Original Article

Association of Left Atrial Volume Index and In-hospital Outcome in Patients with Acute ST Segment Elevation Myocardial Infarction and It's Correlation with the Level of NT-proBNP

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Abstract:

Background: ST segment elevation myocardial infarction (STEMI) is associated with ventricular dysfunction due to ischemic myocardial damage, decrease ventricular compliance and increase filling pressure resulting in left atrial stretching, dilatation, increase left atrial volume and subsequently increase secretion of atrial natriuretic peptides. This study is aimed to determine the association between increase left atrial volume index (LAVI) and in-hospital outcome and to explore the correlation between LAVI and NT-proBNP in patients suffered from acute ST segment elevation myocardial infarction (STEMI).

Methods: This cross sectional analytic study include 92 patients with acute STEMI admitted for reperfusion therapy. 2D Echocardiography was done and based on LAVI, study population were grouped as Group A:LAVI >34 ml/m² (n=48) & Group B:LAVI d"34 ml/m2(n=44).

Results: In-hospital outcome, plasma level of NT-proBNP and echcardiographic evaluation was done successfully. Mean NT-proBNP was significantly high in Group A than Group B (1234.6±738.77 vs 689.52±721.04). Statistically significant association was present between LAVI and adverse in-hospital outcome. Persistent chest pain, hypotension, acute LVF, arrhythmia, acute kidney injury were higher in Group A than Group B and acute LVF occurred significantly (p<0.05) more in Group A than Group B (38.3% vs. 9.1%). Statistically significant correlation was present between LAVI and NT-proBNP (r=0.453; p=0.001). According to receiver-operating characteristic curve (ROC) analysis, LAVI with a cut off value of 33.75 ml/m² can predict adverse in-hospital outcome in patients of acute STEMI underwent reperfusion therapy with sensitivity 66.2% and specificity 75% and better than NT-proBNP with more sensitivity (66.2% vs 50.0%).

Conclusion: Significant association present between increase LAVI and adverse in-hospital outcome and it can predict adverse in-hospital outcome better than NT-proBNP. There is also positive correlation between LAVI and NT-proBNP in acute STEMI.

Key Words: *STEMI, LAVI, NT-proBNP, In-hospital outcome, 2D Echocardiography, Acute LVF.*

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Introduction:

Many factors have been shown to have prognostic value in STEMI. Demographic variables, symptoms, severity, physical signs, echocardioagraphic and radiological measurements, hemodynamic and neuro-hormonal parameters, high TIMI and Mayo risk score, reduced exercise capacity have been shown to be associated with poor outcome[1]. Various degrees of left ventricular systolic and diastolic dysfunction occur during STEMI[2]. It was demonstrated that left atrium (LA) size has a greater predictive value compared with left ventricular (LV) diastolic function measurements and filling pressures, which are substantially influenced by hemodynamics[3,4]. They concluded that LA enlargement implies a poor prognosis in patients with acute MI. The prognostic usefulness of LA volume persisted after adjustment for clinical predictors of outcome and conventional echocardiographic indices of LV systolic and diastolic function. If confirmed in prospective studies, measurement of LA volume could emerge as a simple and important tool for risk stratification and as a guide for future surveillance and therapy in patients with acute MI. The LA volume has been compared to the “glycated hemoglobin of diabetes mellitus”, as it is a reflection of long-standing hemodynamic condition. Estimation of LA volume by Simpson’s method of disc is well validated and recommended by the American Society of Echocardiography (ASE) guidelines. LA volume is then indexed to body surface area and called LAVI. The upper normal limit for 2D echocardiographic LA volume is 34 mL/m2 for both sexes[5]. Plasma concentration of NT-proBNP increases after acute myocardial infarction and this increase correlates to the severity of the infarction. Patients with smaller infarcts show an increase NT-proBNP 20 hours after the initiation of symptoms. Patients with larger infracts, lower ejection fraction and more frequent signs of heart failure, reach maximum BNP levels 5 days after admission. In the acute phase, NT-proBNP values do not reflect patient’s hemodynamic profile, but four days later BNP levels correlate well with the ejection fraction of the left ventricle and with pulmonary wedge pressure[6,7] . Patients with STEMI and short time of presentation may present with completely normal NT-proBNP, but level increases following reperfusion. NT-proBNP reflects ischemic burden, reperfusion success and prognosis, and the current data support repetitive sampling in patients with ACS[8] .NT-proBNP is an established risk scoring biomarker and it has independent prognostic value in determining adverse cardiovascular outcome like hypotension, left ventricular dysfunction, atrial fibrillation, conduction disturbances, re-infarction and death in patients who have an acute STEMI. By identifying association of increase LAVI with adverse in-hospital outcome and by exploring correlation between LAVI an NT-proBNP in the patients suffering from acute STEMI we can be able to predict averse in –hospital outcome by only doing the LAVI in any low resource setting hospital.

The clinical importance of the proposed study is that measuring left atrial volume index (LAVI) by 2D echocardiography and NT-proBNP in patients who have suffered an acute STEMI could provide valuable correlation among them and able to predict the adverse cardiovascular outcome by only doing the LAVI in any low resource setting hospital. Although the prognostic significance of elevated NT-proBNP is well known, the correlation with LAVI could also guide us to predict adverse cardiovascular outcome and may help explain the adverse outcome associated with LA dilatation in patients at the early stage of acute STEMI.

Methods:

This study was conducted in a single tertiary coronary care center National Heart Foundation Hospital and Research Institute(NHFH&RI), Mirpur, Dhaka from from May, 2017 to April, 2018. Patients with acute STEMI underwent reperfusion therapy were included in the study. 2D Echocardiography was performed, NT-proBNP and adverse in-hospital outcome was recorded very meticulously.

Study population

92 patients of acute STEMI admitted for reperfusion therapy were included in the study. Exclusion criteria were as follows: (a)Chronic atrial fibrillation; (b)Poor Echo window; (c)Patients with atrial infarction (elevated PR segment at leads I, II, III, V5, and V6; 0.15-mV depression at precordial leads or 0.12-mV depression at leads I, II, and III); (d)Patients with Killip class III heart failure or above; (e)Patients with any debilitating illness; (f)Patients with a history of prior MI, percutaneous coronary intervention (PCI), or coronary artery by-pass graft operation; (g)Patients with cardiomyopathy or moderate to severe valvular heart disease. All patients were evaluated and treated according to current guidelines. The regional committee for medical research and ethics approved the research protocol. All participants gave written informed consent.

Investigations:

Patient’s baseline 12 lead ECG, daily ECG with time and date including any new event like arrhythmia took at a paper speed of 25mm/sec and 10 mm standardization. Baseline investigations like blood sugar, HbA_1C, serum creatinine, fasting lipid profile, troponin-I, CK-MB, serum electrolytes done accordingly. Heparinized plasma was sent before the echocardiographic evaluation of the patient to measure the plasma level of NT-proBNP by radioimmunoassay. NT-proBNP value 100-900 pg/ml was considered normal and > 900 pg/ml was considered as higher value according to the reference range of the test kit and Getein1100 Immunofluorescence Quantitative Analyzer.

Echocardiography:

ECG guided transthoracic echocardiography was performed by using Vivid E9 made by GE Healthcare with a 2.5 MHZ phased array transducer by an experienced echocardiologist after reperfusion therapy. LA volume obtained from apical four chamber and apical two chamber view in end-systole before mitral valve opening by using the modified Simpson method. The American Society of Echocardiography(ASE) Guidelines recommended the biplane disk summation technique, which incorporates fewer geometric assumptions and the preferred method for measurement of LA volume. The upper normal limit for 2D echocardiographic LA volume is 34 mL/m2 for both genders. It was calculated using the disk summation technique by adding the volume of a stack of cylinders of height (h) and area calculated by orthogonal minor and major transverse axes (D1 and D2) assuming an oval shape[5].

$$\text{LA Volume} = \pi/4(h)\ \Sigma\ (D1)\ (D2)$$

LA volume is then indexed to body surface area as recommended by the American Society of Echocardiography. The upper normal limit for 2D echocardiographic LA volume is 34 mL/m2 for both genders[5]. Left ventricular ejection fraction (EF) was measured by using Simpson's biplane method.

Statistical Analysis:

Structured case record from was prepared for data collection which include particulars of the patients, baseline clinical variables, baseline heart failure status, distribution of risk factors, biochemical variables, echocardiographic variables, treatment strategies, in-hospital outcome. Comparison between groups were done by Student's T-test for continuous variables and categorical data were analyzed by chi-square test. The level of significance was set <0.05 (p value). Association of LAVI and adverse in-hospital outcome association of NT-proBNP level with adverse in-hospital outcome and correlation analysis between LAVI and NT-proBNP was performed and shown in different tables and figures. Correlation analysis was performed to assess the relationships between the LAVI and the NT-proBNP level. ROC curve of LAVI and NT-proBNP was drawn for prediction of adverse in-hospital outcome in the study population. Statistical analysis was performed using SPSS Version 22.0 software (SPSS Inc., Chicago, Illinois, USA).

Result:

A total of 92 consecutive patients were enrolled and divided into two groups on the basis of LAVI. In group A: LAVI >34 ml/m^2, 48 patients and in group B: LAVI d"34ml/ m2, 44 patients were assigned. Baseline data of all patients (n = 92) given in Table 1. It was observed that mean age was 55.15±11.93 years in Group A and 52.18±11.26 years in Group B. Higher study populations (38.8%) in Group B was in the 4^{th} decade and in group A was (35.4%) in the 5^{th} decade and age difference was statistically not significant between two groups. Male patients were 41(85.4%) and 38(86.4%) in Group A and in Group B respectively. Female patients were 7(14.6%) and 6(13.6%) in Group-A and in Group B and the differences were not statistically significant. According to Killip classification of heart failure, statistically no significant difference was present between two groups. All the risk factors except family history of IHD were more in Group B (41.7%, 41.7%, 43.7%, 52.1% and 41.7% vs 43.2%, 54.5%, 46.5% and 54.5%). Family history of IHD were more in Group A than Group B (41.7% vs 27.3%). The differences between two groups were not statistically significant. Table 2 demonstrates baseline clinical variables in the study population. It was observed that acute left ventricular failure occurred more in Group A (22.9%) than Group B (18.2%). Atrial fibrillation occurred more in Group B but PVC occurred more in Group A. VT and VF occurred equally in both the groups . STEMI (extensive anterior) occurred more in group A than Group B (33.2% vs 22.7%). All the above clinical variables were not statistically significant between two groups.

We analyzed 2D echocardiographic variables in the study populations shown in Table 4, and we observed that LA diameter and LVEF were not statistically significant between the two groups but the mean LAVI in Group A is significantly higher than Group B (43.59±7.62 vs 25.18±5.74).

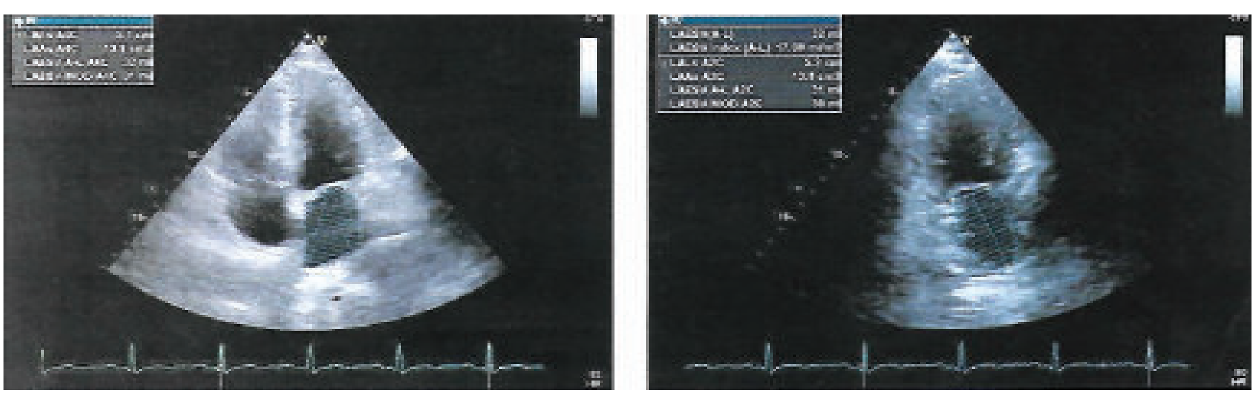

Fig.-1: *Simpson's biplane method of disks (Echolab, NHFH&RI, 2017).*

Table-I

Clinical characteristics in the pooled cohort consisting of all 92 patients

Particulars of the patients	Group-A (LAVI >34 ml/m^2) (n=48)	Group-B (LAVI ≤34 ml/m^2) (n=44)	*p* value
Mean Age ±SD(p value reached from Student's t Test)	55.15±11.93	52.18±11.26	0.224^{ns}
Sex(%)(p value reached from Chi-square(x2) test)			
Male	85.4	86.4	0.896^{ns}
Female	14.6	13.6	0.896^{ns}
Heart Failure Status(%)(p value reached from Chi-square(x2) test)			
Killip Class I	81.3	86.4	0.569^{ns}
Killip Class II	18.7	13.6	0.569^{ns}
Risk factors(%)(p value reached from Chi-square(x2) test)			
Diabetes	41.7	43.2	0.883^{ns}
Hypertension	41.7	54.5	0.217^{ns}
Dyslipidemia	43.7	46.5	0.792^{ns}
Smoking	31.3	34.1	1.000^{ns}
Family history of IHD	41.7	27.3	0.148^{ns}

ns=non significant, s=significant at p<0.05.

Table-II

Baseline clinical variables in the study population (n=92)

Clinical Information On Admission	Group-A (LAVI >34 ml/m^2) (n=48)	Group-B (LAVI ≤34 ml/m^2) (n=44)	*p* value
Acute LVF on Presentation(%)	22.9	18.2	^{b}0.575^{ns}
Arrhythmia(%)			
Atrial Fibrillation	12.5	40	0.157^{ns}
PVC	50	20	0.093^{ns}
VT	12.5	20	0.793^{ns}
VF	12.5	20	0.793^{ns}
Location of STEMI(%)			
Anteroseptal	4.2	15.9	0.058^{ns}
Anterior	18.8	27.3	0.259^{ns}
Extensive anterior	33.2	22.7	0.259^{ns}
Lateral	0.0	2.3	0.293^{ns}
Inferior	20.7	15.8	0.445^{ns}
STEMI Equivalent	2.1	4.5	0.507^{ns}
Inferior + Posterior	4.2	2.3	0.697^{ns}
Inferior + Posterior +RVI	6.3	2.3	0.374^{ns}
Inferior+ RVI	6.3	2.3	0.374^{ns}
Anterior + Inferior	2.1	2.3	1.000^{ns}
Inferior +Posterior + Lateral	2.1	2.3	1.000^{ns}

s= significant, ns= not significant , ^{a}p value reached from unpaired t test, ^{b}p value reached from Chi square test.

Table-III

Biochemical variable in the study population(n=92)

Biochemical variable	Group-A (LAVI >34 ml/m^2) (n=48) Mean±SD	Group-B (LAVI ≤34 ml/m^2) (n=44) Mean±SD	*p* value
NT- ProBNP	1234.6±738.77	689.52±721.04	0.001^{s}

s= significant, ns= not significant , p value reached from Student's t Test.

Table III shows mean NT-proBNP value was more in Group A than Group B(1234.6±738.77 vs 689.52±721.04) and the differences between the two groups were statistically significant(*p* value=0.001).

Table-IV

Echocardiographic variables in the study population (n=92)

Echocardiography 2D	Group-A (LAVI >34 ml/m^2) (n=48)	Group-B (LAVI ≤34 ml/m^2) (n=44)	*p* value
LA Diameter (%)			
Normal (≤40mm)	91.7	97.7	b0.201ns
Increased (>40mm)			
LAVI (Mean±SD)	43.59 ±7.62	25.18 ±5.74	a0.001s
LVEF (Mean±SD)	41.73 ±6.7	43.3 ±6.16	0.093^{ns}

Regarding different treatment strategies(Thrombolysis by streptokinase=STK, Primary PCI= PPCI or Pharmacoinvasive) as shown in Table V, it was observed that the difference in number of patients between two groups were not statistically significant.

Table-V

Treatment strategies in the study population(n=92)

Treatment	Group-A (LAVI >34 ml/m^2) (n=48)	Group-B (LAVI ≤34 ml/m^2) (n=44)	*p* value
Streptokinase(%)	52.1	47.7	0.979^{ns}
Primary PCI(%)	45.8	50.0	0.950^{ns}
Pharmacoinvasive(%)	2.1	2.3	0.950^{ns}

Table-VI

In-hospital outcome in the study population (n=92).

In Hospital outcome	Group-A (LAVI >34 ml/m^2) (n=48)	Group-B (LAVI ≤34 ml/m^2) (n=44)	*p* value
Death	0.0	0.0	
Reinfarction	0.0	0.0	
Persistent Chest Pain			
Yes	16.7	6.8	0.146^{ns}
No	83.3	93.2	0.146^{ns}
Hypotension			
Yes	50.0	31.8	0.077^{ns}
No	50.0	68.2	0.146^{ns}
Cardiogenic Shock	0.0	0.0	
Acute LVF			
Yes	38.31	9.1	0.001^{s}
No	61.7	90.9	0.001^{s}
Arrhythmia			
AF	2.1	2.3	0.985^{ns}
VT	4.2	2.3	0.609^{ns}
Others	6.2	13.6	0.234^{ns}
No	87.5	81.8	0.448^{ns}
Acute Kidney injury			
Yes	33.3	15.9	0.054^{ns}
No	66.7	84.1	0.054^{ns}
Hospital Stay Period (Days)			
≤5	66.7	86.4	0.469^{ns}
6-10	27.1	9.1	0.240^{ns}
>10	6.3	4.5	0.540^{ns}
Mean±SD	5.0±2.2	4.4±2.4	^{a}0.214^{ns}

s= significant, ns= not significant, *p* value reached from Chi-square(x^2) test.

As shown in Table VI in-hospital outcome in the study population and there was no death, reinfarction and cardiogenic shock in the study population. The mean stay period was 5 day in Group-A and 4.4 day in Group-B. Persistent chest pain, hypotension, acute LVF, arrhythmia and acute kidney injury occurred more in Group A than Group B. Total 72 adverse outcome occurred in Group A and 36 in Group B. Acute LVF was significantly higher in Group A than Group B (38.3% vs 9.1%).

Table-VII

In-hospital outcome of different treatment strategies in the study population(n=92).

Outcome	Treatment			*p* value
	STK %	PPCI %	STREPTOKINASE	
Adverse Outcome	78.3	70.5	100.0	0.416^{ns}
Uneventful	21.7	31.8	0.0	0.416^{ns}

According to Table 7 in hospital outcome of different treatment stratigies, 78.3% patients in the STK Group,70.5% patients in PPCI group and 100% patients in the Pharmacoinvasive Group had adverse outcome.

Table-VIII

In-hospital outcome according to LAVI in the study population(n=92).

Outcome	LAVI				*p* value
	High (LAVI >34 ml/m^2) Group A		Normal (LAVI ≤34 ml/m^2) Group B		
	n	%	n	%	
Adverse Outcome	42	87.5	26	59.1	0.002^{ns}
Uneventful	6	12.5	18	40.9	0.002^{ns}

As shown in Table 8 According to LAVI, in-hospital outcome in the study population showed that more patients had adverse outcome in high LAVI Groups than normal LAVI (87.5% vs 59.1%, p=0.002). The differences was statistically significant between two groups.

Table-IX

In-hospital outcome according to NT-proBNP level in the study population (n=92).

Outcome	NT-proBNP				*p* value
	High (>900 pg/ml)		Normal(100-900 pg/ml)		
	n	%	n	%	
Adverse Outcome	35	89.7	33	62.3	0.003^{ns}
Uneventful	4	10.3	20	37.7	0.003^{ns}

Table IX demonstrates that adverse outcome occurred significantly more in high NT-proBNP groups than normal NT-proBNP (89.7% vs 62.3%).

Table-X

Association between LAVI and NT-ProBNP in the study population (n=92)

LAVI	NT-proBNP				*p* value
	High (>900 pg/ml)		Normal (100-900 pg/ml)		
	n	%	n	%	
High (Group A)	30	76.9	18	34.0	
Normal (Group B)	9	23.1	35	66.0	

s=significant

Measures of agreement, Kappa Value 0.422, p value 0.001^{s}

Kappa value indicates moderate agreement

Agreement = 70.7% Kappa Interpretation

Kappa	Interpretation
< 0	Poor agreement
0.0 – 0.20	Slight agreement
0.21 – 0.40	Fair agreement
0.41 – 0.60	Moderate agreement
0.61 – 0.80	Substantial agreement
0.81 – 1.00	Almost perfect agreement

The results of the two modalities, LAVI and NT-proBNP, found Kappa value=0.422 with p value <0.05. This measure of agreement is statistically significant with moderate agreement between LAVI and NT-proBNP. Among 39 high value of NT-proBNP patients, 30(76.92%) patients have high LAVI and 9(23.07%) patients have Normal LAVI. Among total 53 normal NT-proBNP value patients 18(33.96%) patients have high LAVI & 35 (60.03%) have normal value.

In Figure 2, LAVI value was expressed in the study population as ml/m2 and NT-proBNP value as picogram/ml. The value of Pearson's rank correlation coefficient was 0.453 and p value was 0.001. So it can be concluded that, there is a positive significant (p<0.05) correlation between NT-proBNP and LAVI in the study population.

Receiver- operating characteristic curve (ROC) of LAVI and NT-ProBNP for prediction of adverse in hospital outcome in the study population, as shown in figure 3, LAVI had the best area under the curve. ROC curve was constructed as LAVI had area under the curve 0.729, showing cut off value of 33.75 with 66.2% sensitivity and 75.5% specificity and NT-ProBNP had area under the curve 0.631 showing cut off value 900 with 50.0% sensitivity and 83.3% specificity for prediction of adverse in-hospital outcome. ROC analysis showed that LAVI can predict adverse in-hospital outcome better than NT-proBNP (66.2% vs 50.0%).

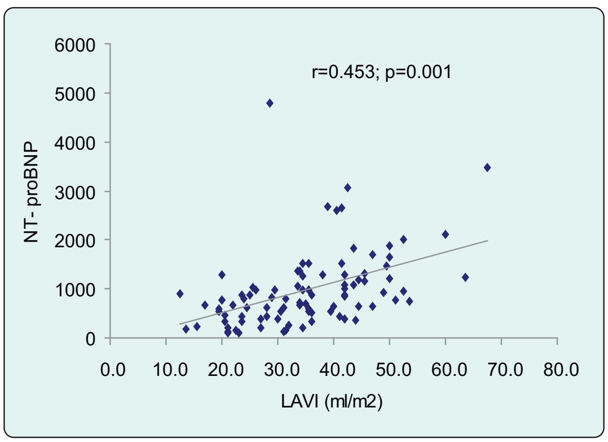

Fig.-2: *Scatter diagram showing positive significant correlation (r=0.453; p=0.001) between LAVI (ml/m2) and NT-proBNP.*

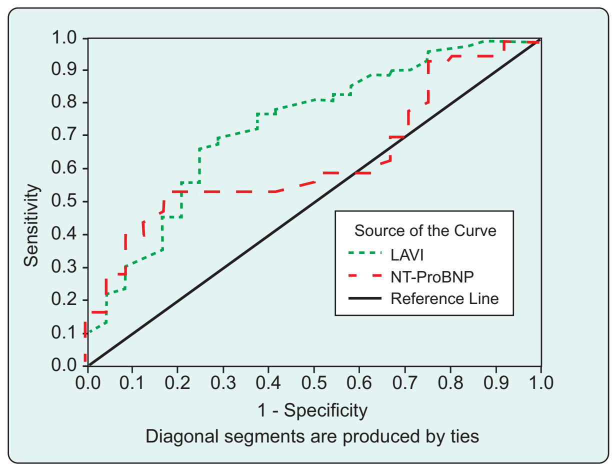

Fig.-3: *Receiver- operating characteristic (ROC) curve of LAVI and NT-ProBNP for prediction of adverse in hospital outcome in the study population.*

Table-XI

Receiver operating characteristic (ROC) curve of LAVI and NT-ProBNP to predict adverse in-hospital outcome in the study population

	Cut of value	Sensitivity	Specificity	Area under the ROC curve	P value	95% Confidence interval (CI) Lower bound	Upper bound
LAVI	33.75	66.2	75.0	0.729	0.001^{s}	0.611	0.848
NT- ProBNP	900.0	50.0	83.3	0.631	0.057^{ns}	0.511	0.751

Discussion:

To the best of our knowledge, this is the first study in Bangladesh showing association between LAVI and adverse in-hospital outcome and also positive correlation between LAVI and the level of NT-proBNP in patients of acute STEMI. This study showed that increased LAVI can predict adverse in hospital outcome with good sensitivity compare to NT-proBNP level (6.2% vs 50.0%).

It was observed that 35.4% patients belonged to age 51-60 years in Group A and 27.3% in Group B. The mean age was 55.15±11.93 years in group A and 52.18±11.26 years in Group B. The difference was statistically not significant between two groups. It was observed that the mean age of patients was 66±11 years in LAVI <40 ml/m2 group and was 69±11 years in LAVI> 40m1/m2 group[9] and the mean age was 61±10 years in higher LAVI group[10]. Similarly, it was observed that mean age was 67.9± 10.4 years in LAVI < 32ml/m2 Group and mean age 70.2±9.7 years in LAVI e" 32ml/m2 patients group[11]. It was also observed that the mean age of LAVI < 32ml/m2 patients group was 65 years with range from 53-75 years and mean age in LAVIe"32m1/m2 patients group was 76 years with range from 67-82 years[12]. The higher mean age and age range obtained by the above authors may be due to geographical variations, racial, ethnic differences and genetic causes that have significant influence on coronary artery disease in their study subjects.

In this study, it was observed that 85.4% patients were male in Group A and 86.4% in group B. The difference was statistically not significant between two groups. Gender differences in LA Volume index does not occur as per reviewed literatures[10,13] .

In this series, it was observed that 22.9% patients had acute LVF on presentation in Group A and 18.2% in Group B, 16.7% arrhythmia in Group A and 9.1% in Group B, 50.0% PVC in Group A and 20.0% in Group B, 33.2% patients suffered extensive anterior MI in Group A and 22.7% in Group B. All the baseline clinical variables were statistically not significant between two groups and there is no differences in location of MI in the study population[14]. Similarly in this study, though extensive anterior MI was more common, but no statistically significant difference were present between the two groups.

In this study, it was observed that 81.3% patients was in Killip Class 1 status in group A and 86.4% in group B. The difference was statistically not significant between two groups. It was also showed no baseline differences in Killip and NYHA class of heart failure among the study groups[14].

In this series, it was observed that 41.7% patients had diabetes in group A and 43.2% in group B, 41.7% hypertensive patients in Group A and 54.5% in Group B, 43.7% dyslipidemia in Group A and 46.5% in Group B, 31.3% were smoker in Group A and 34.1% in Group B, 41.7% had family history of IHD in Group A and 27.3% in Group B. The difference was statistically not significant between two groups. It was showed that LAVI correlated positively with hypertension, diabetes mellitus, dyslipidemia and smoking[15]. These risk factors in the study population was consistent with those found in other studies[16,17]. However different studies carried out in different countries demonstrated different patterns and this may be due to ethnic and cultural differences in the study population.

In this study, it was found that LA diameter was Increased (>40mm) in 8.3% patients in Group A and 2.3% in Group B. The mean LAVI was 43.59±7.62 ml/m2 in group A and 25.18±5.74 ml/m2 in Group B. Mean LVEF was 41.73±6.7 % in Group A and 43.68±6.16 % in Group B. The difference of LAVI was statistically significant between two groups. In one study it was showed significant differences between the two groups[14]. Increased LAVI is consistent with chronic elevation of LV filling pressure and may be an indicator of increased cardiovascular risk [15]. LAVI has been showed to be highly predictive of cardiovascular risks including arrhythmias, atrial fibrillation, left ventricular failure, stroke and death after acute myocardial infarction[4,12,15].The most widely used method for LA diameter measurement is to acquire its anteroposterior (AP) diameter in the parasternal long-axis view but the fact is that linear dimension doesn't correlate with the actual LA size and this should not be used as the sole measurement for LA[18,19].

In this series, it was observed that 52.1% patients got STK in Group A and 47.7% in Group B, 45.8% underwent Primary PCI in group A and 50.0% in Group B, 2.1% underwent pharmacoinvasive therapy in Group A and 2.3% in Group B. The differences were statistically not significant between two groups. It was found that, 78.3% patient had adverse outcome in STK group and 70.5 patients in PPCI group.

In this study, it was observed that there was no in-hospital death, reinfarction and cardiogenic shock occurred in the study population. Mean hospital stay period was 5 days in higher LAVI Group and 4.4 days in normal LAVI Group. 16.7% patients had persistent chest pain in Group

A and 6.8% in Group B, 50.0% hypotension in Group A and 31.8% in Group B, 38.3% acute LVF in Group A and 9.1% in Group B, 4.2% VT in group A and 2.3% in group B, 33.3% acute kidney injury was in Group A and 15.9% in Group B. 72 adverse outcome occurred in Group A and 36 in Group B, ie, more adverse outcome occurred in higher LAVI group. In the present study acute LVF was significantly more in Group A with increased LAVI. Other study also showed that LAVI was associated with systolic and diastolic dysfunction which may result let ventricular failure. One study found that LA volume correlate positively with the grade of diastolic dysfunction, and negatively with LV systolic dysfunction[20]. One study proved that there is a positive correlation with the wall motion score index (WMSI) and LA volume index >32 ml/m2[12] . Another study suggested that when LV dysfunction is present with increased stiffness or non-compliance, LA pressure rises to maintain adequate LV filling and the increased atrial wall tension leads to chamber dilatation and stretch of the atrial myocardium[21]. In this study we also found LV dysfunction in higher LAVI group. One study suggested that LA size is increased and LA emptying decreased in patients with either systolic or diastolic heart failure and it is associated with the new development of LV failure[22].

It was observed that, more patients (87.5%) had adverse in-hospital outcome in Group A with higher LAVI than Group B (59.1%) with normal LAVI. Similarly, more patients (89.7%) had adverse outcome in higher NT-proBNP group compare to normal NT-proBNP group (62.3%). It was demonstrated that, LAVI was a predictor of mortality after AMI, even after adjustment for conventional indices of systolic and diastolic function and concluded that LA volume could emerge as a simple and important tool for risk stratification and as a guide for future surveillance and therapy in patients with AMI[12]. One research showed that atrial natriuretic peptides are useful for guidance of therapy and risk stratification of patients in heart failure and AMI[23]. It was found that plasma NT-proBNP level is a sensitive indicator of cardiac dysfunction, both in the presence and absence of systolic dysfunction, and an useful tool for identiûcation and management[24.] showed that in comparison to other biochemical markers, NT-proBNP level was the most powerful indicator of major adverse cardiovascular events (MACE) and a single measurement of the NT-proBNP level appears to be useful as a prognostic factor in the prediction of MACES in patients after ACS[25 .]

In this present study, it was observed that, 39 patients had higher NT-proBNP level and among them 30(76.9%) patients had higher LAVI and 9(23.1%) belonged to normal LAVI. Normal NT-proBNP level was found in 53 cases among them 18(34.0%) had higher LAVI and 35(66.0%) belonged to normal LAVI. Measures of agreement was 70.7% with Kappa Value 0.422, thus indicates moderate agreement between LAVI and NT-proBNP for prediction of adverse outcome in acute STEMI patients. . In a recent study, it was found that in the setting of acute coronary syndrome, NT-proBNP is an extremely powerful prognostic indicator including patients with STEMI at higher risk[26]. It was showed that NT-proBNP concentration are higher in patients with more severe symptoms and in those with more severe cardiac damage[27]. It was found that there is a strong association between high plasma NT-proBNP and incomplete ST-resolution in patients after reperfusion, and it highlights the potential relevance of NT-proBNP for early risk stratification in the setting of reperfusion therapy after acute myocardial infarction[28]. A study in NICVD showed that raised plasma BNP concentration strongly predict short-term mortality and morbidity in subjects with acute heart failure in STEMI[29].

LAVI value was expressed in the study population as ml/m2 and NT-proBNP value as picogram/ml. The value of Pearson's rank correlation coefficient was 0.453 and p value was 0.001. Thus there was a positive significant correlation between NT-proBNP and LAVI in the study population.

According to receiver-operating characteristic curve it was observed in the present study that LAVI had best area under the curve 0.729 with a cut off value of 33.75 having 66.2% sensitivity and 75.0% specificity for predicting in-hospital adverse outcome. However NT-ProBNP had area under the curve 0.631 with cut off value 900 having 50.0% sensitivity and 83.3% specificity, which indicates that LAVI is better predictor for prediction of adverse in hospital outcome in the study population compared to NT-ProBNP. A study showed that indexed LA volume e"28 ml/m2 was 82.0% sensitive and 93.0% specific and indexed LA volume e"27 ml/m2 was 89.0% sensitive and 86.0% specific for the detection of abnormal diastolic function[15]. Indexed LA volume e"32 ml/m2 was 100.0% specific for the detection of abnormal diastolic function, although the sensitivity decreased to 67.0%, which are comparable with the current study.

Finally, in the present study by ROC analysis it was found that LAVI with a cut off value of 33.75 ml/m2 can predict adverse in-hospital outcome in patients of acute STEMI underwent reperfusion therapy with sensitivity 66.2% and specificity 75%. Moreover, it was found by ROC analysis that LAVI can predict better adverse in-hospital outcome in comparison to NT-proBNP (66.2% vs 50.0%).

Study Limitations

Although the result of this study supports the hypothesis, there were some limiting factors which might affect the results:(a) this study was conducted at a single tertiary care hospital which may not represent the general population, (b)purposive sampling was done instead of random sampling.

Conclusion:

The findings of the present study showed a significant association between increased LAVI and adverse in-hospital outcomes. Thus, it may be concluded that increased LAVI can predict adverse in-hospital outcomes in acute STEMI patients. There is a significant correlation between LAVI and NT-proBNP in patients suffering from acute STEMI. Although the prognostic significance of elevated NT-proBNP is well established, the correlation with LAVI could also guide us in predicting adverse cardiovascular outcomes associated with LA dilatation in patients at an early stage of acute STEMI. LAVI can be measured by a 2D echocardiography machine in any low-resource hospital in our country, and it can be used as a cost-effective tool for predicting adverse cardiovascular outcomes in acute STEMI.

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Disclosure

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