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STUDY OF IMPACT OF HBA1C AND URIC ACID ON ISCHEMIC STROKE SEVERITY AND OUTCOME AT A TERTIARY CARE CENTRE, JAIPUR, RAJASTHAN

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Abstract
Background:- Stroke is a leading cause of morbidity and disability in Asian population. Changes in the HbA1c and Uric acid levels have been suggested as a risk factor for developing ischemic stroke. The present study was designed to evaluate the HbA1c and Uric acid levels in a patient diagnosed with ischemic stroke and correlating it's severity with the National Institute of Health Stroke Scale (NIHSS) and prediction of outcome based on Modified Rankin Scale (mRS) scoring system after 28 days from day of admission.
Material methods:- A Hospital based Prospective Observational study included 150 Patients of Acute ischemic stroke visiting OPD and IPD of Medicine department of MGMC&H Jaipur . We estimated HbA1c and uric acid levels of these patient's and compared them with severity of stroke according to NIHSS scale and correlated the outcome based on Modified Rankin Scale (mRS) scoring system after 28 days from day of admission.
Results:- Increased HbA1c and Uric acid levels positively and significantly ($p < 0.001$) correlated with NIHSS scale. Increased HbA1c and Uric acid levels positively and significantly ($p < 0.001$) correlated with mRS scale.
Conclusion:- It could be concluded that higher HbA1c and uric acid levels can be considered as a risk factor for ischemic cerebral events and higher level is associated with the more severe stroke and poor outcome.

Keywords:- HbA1c, Uric acid, National Institute of Health Stroke Scale(NIHSS), Modified Rankin Scale (mRS)

INTRODUCTION:-
Stroke is defined as a sudden onset of a neurological deficit caused by an acute focal injury to the central nervous system due to a vascular cause.[1] The incidence of strokes occurring every year worldwide is about 17 million and it is the second leading cause of death after coronary artery disease.[2] By 2020 in developed countries, it is predicted that stroke will be accountable for 6.2% of the total burden of illness.[3] These data put forward the need for controlling risk factors, knowledge of identifying the signs of stroke, timely reperfusion therapies and measures to improve delivery of the aforementioned resources for the best possible outcome. Ischemic strokes are the most common (≈85%), the rest being hemorrhagic that includes cerebral and subarachnoid (≈15%).[4]

Uric acid is the ultimate catabolite of purine metabolism in human and higher primates [(5)]. It exists in the extracellular compartment as sodium urate, and it is cleared from the plasma through the kidney [(6)]. Uric acid levels are influenced by age and sex. Prior to puberty, the average serum uric acid is 3.6 mg/dl for males and females. Following puberty, value rises to adult levels with women typically 1 mg/dl less than men. This lower level in women apparently reflects estrogen related enhancement of renal urate clearance.[7] It has been reported that increased levels of uric acid are associated with established cardiovascular risk factor such as elevated serum triglyceride and cholesterol concentration, hypertension, obesity, insulin resistance and metabolic syndrome. On the other hand uric acid has been known to exert neuroprotective effects by acting

as a free radical scavenger.[8] In humans, approximately one half the antioxidant capacity of plasma comes from uric acid. The role of urate in ischemic stroke is poorly understood.

HbA1c has been shown to be a biochemical marker and a good predictor of vascular disruption is patients with diabetes.[9] It has also been shown to associate well with diabetic complications.[9] However, its prognostic value in the acute neurological conditions such as stroke is still not well-substantiated.

MATERIAL METHODS:-

A Hospital based Prospective Observational study was planned, including 150 Patients diagnosed as Acute ischemic stroke on the basis of CT/MRI findings visiting OPD and IPD of Medicine department of MGMC&H Jaipur. We classified these patients according to severity by NIHSS scale and saw the correlation between stroke severity and serum HbA1c, uric acid levels and correlated the outcome based on Modified Rankin Scale (mRS) scoring system after 28 days from day of admission. Patients diagnosed with CT or MRI and more than 18 years of age were included in this study while patients taking drugs which can alter HbA1c, uric acid levels, patients with other acute conditions like MI, DKA etc were excluded from this study.

RESULTS:-

Table 1:- Mean values of different variables

Variables	Mean	Standard deviation
Age(years)	64.43	7.38
NIHSS Score	10.97	9.29
MRS Score	2.53	1.72
HbA1c	8.89	7.83
Uric Acid	2.69	3.30

Mean age of patients were 64.43± 7.38 years. Out of 150 patients 88(58.7%) were male while 62(41.3%) were female. Male to female ratio was 1.42. Mean NIHSS score was 10.97±9.27 and mean MRS score was 2.53±1.72.

Results:

Table 2: Relationship between HbA1c level and NIHSS

HbA1c (%)	NIHSS Range				Total
	Mild	Moderate	Moderate to Severe	Severe	
<6.5	40(100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	40(100%)
6.5-9	15 (40.5%)	22 (59.5%)	0 (0.0%)	0 (0.0%)	37(100%)
9.1-11.5	0 (0.0%)	23 (56.1%)	18 (43.9%)	0 (0.0%)	41(100%)
>11.5	0 (0.0%)	0 (0.0%)	17 (53.1%)	15 (46.9%)	32 (100%)
Total	55 (36.7%)	45 (30.0%)	35 (23.3%)	15 (10.0%)	150 (100.0%)

Cross tabulation, value <0.001

As shown in the table among the study subject having HbA1c level less than 6.5 % all i.e 40(100%) are in mild NIHSS range. Among the study subject having HbA1c level 6.5-9% level 15 (40.5%)and 22 (59.5%) are in mild and moderate NIHSS range respectively. Among the study subject having HbA1c level 9.1-11.5% level 23 (56.1%) and 18 (43.9%) are in moderate and moderate to severe NIHSS range respectively. Finally among the study subject having HbA1c level more than 11.5% level 17 (53.1%) and 15 (46.9%) are in moderate to severe and severe NIHSS range respectively. Thus with increase in HbA1c level the NIHSS severity also increases and this difference is statistically significant (p<0.001)

Table 3: Correlation between NIHSS Score and HbA1c

Parameter	R score	P value	Significance
NIHSS Vs HbA1c	**0.929**	**<0.001**	**S**

Above table shows correlation between HbA1c and NIHSS severity scale. It shows significant positive correlation(p<0.001).

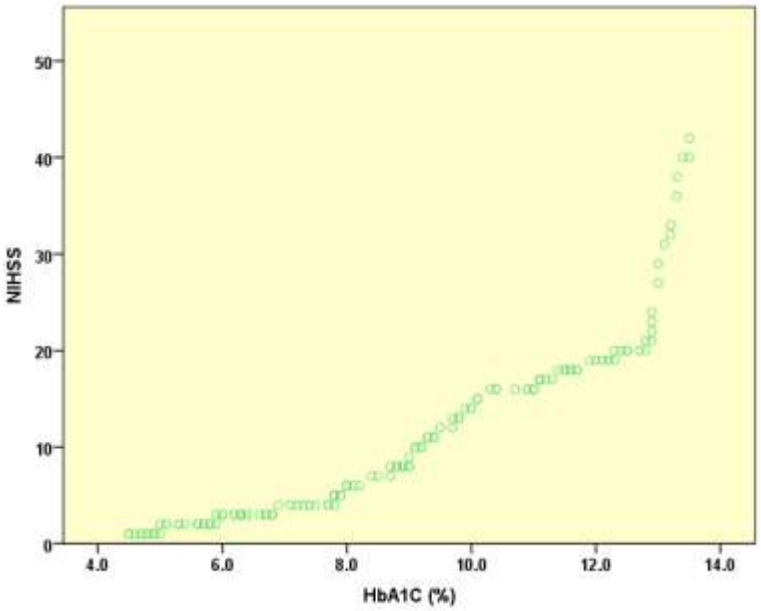

Figure 1: Scatter plot showing correlation between NIHSS score and HbA1c

Table 4: Relationship between Serum HbA1c and MRS

HbA1c (%)	MRS							Total
	0	1	2	3	4	5	6	
<6.5	12 (30.0%)	28 (70.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	40 (100.0%)
6.5-9	0 (0.0%)	17 (45.9%)	20 (54.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	37 (100.0%)
9.1-11.5	0 (0.0%)	0 (0.0%)	8 (19.5%)	10 (24.4%)	23 (56.1%)	0 (0.0%)	0 (0.0%)	41 (100.0%)
>11.5	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	9 (28.1%)	17 (53.1%)	6 (18.8%)	32(100.0 %)
Total	12 (8.0%)	45 (30.0%)	28 (18.7%)	10 (6.7%)	32 (21.3%)	17 (11.3%)	6 (4.0%)	150 (100.0%)

Cross tabulation,p value <0.001

As shown in the table among the study subject having HbA1c level less than 6.5 % level 12 (30.0%) and 28 (70.0%) are having MRS value 0 and 1 respectively. Among the study subject having HbA1c level 6.5-9% level 17 (45.9%) and 20 (54.1%) are having MRS value 1 and 2 respectively. Among the study subject having HbA1c level 9.1-11.5% level 8 (19.5%), 10 (24.4%), and 23 (56.1%) are having MRS value 2,3 and 4 respectively. Finally among the study subject having HbA1c level more than 11.5% level 9 (28.1%), 17 (53.1%), and 6 (18.8%) are having MRS value 4,5 and 6 respectively. Thus with increase in HbA1c level the MRS value also increases and this difference is statistically significant (p<0.001).

Table 5: Correlation between HbA1c and MRS score

Parameter	R score	P value	Significance
HbA1c and MRS score	**0.959**	**<0.001**	**S**

Correlation analysis between serum HbA1c level and MRS shows that MRS is significantly positively correlated with triglyceride with r score 0.959 and p value <0.001.

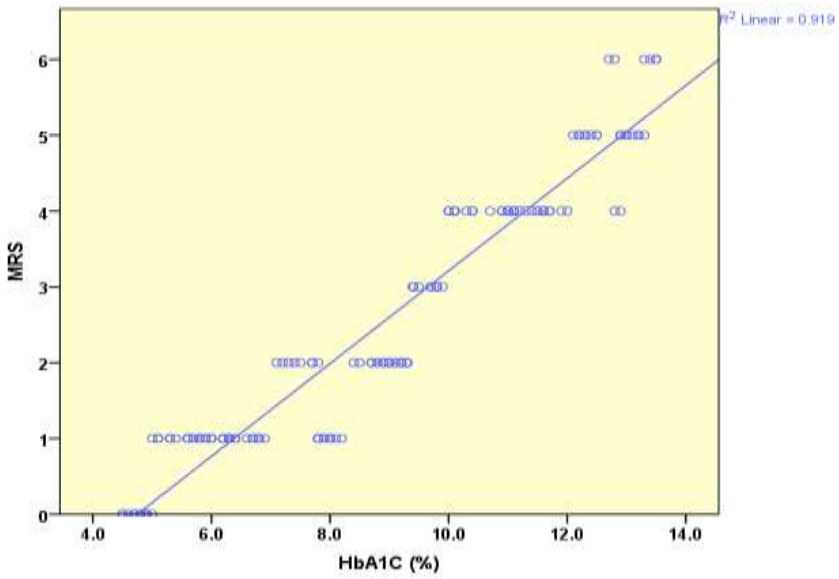

Figure 2: Scatter plot showing correlation between HbA1c and MRS score

Table 6: Relationship between Serum Uric Acid level and NIHSS

Uric Acid (mg/dl)	NIHSS Range				Total
	Mild	Moderate	Moderate to Severe	Severe	
<6	54(100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	54(100%)
6-8	1(3.4%)	28(96.6%)	0 (0.0%)	0 (0.0%)	29(100%)
8.1-10	0 (0.0%)	17(68%)	8(32%)	0 (0.0%)	25(100%)
>10	0 (0.0%)	0 (0.0%)	27(64.3%)	15(35.7)	42 (100%)
Total	55 (36.7%)	45 (30.0%)	35 (23.3%)	15 (10.0%)	15 (100.0%)

Cross tabulation, p value <0.001

As shown in the table among the study subject having uric acid level less than 6mg/dl of blood all i.e 54(100%) are in mild NIHSS range. Among the study subject having uric acid level 6-8 mg/dl of blood 1(3.4%) and 28(96.6%) are in mild and moderate NIHSS range respectively. Among the study subject having uric acid level 8.1-10mg/dl of blood 17(68%) and 8(32%) are in moderate and moderate to severe NIHSS range respectively. Finally among the study subject having uric acid level more than 10mg/dl of blood 27(64.3%) and 15(35.7%) are in moderate to severe and severe NIHSS range respectively. Thus with increase in uric acid level the NIHSS severity also increases and this difference is statistically significant (p<0.001)

Table 7: Correlation between NIHSS Score and Serum Uric Acid level

Parameter	R score	P value	Significance
NIHSS Vs Serum Uric Acid	**0.953**	**<0.001**	**S**

Above table shows correlation between Uric acid and NIHSS severity scale. It shows significant positive correlation(p<0.001).

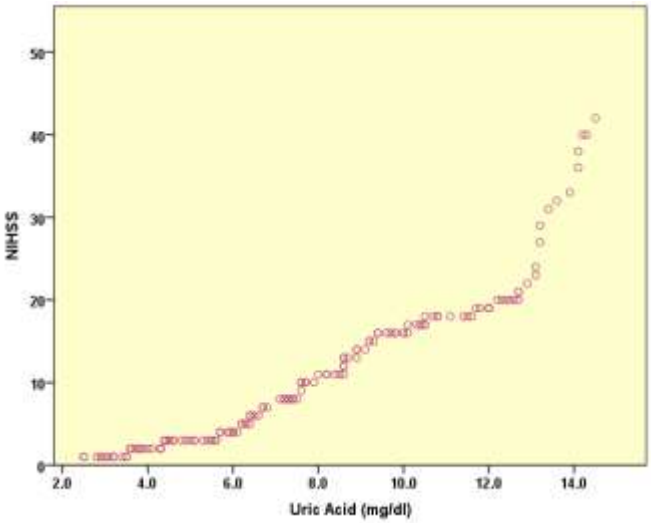

Figure 3: Scatter plot showing correlation between HbA1c and NIHSS score

Table 8: Relationship between Serum Uric Acid level and MRS

Uric Acid (mg/dl)	MRS							Total
	0	**1**	**2**	**3**	**4**	**5**	**6**	
<6	12 (22.2%)	35 (64.8%)	7 (13.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	54 (100.0%)
6-8	0 (0.0%)	10 (34.5%)	19 (65.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	29 (100.0%)
8.1-10	0 (0.0%)	0 (0.0%)	2 (8.0%)	10 (40.0%)	13 (52.0%)	0 (0.0%)	0 (0.0%)	25 (100.0%)
>10	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	19 (45.2%)	17 (40.5%)	6 (14.3%)	42 (100.0%)
Total	12 (8.0%)	45 (30.0%)	28 (18.7%)	10 (6.7%)	32 (21.3%)	17 (11.3%)	6 (4.0%)	150 (100.0%)

Cross tabulation,p value <0.001

As shown in the table among the study subject having uric acid level less than 6mg/dl of blood 12(22.2%), 35(64.8%) and 7(13%) are having MRS value 0,1 and 2 respectively. Among the study subject having uric acid level 6-8 mg/dl of blood 10(34.5%) and 19(65.5%) are having MRS value 1 and 2 respectively. Among the study subject having uric acid level 8.1-10mg/dl of blood 2(8%), 10(40%) and 13(52%) are having MRS value 2,3 and 4 respectively. Finally among the study subject having uric acid level more than 10mg/dl of blood 19(45.2%), 17(40.5%) and 6(14.3%) are having MRS value 4,5 and 6 respectively. Thus with increase in uric acid level the MRS value also increases and this difference is statistically significant (p<0.001)

Table 9: Correlation between Uric Acid and MRS score

Parameter	R score	P value	Significance
Uric Acid VS MRS	**0.966**	**<0.001**	**S**

Correlation analysis between serum uric acid level and MRS shows that MRS is significantly positively correlated with uric acid level with r score 0.966 and p value <0.001.

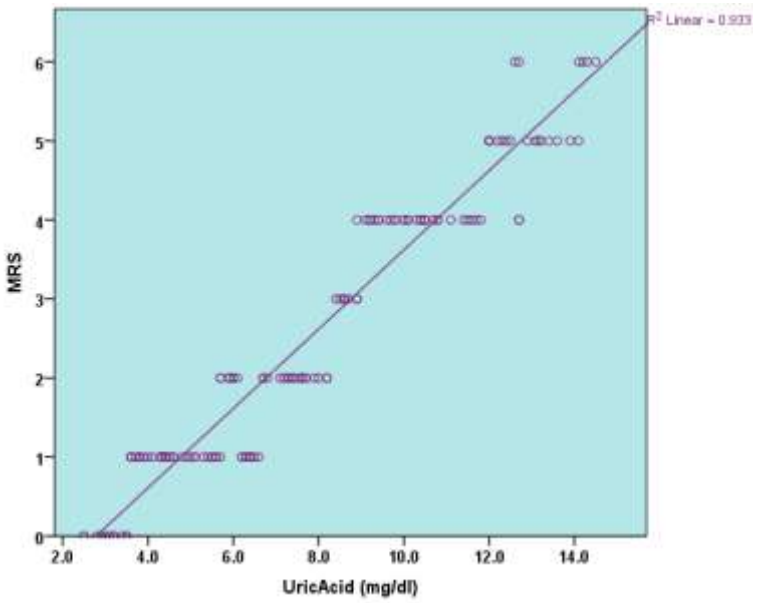

Figure 4: Scatter plot showing correlation between Uric Acid and MRS score

DISCUSSION:-

Stroke bears colossal neurological disease burden, as evidenced by emerging and expansive epidemiological literature. Stroke is the second most common cause of death worldwide, preceded only by ischemic heart disease, and the third most common cause of disability. In India, the Indian Global Burden of Disease Study 1990--2019 estimated that stroke was the largest contributor to disability adjusted life years (DALYs), and a chief contributor to deaths caused by neurological disorders. The total neurological disorder DALYs contributed by stroke was determined to be 37.9% [95% uncertainty interval 29.9--46.1]. The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2019 indicated that the vast proportion of stroke burden is borne by low and middle-income countries, with the age standardized death rates and DALYs being four times higher in World Bank low-income countries.[7]

In this study we included 150 patients of ischemic stroke and categorize these patients according to severity with help of NIHSS scale and predicted outcome with the help of Modified Rankin Scale (mRS) scoring system. We estimated the Serum HbA1c levels and Uric acid levels in all these patients and find out association of these parameter with severity of disease(NIHSS scale) and outcome of disease(mRS score). In our study the mean HbA1c was 8.89±2.69% in this study.

We categorized HbA1c into small groups of <6.5%, 6.5-9%, 9.1-11.5 % and >11.5% respectively. Out of 150 patients maximum 41 patients had HbA1c levels between 9.1%-11.5% followed by 40 patients who had HbA1c levels <6.5% , 37 patients had HbA1c levels 6.5-9% and 32 had HbA1c levels >11.5%. When we saw the relationship of these groups of HbA1c levels with NIHSS scale in these patients we found Out of 40 stroke patients who had HbA1c levels <6.5% all 40(100%) were in mild NIHSS range. Out of 37 stroke patients who had HbA1c levels between 6.5-9% 15 (40.5%)and 22 (59.5%) are in mild and moderate NIHSS range respectively. Out of 41 stroke patients who had HbA1c levels between 9.1-11.5% 23 (56.1%) and 18 (43.9%) are in moderate and moderate to severe NIHSS range respectively. Finally among the 32 study subject having HbA1c level >11.5% level 17 (53.1%) and 15 (46.9%) are in moderate to severe and severe NIHSS range respectively.

When we saw correlation between HbA1c level and NIHSS scale by Pearson correlation we found significant positive correlation($p<0.001$) which shows as HbA1c levels increases severity of stroke increases or we can say more severe stroke correlates with higher levels of HbA1c.

Similarly when we correlate these HbA1C groups with mRS score we found out of 40 patients who had HbA1C levels < 6.5% 12 (30.0%) patients recovered fully and had mRS score 0 while 28 (70.0%) patients had some symptoms with mRS score 1. Out of 37 patients who had HbA1C level 6.5-9% 17 (45.9%) patients had few symptoms with mRS score 1 while 20 (54.1%) patients had mild disability with mRS 2. Out of 41 patients who had HbA1C level 9.1-11.5%, 8 (19.5%), patients had mild disability with mRS score 2, 8 (20.0%) patients had moderate disability with mRS score 3, 23 (56.1%) patients

had moderate to severe disability with mRS score 4. Out of 32 patients who had HbA1C level >11.5% 9 (28.1%) patients had moderate to severe disability with mRS score 4, 17 (53.1%) patients had severe disability with mRS score 5 while 6 (18.8%) patients died within 28 days of stroke with mRS score 6.

Correlation analysis between serum HbA1C level and mRS shows that mRS is significantly positively correlated with HbA1C with r score 0.959 and p value <0.001. It shows poor outcome or poor recovery with increased levels of HbA1C.

Our results were in concordance with study conducted by Sunanda T et al[10] in 2016 which shows in their study showed that FPG, PPG values on admission, NIHSS scores, three months MRS score, when compared among three groups of patients, the difference was statistically significant (P <0.001). Patients with high HbAlc, high FPG, high PPG had high NIHSS score at admission with poor outcomes at 3 months (P<0.001). In neurological impairment aspect, on admission, serious patients(>12 NIHSS) of poor glycemic control accounted for 47.5%, that is higher than good glycemic control (1.7%) and non-diabetics (3.3%).In three months functional outcome aspects, dependent (>2 MRS) patients of poor glycemic control group accounted for 47.5%, that is higher than good glycemic control (5%), non-diabetic (3.3%). And a higher HbA1c levels has a more serious neurological impairment on admission and the prognosis is worse higher three months.

Our result is in line with the result of **Kamouchi et al.[11]** in 2011 studied 3627 patients, the result showed that neurological improvement is lower relevant to age and sex and is higher relevant to the blood HbA1c level on admission.

Another study by **Lei C et al[12]** in 2015 conducted a retrospective study of 526 people with diabetes and 1351 people without diabetes found that elevated HbA1c was associated with poorer 3-month outcomes in ischemic stroke patients with and without diabetes after adjusting for age, sex, hypertension, NIHSS score, systolic and diastolic blood pressure, and blood glucose, stroke subtype and strokerelated complications.

Similar results were found by **Sung JY et al[13]** in 2017 found in a multicenter retrospective study involving 484 patients with acute ischemic stroke, HbA1c was not associated with poor neurologic outcomes in AIS patients with and without DM after adjusting for age, sex, NIHSS at admission, atrial fbrillation, and fasting glucose (OR: 1.700, 95%CI: 0.494–5.859 for patients without DM, OR: 1.163, 95%CI: 0.945–1.430 for patients with DM).

A study conducted by **Wang H et al[14]** in 2019 et al showed contrast results they shows in a retrospective study of 408 patients with frst acute ischemic stroke, after adjusting for age, sex, intravenous recombinant tissue plasminogen activator, NIHSS score, admission glucose, TG, stroke subtype, hypertension, atrial fbrillation, smoking, uric acid, systolic blood pressure, and diastolic blood pressure, the results showed that HbA1c was correlated with 3-month adverse clinical outcomes of AIS patients with DM (OR: 1.482, 95%CI: 1.013–2.167), while there was no correlation HbA1c and between 3-month adverse clinical outcomes of patients without DM (OR:1.355, 95%CI: 0.589–3.118). Another study by Han L et al[15] in 2022 found contrast results in their study involving 267 patients with acute minor ischemic stroke treated with intravenous thrombolysis found that HbA1c was not associated with 90-day functional outcome after adjusting for age, sex, NIHSS on admission, fbrinogen, hypersensitive C-reactive protein, fasting glucose, DM, stroke subtype, and early neurological deterioration (OR: 0.975, 95%CI: 0.747–1.271).

So we can say with results of our study that higher HbA1c level will have a more serious neurological impairment, and the clinical condition might be more serious. So, HbA1c levels at admission might be an important predictor to evaluate the neurological impairment in patients with acute ischemic stroke. The exact mechanism by which poor prestroke glycemic control affects survival of stroke patients is less clear; general complications related to poorly controlled DM could be one explanation. An increased HbA1c level reflects poor long term glycemic control and has specific implications for the structure and function of the vascular bed, including small and large cerebral vessels. Increased HbA1c level might also be a marker of poor compliance, indicating an unhealthy lifestyle.

Another probable mechanism might be associated with long-term high blood glucose and high blood HbA1c,which lead to lesions of large blood vessels and which lead to oxygen dissociation curve to the left, resulting in oxygen dissociation barrier, nerve tissue ischemia and hypoxia, that is not benefit for the recovery of neurological function, and the prognosis is worse.

- **Uric acid**

  Mean Uric acid was 7.83± 3.3 mg/dl in this study. We categorizes Uric acid into small groups of <6 mg/dl, 6-8 mg/dl, 8.1-10 mg/dl and >10 mg/dl respectively. Out of 150 patients maximum 54 patients had Uric acid levels

<6 mg/dl followed by 42 patients who had Uric acid levels >10 mg/dl , 29 patients had Uric acid levels between 6-8 mg/dl and 25 patients had Uric acid levels between 8.1-10 mg/dl. When we saw the relationship of these groups of Uric acid levels with NIHSS scale in these patients we found Out of 54 stroke patients who had Uric acid levels <6 mg/dl all 54(100%) were in mild NIHSS range. Out of 29 stroke patients who had Uric acid levels between 6-8 mg/dl 1(3.4%) were in mild range of NIHSS scale while and 28(96.6%) were in moderate NIHSS range. Out of 25 stroke patients who had Uric acid levels between 8.1-10 mg/dl 17(68%) patients were in moderate range of NIHSS scale while 8(32%) patients were in moderate to severe NIHSS range . Finally among the 42 study subject having Uric acid level >10mg/dl 27(64.3%) were in moderate to severe range of NIHSS scale while 15(35.7%) patients were in severe NIHSS range.

When we saw correlation between Uric acid level and NIHSS scale by Pearson correlation we found significant positive correlation($p<0.001$) which shows as Uric acid levels increases severity of stroke increases or we can say severity of stroke increases with higher levels of Uric acid.

Similarly when we correlate these Uric acid groups with mRS score we found out of 54 patients who had Uric acid levels < 6 mg/dl 12(22.2%) patients recovered fully and had mRS score 0, 35(64.8%) patients had some symptoms with mRS score 1 while 7(13%) patients had mild disability with mRS score 2. Out of 29 patients who had Uric acid level between 6-8 mg/dl 10(34.5%) patients had few symptoms with mRS score 1 while 19(65.5%) patients had mild disability with mRS 2.Out of 25 patients who had Uric acid level 8.1-10 mg/dl , 2(8%), patients had mild disability with mRS score 2, 10(40%) patients had moderate disability with mRS score 3, 13(52%) patients had moderate to severe disability with mRS score 4. Out of 42 patients who had Uric acid level >10 mg/dl 19(45.2%) patients had moderate to severe disability with mRS score 4, 17(40.5%) patients had severe disability with mRS score 5 while 6(14.3%) patients died within 28 days of stroke with mRS score 6. Correlation analysis between serum Uric acid level and mRS shows that mRS is significantly positively correlated with Uric acid with r score 0.966 and p value <0.001. It shows poor outcome or poor recovery with increased levels of Uric acid.

Similar results found by **Yifan Yang et al** [16] in 2024 in their study indicates a significant difference ($P < 0.05$) in SUA levels between young patients with moderate-to-severe stroke and those with mild stroke. This suggests a potential influence of elevated SUA levels on neurological disabilities in patients with stroke, possibly linked to SUA-induced oxidative stress. Multivariate logistic regression analysis recognized SUA levels as an independent risk factor for stroke severity, emphasizing their significant impact on stroke in young individuals. The study hypothesizes that SUA levels heighten the risk of severe stroke in individuals already predisposed to a high risk of stroke. This suggests that SUA levels could serve as a potential free risk factor for the progression of serious stroke, highlighting the need for further exploration into this relationship. The investigation, centered on the relationship between SUA levels and stroke severity, establishes a significant link among young individuals residing in highland areas.

Meta-studies by Kim et al. in 2009 and **Li et al.**[17] in 2013 supported the direct link between elevated SUA levels and stroke. Similar findings showed by **Nieto FJ et al** [18] in 2000 from a meta-analysis of 16 prospective studies, including 238,449 adults and adjusting for multivariate risk factors, suggested that hyperuricemia was associated with a significantly increased risk of stroke incidence and mortality (+47% and +26%, respectively). Contrast results shows in the study conducted by **Kuniyuki Nakamura et al**[19] in 2023 found that ischemic stroke patients who experienced decreases in serum UA levels during the acute phase had unfavorable functional outcomes at 3 months even after adjusting for confounding factors such as comorbidities, BMI, kidney function, stroke subtype, neurological severity, and UA level on admission. Furthermore they found decreases in UA levels were also associated with poor neurological improvement and neurological deterioration during hospitalization.

Mechanism which supports our results is that extensive research has demonstrated that SUA functions as a mediator between oxidative pressure and endothelial function. Sudden changes in the SUA levels may disrupt the physiological components of vital tissues, leading to apoplexy, worsening of hypertension, and eventually resulting in ischemic cerebrovascular disease. Moreover, a significant increase in uric acid may indicate increased xanthine oxidase activity, which is known to produce superoxide and play a crucial role in pathogenesis. Expanded xanthine oxidase activity, a substantial source of reactive oxygen species, has been suggested to contribute significantly to organ damage in animal models of hypertension.

Other mechanism in support is elevated SUA levels have been correlated with increased levels of systemic inflammatory mediators, vascular smooth muscle proliferation, and heightened platelet adhesion, all contributing factors to thrombosis. Consequently, hyperuricemia may play a pathogenic role not only in the occurrence of ischemic stroke but also in the development of vascular stiffness, atherosclerosis, and hypertension.Moreover, SUA impedes the activation of nitric oxide synthase and nitric oxide production by insulin and vascular

endothelial growth factor, leading to increased levels of reactive oxygen species and eventual harm to the vascular endothelium. Nevertheless, these factors may be associated with endothelial dysfunction, heightened levels of circulating systemic inflammatory mediators, thrombosis, and an escalation in oxidative stress.[20]

CONCLUSION:-

In ischemic stroke HbA1c and uric acid levels are well established predictors of severity on a long run . In this study we studied the association of Hba1c and Uric acid with the severity of acute ischemic stroke using National Institute of Health Stroke Scale(NIHSS) and prediction of outcome based on Modified Rankin Scale (mRS) scoring system after 28 days from day of admission. It was found that the HbA1c and Uric acid level are all positively significantly correlated to both NIHSS and mRS indicating that severity and outcome at 28 days may be well predicted with increase serum level of these parameters. Though difference in timing of collection of sample may have caused the difference in the finding of serum HbA1c and in other studies. But a definite indication has been provided by our study. So a proactive measure can be taken as soon as their level increases, to reduce the severity and improve outcome of acute ischemic stroke. Though further studies may be required with larger study sample size to further generate evidence to confirm our findings.

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