CORRELATION OF FAMILY HISTORY OF DIABETES MELLITUS WITH HYPERGLYCAEMIA IN ACUTE STROKE IN NON DIABETIC PATIENT

PATWARY MSA[1], AHASAN HAMN[2], MIAH MT[3], MUNMUN FR[4], BEGUM A[5], SHANCHAY SS[6]

Abstract

Background: *Raised blood glucose is common in diabetic patients in early phase of stroke. It is also known that blood glucose level increases during acute stroke in non diabetic patients.*

Objective: *Objective of this study was to assess the association between family history of diabetes and newly developed diabetes, impaired fasting glucose, impaired glucose tolerance during acute stroke in non diabetic patients.*

Methods: *The purposive sampling method was applied to identify the patients by appropriate history taking about diabetes among the patients and their 1st degree relatives, documentary papers and laboratorial support evidenced by HbA1c level less than 6.5% (This means patient to be non diabetic). Data were collected from 100 patients. The data were collected by questionnaire, pre-tested earlier and data collection sheet illustrating the family history of diabetes mellitus and glycemic status during acute stroke among the nondiabetic patients. It was conducted from January, 2021 to July, 2021 in the Department of Medicine of Dhaka Medical College Hospital.*

Results: *The study found that, mean age of the patents was 61.76±7.33 years. Family history of Diabetes Mellitus (first degree relative) was found among 48% patients.52% patients did not give family history of Diabetes Mellitus. During analysis of the lab investigations among the participants, mean HbA1c level was found 5.69± 0.65 mmol/L which was found normal among the entire patient group. Patients Fasting Blood Sugar (FBS) was tested and mean FBS level was 5.94±0.86.Among the respondents 48% gave family history(1st degree relative) of Diabetes of which 8.3% revealed normal glycemic status , 66.7% showed IGT and 25.0% were diabetic. On the other hand 52% respondents had no family history of Diabetes, among them 50% showed no glycemic abnormality, 42.3% showed IGT and only 7.7% were diabetic.*

Conclusion: *In a nutshell, the study finds that, in patients with no history of diabetes who have acute stroke, may develop moderately elevated glucose levels and it is significantly higher in those who have family history of diabetes mellitus.*

Introduction

Diabetes mellitus (DM) is a disorder that affects the body's function to effectively break down sugar for consumption of energy. According to the Centers for Disease Control and Prevention (CDC), diabetes affects around 29.1 million individuals every year and is the seventh leading cause of mortality in the United States. The World Health Organization predicts that T2DM will be prevalent among 366 million people by the year 2030, which is a dramatic rise from the 171 million that was reported globally in 2000.[1]

1. Dr. Mohammad Shamsul Arefin Patwary, Assistant Professor of Medicine, Dhaka Medical College, Dhaka
2. Dr. H.A.M. Nazmul Ahasan, Professor and Head of Medicine, Popular Medical College, Dhaka
3. Dr. Md. Titu Miah, Principal and Professor of Medicine, Dhaka Medical College, Dhaka
4. Dr. Farzana Rahman Munmun, Junior Consultant of Pediatrics, Bongobondhu Sheikh Mujib Medical University, Dhaka
5. Dr. Aysha Begum, Junior Consultant of Medicine, OSD, DGHS, Dhaka
6. Dr. Shamsuddoha Sarker Shanchay, Junior Consultant of Medicine, 300 bedded Hospital, Narayangonj.

Correspondence: Dr. Mohammad Shamsul Arefin Patwary. Assistant Professor. Department of Medicine, Dhaka Medical College. Mob:01711119841.email:arefinmatra.saj@gmail.com

Hyperglycaemia diagnosed during acute illness is associated with adverse outcomes. Among patients without known diabetes admitted in hospital with myocardial infarction (MI), stroke, pneumonia, and exacerbation of chronic obstructive pulmonary disease (COPD), higher glucose levels are associated with in-hospital and longer-term mortality, intensive care unit admission, prolonged length of stay, and discharge to long-term nursing care.[2]

Although upto one third of acute stroke patients have either diagnosed or newly diagnosed diabetes, probably a major proportion of patients have stress hyperglycemia mediated partly by the release of cortisol and norepinephrine. It is also a manifestation of relative insulin deficiency, which is elevated blood glucose is common in the early phase of stroke. The prevalence of hyperglycemia, defined as blood glucose level>6 mmol/L has been observed in two thirds of all ischemic stroke subtypes on admission and in at least 50% in each subtype including lacunar strokes.[3] It is also a manifestation of relative insulin deficiency, which is associated with increased lipolysis. Even in no diabetic patients, stress hyperglycemia may be a marker of deficient glucose regulation in individuals with insulin resistance and developing diabetes mellitus.[4]

Patients with no history of diabetes who have acute stroke, may develop moderately elevated glucose levels which may affect short term and long term stroke related morbidity and mortality. We should create awareness about a new risk factor–acute hyperglycemia during acute stroke and take appropriate and effective measures to reduce morbidity and mortaliyt[5].

Family history of diabetes is used as an important tool for identifying the people at risk of developing the disease. Participants who have a positive family history of T2DM are more prone for early onset of the disease. Those who have an early onset of T2DM are more prone for diabetic complications and associated morbidity. So positive family history of T2DM plays an important role in the prognosis and outcome of the disease.[6]

Family history of diabetes has a significant, independent, and graded association with the prevalence of diabetes. This association not only highlights the importance of shared genes and environment in diabetes but also opens the possibility of formally adding family history to public health strategies aimed at detecting and preventing the disease.[7]

Although family history of diabetes mellitus is a well-established risk factor for type-2 diabetes, but its impact on hyperglycaemia in acute stroke in non diabetic patients is not clear. Better glycemic control during the acute phase has been shown to improve clinical outcomes from myocardial infarction.[8]A Cross sectional study was undertaken in Dhaka Medical College hospital among the patients who admitted for stroke.

Materials and methods

The study was carried out in Department of Medicine, Dhaka Medical College Hospital.The study period was about 6 months, which started on January, 2021 and ended in July, 2021.

The initial projection of respondents was 163 stroke patients. But finally respondents' number was limited to 100.Purposive sampling method was applied to select the sample. Non-diabetic patients' selected by appropriate history taking, documentary papers, HbA 1c level less than 6.5% (<6.5%) in both male and female of all adult age groups in acute stroke patients. Severely ill patients with intercurrent illness such as thyroid diseases, heart failure, renal failure severely debiliated condition, Diabetes Mellitus patients (e HbA1c 6.5%), patients getting drugs and glucose infusion (glucocorticoids, thiazides), patients and his or her attendants deny participate were excluded from the study.

Fasting blood glucose (FBS) and standard oral glucose tolerance test were done within 3 days from acute stroke patients. On the 2nd or 3rd day, fasting blood sample was drawn for estimation of plasma glucose and HbA1c. All of the remaining subjects were undergone glucose tolerance test with 75gm glucose load on the 3rd day after admission.

Two (2) cc blood from cubital vein for FBS and HbA1c was collected in a test tube containing Na-fluoride & EDTA as anticoagulant and

preservative. For 2hr PPBS blood sample was collected similarly as previous. All samples were sent to laboratory for analysis.

Subjects who had elevated glucose values at fasting (5.6-6.9mmol/l) or at 2h after glucose load (7.8-11 mrnol/l) were classified using the American Diabetic Association guide line-2020 as impaired glucose and Subjects with glucose (fasting e 7 mmol/l and / or 2h e 1 1.1 mmoI/l) were classified as diabetic. Undiagnosed preexisting diabetes was considered possible if the HbA1c values were >6.5%, a induced hyperglycemia was considered if the HbA1c values <6.5%.

Statistical methods

The collected data was checked, verified and then entered into the computer. Variations of p <0.05 or less were considered to be statistically significant. The statistical analysis was done using SPSS software (version 17.0).

Results

While analyzing the age of the respondents, it was found that the study was conducted among 100 respondents of different ages between the 42 years to 78 years age range. However, their mean age was 61.76±7.33 years.

Table-I
Age of the respondents

Age of the respondent	Minimum	Maximum	Mean	Std. Deviation
Age in (years)	42.00	78.00	61.76	7.33
Age of the respondents		Frequency	Percent	
30 to 60 years		40	40.0	
Above 60 years		60	60.0	
Total		100	100.0	

With a view to know about level of concentration of Hb1Ac and its impression to recognize the respondents as previous diabetic or not, patient's HbA1c level was calculated. The concentration of HbA1c level among the 100 respondents was 3.00 mmol/L to 6.40 mmol/L. The average HbA1c level was 5.69± 0.65mmol/L. In case of illustrating the impression of HbA1c, it was found that, HbA1c level was normal among the entire final respondent

Table-II
Status and impression of HbA1c

HbA1c Level (in U/L)	Minimum	Maximum	Mean	Std. Deviation
	3.00	6.40	5.69	.65
HbA_1c Impression		Frequency	Percent	
Responses	Normal	100	100.0	
	Total	100	100.0	

Family history often lay down some risks for the respondent to be victim of metabolic diseases. Respondents' family history was analyzed in order to assess such potential threats by heredity. While analyzing patient's family history of Diabetic Mellitus, It was present among 48% respondents, while 52% didn't give any family history of Diabetes.

Family history of Diabetic Mellitus		Frequency	Percent
Responses	Yes	48	48.0
	No	52	52.0
	Total	100	100.0

Among the respondents 48% gave family history of Diabetes of which 8.3% showed normal glycemic status, 66.7% showed IGT and 25.0% were diabetic. On the other hand 52% respondents had no family history of Diabetes, among them 50% showed no glycemic abnormality, 42.3% showed IGT and only 7.7% were diabetic. Pearson Chi-Square value is 21.860, df 2, p-value is< .001

Table-III
Glycemic status in relation to the family history of Diabetes

Family history of Diabetes	Normal	Glycemic Status IGT	Diabetic	Total
Yes	4	32	12	48
	8.3%	66.7%	25.0%	100.0%
No	26	22	4	52
	50.0%	42.3%	7.7%	100.0%
Total	30	54	16	100
	30.0%	54.0%	16.0%	100.0%

Discussion

The study observed the relation between newly developed IGT and diabetic patients in acute stroke with the family history of Diabetes. Among the respondents 48% gave family history of Diabetes of which 8.3% showed normal glycemic status, 66.7% showed IGT and 25.0% were diabetic. On the other hand 52% respondents had no family history of Diabetes, among them 50% showed no glycemic abnormality, 42.3% showed IGT and only 7.7% were diabetic. Here Pearson Chi-Square value was 21.860, df 2, p-value was< .001. So in this study, it reveals that patients with family history of Diabetes are more vulnerable to develop hyperglycaemia in acute stroke in nondiabetic patients. In a study[9] in Japan in 1994 on family history of diabetes in non diabetic patient, authors said the frequency of a positive family history of diabetes in diabetic patients has increased in recent studies. In that study, it was 16-33% for type 1 diabetes and 43-49% for type 2 diabetes. It was significantly higher than in non-diabetic subjects, and in type 2 than in type 1 diabetic patients. The prevalence of diabetes in parents and siblings of type 2 diabetic patients was higher than in those of type 1 patients, and it was particularly high in parents of young onset type 2 patients. Among type 2 diabetic patients, positive family history was somewhat lower in those with marked obesity in the past. Comparison of groups with varying degrees of glucose intolerance revealed that a family history of diabetes increased in parallel with the impairment of glucose tolerance. The results suggest that genetic factors in the pathogenesis of diabetes are more important in type 2 than in type 1 diabetes, and in the younger onset and less obese subjects than in older onset and more obese patients for type 2 diabetes[9].But in that study it was not observed in acute strokes. We found almost similar result in non diabetic acute stroke patients.

In another study[5] while assessing glycaemic study in acute stroke in non diabetic patients, it was found that in case of 62% of the patients, IFG was found, and in case of 12% patients, FBS value was found to be diabetic while 26% showed normal glycemic status. Average OGTT (2 hours after 75 gm glucose) impression was 8.53± 2.02 mmol/L. OGTT level was normal among 30%, 54% patients had IGT and 16% of the respondents were found diabetic[5]. But in that study, the impact of family history of DM was not evaluated.

In a study[10]it was found that patients with acute stroke having high random blood sugar (RBS) on admission showed significantly higher values of both median NIHSS score and median duration of hospital stay. There were significant associations between stress hyperglycemia and the risk of 30-day mortality, the need for mechanical ventilation and vasopressors and the occurrence of hemorrhagic transformation. The 24-h RBS levels at a cut off >145mg/dl showed a significantly good discrimination power for 30-day mortality[10]. To reduce worse consequences of acute stroke, stress hyperglycaemia in acute stroke should be addressed properly.

In different studies, impact of family history of Diabetes Mellitus(DM) in developing new onset of DM and hyperglycaemia in acute stroke in non diabetic patients were assessed separately. But influence of family history of DM in developing stress hyperglycaemia in acute stroke in non diabetic patient was not determined previously. In this study we found that rising blood sugar was more in patients who have family history of DM than no such family history in acute stroke in non diabetic patients.

Conclusion

The study finds that, in patients with no history of diabetes who have acute stroke, may develop moderately elevated glucose levels and family history of diabetes significantly influence the development of hyperglycaemia in those patients. It may affect short term and long term stroke related morbidity and mortality. We should create awareness about new risk factors– family history of diabetes and hyperglycaemia in acute stroke in non diabetic patient and take appropriate and effective measures to reduce morbidity and mortality.

References

1. Donny Ard, Naa-Solo Tettey, Shinga Feresu, "The Influence of Family History of Type 2 Diabetes Mellitus on Positive Health Behavior Changes among African Americans", *International Journal of Chronic Diseases*, vol. 2020, Article ID 801 6542, 8 pages, 2020. https://doi.org/10.1155/2020/8016542

2. McAllister DA, Hughes KA, Lone N, Mills NL, Sattar N, McKnight J, et al. (2014) Stress Hyperglycaemia in Hospitalised Patients and Their 3-Year Risk of Diabetes: A Scottish Retrospective Cohort Study. PLoS Med 11(8): e1001708. https://doi.org/10.1371/ journal.pmed.1001708

3. Scott JF, Robinson GM, French JM, O'Connell JE, Alberti KGMM, Gray CS. Prevalence of admission hyperglycemia across clinical subtypes of acute stroke. *Lancet.* 1999; 353: 376–77.

4. Lindsberg Perttu J, Roine Risto O. Hyperglycemia in Acute Stroke. *Stroke.* 2004;35:363

5. Patwary MSA, HAM Nazmul, Miah MT, Islam QT. Glycaemic status in acute stroke in nondiabetic patient. Journal of Medicine.2021 Jan; 22(1):22-26

6. Geetha A., Gopalakrishnan S.*, Umadevi R.Study on the impact of family history of diabetes among type 2 diabetes mellitus patients in an urban area of Kancheepuram district, Tamil Nadu. International Journal of Community Medicine and Public Health Gee the A et al. Int J Community Med Public Health. 2017 Nov;4(11):4151-4156

7. Rodolfo Valdez, PHD, MSC, Paula W. Yoon, SCD, MPH, Tiebin Liu, MSPH. Family History and Prevalence of Diabetes in the U.S. Population. Family History and Prevalence of Diabetes in the U.S. Population. Diabetes Care 2007 Oct; 30(10): 2517-2522.

8. Song E-C, Chu K, Jeong S-W, Jung K-H, Kim S-H, Kim M, Yoon B-W. Hyperglycemia exacerbates brain edema and perihematomal cell death after intracerebral hemorrhage. *Stroke.* 2003; 34: 2215–20.

9. Jaqura R, Mastuda A. Family history of diabetesinnon diabetic patient. Diabetes ResClinPract1994Oct,24, Suppl:S69-73

10. El-Gendy, H.A., Mohamed, M.A., Abd-Elhamid, A.E. *et al.* Stress hyperglycemia as a prognostic factor in acute ischemic stroke patients: a prospective observational cohort study. *Ain-Shams J Anesthesiol* 13, 4 (2021). https://doi. org/10.1186/ s 42077-020-00122-6