Incidence of Stress Induced Hyperglycemia in Patient with Acute Stroke in a District Hospital

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Stroke is defined as a syndrome of rapid onset of neurological deficit caused by focal, cerebral, spinal or retinal infarction. It is a common medical emergency. It is the third most common cause of death after the coronary heart disease and cancer especially in the elderly. There are different types of stroke; the most common is ischemic type. This observational study was designed to identify stress induced hyperglycemia in acute stroke patient. It was done in medicine department of 250 bed District Hospital, Kishoreganj from March to July 2017. Patient having stroke admitted in different medicine wards were selected. The patients were selected at random and irrespective of age and sex. Random blood glucose, HbA_{1c} and CT scan of brain is done in all patients. Serum electrolyte was also done to see metabolic abnormalities from other organic disease. HbA_{1c} <6.5% and Random blood glucose>140mg/dl was considered as stress hyperglycemia. Our study reveals out of 60 patients having stroke 37, 18 and 5 euglycemia, stress hyperglycemia and undiagnosed diabetes respectively. Among 18 patients of the stress hyperglycemia 13 had ischemic stroke and 5 had hemorrhagic stroke. Study revealed stress induced hyperglycemia was more common in ischemic stroke.

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Key words: Stress Hyperglycemia, Ischemic stroke, HbA_{1c}, Acute stroke

Introduction

Stroke is defined as a syndrome of rapid onset of neurological deficit caused by focal, cerebral, spinal or retinal infarction.[1] To the public stroke means weakness usually permanent on one side often with loss of speech.

Transient Ischemic Attacks (TIAs) are episodes of stroke symptoms that last only briefly the standard definition of duration is <24 hours, but most TIAs last <1 hour. If a relevant brain infarction is identified on brain imaging, the clinical entity is classified as stroke regardless of the duration of symptoms. TIAs may herald stroke, they are important risk factor that should be considered separately and urgently. The causes of TIAs are similar to the causes of ischemic stroke.[2]

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Stroke is a common medical emergency. It is the third most common cause of death in high- income countries (11% of all death in the UK) and the leading cause of adult disability world-wide. Stroke risk increases with age but one quarter of all strokes occur before the age of 65. Approximately two-thirds of the global burden of stroke is in the middle and low income countries. Stroke rate is higher in Asian and black African populations than the Caucasians.[1]
It is rising in association with less healthy life styles.[3] Patient often has History of Hypertension, Diabetes Mellitus, Mitral or Aortic stenosis or Atherosclerosis.[4]

Of the 180-300 patients per 1, 00,000 populations presenting annually with a stroke, 85% sustain a cerebral infarction and most of the remainder have an intracerebral haemorrhage.[3] Hyperglycemia is common in the early phase of stroke. The prevalence of stress hyperglycemia has been observed in two-thirds of all ischemic strokes. Factors contributing to stress hyperglycemia in the hospital setting are stroke, myocardial infarction, corticosteroid therapy, thiazide diuretics, β-blockers or insulin omission.

Hyperglycemia is frequently encountered during hospitalization owing to increase in patients circulating concentration of stress hormone.[5] Stress hyperglycemia is transient Elevation of the blood glucose due to the stress of illness. It is usually resolves spontaneously, but must be distinguished from various diabetes mellitus.[6] The presence of hyperglycemia in acute stroke increases cerebral infarct size and subsequently worsens neurologic outcome.[7]

Glycosylated serum protein (Fructosamine) and glycosylated hemoglobin (HbA_1) are known indexes of medium and long term exposure to blood glucose and have been used to monitor the degree of glycemic control in diabetic patient.[8] HbA_1c value at or above 6.5% is diagnostic for diabetes mellitus recommended by the American diabetes association.[9]

The American Diabetes Association and American Association of clinical Endocrinologists consensus on the patient of hyperglycemia defined stress hyperglycemia or hospital related hyperglycemia as any blood glucose concentration >7.8mmol/L(140mg/dl).[6]

Hyperglycemia occurs in 60% of the cases with acute stroke and in 12-53% cases without the prior diagnosis of Diabetes. Even in the absence of diabetes, an initially high blood glucose concentration following a stroke is predictor of poor outcome.[10] Stroke patients who have stress hyperglycemia at admission have been associated with three fold higher risk of poor functional recovery and death. Death rate following stroke is 20-25% and 40% of surviving patients are dependent at 6 months.[1] Mortality risk used to be greater in patients who had Hyperglycemic (representing stress hyperglycemia) than in those with diabetes.[6] Repetitive acute glucose fluctuations induce more endothelial apoptosis and greater endothelial dysfunction and oxidative stress responses compared with the less variable excursions both in vitro and in patients with or without known diabetes.[11]
Objective of the study was to determine the incidence of stress induced hyperglycemia in non-diabetic patients.

Method

The study was conducted at 250 bed district hospital Kishoregonj, Bangladesh. It was an observational study. It was conducted for five months from March to July 2017. Sample size was 60 patients, to find out the incidence of

hyperglycemia in non-diabetic acute stroke patients.

Inclusion criteria
1. Patient age- 40 and above.
2. Non-diabetic
3. Acute stroke (Ischemic or hemorrhagic) evidence by CT scan
4. Random blood glucose >140mg /dl
5. Hemoglobin A_{1c} (HbA_{1c})

Exclusion criteria
1. Transient Ischemic Attack (TIA)
2. Space-occupying lesion (SOL)
3. CNS infections
4. Diabetes Mellitus (DM)
5. Drugs like-Corticosteroids, thiazide diuretics, β-blockers etc.
6. Intravenous glucose infusion

Informed consent has taken before including the patient in the study. Consent has taken from the patient as well as from their relatives and care-givers. Demographic profiles including age, gender, blood pressure and family history of diabetes mellitus are recorded for each patient. Random blood glucose is measured immediately after admission and after 24 hours. HbA_{1c} is measured simultaneously. Stress hyperglycemia is labeled if blood glucose label >140mg/dl any time during first 72 hours when HbA_{1c} is < 6.5%. Undiagnosed diabetes is diagnosed when blood glucose label>140mg/dl and HbA_{1c} > 6.5%.

Results

Total 60 patients are enrolled in our study. Out of which 41(57.6%) are ischemic stroke while 19(42.4%) are hemorrhagic stroke. Among 60 patients 36(60%) are male and 24(40%) are female. Age group of stroke patients included in this study are 40 years and above. In ischemic group 23(56.1%) are male and 18(43.9%) are female. In hemorrhagic group 11(57.9%) are male and 8(42.1%) are female. We have found positive family history of diabetes mellitus in ischemic stroke 25(60.9%) and hemorrhagic stroke 8(42.1%). Majority of the patients in this study group belong to age group (51-60) years. Blood glucose status of stroke patients are euglycaemia 37(61.7%), stress hyperglycemia 18(30%) and undiagnosed diabetes 5(8.3%). After admission into hospital according to blood pressure – normotensive 26(43.3%), hypertensive 31(51.7%) and hypotensive patients are 3(5%). Our study shows number of ischemic stroke in normotensive patient 17(41.5%), hypertensive patient 20(48.8%) and hypotensive patient 4(9.7%). And number of haemorrhagic stroke in normotensive patient is 9 (47.4%) and in hypertensive patient is 10(52.6%).

Table I: Age distribution

Age	Ischemic stroke
40-50	3
51-60	19
61-70	13
>70	6
Total	41

Table II: Status of blood pressure

Status	Ischemic stroke	Hemorrhagic stroke	Total number
Normal blood pressure	17	9	26
Hypertension	20	10	30
Hypotension	4	0	4
Total	41	19	60

Table III: Blood glucose level

Status	Ischemic stroke	Hemorrhagic stroke
Euglycaemia	24(64.9%)	13(35.1%)
Stress hyperglycaemia	13(72.2%)	5(27.8%)
Undiagnosed diabetes	4(80%)	1(20%)

Table IV: Gender Variation

Gender	Ischemic stroke	Hemorrhagic stroke
Male(34)	23(56.1%)	11(57.9%)
Female(26)	18(43.9%)	8(42.1%)

Discussion

Hyperglycemia is common in the early phase of stroke. It occurs in 60% of the cases with acute stroke and in 12-53% cases without the prior diagnosis of diabetes. Hyperglycemia during acute illness is associated with adverse outcome. The results of the study show that stress hyperglycemia induced stroke is 30%. Among 60 patients of this study, 18 patients have stress hyperglycemia in the absence of prior diabetes. This result is comparable to other study. This study reveals that stress hyperglycemia induced ischemic stroke more common than hemorrhagic stroke which are differ from some other studies. We compare various demographic profiles and observe that stress induced hyperglycemia is more common in patients who are positive family history of diabetes mellitus and central obesity.[12] Hyperglycemic patients are relatively deficient in insulin. This leads to both peripheral uptake of glucose and increase circulating free fatty acid. Patient without a diagnosis of diabetes who develop stress hyperglycemia are likely to have dysglycemia (i.e, blood glucose level above the normal range but below the threshold for diabetes) or undiagnosed diabetes when not stressed. Hyperglycemia may disrupt the blood brain barrier and promote hemorrhagic infarct conversion.[13] Some study shows that association of stress induced hyperglycemia with stroke is more consistent in non-lacunar type of stroke.[14,15]

The use of HbA_{1c} has been recommended over OGTT as the preferred diagnostic testing in hospitalized patients with hyperglycemia.[16] This study shows age group 51-60 is more affected with stroke which is similar to some other studies. [10, 12,16] In the present study incidence of stroke in male subject are 56.6% and female are 43.4% that is similar to other study.[12, 16] This study shows hypertension is more common in ischemic stroke than hemorrhagic stroke. It is similar to the study of Mansoureh T et al where he found that hypertension history was higher among the ischemic stroke than the hemorrhagic stroke patients.[17]

Hyperglycemia intensifies the risk of cerebral edema and mortality after stroke, this has been rise to the association between serum glucose concentration immediately after stroke and subsequent morbidity and mortality.[6]

Conclusion

Objective of this study is to determine the incidence of stress induced hyperglycemia in non-diabetic patients. The incidence of stress induced hyperglycemia is 30% of patients those have central obesity and positive family history of diabetes mellitus. These patients constitute high risk group, so they need close monitoring blood glucose and prevention of complications. We also recommend large and extensive study on stress induced hyperglycemia to reduce mortality rate in acute stroke.

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