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Demographic and Hemorrhagic Characteristics of Intraventricular Hemorrhage: A Study in a Tertiary Care Hospital, Chittagong, Bangladesh

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Abstract

Background: Intraventricular hemorrhage (IVH) is an acute neurosurgical condition. The incidence of intraventricular hemorrhage (IVH) is increasing nationwide, correlating with an aging and vasculopathic patient population coupled with the widespread use of anticoagulant and antiplatelet medications among which primary IVH occurs in 30% and secondary IVH occurs in 70% of the patients. Aim of the study: the aim of the study is to assess the demographic and hemorrhagic characteristics of Intraventricular hemorrhage. **Methods:** This is a Quasi-experimental study conducted in the Department of Neurosurgery, Chittagong Medical College Hospital, Chittagong, Bangladesh during the period from 24th July 2018 to 23rd July 2019. After a detailed history and clinical examination, 150 Patients were selected for this study. The study participants were divided into two major groups- EVD and Conservative; both groups consisted of 44 patients. Based on inclusion and exclusion criteria, 43 patients were excluded, among them 18 patients had GCS 3 with non-reacting pupil, 8 patients needed surgical evacuation of haematoma and 7 patients legal guardian did not want to continue with the study procedure, 10 patients were dropped out due to not adhering to the follow-up schedule.**Results:** This prospective quasi-experimental study was conducted to compare the outcome of patients with a spontaneous IVH managed with or without EVD. This study also observes demographic and hemorrhagic characteristics among participants. The result of the study is presented in the following pages in tables and column charts. Both the groups were similar in terms of age and sex distribution. Overall mean age was around 60 years with an age range from 15-85 years. More than three fourth of the patients in both groups were from the age group of >50 years (73.83%). The male to female ratio was almost equal in both groups (p = 0.374). There were no differences between EVD and conservative groups regarding medical comorbidities. The most prevalent comorbidity among the patients of both groups was hypertension, followed by diabetes and previous ischemic stroke. The distribution of other predisposing factors and risk factors were also similar in both groups. Overall the most frequent symptoms found in the studied patients were vomiting, followed by loss of consciousness, headache and convulsion. After adjustment patients who were treated conservatively were 3.98 times more likely to die within 90 days than the patients who had EVD. Other independent predictors were higher age, lower GCS at admission, and presence of hydrocephalus on CT. **Conclusion:** All the patients received at least 1 scan during this time frame but they were not performed on the same post bleed day. It is possible that not all worsening or improvement in IVH was included in our analysis. Neuroimaging facilities should be round the clock for providing the earliest intervention where possible. Resuscitation and monitoring facilities should be dynamic.

Keywords: Intraventricular Hemorrhage, Neurosurgery, Demographic and Hemorrhagic Characteristics, Quasi-Experimental Study.

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INTRODUCTION

Intraventricular hemorrhage (IVH) is an acute neurosurgical condition. The incidence of intraventricular hemorrhage (IVH) is increasing nationwide, correlating with an aging and vasculopathic patient population coupled with the widespread use of anticoagulant and antiplatelet medications among which primary IVH occurs in 30% and secondary IVH occurs in 70% of the patients.[1,2] Intraventricular hemorrhage (IVH), hydrocephalus, and herniation syndromes are of particular importance in ICH as they may be lethal to patients with a mortality rate ranging from 45% to 80%. The primary objective of IVH treatment is to reduce increased intracranial pressure (ICP), limit the hemorrhagic mass effect and associated edema thereby halt the development of obstructive hydrocephalus by the prompt removal of irritant blood and blood products from the ventricular system. Complete surgical evacuation of ventricular blood may not always possible if all ventricular system is involved resulting increase risk of edema, bleeding, and infection in an already devastating condition. Associated ICH can occur in various cerebral locations resulting in neurological deficits and disability, but no clear correlation exists between hemispheric ICH location and mortality.[3] Management of Intraventricular hemorrhage started with conventional therapy which includes emergency care and resuscitation of the patient. The patient should be treated in neurointensive care if possible, with endotracheal intubation, mechanical ventilation where necessary. Sedatives, neuromuscular blocking agents that do not elevate ICP should be selected. For those who do not require ICU, care should be assured for control of ICP including resuscitation with intravenous fluids, placement of the head of the bed at 30°, correction of fever with antipyretics, control of blood pressure, hyperglycemia, and deep venous thrombosis prophylaxis, seizure prophylaxis.4 Although conservative treatment is available but ventricular drainage, craniotomy and surgical evacuation of IVH, minimally invasive drainage of IVH have limited experience in the literature. Recent progress in neuroendoscopy allows minimally invasive surgery for patients with cerebral hemorrhage and the use of the technique for IVH can safely achieve reliable decompression and improvement of non-communicating hydrocephalus in the acute phase.[5,6] Another option for treating IVH is EVD with the administration of the fibrinolytic agent, i.e.: r-tPA and urokinase (UK). Some authors show that administration of low doses of intraventricular UK in patients with IVH is safe with careful screening. In most centers, EVD use remains at the discretion of the treating neurosurgeon while further decisions on medical and surgical treatment are guided by clinical decision-making tools such as the ICH score.[7]

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MATERIALS AND METHODS

This is a Quasi-experimental study conducted in the Department of Neurosurgery, Chittagong Medical College Hospital, Chittagong, Bangladesh during the period from 24th July 2018 to 23rd July 2019. After a detailed history and clinical examination, 150 Patients were selected for this study. The study participants were divided into two major groups- EVD and Conservative; both groups consisted of 44 patients. Based on inclusion and exclusion criteria, 43 patients were excluded, among them 18 patients had GCS 3 with non-reacting pupil, 8 patients needed surgical evacuation of haematoma and 7 patients legal guardian did not want to continue with the study procedure, 10 patients were dropped out due to not attend to follow up schedule. So, 107 patients with spontaneous intraventricular hemorrhage were enrolled in this study. Among them, 47 patients' relatives agreed to surgery who were accepted as part of the EVD group and had EVD. The remaining 60 patient's relatives declined authorization for surgery and were accepted as a conservative group and underwent conservative management. Modified graeb score was calculated from the CT scan and documented. On admission, the GCS score was recorded. In the EVD group, all patients were treated with external ventricular drainage after resuscitation and proper counseling to the legal guardian. In the Conservative group, patients were managed conservatively with standard medical management of intraventricular hemorrhage. Study subjects were selected by the Consecutive sampling technique.

Inclusion Criteria

- Patients with intraventricular haemorrhage, either primary or secondary.
- Presence of obstructive hydrocephalus.

Exclusion Criteria

- Traumatic intraventricular haemorrhage.
- Intraventricular haemorrhage with ICH that requires surgical evacuation of the haematoma.
- Patients with GCS score 3 with the non-reacting pupil.
- The patient's legal guardian does not intend to include in the study.

RESULTS

This prospective quasi-experimental study was conducted to compare the outcome of patients with a spontaneous IVH managed with or without EVD. This study also observes demographic and hemorrhagic characteristics among participants. The result of the study is presented in the following pages in tables and column charts. [Table 1] depicts that, both the groups were similar in terms of age and sex distribution. Overall mean age was around 60 years with an age range from 15-85 years. More than three fourth of the patients in both groups were from the age group of >50 years (73.83%). The male to female ratio was almost equal in both groups (p = 0.374). There were no differences between EVD and conservative groups

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regarding medical comorbidities. Most prevalent comorbidity among the patients of both groups' hypertension, followed by diabetes and previous ischemic stroke. The distribution of other predisposing factors and risk factors were also similar in both groups [Table 2]. Overall the most frequent symptoms in the studied patients were vomiting, followed by loss of consciousness, headache and convulsion. There were no significant differences between the two groups regarding presenting symptoms [Table 3]. On the contrary, the preoperative GCS score was significantly lower ($p<0.001$), and MGS was significantly higher ($P=0.001$) among the patients who had EVD compared to the patients treated conservatively. Baseline CT scan findings were similar in both groups [Table 4]. The majority of the patients in both groups had secondary IVH (intracerebral hematoma with ventricular extension). The proportion of the patients had hydrocephalus on CT was 57.4% and 46.7% respectively in EVD and conservatively treated group respectively. [Table 5] shows that treatment modality did not affect survival ($p=0.635$). However, patients who died within 90 days of their IVH were significantly older, had lower GCS scores (Grade 3: GCS ≤8; n=46, 97.9%), and higher MGS scores than the patients who survived. Patients with hydrocephalus died significantly more than the patients without hydrocephalus. Binary logistic regression analysis was done to determine the independent predictor of 90 days mortality following spontaneous IVH. The variables which had a significant association in univariate analysis [Table 6] were entered in the model. [Table 5] depicts that, after adjustment patients who were treated conservatively were 3.98 times more likely to die within 90 days than the patients who had EVD. Other independent predictors were higher age, lower GCS at admission, and presence of hydrocephalus on CT.

Table 1: Demographic data of the study participant (n = 107) with spontaneous IVH

Variables	EVD (n=47)	Conservative (n=60)	P-value
Age (years)			
Mean ±SD	59±14	60±14	0.645† ns
Range	15-85	16-85	
Sex			
Male	21 (44.7%)	32 (53.3%)	0.374*ns
Female	26 (55.3%)	28 (46.7%)	

*P values were derived from Chi-square test;
†: P values were derived from the independent sample t-test.
ns = not significant

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Table 2: Co-morbidities of the study participant (n = 107) with spontaneous IVH with EVD or conservative management

Variables	EVD (n=47)	Conservative (n=60)	P value*
No comorbidity	6 (12.8%)	3 (5.0%)	0.177ns
Previous History			
Hypertension	41 (87.2%)	57 (95.0%)	0.151 ns
Ischemic heart disease	9 (19.1%)	8 (13.4%)	0.437 ns
Diabetes mellitus	11 (23.4%)	15 (25.0%)	1.0 ns
Chronic kidney disease	1 (2.1%)	1 (1.7%)	1.0 ns
Ischemic stroke	7 (14.9%)	10 (16.7%)	0.892 ns
Hemorrhagic stroke	1 (2.1%)	0 (0%)	0.439 ns
Intra cranial space occupying lesion	1 (2.1%)	0 (0%)	0.439 ns
Used Anti-coagulant	8 (17.0%)	13 (21.7%)	0.548 ns
Used Anti-platelet	13 (27.7%)	14 (23.3%)	0.609 ns
No habit of tobacco	5 (10.6%)	15 (25.0%)	0.080 ns
Smoker	16 (34.0%)	16 (26.7%)	0.524 ns
Use betel nut	28 (56.6%)	28 (46.7%)	0.242 ns
Drink alcohol	0 (0%)	1 (1.7%)	0.458 ns

*P values were derived from either the Chi-square test or Fisher 's Exact test as appropriate. ns = Not significant

Table 3: Baseline clinical characteristics of the study participant (n = 107) with spontaneous IVH with EVD or conservative management.

Variables	EVD (n=47)	Conservative (n=60)	P value
Vomiting	45 (95.7%)	52 (86.7%)	0.109* ns
Loss of consciousness	41 (87.2%)	45 (75.0%)	0.114* ns
Headache	16 (34.0%)	16 (26.7%)	0.408*ns
Convulsion	17 (36.2%)	13 (21.7%)	0.097*ns
Systolic blood pressure (mmHg)	171±26	174±28	0.642†ns
Diastolic blood pressure (mmHg)	101±13	102±17	0.811†ns
Pulse, min	72±17	79±12	0.015†s
Respiratory rate, min	24±4	25±4	0.322†ns
Glasgow coma scale	5±2	7±2	
13-15 (Grade 1)	0 (0.0%)	2 (3.3%)	
9-12 (Grade 2)	4 (8.5%)	14 (23.3%)	<0.001†s
≤8 (Grade 3)	43 (91.5%)	44 (73.4%)	
Modified Graeb score	16±6	12±6	0.001†s

*P values were derived from Chi-square test;
†: P values were derived from independent sample t test;
s = significant; ns = not significant

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Table IV: Baseline CT scan findings of the study participant (n=107) with spontaneous IVH with or conservative management

CT findings	EVD (n=47)	Conservative (n=60)	P-value
Type of hemorrhage			
Intraventricular hemorrhage	9 (19.1%)	4 (5.7%)	
Intracerebral hemorrhage withventricular extension	36 (76.6%)	55 (91.7%)	0.095*ns
Subarachnoid hemorrhage withventricular extension	2 (4.3%)	1 (1.7%)	
Hydrocephalus			
No	20 (42.6%)	32 (53.3%)	0.268*ns
Yes	27 (57.4%)	28 (46.7%)	

*P values were derived from Chi-square test ns = Not significant

Table V: Association of different predictive variables with a 90-day mortality of the study participants (n=107) with IVH

Variables	Survived (n=60)	Died (n=47)	P-value
Age (years)			
Mean ±SD	55.93±15.40	65.00±10.89	0.001†s
Sex			
Male	30 (49.2%)	23 (50.0%)	0.931*ns
Admission Glasgow coma scale score			
Mean ±SD	7±2	5±1	
13-15 (Grade 1)	2 (3.3%)	0 (0.0%)	<0.001†s
9-12 (Grade 2)	17 (28.3%)	1 (2.1%)	
≤8 (Grade 3)	41 (68.3%)	46 (97.9%)	
Admission modified Graeb score			
Mean ±SD	12±5	15±7	0.015†s
Hydrocephalus			
Present	17 (27.4%)	38 (84.4%)	<0.001*s
Hemorrhage type			
Intraventricular hemorrhage	10 (16.1%)	3 (6.7%)	0.246*ns
Intracerebral hemorrhage with ventricular extension	51 (82.3%)	40 (88.9%)	
Subarachnoid hemorrhage with ventricular extension	1 (1.6%)	2 (4.4%)	
Group			
EVD	26 (45.9%)	21 (41.3%)	0.635*ns
Conservative	34 (54.1%)	26 (58.7%)	

*P values were derived from Chi-square test;
†: P values were derived from the independent sample t-test.;
ns = not significant; s= significant

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Table VI: Independent predictor of 90-day mortality of the study participants (n=107) with IVH

95% C.I.for OR				
Variables	**Odds ratio (OR)**	**Lower**	**Upper**	**P-value**
Treated conservatively	3.982	1.300	12.194	0.016s
Age in years	1.066	1.024	1.110	0.002 s
Female	0.705	0.268	1.858	0.480 ns
Glasgow coma scale score on admission	0.538	0.398	0.726	<0.001 s
Modified Rankin scale score on admission	1.072	0.985	1.168	0.108 s
Hydrocephalus	12.46	5.24	21.32	<0.001 s

ns = not significant s = significant

DISCUSSION

This quasi-experimental study was conducted to compare the outcome of patients with a spontaneous IVH managed with or without EVD. This study evaluated a large cohort of patients in our setting perspective (107) with spontaneous IVH treated at a government level tertiary care academic centers representing diverse patient populations and demographic characteristics. Approximately 43.92% of patients received an EVD, and the impact of this intervention on patient mortality and clinical outcome by GOS and mRS was determined from discharge till 3 months. We hypothesized that EVD improves the outcome in the patient of spontaneous IVH significantly more than the outcome achieved by conservative treatment. The study revealed that after adjustment for known predictors of IVH outcomes EVD had significantly reduced 90 days mortality compared to conservative treatment but had a similar effect in terms of favorable outcome (GOS>3) after 90 days. Our finding was in accordance with the findings of a recent RCT8 where mortality following medical management for IVH was 100% compared to 75% in a surgically managed group (p=0.02). In the present study, in unadjusted analysis EVD utilization was not associated with a significant reduction of mortality (p=0.635); however, in the adjusted analysis the odds ratio showed a significant protective effect of EVD utilization in IVH (OR: 3.98; 95% CI: 1.3-12.94; p=0.005). A similar observation was observed by Brendan et al., (2016).[9] In the absence of specific treatment (i.e., EVD), IVH irrespective of etiology is associated with a 78 % risk of death and a 90 % risk of poor outcome.[10] In our study, the overall mortality was 43.9%, with 68% of these occurring within the first 48 hours. Mortality correlated with age, admission GCS score, and presence of acute hydrocephalus. This was in agreement with the findings of El-Saadany et al.[11] who reported the overall mortality was 44.4%, with 50% of these occurring within the first 48 hours, but much higher than that of the Lee et al.[12] who reported the overall mortality rate was 19%. The probable reason for this dissimilarly could be explained by much lower baseline GCS of the patients of the present study in comparison to that of the Lee et al.[12] Within the IVH literature, indications

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for EVD use is compelling: Nieuwkamp et al.[10] demonstrate a 26% decrease in IVH mortality associated with EVD utilization (78% vs. 58%) through a meta-analysis, but no difference in functional outcomes (poor outcomes 90% vs. 89%). Nieuwkamp et al.[10] findings are consistent with the results of the present analysis, demonstrating trends toward positive mortality benefit without overall positive functional outcomes benefit. Logistic regression analysis was done to determine the independent predictor of functional dependency after 3 months following spontaneous IVH among the survivors. It revealed that after adjustment patient's treatment modalities either EVD or conservative did not reveal as an independent predictor. Only GCS score at admission was the independent predictor of 90 days functional dependency (mRS>2). This discrepancy between mortality and functional outcome and morbidity may suggest that there are other concomitant physio-pathological mechanisms that influence the final outcome other than initial age, GCS, hydrocephalus. Nieuwkamp et al.[10] in their meta-analysis reported that, in cases of SAH with IVH, the prognosis seems even more dismal, with risks of death and severe handicap of 84% and 93%, respectively, in patients treated without EVD and risks of 67% and 87 %, respectively, in patients treated with EVD. In the present study this trend is supported but probably due to the small representation of such cases might prevent us to get a significant association.

Limitations of the Study

It was a single-center study. The number of patients enrolled in this study was relatively small which, may not reflect the scenario of the whole community. For all critical patients, we could not provide ICU support. Follow-up after discharge was short, a longer follow-up might bring a better result.

CONCLUSION

All the patients received at least 1 scan during this time frame but they were not performed on the same post bleed day. It is possible that not all worsening or improvement in IVH was included in our analysis. Different surgeons with different treatment preferences undertook the patients' care, adding to between patient variability. Other immeasurable underlying differences between the groups may have confounded our results. The referral system should be quick and efficient so that the patients can be treated within the earliest possible time. Neuroimaging facilities should be round the clock for providing the earliest intervention where possible. Neuroimaging facilities should be round the clock for providing the earliest intervention where possible. Resuscitation and monitoring facilities should be dynamic.

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