OPEN ACCESS

Saudi Journal of Medical and Pharmaceutical Sciences
Abbreviated Key Title: Saudi J Med Pharm Sci
ISSN 2413-4929 (Print) | ISSN 2413-4910 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article **Cardiology**

"Correlation between Electrocardiographic Left Ventricular Hypertrophy & Adverse Outcome Following Acute Myocardial Infarction in Hypertensive Patient"

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DOI: 10.36348/sjmps.2022.v08i04.002 | **Received:** 26.02.2022 | **Accepted:** 05.04.2022 | **Published:** 08.04.2022

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Abstract

Introduction*:** Myocardial infarction is one of the most serious pathological condition in which the heart is irritated, inflamed and influenced by multiple factors to cause high mortality and morbidity in the developed and underdeveloped countries. ***Objectives*:** To see correlation between Electrocardiographic left ventricular hypertrophy and adverse outcome following acute myocardial infarction in hypertensive patient. ***Materials and Methods: A Cross sectional analytical study was carried out at the Department of cardiology, Mymensingh Medical College Hospital, Mymensingh Bangladesh from March - 2014 to February- 2015. Patients admitted into cardiology department with Acute Myocardial Infarction with hypertension who fulfill the inclusion and exclusion criteria of the study. Due to time and cost limitation, 65 cases were selected. ***Results*:** A total number of sixty five patients were studied of which 56(86.15%) were male and nine (13.84%) were female. The age range was 40 to 70 years. Mean age of male was 52.9±8.4 and female was 56.5±7.5. The patients were divided into two groups on the basis of presence of absence of electrocardiograph left ventricular hypertrophy. All patients had myocardial infarction with evidence of hypertension at admission or known case of hypertension. Group A consisted of 38 patients (58.45%) with ECG-LVH and group B with no ECG_LVH consisted of 27 patients (41.55%). The mean age of group A was 54.25 ±8.9 and group B was 52.55 ± 8.15. Majority patients (34) belonged to 40-50 years age group (52.30%). Twenty one patients belonged to 51-60 years group (32.30%). Ten patients belonged to 61-70 years age group (15.4%), male: female ratio was 6.2: 1. Out of total 68 patients, 43 patients (64.42%) had hypertension on admission and 24 cases (35.38%) had normal blood pressure on admission. Of the 38 patients of group A, 24 had anterior myocardial infarction (63.15%) and 14 had inferior myocardial infarction (36.84%) and 7 had both anterior and inferior myocardial infarction (10.76%). The statistical analysis was highly significant in between group A & group B. The incidence of QMI was highly significant (P= <0.01) between Group A & Group B. QMI was for more common in group A, the incidence was higher in presence of ECG –LVH. In group A hospital stay (days) was 6.74±1.53 days, and 14% had mortality. On the other hand, in group B, it was found that hospital stay (days) was 5.28±1.06 days, and 2% had mortality. 30 patients (81.89%) developed arrhythmia and 8 cases (21.05%) did not developed arrhythmia in group A. In Group B 16(51.85%) developed arrhythmia and 13 cases (48.14%) didn't develop arrhythmia. Statistically, relation between Group A & Group B was significant (p <0.05). Statistical relationship between group A & group B was significant and this signifies the higher possibilities of occurrence of mortality in ECG-LVH due to hypertension with acute myocardial infarction than without ECG. ***Conclusion*:** The study concluded that ECG-LVH changes following acute myocardial infarction in patients with hypertension had more adverse in-hospital outcomes.

Keywords: Electrocardiographic, Left Ventricular Hypertrophy, Acute Myocardial Infarction, Hypertensive.

INTRODUCTION

Myocardial infarction is one of the most serious pathological condition in which the heart is irritated, inflamed and influenced by multiple factors to cause high mortality and morbidity in the developed and underdeveloped countries. It is emerging as a major health problem in Bangladesh. There is progressive rise of incidence of ischemic heart diseases in Bangladesh as evident from analysis of patient from 1981 to 1989 at National Institute of Cardiovascular diseases (NICVD), with male domination (highest age group being 50-59 years) having smoking as a major risk in our population [1]. WHO has described CAD as potentially dangerous

epidemic for mankind [2]. In western countries 50% of all death are due to cardiovascular diseases, of which 50% is attributed to Myocardial infarction, The overall mortality extending the very early death is approximately 15% -30% of which about 50% mortality takes place within first four weeks. About 60% of all death within 4 weeks occurs within first 2 days. The mortality of the acute attack rises sharply with age, 20% in those under 60 years, near 30% in those over 60 years and 40-50% in the elderly. Some 60% or more of all deaths within 4 weeks occur within first two days [3]. All studies so far reported have identical views on risks factor of CAD. The risk factors are smoking, hypertension, hyperlidemia, diabetes mellitus and decreased physical activities. Other risk factors which have been identified are high age and male sex, obesity, oral contraceptives, personality –A. Stress and occupation, family history, hyperuricemia. Furthermore some other risk factor may yet be identified; the inverse correlation between HDL and the direct correlation with LDL cholesterol concentration and CAD have been the subject of increasing attention [4]. Elevated blood pressure is a staggering health problem for 3 different reasons: (a) it is very common; (b) its effects are sometimes devastating; (c) its remain asymptomatic until late its course. Its effects are widespread and no organ is spared. Hypertension has been identified as single most important risk factor in both coronary heart disease and cerebrovascular accidents; it may also lead directly to congestive heart failure and chronic renal insufficiency. There is no magic threshold of blood pressure above which he or she is safe. The detrimental effects of blood pressure increases continuously as the pressure increases. The prevalence increases with age, although when present in young adults, it tends to be more severe. In most cases hypertension remains fairly stable over years to decades and unless stroke or myocardial infarction supervenes, is compatible with long life [5]. Although significant advances had been made in recognition and control of hypertension, it remains the major risk factor for coronary, cerebral and renal vascular diseases. In the Framingham Cohort, the risk of developing coronary disease was twice as high among hypertensive compared with normotensive subjects and risk of strokes was eight times higher [6]. The Framingham study has identified electrocardiographic evidence of left ventricular hypertrophy with strain as risk factor of cardiovascular diseases [7]. Hypertension associated with the electrocardiographic pattern of left ventricular hypertrophy was associated with a higher incidence of coronary heart disease than was hypertension alone and there was an unusually high risk of the subsequent development of CHD among men age 40 to 59 years. It was shown that at each diagnostic blood pressure category, the presence of LVH by ECG is associated with an excess incidence of coronary heart disease. Left ventricular hypertrophy appeared to make an independent contribution to the risk of development of CHD, increasing the risk of developing CHD 2 to 3 fold when blood pressure is held constant [8]. While several studies including the Framingham in the west have demonstrated relationship of hypertensive electrocardiographic left ventricular hypertrophy and HTN without LVH with myocardial infarction, there are no published studies from Bangladesh regarding the role of hypertensive ECG –LVH and HTN without LVH with myocardial infarction, in the setting of myocardial infarction. This study intends to find the effect and relationship of hypertensive ECG – LVH with myocardial infarction. If the role of left ventricular hypertrophy influences the course of myocardial infarction, then an intervention in the process of hypertensive enlargement and hypertrophy could be a major approach in modifying the incidence and course of myocardial infarction in hypertensive patients [9, 10]. This Study showed that hypertensive ECG-LVH with acute myocardial infarction was more strongly associated with occurrence of CHF, cardiogenic shock, arrhythmia in comparism with the patient without hypertensive ECG-LVH with acute myocardial infarction.

MATERIALS AND METHODS

Type of study: Cross sectional analytical study.

Place of study: Department of cardiology, Mymensingh Medical College Hospital, Mymensingh, Bangladesh.

Period of study: March - 2014 to February- 2015.

Study population: Patients admitted into cardiology department with Acute Myocardial Infarction with hypertension who fulfill the inclusion and exclusion criteria of the study.

Sample size: Due to time and cost limitation, 65 cases were selected.

Sampling method: Purposive sampling

Statistical analysis: The data was edited after collection, then these was processed & analyzed by computer software program, SPSS version 16.

Level of Significance: Was considered as P value < 0.05.

Inclusion Criteria

- Patients admitted into department of cardiology with 1st attack of Acute Myocardial Infarction with hypertension.

Exclusion Criteria

- Patients with previous Myocardial Infarction.
- Patients with myocardial infarction associated with congenital heart disease, valvular heart disease, post coronary artery bypass graft (CABG), dilated

or ischemic cardiomyopathy, HCM, connective tissue disorder etc.

- Patient with congestive heart failure due to hypertension in absence of myocardial infarction, heart failure due to myocardial infarction without history of hypertension or evidence of hypertension, CKD .
- Patient with left bundle branch block (LBBB), pre-excitation syndrome, pulmonary embolism and right ventricular infarction were excluded.
- Those who did not give consent to participate the study.

RESULTS

A total number of sixty five patients were studied of which 56(86.15%) were male and nine (13.84%) were female. The age range was 40 to 70 years. Mean age of male was 52.9±8.4 and female was 56.5±7.5. The patients were divided into two groups on the basis of presence of absence of electrocardiograph left ventricular hypertrophy. All patients had myocardial infarction with evidence of hypertension at admission or known case of hypertension. Group A consisted of 38 patients (58.45%) with ECG-LVH and group B with no ECG_LVH consisted of 27 patients (41.55%). The mean age of group A was 54.25 ±8.9 and group B was 52.55 ± 8.15. Majority patients (34) belonged to 40-50 years age group (52.30%). Twenty one patients belonged to 51-60 years group (32.30%). Ten patients belonged to 61-70 years age group (15.4%), male: female ratio was 6.2:1. The table shows hypercholesterolemia was the commonest of risk factor (53.84%) in both the groups. Diabetes mellitus was the most uncommon of the risk factors (86.16%). Smoking was the commonest of the risk factor of group A (42.1%), and hypercholesterolemia was the commonest risk factor in group B. Sixteen patients (42.1%) had at least one risk factor in Group A and 12 patients (44.44%) had at least one risk factor in Group B. Four patients (10.52%) had no risk factor in Group A and 5 patients (18.51%) had no risk factors in Group B. Eighteen patients (47.36%) had more than one risk factors in Group A and 10 patients (37.03%) had more than one risk factor in Group.

Table 1: Distribution and incidence of age and Risk factors in patients with and without ECG-LVH of the study population (n=65)

Age Groups (Years)	Group A (n=38)		Group B (n=27)		P Value
	Number	%	Number	%	
40-50	18	47.36	16	59.25	
51-60	12	31.57	7	25.92	
61-70	8	21.1	4	14.81	
Means±SD	55.69±19.4		52.8±22.2		>0.05
Risk factor					
Smokers	16	42.1	12	44.44	N.S
Diabetes mellitus	4	10.52	5	18.51	N.S
Dyslpidemia	18	47.36	10	37.03	N.S

P-value reached from unpaired t-test
No statistically significant mean age difference between study group (P>0.05).
Group A: Mean ± SD = 54.25 ±8.9
Group B: Mean ± SD = 52.55 ±8 . 14
N.S= Not significant
p>.05 p-value were analyzed using chi-square test

Out of total 65 patients, 43 patients (64.42%) had hypertension on admission and 24 cases (35.38%) had normal blood pressure on admission. The table 2 shows the 28 cases (73.68%0 of group A were hypertensive on admission and the mean SBP was 174.28 ± 24.56 and DBP was 110.50 ±9.75. The cases (26.32%) had blood pressure with mean SBP was 143.00±12.50 and DBP was 94. 60 ±6.74. In Group B 16 cases (51.85%) were hypertensive with mean SBP was 170.00 ±16.98 and DBP was 106.42 ± 5.70 14 cases (48.15) had blood pressure on admission with mean SBP was 143.00 ±7.22 and DBP was 94.60 ±9.88. There were statistically significant homodynamic parameters difference between the study groups (P < 0.05).

Table 2: Mean blood pressure among patients with and without ECG-LVH on admission of the study population (n=65)

	Group A	Group B	P value
Hypertension Mean±SD ≥ 160	28	15	<0.05
	SBP-174.28±24.56	SBP-70.00±16.98	
	DBP-110.50±9.75	DBP-106.±5.70	
Hypertension Mean±SD ≤ 160	10	12	
	SBP-143.00±12.50	SBP-143.00±7.22	
	DBP-94.60±6.74	DBP-94.60±9.88	

P-value were analyzed using chi-square test

Group A: Blood pressure: Mean ± SD: SBP -166.05 ±27.56, DBP – 105.13 ±13.82,

Group B: Blood pressure: Mean ±SD SBP -158.50 ±19.84, DBP -101.10±9.64

Table 3: Incidence of anterior and inferior infarction in patient with and without ECG –LVH of the study population (n=65)

ECG	Group A (n=38)		Group B (n=27)		P Value
	Number	%	Number	%	
Anterior Infarction	24	63.15	17	62.96	<0.05
Inferir Infarction	14	36.84	10	37.03	

P-value were analyzed using chi-square test

Out of 65 patients, 40 patients (61.54%) had anterior myocardial infarction. 18 patients (27.70%) had inferior infarction and 7 cases (10.76%) had both anterior and inferior infarction combined. Of the 38 patients of group A, 24 had anterior myocardial infarction (63.15%) and 14 had inferior myocardial infarction (36.84%) and 7 had both anterior and inferior myocardial infarction (10.76%). The statistical analysis was highly significant in between group A & group B.

Table 4: Incidence of Q-MI and non QMI with and without ECG-LVH of the study population (n=65)

	Group A (n=38)		Group B (n=27)		P Value
	Number	%	Number	%	
QMI	28	73.68	23	85.18	<0.01
Non QMI	10	26.31	4	14.81	

P-value were analyzed using chi-square test

Of 65 patients, 51 (78.46%) had QMI and 14(21.54%) had non QMI. In group A 28 patients (73.68%) had QMI and 10 had non Q-MI (26.32%). The incidence of QMI was highly significant (P= <0.01) between Group A & Group B. QMI was for more common in group A, the incidence was higher in presence of ECG –LVH.

Table 5: Incidence of heart failure between group A & group B (N=65)

	Group A	Group B	p value
Hear failure (Any Class)	34(68.0)	14(28.0)	<0.001
Killip Class-I	02(04.0)	01(02.0)	1
Killip Class-II	15(30.0)	08(16.0)	0.003
Killip Class-II	10(20.0)	04(08.0)	0.02
Killip Class-IV (Cardiogenic Shock)	07(14.0)	01(02.0)	0.02

p value were analyzed using Chi-Square Test

Table 5 showed that heart failure (any class) was 68% in group A & 28% found in group B which was statistically significant. In group A it was found that Killip class-I was 4%, Killip class-II 30%, Killip class-III 20% and 14% had cardiogenic shock. Killip class-II and III heart failure and cardiogenic shock were significantly more among the group A (34% vs 16%, p 0.03; 24% vs 8%, p 0.02; 14%vs 2%, p 0.02). In group B Killip Class-I was 2%, Killip class-II 16%, Killip class-III 8%, 2% had cardiogenic shock. The incidence of Killip class-1 haert failure was statistically non-significant in these two groups.

Table 6: Incidence of arrhythmia in ECG-LVH and without it (N=65)

	Group A (n=38)		Group B (n=27)		P Value
	Number	%	Number	%	
Arrhythmia	30	78.94	14	51.85	<0.05
No Arrhythmia	8	21.05	13	48.14	

P-value were analyzed using chi-square test

The table 6 shows 30 patients (81.89%) developed arrhythmia and 8 cases (21.05%) did not developed arrhythmia in group A. In Group B 16(51.85%) developed arrhythmia and 13 cases (48.14%) didn't develop arrhythmia. Statistically, relation between Group A & Group B was significant (p <0.05).

Table 7: In hospital outcome between two groups (n=65)

In-hospital outcome	Group A (n=38)		Group B (n=27)		P Value
	Number	%	Number	%	
Hospital stay (days)	6.74±1.53		5.28±1.06		0.001a
Mortality	7	14%	1	2%	0.02

p value were analyzed using Chi-Square Test.

Table 7 showed that in group A hospital stay (days) was 6.74±1.53 days, and 14% had mortality. On the other hand, in group B, it was found that hospital stay (days) was 5.28±1.06 days, and 2% had mortality. Statistical relationship between group A & group B was significant and this signifies the higher possibilities of occurrence of mortality in ECG-LVH due to hypertension with acute myocardial infarction than without ECG.

DISCUSSION

This study, conducted in the cardiology department of MMCH, was cross sectional analytical study. Two group of patient, one with ECG-LVH and other without ECG-LVH, all having acute myocardial infarction with established evidence of hypertension. This study intends to evaluate the effect and relationship of hypertensive LVH in patients with acute myocardial infarction. The age range of population was 40 to 70 years; mean age was 53.50 ±8.50. Majority was between 40-50 years (50.76%) with mean age of 46.45 ±3.50 Thirty eight patients were in group A with mean age of 54.25 ±8.90 and 27 patients in group B with mean age of 52.55 ± 8.14. Group A presented at higher age than Group B. There was 56 male and 9 female with ratio of 6.20:1 in both the groups. Female response was poor due to ignorance and negligence to female medical need, social restriction to independent movement and indifferent outlook in treatment outside home. Mean age of male was 52.9 ±8.4 and female 56.5 ±7.5. The reason for higher age in female at presentation was due to better tolerance of hypertension by women [11], and possibly due to late arrival or the patients with advanced symptoms which had prompted the family member to seek an urgent medical attentions and also due to social restriction as mentioned above. Majority of patients in both group A and B belonged to age group between 40-50 years. The mean age of group A was 54.25 ±8.9 and group B was 52.55 ±8.14 The Framingham study Kannel *et al*., [8] found higher incidence of CHD in patients between the ages of 40 to 59 years with ECG –LVH. In our study greater members of patients between 40-50 years with ECG –LVH. Majority patients did not have conventional risk factors. The least common was the diabetes mellitus. Patients who had risk factor, hypercholesterolemia (>200mg/dI) was the commonest in both the groups. Majority (64.42%) of patients presented with hypertension at admission. The mean SBP was 162.90± 24.75 and DBP was 103.50± 12.29 of all patients were elevated inspires of the fact that all patients who had history of hypertension had treatment for hypertension before admission. The mean SBP and DBP were significantly higher in patients with ECG-LVH than without ECG –LVH. This signifies that a significant rise. Of blood pressures occur in patients of myocardial infarction with ECG-LVH .Blood pressures tended to be higher in persons with ECG –LVH observed in the Framingham study [12]. However the Framingham study did not mention the level of blood pressure in myocardial infarction with ECG-LVH. This study observed rise of blood pressure in patients of myocardial infarction with ECG-LVH .The blood pressure was higher in numbers of patients with ECG –LVH than in patients with normal blood pressure and the result was significant (P =<0.01) as shown in table 4.Table 5 showed that relationship between group A and group B demonstrated significant relationship (p = < .05) regarding the level of blood pressure in patients with ECG –LVH than without it. In patients with ECG-LVH the commonest site of infarction was anterior (71.05%). The incidence was high in relation to inferior infarction (18.42%). The result was significantly (P < 0.01) higher than inferior myocardial infarction in this group of patient (Group A). In patients without ECG-LVH (Group B) the site of infarction did not vary significantly. Both anterior and inferior infarctions were almost nearly equal in incidence in this group and therefore the site of infarction in group B was insignificant. The result between group A and B showed significant outcome (P < 0.05) in setting of

location of myocardial infarction which demonstrated that anterior infarction was much higher in occurrence in patient with ECG-LVH than without ECG-LVH. Anterior infarction was 4 times more common than inferior myocardial infarction in group A. In group B it was almost equal. The incidence of CHF found to be high when LVH was present. The difference of CHF and no CHF in enlarged LV was not significant but when LVH and no LVH was compared the result was significant (p-<0.05). The signifies that CHF was well linked with the ECH-LVH. Thus ECG-LVH independently contribute to CHF. This was due to the fact that ECG-LVH signifies the threshold stage of cardiac reserve and a slight imbalance by any factor, particulary hypertension which was found to be high at the times of admission with myocardial infarction. Our study correlate well with other studies Kannel *et al*., [13] that ECG-LVH was more strongly associated with occurrence of CHF than without ECG-LVH with ECG-LVH. Patient with ECG-LVH with hypertension with acute myocardial infarction need more hospital stay than without ECG-LVH [14]. The data of similar study Teixeira *et al*., [15] showed that length of hospital stay was 6.74± 1.53 in group A and 5.28± 1.06 in group B. In-hospital mortality and cardiogenic shock 14% in group A and 2% in group B. The data of another study (Hillis *et al*., [16] showed that killip class II heart failure was found 30% in group A and 16% in group B. This study report was consistent with finding of present study. The result in respect to arrhythmia showed that greater incidence of arrhythmia in patients with ECG-LVH than with no ECG-LVH. This finding was correlated to findings by other authors Frohlich *et al*., [17], massie *et al.*, [18] The differences between the two groups was statistically significant.

CONCLUSION

The study concluded that ECG-LVH changes following acute myocardial infarction in patients with hypertension had more adverse in-hospital outcomes.

Limitation Of The Study

Although the result of this study support the hypothesis. Yet there are some limitations.

1. The sample size was small.
2. The study was done in single hospital. So the study result may vary from other hospital and community based survey.
3. Short duration, insufficient fund.

RECOMMENDATION

Electrocardiographic Left Ventricular Hypertrophy is an Independent Risk Factor for Adverse Outcome Following Acute Myocardial Infarction in Hypertensive Patient. So special emphasis by close monitoring and follow-up should be given to those patients with Acute ST segment elevation myocardial infarction having Hypertensive LVH to prevent complications and mortality. Patient admitted with 1st attack of acute myocardial infarction. Early PCI/ CABG can also prevent complication & mortality.

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