Original Article

Study on association of Troponin-I level in adult NS1 positive dengue patients in a tertiary care hospital of Bangladesh

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ABSTRACT

Background: Dengue fever is a viral disease which is transmitted by Aedes mosquitoes. It has become a significant public health concern in Bangladesh. The clinical symptoms of dengue fever are often self-limiting. But severe cases can lead to different types of complications especially cardiac complications. Troponin-I is a cardiac biomarker which is elevated in myocardial injury. Its association with dengue virus infection, particularly the dengue patients who are NS1 antigen positive, remains understudied. **Objective:** This objective of this study is to find out the association of Troponin-I level with dengue infection in adult NS1 positive dengue patients in a tertiary care hospital in Bangladesh. **Methods:** A cross-sectional study was conducted on adult patients diagnosed with dengue fever and confirmed by positive dengue NS1 antigen at a tertiary care hospital. The levels of Troponin-I were measured and correlated with clinical symptoms, duration of disease, and other relevant laboratory findings. Data analysis included statistical methods to evaluate the significance of Troponin-I as a marker for cardiac involvement in dengue. **Results:** The study examined the demographic data, clinical characteristics, and laboratory findings of 52 participants, divided into Troponin-I positive (n=16) and Troponin-I negative (n=36) groups. Significant differences were observed in gender distribution and socioeconomic status. Troponin-I positivity was most prevalent among older individuals (>46 years, $p < 0.001$). Clinical parameters showed strong associations with symptoms such as chest pain, headache, and vomiting ($p < 0.001$). Additionally, laboratory analysis identified significant variations in hemoglobin, RBC count, serum bilirubin, SGPT, and creatinine levels ($p < 0.05$). These findings highlight key clinical and laboratory distinctions between Troponin-I positive and negative groups, offering valuable insights into their diagnostic and prognostic significance. **Conclusion:** This study shows distinct demographic, clinical, and laboratory patterns among patients of dengue fever with positive dengue NS1 and positive Troponin-I. Troponin-I positivity in dengue patients is significantly associated with older age, clinical symptoms and laboratory abnormalities, while dengue NS1 positive younger individuals with negative Troponin-I were found to developed milder symptoms. Gender differences and symptoms variability underscore the need for tailored, age-specific diagnostic and therapeutic strategies.

Key words: Dengue fever, Troponin-I, NS1, Cardiac complications.

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Introduction:

Dengue fever is a significant public health concern affecting over 100 countries across tropical and subtropical regions in the world. Each year, approximately 96 million individuals are affected

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by dengue virus according to World Health Organization's (WHO) classification of 2009.[1] Dengue virus infection presents a wide range of clinical manifestations, from asymptomatic cases to more severe forms, including dengue fever, dengue hemorrhagic fever and dengue shock syndrome.[2]

Dengue has emerged as a significant infectious disease in Bangladesh, causing numerous deaths and contributing to the national disease burden.[3] Dengue remains a relatively recent challenge in Bangladesh. The incidence of dengue has risen sharply over the past two decades, making it a significant global health concern in recent years.[4]

Healthcare professionals have gained valuable experience in managing dengue patients with the help of national and international guidelines. The high mortality and morbidity rates continue to exert immense pressure on the already overburdened healthcare system.[5] In addition to high fever, a hallmark of this vector-borne illness and other clinical manifestations of dengue have evolved over time, adding complexity to its management.

Compounding the challenge, dengue often co-circulates with seasonal flu, leading to diagnostic confusion and delays in treatment.[6] It is necessary for physicians to familiarize themselves with both common and uncommon presentations of dengue to enable early suspicion and diagnosis. In dengue virus infection cardiovascular involvement is frequently found and it is due to the result of myocardial inflammation due to direct invasion by viruses and the production of inflammatory cytokines and free oxygen radicles.[7] In Thailand, among studies, the incidence of cardiac involvement in dengue viral infection varies from 15 to 40%.[8-9] Various forms of cardiac involvement in dengue viral infection include transient atrioventricular block, relative bradycardia, myocarditis, acute pulmonary edema , cardiogenic shock etc.[10-12] Although severe cardiac complications, such as myocarditis, have been reported in the literature, few sectional or cohort study studies have been during dengue infection.[13-16] The prevalence of myocarditis in the worst dengue outbreak was 11.28% in China, and incidence of myocarditis increased with disease severity.[17]

This study aims to explore the association of Troponin-I levels with dengue infection in adult NS1 positive dengue patients at a tertiary care hospital in Bangladesh.

Materials and methods

This cross-sectional analytical study was conducted among confirmed dengue patients at the Department of Biochemistry, Z.H Sikder Womens Medical College, Rayerbazar, Dhaka. Total of 52 participants were selected through purposive sampling between January and June 2024, with informed written consent obtained from each individual. For all cases comprehensive histories were taken, relevant investigations were recorded as clinically indicated and Troponin-I test was done.

Inclusion criteria

Male and female adult patients presented with fever and tested positive for non-structural protein 1 (NS1).

Exclusion criteria: Patients unwilling to participate, patients with significant comorbidities and patients under 18 years.

Results

The socioeconomic stratification highlighted potential environmental or lifestyle contributors to the studied conditions. Among the patients who developed both Troponin-I and NS1 positive, the gender distribution indicated a slightly higher proportion of male (61.5%) compared to female (38.5%). p-value<0.001 suggested statistical significance. This aligns with observations in other studies where males are often more exposed to risk factors associated with certain medical conditions.

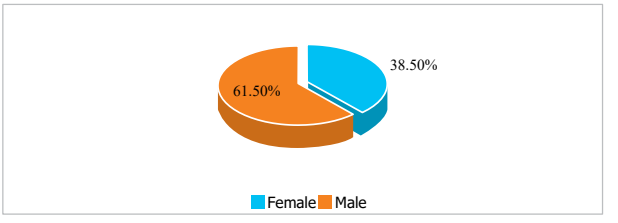

Figure 1: Gender distribution of the study subjects (n=52)

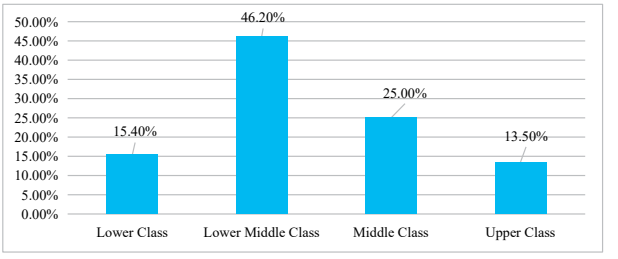

Figure 2: Bar diagram shows the socioeconomic conditions of the study subjects (n=52)

Table 1: Age category of the study subjects in both group (n=52)

Age Category	Troponin-I		NS1		P value
	Positive (n=16)	Negative (n=36)	Positive (n=52)	Negative (n=0)	
18-30	0(0%)	21 (58.33%)	22 (42.30%)	0 (0%)	-
31-45	5 (31.25%)	10 (27.78%)	13 (25.00%)	0 (0%)	-
46-60	11 (68.75%)	5 (13.89%)	17 (32.70%)	0 (0%)	<0.0001*

* Significant, p-value calculated by chi-square test.

The data reveals a significant association between age categories and Troponin-I and NS1 positivity (p<0.0001). Among individuals aged 46-60 the highest Troponin-I positivity (68.75%) was observed suggesting a greater likelihood of cardiovascular involvement with advancing age. In difference the 18-30 age group exhibited the highest NS1 positivity (42.30%), indicating a stronger prevalence of NS1 detection in younger individuals. The 31-45 age group showed intermediate levels for both markers, with 31.25% testing positive for Troponin-I and 25.00% for NS1.

Table 2: Demographic characteristics of study subjects in both groups (N=52)

Variables	Total	Troponin-I		NS1		P value
		Positive (n=16)	Negative (n=36	Positive (n=52)	Negative (n=0)	
Total (n%)	52	16 (30.8%)	36 (69.2%)	52(100%)	0(0%)	-
Age(Mean±SD)	42.14±17.41	59.21± 11.17	32.73±14.41	39.43±18.32	-	0.251
Male	39.66± 20.02	10 (62.5%)	22 (61.11%)	32 (61.5%)	0(0%)	<0.001*
Female	37.35± 19.19	6 (37.5%)	14 (38.89%)	20 (38.5%)	0(0%)	<0.001*

*Significant, p-value calculated by independent t-test, chi-square test

The average age of the Troponin-I positive group (59.21 years) was significantly greater than that of the NS1 group (39.43 years) (Table 2) where p value is not significant., suggesting that age may be a potential risk factor for outcomes associated with Troponin-I.

Table 3: Clinical symptoms for the study subject in both groups (N=52)

Variables	Total	Troponin-I		NS1		P value
		Positive (n=16)	Negative (n=36)	Positive (n=52)	Negative (n=0)	
Duration of Fever days) (Mean±SD)	7.71± 2.16	9.15± 2.25	7.07±1.07	7.31±2.21	-	0.066
Duration of Hospital Stay (days)(Mean±SD)	6.66± 3.53	9.83± 3.21	5.35±2.34	6.61± 3.22	-	0.988
History of Body Pain (%)	14 (26.9%)	04 (25.00%)	10 (27.77%)	14 (26.9%)	0(0%)	<0.001*
History of Headache (%)	37 (71.2%)	10 (62.50%)	27 (75%)	37 (71.2%)	0(0%)	<0.001*
History of Vomiting	49 (94.2%)	16 (100%)	33 (91.66%)	49 (94.2%)	0(0%)	<0.001*
History of Weakness (%)	11 (21.2%)	3 (18.75)	8 (22.22%)	11 (21.2%)	0(0%)	<0.001*
History of Nausea (%)	12 (23.1%)	4 (25.00%)	7 (19.44%)	12 (23.1%)	0(0%)	<0.001*
History of Chest Pain (%)	19 (36.5%)	15 (93.75%)	4 (11.11%)	19 (36.5%)	0(0%)	<0.001*

* Significant, p-value calculated by independent t-test, chi-square test.

Troponin-I positive individuals had longer durations of fever (9.25 days compared to 7.17 days) and hospital stays (9.81 days compared to 5.25 days). They also showed higher rates of chest pain (93.75%) and vomiting (100%), highlighting the more severe nature of their clinical condition. The occurrence of chest pain, body pain, weakness, nausea and vomiting in relation to Troponin I and NS1 positivity are statistically significant ($p < 0.001$).

Table 4: Laboratory findings in subjects in both groups (N=52)

Variables	Troponin-I		NS1		P value
	Positive (n=16)	Negative (n=36)	Positive (n=52)	Negative (n=0)	
CBC (Hb g/dL)	13.23± 2.15	13..14±1.39	13.32± 1.60	-	0.008*
Total RBC (millions/)	4.55± 0.76	4.76± 0.44	4.70± 0.56	-	0.006*
Total WBC (cells/)	5019.50 ±2409.75	9646.39 ±16244.89	8084.27± 13677.35	-	0.142
Platelet count (mc/L)	141937.50± 61174.57	147916.67± 59734.35	146076.92±59642.34	-	0.575
S. Bilirubin (mg/dL)	0.86± 0.24	0.79± 0.17	0.81±0.19	-	0.038*
SGPT (U/L)	109.50±62.42	44.64± 25.35	60.60±50.01	-	<0.001*
SGOT (U/L)	53.44± 18.86	32.69± 13.93	39.08± 18.20	-	0.075
Alkaline Phosphatase (IU/L)	221.25± 52.13	183.42± 42.71	195.06± 48.60	-	0.396
S.Creatinine (mg/dL)	1.69± 2.29	0.78± 0.23	1.06± 1.33	-	0.010*
B.Urea (mg/dL)	39.06± 7.996	26.58± 6.80	30.42± 9.18	-	0.540
CRP (mg/L)	14.91± 23.14	18.35± 28.19	17.29± 26.56	-	0.611

** Significant, p-value calculated by independent t-test.*

Lower in Troponin-I positive subjects ($p = 0.008$), possibly reflecting anemia of chronic disease. Elevated SGPT ($p<0.001$) and S.Creatinine ($p=0.010$) in Troponin-I positive subjects point toward liver and renal dysfunction. Slight reductions in RBC count and no significant platelet difference suggest selective impacts on hematological parameters.

Discussion

Dengue fever, commonly referred to as break bone fever due to the severe musculoskeletal pain it can cause, is a vector-borne viral illness. The virus, which exists in four serotypes (DENV 1, 2, 3, 4) is transmitted by Aedes mosquitoes.[4] In Bangladesh, all four serotypes are present; however, until 2002, DENV 3 was the predominant strain.[5,6] This serotype re-emerged as a dominant threat in 2018.[18] During the intervening years, DENV 2 and DENV 3 were the primary circulating serotypes responsible for outbreaks.[19]

This study analyzed the demographic, clinical and laboratory characteristics of 52 subjects divided into groups based on Troponin-I and NS1 test results. Gender distribution (Figure 1) revealed a slightly higher proportion of males (61.5%) compared to females (38.5%). Another study was found majority of the participants were female (67%) and most of the cases were from rural areas (52%). The mean age of the participants was 33 years with a range of 19 to 77 years.[20] Socioeconomic conditions (Figures 2) illustrated the diversity of the study population.

Our study revealed a significant age-wise distribution (Table 1), with the highest Troponin-I positivity in the 46–60 age group (68.75%) and NS1 positivity primarily in the 18–30 age group (42.30%), indicating a strong age-related association ($p<0.001$). Demographic analysis (Table 2) showed that Troponin-I-positive individuals were older (mean age: 59.21 ± 11.17) compared to NS1-positive patients (mean age: 39.43 ± 18.32). Additionally, both groups exhibited a male predominance, with significant gender-related differences ($p<0.001$). Our study found that the majority of dengue-affected patients were young, consistent with findings from other studies.[21]

Clinical data (Table 3) indicated that Troponin-I-positive patients had longer hospital stays (9.15 ± 2.25 days) and a higher prevalence of chest pain (93.75%, $p<0.001$) compared to those positive for NS1. Vomiting was a frequent symptom in both groups (94.2%). Additionally, laboratory results (Table 4) highlighted significant differences in hemoglobin, RBC, bilirubin, SGPT, and creatinine levels, with Troponin-I-positive patients exhibiting more pronounced abnormalities ($p<0.05$ for all).

Our study showed a higher prevalence of gastrointestinal symptoms compared to recent studies.[22,23] The most common bleeding manifestations were epistaxis and melaena which aligns with findings from other research.[24] These bleeding symptoms were notably more frequent in severely affected subjects, consistent with recent studies.[25]

Overall, the results suggest that in dengue patients Troponin-I positivity is associated with older age, more severe symptoms, and greater laboratory abnormalities, while the group of dengue patients with negative Troponin I is linked to a younger demographic with less severe clinical manifestations. These findings underscore the need for age-specific diagnostic and therapeutic approaches in managing such conditions.

Conclusion

This study provides valuable insights into the demographic, clinical, and laboratory profiles of patients categorized by Troponin-I and NS1 test results. The findings reveal distinct patterns, with dengue patients with Troponin-I positivity associated with older age, more severe clinical presentations, and significant laboratory abnormalities, whereas Troponin negative NS1 positivity predominantly affects younger individuals with relatively milder manifestations. The significant gender-based differences and symptoms variability highlight the importance of tailored diagnostic and therapeutic strategies. These results underscore the necessity for an age-specific and symptom-oriented approach in managing dengue patients with these clinical profiles, aiming to improve outcomes and resource allocation in healthcare settings.

Limitations

This study's small sample size and single-center design may limit the generalizability of the findings. The cross-sectional study precludes establishing causality or long-term outcomes. Relevant factors such as comorbidities, lifestyle habits, and socioeconomic details were not explored. Advanced diagnostic markers were not utilized. Additionally, the absence of follow-up data and potential selection bias may affect the representativeness and applicability of the results.

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