IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 22, Issue 7 Ser.4 (July. 2023), PP 57-63
www.iosrjournals.org

Study The Correlation Of Glycosylated Hemoglobin (Hba1c) With The Severity Of Ischemic Stroke In Patients With Diabetes Mellitus V/S Non-Diabetics

Dr. Sanjay Shree[1], Dr. Jitendra Kumar Jatav[2]
[1] *Postgraduate resident- Department of General Medicine at N.S.C.B Medical College, Jabalpur*
[2] *Associate Professor- Department of General Medicine at N.S.C.B Medical College, Jabalpur*

Abstract
Background:*Diabetes Is 5th Leading Cause Of Death In India, 65% Of This Death Is Attributed To Stroke, Cardiovascular Death, Or Both. Ischemic Stroke Incidence Is 2.5 To 3.5 Times Higher Among Diabetics Compared To Non-Diabetic. This Study Was Conducted To Assess The Impact Of Diabetes On The Pattern And Severity Of Stroke (Ischemic) With The Help Of Glycosylated Hemoglobin (Hba1c), Which Is Easily Accessible And Affordable So Various Medical Therapies Should Be Implemented To Prevent It.*
Material And Method: *The Total Sample Size/Study Population Was 200 Ischemic Stroke Patients Department Of Medicine And Neurology In Netaji Subhash Chandra Bose Medical College, Jabalpur (M.P) - 100 Patients For Case (Diabetic), 100 Patients For Control (Non Diabetic). Study Design: Case-Control Study (Observational And Analytical Study).*
Results: *In This Study, Cases Were Sub-Categorized Into Good Glycemic Control- Ggc (Hba1c < 7%) And Poor Glycemic Control- Pgc (Hba1c > 7%). Diabetes Was More Prevalent In Male (58.5%) Compared To Female (41.5%) In Which Poor Glycemic Control Was More Common In Males (55.8%) Compared To Females (44.2%). According To The Toast Classification And Nihss Scoring Systems, Ggc Has 16.7% Of Large Artery Occlusion And Pgc Has 36.5 Percent Of Large Artery Occlusion. In The Non Diabetic Group, 1% Has Large Artery Occlusion. In Nihss Score, 2.1% Of Patients Have Severe Stroke In The Ggc Group, 11.5% Have Severe Stroke In The Pgc Group, And In The Non Diabetic Group, 0.5% Has Severe Stroke.*
Conclusion: *Sunanda Et Al. (2016) Discovered That Glycemic Control Has A Significant Association With The Severity And Outcome Of Diabetic Ischemic Stroke Patients Using Hba1c Estimation. The Severity Of Ischemic Stroke Patients During Hospital Stay Was Examined In This Study With Non-Diabetics As A Control, Resulting In A Study With A Stronger Association. Among The Diabetic Stroke Patients, The Severity Of Deranged Glycemic Status Was Found To Have An Influence On The Stroke Severity. Estimation Of Hba1c Levels At The Time Of Admission Might Be A Predictor Of The Severity Of Neurological Impairment And Functional Outcome In Patients With Acute Ischemic Stroke.*
Keywords: *Hba1c- Glycosylated Hemoglobin, Pgc (Poor Glycemic Control) And Ggc (Good Glycemic Control) Nihss (National Institute Of Health Stroke Scale) Score, Toast Classification (The Trial Of Org 101072 In Acute Stroke Treatment)*

Date of Submission: 02-07-2023 Date of Acceptance: 12-07-2023

I. Introduction:

According to WHO stroke is defined as rapidly developing clinical sign of focal or global disturbance of cerebral function that persists for more than 24 hours or leading to death with no apparent cause other than vascular origin[1].The American Stroke Association now add some changes in definition of stroke that incorporates the findings of brain imaging so that stroke is defined as an episode of focal neurological dysfunction (even if less than 24 hours in duration) in which the autopsy, computed tomography (CT) brain scan, or magnetic resonance imaging (MRI) brain scan shows features consistent with focal brain infarction or hemorrhage[2].

A reduction of perfusion lasting longer than a few seconds suffices to cause cerebral ischemia, and overt neurologic symptoms manifest[1]. This is mainly attributable to absent glycogen stores in the brain tissue. Brain infarction can be caused by cessation of blood flow for a minute. Quick restoration of blood flow can cause full recovery of brain tissue and thus only transient symptoms, thus leading to the transient ischemic attack. Stroke is defined to have occurred when neurologic symptoms persist for24 hours and more or if there is imaging evidence of infarction[1]. A generalized blood flow compromise due to systemic hypotension can initially

cause syncope. Persistent hypotension causes infarction at the borderline areas between the major blood vessel territories, called water-shed infarcts[1].

In more severe cases, global hypoxia-ischemia can result in diffuse brain injury and hypoxic-ischemic encephalopathy. Focal ischemia results from thrombosis or emboli in the arteries.[1]

II. Material And Methods:

An Observation and analytical- case control study was done at Department of Medicine and Neurology in Netaji Subhash Chandra Bose Medical College, Jabalpur (M.P) from February, 2021 to August, 2022 and data was collected prospectively.

The Institutional Ethical Committee of Netaji Subhash Chandra Bose Medical College approved the study protocol. Informed consent was obtained from the patients.

Inclusion criteria- Patient ≥16 years of age admitted in various wards of General Medicine and/or Neurology units of Medical College with history of abrupt onset of a focal neurological deficit of vascular origin (ischemic) which persisted for more than 24 hours, Patients with acute ischemic stroke proven by the imaging modality, Patient with written consent for study research.

Exclusion criteria- Patient age less than 15 years, Transient ischemic attack patients, Patients with recurrent cerebro-vascular accident, Hemorrhagic strokes, Venous strokes, Head trauma, Intracranial space occupying lesions, Neuro infections causing weakness, Sub dural hemorrhage.

The total sample size/study population was 200 ischemic stroke patients - 100 patients for case (diabetic), 100 patients for control (non diabetic).

Detailed history was taken and clinical physical examination was done. Severity score system according to National health stroke scale (NIHSS) and Toast criteria for ischemic stroke classification was used. Relevant hematology investigations, CT Brain to select ischemic stroke patients, Electrocardiogram, HbA1C % (sample of 2 ml blood collected in EDTA vial which was assessed in RX MODENA, Version- 3.0(RX 9003) machine.) was also done.

III. Results:

Table- 1: Symptoms distribution of acute ischemic stroke partients among diabetic and non diabetics

Symptom		Diabetic (n=100)				Non diabetic (n'=100)		Total		χ2	df	P- value
		GGC		PGC								
		number	%	number	%	number	%	number	%			
Hemiparesis												
	No	9	36.5	2	4.2	14	14	35	17.5			
	Yes	33	63.5	46	95.8	86	86	165	82.5	19.81	2	<0.001
Paraparesis												
	No	48	100	52	100	98	98	198	99			
	Yes	0	0	0	0	2	2	2	1	2.02	2	0.364
Monoparesis												
	No	48	100	52	100	98	98	198	99			
	Yes	0	0	0	0	2	2	2	1	2.02	2	0.364
Quadriparesis												
	No	47	97.9	34	65.4	98	98	179	89.5			
	Yes	1	2.1	18	34.6	2	2	21	10.5	43.49	2	<0.001
Facial palsy												
	No	31	64.6	34	65.4	60	60	125	62.5			
	Yes	17	35.4	18	34.6	40	40	75	37.5	0.54	2	0.763
Dysphagia												
	No	48	100	52	100	99	99	199	99.5			
	Yes	0	0	0	0	1	1	1	0.5	1.01	2	0.605
Slurring of speech												
	No	24	50	35	67.3	71	71	130	65			
	Yes	24	50	17	32.7	29	29	70	35	6.45	2	0.040
Aphasia												
	No	46	95.8	30	57.7	83	83	159	79.5			
	Yes	2	4.2	22	42.3	17	17	41	20.5	23.78	2	<0.001

Table- 2: TOAST classification and NIHSS score acute ischemic stroke partients among diabetic and non diabetics

		GGC (n=48)		PGC (n=52)		Non diabetic (n=100)		Total		$\chi 2$	df	p
		n	%	N	%	n	%	n	%			
TOAST Classification												
	1	8	16.7	19	36.5	16	16	43	21.5			
	2	40	83.3	33	63.5	83	83	156	78			
	3	0	0	0	0	1	1	1	0.5	10.30	4	0.036
NIHSS score												
	1- 4	34	70.8	29	55.8	83	83	146	73			
	5 - 15	10	20.8	12	23.1	15	15	37	18.5			
	16 - 20	3	6.3	5	9.6	2	2	10	5			
	21 - 42	1	2.1	6	11.5	0	0	7	3.5	22.45	6	0.001

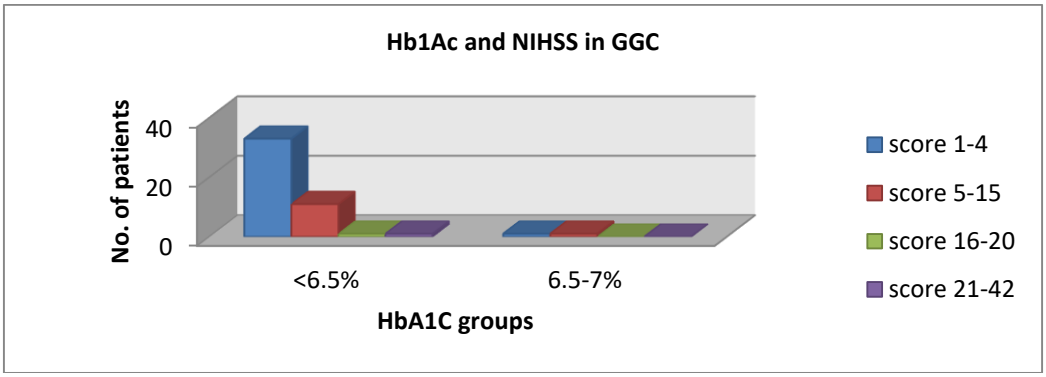

Figure- 1: Column diagram representing distribution according to levels of serum HbA1c and NIHSS among GGC (Goor glycemic control) patients

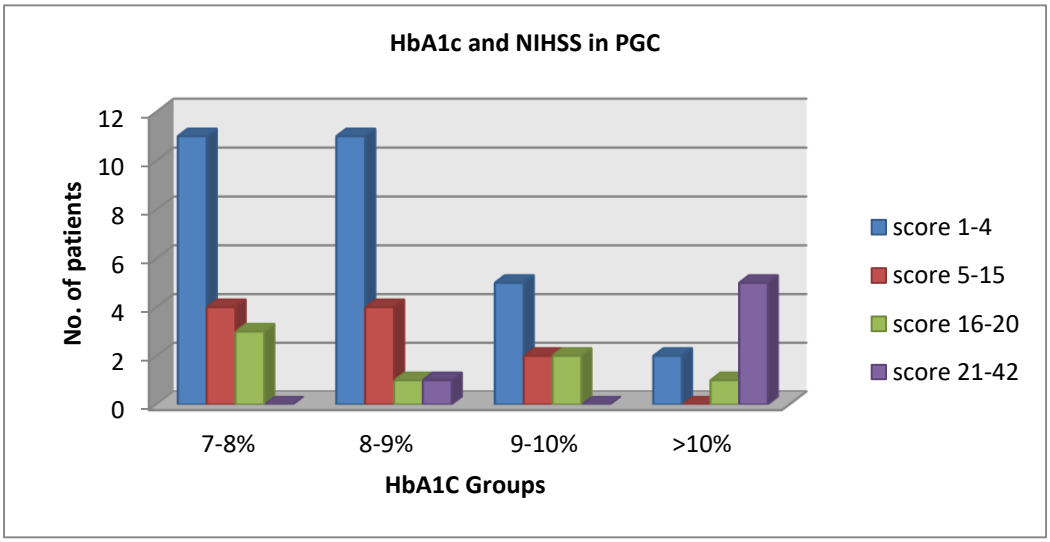

Figure- 2: Column diagram representing distribution according to levels of serum HbA1c and NIHSS among PGC (Poor glycemic control) patients

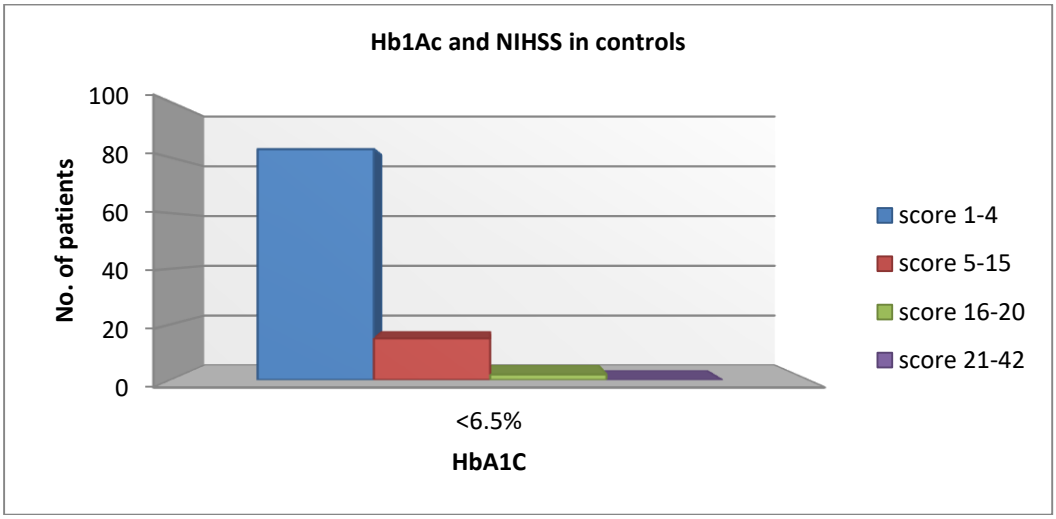

Figure- 3: Column diagram representing distribution according to levels of serum HbA1c and NIHSS among non diabetic patients

Table- 3: Distribution of patients according to outcome during hospital stay

Outcome- during hospital stay	Case (n=100)				Control (n'=100)	%
	GGC	%	PGC	%		
Survived/ discharged	45	93.75%	39	75%	97	97%
Death	3	6.25%	13	25%	3	3%
Total	48	100%	52	100%	100	100%

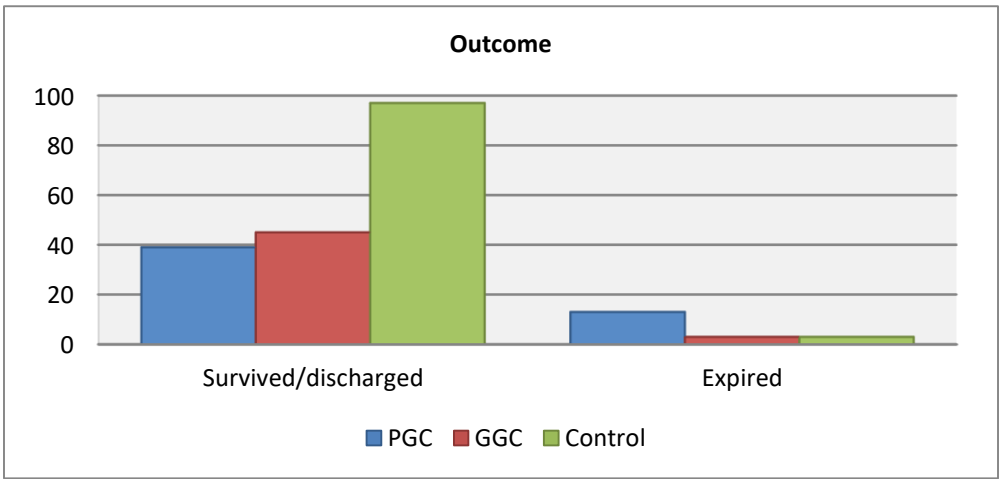

Figure- 4: Bar diagram representing outcome of enrolled patients

Table- 4: Association of continuous variables among all enrolled patients

	PGC (n=52)		GGC (n=48)		Non diabetic (n=100)		f- value	p
	mean	sd	mean	sd	mean	Sd		
Age	58.1	15.1	57.6	13.2	47.4	15.0	12.894	<0.001
HbA1c	8.63	1.22	5.82	0.51	4.79	0.80	326.6	<0.001
Total serum cholesterol	189.85	19.22	179.29	24.91	175.80	41.47	3.07	0.04
HDL	38.26	4.51	43.71	2.519	44.949	3.7	57.3	<0.001
LDL	165.96	29.69	109.62	20.09	102.49	20.64	135.1	<0.001
Triglycerides	189.58	26.19	122	35.85	140.49	46.29	40.9	<0.001
VLDL	32.67	6.99	18.42	6.96	22.2	9.23	41.6	<0.001
NIHSS	5.18	4.05	5.5	5.7	5.18	4.05	9.34	<0.001

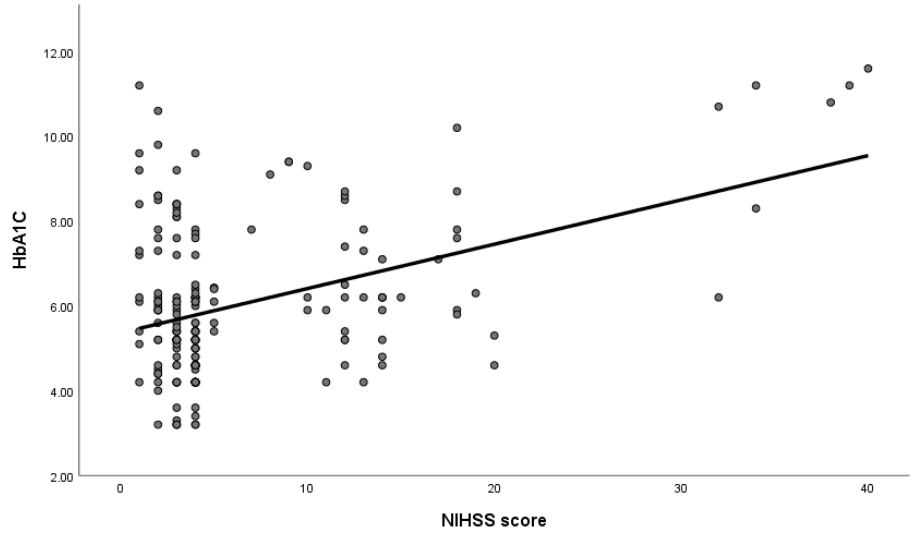

Figure- 5: Scatter plot showing correlation between NIHSS score and HbA1c
Pearson correlation coefficient r = 0.413 p<0.001

IV. Discussion:

Population characteristics:

In present study total 200 patients were selected and primary and secondary objectives were accomplished.

Out of the total 100 patients which were cases (diabetic ischemic stroke), 54 patients (54%) were males and 36 (36%) were females. Out of total 100 patients which were control (non diabetic ischemic stroke) 63 patients (63%) were males and 37 patients (37%) were females.

Case patients were further classified into two subgroups based on glycemic control (glycosylated hemoglobin) that is good glycemic control (GGC- HbA1c < 7%) and poor glycemic control (PGC- HbA1c > 7%). Out of total 48 GGC patients, 25 patients (52.1%) were males and 23 patients (47.9%) were females.Out of total 52 PGC patients 29 patients were males (55.77%) and 23 patients were females (44.23%). showing an increased incidence of the disease in the male population in both subgroups of cases.

This was in coherence with a study conducted by **Sunanda et al (3) in 2016** in which total 130 patients were taken showing 66.7% and 80% male patients in GGC and PGC groups respectively also 73.3% male patients in control group. Another study conducted by **Clara et al(4) in 2014** in which 260 patients were included and it also showed male predominance in the diabetic case group with 59.8% male subjects and female predominance in non diabetic control group with 54.2 female subjects. Male predominance was also seen by **Natuva et al (5) in 2016** in which they comprised 72% of study population (diabetic ischemic stroke patients).Also in study **Patibandla S et al (6) conducted in 2017** in which 60 patients were included showing male predominance were seen in which 68.3% patients were male.

Overall prevelance of diabetes is more in male compared to female population

The mean age of presentation in our study in GGC group was 57.6 ± 13.2 years, In PGC group was 58.1 ± 15.1 years and in non diabetic group was 47.4 ± 15.0 years, showing increased prevalence of stroke among older patients.

This was in consistency with **Sunanda et al (3) in 2016** where, in GGC group was 53.53 ± 11.864 years, in PGC group was 59.95 ±12.397 years and in non diabetic group was 59.03 ±14.459 years. In study **Clara et al (4) conducted in 2014** mean age group among diabetic patient was 76.5 ± 8.8 years and among non diabetic was 79.2 ±7.8 years. In **Natuva et al (5) conducted in 2016** mean age group among diabetic patient was 53.78 ± 12.679 years and study **Patibandla S et al (6) conducted in 2017** mean age group among diabetic patient was 61.683 ± 12.97 years

Sympatomatogy characteristics:

The ischemic stroke patient studied here presented to the hospital with predominant complaints of hemiparesis (79% in case and 86% in control), paraparesis (0% in case and 2% in control), monoparesis (0% in case and 2% in control), quadriparesis (19% in case and 2% in control), facial palsy (35% in case and 40% in control), dysphagia (0% in case and 1% in control), slurring of speech (41% in case and 29% in control)and aphasia (24% in case and 17% in control) followed by fever (63.50%).

Although combinations of the various symptoms are present in both case and control group of patient

Risk factor characteristics:

In present study various risk factors were also studied including smoking, alcohol, hypertension and cardiac disease (old myocardial infarction, valvular heart disease).

Smoking was more prevalent in diabetic PGC patients (44.2%) compared to diabetic GGC patients (33.3%), it was in consistency with **Sunanda et al (3) in 2016** where smoking was again more prevalent among diabetic PGC patients (60%).

Alcohol was also more prevalent in diabetic PGC patients (42.3%) compared to diabetic GGC patients (29.2%), which was again in consistency with **Sunanda et al (3) in 2016** were also alcohol was more prevalent among diabetic PGC patients (47.5%).

Hypertension was more prevalent in non-diabetic patients (47%) compared to GGC (37.5%) and PGC (26.9) diabetic patients but in the it was more prevalent in PGC diabetic patients (77.5%) compared to GGC diabetic group (61.7) and non- diabetic group (53.3%)

Cardiac disease was more prevalent in diabetic PGC patients (90.4%) compared to diabetic GGC patients (89.6%) and non- diabetic patients (87%), which was again in consistency with **Clara et al (4) in 2014** were also cardiac was more prevalent among diabetic patients (67%).

Stroke classification characteristics:

In present study stroke was classified on the basis of TOAST Classsification, it was found that in diabetic case group TOAST subtype 1- large vessel disease was more prevalent in poor glycemic control patients 36.5% compared to good glycemic case (16.7%) and non diabetic control patients (16%) and TOAST subtype 2- small vessel disease was more prevalent in good glycemic control patients of diabetic case (83.3%) compared to poor glycemic cases (63.5%) and non diabetic control patients (83%).

Similar result was present according to study **Sunanda et al (41) in 2016** and **Clara et al (41) in 2014**

Lipid profile characteristics:

Various lipid parameters were studied including Triglyceride, LDL, HDL, VLDL and total cholesterol levels.

In present study it was found that mean **Triglyceride** in diabetic good glycemic case was 122.0 ± 35.85, in poor glycemic case was 189.58 ± 26.19 and in non diabetic control 140.49 ± 46.29 was which was similar to study **Sunanda et al (3) in 2016** in which mean triglyceride in diabetic good glycemic patient was 141.12 ± 55.986, in poor glycemic patient was 181.50 ± 76.827 and in non diabetic patient was 112.73 ± 44.058 and also in study **Clara et al (4) in 2014,** mean triglyceride in diabetic was 58 ± 30.93 and in non diabetic was 46.4 ± 23.2

Mean **LDL** in diabetic good glycemic case was109.62 ± 20.09, in poor glycemic case was 134.3 ± 29.69and in non diabetic control was 102.49 ± 20.64which was similar to study **Sunanda et al (3) in 2016** in which mean LDL in diabetic good glycemic patient was 104.15 ± 31.418, in poor glycemic patient was 113.08 ± 42.340 and in non diabetic patient was 102.87 ± 34.859 and also in study **Clara et al (4) in 2014,** mean LDL in diabetic was 108.28 ± 96.67 and in non diabetic was 119.88 ± 38.67.

Mean **HDL** in diabetic good glycemic case was 43.71 ± 2.519, in poor glycemic case was 38.26 ± 4.51 and in non diabetic control was 44.949 ± 3.7 which was similar to study **Sunanda et al (3) in 2016** in which mean HDL in diabetic good glycemic patient was 46.02 ± 11.425, in poor glycemic patient was 45.35 ± 14.677 and in non diabetic patient was 44.67 ± 13.311 and also in study **Clara et al (4) in 2014,** mean HDL in diabetic was 50.27 ± 19.33 and in non diabetic was 58 ± 19.33.

Mean **VLDL** in diabetic good glycemic case was 18.42 ± 6.96, in poor glycemic case was 32.67 ± 6.99 and in non diabetic control was 22.82 ± 9.23which was similar to study **Sunanda et al (3) in 2016** in which mean VLDL in diabetic good glycemic patient was 30.40 ± 14.141, in poor glycemic patient was 42.6 ± 20.808 and in non diabetic patient was 22.03 ± 8.888.

Mean **Total cholesterol** in diabetic good glycemic case was 179.29 ± 24.91, in poor glycemic case was 189.85 ± 19.22 and in non diabetic control was 175.80 ± 41.47which was similar to study **Sunanda et al (3) in 2016** in which mean total cholesterol in diabetic good glycemic patient was 186.78 ± 39.266, in poor glycemic patient was 207.63 ± 47.669 and in non diabetic patient was 173.23 ± 48.680 and also in study **Clara et al (4) in 2014,** mean total cholesterol in diabetic was 193 ± 46.4 and in non diabetic was 166.28 ± 42.54.

HbA1c characteristics:

In present study it was found that mean HbA1c in diabetic good glycemic case was 5.82 ± 0.51, in poor glycemic case was 8.63 ± 1.22and in non diabetic control was 5.5 ± 4.05 which was similar to study **Sunanda et al (3) in 2016** in which mean HbA1c in diabetic good glycemic patient was 5.9217 ± 0.46106, in poor glycemic patient was 8.5050 ± 1.26003 and also in study **Clara et al (4) in 2014,** mean HbA1c in diabetic was 6.5 ± 1.6 and in non diabetic was 4.9 ± 0.7

NIHSS characteristics:

Stroke severity was assessed with the help of NIHSS scoring in which stroke is classified as no stroke symptom (score- 0), minor stroke symptom (score- 1 to 4), moderate stroke symptom (score- 5 to 15), moderate to severe stroke (score- 16 to 20) and severe stroke symptom (score- 21 to 42)

In present study it was found that mean NIHSS score in diabetic good glycemic case was 5.5 ± 4.05, in poor glycemic case was 10.11 ± 11.3 and in non diabetic control was 5.18 ± 4.05 which was similar to study **Sunanda et al (3) in 2016** in which mean NIHSS score in diabetic good glycemic patient was 6.47 ± 2.213, in poor glycemic patient 12.3 ± 3.180 and in non diabetic control was 8.73 ± 4.315. But in study **Clara et al (4) in 2014,** mean NIHSS score in diabetic was 5.8 ± 7 and in non diabetic was 6.5 ± 6.8.

V. Conclusion:

In current scenario, burden of diabetes is increasing in India with time and along with its complications that are microvascular and macrovascular, one of which is stroke. There is an increased risk of stroke and its severity when a patient has diabetes with poor glycemic control. There are very few studies which compare the severity of stroke in patients of diabetes with good and poor glycemic control with non diabetic. Therefore, this study was conducted to assess the impact of diabetes on the pattern and severity of stroke (ischemic) with the help of glycosylated haemoglobin (HbA1C), which is easily accessible and affordable, so that various medical therapies should be implemented to prevent it.

In this study we have studied severity of total 200 ischemic stroke patients during hospital stay with 100 diabetic patients as case and 100 non diabetic patients as control resulting in a study with stronger association.

Stroke severity was assessed by NIHSS score and glycemic index was checked on the basis of glycosylated hemoglobin (HbA1c %) which was done in all patients with our without known case of diabetes. Male preponderance was found among stroke patient and diabetes as well. Most of the patients were more than 40 years of age.

The study has shown that statistically significant relationship exists between HbA1c and severity of stroke and its outcome of disease during hospital stay.

Hence from this study, it can be concluded that all patients of ischemic stroke must be checked for glycosylated hemoglobin. Estimation of HbA1c levels at the time of admission might be a predictor of the severity of neurological impairment and functional outcome in patients with acute ischemic stroke, so further intervention and lifestyle modification must be done to prevent morbidity and mortality in patients of ischemic stroke.

We also came to conclusion that glycemic index were significantly associated with various lipid derangement such as Triglyceride, LDL, HDL, VLDL, Total cholesterol. So, HbA1c levels can be used as a predictive tool for predicting the lipid derangements.

References

[1]. Towfighi A, Saver JL. Stroke Declines From Third To Fourth Leading Cause Of Death In The United States: Historical Perspective And Challenges Ahead. Stroke. 2011;42(8):2351- 2355.
[2]. Smajlović D. Strokes In Young Adults: Epidemiology And Prevention. Vasc Health Risk Manag. 2015;11:157-164.
[3]. Sunenda T Et Al Study On Role Of Hba1c At Admission On Severity And Functional Outcome Of Ischemic Stroke In Patients With Diabetes Mellitus, 2016, 7:3 DOI 10.4172/2155-9562, 1000377.
[4]. Clara H Et Al The Role Of Prestrike Glycemic Control On Severity And Outcome Of Acute Ischemic Stroke-Volume 2014 | Article ID 694569 | Https://Doi.Org/10.1155/2014/694569\.
[5]. Sai Sampath Kumar Natuva1 Et Al Independent Predictors Of Severity And Functional Outcome Of Acute Ischemic Stroke In Patients With Diabetes Research Article (2016) Open Access Http://Dx.Doi.Org/10.17756/Jnen.2016-012.
[6]. Sivaji Patibandla Et Al Study Of The Severity Of Stroke At The Time Of Presentation In Diabetic Patients Correlating With Glycemic Control (2017) Https://Doi.Org/10.18203/2349-3933.Ijam20170479