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ORIGINAL ARTICLE

Frequency of Metabolic Syndrome in Case with Ischemic Stroke

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ABSTRACT

Background: Ischemic stroke is a leading cause of mortality and long-term disability worldwide, with a complex interplay of genetic and environmental risk factors. Among these, modifiable risk factors such as smoking, hypertension, dyslipidaemia, and diabetes have been well-established. In addition, Metabolic Syndrome (MetS), a cluster of conditions including obesity, insulin resistance, hypertension, elevated triglycerides, and reduced HDL cholesterol, significantly heightens the risk of ischemic stroke.
Objective: This study aimed to assess the prevalence of Metabolic Syndrome in patients with ischemic stroke.
Study Design: A cross-sectional observational study.
Duration: 6-month period from May 16, 2019, to December 16, 2019.
Methods: The study was conducted at the Department of Medicine, Lady Reading Hospital, Peshawar, involving 120 CT-confirmed ischemic stroke patients. These patients were evaluated for the presence of Metabolic Syndrome using standard diagnostic criteria.
Results: The cohort had a mean age of 58.8 ± 9.8 years, with 64.2% being male. Metabolic Syndrome was identified in 55% of the study participants, highlighting its significant association with ischemic stroke.
Conclusion: Metabolic Syndrome is a prevalent and substantial risk factor for ischemic stroke. This underscores the importance of early detection and management of MetS, as well as the need for community-based research to further explore its role in stroke pathogenesis.
Keywords: Ischemic stroke, metabolic syndrome, obesity, hypertension, dyslipidaemia, smoking.

INTRODUCTION

Ischemic stroke is a multifactorial, heterogeneous neurological disorder characterized by the sudden onset of deficits due to cerebral infarction at specific vascular territories. It is the leading cause of adult disability and the second most common cause of mortality worldwide[1,2]. The incidence, prevalence, and outcomes of stroke vary globally, with a notably higher burden in Asian populations compared to Caucasians, largely due to the rising prevalence of modifiable risk factors such as hypertension, diabetes mellitus, dyslipidaemia, sedentary lifestyle, and poor dietary habits[3]. The occlusion of a major cerebral artery during ischemic stroke leads to a central ischemic core surrounded by a penumbra, where tissue is at risk but salvageable. Irreversible injury occurs within minutes in the core due to necrosis and apoptosis[4]. Non-neurological complications like infections, gastrointestinal bleeding, and thrombosis are frequent and worsen stroke outcomes[5]. Metabolic Syndrome (MetS)—a constellation of risk factors including abdominal obesity, insulin resistance, hypertension, hypertriglyceridemia, and low HDL cholesterol—is a well-established independent risk factor for both coronary artery disease and ischemic stroke[6]. The syndrome's prevalence varies with genetic, environmental, and lifestyle factors. Multiple international studies have reported varying frequencies of MetS among ischemic stroke patients. One study reported MetS in 62% of cases[7], another in 44%[8], and a recent population study found a 37.4% incidence[9]. However, limited data is available from local populations, warranting a focused study in this region. Given potential differences in genetic makeup, lifestyle, and dietary practices, this study aims to evaluate the frequency of MetS in ischemic stroke patients in a local hospital setting Ischemic strokes result from vascular occlusions due to thrombosis, embolism, or systemic hypoperfusion, reducing cerebral blood flow below the threshold needed to maintain neuronal viability[10]. Risk factors are classified as modifiable (hypertension, diabetes, dyslipidaemia, smoking, obesity) and non-modifiable (age, gender, ethnicity, genetics)[11]. Diabetes, particularly in younger populations, has shown a significantly higher stroke risk[12]. Clinical presentation includes focal neurological signs such as hemiparesis, hemisensory loss, dysarthria, aphasia, and visual field deficits[13]. Diagnosis relies on rapid neurological assessment and imaging—CT and MRI being the primary modalities. Diffusion-weighted MRI is especially sensitive in early detection[14]. Management of ischemic stroke focuses on timely reperfusion, mainly via thrombolytics like recombinant tissue plasminogen activator (rt-PA), ideally administered within 3 to 4.5 hours of symptom onset[15,16]. Antiplatelet therapy (e.g., aspirin), blood pressure control, glycaemic management, and secondary prevention strategies like statins and lifestyle interventions are key to improving outcomes[17]. MetS exacerbates stroke risk through shared pathophysiological mechanisms, including endothelial dysfunction, inflammation, and prothrombotic states[18]. Studies suggest MetS increases the severity and recurrence of ischemic events and worsens prognosis post-stroke[19].

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MATERIALS AND METHODS

Study Design: This was a cross-sectional survey conducted to assess the frequency of metabolic syndrome in patients presenting with ischemic stroke.
Study Setting: Department of Medicine, Lady Reading Hospital, Peshawar, Pakistan.
Study Duration: The study was conducted over a period of 6 months, from May 16, 2019 to December 16, 2019, following the approval of the research synopsis.
Sample Size: A total of 120 patients were enrolled. The sample size was calculated using a 95% confidence level, 9% margin of error, and an expected prevalence of metabolic syndrome of 37.4% in ischemic stroke patients.
Sampling Technique: Non-probability consecutive sampling was employed for patient selection.
Inclusion Criteria:

1. Both male and female patients.
2. Age between 41 and 80 years.
3. Presentation within 72 hours of symptom onset of ischemic stroke.

Exclusion Criteria:

1. History of previous stroke.
2. Use of statins within the past 3 months.
3. Severe cardiorenal or nutritional disorders influencing blood pressure, lipid, or glucose levels.
4. History of spinal surgery within the last one year.
5. Diagnosed cerebral carcinoma on CT brain.

Data Collection Procedure: Patients fulfilling the inclusion criteria were selected from the Emergency and Outpatient Departments.

Informed written consent was obtained from patients or their attendants, ensuring confidentiality and voluntary participation. Ethical approval was secured from the institutional review board.
Each patient underwent:
Laboratory Evaluation: Blood samples were analysed for lipid profile (Triglycerides, LDL, VLDL, HDL) and blood sugar levels at the hospital's central laboratory.

Waist circumference was measured at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest, with two readings averaged for accuracy.

Detailed history and demographic data were recorded, including age, gender, residence (urban/rural), education status, smoking status, and presence of metabolic syndrome.

All data were recorded using a structured proforma by the principal investigator.
Data Analysis: Data were analysed using IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp., Armonk, NY).
Descriptive Statistics: Frequencies and percentages were computed for categorical variables (age groups, gender, residence, education, smoking status, metabolic syndrome).

Mean and standard deviation were calculated for continuous variables (age in years, waist circumference, blood pressure, HbA1c).
Inferential Statistics: Stratification was performed for effect modifiers such as age group, gender, residence, education, and smoking.

Post-stratification, the Chi-square test was applied. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

In this cross-sectional study involving 120 patients with ischemic stroke, the mean age was 58.8 ± 9.8 years, ranging from 43 to 78.9 years. The majority of patients (38.3%) were aged between 61 and 70 years, followed by 27.5% between 40 and 50 years. Males comprised 64.2% of the sample, while females made up 35.8%. Most patients were from rural areas (55.8%) and 60.8% were literate. More than half of the participants (51.7%) reported a history of smoking. The frequency of metabolic syndrome among all patients was 55%. Stratified analysis revealed a statistically significant association between metabolic syndrome and age group (p = 0.037), with the highest prevalence (72.7%) in the 40–50-year age group. A strong and significant association was also observed with gender (p < 0.001), as 80.5% of males had metabolic syndrome compared to only 9.3% of females. Educational status showed a significant relationship (p < 0.001), with metabolic syndrome being more prevalent in literate individuals (71.2%) than in illiterate ones (29.8%). Smoking was also significantly associated with metabolic syndrome (p = 0.030), with higher prevalence among smokers (64.5%) compared to non-smokers (44.8%). No significant association was found between residence and metabolic syndrome (p = 0.671). These findings suggest that metabolic syndrome is common in ischemic stroke patients and is significantly influenced by factors such as age, gender, smoking status, and education level.

Table 1: Demographic Characteristics of Patients (n = 120)

Variable	Categories / Values	Frequency	Percent (%)
Age (years)	Mean ± SD	58.8 ± 9.8	-
	Range (min–max)	43 – 78.9	-
Age Groups	40–50 years	33	27.5
	>50–60 years	30	25.0
	>60–70 years	46	38.3
	>70–80 years	11	9.2
Gender	Male	77	64.2
	Female	43	35.8
Residence	Urban	53	44.2
	Rural	67	55.8
Education Status	Literate	73	60.8
	Illiterate	47	39.2
Smoking Status	Yes	62	51.7
	No	58	48.3

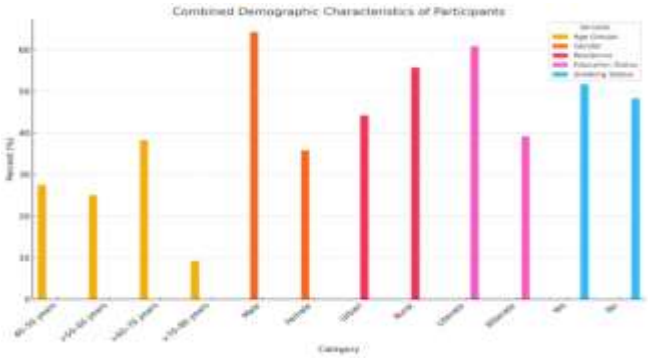


Table 2: Frequency of Metabolic Syndrome (n = 120)

Metabolic Syndrome Status	Frequency	Percent (%)
Yes	66	55.0
No	54	45.0

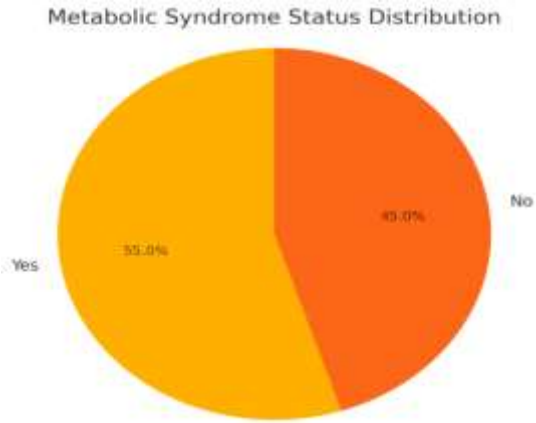
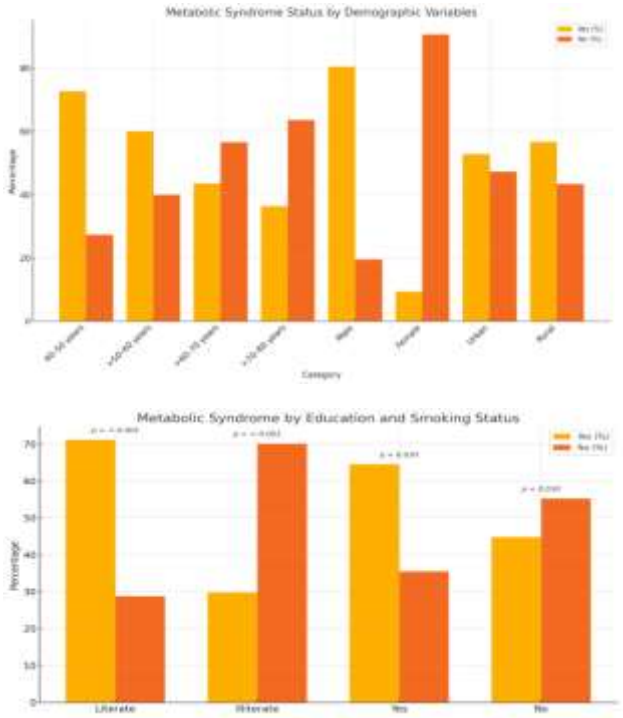


Table 3: Stratification of Metabolic Syndrome by Demographic Variables

Variable	Categories	Yes (N)	Yes (%)	No (N)	No (%)	P-Value
Age Group	40–50 years	24	72.7	9	27.3	0.037
	>50–60 years	18	60.0	12	40.0	
	>60–70 years	20	43.5	26	56.5	
	>70–80 years	4	36.4	7	63.6	
Gender	Male	62	80.5	15	19.5	< 0.001
	Female	4	9.3	39	90.7	
Residence	Urban	28	52.8	25	47.2	0.671
	Rural	38	56.7	29	43.3	

Table 4: Stratification of Metabolic Syndrome by Behavioural and Socioeconomic Factors

Variable	Categories	Yes (N)	Yes (%)	No (N)	No (%)	P-Value
Education Status	Literate	52	71.2	21	28.8	< 0.001
	Illiterate	14	29.8	33	70.2	
Smoking Status	Yes	40	64.5	22	35.5	0.030
	No	26	44.8	32	55.2	



DISCUSSION

Stroke is the leading neurological cause of hospitalization in many developing countries, including Pakistan. The World Health Organization defines stroke as the rapid onset of neurological deficits lasting more than 24 hours, due to vascular causes, confirmed via neuroimaging such as CT scan, and excluding non-vascular etiologist[20]. Stroke can be classified as transient, evolving, or complete, with ischemic strokes constituting nearly two-thirds of all strokes globally and over 70% of strokes in Pakistan[21]. Among ischemic strokes, thrombotic and embolic events are the primary subtypes. Several risk factors contribute to the development of ischemic stroke. These include fixed factors like age, sex, and ethnicity, and modifiable ones such as hypertension, diabetes, dyslipidaemia, obesity, and smoking. In Pakistan, hypertension accounts for approximately 65% of ischemic stroke cases, followed by diabetes (36.3%), dyslipidaemia (32.7%), and smoking (32%)[22]. Effective control of these modifiable factors through lifestyle changes and pharmacological interventions is essential in secondary stroke prevention[23,24]. Metabolic syndrome (MetS), which encompasses abdominal obesity, insulin resistance, dyslipidaemia, and hypertension, has been independently associated with a significantly higher risk of stroke across ethnicities and genders. A meta-analysis reported an odds ratio of 2.16 for stroke in individuals with MetS[25]. Its components are recognized as independent predictors for cardiovascular and cerebrovascular disease. Early identification and management of MetS, especially among young adults, may significantly reduce stroke burden.

In our study, 55% of ischemic stroke patients had metabolic syndrome, a frequency consistent with international findings, such as those by Koren and Morag et al., who reported a prevalence of 56%[26]. Jia et al. emphasized that although MetS is a strong predictor of stroke, hypertension alone may exert a stronger influence on stroke onset in older adults[27]. Hwang et al. in a Korean study further highlighted fasting blood sugar and MetS as leading predictors of cardiovascular disease[28]. Our study also revealed gender differences: metabolic syndrome was more prevalent in males, which aligns with existing literature. Studies have shown that men with MetS have higher mortality rates, even in the absence of baseline cardiovascular disease or diabetes[29]. Moreover, individuals with MetS are at a three-fold increased risk of developing stroke, coronary heart disease, and myocardial infarction[30]. The presence of intracranial atherosclerosis, more common among MetS patients, also increases stroke risk, as noted by Ovbiagele et al., where 50% of patients with symptomatic intracranial stenosis had metabolic syndrome[31]. Additionally, silent cerebral ischemic lesions are more prevalent in MetS patients, independent of other risk factors, suggesting that metabolic disturbances contribute to subclinical vascular injury[32]. Given the rising global and regional burden of MetS, especially in the elderly, it's critical to study and monitor its prevalence in different populations to guide targeted interventions[33]. Sex-based differences in MetS impact have also been reported. The Atherosclerosis Risk in Communities (ARIC) study and Framingham Heart Study indicated that women with multiple MetS components had a relative risk of 5.9 for coronary artery disease compared to 2.3 in men, indicating that MetS may be more deleterious in women[34]. Ethnic disparities further complicate this risk stratification. South Asians, including Pakistanis, have a greater tendency toward central obesity, often at lower BMI levels, and thus a higher risk of MetS and related complications, even with normal body weight[35]. summary, this study reaffirms the strong association between metabolic syndrome and ischemic stroke in the Pakistani population. The observed high prevalence of MetS among stroke patients underlines the urgent need for public health strategies focusing on early screening, lifestyle modification, and control of individual metabolic components to reduce stroke-related morbidity and mortality.

CONCLUSION

Stroke is still a calamity, and vitamin D could have played pivotal role in the pathogenesis of stroke. Since most of our population is already deficiency in 25hydroxyvitamin D, therefore, relationship between stroke and vitamin D deficiency cannot be studied at hospital settings. We recommend more analytical research projects not only at hospital level but also at community level to draw conclusions about the relationship between vitamin D status and occurrence of stroke.

Author Contributions:

- **Dr Hafiz Rahman**: Conceptualization, methodology, data collection, analysis, and writing the original draft.
- **Dr Kamran Ahmad**: writing, and review of the manuscript.
- **Dr Junaid Raqib**: statistical analysis,
- **Sultana Shaheen**: manuscript review.
- **Prof Dr Mohammad Imran Younus**: manuscript editing.

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