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"Evaluation of Computed Tomography (CT) Scan of the Stroke Patients in Hypertension by Location of Hemorrhage and Infarction"

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Abstract
Introduction: *Stroke is a major public health problem and the third leading cause of death worldwide, with several degrees of reversible and irreversible disability among survivors. Hypertension is a major risk factor for stroke and antihypertensive therapy provides general benefits to patients with a history of stroke or transient ischemic attacks (TIA's).* ***Objective:*** *To assess evaluation of computed tomography (CT) scan of the stroke patients in hypertension by location of hemorrhage and infarction.* ***Materials and Methods:*** *This observational cross sectional study was done among stroke patients admitted in Department Of Neurology, Enam Medical College and Hospital, Savar, Dhaka, Bangladesh who have history of hypertension or taking antihypertensive drugs. Study duration January to December 2021. Sampling was purposive and 101 samples were included in this study. All patients presenting to the emergency or neurology unit with clinical features of stroke was referred to the radiology department for CT scan of the brain. A detailed cardiovascular and neurological examination was done by the attending physician.* ***Results:*** *In this study mean age was 60.24(±11.73) years, minimum age was 42 and highest age was 85 years. Maximum stroke were found between the ages 65 to 74 years. The mean age was 66.23(±11.8) years. My study shows 66.3% were male and 33.7% were female, and male female ratio was 1.94:1. Maximum were re 5th to 7th decade. Table shows female preponderance between 60-69 years ago group but in subsequent decades there was male preponderance ($p>0.05$) that was not statistically significant. Table shows both ischemic 41 (69.49%) & hemorrhagic 26(61.90%) strokes are more common in male patients. 57.4% came from urban area while 42.57% came from rural area. 58.41% were ischemic stroke and 41.58% were hemorrhagic stroke. Infarction in CT scan involved, capsulo-ganglionic region (24 cases; 40.67%), cerebral cortex (18 cases; 30.50%), thalamus (07 cases; 11.86%), pons (04 cases; 6.77%), and cerebellum (06 cases; 10.16%) respectively. shows that predominant area involved in lacunar infarction were internal capsule (46.7%) & basal ganglia (33.3%). In our study shows area involved in hypertensive strokes are capsule-ganglionic region (21 cases; 50.00%), thalamus (10 cases; 23.80%), cerebral cortex (06 cases; 14.28%), pons (03 cases; 7.14%) & cerebellum (02 cases; 4.76%) respectively. 21.78% were stage-1, 41.58% were stage-II and 36.63% were stage-III. Association of level of hypertension with Patten of stroke significant. Ischemic stroke were found predominantly in stage-1 (27.11%) and stage-11 (47.45%) where predominantly 22(52.38%) hemorrhagic stroke were found in stage-III ($p<0.05$) that was statistically significant. Our study the short term complications including Hyponatremia (21.42%), RTI (23.80%), Pressure sore (16.6%), DVT (7.14%) and death (9.52%) are common among hemorrhagic stroke patients.* ***Conclusion:*** *Although infarction is a more common cause of stroke than hemorrhage, the incidence of hemorrhage was found to be higher than that in western countries. Smoking was the commonest risk factor associated with stroke and is also seen in combination with alcohol consumption in many cases. CT scan is important to differentiate between cerebral infarction and intracerebral hemorrhage because nowadays, proper management of the acute stroke syndrome is based on the correct diagnosis of the pathological type. There are multiple associated risk factors associated with stroke. Change in lifestyle and eating habits may help reduce the incidence of stroke.*

Keywords: *Hemorrhage, Stroke Patients, Hypertension Tomography (CT).*

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I. Introduction

Stroke is a clinical term that describes a sudden loss of neurologic function persisting for more than 24 h that is caused by an interruption of the blood supply to the brain. Stroke is a major public health problem and the third leading cause of death worldwide, with several degrees of reversible and irreversible disability among survivors [1, 2]. Hypertension is a major risk factor for stroke and antihypertensive therapy provides general benefits to patients with a history of stroke or transient ischemic attacks (TIA's) [3]. At the beginning of 21st century and emerging of new era, cerebrovascular decease is a major cause of death and disability worldwide [4]. Among the stroke subtypes, cerebral ischemia and infarction constitute about 85-90% of the total stroke subtypes in western countries with only about 10-15% patients with cerebral haemorrhage [5]. But contrary to the western population, hemorrhagic stroke constitutes a larger percentage of stroke subtypes on this side of the globe as seen in countries like Japan and China probably because of poorly controlled hypertension [6]. The diagnosis and classification of stroke was based on clinical judgment, with the advent of radioimaging techniques in stroke being visualized using either computed tomography (CT) or magnetic resonance imaging (MRI). CT has greatly influenced the diagnosis and management of stroke and added significantly to our understanding of pathophysiology of stroke. The main role of imaging in stroke is to differentiate an intracranial hemorrhage from an infarct, to define the ischemic region, to distinguish between infarct core and penumbra, to depict the vessel status, and to rule out other pathologic processes that can present with stroke-like symptoms. However, the level to which BP should be lowered to achieve maximal benefits among survivors of stroke and TIA's is not precisely known, although post hoc analysis of PROGRESS suggests a goal <13mm Hg systolic BP (SBP) [7]. Up to 50% of strokes may be attributable to elevated blood pressure and hypertension is the most important modifiable risk factor for stroke [8,9]. In Bangladesh the gravity of the situation can be assessed by the high incidence of admission of stroke patient in general hospitals despite lack of adequate data. In a study in IPGM&R (now BSMMU) in 1986 it was found that of all the patients attending department of Medicine stroke patients comprised 16.96% among which 70% due to thrombo-embolism. Both ischemic and hemorrhagic stroke have strong gradients with blood pressure, the relative risk of ischemic and hemorrhagic stroke increases 2.23 and 3.18 times respectively. Fall in blood pressure observed over the 20th century may lead to bigger reduction in the incidence of hemorrhagic stroke compared with ischemic stroke [10]. For diagnosing and differentiating the type of stroke as early as possible, computed tomography (CT) scanning of the brain is the gold standard investigative procedure and in practice most stroke patients should ideally have a CT scan done [11]. CT scan is preferable to magnetic resonance imaging (MRI) in the acute stage because MRI does not easily detect intracranial hemorrhage within the first 48 hours after a bleeding episode [12]. The increasing availability of CT scanners in Nigeria has made neuroimaging an option in the management of patients with stroke. Furthermore, the use of CT especially in acute stroke is further enhanced by the advent of additional CT techniques which include CT perfusion imaging and CT angiography. The combination of these techniques with noncontrast CT has greatly improved the detection and diagnosis of acute infarction [13, 14].

II. Materials and Methods

This observational cross sectional study was done among stroke patients admitted in Department Of Neurology, Enam Medical College and Hospital, Savar, Dhaka, Bangladesh who have history of hypertension or taking antihypertensive drugs. Study duration January to December 2021. Sampling was purposive and 101 samples were included in this study. All patients presenting to the emergency or neurology unit with clinical features of stroke was referred to the radiology department for CT scan of the brain. A detailed cardiovascular and neurological examination was done by the attending physician. Important clinical history and risk factors was taken from each patient (ie hypertension, diabetes mellitus, coronary artery disease, smoking, alcohol intake, previous history of TIA/ stroke). USG of the carotid / vertebral artery was also done where advised. Any patients with suspected stroke were included in this study regardless of cause like tumoral bleed or secondary to vascular malformation. Infarct with secondary hemorrhagic was included under primary infarct. Repeat CT scan after 24 hour was done in any patient with clinical stroke and normal early CT scan findings.

III. Results

Table 1: Age group distribution of the study population (n=101)

Age group	Frequency	Percent
40-49 years	13	12.87
50-59 years	19	18.81
60-69 years	30	29.70
70-79 years	23	22.77

80 or more	16	15.84
Total	101	100.0
Mean±SD	62.32(±10.15)	42-85 years
Type Of Stroke		
Infarction Male Female	 41 18	 69.49 30.50
Hemorrhage Male Female	 26 16	 61.90 38.09
Area Urban Rular	 58 43	 57.4 42.57
Stroke In CT Scan Ischemic Stroke Hemorrhagic Stroke	 59 42	 58.41 41.58

Table-1 shows mean age was 62.32 (±10.15) years, minimum age was 42 and highest age was 85 years. Maximum were re 5th to 7th decade. Table shows that female preponderance between 60-69 years ago group but in subsequent decades there was male preponderance (p>0.05) that was not statistically significant. Both ischemic 41 (69.49%) & hemorrhagic 26(61.90%) strokes are more common in male patients. 57.4% came from urban area while 42.57% came from rural area. 58.41% were ischemic stroke and 41.58% were hemorrhagic stroke.

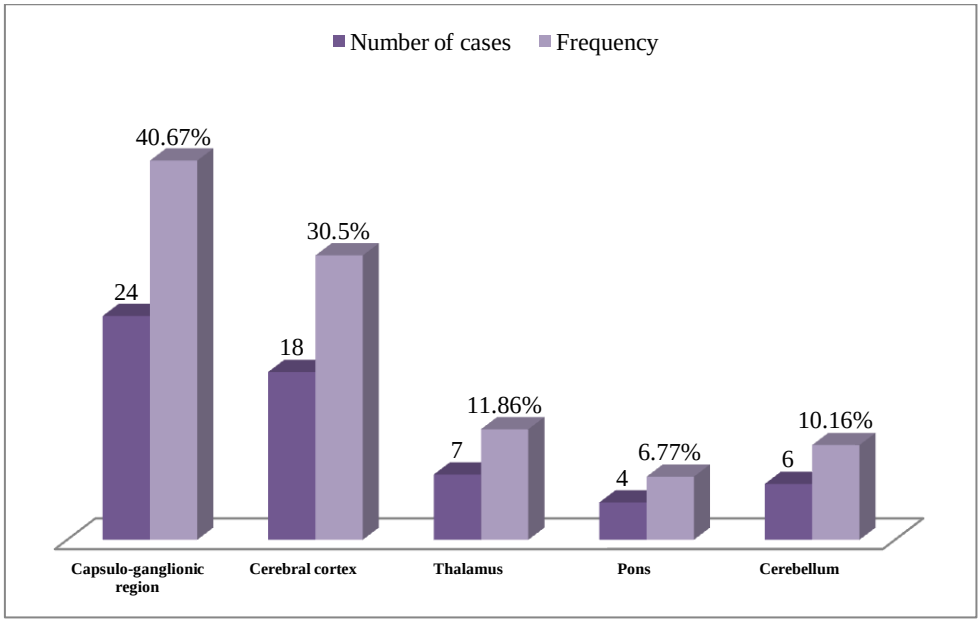

Fig-1: Distribution of location of infarction in CT scan.

Fig-1 shows infarction in CT scan involved, capsulo-ganglionic region (24 cases; 40.67%), cerebral cortex (18 cases; 30.50%), thalamus (07 cases; 11.86%), pons (04 cases; 6.77%), and cerebellum (06 cases; 10.16%) respectively.

Table 2: Location of lacunar infarction in CT scan.

Location	No. of cases with lacunar infarctions (n=15)
Internal capsule	7 (46.7%)
Basal ganglia	5 (33.3%)
Cerebral cortex	1 (6.7%)
Thalamus	2 (13.3%)

Table-2 shows predominant area involved in lacunar infarction were internal capsule (46.7%) & basal ganglia (33.3%).

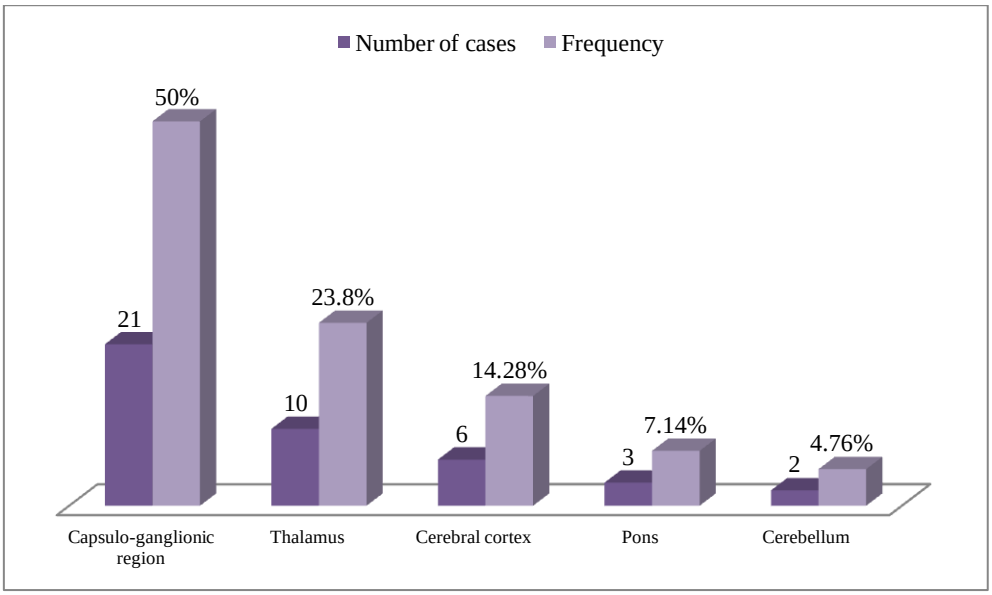

Fig-2: Location of primary intracranial haemorrhage.

Fig-2 shows area involved in hypertensive strokes are capsule-ganglionic region (21 cases; 50.00%), thalamus (10 cases; 23.80%), cerebral cortex (06 cases; 14.28%), pons (03 cases; 7.14%) & cerebellum (02 cases; 4.76%) respectively.

Table 3: Distribution of staging of blood pressure (BP) in study population (N=101)

Stage	Frequency	Percent
Stage-I Hypertension (SBP 140-159/DBP 80-89)	22	21.78
Stage-II Hypertension (SBP 160-179/DBP 90-99)	42	4.58
Stage-III Hypertension (SBP 180-179/DBP2≥ 110	37	36.63
Total	101	100

SBP-Systolic Blood Pressure, DBP = Diastolic Blood Pressure.

Table-3 shows 21.78% were stage-1, 41.58% were stage-II and 36.63% were stage-III.

Table 4: Distribution of level of hypertension among the pattern of stroke (N=101)

Hypertension	Ischemia	Hemorrhage	P value
Stage-I	16(27.11%)	06(14.28%)	<0.04
Stage-II	28(47.45%)	14(33.33%)	
Stage-III	15(25.42%)	22(52.38%)	
Total	59	42	101

Table-4 shows significant association of level of hypertension with Patten of stroke. Ischemic stroke were found predominantly in stage-1 (27.11%) and stage-11 (47.45%) where predominantly 22(52.38%) hemorrhagic stroke were found in stage-III ($p<0.05$) that was statistically significant.

Table 5: Distribution of short term complications among the types of stroke (N=101)

Type of Stroke	Hyponatremia	RTI	Pressure Sore	DVT	Death
Ischemia	05(8.47%)	06(10.16%)	04(6.77%)	01(1.69%)	02(3.34%)
Hemorrhage	09(21.42%)	10(23.80%)	07(16.6%)	03(7.14%)	04(9.52%)
Total	14	16	11	04	06

RTI: Respiratory tract infection, DVT: Deep venous thrombosis.

Table-5 shows that all the short term complications including Hyponatremia (21.42%), RTI (23.80%), Pressure sore (16.6%), DVT (7.14%) and death (9.52%) are common among hemorrhagic stroke patients.

IV. Discussion

This study was among patients in their 5th (40–49 years' age group) and 7th decades of life (50–59 years' age group) accounting for 31.68%. Similar finding was reported by Ikpeme et al.,[14] Watila et al.,[15] and Eze et al. [16] in their studies. In this study mean age was 60.24(±11.73) years, minimum age was 42 and highest age was 85 years. Maximum were 5^{th} to 7^{th} decade. This result is compare with Hakim M et al [17], study maximum stroke were found between the ages 65 to 74 years. The mean age was 66.23(±11.8) years. In our country a similar study was done by Chowdhury et al [18], on stroke patients and found the same age incidence of stroke between 5th to 7th decade that is nearly similar to my study. This discrepaney with the

present time is that a small portion of the population of our country survives up to that age. My study shows 66% were male and 34% were female, and male female ratio was 1.94:1. The result is comparable with Hakim M et al." shown male female ratio was 1.44:1 (male 59: female 41) this observation is closely approximated to the result of my study and also coincide with that of Chowdhury et al [18] The present study defers with a previous study of Alamgir et al [19] which showed male: female ratio was 4:1 Another study of western population in London in 1990 showed that male suffer more than female (Male female ratio was 1.5:1) [20] this also coincide with my study. This present study shows that the study subjects were from both urban and rural areas with slight urban dominance (57%). This indicated that incidence of stroke is common both in urban and rural population which was contradicted by the study of Basher et al, which showed mainly urban preponderamce [21]. Fig-1 shows infarction in CT scan involved, capsulo-ganglionic region (24 cases; 40.67%), cerebral cortex (18 cases; 30.50%), thalamus (07 cases; 11.86%), pons (04 cases; 6.77%), and cerebellum (06 cases; 10.16%) respectively. This is in agreement with other previous studies who reported a higher prevalence of ischemic than hemorrhagic stroke.[14,22,23] However, our study differs from what was reported by Obajimi et al. [24] The higher prevalence of infract compared to hemorrhage on cranial CT may likely be due to the fact that ischemic stroke is associated with more risk factors compared to hemorrhagic stroke where hypertension is the prevalent risk factor. Table-2 shows predominant area involved in lacunar infarction were internal capsule (46.7%) & basal ganglia (33.3%). Internal capsule & the basal ganglia are the prime sites of involvement in hypertensive infarctive patients which is also supported by the study of Shams & Khan et al [25] Lacunar infarctions are deep subcortical infarctions that generally involve perforating arteries supplying regions such as deep gray matter and brainstem. Lacunar infarctions are generally less than 1 cm and are not larger than 1.5 cm in diameter [26]. Lacunar infarctions are predominantly in the basal ganglia, the white matter of the internal capsule, the brainstem, and the deep white matter of the hemispheres. Fig-2 shows area involved in hypertensive strokes are capsule-ganglionic region (21 cases; 50.00%), thalamus (10 cases; 23.80%), cerebral cortex (06 cases; 14.28%), pons (03 cases; 7.14%) & cerebellum (02 cases; 4.76%) respectively. In this study it was revealed that short term complications are more common with hemorrhage than infarction which also correlates with several studies [1, 25, 26]. This study reveals that ischemic stroke were found predominantly in 21.78% were stage-1, 41.58% were stage-II hypertensives where hemorrhage stroke were found predominantly in stage-III $p<0.05$) that was statistically significant which supports the opinion of several researchers findings who found more association of stroke with high grade hypertension [27]. Table-5 shows that all the short term complications including Hyponatremia (21.42%), RTI (23.80%), Pressure sore (16.6%), DVT (7.14%) and death (9.52%) are common among hemorrhagic stroke patients. It is traditionally believed that intra-cerebral hemorrhage is more closely associated with hypertension than infarction but the Farmingham study showed that the incidence of athero-thrombotic lesions also closely correlated with the blood pressure levels. It has been observed that sudden, prolonged and profound hypertension in a hypertensive can lead to small vessel infarct [28]. In untreated cases of hypertension, hemorrhage was more common than infarction. In treated cases infarction was more common than haemorrhage [29]. Furthermore, men are more involved in stressful activities, especially the social economic stress from family and work and the male gender has been established as a risk factor for stroke.

V. Conclusion

Although infarction is a more common cause of stroke than hemorrhage, the incidence of hemorrhage was found to be higher than that in western countries. Smoking was the commonest risk factor associated with stroke and is also seen in combination with alcohol consumption in many cases. CT scan is important to differentiate between cerebral infarction and intracerebral hemorrhage because nowadays, proper management of the acute stroke syndrome is based on the correct diagnosis of the pathological type. There are multiple associated risk factors associated with stroke. Change in lifestyle and eating habits may help reduce the incidence of stroke.

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