Comprehensive Assessment Of Risk Factors For Transient Ischemic Attacks In The Population Of Kashkadarya Region

Muso Urinov[1], Muhammad Mustafayev[2], Bakhtiyor Akhmedov[3], Ravshan Tulakov[4]

[1]Bukhara State Medical Institute, Bukhara, Uzbekistan
ss-1961@mail.ru
https://orcid.org/0009-0007-1852-5744
[2]Lecturer, Faculty of Medicine, Karshi State University
E-mail: mustafayevmuhammad800@gmail.com
https://orcid.org/0009-0000-0086-2880
[3]Lecturer, Department of Clinical Anatomy, Karshi State University, Uzbekistan
https://orcid.org/0009-0002-2509-6937
bakhtiyor_akhmedov@mail.ru
[4]Director of the Kashkadarya Regional Branch of the Republican Scientific Center for Emergency Medical Care, Uzbekistan
tulakov72@mail.ru
https://orcid.org/0009-0005-0219-8035

ABSTRACT

Transient ischemic attack (TIA) remains one of the most important clinical predictors of impending ischemic stroke and a major contributor to the global cerebrovascular burden. According to the Global Burden of Disease (GBD-2021) analysis, Central Asia ranks among the three world regions with the highest stroke-specific mortality and disability-adjusted life-year (DALY) losses, with no significant improvement observed since 1990. In contrast, high-income countries demonstrate a sustained decline in cerebrovascular mortality due to earlier detection, risk-factor control, and widespread implementation of secondary prevention programs. This disparity underscores the urgent need for region-specific research and targeted interventions in countries such as Uzbekistan.

TIA represents a critical “pre-stroke window.” Approximately 15–25% of all ischemic strokes occur within the first 90 days following a TIA, while timely diagnosis and evidence-based prevention can reduce subsequent stroke risk by 60–80%. Despite the prognostic importance of TIA, Uzbekistan lacks systematic epidemiological data, structured registries, and validated regional risk-stratification tools. Existing national stroke registries report 1.0–1.4 new strokes per 1,000 population annually, but TIA-related data remain largely unaccounted for, limiting effective planning of preventive strategies.

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INTRODUCTION

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Transient ischemic attack (TIA) remains one of the most important clinical predictors of impending ischemic stroke and a major contributor to the global cerebrovascular burden. According to the Global Burden of Disease (GBD-2021) analysis, Central Asia ranks among the three world regions with the highest stroke-specific mortality and disability-adjusted life-year (DALY) losses, with no significant improvement observed since 1990. In contrast, high-income countries demonstrate a sustained decline in cerebrovascular mortality due to earlier detection, risk-factor control, and widespread implementation of secondary prevention programs. This disparity underscores the urgent need for region-specific research and targeted interventions in countries such as Uzbekistan.

TIA represents a critical “pre-stroke window.” Approximately 15–25% of all ischemic strokes occur within the first 90 days following a TIA, while timely diagnosis and evidence-based prevention can reduce subsequent stroke risk by 60–80%. Despite the prognostic importance of TIA, Uzbekistan lacks systematic epidemiological data, structured registries, and validated regional risk-stratification tools. Existing national stroke registries report 1.0–1.4 new strokes per 1,000 population annually, but TIA-related data remain largely unaccounted for, limiting effective planning of preventive strategies.

Kashkadarya Region represents a unique epidemiological setting shaped by several demographic and environmental determinants. The proportion of individuals aged ≥60 years has reached 11% and continues to rise, significantly increasing age-related vascular vulnerability. Extreme summer temperatures (up to +45°C), limited access to drinking water, and recurrent dehydration contribute to hemoconcentration and multifactorial hypertension. Urban–rural differences further complicate the regional risk structure: physical inactivity, obesity, and type 2 diabetes are more common in urban residents, whereas arterial hypertension, chronic ischemic heart disease, and dehydration-related stress predominate in rural communities. These disparities highlight the necessity of a geographically sensitive analysis of TIA risk factors.

To date, Uzbekistan has not conducted large-scale, region-specific investigations of the contributions of atherosclerotic stenosis, cardioembolic sources, hemostatic imbalance, and inflammatory markers to the development of TIA. As a result, no local clinical algorithms for screening, risk stratification, or early secondary prevention have been established. Meanwhile, the national program *Healthy Generation – 2030* sets a strategic objective to reduce premature cardiovascular mortality by 25%, an ambition unlikely to be achieved without comprehensive regional data on modifiable and non-modifiable risk factors.

Given these gaps, the present study provides the first comprehensive assessment of clinical, cardiovascular, metabolic, hemodynamic, and inflammatory risk factors for TIA in the population of Kashkadarya Region. By comparing urban and rural cohorts, the study aims to identify specific regional patterns and stratify risk clusters that may guide localized preventive strategies. The results are expected to support the development of targeted clinical guidelines, optimize resource allocation, and enhance the effectiveness of TIA prevention programs within the region.

RESULTS OF THE STUDY

The study was conducted at the Neurology Department of the Kashkadarya Regional Branch of the Republican Scientific Center for Emergency Medical Care (RSCECM) and the Department of Neurology of Bukhara State Medical Institute during 2022–2024. The research design was retrospective–prospective, following a case–control model.

The study material represents a representative regional TIA cohort for Kashkadarya Region and enables comparison between urban and rural populations (Table 1). It provides a comprehensive assessment of clinical, hemodynamic, hemostatic, and inflammatory determinants of TIA risk (Table 2).

Table 1. Study Material

Parameters	Description
General population	All TIA cases among residents of Kashkadarya Region (population 3,560.6 thousand; urban 42.9%, rural 57.1%) during 2022–2024
Sample	376 patients hospitalized with clinically confirmed TIA (ICD-10 G45)
Grouping	• Main group (MG): 231 urban residents (60.6 ± 15.7 years) • Comparison group (CG): 145 rural residents (65.3 ± 16.4 years)
Sex distribution	Men: 137 (36.4%); Women: 239 (63.6%)
Age	48–90 years; predominant category 60–74 years (43.1%)

Table 2. Research Methods

Parameter	Description
Clinical data	Medical records; NIHSS, ABCD², mRS scores; neurological examination at admission, on day 1 and day 7
Instrumental methods	CT/MRI of the brain; carotid Doppler and duplex scanning; transcranial Doppler (TCD); ECG/Holter monitoring; echocardiography; cervical X-ray/functional imaging
Laboratory block	Complete blood count, biochemical profile, coagulation panel, C-reactive protein, D-dimer
Risk factors	Hypertension, type 2 diabetes, dyslipidemia, obesity, smoking, chronic ischemic heart disease, atrial fibrillation; data obtained via questionnaire and medical charts
Inclusion criteria	≥ 18 years; TIA prior to admission; examination ≤ 24 h; consent for 1-year follow-up
Exclusion criteria	Any prior stroke, traumatic brain injury, tumor, severe somatic or psychiatric disease, refusal to participate
Comparison cohort	Population-based sample (n ≈ 1,200) from 4 rural and 2 urban outpatient clinics; questionnaire data and BP/lipid screening

STATISTICAL ANALYSIS

Statistical processing of the clinical and instrumental data was performed using methods of variational statistics in Microsoft Office Excel 2019. The mean value and standard error of the mean were calculated using the method of moments (M ± m), along with the standard deviation (σ).

The statistical significance of differences was assessed using Student's *t*-test for parametric distributions and Fisher's *F*-test for non-parametric distributions. Differences were considered statistically significant at a 95% confidence interval ($p \leq 0.05$).

RESULTS

Over the three-year study period, a diagnosis of TIA was established in 376 patients treated at the Neurology Department of the Kashkadarya Branch of the Republican Scientific Center for Emergency Medical Care (2022–2024). Patients with TIA were divided into two study groups:

- Main group (MG) — 231 individuals (64.1%) residing in urban areas; mean age 60.6 ± 15.7 years.
- Comparison group (CG) — 145 individuals (35.9%) residing in rural areas; mean age 65.3 ± 16.4 years.

In both groups, women predominated (55.8% in MG and 60.7% in CG), which is likely associated with a longer life expectancy among women and a higher level of health-seeking behavior. Men accounted for 44.2% in the MG and 39.3% in the CG. Differences between the groups in sex distribution did not reach statistical significance ($p > 0.05$).

Overall, TIA severity according to Schmidt's classification (1970) showed the following distribution:

- Mild form (episodes lasting 5–10 minutes) — 33.0% of patients;
- Moderate form (lasting up to several hours) — 40.7%;
- Severe form (lasting more than several hours but not exceeding 24 hours) — 26.3%.

Among elderly patients, moderate and severe forms of TIA were more frequently observed, which may be related to more pronounced vascular pathology and impaired cerebral perfusion (Fig. 1).

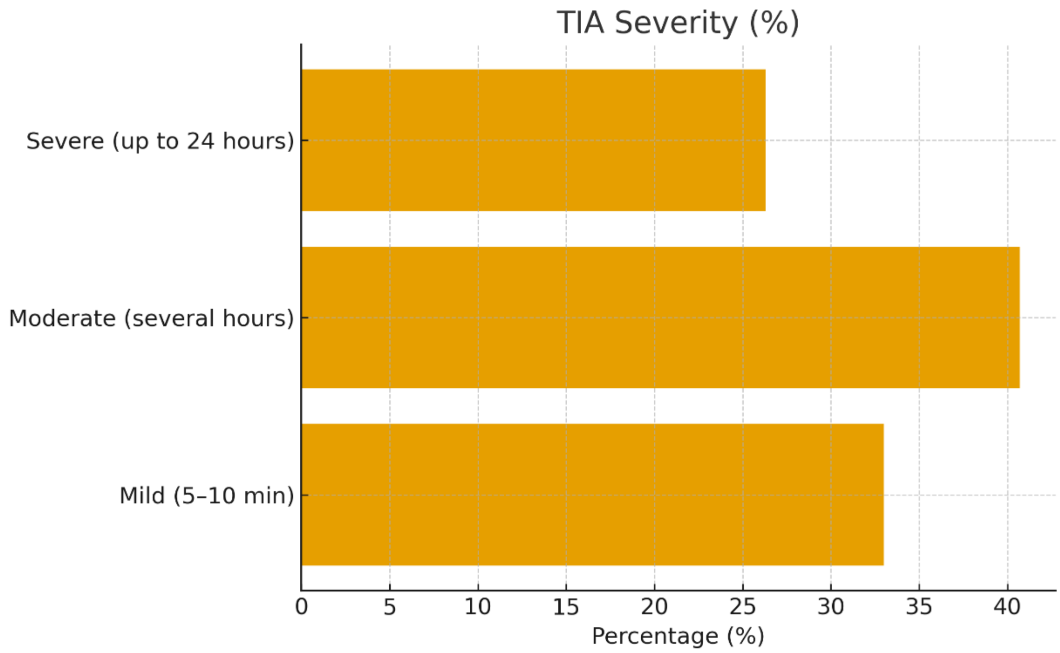

Figure 3.1. TIA Severity Gradation

Table 3.4 presents the distribution of TIA severity in the urban (MG) and rural (CG) groups, as well as the overall distribution in the entire sample (n = 376):

Mild severity (Grade I, 5–10 minutes): in the urban population, the proportion of mild TIAs is 22.1% (51 out of 231), whereas in the rural population it is 50.3% (73 out of 145). Overall, mild attacks were recorded in one-third of patients (33.0%, 124 out of 376). The difference between the MG and CG groups is statistically significant ($p < 0.001$), indicating a considerably higher proportion of mild episodes in rural areas.

Table 3. TIA Severity Distribution Across Groups

TIA Severity	Urban Group (n=231)	Rural Group (n=145)	Total (n=376)	p-value
Mild (Grade I, 5–10 min)	51 (22.1%)	73 (50.3%)	124 (33.0%)	< 0.001
Moderate (Grade II, several hours)	109 (47.2%)	44 (30.4%)	153 (40.7%)	< 0.001
Severe (Grade III, up to 24 h)	71 (30.7%)	28 (19.3%)	99 (26.3%)	< 0.001

Moderate severity (Grade II, lasting up to several hours): almost half of urban patients experienced moderate TIA episodes (47.2%, 109 out of 231), whereas in rural areas this proportion was only 30.4% (44 out of 145). In the overall sample, moderate TIAs accounted for 40.7% (153 out of 376). The difference is also statistically significant ($p < 0.001$).

Table 4. TIA Severity Distribution Across Groups (%)

TIA Severity	Urban Group (n=231)	Rural Group (n=145)
Mild (5–10 min)	22.1%	50.3%
Moderate (several hours)	47.2%	30.4%
Severe (up to 24 hours)	30.7%	19.3%

Severe severity (Grade III, up to 24 hours): severe attacks were recorded in 30.7% of urban patients (71 out of 231) and in 19.3% of rural residents (28 out of 145), resulting in a total of 26.3% of all cases (99 out of 376). This difference is statistically significant ($p < 0.001$), indicating a higher proportion of severe episodes in the urban population (Fig. 2).

Thus, mild forms of TIA are significantly more common in the rural group, whereas moderate and severe TIAs predominate in the urban group. This reflects differences in the clinical profile and possibly in the accessibility or speed of emergency medical care in different communities.

Gender analysis showed that women account for 63.2% of patients with TIA, which corresponds to the general population trend of longer life expectancy among women and their higher likelihood of seeking medical care. In men, TIAs were more often observed at the age of 60–74 years, whereas in women a higher frequency was recorded in old age (75 years and older), which is probably associated with more pronounced hormonal and vascular changes in the postmenopausal period.

In addition, overall, the urban group showed a larger proportion of moderate and severe TIAs. Moderate TIA severity was observed in 47.2% of the MG patients, compared to 35.9% in the CG ($p < 0.05$). The proportion of severe TIAs (up to 24 hours) was also higher in the main group — 30.7% versus 21.4% in the comparison group ($p < 0.05$). These statistically significant differences confirm the importance of considering these risk factors when predicting the disease course.

Thus, the frequency of TIA in elderly patients is high, and its structure is characterized by the predominance of vascular risk factors, higher involvement of women, and a tendency toward more severe forms. These findings emphasize the need for early diagnosis and active secondary preventive interventions in this age group.

Cardiovascular diseases (CVDs) are key triggers for transient ischemic attacks (TIA), as confirmed by the high prevalence of arterial hypertension (72.3% in urban patients and 75.2% in rural patients, $p > 0.05$), atherosclerosis of major arteries (63.2% and 67.6%, $p > 0.05$), and atrial fibrillation (28.1% and 32.4%, $p > 0.05$) (Fig. 3.2).

Comparison between urban and rural populations showed no statistically significant differences in the main cardiovascular risk factors. However, chronic ischemic heart disease (CIHD) was more frequently recorded in rural patients (35.9%) compared to urban residents (31.2%), which may be associated with later detection of cardiovascular diseases and limited access to specialized medical care in rural areas (Table 4).

Table 5. Major Risk Factors in Patients With TIA

Risk Factor	Percentage (%)
Obesity	22.5%
Type 2 diabetes	27.1%
Atrial fibrillation	29.7%
Atherosclerosis of major arteries	64.8%
Arterial hypertension	73.2%

Analysis of risk factors in the groups showed that dyslipidemia was observed in approximately half of the patients in both groups (48.5% in the urban group and 51.7% in the rural group, $p > 0.05$), indicating the important role of lipid metabolism in the development of ischemic attacks. Smoking was slightly more common among urban patients (34.2%) compared with rural residents (29.7%), which may be associated with differences in lifestyle and levels of awareness regarding the harmful effects of smoking.

Metabolic disorders also play a significant role in the pathogenesis of TIA. Type 2 diabetes mellitus was more frequently diagnosed in urban residents (25.8% versus 17.2% in rural patients, $p < 0.05$), which is likely related to lower medical awareness, limited access to glycemic control, and differences in dietary habits.

Table 6. Cardiovascular and Metabolic Risk Factors for TIA in Urban and Rural Populations

Parameter	Urban Group (MG) (n = 231)	Rural Group (CG) (n = 145)	p-value
Arterial hypertension	72.3% (167)	75.2% (109)	> 0.05
Atherosclerosis of major arteries	63.2% (146)	67.6% (98)	> 0.05
Atrial fibrillation	28.1% (65)	18.6% (27)	< 0.05
Type 2 diabetes mellitus	25.8% (60)	17.2% (25)	< 0.05
Obesity	21.2% (49)	12.4% (18)	< 0.05

Obesity and metabolic syndrome were also detected somewhat more frequently in urban residents (21.2% and 26.2%, respectively) compared with the rural population (12.4% and 12.9%). However, the difference did not reach statistical significance ($p > 0.05$).

Table 7. Cardiovascular and Metabolic Risk Factors for TIA (Urban vs Rural)

Risk Factor	Urban Group (MG) (n = 231)	Rural Group (CG) (n = 145)
Arterial hypertension	72.3%	75.2%
Atherosclerosis of major arteries	63.2%	67.6%
Atrial fibrillation	28.1%	18.6%
Type 2 diabetes mellitus	25.8%	17.2%
Obesity	21.2%	12.4%

Hypodynamia (low physical activity) was more pronounced in the urban group (51.7%) compared with the rural population (16.3%), which may be explained by lifestyle changes among urban residents—reduced traditional physical workload, especially in older age groups, and increased time spent in sedentary activities (Table 4).

The most common risk factors in both groups were arterial hypertension (72.3% in the urban group and 75.2% in the rural group) and atherosclerosis of major arteries (63.2% and 67.6%). In the urban group, atrial fibrillation, type 2 diabetes, and hypodynamia were also more prevalent. These factors are traditionally associated with the development of TIA and are highly relevant for secondary prevention.

Thus, cardiovascular risk factors are equally prevalent among TIA patients regardless of their place of residence, which underscores the importance of timely diagnostics and correction of cardiovascular diseases both in urban and rural settings.

Chronic ischemic heart disease, type 2 diabetes, obesity, and metabolic syndrome were somewhat more common in urban residents, requiring more intensive metabolic control in this population. Hypodynamia was more frequently observed in urban patients, which may indicate the need for additional motivation toward physical activity and preventive programs. Urban residents were also more likely to smoke, be obese, and have metabolic disorders, reflecting different behavioral risk patterns.
Analysis of 376 case histories showed a high proportion of modifiable risk factors:
• Arterial hypertension (AH) – 73.2% (n = 275)
• Dyslipidemia – approximately 50% (48.5% in urban residents; 51.7% in rural residents)
• Type 2 diabetes mellitus (T2DM) – 25.8% in urban patients vs. 17.2% in rural patients ($p < 0.05$)
• Smoking – 34.2% and 29.7%, respectively
• Chronic ischemic heart disease (CIHD) – 31.2% (urban) and 35.9% (rural)
Among non-modifiable factors, the most common were: age ≥ 60 years — 83.1% of the entire sample, and female sex — 63.6% (Table 5).

Table 8. Association of Risk Factors With TIA Severity and Recurrence

Risk Factor	Association with Severity (TIA II–III vs I)	p-value	Association with 1-Year Recurrence	p-value
Arterial hypertension	Strong association (OR 2.1; 95% CI 1.4–3.2)	< 0.01	Moderate increase (HR 1.4)	< 0.05
Atherosclerosis of major arteries	Significant association (OR 1.8)	< 0.05	Weak association	> 0.05
Atrial fibrillation	Strong predictor of severe TIA (OR 2.5)	< 0.01	High recurrence risk (HR 1.7)	< 0.01
Type 2 diabetes mellitus	Moderate association with severity (OR 1.6)	< 0.05	Significant recurrence increase (HR 1.5)	< 0.05
Obesity / metabolic syndrome	Weak association	> 0.05	Weak association	> 0.05
Age ≥ 75 years	Very strong severity predictor (OR 3.1)	< 0.001	Strong recurrence predictor (HR 1.8)	< 0.01
Positive family history (stroke/TIA)	Earlier onset of TIA	< 0.05	Doubled recurrence risk (HR 1.9)	< 0.01

The model (Nagelkerke $R^2 = 0.37$) shows that arterial hypertension (AH) provides the largest individual contribution ($\beta = 0.38$; 34% of the total variance), followed by type 2 diabetes mellitus (T2DM) and age. Female sex increased overall morbidity but did not influence TIA severity after adjustment for age.

In urban patients, “metabolic” clusters dominate: dyslipidemia ↔ atherosclerosis ($r = 0.68$; $p < 0.01$) and physical inactivity ↔ obesity ($r = 0.65$). In the rural population, correlations were stronger between T2DM ↔ obesity ($r = 0.73$) and climate-induced dehydration ↔ arterial hypertension ($r = 0.70$). This confirms the need for different preventive strategies: metabolic control in urban areas and antihypertensive/cardioprotective measures in rural settings.

Targeted questioning revealed a positive family history of stroke and/or TIA in 28% of patients (n = 105). The presence of a family stroke history was associated with a younger age of onset (61.4 ± 8.2 years vs. 64.9 ± 9.1 years; $p = 0.03$) and doubled the risk of recurrent TIA within one year (HR 1.9; 95% CI 1.2–3.1).

CONCLUSIONS

1. Arterial hypertension is the main modifiable driver of TIA; its correction can prevent up to 34% of severe attacks.
2. Metabolic factors (T2DM, dyslipidemia, obesity) form the second most important risk contour, especially in urban environments.
3. Smoking and chronic ischemic heart disease increase hemodynamic instability, raising the likelihood of embolic episodes.
4. Among non-modifiable factors, age is critical: after 75 years, the risk of moderate/severe TIA nearly doubles.
5. Hereditary predisposition accelerates onset and worsens prognosis, supporting the need for screening first-degree relatives.

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