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Evaluation Of Hba1c As A Valid Tool For Risk Assessment In Ischemic Stroke And TIA

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ABSTRACT
Background: Stroke is the second leading cause of death in the world in the last two decades. The present study was conducted to evaluate HbA1C as a valid tool for risk assessment in ischemic stroke and TIA.
Materials & Methods: 50 patients who were diagnosed with acute ischemic stroke or TIA, were included. Diagnosis of acute ischemic stroke was made on CT/MRI scan. Estimation of HbA1C was done by photometric test using ion exchange resin. Estimation of blood glucose level was done by glucose oxidase method.
Results: Group I was non- diabetic having 10, group II was pre- diabetic having 8 and group III was diabetic having 22 patients. There were 30 (60%) males and 20 (40%) females. In group A there were 6 males and 4 females, group B had 10 males and 8 females while in group C there were 14 males and 8 females. The sex distribution amongst the three groups did not reveal any statistical difference, and hence all the three groups were comparable.
Conclusion: HbA1C is a novel marker for determining the glycaemic status of a person. In cases of acute ischemic stroke and TIA, HbA1C should be used as a screening tool in determining the previous glycaemic status, prevalence of prediabetes and differentiate it from stress hyperglycaemia.

Key words: Acute ischemic stroke, Diabetes, Glucose

1. INTRODUCTION

Stroke or cerebrovascular accident (CVA) is defined as abrupt onset of a neurologic deficit that is attributable to a focal vascular cause. Stroke is the second leading cause of death in the world in the last two decades.[1] Stroke is no longer a disease of the developed world. Low and middle-income countries account for 85.5% of total stroke deaths worldwide and the number of disability-adjusted life years in these countries was approximately seven times that in high income countries.[2,3]
Strokes are broadly categorized into ischemic and haemorrhagic stroke (ICH). Ischemic stroke accounts for 75-85% of all stroke cases.[4] As per the AHA-endorsed revised definition, transient ischemic attack (TIA) is defined as "a transient episode of neurologic dysfunction lasting less than 24 hours caused by focal cerebral, spinal cord, or retinal ischemia, without

acute infarction".[5] TIA carries a particularly high short-term risk of stroke, and approximately 15% of diagnosed strokes are preceded by TIAs. 7-40% of the stroke patients are found to have history suggestive of TIA episodes. Haemorrhagic stroke, the other major category of stroke occurs when the vessel ruptures either in the substance of the brain or in the subarachnoid space. The clinical manifestations of stroke are highly variable because of the complex anatomy of the brain and its vasculature.[6]

There are several possible mechanisms wherein diabetes leads to stroke. These include vascular endothelial dysfunction, increased early-age arterial stiffness, systemic inflammation and thickening of the capillary basal membrane. Vascular endothelial function is critical for maintaining structural and functional integrity of the vessel walls as well as the vasomotor control.[7] The present study was conducted to evaluate HbA1C as a valid tool for risk assessment in ischemic stroke and TIA.

2. MATERIALS & METHODS

This was a cross sectional study done on 50 patients who were diagnosed with acute ischemic stroke or TIA, attending the outpatient department or admitted in the Medicine ward of Government Medical College and associated Guru Nanak Dev Hospital, Amritsar. The study was conducted after approval from institutional thesis and ethical committee.

Patients were informed about the study procedure and written informed consent was taken according to the proforma attached. Patient's confidentiality was maintained.

Diagnosis of acute ischemic stroke was made on CT/MRI scan. On CT scan, hyperdense segment of a vessel, loss of grey-white matter differentiation, and hypoattenuation of deep nuclei can be seen in the early stages. As the time passes on, a region of low density with negative mass effect can appear which corresponds to gliosis. On MRI, there is hyperintensity in T2 weighted image and hypointensity in T1 weight image. Other sequences like ADC (Apparent Diffusion Coefficient) map and DWI (Diffusion weighted) can be used.

Estimation of HbA1C was done by photometric test using ion exchange resin. Estimation of blood glucose level was done by glucose oxidase method. All data was collected, compiled and expressed as mean ± standard deviation. The observations were tabulated and data was subjected to statistical analysis. Karl Pearson's correlation coefficient method and one-way ANOVA was used for statistical analysis of data. Statistical significance was accepted at $p < 0.05$.

3. RESULTS

Table I Groups divided on the basis of hba1c

Groups	**HbA1C**	**Number of patients**
Group A (Non- diabetic)	<5.7%	10
Group B (Pre-diabetes)	5.7-6.4%	18
Group C (Diabetes)	>6.5%	22

Table I shows that group I was non- diabetic having 10, group II was pre- diabetic having 8 and group III was diabetic having 22 patients.

Table II Sex wise distribution

Sex	**Non-diabetic patients**	**Prediabetic patients**	**Diabetic patients**	**Total**
Male	6(12%)	10(20%)	14(28%)	30(60%)

Female	4(8%)	8(16%)	8(16%)	20(40%)
Total	10(20%)	18 (36%)	22(44%)	50(100%)

Table II shows that there were 30 (60%) males and 20 (40%) females. In group A there were 6 males and 4 females, group B had 10 males and 8 females while in group C there were 14 males and 8 females. The sex distribution amongst the three groups did not reveal any statistical difference, and hence all the three groups were comparable.

Table III Baseline characteristics in different groups

Variables	**Group A**	**Group B**	**Group C**	**p value**
Number (F/M)	10 (6/4)	18 (7/11)	22 (14/8)	-
SBP (mmHg)	147±17.26	142±24.47	143.63±24.35	0.862
DBP (mmHg)	89.2±13.57	82.11±17.78	85.09±15.30	0.532
Mean Age (years)	64.2±12.452	63.83±12.644	59.95±12.98	0.564
FBS (mg/dl)	96.6±15.51	116±37.5	163.09±73.35	0.003
RBS (mg/dl)	132.1±18.45	157±54.9	205.63±78.95	0.007
HbA1C (%)	5.3±0.26	6.15±02	8.43±1.8	0.001
Cholesterol (mg/dl)	148.6±28.84	151.16±37.85	220. 5±37.22	0.001
LDL (mg/dl)	91.6±33.34	97.5±30.05	154.21±50.63	0.001
HDL (mg/dl)	41±3.34	39.88±3.04	37.68±5.45	0.08
TG (mg/dl)	106.9±15.63	1.9.22±29.85	175.54±56.86	0.001
Blood urea (mg/dl)	34.42±10.55	50.18±21	58.63±23.84	0.024
S. Creatinine (mg/dl)	0.98±0.28	1.42±0.71	1.53±0.95	0.185
Mean Haemoglobin (Hb)	11.82±1.75	10.65±1.63	11.32±2.10	0.272
Mean TLC (cells/mm^3)	8730±2155.63	9033.33±3523.03	9448.18±3064.51	0.814

Table III shows baseline characteristics such as Systolic blood pressure, diastolic blood pressure, mean age, FBS, RBS, HbA1C, cholesterol, LDL, HDL, TG, Blood urea, S. Creatinine, haemoglobin and mean TLC between all groups. The difference was significant ($P< 0.05$).

Table IV Comparison between RBS and HBA1c

RBS (mg/dl)	**HbA1C (%)**			**TOTAL**
	<5.7 %	**5.7%-6.4%**	**>6.4%**	
<140 mg/dl	5	8	7	20
140-199 mg/dl	5	7	5	17
>/=200mg/dl	0	3	10	13
Total	10	18	22	50

Table IV shows that in group A, 5 patients were in the non-diabetic range and 5 patients were in the prediabetic range. In group B, 8 patients were in the non-diabetic range, 7 patients in the prediabetic range and 3 patients were in the diabetic range. In group C, 7 patients were in non-diabetic range, 5 patients were in diabetic range and 10 patients were in diabetic range. This observation also correlates with the high prevalence of stress hyperglycaemia in the population. In group A, stress hyperglycaemia was seen in 50% of the patients. In group B, it

was seen in 16.16 % of the patients. In group C, it could not be commented upon. Most of the patients were in non-diabetic range.

4. DISCUSSION

Acute Ischemic Stroke is one of the leading cause of mortality and morbidity in both developing and developed counties.[8] Diabetes is common risk factor for development of stroke. Not only does it increase the risk of stroke, but higher levels of glycaemia at presentation are associated with longer hospital stay, higher morbidity and mortality.[9] This present study was a cross sectional study done on 50 patients of acute ischemic stroke/TIA admitted in Guru Nanak Dev hospital, Amritsar. Patients were subjected to blood investigations (FBS, RBS, HbA1C, lipid profile, Hb, TLC, and RFT).[10] The study population was divided into three groups- Group A, Group B and Group C on the basis of HbA1C.
We found that group I was non- diabetic having 10, group II was pre- diabetic having 8 and group III was diabetic having 22 patients. Baig et al[11] included a total 500 subjects included who were in the age group 35-70 years, of either sex and without any family history of DM. The subjects were divided into two groups. Group I included 250 normal healthy individuals and Group II included 250 diagnosed patients of type 2 DM with or without complications. The study and control group were almost of the similar ages. FBS, 2 hours PP and HbA1C were done in both control and study cases. FBS & 2 hours PP of control groups were 95.5 ± 9.8 & 168.45 ± 22.8 (mg/dl) respectively & that of type 2DM was 198.5 ± 25.6 & 295.8 ± 32.6 respectively. The HbA1C % of all the 30 cases of Diabetic retinopathy & all the cases with micro-albuminuria was >7.5%. It was concluded that HbA1C can be used effectively for the diagnosis of type 2 DM & it can be used for predicting the complications of type 2 as per this study it was concluded that HbA1C is better parameter than FBS & 2 hour PP BS level in diagnosing & predicting the complications of diabetes.
We found that in group A, 5 patients were in the non-diabetic range and 5 patients were in the prediabetic range. In group B, 8 patients were in the non-diabetic range, 7 patients in the prediabetic range and 3 patients were in the diabetic range. In group C, 7 patients were in non-diabetic range, 5 patients were in diabetic range and 10 patients were in diabetic range. This observation also correlates with the high prevalence of stress hyperglycaemia in the population. In group A, stress hyperglycaemia was seen in 50% of the patients. In group B, it was seen in 16.16 % of the patients.

Rozanski et al[12], 512 patients diagnosed with acute ischemic stroke were included. Median age of patients included in the study was 68.5. 192 subjects were female and 320 were male. Median National Institutes of Health Stroke Scale on admission was 3. WMD was present in 460 (89.8%) patients. In univariate analysis, age, arterial hypertension, reduced estimated glomerular filtration rate, HbA1C levels, DM, and female sex were associated with the presence of White Matter Disease ($P<0.05$). In multiple regression analysis, age, arterial hypertension, and elevated levels of HbA1C ($P<0.05$) remained independently associated with the extent of WMD.[54]

In an observational study conducted by Hirani et al[13] on 50 patients of acute ischemic stroke, HbA1C and NIHSS (National Institutes of Health Stroke Scale) was done on admission. The data was recorded statistically and it was concluded that the patients who had a low NIH score had HbA1C level < 5.7 and higher serum values of HbA1C was associated with a bad prognosis and had a higher NIH score i.e. >10.
The limitation of the study is small sample size.

5. CONCLUSION

Authors found that HbA1C is a novel marker for determining the glycaemic status of a person. In cases of acute ischemic stroke and TIA, HbA1C should be used as a screening tool in determining the previous glycaemic status, prevalence of prediabetes and differentiate it from stress hyperglycaemia.

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