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Association between Hba1c Level on Admission with Severity and FunctionalOutcome of Acute Stroke Patients

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Abstract

Introduction: Among all the neurologic disease stroke ranks first in frequency and importance. Stroke is one of the leading causes of mortality and morbidity worldwide.

Materials and methods: An observational study of 173 stroke patients presenting within 24 hours of onset, was undertaken. Patients were divided into three groups, non-diabetic (Hba1c <5.7%), prediabetic (5.7 -6.4%) and diabetic (≥6.5%). Neurological status was assessed by NIHSS (National institute of health stroke scale) score on admission and on day 7/discharge. Functional outcome was assessed by Modified Rankin Scale (MRS) on day 7/discharge.

Results- The average age of the patients was 61.3+_ 10.74 years. The male female ratio was 1.7:1. 52.6% had ischemic stroke while as 82% had haemorrhagic stroke. Neurological improvement was noted in non-diabetic group as there was decrease in mean NIHSS score from admission to day 7. Neurological deterioration was noted in pre-diabetic and diabetic groups as there was increase in mean NIHSS score from admission to day 7. Poor functional outcomes as defined by higher MRS score on discharge, were noted in prediabetic and diabeticpatients.

Conclusion: HbA1c level is an important tool to know the prognosis in acute stroke patients. Both diabetes and pre-diabetes are associated with poor neurological and functional outcome as compare to non-diabetes in acute stroke patients.

Keywords: ICH- Intracerebral Haemorraghe, MRS-Modified Rankinson scale, NIHSS-National Institute of Health Stroke Scale, Hba1c-Glycated Hemoglobin

Introduction

A stroke is a medical condition in which poor blood flow to the brain results in cell death. There are two main types of stroke: ischemic, due to lack of blood flow, and haemorrhagic, due to bleeding. Both result in parts of the brain not functioning properly. Signs and symptoms of a stroke may include an inabilityto move or feel on one side of the body, problems in understanding or speaking, dizziness, or loss of vision to one side.

Signs and symptoms often appear soon after the stroke has occurred. If symptoms last less than one or two hours it is known as a transient ischemic attack (TIA) or mini-stroke. A haemorrhagic stroke may also be associated with a severe headache. The symptoms of a stroke can bepermanent. Long-term complications may include pneumonia or loss of bladder control[1].

The main risk factor for stroke is high blood pressure. Other risk factors include tobacco smoking, obesity, high blood cholesterol, diabetes mellitus, a previous TIA, and atrial fibrillation.

Diagnosis is typically based on a physical examination and supported by neuro imaging such as a CT scan or MRI scan. A CT scan can rule out bleeding,but may not necessarily rule out ischemia, which early on typically does not showup on a CT scan. Other tests such as an electrocardiogram (ECG) and blood tests are done to determine risk factors and rule out other possible causes. Low blood

sugar may cause similar symptoms[2].

Prevention includes decreasing risk factors, as well as possibly aspirin, statins, surgery to open up the arteries to the brain in those with problematic narrowing, and warfarin in those with atrial fibrillation.In 2013 approximately 6.9 million people had an ischemic stroke and 3.4 million people had a haemorrhagic stroke. In 2015 there were about 2.4 million people who had previously had a stroke and were still alive. Between 1990 and 2010 the number of strokes which occurred each year decreased by approximately 10% in the developed world and increased by 10% in the developing world. In 2015, stroke was the second most frequent cause of death after coronary artery disease, accounting for 6.3 million deaths (11% of the total). About 3.0 million deaths resulted from ischemic stroke while 3.3 million deaths resulted from haemorrhagic stroke. About half of people who have had a stroke live less than one year. Overall, two thirds of strokes occurred in those over 65 years old3.Stroke is also a leading cause of functional impairments, with 20% of survivors requiring institutional care after 3 months and 15%-30% being permanently disabled4.Strokes can be classified into two major categories: ischemic and haemorrhagic. Ischemic strokes are caused by interruption of the blood supply to the brain, while haemorrhagic strokes result from the rupture of a blood vessel or an abnormal vascular structure. About 87% of strokes are ischemic, the rest being haemorrhagic. Diabetes is an established risk factor for the development of cardiovascular diseases, including stroke. The risk of stroke in diabetic patients is twice as high as in non-diabetic people in a general population5. Furthermore, if stroke occurs in diabetic patients, their outcomes are less favourable than in non-diabetic patients. A large number of studies have demonstrated residual neurological deficits and functional outcomes to be worse compared with non-diabetics: consequently, hospital and long-term mortality were worse in diabetic patients compared with non-diabetics6.Pre-diabetes is an intermediate metabolic state between normal glucose metabolism and type 2 diabetes, representing a high risk of developing type 2 diabetes in the future. Up to 70% of the patients with pre-diabetes may develop type 2 diabetes. Pre-diabetes comprises impaired fasting glucose and/or impaired glucose tolerance and/or impaired glycated haemoglobin (HbA1C). The risk of developing type 2 diabetes is approximately 0.7% per year in normoglycemic individuals, whereas patients with impaired fasting glucose or impaired glucose tolerance have a yearly risk of 5-10%. The transition from pre-diabetes to type 2 diabetes usually takes

several years but may also be more rapid. Patients with pre- diabetes do not only have an increased risk of type 2 diabetes but also of cardiovascular diseases, including stroke and recurrent stroke. There is a growing recognition that patients with pre-diabetes should be treated more aggressively7. HbA1C level reflects the mean glucose control range for the previous 2-3 months in patients with or without diabetes mellitus. HBA1C level is widely recommended as the therapeutic guideline for the prevention of cardiovascular complication in patients with diabetes. Recently, published clinical practiserecommendation from the American Diabetes Association advocate the use of a HbA1c level greater than 6.5% for the diagnosis of diabetes, largely on the basis of the established association between HbA1c level and micro vascular complication. Compared with fasting glucose, HbA1c has higher repeatability, can be tested in a long-fasting status, and is a relatively stable marker for glucose level8. The following levels of HbA1c were used to diagnose diabetes9; normal:<5.7%, pre-diabetes: 5.7-6.4%, diabetes; 6.5% or higher.The role of HbA1C in the prediction of acute stroke in non-diabetic subject is not clear. Different HbA1c levels in patients with acute stroke has different neurological impairment on admission and on discharge, prognosis is also different, showing that a higher blood HbA1c levels have a more serious neurological impairment and the prognosis is worse.Some researchers argue that it is the acute or 'stress' hyperglycaemia; that is, peaks of blood glucose levels during an acute stroke admission, which confers poorer outcomes10,11, whereas others propose that it is chronic dysglycemia that drives the pathological processes in stroke patients12,13. The uncertainty in the literature offers an opportunity for further research to inform best clinical practice. Compared with fasting blood glucose (FBG), testing of HbA1c has the advantage of providing an average measure of glycaemia over the past 120 days, thereby reducing the potential for misdiagnosis as a result of stress hyperglycemia14. Testing requires only one blood sample and does not require the patient to be fasted, and as such, has the potential to be utilized in the hospitalsetting for routine screening of diabetes mellitus15. A limitation of the use of HbA1c relates to conditions that affect red blood cell count and the survival time of red blood cells, such as anaemia or other hemoglobinopathies14. Previous studies have shown that HbA1c can predict the risk of incident stroke16. With the increasing burden of diabetes, there might be a role for routine HbA1c testing in all people admitted with stroke17 in order to identify and improve glycaemic management18,3.Severe studies were done in the past to elucidate the role of glycated haemoglobin on neurological and functional outcome in acute stroke patients. One study done by Kamouchi M et al (2011)6 concluded that Hba1c on admission was an independent significant predictor for neurological and functional outcomes.Another study done by Zhang G et al (2015) 19 found that high Hba1c levels were independently associated with large hematoma volume, deep ICH, and poor outcome.Baghel PS et al (2016)20 concluded that different Hba1c levels in patients with acute stroke has different neurological impairment on admission and on discharge, prognosis are also different, showing that a higher blood Hba1c levels have a more serious neurological impairment and the prognosis is worst.Hjalmarsson C et al (2014)13 also demonstrated that poor prestroke glycaemic control is (1) an independent determinant of stroke severity, (2) a goodpredictor of acute and long-term survival and (3) a robust marker of neurological functional outcome.

Materials and Methods

The present prospective observational study was conducted in the Postgraduate Department of Medicine, Government S.M.H.S. Hospital, an associated hospital of Government Medical College, Srinagar. After obtaining the ethical clearance from the Institutional Ethical Committee, patients fulfilling the inclusion and exclusion criteria were included in the study after obtaining the proper informedconsent in local language. The study was conducted over a period of two years.

Inclusion Criteria

All patients with features of acute onset stroke confirmed by history, examination and NCCT head or MRI brain irrespective of diabetic status.

Exclusion Criteria

1. Patients with previous history of stroke.
2. Patients with space occupying lesions.
3. Anticoagulant induced ICH
4. Transient ischemic attacks

A complete history, physical examination, and systemic examination were done in all patients. Five millilitres venous blood was taken at the time of hospital admission for subsequent measurement of admission blood glucose level, HbA1c level, and other routine examinations. After taking blood samples, all patients were sent for urgent NCCT head. Diabetic status was assigned on the basis of the history of diabetes or treatment with hypoglycaemic agents or elevated HbA1c or persistent/marked hyperglycaemia. Patients were divided into three groups on the basis of HbA1c levels. Group I having HbA1c values <5.7% i.e. (non- diabetic), Group II having HbA1c values 5.7-6.4% i.e. (pre-diabetic) and Group III having HbA1c values ≥6.5% (diabetic). The severity of neurologic impairment was evaluated by the National Institutes of Health Stroke Scale (NIHSS) score, on admission and after day 7/during discharge. The functional status was evaluated by Modified Rankin Scale (MRS) on day 7/ discharge which ever was earlier. Neurological outcomes were neurological improvement defined as four- point decrease in NIHSS during hospitalization or a 0-point status on NIHSS on day 7 or at discharge and neurological deterioration defined as ≥1 point increase in NIHSS during hospitalization. A poor functional outcome was defined as death(MRS 6) or dependency (MRS 2-5).

Observations And Results

Most common age group in our study was 60-69 years (80/173, 46.2%) followed by 42 (24.3%) patient who belonged to 50-59 years age group. There were 37 (21.4%) patients aged >70 years while as 14 (8.1%) patients belonged to <50 years age group. The mean age in our study was 61.3+10.74 years.

Table 1: Age distribution of study patients

Age (Years)	No. of Patients	Percentage
< 50	14	8.1
50-59	42	24.3
60-69	80	46.2
≥ 70	37	21.4
Total	173	100
Mean±SD=61.3±10.74		

Males outnumbered females in our study with 108 (62.4%) malesversus 65 (37.6%) females. The male to female ratio was 1.7:1.

Table 2: Gender distribution of study patients

Gender	No. of Patients	Percentage
Male	108	62.4
Female	65	37.6
Total	173	100
Male: Female=1.7:1		

Out of 173 patients studied, 91 (52.6%) had ischemic stroke whileas 82 (47.4%) had haemorrhagic stroke.

Table 3: Distribution of study patients as per type of stroke

Type of stroke	No. of Patients	Percentage
Ischemic stroke	91	52.6
Haemorrhagic stroke	82	47.4
Total	173	100

Out of 173 patients, 72 (41.6%) had normal HbA1c levels, 38 (22%)patients had 5.7-6.4 HbA1c levels and were considered as pre-diabetics while as 63 (36.4%) patients had HbA1c levels of ≥6.5 and hence considered as diabetics.

Table 4: Showing HbA1c (%) levels of study patients at admission

HbA1c (%)	No. of Patients	Percentage
< 5.7	72	41.6
5.7-6.4	38	22.0
=6.5	63	36.4
Total	173	100
Mean±SD=6.02±1.89		

At admission, out of 72 non-diabetics patients, 49 (68.1%) had mild NIHSS score (<4), 18 (25%) patients had moderate NIHSS score (4-15) while as 5 (6.9%) patients had severe NIHSS score (>15). Of the 38 prediabeticpatients, 18 (47.4%) had mild NIHSS score (<4), 16 (42.1%) patients hadmoderate NIHSS score (4-15) while as 4 (10.5%) patients had severe NIHSS score (>15). Out of 63 diabetics patients, 19 (30.2%) had mild NIHSS score (<4), 26 (41.3%) patients had moderate NIHSS score (4-15) while as 18 (28.6%) patients had severe NIHSS score (>15).

On Admission, HbA1c levels and mean NIHSS score on admission in acute stroke patients were studied and it was found that patients in group I (non- diabetic) with HbA1c levels of <5.7 had mean NIHSS of 6.87. Patients in Group II (Prediabetics) had mean NIHSS score of 8.14 while as patients in Group III (Diabetics) had mean NIHSS score of 11.23

Table 5: Showing association between HbA1c levels andNIHSS score on admission

NIHSS Score	Nondiabetic(< 5.7)		Prediabetic(5.7-6.4)		Diabetic(≥6.5)	
	No.	%age	No.	%age	No.	%age
Mild (< 4)	49	68.1	18	47.4	19	30.2
Moderate (4-15)	18	25.0	16	42.1	26	41.3
Severe (> 15)	5	6.9	4	10.5	18	28.6
Total	72	100	38	100	63	100
Chi-square=23.794; P-value<0.001 (Statistically Significant)						

At day 7 / discharge, out of 72 non-diabetics patients, 59 (81.9%) had mild NIHSS score (<4), 10 (13.9%) patients had moderate NIHSS score (4- 15) while as 3 (4.2%) patients had severe NIHSS score (>15). Of the 38 prediabetic patients, 13 (34.2%) had mild NIHSS score (<4), 15 (39.5%) patients had moderate NIHSS score (4-15) while as 10 (26.3%) patients had severe NIHSS score (>15). Out of 63 diabetics patients, 10 (15.9%) had mild NIHSS score (<4),23 (36.5%) patients had moderate NIHSS score (4-15) while as 30 (47.6%) patients had severe NIHSS score (>15). HbA1c levels and mean NIHSS score on day 7 / discharge in acute stroke patients were studied and it was found that patients in Group I (non- diabetic) with HbA1c levels of <5.7 had mean NIHSS of 4.31. Patients in Group II (Prediabetics) had mean NIHSS score of 8.67 while as patients in Group III (Diabetics) had mean NIHSS score of 12.89.

Table 6: Showing association between HbA1c levels and NIHSS score on Day-7/Discharge

NIHSS Score	Nondiabetic(< 5.7)		Prediabetic (5.7-6.4)		Diabetic(≥ 6.5)	
	No.	%age	No.	%age	No.	%age
Mild(< 4)	59	81.9	13	34.2	10	15.9
Moderate(4-15)	10	13.9	15	39.5	23	36.5
Severe(> 15)	3	4.2	10	26.3	30	47.6
Total	72	100	38	100	63	100
hi-square=66.908; P-value<0.001 (Statistically Significant)						

Of the 72 patients in Group I (non-diabetics) 60 (83.3%) had MRS score of 0-2 (Independent), 9 (12.5%) patients had MRS score of 3-5 (Dependent) while as 3 (4.2%) expired (MRS grade 6). Of the 38 patients in Group II (pre- diabetics) 14 (36.8%) had MRS score of 0-2 (Independent), 12 (31.6%) patients had MRS score of 3-5 (Dependent) while as 12 (31.6%) expired (MRS grade 6). Out of 63 patients in Group III (diabetics) 9 (14.3%) had MRS score of 0-2 (Independent), 18 (28.6%) patients had MRS score of 3-5 (Dependent) while as 36 (57.1%) expired (MRS grade 6).

Table 7: Showing association between HbA1c levels and MRS score on Day-7/Discharge

MRS Score	Nondiabetic(< 5.7)		Prediabetic(5.7-6.4)		Diabetic≥6.5)	
	No.	%age	No.	%age	No.	%age
Independent(0-2)	60	83.3	14	36.8	9	14.3
Dependent (3-5)	9	12.5	12	31.6	18	28.6
Death (6)	3	4.2	12	31.6	36	57.1
Total	72	100	38	100	63	100
Chi-square=72.321; P-value<0.001 (Statistically Significant)						

Discussion

Age and Sex: Most common age group in our study was 60-69 years (80/173, 46.2%) followed by 42 (24.3%) patient who belonged to 50-59 years age group. There were 37 (21.4%) patients aged >70 years while as 14 (8.1%) patients belonged to<50 years age group. The mean age in our study was 61.3+10.74 years. Malesoutnumbered females in our study with 108 (62.4%) males versus 65 (37.6%) females. The male to female ratio was 1.7:1. Our results are consistent with the findings Wang H et al (2019)21 and Madhu KR t al (2018)22 where the mean age was 63.8 years and 63.59 years. **Kalyani M et al (2017)[23]** conducted a study in which 62% were males and 38% were females. **Mostafa MA et al (2015)[24]** conducted a study on 50 patients with age ranging from 45 to 94 years with males54% and females 46%. The mean age was 62.52±8.10 years in a study done by **Pradhan B et al. (2018)[25]**. There were 58% males and 42% females in their study.**Kalyani M et al (2017)[23]** in their study had 62% males and 38% females with maximum patient (54%) in the age group of 51-70 years.

Type of Stroke

Out of 173 patients studied, 91 (52.6%) had ischemic stroke while as 82 (47.4%) had haemorrhagic stroke. Bandyopadhyay M et al (2017)[26] conducted a study in which 53% were ischemic stroke patients and 45% patients were haemorrhagic. Pradhan B et al. (2018)[25] in their study had 64% ischemic stroke and 36% haemorrhage stroke patients. Hassan MK et al (2013)[27] reported incidence of 58.5% as ischemic strokes and 41.5% haemorrhagic strokes and Siddiqui MR et al (2012)[28] reported 53% ischemic and 45% haemorrhagic in their series.

Glycemic Status

Out of 173 patients, 72 (41.6%) had normal HbA1c levels, 38 (22%) patients had 5.7-6.4 HbA1c levels and were considered as pre-diabetics while as 63 (36.4%) patients had HbA1c levels of ≥6.5 and hence considered as diabetics with a mean HbA1c level of 6.02+1.8%. Patel V et al (2019)[29] conducted a study to evaluate etiological, demographic, clinical course and identification of risk factors in acute stroke. In their study 35% patients were diabetics. In studies using HbA1c and a history of diabetes as a diagnostic criterion, an estimated 24.7– 56.2% of stroke patients had known diabetes. There were five studies[30,31 ,32 ,33 ,34] that included purely haemorrhagic stroke, with a prevalence of diabetes ranging between 8.2 and 50.2%. The mean HbA1c level was 6.4+1.5mmol/L in a study done by Wang H et al (2018)[21]. The mean prevalence of diabetes in stroke patients was highest in Southeast Asian (Singapore[35], India[36], Indonesia[37]) and East Asian countries (China[12], Japan[11], Taiwan[38]), which were 33.5 and 32.3%, respectively.

Severity of Stroke At Admission

Severity of stroke was assessed with NIHSS at admission, out of 72 non- diabetics patients, 49 (68.1%) had mild NIHSS score (<4), 18 (25%) patients had moderate NIHSS score (4-15) while as 5 (6.9%) patients had severe NIHSS score(>15).

Of the 38 prediabetic patients, 18 (47.4%) had mild NIHSS score (<4), 16 (42.1%) patients had moderate NIHSS score (4-15) while as 4 (10.5%) patients had severe NIHSS score (>15). Out of 63 diabetics patients, 19 (30.2%) had mild NIHSS score (<4), 26 (41.3%) patients had moderate NIHSS score (4-15) while as 18 (28.6%) patients had severe NIHSS score (>15). On Admission, HbA1c levels and mean NIHSS score on admission in acute stroke patients were

studied and it was found that patients in group I (nondiabetic) with HbA1c levels of <5.7 had mean NIHSS of 6.87. Patients in Group II (Prediabetics) had mean NIHSS score of 8.14 while as patients in Group III (Diabetics) had mean NIHSS score of 11.23. In our study severe stroke was present in patients with Hba1c ≥6.5 (diabetics) compared to patients with HbA1c 5.7-6.4 (Prediabetics) and HbA1c <5.7 (Non-diabetic) which was statistically significant with P-value < 0.001 and mean HbA1c was also high in patients with HbA1c ≥ 6.5 (diabetics). Our results were confirmed in a study done by Baghel MS et al (2016)[20] in which on admission severe stroke was present in diabetic patients, as there was significant ($P < 0.05$) increase in mean NIHSS score, and pre-diabetics had non-significant ($P > 0.05$) increase in mean NIHSS score, as compare to non-diabeticpatients.

Severity of Stroke At Day 7/Discharge

At day 7 / discharge, out of 72 non-diabetics patients, 59 (81.9%) had mild NIHSS score (<4), 10 (13.9%) patients had moderate NIHSS score (4-15) while as 3 (4.2%) patients had severe NIHSS score (>15). Of the 38 prediabetic patients, 13 (34.2%) had mild NIHSS score (<4), 15 (39.5%) patients had moderate NIHSS score (4-15) while as 10 (26.3%) patients had severe NIHSS score (>15). Out of 63 diabetics patients, 10 (15.9%) had mild NIHSS score (<4), 23 (36.5%) patients had moderate NIHSS score (4-15) while as 30 (47.6%) patients had severe NIHSS score (>15). HbA1c levels and mean NIHSS score on day 7 / discharge in acute strokepatients were studied and it was found that patients in Group I (non-diabetic) withHbA1c levels of <5.7 had mean NIHSS of 4.31. Patients in Group II (Prediabetics) had mean NIHSS score of 8.67 while as patients in Group III (Diabetics) had mean NIHSS score of 12.89. In our study stroke severity as assessed by NIHSS increased from admission to day 7/discharge in both prediabetic and diabetic (Hba1c 5.7-6.4 and ≥6.5). Mean NIHSS also increased in both Prediabetic and diabetic. However, in non-diabetic patients' neurological improvement was noted, as there was decrease in NIHSS score and mean NIHSS from admission to day 7/discharge.

Our results were confirmed in a study done by Bagel MS et al (2016)[20] in which on day 7/discharge, severe stroke was present in both diabetic and pre- diabetic patients as there was significant ($P < 0.05$) increase in mean NIHSS scoreas compared to non-diabetic patients. Neurological improvement was noted in non-diabetic group, as there was decrease in mean NIHSS score from admission to day 7. Neurological deterioration was noted in pre-diabetic and diabetic groups as there was increase in mean NIHSS score from admission to day 7.

Outcome of Stroke

Outcome at day 7/discharge was assessed by MRS scale. Of the 72 patients in Group I (non-diabetics) 60 (83.3%) had MRS score of 0-2 (Independent), 9(12.5%) patients had MRS score of 3-5 (Dependent) while as 3 (4.2%) expired (MRS grade 6). Of the 38 patients in Group II (pre-diabetics) 14 (36.8%) had MRS score of 0-2 (Independent), 12 (31.6%) patients had MRS score of 3-5 (Dependent) while as 12 (31.6%) expired (MRS grade 6). Out of 63 patients in Group III (diabetics) 9 (14.3%) had MRS score of 0-2 (Independent), 18 (28.6%) patients had MRS score of 3-5 (Dependent) while as 36 (57.1%) expired (MRS grade 6).HbA1c levels and mean MRS score on day 7 / discharge in acute stroke patients were studied and it was found that patients in Group I (non-diabetic) with HbA1c levels of <5.7 had mean MRS score of 1.9. Patients in Group II (Prediabetics) had mean MRS score of 3.4 while as patients in Group III (Diabetics) had mean MRS score

of 4.3. The statistically significant association was observed between Group II and Group I and Group III and I with p value of<0.05.In our study poor functional outcome as defined by high MRS score was noted in both prediabetic and diabetic patients which was statistically significant with P-value < 0.001.Our results were confirmed in a study done by Baghel MS et al., (201620) in which poor functional outcome was noted in both prediabetic and diabetic patients.Kamouchi M et al (2011)6, Hjalmarsson C et al (2015)13 and Shuangxi G et al (2012)39 also observed statistically significant association of HbA1c level in acute stroke by MRS with a p value of <0.05.

Summary

The present prospective observational study was conducted in the Postgraduate Department of Medicine, Government S.M.H.S. Hospital, an associated hospital of Government Medical College, Srinagar. After obtaining the ethical clearance from the Institutional Ethical Committee, patients fulfilling the inclusion and exclusion criteria were included in the study after obtaining the proper informed consent in local language. The study was conducted over a period of two years. Most common age group in our study was 60-69 years (80/173, 46.2%) followed by 42 (24.3%) patient who belonged to 50-59 years age group. There were 37 (21.4%) patients aged >70 years while as 14 (8.1%) patients belonged to <50 years age group. The mean age in our study was 61.3+10.74 years. Males outnumbered females in our study with 108 (62.4%) males *versus* 65 (37.6%) females. The male to female ratio was 1.7:1. Out of 173 patients studied, 91 (52.6%) had ischemic stroke while as 82 (47.4%) had hemorrhagic stroke.

Out of 173 patients, 72 (41.6%) had normal HbA1c levels, 38 (22%) patients had 5.7-6.5 HbA1c levels and were considered as pre-diabetics while as 63 (36.4%) patients had HbA1c levels of >6.5 and hence considered as diabetics. Mean HbA1c level was 6.02+1.8%.

In our study severe stroke was present at admission in patients with Hba1c ≥6.5 (diabetics) compared to patients with HbA1c 5.7-6.4 (Prediabetics) and HbA1c <5.7 (Non-diabetic) which was statistically significant with P-value < 0.001 and mean HbA1c was also high in patients with HbA1c >6.5 (diabetics).

In our study stroke severity as assessed by NIHSS increased from admission to day 7/discharge in both pre-diabetic and diabetic (Hba1c 5.7-and ≥6.5). Mean NIHSS also increased in both Pre-diabetic anddiabetic. However, in non-diabetic patients' neurological improvement was noted, as there was decrease in NIHSS score and mean NIHSS from admission to day 7/discharge.In our study poor functional outcome as defined by high MRS score was noted in both prediabetic and diabetic patients which was statistically significant with P-value < 0.001.

Conclusion

Diabetes is a known risk for poor neurological and functional outcomes, which was again confirmed by this study but pre-diabetes had also poor neurological and functional outcomes as compared to non-diabetes in acute stroke patients. Hence, HbA1c level should be determined in every Acute stroke patient to know the prognosis and for further treatment plan after stroke.

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