were smokers, and sixteen had a history of irregular treatment. Additionally, 15% had a previous history of stroke. Within the three-month follow-up period, twenty patients died. Hypertension, smoking, and a history of irregular treatment showed significant associations with mortality.

Table 2: Showing clinical and radiological findings in relation to mortality of the cases.

Clinical and radiological findings	Survived (n=55)	Died (n=25)
Headache	15	6
Vomiting	12	10
Convulsion	29	17
Altered sensorium	44	33
Weakness of limbs	45	30
Systolic BP (mm Hg)	122.3±12.5	173.3±29.6
Diastolic BP (mm Hg)	66.3±9.2	62.3±10.3
ICH Score	0.54±0.2	1.5±0.8
GCS<8	36	21
Random glucose (mg/ dL)	116.5±21.3	132.1±40.3
Volume (ml)	10.2±12.4	21.3±12.1
Midline shift	43	13
Hydrocephalus	39	19
Hematoma growth	*5*	9

15 of the patients presented with headache, 12 with vomiting, 29 with convulsion, 44 with altered sensorium, and 45 with weakness of limbs. Mean systolic BP was 122.3±12.5 mm of Hg and diastolic BP was 66.3±9.2 mm of Hg. Random blood sugar was 116.5±21.3 mg/dl. In 36 patients, the GSC score was <8.

Table 3: Showing ICH score in relation to mortality of the cases.

ICH Score	Total cases (n=60)	Died (n=20)	Mortality (%)
0	13	4	5.6
1	21	5	12.8
2	8	3	23.8
3	10	6	28.6
4	6	1	39.8
5	2	1	25

5% of the cases had an ICH score of 4 and above. 9.5% of patients died before discharge and 21.9% by the completion of three months. 33.4% had good outcomes as per the mRS score by the end of three months.

DISCUSSION

Spontaneous intracerebral hemorrhage (SICH) stands out among the causes of mortality associated with cerebrovascular accidents due to its high mortality and morbidity rates. Despite advancements in radiological assessments and newer treatment approaches, the prognosis for this condition remains unfavorable.[19] Several predictive models, such as the ICH score, have been developed to better understand the clinical progression and outcomes of SICH. However, research on SICH outcomes is limited. Given its life-threatening nature, SICH requires urgent medical attention to ensure timely and appropriate treatment decisions, particularly in predicting 30-day mortality.[20]

In a study by **Bhatia R et al., 2013**[21] 30-day mortality was 32.7% (70 out of 214 patients). In line with previous research findings, factors such as age, gender, and comorbidities such as hypertension, diabetes, and alcohol abuse did not emerge as significant predictors of outcomes in the current study. However, the present study reaffirmed that the volume of intracerebral hemorrhage (ICH) was among the most influential factors in predicting outcomes for patients with spontaneous intracerebral hemorrhage (SICH). In the study by **Hegde A et al.2018**[19], a volume of more than 30 mL with intraventricular extension and hydrocephalus was an indicator of poor outcome.

Hypertension is the most common risk factor in all the studies relating to SICH. **Feldmann et al.2005**[22] have reported a relative risk of 3.9 for ICH in patients with hypertension. It is suggested that elevated blood glucose levels upon admission may worsen outcomes by exacerbating cerebral edema and damage. A recent

meta-analysis by **Zheng et al. 2018**[23] concluded that hyperglycemia was associated with poor functional outcomes in patients with ICH. Yet, the existing body of evidence concerning blood glucose variability and its impact on ICH remains relatively limited, and random blood glucose levels have not emerged as predictors of mortality in studies on ICH conducted in India.

The study done by **Safatli DA et al.2016**[24] where the supratentorial bleeding volume of more than 32 mL and infratentorial bleeding volume more than 21 mL correlate with poor outcome. However, there are notable discrepancies in the cutoff values for ICH volume across different studies. The current study's finding that infratentorial ICH location correlates with higher 30-day mortality aligns with previous research. This underscores the potential significance of timely surgical intervention in improving patient outcomes. Additionally, the present study highlights the importance of utilizing validated outcome grading scores such as the ICH score and ICH-GS for accurately predicting 30-day mortality in patients with spontaneous intracerebral hemorrhage (SICH).

Modi et al.2017[25] found a mortality rate of 100% in a GCS score of 4 or less. **Hegde et al. 2018**[19] reported that GCS scores <8 and higher ICH scores were significantly associated with mortality. They have noted that while the original Hemphill ICH score remains a dependable tool for outcome evaluation, the Essen ICH score, which relies solely on clinical criteria, could be a practical alternative for implementation in Indian settings. **Ojha et al. 2015**[16] also found that a GCS score <8 was associated with increased mortality. As the ICH scores rose, mortality rates also escalated, reaching 100% in patients with ICH scores of 5 and 6. Their conclusion emphasized the necessity of integrating the ICH score as a routine evaluation in the management of patients with intracerebral hemorrhage.

Limitation

The main limitations of the current study included a relatively small sample size, a brief follow-up period (3 months), and outcome evaluation limited to the modified Rankin Scale (mRS). Critical parameters such as cognitive impairment were not assessed. Additionally, biomarkers and emerging predictors like ferritin, β-amyloid, vascular endothelial growth factor (VEGF), and ApoC-III were not investigated. This study focused on short-term outcomes, highlighting the necessity for further research examining the long-term outcomes in patients with spontaneous intracerebral hemorrhage (SICH). The decision between surgical and conservative management varied among physicians and neurosurgeons, influenced by their individual expertise and risk assessments.

CONCLUSION:

Intracerebral hemorrhage is concluded to be associated with high mortality rates. Key factors contributing to increased mortality include hypertension, smoking, symptoms such as vomiting and altered sensorium at presentation, lower Glasgow Coma Scale (GCS) score, and high Intracerebral Hemorrhage (ICH) score, along with unfavorable radiological features such as midline shift, larger hematoma size, and infratentorial extension. Early recognition of these factors may aid in more accurate prognosis assessment and timely intervention. Intraventricular extension, hematoma growth, and hydrocephalus consistently emerge as significant predictors of death and poor outcomes following spontaneous intracerebral hemorrhage. Further research is warranted to evaluate the risk of spontaneous intracerebral hemorrhage among hypertensive patients and to predict outcomes using novel indicators, including biomarkers.

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