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Elevation of Troponin I in Ischemic Stroke of Outcomes in Patients with Acute Stroke

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ABSTRACT

Background: Stroke is the second leading cause of death in the world, comprising approximately 10% of all deaths. Troponin is a sensitive marker of myocardial injury. Rise in serum troponin is characteristic for myocardial ischemic injury; however it can rise in several other conditions (e.g. renal failure, heart failure, pulmonary edema, and sepsis). Stroke is the second leading cause of death worldwide, comprising approximately 10% of all deaths. A substantial number of stroke patients have elevated cardiac troponin levels and are associated with poorer prognosis.

Methods: This prospective observational study was done at the department of neurology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from January to 100 acute ischemic stroke patients was enrolled. Data included vital signs, laboratory parameters, and clinical features evaluated at the time of admission. The National Institute of Health Stroke Scale (NIHSS) and modified Rankin Scale (mRS) were used to assess stroke severity and outcomes.

Results: A total of 100 patients with acute ischemic stroke were enrolled in the study, and clinical and demographic characteristics the mean age was 58.68 ± 17.36. The mean age of patients in both groups. Elevated troponin I (>0.034 mg/ml) was observed in eight (8.00%) patients. Compared to patients with normal troponin I, patients with elevated troponin I were older (mean age 61 *vs.* 59.68 years), had higher blood glucose(10.6 *vs.* 7.04 mmol/L), higher median white blood cells (9.3 *vs.* 8.9 1,000/m^3) and creatinine levels(118.5 µmol/L *vs.* 94.9 µmol/L), higher mean NIHSS scores on admission (15 *vs.* 8.6), and discharge (13.5 *vs.* 6.8), higher median mRS scores(4.13 *vs.* 1.8) at discharge (p^{13} (OR 15.902; 95%CI (3.6569.28), p=0.029 mg/mL (odds ratio (OR):28.451; 95% CI (2.785-290.6), p=0.005) were significant predictors of poor outcomes. Significant predictor of in hospital mortality only included troponin I level >0.04 ng/mL (OR 0.071; 95% CI (0.005-1.037), P=0.05).

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White blood cells (1000/mm^3)**	8730.04	2937.88	9363.41	3228.4	0.325
Glucose (mmol/l)**	7.23	4.22	7.5	5.16	0.784
Creatinine(µmol/L)**	88.86	24.32	112.58	59.55	0.007
Troponin I (ng/mL)**	0.013	0.0032	0.029	0.038	0.001
NIHSS score (on admission)**	7.1	3.51	12.44	4.65	<0.001
NIHSS Score (on discharge)**	5.1	3.085	11.4	4.43	<0.001
Modified rankin scale**	1.16	0.751	3.71	1.06	<0.001
Length of stay (days)**	9.43	4.18	11.09	7.54	0.025
Cardioembolism*	2		12	0.158	
Male sex*	9		30	0.291	

In hospital, deaths were associated with higher total counts (11903, p=0.02), creatinine levels (157.6, p=0.001), and troponin I levels (0.043 ng/mL, p=0.016). NIHSS score on admission did not show a significant association with in hospital mortality. Length of stay was also similar between the groups. Dichotomous analysis showed a significant correlation between death and cardioembolic stroke. Age and sex were not associated with in hospital death, as shown in Table 6.

Table 6: Correlation of clinical features and in hospital mortality in 100 acute ischemic stroke patients Data presented as *number (percent) and **mean ± S.D.

Characteristics	**Death**				**P value**
	Yes(n=5)		**No(n=95)**		
	Mean	S.D.	Mean	S.D.	
Mean Age(years)**	68	18.33	58.3	16.91	0.242
Systolic pressure(mmHg)**	127	18.235	133.78	24.74	0.564
Diastolic pressure(mmHg)**	83	22.02	82.85	13.82	0.983
Heart rate(Bpm)**	84.6	4.09	82.14	10.77	0.643
White blood cells(1000/mm^3)**	11903	5442.97	8789.1	2824.07	0.025
Glucose(mmol/l)**	5.94	1.11	7.39	4.64	0.22
Creatinine(µmol/L)**	157.6	97.28	93.68	34.24	0.001
Troponin I(ng/mL)**	0.043	0.037	0.01743	0.022	0.016
NIHSS Score(on admission)**	10.8	7.25	9.16	4.824	0..470
Modified Rankin Scale**	6		1.81	1.199	<0.001
Length of stay(days)**	11	11.787	10.24	5.15	0.5

Cardioembolism*	2(40%)	22(23.15%)	<0.001
Male gender*	3(60%)	46(48.42%)	0.598

Multiple regression analysis of the significant dichotomous variables was done with cut-off levels according to the mean values of poor outcomes. Multiple logistic regression analysis revealed that NIHSS score on admission >13 (odds ratio (OR) 15.902; 95%CI (3.65- 69.28), p=<0.001) and abnormal troponin I level, troponin I>0.029 mg/mL) (odds ratio (OR): 28.451; 95% CI (2.785- 290.6), p=0.005) were significant predictors of poor outcomes; however, creatinine levels did not show any significance in predicting the outcomes, as shown in Table 7.

Table 7: Regression model of factors influencing outcomes in 100 patients with acute ischemic stroke.

Characteristics	B	S.E.	Wald	Df	P value	Expo (B)	95% CI for EXP(B)	
							Lower	Upper
NIHSS score on admission >13	2.766	0.751	13.572	1	0	15.902	3.65	69.287
Creatinine> 113 µmol/L	1.047	0.87	1.45	1	0.229	2.849	0.518	15.661
Troponin I>0.029 ng/mL	3.348	1.186	7.974	1	0.005	28.451	2.785	290.63
Constant	9.417	1.943	23.501	1	0	0		4

Only troponin I level>0.04 ng/mL (odds ratio (OR) 0.071; 95% CI (0.005-1.037), P=0.05) was a significant predictor of in-hospital mortality, as shown in Table 8.

Table 8: Regression model of factors influencing deaths in patients with acute ischemic stroke.

Characteristics	Std. Error	Wald	Sig.	Expo(B)	95% confidence interval for Expo(B)	
					Lower	Upper
TotalWBC>11900	1.117	3.037	0.081	0.143	0.016	1.275
Creatinine>158 µmol/L	1.328	3.347	0.067	0.088	0.007	1.189
Troponin I>0.04 ng/mL	1.368	3.737	0.05	0.071	0.005	1.037

DISCUSSION

Stroke is the second fourth most common cause of death, after Ischemic Heart Disease (IHD); meanwhile, IHD is the second most common cause of death after stroke. This study demonstrates the prognostic significance of elevated troponin in patients with ischemic stroke. Patients with increased troponin I had increased chances of unfavorable functional outcomes at discharge and mortality. Troponin I is a highly sensitive and specific marker of acute myocardial infarction. Hence other cardiac biomarkers were not considered for evaluation in this study. Elevated troponin I am characteristic of a number of cardiac diseases as well such as heart failure, pericarditis, myocarditis, atrial fibrillation, and tachycardia. Elevated troponin I have also been found in patients with chronic renal failure, sepsis, critical illness, pulmonary embolism, chronic obstructive pulmonary disease, and stroke [17]. Elevated levels of cardiac troponin have been reported in 10-34% of patients with acute stroke. Some studies reported that elevated troponin levels were more common in patients with stroke due to cardio embolism, who also had evidence of atrial fibrillation, ischemic heart disease, or heart failure [18,19]. Abnormal troponin I levels were observed in 8.00% of the patients in our study. We found that patients with

abnormal troponin I was more likely to have large artery atherosclerosis and cardio embolism. Patients with elevated troponin I levels were older and had higher creatinine levels and blood glucose levels than patients with normal troponin I levels. Patients with elevated troponin I presented with more severe initial stroke severity. Worse outcomes and higher in hospital mortality were observed in patients with abnormal troponin I, similar to those reported by Di Angel Antonio [20]. Increase in catecholamine release as a result of hypo perfusion of the posterior hypothalamus occurs in neurologic causes resulting in autonomic nervous system imbalance and increased sympathetic output. Involvement of the insular cortex is known to be associated with more frequent occurrences of cardiac complications after acute stroke. Brain magnetic resonance imaging to identify the precise location of the stroke was not performed in all patients; therefore, we were not able to analyze the involvement of the insular or parietal cortex. Higher troponin levels were associated with the severity of stroke rather than the location of stroke. Abnormal troponin levels were more likely to be due to cardiac and renal causes than the cerebral causes. The average age of patients with abnormal troponin I, patients with poor outcomes, and patients who died in the hospital in this study was approximately 65 years. reported that age ≥ 76 years was independently associated with elevated troponin levels in patients with acute ischemic stroke. But in our study, age was not significantly different between the groups. In our study, blood glucose was significantly elevated in the positive troponin I group however was not associated with poor outcomes. Similarly, elevated creatinine level >112 µmol/L at the time of admission was associated with poor outcomes of stroke. Showed that elevated creatinine levels at the time of admission were associated with increased mortality in stroke patients. With the exception of the NIHSS score on admission, only elevated troponin I was a strong independent predictor of both poor outcomes and death. Abnormal troponin I had an OR of 28.451 for poor outcomes and an OR of 0.071 for in hospital mortality. The American stroke association recommends the routine checking of markers of cardiac ischemia during acute stroke. Dynamic changes in the troponin levels (>50%) within 24 hour in stroke patients were better indicator for in hospital mortality than the patients whose troponin levels were elevated but remain stable. Elevation of troponin level has been associated with increased risk of mortality and disability compared to other factors as shown in multiple studies. In the present study, abnormal troponin I was a predictor of both poor outcomes and in hospital mortality. An NIHSS score ≥ 12 on admission was also a strong predictor of both poor outcomes and in hospital mortality. This study has a number of limitations. Cardiac illness like cardiomyopathy and heart failure were not excluded from the study. Troponin was only examined in a subgroup of patients and was not systematically assessed in all patients presenting with ischemic stroke. Troponin I was checked only once in each patient in the emergency room without a known lag time between exact time period of onset of symptoms and troponin measurement, without dynamic assessment.

CONCLUSION

Elevation of troponin I in ischemic stroke independently predicted unfavorable functional outcomes at discharge and in hospital mortality. Compared to other laboratory parameters, troponin I is a better predictor of outcomes of stroke. Careful and prompt evaluation of patients with acute stroke is needed in the setting of elevated troponin I.

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