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Original Article

Clinical Characteristics and Outcome of Spontaneous Intracerebral Hemorrhage

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Abstract

Background

Stroke is the second leading cause of death and disability globally. Intracerebral hemorrhage represents a prominent subtype comprising 10-20% of all strokes and posing substantial challenges, particularly in low-income countries. This study aims to unravel the clinical profile and outcomes of spontaneous ICH patients at our institute.

Materials and Methods

This is a prospective observational study conducted at the department of Neurosurgery Nobel Medical College Teaching Hospital, Biratnagar, Nepal over a period of one and half years.

Results

In the Present study, a total of 285 populations were studied, where there was male preponderance with the mean age of 57.9 years. Commonest clinical manifestation was sudden onset headache (75.1%) followed by decreased level of consciousness. Hypertension was the commonest cause of ICH. Basal ganglia were the primary location of bleed. The statistical analysis revealed a significant difference in the mean clot volume between survivors and non-survivors. There was a strong association between ventricular extension of hematoma and outcome. Surgical hematoma evacuation was performed in 30.9% of cases. Favorable outcomes, defined by a modified Rankin Scale score of 0-3, were achieved in 58.9% of participants.

Conclusion

Age, sudden onset headache, and hypertension predict mortality in primary intracerebral hemorrhage (ICH), particularly with advanced age linked to poorer outcomes. A Glasgow Coma Score less than eight increases mortality risk, while clot volume and intraventricular extension play crucial roles in ICH outcome.

Keywords: *Basal ganglia, Glasgow coma scale, Hypertension, Intracerebral hemorrhage*

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Introduction

Stroke is the second leading cause of death worldwide, and one of the leading causes of disability [1, 2]. Intracerebral hemorrhage is the second most common subtype of stroke after ischemic stroke and accounts for approximately 10 % to 20 % of all strokes [3]. WHO estimates in the last decade indicate that death from stroke in low-income and middle-income countries accounted for 85·5% of stroke deaths worldwide, and the disability-adjusted life years (DALYs) lost in these countries were almost seven times those lost in high-income countries[4]. The manifestation of intracerebral hemorrhage (ICH) changes quickly, fluctuates greatly, has extremely high mortality and disability rate [5,6], and it is a life-threatening condition [7]. ICH is further subdivided into lobar and deep ICH. Lobar is mostly due to amyloid angiopathy and deep is caused mostly by hypertensive angiopathy [8]. Spontaneous ICH is classified as primary when caused by the rupture of small vessels, or secondary when hemorrhage is due to the presence of cerebral vascular malformation, brain tumor, or other rare non-traumatic causes [9].

Despite the advances in imaging of ICH, the proper identification and management of ICH remains a challenge in developing countries, where the lack of resources, skilled manpower, and the gap between health service availability and affordability plays a significant role.

This study aims to portray the clinical profile and outcome of the patients with spontaneous ICH managed in our institute.

Materials and Methods

This is a prospective observational study conducted in the department of neurosurgery at Nobel Medical College Teaching Hospital, Biratnagar, Nepal, from June 2022 to December 2023 after obtaining the approval from the ethical review committee of the institute after consent from all the individuals or legal guardians in the study. All the cases with primary spontaneous ICH were included in the study. Secondary ICH and cases of ICH managed primarily in other centers, ICH associated with Coagulopathy and other Systemic disease which alters the natural course of ICH were excluded. Sample size was calculated by using the incidence of ICH as per a study by Sai et al. [10] where the incidence of primary ICH was found to be 29.6. Sample size $(n)= Z^2X\ p\ X\ q\ /\ d^2$. Considering p= 0.29, d= 0.06, and a confidence level of 95%, the minimum sample size was calculated to be 224.

Variables considered in the study were age at presentation, gender, etiology, hematoma location, and Glasgow Coma Scale (GCS) scoring, and outcome variables included the modified Rankin Scale at discharge, death, vegetative state, or severe disability. The treatment approach varied based on factors such as hematoma size, location, and etiology, with some patients undergoing surgical evacuation, while others received conservative treatment as per the standard departmental protocol i.e hyperosmolar therapy (inj Mannitol 20% as per body weight with dose of 1 gm/kg three times a day without without antiepileptics medication where indicated. The targeted blood pressure was 140/80 mmHg. Those cases with conservative management which did not respond the treatment and persistent rise in intracranial pressure (ICP) noted clinically, were subjected for with external ventricular drainage or surgery for hematoma evacuation .ICP was not measured in those without having intraventricular hematoma where external ventricular drainage (EVD) was not used. The clinical profile, operative details, and outcomes were documented .

Comparative analysis of the outcome variable for age, gender, GCS, etiology, hematoma location, and treatment modality aimed to identify any statistically significant differences in outcome rates.

Statistical analysis was done using Statistical Package for the Social Sciences software version 16 (SPSS-16). Descriptive statistics, swa employed to characterize data variables and results were shown in the table where necessary.

Results

In the present study, a total of 285 patients were analyzed during the study period which is as shown below. The present study comprises of male preponderance which constitute 73.3% (n=209). The mean age of the study population was 57.97 years (13-97 years). Majority of patients (51.6%) fall under the age group of 50-69. Only two patients were above 90 years.Age distribution of study population is shown in Table1.

Table 1: Distribution according to age group and gender

Age group	Male	Female	Total
10-29	2	3	5 (1.8%)
30-49	49	17	66 (23.3%)
50-69	104	43	147 (51.6%)
70-89	52	13	65 (22.8%)
=90	2	0	2 (0.7%)
Total	209	76	285

The most common clinical presentation was headache followed by focal deficits which was seen in about 72% and 28 % respectively. The majority of the study population presented with GCS in the range of 9-12,which comprised of 75% (n=214) followed by GCS of 13-15 in 13.7% (n=39) and 3-8 in 11.2%(n=32). The major risk factor associated was hypertension for both male and female as shown in table 2.

Table 2: Associated Risk factors in study population

Risk factors	Male	Female	Total (%)
Hypertension	159	56	215(75.4)
Hypertension & Alcoholic	11	4	15(5.3)
Hypertension & Diabetes mellitus	4	2	6(2.1)
Alcoholic	0	1	1(0.4)
Anticoagulant	5	3	8(2.8)
None	30	10	40(14)
Total	209	76	285

The majority of the bleeding 56.8% (n=162) was found in the basal ganglia region followed by thalamus, cerebellum, pons and others in 26.7% (n=76),7% (n=20),6.3%(n=18) and 3.2%(n=9) respectively. Thesupratentorial bleed was seen in 86.3% (n=246) and the infratentorial bleed was seen in 13.7% (n=39). Only 7.01% (n=20) had an increase in hematoma size. In 68.8% (n=196) the hematoma volume was less than 30ml and it was more than 30 ml in 31.2%(n=89).The mean volume of the clot in the mortality group was 33.2ml, and the mean volume amongst the survivors was 19.4ml. Ventricular extension of hematoma was seen in 28.80% of the study population. A chi-square test of independence was performed to examine the relationship between ventricular extension and complications. The relation between these variables was significant, $X^2(5, N=285) =26.6, p<0.05$. Around 50 % of patients had an ICH score of two. ICH score distribution is shown in Table 3.

Table 3: ICH score

ICH score	Frequency (n)	Percentage (%)
0	0	0
1	115	40.4
2	143	50.2
3	24	8.4
4	1	0.4
5	0	0
6	2	0.7

Surgical evacuation of hematoma was done in 30.9% (n=88) patients whereas 69.1% of patients were managed conservatively. EVD was placed in 18.9% (n=54) of patients. Tracheostomy was required in 5.3% (n=17) patients. The mean duration of hospital stays was 11.8 days. Out of total tracheostomies performed, ten cases belong to those who were managed conservatively.

The most common complication in the present study was chest infection seen in 22.5% followed by urinary tract infection which was seen in 7.4% .Post-stroke seizure bowel bladder incontinence, cognitive impairment, post-stroke depression was seen in 7.4% of individuals. Other complications seen were as tabulated below in table 4.

Table 4: Complications in the present study

Complications	Surgery		Total	Percentage of total (%)
	Yes	No		
Chest infection	14	50	64	22.5
UTI	5	16	21	7.4
DVT	2	3	5	1.8
Meningitis	1	11	13	4.6
Other	7	14	21	7.4
Death	2	8	10	3.5

Good outcome (mRS 0-3) was found in 58.9% while poor outcome (mRS 4-5) was found in 41.1% as shown in Table 5. Death occurred in ten patients among them 8 were conservatively managed patients.

Table 5: Modified Rankin Scale at discharge

mRS	Frequency (n)	Percentage (%)
0	0	0
1	3	1.1
2	12	4.2
3	153	53.6
4	104	36.5
5	3	1.1
6	10	3.5

The mean duration of hospital stays for those who were managed conservatively was 11.8 days whereas for those who went for surgery was 12.2 days. Those who stayed in inhouseneurorehabilitation were not included in the analysis the reason being patients were fit for discharge but hospital stay was prolonged due to family issues including care taker at home.

Discussion

Intracranial hemorrhage has very devastating consequences. Identification of risk factors, initiating corrective measures, and tailoring the treatment is very crucial especially in resource limited settings. There is limited literature Published studies related to hemorrhagic stroke from Nepal. Our study unveiled intriguing demographic patterns among individuals afflicted with spontaneous intracranial hemorrhage, hinting at potential underlying predispositions that warrant further exploration. The heterogeneous clinical presentations observed underscore the necessity for personalized treatment strategies tailored to individual patient needs. Our analysis emphasized the pivotal role of imaging modalities in facilitating accurate diagnosis and guiding therapeutic interventions, yet despite these advancements, the outcomes remained varied and multifaceted.

The mean age of the study population in the present study was 57.97 years which was similar to the study conducted by Hemphill et al. where the mean age of study population was 66 years [11]. Majority of patients (51.6%) fall under the age group of 50-69. Increasing age is associated with higher mortality and complications. In this study, out of 10 mortalities, 7 were above 60 years. Numerous authors have demonstrated that older individuals with acute intracerebral hemorrhage (ICH) face more adverse consequences in comparison to younger individuals, encompassing outcomes such as mortality, dependency, and overall quality of life [12-14].

Sudden onset headache was the commonest clinical presentation in the present study which was 72% which was similar to the findings of sturdy by An SJ et. al.[15] In studies addressing spontaneous intracerebral hemorrhage (SICH), hypertension emerges as the predominant risk factor. Feldmann et al. documented a relative risk of 3.9 for intracerebral hemorrhage in individuals with hypertension [16].In 75.4% of patients' hypertension was a risk factor in the present study.

The role of surgery in spontaneous intracerebral hemorrhage (SICH) remains a topic of debate. A meta-analysis conducted by Prasad et al. following the STICH 1 trial concluded that the addition of surgery to medical management reduces the likelihood of death or dependency compared to medical management alone [17]. In Troberg's study, purportedly the most extensive investigation into long-term functional outcomes with a follow-up period of up to 10.8 years after surgery for intracerebral hemorrhage (ICH), findings revealed that 31% of all operated ICH patients had succumbed to the condition after one year, and only 24% of patients assessed for long-term functional outcomes were independent in their daily activities [18] . Regardless of the duration of follow-up, pre-existing heart disease and a decreased level of consciousness before surgery consistently emerged as predictors of mortality. In contrast, our study found no significant impact of clot evacuation on mortality ($p = 0.448$).

The most common medical complication encountered in the present study during management was chest infection which was seen in about 22.5% followed by urinary tract infection seen in 22.5%. (22.5% followed by urinary tract infection (7.4%). Post-stroke seizure bowel bladder incontinence, cognitive impairment, post-stroke depression was seen in 7.4% of individuals. The specific early post stroke complication as reported by Langhorne P et al [19]were as neurological-recurrent stroke (9% of patients), epileptic seizure (3%); infections-urinary tract infection (24%), chest infection (22%), others (19%); mobility related-falls (25%), falls with serious injury (5%), pressure sores (21%); thromboembolism-deep venous thrombosis (2%), pulmonary embolism (1%); pain-shoulder pain (9%), other pain (34%); and psychological-depression (16%), anxiety (14%), emotionalism (12%), and confusion (56%) The incidence of late post-stroke spasticity and hypertonicity, post stroke depression, urinary incontinence, seizure, cognitive impairment, have been reported as 60%, 25-30% ,15%,10%, 5-9% [20]. Bhatia et al. and Namani et al., have observed unfavorable outcomes with presenting Glasgow Coma Score (GCS) below 8 with fatality rates of 72.9% and 100%, respectively [21,22]. In our observations, we noted a mortality rate of 30% in patients presenting with a GCS of less than 8.

Studies indicate that for every additional milliliter increase in initial clot volume, there is a corresponding 1% rise in the risk of mortality [23] Furthermore, it has been demonstrated that around 25% of intracerebral hemorrhage (ICH) patients experience clinically significant hematoma growth [24]. For each 10% expansion in hematoma volume growth, there is a 5% escalation in the risk of death [23]. The mean volume of the clot in the mortality group was33.2ml, and the mean volume amongst the survivors was 19.4ml (X^2test, $p < 0.001$).

In a study by Hegde A et. al, Spontaneous Intracranial Hemorrhage (ICH) often exhibits intraventricular extension (IVE) in 40-60% of

cases, a significant predictor of 30-day outcomes [25].Similarly, in the present study, ventricular extension was significantly associated with complications ($p<0.05$).

Functional outcome was assessed at the time of discharge using mRS. Good outcome (mRS 0-3) was found in 58.9% while poor outcome (mRS 4-5) was found in 41.1%. Poon et al.'s systematic review and meta-analysis of 122 longitudinal cohort studies reporting long-term (>30 days) outcomes after spontaneous 'primary' ICH have shown a 1-year survival of 46.0% and a 5-year survival of 29.2% following SICH [26].

Conclusion

Age is a significant predictor of mortality, with older individuals facing more adverse outcomes in a patient with primary ICH. Sudden onset headache and hypertension emerged as common factors, while a Glasgow Coma Score below 8 was associated with increased mortality. Clot volume and intraventricular extension were identified as crucial determinants of risk, highlighting the complexity of ICH management.

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Conflict of interest

The authors declare that there are no conflicts of interest or financial disclosures to report pertaining to this manuscript.

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