

## Frequency of Microalbuminuria In Hypertensive Patients With Acute Ischemic Stroke

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**Abstract:** Microalbuminuria is an established marker of endothelial dysfunction and is associated with increased cardiovascular and cerebrovascular risk. In hypertensive patients presenting with acute ischemic stroke, the presence of microalbuminuria may indicate heightened vascular injury and poorer prognosis. Early identification may assist in risk stratification and secondary prevention. **Objective:** To determine the frequency of microalbuminuria in hypertensive patients presenting with acute ischemic stroke at Saidu Group of Teaching Hospital, Swat. **Methods:** This study was conducted on 150 hypertensive patients aged 18-65 years with acute ischemic stroke at the Department of General Medicine, Saidu Group of Teaching Hospital, Swat, from 26 September 2024 to 26 March 2025. Patients with hemorrhagic stroke, end-stage renal disease, and pregnancy were excluded. Hypertension was defined as systolic blood pressure  $\geq 130$  mmHg and diastolic blood pressure  $\geq 80$  mmHg. Microalbuminuria was assessed using spot urine albumin-creatinine ratio, with values between 30 and 300 mg/g considered positive. Data were analysed using SPSS 23. **Results:** The mean age of 150 patients was  $51.37 \pm 12.06$  years. Gender-wise, 81 patients (54.0%) were male. Microalbuminuria was diagnosed in 62 (41.3%) patients. Significant association of microalbuminuria was observed with prolonged duration of stroke, diabetes, and hypertension. **Conclusion:** The frequency of microalbuminuria in hypertensive patients with acute ischemic stroke in this study was 41.3%, and it was significantly associated with diabetes mellitus, smoking, and delayed presentation. Routine screening for microalbuminuria may help in early risk stratification and guide secondary prevention strategies in this high-risk population.

**Keywords:** Microalbuminuria, Hypertension, Ischemic stroke, Diabetes mellitus, Smoking, Risk factors

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### Introduction

Stroke is one of the leading causes of mortality and long-term disability worldwide, with approximately 15 million individuals suffering from stroke annually and nearly 5 million left disabled. A substantial rate of strokes is acute ischaemic caused by the sudden decrease in the cerebral blood flow due to the arterial occlusion. Among established risk factors for ischaemic stroke, hypertension remains the most prominent, with elevated blood pressure contributing to one third of the attributable risk. One such biomarker is microalbuminuria, which is historically linked to early renal dysfunction but is increasingly recognised for its association with endothelial dysfunction and cardiovascular risk (1-3).

Microalbuminuria reflects generalised vascular injury and endothelial perturbation, which sometimes precede cerebrovascular disease. The biological credibility of such a link lies in shared pathophysiological mechanisms of endothelial dysfunction, increased vascular permeability, and inflammation, which not only contribute to renal microvascular variations but also cause atherogenesis. Epidemiological evidence reported that microalbuminuria anticipates the risk of stroke along with other major adverse cardiovascular events following modification for traditional risk factors, including diabetes, smoking, and lipid profiles (3-6).

Microalbuminuria may not just be a passive marker of vascular injury but may also reflect active mechanisms that fuel the development of atherosclerosis and thrombogenesis. A study demonstrated that elevated urinary albumin excretion is associated with markers of carotid atheroma and systemic atherogenic features, which are associated with an increased rate of ischaemic cerebrovascular events (7-9). Regardless of mounting evidence, the relationship between hypertension, microalbuminuria, and acute ischaemic stroke has not been highlighted in low-income settings. The mechanistic pathways may be further illuminated by investigations suggesting that microalbuminuria sometimes coexists with indicators of

target organ damage in hypertension, all of which contribute to greater susceptibility to stroke (8-10).

Microalbuminuria has emerged as a significant marker of endothelial dysfunction reflecting the early target organ damage in hypertensive patients. Data from the South Asian populations, such as Pakistan, remains limited, making it essential for assessing the frequency of microalbuminuria in hypertensive stroke patients within this context. The findings of this investigation can enhance understanding of the pathophysiological connection between renal and cerebrovascular disease, facilitating early identification of high-risk individuals and potentially guiding targeted management policies to minimize stroke-related complications and improve patient outcomes.

### Methodology

The present cross-sectional study was conducted at the Department of General Medicine, Saidu Group of Teaching Hospital, Swat, from 26 September 2024 to 26 March 2025. Ethical approval was obtained from the hospital's IRB prior to the study. 150 patients were selected for this study. This sample size was calculated using the WHO sample size calculator, assuming a 47% frequency of microalbuminuria in patients with hypertension presenting with ischemic stroke, a 95% confidence interval, and an 8% margin of error. A non-probability consecutive sampling technique was used.

Patients aged 18 to 65 years, having either gender, with hypertension defined as systolic blood pressure (SBP)  $\geq 130$  mm Hg AND/diastolic blood pressure (DBP)  $\geq 80$  mm Hg by using sphygmomanometer in patients presenting with all of the following symptoms such as headaches, blurred vision, and difficulty breathing or patients with history of hypertension (already on hypertension drugs), and acute ischemic stroke defined as patients presenting with all of the following symptoms such as numbness, weakness, and speech impairment. A CT scan of the brain was performed for the diagnosis, showing both of the following: hypodensity



due to reduced blood flow, and loss of the difference between gray matter. Exclusion criteria were applied to patients with hemorrhage stroke, end-stage renal disease, and pregnancy.

After obtaining written informed consent from the patients, their demographic details, including age, gender, BMI, residence area, educational status, occupation status, and socio-economic background, were documented. The history of diabetes and smoking was taken into account as well. Patients with acute ischemic stroke diagnosed with hypertension were evaluated for microalbuminuria, which was defined as Urine Albumin-Creatinine Ratio between 30 and 300 milligrams of albumin per gram of creatinine (mg/g) on spot urine sample analysis on laboratory examination in patients presenting with all of the following indications, such as proteinuria, and severe tiredness. All the assessments were conducted under the supervision of a consultant.

Data were analyzed using IBM SPSS 23. Mean and SD were used for numerical data, such as age, height, weight, BMI, urine albumin-creatinine ratio, duration of hypertension, and duration of ischemic stroke. Frequencies and percentages were presented for categorical data such as gender, microalbuminuria, smoking, diabetes, residence area, education status, occupation status, and socioeconomic background. Microalbuminuria was stratified by age, BMI, gender, duration of hypertension, duration of ischemic stroke, smoking, diabetes, residence area, education status, occupation status, and socioeconomic background to address the effect modifiers. Post-stratification, chi-square or Fisher's exact test was applied at the 5% level of significance.

**Results**

This study included 150 patients with hypertension who had experienced an acute ischemic stroke. The patients' age was 51.37±12.06 years. Their mean body mass index was 25.85 ± 1.50 kg/m². Table 1 presents the clinical characteristics of the patients.

Gender-wise, there were 81 males (54.0%) and 69 females (46.0%). The remaining demographic data are presented in Table 2.

Figure 1 presents the distribution of comorbidities, such as diabetes and smoking, within the population.

Microalbuminuria was detected in 62 patients (41.3%) in this hypertensive cohort with acute ischemic stroke (Table 3).

The comparative analysis identified duration of ischemic stroke more than 8 hours (p = 0.001), diabetes (p = 0.002), and smoking (p = 0.002) as significant associated factors of microalbuminuria (Table 4).

**Table 1: Clinical characteristics**

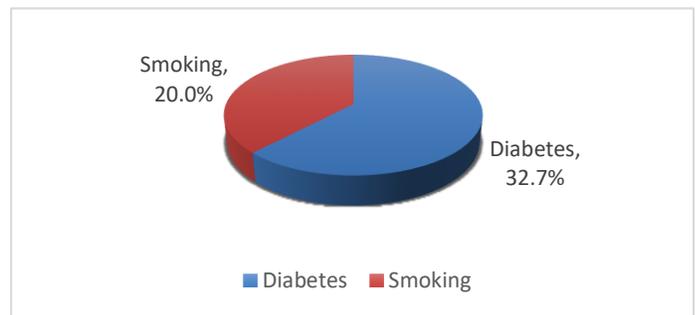
Clinical characteristics	Mean	Std. Deviation
Duration of hypertension (Years)	5.12	1.258
Duration of ischemic stroke (Hours)	7.69	3.45
Urine Albumin-Creatinine Ratio (mg/g)	43.0733	25.39146

**Table 2: Demographics**

Demographics	n	%	
Gender	Male	81	54.0%
	Female	69	46.0%
Education status	Literate	68	45.3%
	Illiterate	82	54.7%
Occupation status	Employed	65	43.3%
	Unemployed	85	56.7%
Area of residence	Urban	87	58.0%
	Rural	63	42.0%
Socioeconomic status	Lower class	60	40.0%
	Middle class	63	42.0%
	Upper class	27	18.0%

**Table 3: Frequency of microalbuminuria**

Microalbuminuria	n	%
Yes	62	41.3%
No	88	58.7%



**Figure 1: Comorbidities**

**Table 4: Stratification of microalbuminuria with demographics, comorbidities, and clinical parameters**

		Microalbuminuria				P value
		Yes		No		
		n	%	n	%	
Age distribution (Years)	18 to 35	8	12.9%	9	10.2%	0.41
	36 to 50	15	24.2%	30	34.1%	
	> 50	39	62.9%	49	55.7%	
Gender	Male	34	54.8%	47	53.4%	0.86
	Female	28	45.2%	41	46.6%	
BMI (Kg/m2)	18.5 to 24.9	20	32.3%	30	34.1%	0.81
	> 24.9	42	67.7%	58	65.9%	
Duration of hypertension (Years)	1 to 3	8	12.9%	9	10.2%	0.61
	> 3	54	87.1%	79	89.8%	
Duration of ischemic stroke (hours)	2 to 8	29	46.8%	64	72.7%	0.001
	> 8	33	53.2%	24	27.3%	
Diabetes	Yes	29	46.8%	20	22.7%	0.002
	No	33	53.2%	68	77.3%	
Smoking	Yes	20	32.3%	10	11.4%	0.002
	No	42	67.7%	78	88.6%	
Education status	Literate	29	46.8%	39	44.3%	0.76
	Illiterate	33	53.2%	49	55.7%	
Occupation status	Employed	30	48.4%	35	39.8%	0.29
	Unemployed	32	51.6%	53	60.2%	

Area of residence	Urban	31	50.0%	56	63.6%	0.09
	Rural	31	50.0%	32	36.4%	
Socioeconomic status	Lower class	25	40.3%	35	39.8%	0.67
	Middle class	24	38.7%	39	44.3%	
	Upper class	13	21.0%	14	15.9%	

## Discussion

The present study examined the frequency of microalbuminuria in 150 hypertensive patients presenting with acute ischemic stroke. The mean age was  $51.37 \pm 12.06$  years, which is slightly younger than that reported by Hammad et al.  $57.6 \pm 14.82$  years in their study of 148 hypertensive patients with acute ischemic stroke.<sup>8</sup> Farooq et al reported a mean age of  $60.06 \pm 14.31$  years in their study of 195 patients with ischemic stroke, while Nidhinandana et al. reported an older mean age of  $66.1 \pm 12.7$  years among 173 ischemic stroke patients.<sup>11-12</sup> The younger age profile in the present study may reflect demographic variations or differing inclusion criteria. The gender distribution in this study showed a male predominance with 81 (54.0%) males and 69 (46.0%) females. This pattern aligns with the existing literature, as Hammad et al. reported 87 males (58.8%) in their cohort, and Farooq et al. reported 105 males (53.8%) (8,11). Zakria et al. also observed a male majority, with 51 males (53.7%) among their 95 patients (13).

The mean body mass index in the present study was  $25.85 \pm 1.50$  kg/m<sup>2</sup>, which is similar to the  $25.9 \pm 7.48$  kg/m<sup>2</sup> reported by Hammad et al. and the  $25.1 \pm 4.0$  kg/m<sup>2</sup> reported by Nidhinandana et al (8,12). These figures suggest that overweight and obesity are common among patients with hypertension and ischemic stroke across different populations. The mean duration of hypertension in this study was  $5.12 \pm 1.26$  years, which is somewhat longer than the  $3.19 \pm 5.28$  years reported by Hammad et al (8). This difference may be attributable to variations in the study populations or to differences in the definitions used to establish the onset of hypertension. The mean duration from stroke onset to presentation was  $7.69 \pm 3.45$  hours in the current study, which is shorter than the  $13.80 \pm 9.9$  hours reported by both Farooq et al. and Zakria et al (11,13).

The frequency of diabetes mellitus in this study was 49 (32.7%), which is comparable to the 30.4% reported by Hammad et al., the 34.9% reported by Farooq et al., and the 34.7% observed by Zakria et al (8,11,13). Gaurav et al. reported a similar frequency of 34.29% in their case-control study of 70 patients with acute ischemic stroke (2). These findings across multiple studies highlight the well-established association between diabetes and cerebrovascular disease and highlight the importance of glycaemic control in stroke prevention strategies.

In this study, the frequency of microalbuminuria was 41.3%. This figure aligns with Hammad et al., who reported microalbuminuria in 68 of 148 patients (45.9%) with hypertension and acute ischemic stroke (8). Farooq et al. reported microalbuminuria in 94 of 195 patients (48.2%) with ischemic stroke, while Zakria et al. reported it in 46 of 95 patients (48.4%) (11, 13). Gaurav et al. reported microalbuminuria in 48.57% patients with acute ischemic stroke (2).

The association between various clinical factors and microalbuminuria was also examined. The age distribution showed that the majority of patients with microalbuminuria were aged 50 years or older, compared with those without microalbuminuria. Although this difference did not reach statistical significance, Gaurav et al. found a significant association between advancing age and microalbuminuria.<sup>14</sup> Similarly, Gumbinger et al. reported a significant association between microalbuminuria and higher age (14).

The duration of ischemic stroke at presentation was a significant predictor of microalbuminuria. Among patients with microalbuminuria, the majority presented after more than 8 hours from symptom onset. Farooq et al. similarly observed that microalbuminuria was more frequent within the first 24 hours after stroke onset, and Mathur et al. also noted a higher

prevalence of microalbuminuria in patients presenting early after stroke (11,16). This association may reflect the acute inflammatory response and systemic endothelial dysfunction that accompany cerebral ischaemia, which could transiently increase glomerular albumin permeability.

The presence of diabetes mellitus and smoking also showed a significant association with microalbuminuria in the present study. Studies have shown that diabetes and smoking are associated with microalbuminuria (12,14).

## Conclusion

In conclusion, the present study exhibited a higher frequency of microalbuminuria in hypertensive patients presenting with acute ischemic stroke (41.3%). The study found a significant relationship between microalbuminuria and prolonged stroke duration of more than 8 hours, diabetes, and hypertension. Routine screening for microalbuminuria should be incorporated in the initial assessment of hypertensive patients presenting with acute stroke to facilitate early risk stratification and guide more aggressive management of modifiable risk factors.

## 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. (93-ERB/024)

### Consent for publication

Approved

### Funding

Not applicable

## Conflict of interest

The authors declared no conflicts of interest.

## Author Contribution

### AH (PGR), WK (Professor)

*Manuscript drafting, Study Design, Data analysis*

*Review of Literature, Data entry, Data analysis, and drafting an 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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