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Original Research Article

Frequency of Metabolic Syndrome in Patients With Ischemic Stroke

Naeem Khan[1], Shehzad[1], Muhammad Bilal[1], Abdul Hanan[1], Aamir Khan[2], Yasir[1]

[1]Qazi Hussain Ahmad Medical Complex MTI Nowshera, Pakistan
[2]General Medicine, Khyber Teaching Hospital Peshawar, Pakistan
**Corresponding author`s email address:* naemkhn7888@gmail.com

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Abstract: *Stroke is the second-leading cause of mortality globally and metabolic syndrome is considered a distinct risk factor for stroke.* ***Objective:*** *The aim this study was to determine the frequency of metabolic syndrome in patients with ischemic stroke.* ***Method:*** *The current cross-sectional study was conducted in Qazi Hussain Ahmad Medical Complex, Nowshera, over 6 months after taking approval from the CPSP and ethical board of the institute from 2nd July 2024 to 2nd January 2025. A total of 145 individuals of both gender and different age groups (30-70 years) diagnosed with ischemic stroke were included. Demographic features such as age, gender, occupation, BMI socio economic status, smoking history and residency were recorded. Individuals with ischemic stroke were examine for metabolic syndrome which were labeled positive based on the 3 criteria that are triglycerids level ≥ 150mg/dl, HDL level ≤ 40mg/dl in males and ≤ 50mg/ dl in females ,hypertension (blood pressure ≥ 130/85) and diabetes Fasting blood glucose ≥ 126mg/d. Data was analyzed through SPSS version 21.0. The Shapiro-Wilk test was used to determine the uniformity of the continuous data. Ages, height, weight, body mass index & the duration of acute ischemic stroke were calculated using mean, SD, or median (with IQR). Chi-square and Fisher exact tests were employed to assess the significance of study parameter proportions across courses. A p-value less than 0.05 was regarded as statistically significant.* ***Results:*** *A total of 145 individuals with ischemic heart disease were enrolled in this study out of which 102(70.3%) were male and 43(29.6%) were females. Metabolic syndrome was identified in 72(50%) individuals. Gender significantly correlates with metabolic syndrome (P < 0.05). The mean triglyceride level was 1151.36±17.8 mg/dL, HDL level was 45.6±5.9 mg/dL and fasting blood glucose level was 118.6 ± 38.4 mg/dL. The most common components were hypertension and low HDL, which were positive in 85 (58.6%), followed by diabetes & elevated triglycerides levels in 66 (45.5%) and 58 (40%).* ***Conclusion:*** *Our study concluded that metabolic syndrome is a major risk factor for ischemic stroke.*

Keywords: Frequency; Metabolic syndrome: ischemic stroke

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Introduction

There is emerging evidence that metabolic syndrome (MetS) is a significant risk factor in the development of atherosclerotic disorders. In April 2005, eight Japanese associations worked to develop diagnostic criteria for it (1). The World Health Organization defines a stroke as "rapidly developing signs and symptoms of focal or global disruption of brain activity, persisting more than a day or leading to death, with no obvious reason other than vascular origin (2). Stroke can induce a range of neurological symptoms and signs, depending on its severity, location, and etiology. Examples of neurological conditions include unconsciousness, hemiplegia, paraplegia, monoplegia, cerebral palsy, speech disturbances, and sensory impairments. The most prevalent condition is hemiplegia, which affects around 90% of individuals. A WHO research done in 12 countries found that stroke incidence rates fluctuated between 0.2 to 2.5 per 1000 people annually (2). Stroke is responsible for almost 2% of all hospital cases, 4 percent of medical cases, nearly 20% of neurological hospitalizations, according to data from major Indian urban university hospitals (2). Every year, roughly fifteen million new acute stroke episodes occur globally. Two-thirds of these individuals reside in poor and middle-income countries, including India. By 2050, these locations are expected to account for 80% of all stroke incidents. Stroke is the major cause of mortality and disability in underdeveloped nations, with an average age at presentation 15 years lower than in developed countries (3, 4). Metabolic syndrome gained significant attention in recent years, with over five classifications proposed by medical groups (5). Metabolic syndrome is prevalent in developed countries with rates ranging from 22 to 39%. India has a significantly higher incidence rate than other Asian countries (6, 7). Metabolic syndrome is responsible for 30% of ischemic strokes in females versus 4% in males, according to findings (8, 9). Metabolic syndrome increases the risk of acute ischemic stroke in the elderly, with considerable contributions from all components. In individuals with metabolic syndrome, good cholesterol called HDL loses its protective effect against ischemic stroke (5). The current study was carried out to find out the frequency of metabolic syndrome in patients with ischemic stroke.

Methodology

The current cross sectional study was conducted in Qazi Hussain Ahmad Medical Complex, Nowshera over a period of 6 months after taking approval from the CPSP and ethical board of the institute from 2nd July 2024 to 2nd January 2025. Consecutive non-probability sampling technique was used and sample size was determined through WHO calculator. A total of 145 individuals of both gender and different age groups (30-70 years) diagnosed with ischemic stroke were included while individuals with transient ischemic attacks, hemorrhagic stroke, and chronic liver and kidney diseases were excluded.
Individuals fulfilling the selection criteria were included .Written consent were taken from each participant and were briefed about the study aims. Demographic features such as age, gender, occupation, BMI socio economic status, history of smoking and residency were recorded. Individuals with ischemic stroke were examine for metabolic syndrome which were labeled positive based on the 3 criteria that are triglycerides level ≥ 150mg/dl, HDL level ≤ 40mg/dl in males and ≤ 50mg/ dl in females ,hypertension (blood pressure ≥ 130/85) and diabetes Fasting

blood glucose ≥ 126mg/d. the whole assessment was completed under the supervision of experienced consultant .

The data was analyzed through SPSS version 21.0 The Shapiro-Wilk test was used to determine the uniformity of the continuous data. Ages, height, weight, body mass index & the duration of acute ischemic stroke were calculated using mean, SD, or median (with IQR). Chi-square and Fisher exact tests were employed to assess the significance of study parameter proportions across courses. A p-value less than 0.05 was regarded as statistically significant. Data was presented in tables and figures.

Results

A total of 145 individuals with ischemic heart disease were enrolled in this study out of which 102(70.3%) were male and 43(29.6%) were females. History of smoking was found in 100(68.9%) and majority of the study participants were belong to low class family 110(75%). Out of the total participants, 70 (48.2%) lived in urban regions and 75 (51.7%) in rural areas. Demographic features of the study participants is presented in table 1. The Shapiro-Wilk test was used to analyze the distribution of continuous data, including age (P=0.389), height (P=0.0002), weight (P=0.0001), BMI (P=0.068), & the period of ischemic stroke (P=0.393) as presented in table 2. Metabolic syndrome was identified in 72(50%) individuals as shown in figure 1. Gender significantly correlates with metabolic syndrome (P < 0.05) as presented in Table 3. The mean triglyceride level was 1151.36±17.8 mg/dL, HDL level was 45.6±5.9 mg/dL and fasting blood glucose level was 118.6 ± 38.4 mg/dL. Table 4 displays the results for each component of the metabolic syndrome. The most common components were hypertension and low HDL, which were positive in 85 (58.6%), followed by diabetes & elevated triglycerides levels in 66 (45.5%) and 58 (40%), respectively as presented in table 4.

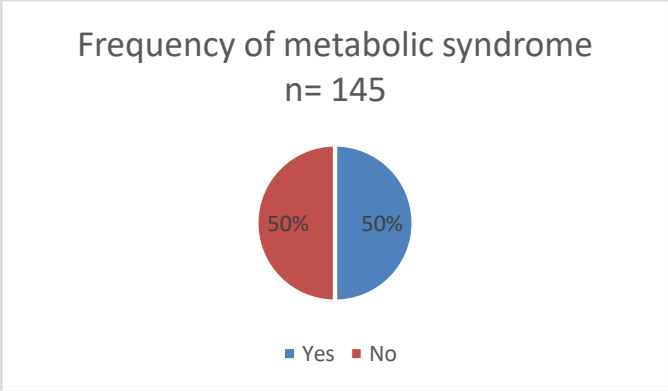

Figure 1 Frequency of metabolic syndrome

Table 1. The descriptive statistics data are shown as medians and IQRs. n=145

Variable	**Median (IQR)**
Age (years)	45 (30-70)
Height (cm)	169 (154-180)
Weight (Kg)	76 (54-100)
Body Mass index (Kg/m2)	25.83 (20.03-39.27)
Duration of Acute Ischemic Stroke (hours)	41.9 (25.0-74.0)
History of smoking	**Frequency /percentage**
Yes	100(68.9%)
No	45(31.0%)
Socio-economic status	
Low class	110(75%).
Intermediate	18(12.4%)
High class family	17(11.7%)
Residency	
Urban	70(48.2%)
Rural	75(51.7%)
Gender	
Male	102(70.3%)
Female	43(29.6%)

Table 2. Statistical analysis for the Shapiro-Wilk test

Variable	**Mean ± SD**	**P-Value**
Age in years	75.21±7.88	0.389[F]
Height	167.79±8.27	0.0002[C]
Weight	76.00±10.70	0.0001[C]
Body mass index	26.12±4.51	0.068[F]
Duration of acute ischemic stroke	41.41±9.93	0.393[F]
C= Chi-square test, F , Fisher's exact test		

Table 3 Gender wise distribution of metabolic syndrome

Gender	**Yes**	**No**	**Total**	**P value**
Male	44(43%)	58(57%)	102(70.3%)	<0.05
Female	28(65%)	15(45%)	43(29.6%)	
Total	72(50%)	73(50.34%)	145(100%)	

Table 4. Frequency of each factor of the metabolic syndrome

Factor	**Male**	**Female**	**Total**
Hypertension (Blood Pressure ≥ 130/85)	50	35	85(58.6%)
HDL Level ≤ 40mg/dl in males and ≤ 50mg/ dl in females	55	30	85(58.6%)
Triglycerides Level ≥ 150mg/dl	40	16	66(45.5%)
Diabetes Fasting blood glucose ≥ 126mg/dl	45	13	58(40%)

Discussion

Stroke is the second-leading cause of mortality globally, with potential to become the main cause in the future. Modifiable and unmodifiable risk factors for ischemic stroke include hypertension, diabetes, dyslipidemia, smoking, alcohol intake, age, and gender. Metabolic syndrome is considered a distinct risk factor for vascular disease and stroke (8). over the next 5-10 years, it increases the risk of type 2 diabetes and cardiovascular disease (9). The incidence of metabolic syndreme varies globally, from less than 10% to up to 84%, depending on geography, rural or urban environment, demographic makeup, and description of the disease (10). The "metabolic syndrome" refers to metabolic disorders that raise the risk of heart attack and stroke. Metabolic syndrome is characterized by obesity, hypertriglyceridemia, low HDL cholesterol, hyperglycemia, and hypertension, according to the NCEP/ATP III and IDF. Each of these causes can cause ischemic stroke. Our study found that metabolic syndrome occurred in 50% of ischemic stroke patients. Gorter et al. reported metabolic syndrome in 40-50% of patients with cerebrovascular disorders, which supports our statement (11). Koren-Morag et al. found metabolic syndrome in 56% of individuals with ischemic stroke (12). De Silva identified metabolic syndrome in 61 percent of South Asian patients suffering from ischemic stroke.[13] In the Framingham offspring research, metabolic syndrome was revealed to be a more significant risk factor for ischemic stroke than diabetes mellitus (14). In our study, metabolic syndrome was detected in 28 (65%) females and 44 (43%) males. The Northern Manhattan research, which included Hispanic, African-American, and Caucasian participants, found that women with metabolic syndrome have a higher risk of stroke compared to males (15). KorenMorag et al. found that metabolic syndrome without diabetes mellitus was an important risk factor for ischemic stroke in both genders, but more so in women (12). Female sex increases the risk of metabolic syndrome and ischemic stroke. In our study the most common components were hypertension and low HDL, which were positive in 85 (58.6%), followed by diabetes & elevated triglycerides levels in 66 (45.5%) and 58 (40%), respectively. The Copenhagen City Heart Study discovered that increasing HDL levels by 1.0 mmol/l (39 mg/dl) reduced the risk of ischemic stroke by 47% (16). High blood pressure is a significant component of metabolic syndrome in our patients 85(58.6%).McNeill et coworkers discovered that elevated blood pressure is a key component of metabolic syndrome, increasing the incidence of ischemic stroke by 1.5-2 times (17). Our study found a substantial link between impaired fasting glucose and stroke, with 58 (40%) patients having fasting blood sugar levels over 100 mg/dl. Basharat et al. found that hypertension (86.8%) was the leading risk factor for stroke, followed by diabetes (59.8%), dyslipidemia (59.1%), and smoking (18.1%). Low HDL levels are now recognized as a risk factor for ischemic stroke (18).

Conclusion

Our study concluded that metabolic syndrome is a major risk factor for ischemic stroke. Female individuals who suffered ischemic stroke were more likely to have metabolic syndrome than male individuals. In our study, metabolic syndrome was associated with higher rates of hypertension and low HDL values.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-MMNCS-0331d-24)

Consent for publication
Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

NK (TMO)
Manuscript drafting, Study Design,
S (TMO)
Review of Literature, Data entry, Data analysis, and drafting article.
MB (TMO)
Conception of Study, Development of Research Methodology Design,
AH (Associate Professor)
Study Design, manuscript review, critical input.
AK (TMO)
Manuscript drafting, Study Design,
Y (TMO)
Review of Literature, Data entry, Data analysis, and drafting article

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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