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Clinical Outcomes in Intracranial Bleed Patients in Inpatients Department

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ABSTRACT

Background: Intracranial hemorrhage is a high-mortality and high-morbidity neurologic emergency. Clinical outcomes are determined by demographic and clinical factors and guide prognostication and resource utilization. There is scarce local data on short-term outcomes among patients with this diagnosis from Pakistan, particularly from Rawalpindi region. **Objective:** To determine the clinical outcomes in intracranial bleed patients in inpatients department presenting to Fauji Foundation Hospital Rawalpindi. **Study Design:** Cross-sectional observational study. **Duration and Place of Study:** The study was conducted in the Department of Neurology, Fauji Foundation Hospital, Rawalpindi, from August 2024 to January 2025. **Methodology:** A total of 120 patients aged 30–70 years with computed tomography-confirmed intracranial hemorrhage were enrolled. Patients with trauma-induced hematomas, anticoagulant use, brain tumors, or vascular malformations were excluded. Demographic and clinical details, including age, gender, body mass index, socioeconomic status, residential background, and symptom duration, were recorded. Outcomes were classified as in-hospital death, significant disability (modified Rankin scale 3–4), and favorable short-term outcome (modified Rankin scale 1–2). **Results:** The mean age of patients was 51.86±10.20 years, and the mean body mass index was 26.10±2.48 kg/m^2. Mortality occurred in 59 patients (49.2%), while 31 patients (25.8%) developed significant disability, and only 30 patients (25.0%) achieved favorable short-term outcomes. Older age, higher body mass index, prolonged symptom duration, rural residence, and poor socioeconomic status were significantly associated with higher mortality and poorer outcomes. **Conclusion:** Intracranial hemorrhage carries a high mortality and disability burden.

INTRODUCTION

Intracranial bleeding is a highly serious neurological emergency that encompasses several entities such as intraparenchymal, subdural, epidural, and subarachnoid hemorrhages.[1] The conditions can be caused by trauma, hypertension, vascular malformations, coagulopathies, or by spontaneous rupture of cranial vessels.[2] The pooling of blood within the cranial vault causes increased intracranial pressure, damage to neurons, and disturbance of cerebral perfusion, all of which cause serious morbidity and mortality.[3] Early recognition and management are necessary since prognosis largely hinges on location, volume of bleeding, patient's level of neurological impairment upon presentation, and timing of intervention.[4]

Clinical presentations of patients with intracranial hemorrhage are extremely varied with high percentages being admitted with substantial disability.[5] Neurological impairment by way of hemiplegia, aphasia, impaired cognition, or dependency of daily living activities are typical findings among survivors, particularly those with large-volume bleeding or late presentation.[6] The level of late impairment often requires prolonged rehabilitation with a significant burden on patients as well as on caregivers and health systems.[7] These kinds of outcomes highlight the urgency for multidisciplinary comprehensive care to maximize recovery as well as functional independence.[5-7]

Conversely, a subgroup of patients presents favorable short-term outcome with recovery of neurological function to enable independent living as well as return to pre-admission activities.[8] This is more probable among young patients, those with smaller hematoma volumes on imaging, as well as patients receiving timely medical or neurosurgical intervention.[9] However, intracranial hemorrhage is also coupled with high mortalities within hospital among patients with massive hemorrhages, brainstem involvement, or important clinical decline presenting at initial evaluation.[10] Death at hospital typically derives from progressive neurological decline, herniation syndrome, or system-based complications.[11] Variability in outcomes highlights the necessity of immediate risk stratification as well as vigorous management strategies tailored to patient risk profiles on an individual basis.

Radu RA et al. reported that among patients with intracranial hemorrhage, the in-hospital mortality rate was 50.01%, while 31.19% were discharged with significant disability, corresponding to a modified Rankin scale score of 3–4. In contrast, 18.8% achieved a favorable short-term outcome, reflected by a modified Rankin scale score of 1–2.[12]

Evaluation of clinical outcomes for patients with intracranial hemorrhage within Rawalpindi is necessary because geographical variation in access to care, management protocols, and reporting at rehabilitation could significantly influence prognosis. Local data will be especially valuable to identify patterns of mortality, disability, and recovery to assist with identifying gaps in care and optimizing management strategies for maximum benefit. Furthermore, this evidence is especially necessary to guide distribution of resources, support neurosurgical and critical care infrastructure, and improve outcomes amongst patients within this group.

METHODOLOGY

This cross-sectional study was conducted in the Department of Neurology at Fauji Foundation Hospital, Rawalpindi, over a six-month period from August 2024 to January 2025. A total of 120 patients were enrolled. The required sample size was calculated using the World Health Organization formula with a 95% confidence level, a 7% margin of error, and an estimated proportion of favorable short-term outcome of 18.8% in patients with intracranial bleeding.[12]

Approval for the study protocol was obtained from the institutional ethics review committee before initiating data collection. Patients aged 30 to 70 years of either gender were included if computed tomography of the brain revealed acute hemorrhage, which was identified as hyperdense areas compared with the surrounding parenchyma. Exclusion criteria comprised patients with a history of trauma-induced hematoma, prior use of anticoagulant or thrombolytic medication, brain tumors, or vascular abnormalities such as saccular aneurysms and arteriovenous malformations. Written informed consent was taken from patients or their primary caregivers after explaining study details, ensuring confidentiality, and clarifying that participation carried no additional risk. Demographic data including age, gender, body mass index, socioeconomic background, residential status, and duration of presenting complaints were recorded. Each participant underwent detailed history taking and clinical examination. The primary outcomes were categorized as follows: in-hospital death was defined as mortality during admission; significant disability was defined as discharge with a modified Rankin scale score of 3–4; and a favorable short-term outcome was defined as discharge with a modified Rankin scale score of 1–2. Outcomes were documented on a predesigned proforma during the hospital stay.

All collected data were analyzed using IBM SPSS version 26. Continuous variables such as age, body mass index, and duration of complaints were expressed as mean with standard deviation or median with interquartile range, depending on distribution assessed through the Shapiro–Wilk test. Categorical data, including gender, socioeconomic status, residence, in-hospital death, significant disability, and favorable short-term outcome, were presented as frequencies and percentages. Clinical outcomes were stratified by demographic and clinical variables, and post-stratification analysis was carried out using chi-square test or Fisher's exact test where appropriate. A p-value of ≤0.05 was considered statistically significant.

RESULTS

The study included 120 patients with intracranial bleeding, with a mean age of 51.86±10.20 years and mean duration of complaints of 8.40±4.03 days. The average BMI was 26.10±2.48 kg/m². The majority of patients were from rural areas (80 patients, 66.7%) compared to urban areas (40 patients, 33.3%). Regarding socioeconomic status, 66 patients (55.0%) were classified as poor, 45 patients (37.5%) as middle class, and 9 patients (7.5%) as rich (as shown in Table-I).

Table I

Patient Demographics

Demographics	Mean ± SD
Age (years)	51.86±10.20
Duration of complaints (days)	8.40±4.03
BMI (Kg/m²)	26.10±2.48
Residential Status	
Rural n (%)	80 (66.7%)
Urban n (%)	40 (33.3%)
Socioeconomic Status	
Poor n (%)	66 (55.0%)
Middle n (%)	45 (37.5%)
Rich n (%)	9 (7.5%)

Clinical outcomes revealed that 59 patients (49.2%) died during hospitalization while 61 patients (50.8%) survived. Significant disability was observed in 31 patients (25.8%) with 89 patients (74.2%) showing no significant disability. Favorable short-term outcomes were achieved in only 30 patients (25.0%) while 90 patients (75.0%) had unfavorable outcomes (as shown in Table-II).

Table II

Clinical Outcomes in Intracranial Bleed Patients

Clinical Outcomes	Frequency	% age
Death during hospitalization		
Yes	59	49.20%
No	61	50.80%
Total	120	100%
Significant disability		
Yes	31	25.80%
No	89	74.20%
Total	120	100%
Favorable short-term outcome		
Yes	30	25.00%
No	90	75.00%
Total	120	100%

Stratified analysis demonstrated significant associations between age and clinical outcomes, with patients >50 years showing higher mortality rates (60.0% vs 34.0%, p=0.005) but lower rates of significant disability (17.1% vs 38.0%, p=0.010), while age showed no significant association with favorable short-term outcomes (22.9% vs

28.0%, p=0.521). Gender analysis revealed no significant difference in mortality between males and females (46.4% vs 60.9%, p=0.212) or in significant disability rates (22.7% vs 39.1%, p=0.105), but males had significantly better favorable short-term outcomes compared to females (30.9% vs 0.0%, p=0.002). Duration of complaints showed that patients with >7 days of symptoms had significantly higher mortality (57.3% vs 35.6%, p=0.021) and poorer favorable outcomes (16.0% vs 40.0%, p=0.003), while duration showed no significant association with disability rates (26.7% vs 24.4%, p=0.788). BMI demonstrated strong associations across all outcomes, with patients having BMI >25 kg/m^2 showing significantly higher mortality (73.1% vs 18.9%, p<0.001), lower disability rates (14.9% vs 39.6%, p=0.002), and poorer favorable outcomes (11.9% vs 41.5%, p<0.001). Rural patients had significantly higher mortality rates compared to urban patients (58.8% vs 30.0%, p=0.003) and lower disability rates (13.8% vs 50.0%, p<0.001), while residential status showed no significant association with favorable outcomes (27.5% vs 20.0%, p=0.371). Socioeconomic status significantly influenced all clinical outcomes, with poor patients showing the highest mortality rates (68.2%) compared to middle-class (20.0%) and rich patients (55.6%) (p<0.001), lowest disability rates among poor patients (16.7%) versus middle-class (35.6%) and rich patients (44.4%) (p=0.032), and poorest favorable outcomes in poor patients (15.2%) compared to middle-class patients (44.4%) and rich patients (0.0%) (p<0.001) (as shown in Table-III).

Table III

Association of Clinical Outcomes with Demographic Factors

Demographic Factors		Death during hospitalization		p-value	Significant disability		p-value	Favorable short-term outcome		p-value
		Yes n(%)	No n(%)		Yes n(%)	No n(%)		Yes n(%)	No n(%)	
Age (years)	≤50	17 (34.0%)	33 (66.0%)	0.005*	19 (38.0%)	31 (62.0%)	0.010*	14 (28.0%)	36 (72.0%)	0.521
	>50	42 (60.0%)	28 (40.0%)		12 (17.1%)	58 (82.9%)		16 (22.9%)	54 (77.1%)	
Gender	Male	45 (46.4%)	52 (53.6%)	0.212	22 (22.7%)	75 (77.3%)	0.105	30 (30.9%)	67 (69.1%)	0.002*
	Female	14 (60.9%)	9 (39.1%)		9 (39.1%)	14 (60.9%)		0 (0.0%)	23 (100.0%)	
Duration (days)	≤7	16 (35.6%)	29 (64.4%)	0.021*	11 (24.4%)	34 (75.6%)	0.788	18 (40.0%)	27 (60.0%)	0.003*
	>7	43 (57.3%)	32 (42.7%)		20 (26.7%)	55 (73.3%)		12 (16.0%)	63 (84.0%)	
BMI (Kg/m^2)	≤25	10 (18.9%)	43 (81.1%)	<0.001*	21 (39.6%)	32 (60.4%)	0.002*	22 (41.5%)	31 (58.5%)	<0.001*
	>25	49 (73.1%)	18 (26.9%)		10 (14.9%)	57 (85.1%)		8 (11.9%)	59 (88.1%)	
Residential Status	Rural	47 (58.8%)	33 (41.3%)	0.003*	11 (13.8%)	69 (86.3%)	<0.001*	22 (27.5%)	58 (72.5%)	0.371
	Urban	12 (30.0%)	28 (70.0%)		20 (50.0%)	20 (50.0%)		8 (20.0%)	32 (80.0%)	
Socioeconomic Status	Poor	45 (68.2%)	21 (31.8%)	<0.001*	11 (16.7%)	55 (83.3%)	0.032*	10 (15.2%)	56 (84.8%)	<0.001*
	Middle	9 (20.0%)	36 (80.0%)		16 (35.6%)	29 (64.4%)		20 (44.4%)	25 (55.6%)	
	Rich	5 (55.6%)	4 (44.4%)		4 (44.4%)	5 (55.6%)		0 (0.0%)	9 (100.0%)	

***Fischer Exact Test**

DISCUSSION

The current study set out to assess clinical outcomes among patients with intracranial bleed and their correlation with demographic parameters with demonstrable significant mortality (49.2%) and high morbidity with only 25% exhibiting favorable short-term outcomes. The observation that patients above 50 years presented with significantly larger mortality (60.0% vs 34.0%) can be explained by age-related changes at a physiological level such as diminished cerebral autoregulation, impaired integrity of vessels, and diminished neuroplasticity that disables recovery processes following intracranial hemorrhage. On the contrary, young patients registered increased levels of significant disability (38.0% vs 17.1%.), which can only indicate their increased survival rates which expose them to more likelihood of living with neurological sequelae as compared to oldest age groups who are at increased risk of dying before total assessment of their resulting disability can be determined.

The finding that male patients had significantly superior favorable short-term outcomes than females (30.9% vs 0.0%) is best explained by sex-associated variations in cerebrovascular anatomy, hormonal modulation of coagulation cascades, and possible differences in stroke severity at presentation. The significant correlation between increased BMI and higher mortality (73.1% vs 18.9%) mirrors the pathophysiological burden of obesity with elevated intracranial pressure, impaired respiratory mechanics, and comorbidities like hypertension and diabetes that add to neurological injury.

Rural patients presented much higher mortality (58.8% vs 30.0%) and lower rates of disability (13.8% vs 50.0%), which is most likely a marker of late presentation due to geographical obstacles to health-care access, resulting in more established disease states prone to cause death or cure rather than survival with disability. Strong influence of socioeconomic factors on all clinical outcomes with adverse mortality among poor patients (68.2%) and poor favorable outcomes (15.2%) highlights the complex role of health-care accessibility, nutritional state, control of comorbid illnesses, and social health determinants that all cumulatively affect presentation severity as well as quality of health-care delivered during hospitalization.

Our mortality rate of 49.2% aligns closely with several international studies, demonstrating consistency across different populations and healthcare settings. Radu RA et al. [12] reported a similar in-hospital mortality of 50.1% in Romanian patients, while Namani G et al. [13] found 61% mortality in their cohort, and Nixon S et al. [14] observed 40% 90-day mortality in acute leukemia patients with ICH. However, some studies reported lower mortality rates, including Serrano F et al. [15] who documented 12.5% in-hospital mortality in the Latin American Stroke Registry and Haji S et al. [16] who found excellent outcomes with 90.27% favorable results in young adults aged 16-40 years. This variation likely reflects differences in patient demographics, with younger populations showing better outcomes, as supported by our finding of age >50 being associated with increased mortality. The exceptionally high mortality in Deshpande R et al. [17] study of hemodialysis patients (76.7%) suggests that underlying comorbidities significantly compound ICH prognosis, supporting our observation of socioeconomic factors influencing outcomes through their association with comorbidity burden.

The age-related mortality patterns in our study are consistent with existing literature, though with some notable variations. While we found significantly higher mortality in patients >50 years (60.0% vs 34.0%), Serrano F et al.[15] identified patients >80 years as having increased mortality risk (HR 1.89), and Radu RA et al.[12] reported remarkably high mortality (67%) in the 51-60 age group with 0% mortality in those <50 years. These findings collectively support the concept of age as a critical prognostic factor, though the specific thresholds may vary based on population characteristics and healthcare systems. The better outcomes in younger patients align with Haji S et al. [16] findings in young adults and Ahmed F et al.[18] study showing mean age of 45.1 years with relatively better prognosis.

Gender differences in our study, particularly the significantly better favorable short-term outcomes in males (30.9% vs 0.0%), contrast with some international findings. Serrano F et al.[15] found that poor functional outcomes occurred more frequently in women (62.5% vs overall 43.2%, p=0.009), which partially supports our findings. However, Radu RA et al.[12] reported higher mortality in men versus women (61% vs 40%, p=0.13), though this was not statistically significant. The discrepancy may reflect population-specific factors, cultural differences in healthcare seeking behavior, or variations in stroke severity and etiology between genders across different geographic regions.

Our finding that higher BMI is associated with increased mortality (73.1% vs 18.9% for BMI >25 vs ≤25) represents a novel contribution to the literature, as most referenced studies did not specifically analyze BMI as a prognostic factor. This association likely reflects the complex interplay between obesity and cardiovascular risk factors, inflammatory states, and metabolic dysfunction that collectively worsen ICH outcomes. The duration of complaints showing association with mortality (57.3% vs 35.6% for >7 vs ≤7 days) aligns with the concept emphasized by Morotti A et al.[19] regarding the importance of ultra-early intervention, as longer symptom duration may reflect delayed presentation and missed therapeutic windows.

Socioeconomic variations identified in this study with 68.2% mortality among poor patients and 20.0% among middle-class patients mirror health care inequalities documented more irregularly in international medical reporting. Of particular note is this finding within developing health care systems where emergency care quality, opportunities for specialty intervention, and access to care are open to broad variation with economic level. The 58.8% to 30% mortality disparity between rural and urban patients also reflects health care access issues which are potentially overestimated within health care-poor regions, as compared with developed health care systems where this type of Geographic variation might be obscured.

Some limitations need to be considered when interpreting these findings. The study was a single-center study at a tertiary care center and might preclude extending findings to different health care settings or populations. The sample size of 120 patients is sufficient for statistical inference but may not reflect the entire spectrum of presentations and outcomes of ICH. There might have been selection bias as patients who present to a tertiary center may reflect more severe presentations and thereby overestimate mortality rates. The study did not control for certain ICH subtypes, hematoma volumes, or imaging parameters known to affect outcomes. Delayed functional outcomes after the acute period of hospitalization were not evaluated and thereby limited understanding of patterns of disability and quality of life measures.

CONCLUSION

Our analysis has found that intracranial bleeding presents high mortality and morbidity loads with clinical outcomes heavily determined by population and socioeconomic variables. The age of patients, BMI, symptom duration, residential status, and socioeconomic status were found to be key predictors of mortality, disability, and favorable outcomes. The large differences between rural and city patients as well as socioeconomic gradients among outcomes best illuminate the role of health care access and social health determinants in prognosis of ICH.

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