

Association of Raised Troponin Levels With Mortality in Acute Ischemic Stroke Patients

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Abstract: Troponin-T is a well-established cardiac biomarker used primarily in diagnosing myocardial infarction. However, its elevation in acute ischemic stroke (AIS) patients has been increasingly recognized as an indicator of poor prognosis. Elevated troponin-T levels may result from direct neurogenic myocardial injury or underlying cardiac pathology and may serve as a useful prognostic marker for mortality in stroke patients. **Objective:** To determine the association of raised troponin-T levels with short-term mortality in patients presenting with acute ischemic stroke. **Methods:** This prospective observational study was conducted at the Department of Medicine, Sir Ganga Ram Hospital, Lahore, from June 15, 2024, to December 14, 2024. A total of 200 patients with confirmed acute ischemic stroke were enrolled. Serum troponin-T levels were measured using centrifuged serum samples. Patients were categorized into two groups: Group A (raised troponin-T levels) and Group B (normal troponin-T levels). All patients were followed up for a period of 3 months to record mortality. Data were analyzed using SPSS v25. Mortality risk was compared between groups using Chi-square test, with relative risk (RR) and 95% confidence interval (CI) calculated. A p-value < 0.05 was considered statistically significant. **Results:** Among 200 patients, 67.5% (n = 135) were male and 32.5% (n = 65) were female. The mean age was 49.83 ± 7.79 years. Hypertension and diabetes were present in 49.0% and 37.0% of patients, respectively. Obesity was seen in 20.5% (mean BMI = 24.32 ± 1.87 kg/m²), and 34.0% were smokers. Overall mortality was 13.0% (n = 26). Group A (raised troponin-T) showed a significantly higher mortality rate of 20.0% (n = 20) compared to 6.0% (n = 6) in Group B (p = 0.003). The relative risk of mortality in Group A was 3.97 (95% CI: 1.50–10.22), indicating a strong association. **Conclusion:** Raised troponin-T levels are significantly associated with increased mortality in acute ischemic stroke patients. Routine assessment of troponin-T in such patients can aid in early risk stratification and guide intensive monitoring and management. Early identification of high-risk patients could reduce mortality and improve overall outcomes.

Keywords: Ischemic Stroke, Mortality, Troponin-T levels

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Introduction

Ischemic stroke is the most prevalent form of stroke, comprising about 87% of all stroke cases globally. Its incidence varies geographically, with higher rates seen in low- and middle-income countries due to limited access to preventive care and the growing prevalence of risk factors like hypertension, diabetes, obesity, and tobacco use. Aging populations and lifestyle shifts further amplify its global burden (1, 2). Pathogenetically, ischemic stroke results from reduced or interrupted blood flow to a part of the brain, commonly caused by arterial blockages (3). These blockages may stem from thrombus formation (often in major arteries like the carotid), embolism (frequently originating from cardiac conditions such as atrial fibrillation), or small vessel disease associated with chronic hypertension or diabetes (4, 5).

Ischemic stroke is a major public health concern in Pakistan, contributing significantly to morbidity and mortality. With an estimated stroke prevalence of 4.8%, ischemic stroke represents the majority of cases. The high burden is driven by the increasing prevalence of risk factors such as hypertension, diabetes, dyslipidemia, smoking, and physical inactivity, coupled with limited public awareness and preventive healthcare services (6). Delayed hospital presentation and low utilization of advanced treatments like thrombolytic therapy further worsen patient outcomes (7). Elevated troponin-T levels in patients with acute ischemic stroke are a significant indicator of poorer outcomes and increased mortality risk. While troponin-T is primarily a marker of myocardial injury, its elevation in stroke patients can result from multiple factors (4). These include concurrent cardiac conditions, such as coronary artery disease, or neurogenic myocardial injury caused by stroke-induced autonomic

dysfunction. This dysfunction can lead to excessive catecholamine release, resulting in myocardial stress and subsequent troponin elevation. Research has consistently demonstrated that higher troponin-T levels are associated with more severe strokes, greater incidence of complications like arrhythmias, and higher rates of both in-hospital and long-term mortality (8). Therefore, assessing troponin-T levels in acute ischemic stroke patients provides valuable prognostic insight and aids in identifying individuals who may require intensive cardiovascular monitoring and management (9-11).

There is a strong association of troponin levels with mortality in stroke patients but no study was done in the community of Pakistan. So that we will conduct this study for the analysis of troponin levels in stroke patients.

Methodology

This cohort study was done at Department of Medicine Sir Ganga Ram Hospital Lahore in patients presenting in Emergency and Indoor of Medicine from 15-06-2024 to 14-12-2024 using Non- probability consecutive sampling technique. The data was collected from 200 (100 in each group) patients using this P1 = 17 % versus 2 % mortality in raised troponin T levels and normal levels, respectively (12).

$n = \frac{(Z_{\alpha/2} + Z_{\beta})^2 * (P1 * (1 - P1) + P2 * (1 - P2))}{(RR^2 * P1 * (1 - P1) + RD^2)}$, assuming $\alpha = 0.05$, $\beta = 0.20$ (corresponding to a power of 0.80).

Patients with ischemic stroke of either sex aged between 18 to 60 years were included in our study. Stroke was defined as sudden onset of any following symptoms such as; Trouble speaking and understanding what



others are saying, paralysis or numbness of the face, arm or leg which are consistent with radiological findings such as CT Scan of brain showing hypodense area consistent with clinical findings. Patients suffering from renal disease that is with eGFR < 60mL/min/1.73m, significant comorbid cardiac diseases including myocardial infarction, fulminant hepatic failure, myocarditis, cardiomyopathy, infective endocarditis, hemorrhagic stroke and those not giving consent of participation were excluded from our study.

All stroke patients with blood sample for trop -T were included. Clinical characteristics were recorded using a standardised questionnaire. Comorbidities relevant for this analysis were assessed on presentation and as judged by the doctor. Troponin level was considered raised above the normal value given by the lab. However, in general, the normal range of troponin levels is typically considered to be less than 0.03 ng/mL (nanograms per milliliter) for high-sensitivity troponin assays. Troponin level was measured in the patients within 12 to 24 hours of stroke onset. Blood sample was drawn for the separation of serum at 3000rpm in centrifuged machine. Serum was used for the analysis and for the finding of troponin value.

Group A: Raised levels of Troponin

Group B: Normal level of Troponin

All patients in the group A and B were followed-up for upto 3 months. All the data was analysed by SPSS version 23.0 and quantitative variables like age and troponin levels were presented by mean and SD. All

qualitative variables like medical history, stroke characteristics and mortality was reported by frequency and percentage. To examine the association between raised troponin-T levels and mortality outcomes using appropriate statistical tests, such as chi-square test and odds ratios were calculated. Adjustments for potential confounding variables, such as age, stroke severity, and comorbidities, were made in the analysis.

Results

Of these 200 study cases, 135 (67.5 %) were male patients while 65 (32.5 %) were female patients. Mean age of our study cases was 49.83 ± 7.79 years (range; 35 years to 65 years). Mean age of the male patients was 51.00 ± 7.78 years and for female patients was 47.38 ± 7.28 years ($p=0.002$) and 151 (75.5 %) were aged more than 40 years. Of these 200 study cases, 86 (43.0 %) belonged to rural areas and 114 (57.0 %) belonged to urban areas. Poor socioeconomic status was noted in 75 (37.5%) while 125 (62.5%) were middle income. Diabetes was present in 74 (37.0 %) and 98 (49.0 %) of our study cases were hypertensive. Mean body mass index was 24.32 ± 1.87 kg/m² and 41 (20.5 %) were obese while 68 (34.0%) were smokers. Mortality was noted in 26 (13.0%) of our study cases, Mortality in group A was noted to be in 20 (20.0%) versus 6 (6.0%) in group B ($P = 0.003$), $RR = 3.97$ (1.50 - 10.22 at 95 % CI).

Table 1: Baseline characteristics in both groups. (n=200)

Characteristics	Groups		P value
	Group A (n = 100)	Group B (n = 100)	
Gender			
Male (n= 135)	64(64.0 %)	71(71.0 %)	0.291
Female (n=65)	36 (36.0 %)	29 (29.0 %)	
Age groups			
≤40 Years (n= 49)	22 (22.0%)	27 (27.0 %)	0.411
> 40 Years (n=151)	78 (78.0%)	73(73.0 %)	
Residential status			
Rural (n= 86)	41 (41.0 %)	45 (45.0 %)	0.568
Urban (n=114)	59 (59.0 %)	55 (55.0 %)	
Socioeconomic status			
Poor (n=75)	37(37.0 %)	38 (38.0 %)	0.584
Middle Income (n=12)	63 (63.0 %)	62 (62.0 %)	
Diabetes			
Yes (n=08)	34 (34.0%)	40 (40.0 %)	0.380
No (n=52)	66 (66.0%)	60 (60.0 %)	
Hypertension			
Yes (n=14)	50 (50.0 %)	48 (48.0 %)	0.776
No (n=46)	50 (50.0 %)	52 (52.0 %)	
Obesity			
Yes (n=10)	18 (18.0 %)	23 (23.0 %)	0.381
No (n=50)	82 (82.0 %)	77 (77.0 %)	
Smoking			
Yes (n=68)	30 (30.0%)	38 (38.0%)	0.232
No (n=132)	70 (70.0%)	62 (62.0 %)	

Table 2: Distribution of mortality among study cases. (n = 200)

Mortality (n=200)	Group A		Group B	
	Frequency	%	Frequency	%
Yes n = 26 (13.0 %)	20	20.0	06	6.0
No n= 174 (87.0 %)	80	80.0	94	94.0
Total	100	100	100	100

* $P=0.003$, $RR = 3.91$ (1.50 - 10.22 at 95 % CI).

Discussion

Ischemic stroke is a major cause of mortality in Pakistan, highlighting critical gaps in the healthcare system. High death rates are primarily driven by delayed patient presentation, limited availability of thrombolytic therapy and the scarcity of specialized stroke care facilities (13). Public awareness of stroke symptoms and the urgency of early medical intervention remains low which lead to significant treatment delays. Furthermore, systemic challenges such as inadequate emergency response systems, limited diagnostic resources and a shortage of trained neurologists contribute to the poor outcomes (14).

Of these 200 study cases, 135 (67.5 %) were male patients while 65 (32.5 %) were female patients. Alhazzani et al (15) from Saudi Arabia reported 62.12 % male patients with ischemic stroke. An American study conducted by Brewer et al (16) has also reported similar results. Ken - Dror et al (17) from United Kingdom has also reported 70.7 % male patients in ischemic stroke patients. Similarly, Gajurel et al (18) from Nepal has also reported 53.1 % male patients with ischemic stroke. A Chinese study conducted by Bai et al (19) also reported 64 % male patients with ischemic stroke.

Mean age of our study cases was 49.83 ± 7.79 years (range; 35 years to 65 years). Mean age of the male patients was 51.00 ± 7.78 years and for female patients was 47.38 ± 7.28 years ($p=0.002$) and 151 (75.5 %) were aged more than 40 years. Alhazzani et al (15) from Saudi Arabia also reported similar trends in ischemic stroke patients. An American study conducted by Brewer et al (16) has also reported higher results with 67.73 ± 14.69 years mean age in ischemic stroke, the reason for this difference is due to our methodology as our study included only patients with maximum 60 years of age. Ken - Dror et al (17) from United Kingdom has also reported 50.9 ± 9.7 years mean age of the ischemic stroke patients, similar to our results. Gajurel et al (18) from Nepal has also reported 60.15 ± 16.5 years mean age of the patients with ischemic stroke. A Chinese study conducted by Bai et al (19) also reported 63.27 ± 11.32 years mean age of the patients with ischemic stroke.

Diabetes was present in 74 (37.0 %) and 98 (49.0 %) of our study cases were hypertensive. Alhazzani et al (15) from Saudi Arabia also reported 49.4 % diabetes and 57.7 % hypertension in patients with ischemic stroke. An American study conducted by Brewer et al (16) has also reported similar results with diabetes was 36.7 % and hypertension was 78.8 % in ischemic stroke. Ken - Dror et al (17) from United Kingdom has also reported 46.1 % diabetes and 58.6 % hypertensive patients in ischemic stroke patients. Gajurel et al (18) from Nepal has also reported 18.6 % diabetes and 35 % hypertensive patients with ischemic stroke. A Chinese study conducted by Bai et al (19) also reported 26 % diabetes and hypertension each in patients with ischemic stroke.

Mean body mass index was 24.32 ± 1.87 kg/m² and 41 (20.5 %) were obese while 68 (34.0%) were smokers. Alhazzani et al (15) from Saudi Arabia reported 42.0 % obesity and history of smoking was 10.0 % in patients with ischemic stroke. An American study conducted by Brewer et al (16) has reported 28.18 ± 7.01 kg/m² mean BMI and 26.5 % smoking in ischemic stroke which is higher than our patients. The reason can be demonstrated by the fact of higher obesity trends in American population in comparison with our South Asian population. Ken - Dror et al (17) from United Kingdom has also reported 32.0 % smoking, 24.7 ± 3.7 kg / m² mean body mass index and 27.0 % obesity in patients with ischemic stroke patients. Gajurel et al (18) from Nepal has also reported 57.9 % obesity and 59.3 % smoking in patients with ischemic stroke which shows higher trends of obesity as compared with our patients. A Chinese study conducted by Bai et al (19) also reported 28.35 ± 3.66 kg / m² mean BMI and 50 % smoking rate in patients with ischemic stroke.

Stroke outcomes in Pakistan are often poor due to late diagnosis, insufficient access to specialized stroke care, and a lack of comprehensive rehabilitation services. Mortality rates are high, and survivors frequently endure significant disabilities, adversely affecting their quality of life. Socioeconomic inequalities exacerbate these challenges, as many patients

face barriers to affordable treatment and long-term care. To mitigate the burden of ischemic stroke in Pakistan, targeted public health strategies are essential, including widespread education on risk factor management, improved access to timely interventions, and the development of dedicated stroke care units to enhance survival and recovery outcomes. Mortality was noted in 26 (13.0%) of our study cases, Mortality in group A was noted to be in 20 (20.0%) versus 6 (6.0%) in group B ($P = 0.003$), $RR = 3.97$ (1.50 - 10.22 at 95 % CI). The frequency of mortality in raised trop - T was 17 % versus 2 % in control subjects (12) . These results are close to our study results. Another study conducted by Alhazzani et al (7) has also demonstrated significant association of raised troponin T level with in-hospital mortality in ischemic stroke ($RR = 2.34$, 95 % CI, 1.30 - 3.38).

Conclusion

Our study results indicate high frequency of mortality in patients with raised troponin T levels with ischemic stroke. There was significant association of raised troponin T levels with mortality as compared to those with normal troponin T levels in ischemic stroke patients. All the clinicians treating such patients of ischemic stroke should monitor for troponin T levels which will save them from future adverse events. This will decrease disease morbidity, mortality and prolonged hospitalizations in these patients.

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-IDKKD-02089-23)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

MJ (Resident)

Manuscript drafting, Study Design,

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Review of Literature, Data entry, Data analysis, and drafting articles.

ZA (Resident)

Conception of Study, Development of Research Methodology Design,

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Study Design, manuscript review, critical input.

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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