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Use of CT-Scan for Predicting Mortality of Acute Intracerebral Haemorrhagic Stroke within 7 and 28 Days

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Abstract

Background: Recognition of factors affecting morbidity and mortality of a disease helps in the proper management of a disease. CT scan of Brain is an essential investigation for all stroke patients. Identifying different characteristics of the CT findings of stroke patients which affect morbidity and mortality will help in the specific management of stroke patients. Thus this study was done to identify such factors from CT scan of Brain which will help in the proper management of stroke patients. **Objectives:** The aim of this present study was to determine the 7th and 28th days' mortality rate of acute intracerebral hemorrhagic stroke and to determine the predictors of mortality. **Methodology:** Consecutive CT scan proven stroke patients following ICH were studied in the department of Radiology & Imaging at Rajshahi Medical College, Rajshahi, Bangladesh in collaboration with the Department of Neurology of Rajshahi Medical College, Rajshahi from January 2012 to December 2013. Site, size and volume of haematoma, midline shift, pineal gland displacement, hydrocephalus and intraventricular extension of haemorrhage were correlated with the mortality within 7th and 28th days of acute stroke. Risk factors like hypertension, smoking, diabetes and alcoholism were also recorded. **Result:** Ninety-nine consecutive CT scan proven stroke patients following ICH were studied. The 28-day mortality of intracerebral hemorrhage was 44.44% and it was 29.30% within the first 7 days of onset. Maximum number of death occurred in brainstem haemorrhage (75%), initial haematoma volume 61 to 80 ml (89.47%), >80 ml (91.7%), pineal gland displacement >3mm (79.5%), septum pellucidum displacement >5 mm (72.4%), ventricular extension (88.57%), and hydrocephalus (76.74%). **Conclusion:** The present study shows that deaths within 7th and 28th day of acute haemorrhagic stroke are correlated with the initial CT findings which could be regarded as a good predictor of mortality. *[Journal of National Institute of Neurosciences Bangladesh, 2019;5(1): 42-46]*

Keywords: Stroke, Intracerebral haemorrhage, Mortality, CT scan of brain

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Introduction

Intracerebral haemorrhage (ICH) is referred to as bleeding in the brain parenchyma itself. It is the most common type of non traumatic intracranial haemorrhage and an important cause of stroke, especially in Asians and Blacks. It accounts for 10 to 15 percent of all strokes

in Whites and about 30 percent in Blacks and individuals of Asian origin. It is a major cause of morbidity and mortality of stroke[1].

Brain imaging is the cornerstone for diagnosis of ICH. Although MRI is an excellent tool for considerable information on the process of acute stroke; MRI is not readily available to the most patients presented with acute stroke in a rural or community hospital. CT scan is the imaging modality of choice in patients presented with acute stroke, which can detect ICH within few minutes of onset of stroke[2]. It is safe and non-invasive, helps to measure the hematoma size, location of the hemorrhage and the presence of intraventricular, subarachnoid or subdural blood, or to find out any mass effect in primary non-traumatic ICH. All these pieces of information are extremely useful in assessing the clinical and functional outcome in acute ICH, which cannot be obtained by clinical examination itself[3]. It is useful for the physician to predict the functional outcome from a first CT scan of the brain done at the time of the hospital admission. The purpose of this study is to find out how we can predict a short-term in-hospital mortality and morbidity from these CT scan findings; how hematoma volume, location of stroke, midline shift, intraventricular extension of bleed, ventricle compression influence the clinical outcome in patients with acute stroke.

Methodology

This cross-sectional observational study was performed in different private clinics of Rajshahi, Bangladesh and the Department of Radiology & Imaging, Rajshahi Medical College Rajshahi in collaboration with the Department of Neuromedicine of Rajshahi Medical College, Rajshahi, Bangladesh from January 2012 to December 2013 for a period of two (02) years. The study population was comprised of total 99 patients who had definite evidence of first ever acute intracerebral haemorrhage and were diagnosed by computed tomography (CT). Informed consent was taken approved by institutional ethical committee of Rajshahi Medical College, Rajshahi. Data was collected on the basis of inclusion and exclusion criteria, with irrespective of sex in OPD or the ward, of department of Neuromedicine of Rajshahi Medical College, Rajshahi. Following patients were excluded from the study like patients who had prior stroke with established neuro-deficit, patients who had time gap from the onset of stroke to the presentation to the hospital been more than 24 hours, patients who had hemorrhagic stroke due to trauma, sub-arachnoid hemorrhage and rupture aneurysm. Non-contrast CT-scan was done within 24 hours of suspected acute stroke. After completion of CT-scan volume of hematoma which was computed by getting the product of L x W x AP x 0.523 where L was the vertical diameter showing hematoma on CT scan, W was the greatest transverse diameter of the bleed, AP was the greatest antero-posterior diameter of the hematoma perpendicular to W and 0.523 was a constant factor (Figure I), location of stroke, presence of intraventricular extension of bleed, midline shift and presence of hydrocephalus were obtained.

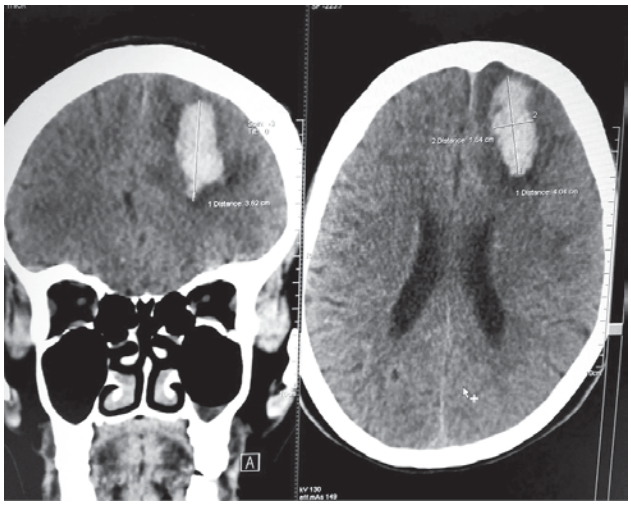

Figure I: Measurement of volume of intracerebral haemorrhage.

Results

A total of 99 cases were included in the study. The age of the subjects ranged from 35 to 86 years with a mean age of 59.62(+12) years. Male-female ratio was 1.7:1. Majority of the patients were between 51 to 70 years and representing 68.42%. Hypertension was the most common (82.12%) risk factor. Other risk factors were chronic smoking (23.20%) and diabetes mellitus (18.25%). The site of ICH were 61(61.62%) in capsulogangloinic region followed by lobar 17(17.17%), thalamus 10(10.11%), cerebellum 7(7.07%), brainstem 4(4.04%). Total death was 31 (50.82%) in capsulogangloinic region, 2(11.76%) in lobar haemorrhage, 7(70.00%) in thalamic region, 75.00% in brainstem and 14.29% in cerebellar haemorrhage Total death was 44(44.44%) in 28 days and most common site for death was brainstem, thalamus and capsuloganglionic region in order of frequency. P value was significantly higher and it was 0.018 (Table 1).

Table 1: Mortality by site (n=99)

Site	No. of patient (%)	Within 7 days No. of death (%)	8th to 28th days No. of death (%)	Total death (Within 28 days)	P value
Capsulogangloinic	61 (61.62)	21 (34.42)	10 (16.39)	31 (50.81)	
Lobar	17 (17.18)	1 (5.88)	1 (5.58)	2 (11.76)	
Thalamus	10 (10.11)	5 (50.0)	2 (20.0)	7(70.00)	0.018
Cerebellum	7 (7.07)	0 (0.0)	1 (14.29)	1 (14.29)	
Brainstem	4 (3.57)	2 (50.0)	1 (25.0)	3 (75.0)	
Total	**99 (100)**	**29 (29.30)**	**15 (15.15)**	**44 (44.44)**	

P value 0.018 means significantly higher at ($p<0.05$).

Table 2: Volume of haemorrhage and mortality of ICH (n=99)

Volume (mL)	No. of patient 99(%)	Within 7 days No. of death (%)	8th to 28th days No. of death (%)	Total death (Within 28 days)	P value
Upto 40	45(45.45)	3(6.67)	2(4.44)	5(11.11)	
41 to 60	23(23.23)	6(26.09)	5(21.74)	11(47.83)	
61 to 80	19(19.19)	10(52.63)	7(36.84)	17(89.47)	0.011
More Than 80	12(12.12)	10(83.33)	1(8.33)	11(91.67)	

P value 0.011 means significantly higher at ($p<0.05$).

Of the 60 patients whose CT detected pineal gland without displacement or displacement upto 3 mm total death was 13(21.67%) within 28 days. Pineal gland displacement >3 mm was found in 39(39.39%) and total death was 31(79.49%) within 28 days and it was statistically significant (p value 0.028). The highest number of death was from pineal gland displacement >3 mm and within 7 days (Table 3).

Septum pellucidum displacement upto 5 mm or without displacement was found in 70 (70.54%) patients and total death was 23 (32.86%) within 28 days. Septum pellucidum displacement >5 mm was found in 29(29.29%) and total death was 21(72.42%) within 28 days and it was statistically significant (p value 0.033) (Table 4).

Intraventricular extension of haemorrhage was found in 35(35.35%) patients and total death was 31(88.57%) within 28 days. There was no extension of haemorrhage in intraventricular location in 64(64.65%) patients and total death was 13(25.71%) within 28 days. It was statistically significant (p value 0.017) (Table 5).

Table 3: Mass effect of haemorrhage mortality by pineal gland displacement (n=99)

Pineal gland displacement	No. of patient 99(%)	Within 7 days No. of death (%)	8th to 28th days No. of death (%)	Total death (Within 28 days)	P value
upto 3 mm	60(60.61)	7 (11.67)	6 (10.00)	13(21.67%)	
More than 3 mm	39(39.39)	22 (56.41)	9 (23.08)	31(79.49%)	0.028

P value reached from chi square test. The difference was significant ($p<0.05$) between two groups.

Table 4: Mass effect of haemorrhage mortality by septum pellucidum displacement (n=99)

Septum pellucidum displacement	No. of patient (%)	Within 7 days (n=29) No. of death (%)	8th to 28th days (n=15) No. of death (%)	Total death (Within 28 days)	P value
upto 5 mm	70 (70.71)	7 (11.67)	8 (11.43)	23 (32.86%)	
> 5 mm	29 (29.29)	22 (56.41)	7 (24.14)	21(72.42%)	0.033

P value reached from chi square test. The difference was significant ($p<0.05$) between two groups

Table 5: Ventricular extension of the haemorrhage (n=99)

Ventricular extension	No. of patient (%)	Within 7 days (n=31) No. of death (%)	8th to 28th days (n=18) No. of death (%)	Total death (Within 28 days)	P value
No	64 (64.65)	7 (10.94)	6 (9.38)	13(25.71%)	
Yes	35 (35.35)	22 (62.86)	9 (25.71)	31(88.57%)	0.017

P value reached from chi square test. The difference was significant ($p<0.05$) between two groups.

Table 6: Correlation of hydrocephalus and mortality in haemorrhagic stroke (n=99)

Hydrocephalus	No. of patient 99(%)	Within 7 days (n=29) No. of death (%)	8th to 28th days (n=15) No. of death (%)	Total death (Within 28 days)	P value
No	56 (56.57)	8 (14.29)	4 (7.14)	12 (21.43)	
Yes	43 (43.43)	21 (48.84)	11 (25.55)	33 (76.74)	0.018

P value reached from chi square test. The difference was significant ($p<0.05$) between two groups.

Hydrocephalus present in haemorrhagic stroke was in 43 (43.43%) patients and total death was 32 (74.42%) within 28 days. There was no hydrocephalus in 56 (56.57%) patients and total death was 12 (21.43%) within 28 days. P value was 0.018 and it was statistically significant (Table 6).

Discussion

Stroke due to intracerebral haemorrhage is an important cause of death. It is not possible to differentiate reliably between intracranial haemorrhage and infarction on the basis of clinical features alone[4]. For diagnosing and differentiating the type of stroke as early as possible, computed tomography (CT) scanning of the brain is the gold standard investigation and in practice most stroke patients should ideally have a CT scan done[5].

Present study showed that majority of the subjects belonged to the age group of 51 to 70 years comprising 68.42% with a mean age of 59.62 years, which is comparable to the study by Singh et al[1]. Male female ratio was 1.7:1. Similar study was also observed by Singh et al[1].

Hypertension was found to be the commonest risk factor (82.12% of the cases) in the present study. Similar observation was reported by Singh et al[1] 78%, by Douglas et al[6] in 80% and 75% of ICH by Scott et al[7]. Cigarette smoking was associated with ICH in 23.20% of cases. Comparable observations were found 24.0% by Singh et al[1] and 27.0% by Shinton et al[8] and by Tatu et al[9] in 18% of ICH cases. Diabetes was found in 18.25% of cases. Singh et al[1] and Nilsson et al[10] reported 6% and 10% haemorrhagic stroke in diabetic patients respectively.

The site of ICH is more common in capsulogangloinic region 61(61.62%) followed by lobar 17(17.17%). Next common site is thalamus 10(10.11%), cerebellum 7(7.07%), brainstem 4(4.04%). Total death was 44(44.44%) in 28 days and most common site for death was brainstem, thalamus and capsuloganglionic region in order of frequency. Singh et al[1] reported the sites of lesion in intracerebral haemorrhage determined by CT-scan in order of frequency in a study were basal ganglia (65%), lobar (17%), thalamus (13%), pons (3%) and cerebellum (2%). Feldmann[11] reported the sites of involvement by ICH in order of putamen (35%), lobar (30%), cerebellum (15%), thalamus (10%) and pons (5%). Tatu et al[9] found ICH to be the most prevalent in lobar (36.5%), followed by lentiform area (32%), thalamic (15.7%), cerebellar (8.8%), midbrain and pons (2.0%), intraventricular haemorrhage (92.0%), caudate (1.0%) and multiple (2.0%). Scott et al[7] in their study found that putaminal bleeding (35.0%) was the commonest followed by lobar (30.0%), thalamus (10.0%), cerebellum (15.0%), pons (5.0%) and caudate (5.0%). The finding in the present study is comparable with Scott et al[7] except for cerebellum which is the least common site in the present study.

Haematoma volume upto 40 ml caused death in 11.11%; however, in volume of 41 to 60 ml mortality was 47.83%, in 60 to 80 ml it was 89.47% and in > 80 ml death was 91.67%. Lampel[12] quoted that critical lethal outcome were associated with 50 ml[13] or 80 ml14 in lobar haemorrhage. Kase[15] found lobar ICH with volume larger than 50 ml who were comatose on admission have mortality close to 100%. Similar pattern of higher mortality among the patients having larger haematoma volume was also noted in the present study with statistically significant findings. Singh et al[1] found 85.2% and 90.9% mortality among the ICH volume greater than 60 ml and 80 ml respectively. Mukherjee et al[16] observed 67.3% mortality among ICH volume greater than 40 ml.

Wiggins et al[17] reported that ICH with mid line shift or pineal gland displacement >3 mm showed mortality rate of 40%. In the present study, ICH with pineal gland displacement >3 mm shows (79.49%) mortality rate and septum pellucidum displacement >5 mm shows 72.42% morality. These differences may be due to difference in multiple risk factor incidence such as hypertension but our study matches with the study of Singh et al[1] who show 70.0% mortality rate.

Intracerebral haemorrhage with intraventricular extension influenced the mortality rate of 65.0%, 70.0% and 74.0% as observed by Wiggins et al[17], Fieschi et al[18] and Singh et al[1] respectively. In the present study ICH with intraventricular extension

influenced the mortality rate of 88.57% than without intraventricular extension of 25.71% mortality which is comparable with the above studies.

This study demonstrates the impact of hydrocephalus on outcome from ICH. Mortality was 74.43% in ICH with hydrocephalus and 21.43% in ICH without hydrocephalus. This present study corresponds with the study of Michael et al[19].

The overall mortality rate of 52.0% in 30 days was reported by Bamford et al[20] with 56% of the death occurring within the first 3 days of onset. In other studies, 30 days ICH mortality rate was found to be 30% by Fieschi et al[18] and 35.0% by Anderson et al[21]. Tatu et al[9] reported overall mortality of 24.2% in 30 days and death within the first 3 days constituted 48% of all deaths. In the present study over all 7 days, and 28 days, mortality rates were found to be 29.30% and 44.44% respectively which could be comparable to above studies. Similarly 30 days, mortality rate was found in the study by Frank et al[22] and Singh et al[1]. However, Silver et al[23] reported 80.0% mortality within 72 hours in their study. These differences in the mortality may be due to variations in population, risk factors, facilities availability and other factors.

Anderson et al[21] reported 28 days case fatality rate among the ICH locations as 100.0% in brain stem, 30.0% in cerebellum, 22.0% in basal ganglia and thalamus, and 21.0% in lobar haemorrhage. Almost similar pattern of case fatality were also observed in the present study.

Conclusion

The present study showed that deaths within 7th and 28th day of acute haemorrhagic stroke were correlated with the initial CT findings. Mortality was increased with increasing amount of CT detected haemorrhage with more than 90% mortality in those having more than 80 ml of CT detected haemorrhage. Increasing mass effect of haemorrhage as detected by significant pineal gland or septum pellucidum displacement, intraventricular extension of haemorrhage and presence of hydrocephalus also significantly increased the chance of mortality.

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