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# Gender-based Difference in Frequencies of Modifiable Risk Factors in Hospitalized Patients with Acute Stroke

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## ABSTRACT

***Objective:*** To compare the gender-based frequency of modifiable risk factors in patients presenting with acute stroke at a tertiary care hospital.

***Study Design:*** Analytical cross-sectional study.

***Place and Duration of Study:*** Department of Medicine, Pak Emirates Military Hospital Rawalpindi, Pakistan, from Jan to Dec 2024.

***Methodology:*** A total of 150 patients were added to the study and were divided into Group-A (n=73) including male patients and Group-B (n=77) including female patients diagnosed with acute stroke. Study variables included demographic data including age, gender, weight, BMI, socioeconomic, marital status, type of stroke and endorsement of modifiable stroke risk factors which included history of hypertension, diabetes, smoking, alcohol intake, hyperlipidemia, obesity, previous history of stroke, sedentary lifestyle, history of atrial fibrillation and/or valvular heart disease.

***Results:*** Frequency between modifiable risk factors in Group-A versus Group-B showed hypertension in 49(67.1%) versus 56 (72.7%) patients ($p$=0.454), diabetes in 29(39.7%) versus 35(45.5%) patients ($p$=0.478), dyslipidemia in 24(32.9%) versus 36 (46.8%) patients ($p$=0.083), smoking in 58(79.5%) versus 23(29.9%) patients ($p$<0.001), alcohol intake in 07(9.6%) versus 00(0%) patients ($p$=0.005), obesity in 22(30.1%) versus 31(40.3%) patients ($p$=0.195), previous history of stroke in 07(9.6%) versus 11(14.3%) patients ($p$=0.376).

***Conclusion:*** We conclude that smoking, hypertension and diabetes in males and hypertension, diabetes and dyslipidemia in females remain the top modifiable risk factors present in acute stroke patients

**Keywords:** Diabetes, Dyslipidemia, Gender, Multifactorial, Risk Factors, Stroke.

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## INTRODUCTION

Stroke and its sequelae are associated with high morbidity and mortality and are the leading cause of death worldwide.[1] According to data published by the Stroke Society of Pakistan, the prevalence of stroke in the country according to recent estimates is around 1.2%, with the incidence reported in 250 per 1,00,000 persons per year.[2] Despite considerable efforts, stroke care in the country requires attention for improvement. Literature shows that acute stroke is associated with multiple risk factors, many of which are modifiable, and the incidence can be decreased my forming focused preventive programs and treatment guidelines in patients are high risk for the condition.[3] The most common risk factors reported globally are hypertension, diabetes and smoking. Other modifiable risk factors include obesity, sedentary lifestyle, hyperlipidemia, and alcohol consumption.[4]

The most reliable system for stroke prevention is the development of reliable, patient centric individualized risk assessment tools based on the risk factors present in the demographic area.[5] Studies done in China, India, and in the UK and US all show that is high heterogenicity in the prevalence of modifiable risk factors from area to area.[6] Literature also shows that the risk factors have remained the same in the last 20 years, but their prevalence has changed considerably due to lifestyle changes in the past decade.[7] Even in Pakistan, the frequency of risk factors is different from one province to the other. Evidence based studies report that the frequency of risk factors is different in males versus females due to hormonal differences.

Our study aimed to compare gender-based frequencies of major modifiable stroke risk factors since consideration of gender specific risk factors would help design better risk assessment tools in patients of our demographic area.

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## METHODOLOGY

This analytical cross-sectional was carried out at the Department of Medicine, Pak Emirates Military Hospital Rawalpindi, Pakistan, from Jan to Dec 2024, after approval from the Institutional Ethical Review Board (vide letter no. A/28/ERC/26/24 dated 1st Dec 2023).

**Inclusion Criteria:** Patients of either gender, aged 18-65 years admitted in the neurointensive care unit (NICU) with a confirmation of acute stroke on CT scan brain were included.

**Exclusion Criteria:** Patients unable to provide adequate history, those with incomplete investigation results, and those lost to follow-up were excluded.

The sample size for two groups was calculated keeping the anticipated population proportion presenting with acute stroke in male versus females at 41.2% versus 58.8% respectively.[8] Minimum sample size came out to be 123 patients. We included a total of 150 patients in our final assessment protocol according to the inclusion criteria furnished. Patients were divided into Group-A in case of male and Group-B in case of female gender (Figure-1).

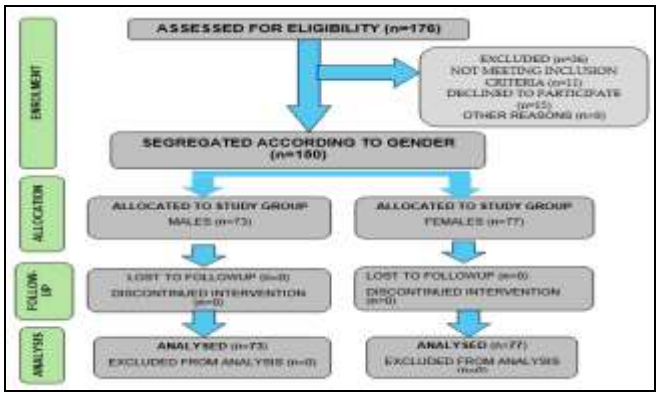



**Figure-1: Phases Of The Study (N=150)**

The study method included all patients as per the inclusion criteria furnished, using non-probability consecutive sampling. Before the start of the study, a written informed consent was taken from the patient if stable and oriented or the next of kin in case the patient was unable to give consent. They were informed about the study protocol and permission for using the data required for the study but were unaware of the study variables or study outcomes to prevent bias and ensure blinding. After admission in the NICU, a proforma was attached in all admission documents of all patients to be filled by the resident on duty and to be submitted to the duty staff at the end of each shift. The proforma included demographic data including age, gender, weight, BMI, socioeconomic, marital status, type of stroke and detailed history and endorsement of modifiable stroke risk factors which included history of hypertension, diabetes, smoking, alcohol intake, hyperlipidemia, obesity, previous history of stroke, sedentary lifestyle, history of atrial fibrillation and/or valvular heart disease.

Obesity was labeled as a BMI of more than 24 kg/m2, hypertension was defined as a systolic blood pressure of more than 140 mmHg and/or a diastolic blood pressure of more than 90 mmHg on three consecutive readings, previous positive history or on anti-hypertensive medication for at least 3 months, diabetes was defined as a BSF of more than 125 mg/dl and/or a HbA1C level of more than 6.5% or on anti-diabetic medication for at least three months, smoking status was labeled if a patient had a pack history of more than 5 years, or was smoking more than 5 cigarettes per day for 6 months, hyperlipidemia or dyslipidemia was labeled if two or more parameters were deranged from the reference limits including total cholesterol (TC) more than 6.22 mmol/l, triglycerides more than 2.26 mmol/l, high density lipoproteins less than <1.04 mmol/l and low density lipoproteins more than 4.14 mmol/l, and/or lipid lowering therapy for more than 6 months.

Primary variables studied were the frequency comparison of modifiable risk factors between males and females presenting with acute stroke. Demographic data were statistically described in terms of Mean±SD, frequencies, and percentages when appropriate. Independent samples t-test was used to compare statistically significant means. Frequency variables were compared using the Fisher-exact test. A *p*-value of ≤0.05 was considered statistically significant. All statistical calculations were performed using Statistical Package for Social Sciences (SPSS) 26.

## RESULTS

A total of 176 patients were assessed for inclusion in the study protocol,[11] did not meet the inclusion criteria and 15 declined to give consent to be included. 150 patients were finally added to the study and were divided into Group-A (n=73) including patients with male gender and Group-B (n=77) including patients with female gender. Mean age of patients in Group-A was 61.2±3.9 years versus 61.3±4.1 years in Group-B (*p*=0.921). Mean weight between both groups was 82.48±9.57 kg versus 83.08±9.20 kg (*p*=0.697). Marital status between both groups showed 49(67.1%) married

and 24(32.9%) unmarried patients in Group-A versus 52(67.5%) married and 25(32.5%) unmarried in Group-B ($p$=0.957). Socioeconomic status between both groups showed 19(26.0%) versus 14(18.2%) patients belonging to a low socioeconomic background, 39(53.4%) versus 46(59.7%) belonging to a modest socioeconomic background and 15(20.5%) versus 17(22.1%) belonging to a well-off socioeconomic background ($p$=0.081). Ischemic stroke was seen in 57(78.1%) versus 51(66.2%) patients, while hemorrhagic stroke was seen in 16(21.9%) versus 26(33.8%) patients between Group-A and Group-B ($p$=0.106), which can be seen in Table-I.

**Table-I Demographic Characteristics across Groups (n=150)**

| VARIABLE | Group-A (n=73) n (%) | Group-B (n=77) n (%) | *p*-value |
|---|---|---|---|
| Age (Years), Mean±SD | 61.2±3.9 | 61.3±4.1 | 0.921 |
| Weight (Kg), Mean±SD | 82.4±9.5 | 83.0±9.2 | 0.697 |
| BMI (kg/m²) | 29.0±4.6 | 28.5±4.8 | 0.522 |
| **Marital Status** | | | |
| Married | 49(67.1%) | 52(67.5%) | 0.957 |
| Unmarried | 24 (32.9%) | 25(32.5%) | |
| **Socioeconomic Status** | | | |
| Low | 19(26.0%) | 14(18.2%) | 0.081 |
| Modest | 39(53.4%) | 46(59.7%) | |
| Well-Off | 15(20.5%) | 17(22.1%) | |
| **Type of Stroke** | | | |
| Ischemic | 57(78.1%) | 51(66.2%) | 0.106 |
| Hemorrhagic | 16(21.9%) | 26(33.8%) | |

**BMI: Body Mass Index*

Comparison of frequency between modifiable risk factors in Group-A versus Group-B showed hypertension in 49(67.1%) versus 56(72.7%) patients ($p$=0.480), diabetes in 29(39.7%) versus 35(45.5%) patients ($p$=0.512), dyslipidemia in 24(32.9%) versus 36(46.8%) patients ($p$=0.097), smoking in 58(79.5%) versus 23(29.9%) patients ($p$<0.001), alcohol intake in 07(9.6%) versus 0(0.0%) patients ($p$=0.006), obesity in 22(30.1%) versus 31(40.3%) patients ($p$=0.233), previous history of stroke in 07(9.6%) versus 11(14.3%) patients ($p$=0.455), sedentary lifestyle in 15(20.5%) versus 21(27.3%) patients ($p$=0.347) and ischemic/valvular heart disease seen in 14(19.2%) versus 12(15.6%) patients ($p$=0.667), which can be seen in Table-II.

## DISCUSSION

We aimed our study to identify demographic risk factors in our population presenting with acute stroke and segregate them to better understand whether any difference existed among genders. Our study concluded that for the male gender the three most common risk factors presented were smoking, hypertension and diabetes. In the female gender, the top three risk factors were hypertension, diabetes and dyslipidemia. They were followed closely in frequency by obesity in both groups. Critical analysis with national and international studies showed that mean age for stroke diagnosis was in the early sixties. This was in line with studies reporting similar age for presentation done by Sreejith *et al*. which reported a mean age of diagnosis of around 62 years compared to our reported age of around 61 years.[9] They also reported no major gender-based difference in the age when compared to males versus females which was also in line with our study reporting no statistical difference with age between the two gender groups. Comparative to a study done in Lahore by Yousaf *et al*. in 2021, the reported mean age in their study group was 68 and 71 for males and females versus our reported age of 61.[10] So the general consensus of local as well as international literature has reported an age presentation of above 60 years for both gender groups. Khan *et al*. reported the mean age at around 63 years for both groups in a study done in Khyber Pakhtunkhwa in 2022 reporting similar age groups between both genders.[11]

**Table-II: Comparison of Modifiable Risk Factors across Groups (n=150)**

| VARIABLE | Group-A (n=73) n (%) | Group-B (n=77) n (%) | *p* value |
|---|---|---|---|
| Hypertension | 49(67.1%) | 56(72.7%) | 0.480 |
| Diabetes | 29(39.7%) | 35(45.5%) | 0.512 |
| Dyslipidemia | 24(32.9%) | 36(46.8%) | 0.097 |
| Smoking | 58(79.5%) | 23(29.9%) | <0.001 |
| Alcohol Intake | 07 (9.6%) | 00 (0.0%) | 0.006 |
| Obesity | 22(30.1%) | 31(40.3%) | 0.233 |
| Previous Stroke History | 07 (9.6%) | 11(14.3%) | 0.455 |
| Sedentary Lifestyle | 15(20.5%) | 21(27.3%) | 0.347 |
| Ischemic/Valvular Heart Disease | 14(19.2%) | 12(15.6%) | 0.667 |

When comparing the type of stroke on presentation between the gender groups, ischemic stroke remained the highest presenting type in both males and females with male frequency more than 75% versus a female reported frequency of around 66%. National literature is also consistent with the above findings with similar frequencies seen in studies done by Gulzar *et al*.[12] Radiological confirmation of stroke type by Arshad *et al*. also reported ischemic stroke being more common in both genders with higher frequencies in the male gender.[13] When talking about the risk factors smoking came out to be the biggest risk factor in males followed by hypertension and diabetes while it was hypertension and diabetes in females. This is in line with reported literature in the

last 5 years with both national and international studies identifying hypertension, diabetes and smoking as major risk factors.[14,15] Long term burden of disease and risk factors reported and projected from 1990-2030 also show an increase in the frequency in females for hypertension, diabetes, dyslipidemia and obesity while for males, hypertension, smoking, alcohol and diabetes are projected to be major risk factors.[16] These reported frequencies have seen a major conformity globally with slight variations seen in specific demographic areas with alcohol intake less in Muslim countries and smoking being very less in females in conservative setups of South East Asia. These variations need consistent reporting and would help countries define programs to identify high risk factor patients and age groups with gender differentiation.[17,18]

It is pertinent to mention that our study also supports the global demographics for major diseases between both genders. A study done by Chung *et al*. reported that hypertension, diabetes and dyslipidemia remain the most common risk factors more prevalent in the female gender than males. Hormonal factors and post-menopausal changes are reported to be major reasons for this predilection towards the female gender.[19]

## LIMITATIONS OF STUDY

The limitations of a single-center study, such as generalizability, and association of hormonal and physiological factors for these modifiable risk factors needs further study to offer better treatment strategies in patients presenting with acute stroke.

## CONCLUSION

We conclude that smoking, hypertension and diabetes in males and hypertension, diabetes and dyslipidemia in females remain the top modifiable risk factors present in acute stroke patients.

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**Funding Source:** None.

**Authors Contribution**

Following authors have made substantial contributions to the manuscript as under:

MAHS & MNAK: Conception, study design, drafting the manuscript, approval of the final version to be published.

NSK & MEW: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

MHL & EI: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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