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Original Research Article

Metabolic Syndrome and Outcomes in Acute Ischemic Stroke: A Study Using the Modified Rankin Scale

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ABSTRACT:

Background and objective:

Several pieces of data imply that metabolic syndrome (Met S) increases the risk of stroke. The modified Rankin scale (MRS), a clinician-reported evaluation of global impairment, is frequently used to assess the outcomes of patients with acute ischemic stroke. Patients with Met S and AIS were examined using modified Rankin Scale scores to determine their prognosis.

Methods:

The study involved fifty patients hospitalised at the D Y Patil Medical College Kolhapur between October 2020 and August 2022 with acute ischemic stroke symptoms. Initial symptomatic atherothrombotic ischemic stroke was detected using the diagnostic criteria of the Trial of Org 10172 in Acute Stroke Treatment (TOAST). They were utilising the NCEP ATP III criteria for metabolic syndrome evaluation. Mortality at three months was the primary outcome. (a Rankin modified score of 4-6) At three months, secondary outcomes included recovery, disability, and death.

Results:

Fifty individuals were hospitalised for the trial. In the present study, 62 per cent (31 out of 50) of ischemic stroke patients were found to have metabolic syndrome. Compared to patients without metabolic syndrome, 67.74% of those diagnosed had an MRS score of more than 3. In contrast, only 31.58% of those without metabolic syndrome had an MRS value larger than 3. Compared to persons who did not have metabolic syndrome, those who did were more likely to die (19%) and be handicapped (71%) than those who did not have metabolic syndrome (47% and 16%). The incidence of discharge was significantly higher among individuals without metabolic syndrome (37%) compared to those with metabolic syndrome (10%).

Conclusion:

According to the results of our research, Met S was shown to be associated with a bad outcome in individuals diagnosed with acute ischemia. The development of efficient prophylactic interventions against metabolic syndrome and its separate components is required to bring the risk of future strokes down to a more manageable level.

Key Words: Modified Rankin Scale, Metabolic Syndrome, Stroke, Prognosis, Disability, Recovery, Mortality

1. INTRODUCTION

The National Cholesterol Education Program Adult Treatment Panel III (NCEP/ATP III) defines metabolic syndrome (Met S) as the presence of three or more of the following five components [1]: central obesity; elevated triglycerides; diminished high-density lipoprotein (HDL) cholesterol; high blood pressure (BP); and elevated fasting glucose. Met S refers to a collection of risk factors that can result in cardiovascular disease. Met S is a significant risk factor for cardiovascular events and strokes [2], giving it a double-whammy of health risks. Stroke is the most common neurological emergency and the second leading cause of death and acquired disability among adults [3,4]. Recent research indicates that the risk of stroke has increased by 100 per cent in low- and middle-income countries over the past decade and that 85 per cent of all stroke-related deaths worldwide occur in the developing world [5]. Stroke is estimated to be responsible for the loss of 6,36 million DALYs in South East Asia, with India accounting for 81% of the region's population. The metabolic syndrome is a collection of risk factors that, when present in combination, enhance the probability of developing atherosclerotic vascular disease. These risk factors include atherogenic dyslipidemia, hypertension, insulin resistance, and obesity. Men and women with diabetes and metabolic syndrome have a higher risk of suffering an ischemic stroke [6]. The modified Rankin Scale also referred to as the MRS, is a measure of global disability that is reported by physicians and has been widely used to assess recovery after stroke [7,8]. And as the key outcome measure in randomised clinical trials (RCTs) of newly discovered therapeutics for acute stroke [9].

Historical Development

With the publication of the first Rankin Scale in 1957, the MRS's history began. Dr John Rankin invented the Rankin Scale (RS) in Glasgow, Scotland. It comprises five stroke severity categories ranging from "no significant impairment" to "severe disability." The MRS was introduced in 1988 and contained six categories (ranging from grades 0 to 5), while the RS has just five.

GRADE	ORIGINAL RS (7)	MODIFIED RS (8)
0	NA	No symptoms at all
1	No significant disability: able to carry out all usual duties	No significant disability: despite symptoms, able to carry out all usual duties and activities
2	Slight disability: unable to carry out some of previous activities but able to look after own affairs without assistance	Slight disability: unable to perform all previous activities but able to look after own affairs without assistance
3	Moderate disability: requiring some help but able to walk without assistance	Moderate disability: requiring some help but able to walk without assistance
4	Moderately severe disability: unable to walk without assistance, and unable to attend to own bodily needs without assistance	Moderately severe disability: unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability: bedridden, incontinent and requiring constant nursing care and attention	Severe disability: bedridden, incontinent and requiring constant nursing care and attention
6	NA	Death*
NA indicates not applicable,		

2. MATERIAL AND METHODS

We conducted a Longitudinal Prospective Observational study on fifty patients admitted to the Department of General Medicine at the DY Patil Medical College in Kolhapur, with clinical findings suggesting an acute ischaemic stroke between October 2020 and August 2022. The patients all had symptoms that were consistent with an acute ischaemic stroke. Patients brought to the Medicine ward after suffering a first-ever ischemic atherothrombotic stroke that lasted fewer than twenty-four hours were considered for involvement in the study. In addition, patients needed to be willing to come back for a follow-up appointment after three months had passed. Patients were not permitted to participate in the trial if they were less than 16 years old or had a history of experiencing an intracranial haemorrhage. Patients with a preexisting condition known to be a cause of embolus, such as atrial fibrillation (AF), moderate to severe valvular heart disease, a history of a prior stroke, or a severe cardiorenal or nutritional illness. Patients who have a preexisting condition that is known to be a cause of embolus. Our institution's institutional review board has approved this study; thus, we may move forward. The criteria defined by the Revised NCEP/ATP III [10] ultimately led to the term "metabolic syndrome."

The diagnostic criteria from the Trial of Org 10172 in Acute Stroke Treatment (TOAST) [11] were used to conclude that the patient had had the first ever symptomatic atherothrombotic ischemic stroke. Every patient was questioned about their gender, age, smoking history and smoking behaviours, weight, height, and whether or not there was a history of heart disease or stroke in their family. At the time of admission and again after three months, we will gather data from a full neurological assessment in addition to a physical examination. The Modified Rankin Scale was used to maintain a record of the results obtained after the three months (recovery, death, or impairment).

Statistical Analysis

Student's t-test was used to compare the mean values of continuous variables.

The categorical variables and other components of metabolic syndrome were compared using the chi-square test. Anthem ratios (OR) and 95% confidence intervals were calculated whenever appropriate. A p-value of less than 0.005 was regarded as statistically significant. Using the SPSS programme, data were input and analysed.

3. RESULTS AND OBSERVATIONS

Table 1: Prevalence of Metabolic Syndrome

Metabolic Syndrome	Frequency	Percentage
Yes	31	62
No	19	38
Total	50	100

This research revealed that most1 ischemic stroke patients (62%) also had metabolic syndrome (Met S). Specifically, 31 (62%) of 50 ischemic stroke patients were revealed to

have Met S, whereas 19 (38%) did not. The incidence and proportion of patients with Met S are shown in Table 1, which summarises these findings.

Table 2: Comparison of Co-morbidities and Body Mass Index between AIS patients with and without Met S

Comorbidities	Met S 0=31)		Non-Met S (n=19)		Total	p-value
	Frequency	Percent	Frequency	Percent		
Diabetes Mellitus	13	41.9	6	20.7	19 (38%)	0.464
Hypertension	19	61.3	8	27.6	27 (54%)	0.186
BMI $\geq 25 Kg/m^2$	19	61.3	5	26.3	24 (48%)	0.035

Diabetes Mellitus (41.9%) and Hypertension (61.3%) were more common in Metabolic Syndrome as compared to non-Metabolic Syndrome (20.7% and 27.6%, respectively) but the difference between the groups was not significant for none of the co-morbidities (all p-value>0.05).

BMI >25Kg/m^2 was seen in 19 (61.3%) patients with Metabolic Syndrome but in only 5 (26.3%) non-Met S patients. The difference was statistically significant (p-value 0.035).

Table 3: Comparison of Biochemical parameters between AIS patients with and without Met S

Laboratory Parameters	Met S		Non-Met S		P value
	Mean	Std. Deviation	Mean	Std. Deviation	
Haemoglobin	13.44	2.12	12.92	2.09	0.396
Serum Urea	30.41	14.29	37.43	32.02	0.293
Serum Creatinine	1.08	0.40	1.26	0.80	0.294
Fasting BSL	141.26	42.20	108.13	40.94	0.009

Fasting Triglyceride	168.37	52.55	113.08	24.10	0.000
Fasting	34.90	4.89	51.09	11.16	0.000

The results from Table 3 show that mean fasting blood sugar levels and fasting triglyceride levels were significantly higher in patients with metabolic syndrome (Met S) compared to those without Met S (p-value <0.05). Specifically, fasting blood sugar levels were 141.26±42.20 mg/dL in patients with Met S, and 108.13±40.94 mg/dL in patients without Met S. Fasting triglyceride levels were 168.37±52.55 mg/dL in patients with Met S and 113.08±24.10 mg/dL in patients without Met S. Additionally, mean fasting HDL levels were significantly lower in patients with Met S compared to those without Met S (p-value <0.05). The mean fasting HDL level was 34.90±4.89 mg/dL in patients with Met S and 51.09±11.16 mg/dL in patients without Met S. Other laboratory parameters, such as haemoglobin, serum urea, and serum creatinine, were similar between the two groups and showed no significant difference (p-value >0.05).

Table 4: Comparison of Mean Waist Circumference of the AIS patients with and without Met S

Met S		**Non-Met S**		**P value**
Mean	Std. Deviation	Mean	Std. Deviation	
40.65	3.72	37.95	2.76	<0.001

The results from Table 4 show that mean waist circumference was significantly higher in patients with metabolic syndrome (Met S) compared to those without Met S (p-value <0.001). Specifically, the mean waist circumference was 40.65±3.72 cm in patients with Met S and 37.95±2.76 cm in patients without Met S. This suggests that patients with Met S have a larger waist circumference on average compared to those without Met S. Waist circumference is an important measure of abdominal obesity and is closely related to the risk of developing metabolic disorders such as diabetes and cardiovascular disease. Therefore, these findings indicate that patients with Met S may have a higher risk of developing these conditions due to their larger waist circumference.

Table 5: Classification of AIS patients as per Modified Rankin Scale

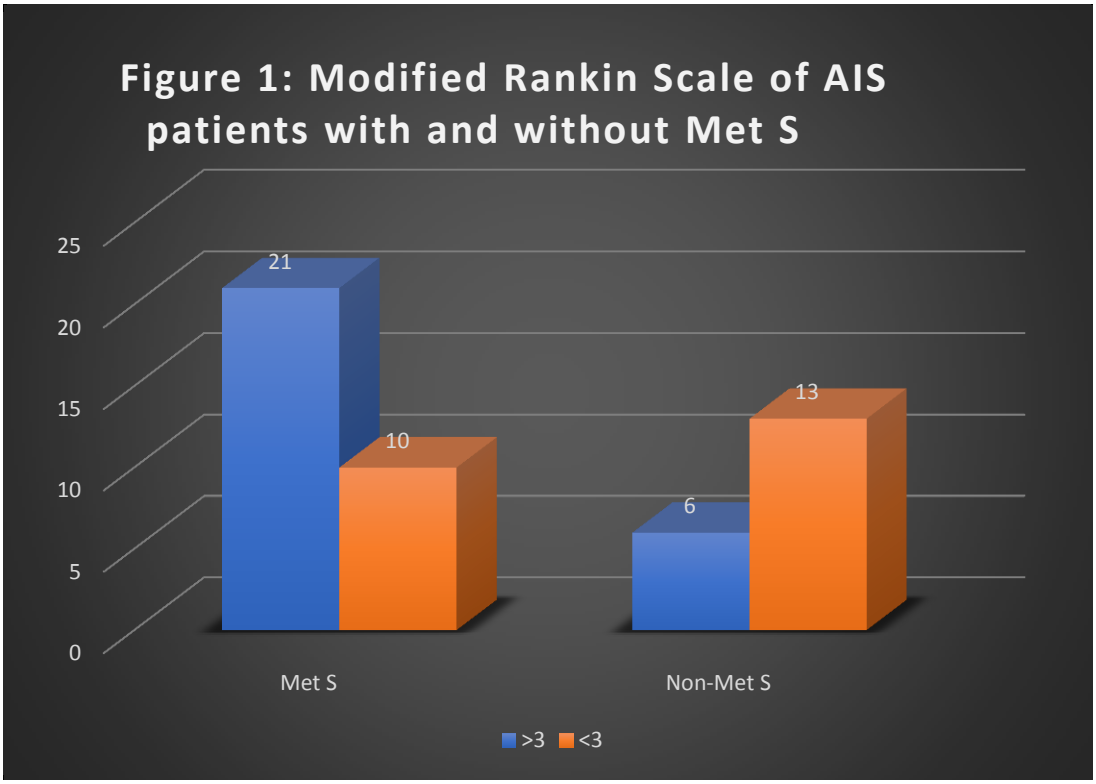
Modified Rankin Scale	**Frequency**	**Percent**
0	8	16
1	2	4

2	8	16
3	5	10
4	11	22
5	7	14
6	9	18
Total	50	100

In the present study, most patients (22%) had a Modified Rankin Scale (MRS) score of 4, indicating a moderate disability. The second highest frequency (18%) was found in patients with a score of 6, indicating severe disability. Additionally, 16% of patients scored 0 (no symptoms), and 16% scored 2 (minor disability). The remaining frequencies were distributed among scores of 1 (4%), 3 (10%), 5 (14%), and 6 (9%). The total sample size of this study was 50 patients.

Table 6: Modified Rankin Scale of AIS patients with and without Met S

Modified Rankin Scale	**Group**		**Total**	**Chi-Square& p-value**
	Met S	Non-Met S		
>3	21(67.74%)	6(31.58%)	27(54%)	6.202 0.013
<3	10(32.26%)	13(68.42%)	23(46%)	
Total	31(100%)	19(100%)	50(100%)	



In the present study, the Modified Rankin Scale (MRS) scores were analysed about the presence of metabolic syndrome (Met S) in patients with acute ischemic stroke (AIS). The results indicate a significant difference in MRS scores between patients with and without Met S (p-value = 0.013). Specifically, 67.74% of patients with Met S had an MRS score greater than 3, indicating a moderate to severe degree of disability, compared to only 31.58% of patients without Met S. Conversely, 32.26% of patients with Met S had an MRS score less than 3, indicating a mild degree of disability, compared to 68.42% of patients without Met S. The total sample size of this study was 50 patients, with 31 (62%) having Met S and 19 (38%) not having Met S.

Table 7: Association between Modified Rankin Scale and Fasting Blood Sugar Levels in AIS patients

Modified Rankin Scale	Blood Sugar Level		Total	P value
	High	Normal		
0	3(9.09%)	5(29.41%)	8(16%)	
1	0(0%)	2(11.76%)	2(4%)	
2	3(9.09%)	5(29.41%)	8(16%)	
3	4(12.12%)	1(5.88%)	5(10%)	

4	9(27.27%)	2(11.76%)	11 (22%)	0.017
5	7(21.21%)	0(0%)	7(14%)	
6	7(21.21%)	2(11.76%)	9(18%)	
Total	33(100%)	17(100%)	50(100%)	

In Table 7, the association between Modified Rankin Scale (MRS) scores and fasting blood sugar levels (BSL) was analysed in patients with acute ischemic stroke (AIS). The results indicate a significant association between high BSL and high MRS scores (p-value = 0.017). Specifically, 9.09% of patients with normal BSL had an MRS score of 0 (no symptoms), and 29.41% had an MRS score of 2 (minor disability), compared to 21.21% of patients with high BSL who had an MRS score of 5 (moderate disability) and 21.21% who had an MRS score of 6 (severe disability). Additionally, 27.27% of patients with high BSL had an MRS score of 4 (moderate disability), compared to 11.76% of patients with normal BSL. The total sample size of this study was 50 patients, with 33 (66%) having high BSL and 17 (34%) having normal BSL.

Table 8: Association between Modified Rankin Scale and Fasting Triglycerides Levels in AIS patients

Modified Rankin Scale	**Fasting Triglycerides Level**		**Total**	**P value**
	High	Normal		
0	2(8.33%)	6(23.08%)	8(16%)	0.055
1	0(0%)	2(7.69%)	2(4%)	
2	1(4.17%)	7(26.92%)	8(16%)	
3	3(12.5%)	2(7.69%)	5(10%)	
4	8(33.33%)	3(11.54%)	11(22%)	
5	5(20.83%)	2(7.69%)	7(14%)	
6	5(20.83%)	4(15.38%)	9(18%)	
Total	24(100%)	26(100%)	50(100%)	

In the present study, the association between Modified Rankin Scale (MRS) scores and fasting triglyceride levels (TGs) was analysed in patients with acute ischemic stroke (AIS). The results indicate a trend towards an association between high TGs and high MRS scores, but the association did not reach statistical significance (p-value = 0.055). Specifically, 8.33% of patients with normal TGs had an MRS score of 0 (no symptoms), and 23.08% had an MRS score of 2 (minor disability), compared to 20.83% of patients with high TGs who had an MRS score of 5 (moderate disability) and 20.83% who had an MRS score of 6 (severe disability). Additionally, 33.33% of patients with high TGs had an MRS score of 4 (moderate disability), compared to 11.54% of patients with normal TGs. The total sample size of this study was 50 patients, with 24 (48%) having high TGs and 26 (52%) having normal TGs.

Table 9: Association between Modified Rankin Scale and Fasting HDL Levels in AIS patients

Modified Rankin Scale	Fasting HDL Level		Total	P value
	Low	Normal		
0	5(15.15%)	3(17.65%)	8(16%)	0.018
1	1 (3.03%)	1(5.88%)	2(4%)	
2	1 (3.03%)	7(17.65%)	8(16%)	
3	4(12.12%)	1(5.88%)	5(10%)	
4	8(24.24%)	3(17.65%)	11(22%)	
5	7(21.21%)	0(0%)	7(14%)	
6	7(21.21%)	2(11.74%)	9(18%)	
Total	33(100%)	17(100%)	50(100%)	

The association between fasting HDL levels and the Modified Rankin Scale (MRS) in 50 acute ischemic stroke (AIS) patients(Table 9). The results showed that the majority of AIS patients with low fasting HDL levels had higher MRS scores (24% had a score of 4 and 21% had a score of 5) compared to those with normal fasting HDL levels (17.65% had a score of 0 and 4, respectively). Furthermore, the data revealed that low fasting HDL levels were significantly associated with high MRS scores (p-value of 0.018).

Table 10: Association between Modified Rankin Scale and Waist Circumference in AIS patients

Modified Rankin Scale	Waist Circumference		Total	P value
	High	Normal		
0	5(19.23%)	3(12.5%)	8(16%)	0.311
1	0(0%)	2(8.33%)	2(4%)	
2	3(11.54%)	5(20.83%)	8(16%)	
3	4(15.38%)	1(4.17%)	5(10%)	
4	6(23.08%)	5(20.83%)	11(22%)	
5	2(7.69%)	5(20.83%)	7(14%)	
6	6(23.08%)	3(12.5%)	9(18%)	
Total	26(100%)	24(100%)	50(100%)	

The study investigated the association between waist circumference (WC) and the Modified Rankin Scale (MRS) in 50 acute ischemic stroke (AIS) patients. The results(Table 10) showed that the majority of AIS patients with high WC had higher MRS scores (23% had a score of 4 and 6) compared to those with normal WC (20.83% had a score of 2 and 4). However, the data revealed that the association between WC and MRS score was not statistically significant (p-value of 0.311).

Table 11: Association between Modified Rankin Scale and Blood Pressure in AIS patients

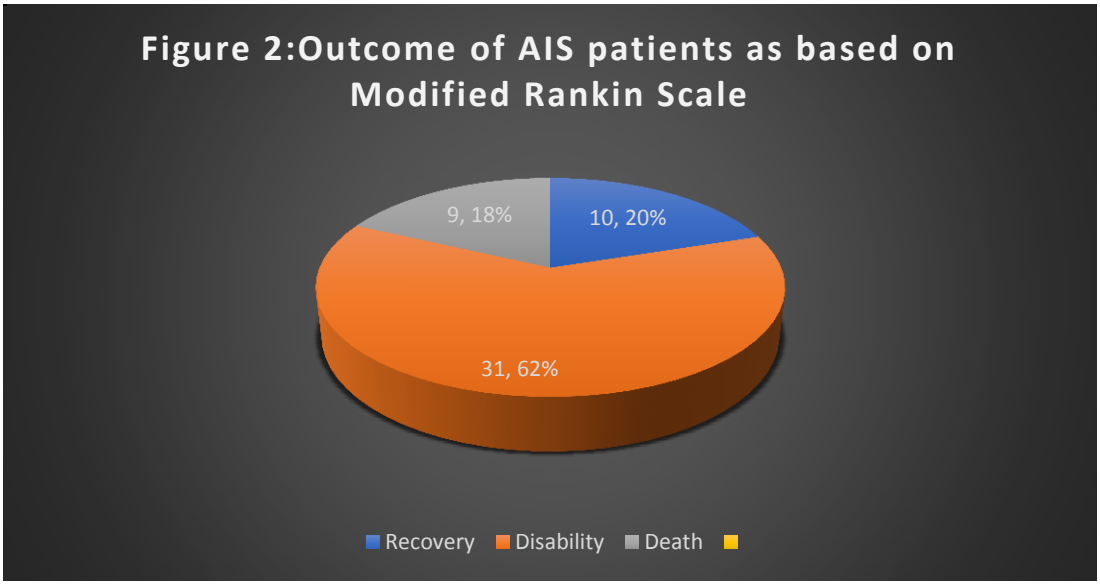
Modified Rankin Scale	Blood Pressure		Total	P value
	High	Normal		
0	5(13.89%)	3(21.43%)	8(16%)	

1	1(2.78%)	1 (7.14%)	2(4%)	0.564
2	4(11.11%)	4(28.57%)	8(16%)	
3	4(11.11%)	1(7.14%)	5(10%)	
4	8(22.22%)	3(21.43%)	11(22%)	
5	6(16.67%)	1(7.14%)	7(14%)	
6	8(22.22%)	1(7.14%)	9(18%)	
Total	36(100%)	14(100%)	50(100%)	

The association between blood pressure and the Modified Rankin Scale (MRS) in 50 acute ischemic stroke (AIS) patients. The results showed that AIS patients with high blood pressure were more likely to have higher MRS scores, with a larger proportion of patients in scores 4 and 6 (22.22% each) than those with normal blood pressure. However, the data revealed that the association between blood pressure and MRS score was not statistically significant (p-value of 0.564)

Table 21: Outcome of AIS patients as based on the Modified Rankin Scale

Outcome	Frequency	Percent
Recovery	10	20
Disability	31	62
Death	9	18
Total	50	100



The study evaluated the outcomes of 50 acute ischemic stroke (AIS) patients using the Modified Rankin Scale (MRS). The results showed that 20% of patients (10 out of 50) achieved recovery, while 62% (31 out of 50) had some disability. Additionally, 18% (9 out of 50) of patients died. The total number of patients included in the study is 50, and the outcomes add up to 100%.

4. DISCUSSION

Metabolic syndrome has been recognised as a risk factor for cardiovascular diseases such as coronary arterial disease and stroke. This research aimed to investigate the association between metabolic syndrome's components and acute stroke's short-term prognosis. To do this, we analysed neurological parameters that determine the presence of the metabolic syndrome and characterise the clinical profile of acute ischemic stroke. After the patient, a comprehensive neurology examination and disability evaluation using the modified Rankin scale was performed. To evaluate the patient's prognosis, neurological improvement, impairment, and mortality were related to metabolic syndrome. This hospital-based investigation revealed a significant positive association between metabolic syndrome and acute ischemic stroke. In the present study, metabolic syndrome (Met S) was restricted to 31 (62%) of 50 ischemic stroke patients [Table 1]. The prevalence of Metabolic Syndrome in Chinese studies on acute ischemic stroke [12] was 51.4% and 57.29%, respectively. In studies by Milionis HJ et al. and others [13], Metabolic Syndrome accounted for 46% of cases. In the research conducted by Shrestha et al. [14] and E.I. Sorkhou et al. [15], the prevalence was 32% and 34%, respectively. Most co-morbidities linked with Met S patients and Non-Met S individuals with AIS were also examined. We discovered that 41.9% of AIS patients with Met S developed Type 2 Diabetes Mellitus, compared to just 20.7% of those without Met S. Upon comparison of the hypertensive profile, 61.3% of AIS patients with Met S and 27.6% of those without Met S were hypertensive. 61.3 per cent of AIS patients with Met S had a BMI of more than 25kg/m2. The prevalence of comorbidities is greater in the Met S group of AIS patients than in the Non-Met S group [Table 2].

Those with Metabolic Syndrome exhibited significantly higher mean fasting glucose and fasting triglyceride levels than patients without Metabolic Syndrome (p0.05).

(p 0.05) Patients with Metabolic Syndrome exhibited substantially lower mean fasting HDL values than those without Metabolic Syndrome. The mean waist circumference of Metabolic

Syndrome patients was significantly greater than that of non-Metabolic Syndrome patients (p 0.001) [Table 3 & 4]. Consequently, abdominal fat leads to dyslipidemia, hyperglycemia, and hypertension. Recent research reveals an association between obesity, insulin resistance, and inflammation [16]. Moreover, inflammatory marker increases are related to metabolic risk factors and the acceleration of atherosclerotic illnesses. In the general population, hypertension is the most prevalent modifiable risk factor for stroke. The hypertension component of the metabolic syndrome demonstrated the greatest and most consistent connection with acute stroke in our investigation. The origins of hypertension are multifaceted. In insulin resistance, insulin loses its typical physiological vasodilatory effect. However, salt reabsorption in the kidneys continues to have a stimulatory impact on the sympathetic nervous system. Hypertension increases the atherosclerotic process in the carotid and vertebral arteries, which often begins in the bigger extracerebral arteries, namely the carotid bifurcation [17]. With time, this process expands distally to the smaller intracerebral arteries, resulting in greater vascular resistance and hypertension during exercise and an increased risk of cardiovascular events. As a component of metabolic syndrome, hypertension was related to an elevated risk of acute ischemic and hemorrhagic stroke.

Dyslipidemia is a defining characteristic of metabolic Syndrome. It has elevated TG levels and low HDL-C levels. Hypertriglyceridemia decreases the cholesteryl ester content of the lipoprotein core, resulting in a decrease in HDL-C. There is usually a preponderance of small dense LDL-C when fasting TG is more than 180 mg/dl, increasing atherogenic risk in individuals with metabolic syndromes [18]. The relationships between serum TG levels and stroke are controversial [19]. It has been demonstrated that postprandial hypertriglyceridemia is related to carotid artery atherosclerosis. Independent of age and sex, the Copenhagen City Heart Study discovered a log-linear relationship between serum TG levels and non-hemorrhagic stroke. Regardless of age and gender [20].

In most research, an inverse connection between HDL-C and the risk of stroke has been shown. In the Northern Manhattan Stroke Study [21], increasing HDL-C levels were related to a decreased risk of ischemic stroke among the elderly and various racial or ethnic groups. In addition, our research demonstrated that a low HDL-C level was significantly associated with acute stroke. Consistent with the investigation by Md. Jabed Iqbal et al. (54%) from Bangladesh[22] and the study by Bernadette Boden-Albala et al. [23] (also known as the NOMAS study). Metabolic syndrome is a risk factor for stroke with a metabolic aetiology. Compared to patients without Metabolic Syndrome, the majority of Metabolic Syndrome patients (67.74%) had MRS scores greater than 3 (31.58%).

Metabolic Syndrome was significantly linked with increased NIRS (p-value 0.013). Similarly, the mean MRS score of patients with Metabolic Syndrome was substantially greater (3.90 1.78) than that of patients without Metabolic Syndrome (2.37 2.11; p 0.008). A cohort study of 1131 males by Kurl S et al. [24] revealed that patients with metabolic syndrome had a 2.05-fold risk for all strokes and a 2.41-fold risk for ischemic stroke. In a cross-sectional study with 9 669 Greek individuals done by V. Athyros et al. and others, the prevalence of CVD in patients with metabolic syndrome was compared[25]. Regardless of the criterion chosen, the data indicate that CVD's prevalence increased with metabolic syndrome. Cerebrovascular atherosclerosis, namely occlusive diseases of the major arteries, would be hastened by central obesity and dyslipidemia (increased TG, decreased HDL-C, and increased LDL-C)[26]. The major risk factor for all stroke subtypes is hypertension [27]. Compared to individuals without Metabolic Syndrome (47%), most stroke patients (71%) experienced disability. Compared to individuals without Metabolic Syndrome (16%), those with Metabolic Syndrome had a higher death rate (19%). Those without Metabolic Syndrome

had a higher rate of discharge (37%) than those with Metabolic Syndrome (10%). However, neither group's results were statistically significant (p-value 0.064).

5. CONCLUSION

ACCORDING TO ONE STUDY, Met S is a major predictor of poor functional outcomes following an ischemic stroke. The majority of patients with Metabolic Syndrome (67.74%) had a Modified Rankin Scale (MRS) score of greater than 3 compared to individuals without Metabolic Syndrome (31.58%). Higher MRS levels were related to Metabolic Syndrome (p = 0.013). Those with Metabolic Syndrome had significantly higher mean MRS scores (3.90±1.78) than patients without Metabolic Syndrome (2.37±2.11) (p = 0.008). After a three-month follow-up period, acute stroke patients accompanied by metabolic syndrome were related to increased morbidity. Therefore, it is necessary to create preventative measures to regulate Metabolic Syndrome and each component condition to prevent future strokes.

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