# Clinical, Electrocardiographic and Echocardiographic Profile of Ischemic Cardiomyopathy: An analysis of 100 cases .

Mainul Islam[1], M.Atahar Ali[2], Umme Habiba Ferdaushi[3], Shaila Nabi[4], Sayeedur Rahman Khan[5], Md. Shariful Islam[5], Hasan Mahmoud[3]

**Abstract:**

**Background:** Ischemic heart disease (IHD) is one of the leading cause of morbidity and mortality worldwide. Ischemic cardiomyopathy (ICM) is a delayed complication of IHD that arises as dilated cardiomyopathy with depressed ventricular function, which cannot be attributed entirely to coronary artery obstruction or ischemic injury.

**Objectives:** To evaluate the clinical, electrocardiographic and echocardiographic profile of patients presenting with ischemic cardiomyopathy.

**Methods:** In this cross sectional observational study 100 patients of ischemic cardiomyopathy admitted in hospital or visited OPD in NICVD, Dhaka from March'15 to Sept'15 were studied. Enrollment of the patients were done after fulfilling the inclusion and exclusion criteria. Clinical, electrocardiographic and echocardiographic data were collected then data analysis was done.

**Results:** Data analysis of 100 patients was showed age range was 40-80 years and mean age was 61.4±7.9 years. 79% subjects were male. Most common symptoms were dyspnea (93%), chest pain(73%), palpitation (39%) and edema (23%). Most patients were in NYHA functional class IV (43%). 64% cases had history of anterior myocardial infarction (MI), 22% had inferior MI, 25% had H/O PTCA and 7% had CABG. 71% subjects had tachycardia, 65% had lungs basal rales, 56% had systolic blood pressure below 100 mmhg and 25% had edema. ECG findings was as follows sinus rhythm (85%), Sinus tachycardia 71%, AF 15%, LBBB 34%, RBBB 12%, pathological Q in anterior surface 65% and inferior surface 21%, non specific ST-T changes 41% and PVCs was found in 17%.On echocardiography ,anterior wall hypokinesia was seen in 52% and global hypokinesia in 43%. Mean left ventricular ejection fraction (LVEF) was 31±5.9% and mean left ventricular internal diastolic diameter (LVIDd) was 6.5±0.4 cm. (59%) subjects had mitral regurgitation (MR) grade-I and 20% had MR grade-II.

**Conclusion:** The clinical presentation of ischemic cardiomyopathy varies from patient to patient. Severity of symptoms correlates with severity of left ventricular systolic dysfunction, left ventricular diameter and mitral regurgitation grade . Anterior Myocardial infarction has more chance to develop ischemic cardiomyopathy.

*Key words:* Cardiomyopathy, Heart failure, Electrocardiogram, Echocardiography.

## Introduction:

Coronary artery disease (CAD) is the leading cause of mortality and morbidity in industrialized countries and it is emerging as public health problem in developing countries[1]. It is established that 30% of all deaths can be attributed to cardiovascular disease, of which more than half are caused by CAD. Globally, of those dying from cardiovascular diseases, 80% are in developing countries not in the western world [2]. By the year 2020, CAD will hold first place in the world health organization's list of leading cause of disability[3].

Bangladesh has undergone a remarkable demographic transition over last three decades. Striking changes have

1. Assistant Registrar, NICVD, Dhaka.
2. Senior Consultant of Cardiology, Evercare Hospitals, Dhaka
3. Junior Consultant of Cardiology, NICVD, Dhaka.
4. Associate Prof. of Cardiology, NICVD, Dhaka.
5. Medical Officer, NICVD, Dhaka

**Address of Correspondence:** Dr. Mainul Islam, Assistant Registrar, NICVD, Dhaka, Bangladesh. E-mail:mainulislam67@yahoo.com

also been observed in the lifestyle and food habit in our population[4].

While Bangladesh is turning from agro-based socioeconomic structure towards industry based setting, coronary artery disease in middle aged and young group is also appearing into scene[5]. The prevalence of CAD in Bangladesh was estimated as 3.3 per thousand in 1976 and 17.2 per thousand in 1986 indicating fivefold increase of the disease by 10 years[6].Three small scale studies showed average prevalence of ischemic heart disease (IHD) is 6.5 per thousand population of Bangladesh [7]. According to Bangladesh bureau of statistics, 2006. IHD is the fourth leading cause of death [8].

Complications of CAD are acute and chronic. The most common chronic complication of CAD is chronic ischemic heart failure wherein the heart becomes dilated, myocardium become thinned, scarred and fibrosed ; as a result systolic LV dysfunction develops, leading to congestive heart failure. In a word this condition known as ischemic cardiomyopathy[9]. Burch and Colleagues in 1970 first used the term Ischemic Cardiomyopathy to describe the condition in which Coronary Artery Disease results in severe myocardial dysfunction[10]. In the United States, the most common form of dilated Cardiomyopathy is ischemic Cardiomyopathy or the Cardiomyopathy that follows myocardial infarction[11].

Dilation of LV and a decrease of ejection fraction occurs in 15-40% of subjects within 12-24 months after anterior MI[12,13] and in a smaller percentage of subjects after an inferior MI[12]. Based on limited data[14], it is tempting to speculate that subjects who undergo the remodeling process and develop an ischemic cardiomyopathy are those with particularly heightened compensatory mechanisms, perhaps as result in polymorphic variation in this system[15]. The remodeling process is an attempt of the compromised ventricle to increase its performance by increasing stroke volume, but ultimately, it correlates with an adverse outcome in the long run[16].

The gross pathology of ischemic cardiomyopathy includes transmural or sub endocardial scarring representing old MIs that may compromise up to 50% of LV chamber. The histopathology of the non-infarcted is similar to changes which occur in dilated cardiomyopathy[17].

The prognosis of idiopathic dilated Cardiomyopathy is considered to be better than that of Ischemic cardiomyopathy[18,19] and prior to the use of ACE inhibitors; the survival was approximately 50% at 5 year[20].

This study was conducted to evaluate the demographic variations, clinical findings, electrocardiographic and echocardiographic findings in patients of Ischemic Cardiomyopathy.

**Methods:**
A total 100 patients with history of ischemic heart disease with left ventricular dilatation and systolic dysfunction admitted in or visited at OPD of NICVD for a period of six months from March'15 to Sept'15 were studied. It was a cross sectional observational study.  Enrollment of the patients were done after fulfilling the inclusion and exclusion criteria. Patients were included in this study by consecutive purposive sampling. All patients gave written informed consent for the study. After enrollment clinical evaluation was done by detailed history taking and proper clinical examination. Then electrocardiogram and echocardiogram were done. All data were collected in a pre-formed data sheet. Statistical analysis was performed using SPSS version 16 (statistical Package for Social Science). Results were expressed as mean ± SD.

**Inclusion criteria:**
Chronic heart failure patients with dilated Left ventricle with one of the followings[10]:-

1.    History of myocardial infarction.

2.    H/O revascularization (CABG/PCI)

3.    In coronary angiography (CAG) ³ 70% stenosis of major epicardial artery.

Exclusion criteria:

1.    Idiopathic Dilated cardiomyopathy.

2.    Valvular heart disease i.e.  Valvular cardiomyopathy.

3.    Hypertrophic cardiomyopathy.

4.    Restrictive cardiomyopathy.

5.    Post-partum dilated cardiomyopathy

6.    Ischemic cardiomyopathy with device therapy (CRT/ICD).

**Results and Observations:**
A total 100 patients of ischemic cardiomyopathy were included in this study.The data analysis of these patients showed mean age was 61.4±7.9 years ranges from 40 years to 80 years and 79 (79%) were  male.

**Table-I**
*Distribution of the study patients according to clinical presentations(n-100)*

| Sign and symptoms | Number | Percent |
|---|---|---|
| Dyspnea | 92 | 92.0 |
| Chest pain | 73 | 73.0 |
| Palpitation | 39 | 39.0 |
| Edema | 23 | 23.0 |
| Paroxysmal Nocturnal Dyspnea (PND) | 52 | 52.0 |
| Orthopnea | 46 | 46.0 |
| Cardiogenic shock | 21 | 21.0 |
| Syncope | 5 | 5.0 |
| Cardiac arrest | 5 | 5.0 |

Table I displays the clinical symptoms of the studied ischemic cardiomyopathy patients.  The remarkable symptoms presented  were dyspnea (92%), chest pain (73%),Paroxysmal nocturnal dyspnea (52%), orthopnea (46%), palpitation (39%), edema (23%) and cardiogenic shock (21%). The rest of the symptoms such as syncope and cardiac arrest were present in 5% patients.

**Table-II**
*Distribution of the study patients according to NYHA class (n=100).*

| NYHA class | Number | Percent |
|---|---|---|
| Class I | 0 | 0 |
| Class II | 25 | 25.0 |
| Class III | 32 | 32.0 |
| Class IV | 43 | 43.0 |

Table II showes NYHA class II, III and IV were observed 25%, 32% and 43% in study population respectively. Majority of the patients were in NYHA functional class IV.

Risk factor evaluation shows 40% patients had diabetes, 40% patients had hypertension, 47% were smokers, 25% had family history of coronary artery diseases and 25% patient had chronic kidney diseases.

**Table-III**
*Distribution of the study patients according to past history of MI and intervention (n=100).*

| Myocardial Infarction (MI) | Number | Percent |
|---|---|---|
| Anterior | 64 | 64.0 |
| Inferior | 22 | 22.0 |
| Interventional procedure | | |
| PTCA | 25 | 25.0 |
| CABG | 7 | 7.0 |

Table III demonstrates MI and interventional status of the study patients. 64% and 22% patients were diagnosed as anterior MI and inferior MI respectively. 25% and 7% patients had undergone interventional treatment as PTCA and CABG respectively.

The physical  examinations demonstrated the presence of tachycardia and pulmonary rales were more common in patients 71% and   65% respectively. Patients with systolic BP <100 mmHg in 35%, pallor in 26%, raised JVP in 18%, hepatomegaly in 20%, pedal edema in 25%, ascites in 17%,  gallop in 41% and systolic murmur in 18% patients.

**Table-IV**
*Distribution of the study patients according to ECG findings (n=100).*

| ECG findings | Number | Percent |
|---|---|---|
| Sinus | 80 | 80.0 |
| Atrial fibrillation | 15 | 15.0 |
| Ventricular Tachycardia/Ventricular Fibrillation | 5 | 5 |
| Sinus tachycardia | | |
| QRS morphology | 71 | 71.0 |
| -Normal narrow | | |
| -LBBB | 54 | 54.0 |
| -RBBB | 34 | 34.0 |
| Pathological- Q | 12 | 12.0 |
| -Anterior surface | | |
| -Inferior surface | 65 | 65.0 |
| ST-T changes | 21 | 21.0 |
| PVCs | 41 | 41.0 |
| | 17 | 17.0 |

Table IV showes majority of the ECG is in sinus rhythm (80%), atrial fibrillation (15%) and ventricular tachycardia / ventricular fibrillation ( 5%). The sinus tachycardia (71%) was more frequently seen in patients with ischemic cardiomyopathy followed by LBBB (34%), and RBBB (12%).  Anterior and inferior surface in pathological Q were found in 65% and 21% respectively. ST-T changes had in 41% patients. PVCs was found in 17% patients of the study population.

**Table-V**

*Echocardiographic structural  and functional parameters of the study patients (n=100).*

| Characteristics | | Number | Percent (%) | Mean ± SD Range (min-max) |
|---|---|---|---|---|
| Regional wall motion abnormality (RWMA) | | | | |
| | Anterior wall | 52 | 52.0 | |
| | Inferior wall | 12 | 12.0 | |
| | Global | 43 | 43.0 | |
| LVEF in % | | | | 31.9±5.9(20 − 45) |
| | Severe impairment (<30) | 30 | 30.0 | |
| | Moderate impairment (30 -44) | 68 | 68.0 | |
| | Mild impairment (45-54) | 2 | 2.0 | |
| LVIDd in cm | | | | 6.5±0.4(5.6 − 8.2) |
| | Severely enlarge (Male>6.9 cm, Female>6.2 cm ) | 31 | 31.0 | |
| | Moderate enlarge (Male 6.4-6.8 cm, Female 5.8-6.1 cm) | 35 | 35.0 | |
| | Mildly enlarge (Male 6.0-6.3 cm, Female 5.4-5.7 cm) | 34 | 34.0 | |
| LVIDs in cm | | | | 5.2±0.5(4.0 − 6.2) |
| | Enlarge (> 4.1 cm) | 100 | 100.0 | |
| MR grading | | | | |
| | Grade I | 59 | 59.0 | |
| | Grade II | 20 | 20.0 | |
| | Grade III | 14 | 14.0 | |
| | None | 7 | 7.0 | |

Table: V demonstrates anterior wall hypokinesia in 52%, inferior wall hypokinesia in 12% and global hypokinesia in 43% ischemic cardiomyopathy patients. Left ventricular systolic dysfunction was moderately impaired in 68% patients, severely impaired in 30% and mildly impaired in 2% patients. Mean Left ventricular ejection fraction (LVEF) was observed 31.9±5.9% with range of 20-45%. Moderately enlarge LVIDd in 35% patients, mildly enlarge in 34% patients and severely enlarge in 31% patients. Mean LVIDd was found 6.5±0.4cm with a range of 5.6-8.2cm. Enlarge LVIDs had in 100% patients. Mean LVIDs was found 5.2±0.5cm with a range of 4.0-6.2 cm. Mitral Regurgitation (MR) with grade I was the most common

(59%) patients followed by grade II in 20% and grade III in 14% patients. 7%  patients had no MR.

**Discussion:**

This study intended to evaluate the clinical profile of patient presenting with Ischemic cardiomyopathy. After analyzing the collected data and results it is found that ischemic cardiomyopathy is a delayed complication of ischemic insult to heart and one of the leading cause of hospital admission of heart failure patients.

Ischemic cardiomyopathy caused by coronary artery disease is far more common than are the other clinicophysiological syndromes caused by coronary artery

disease that are associated with chronic heart failure [21, 22]. The other syndromes of coronary artery disease causing heart failure, are almost always considered as diagnostic possibilities in an individual patient with heart failure because of an accompanying history of chest pain, detection of cardiac murmur, and electrocardiographic evidence of myocardial infarction. By contrast, Cardiomyopathy caused by coronary artery disease is known to occur, without accompanying clinical clues to the presence of coronary artery disease[23]. Coronary artery disease becomes more severe and more symptomatic with  aging [24,25] and advanced age adversely affects the survival of patients with acute ischemic syndrome [26,27].

In this study, the mean age was found 61.4±7.9 years. Similar age incidences were reported in the previous studies [30].

 In our study, presenting symptoms were dyspnea 92 (92%), chest pain 73 (73%), palpitation 39 (39%), edema 23 (23%), paroxysmal nocturnal dyspnea (PND) 52 (52%), orthopnea 46 (46%), shock 21 (21%), syncope and cardiac arrest were 5(5%).Most of the symptoms were consistent with previous study[1,5] except chest pain which was more frequent (92%) in previous study[28].

Out of these patients- 25% patients were in New York Heart Association (NYHA) class II, 32% were in class III and 43% patients class IV. In previous study[28] maximum patients were in NYHA class III 46% but in our study maximum patients were in class IV 43%. It may be due to our majority of the patients were hospital admitted patients.

Among our population 40% were hypertensive and 40% were diabetic, 47% were smoker, 25% had family history of CAD and 23% patients were suffering from chronic kidney disease. These statistics are consistent with previous study[29] except smoking which were more frequent in our study.

In our study patients 71% had tachycardia, 35% blood pressure (BP) <100mmhg, 26% pallor,18% raised JVP, 20% hepatomegaly, 25% pedal  edema , 17% ascites, 65% basal rales,41% gallop  and 18% had apical systolic murmur which were  not consistent with previous study[28] except tachycardia. In previous study all parameters were in higher  percentages.

Electrocardiography (ECG) findings in this study were similar to previous study[29.]

In echocardiography anterior wall hypokinetic (left anterior descending artery territory) was 52%, inferior wall hypokinetic (right coronary artery territory) was 12% and overlapping or global hypokinetic was 43%. There were similae findings with previous study[36]. Maximum patients left ventricular ejection fraction (LVEF) were moderately impaired i.e. LVEF-(30-44%) and the no. of the patients were 62%. The mean left ventricular ejection fraction (LVEF) was found 31.9±5.9 %. In previous studies it was 26.6±7.8 %[36], 27.8±5.7 %[37], and 26±9.5%[31]. The mean LVIDd and LVIDs were found 6.5 ±0.5 and 5.2±0.5 respectively which were similar to previous study[29].On echo-color Doppler study 59% patients had mitral regurgitation (MR) grade-I, 20% MR grade-II, 14% MR grade-III and 7% had no MR. Previous study[29,32] related to ischemic cardiomyopathy and dilated cardiomyopathy also showed similar pictures. We, the physicians have to take challenge to manage these patients daily. Most of the patients are not able to take proper treatment due to economic constrain. Some of these patients have the criteria for modern treatment of heart failure i.e. device therapy alongside to medical management, so that morbidity and mortality can be reduced.

**Limitations of the study:**

1.    As the sample size was small and the study period was short, it is difficult to generalize all the findings to a reference population.

2.    It was not possible to perform CAG to all study population. So angiographic diagnosis was not made in all cases.

3.     Most of the patients were hospital admitted. So the community prevalence is difficult to assess.

4.     Number of hospitalizations since diagnosis was not shown in this study.

5.     As it is single population observational study there was no comparison with other cardiomyopathy.

**Conclusion:**

Ischemic cardiomyopathy is a one of the commonest causes of congestive heart failure causing repetitive hospital admissions.  The clinical presentation of ischemic cardiomyopathy varies from patient to patient, and most patients present with delayed symptoms. Severity of symptoms correlate with severity of left ventricular systolic dysfunction, left ventricular diameter and mitral regurgitation grade . Anterior Myocardial infarction has more chance to develop ischemic cardiomyopathy.

**References:**

1.    The world Health report, 2003. Neglected global epidemic three growing threat shaping the future World Health Organization,Geneva,2003;85-99

2.    Anderson RN United States life tables: Eliminating certain causes of death Hyattsville MD: National center for health   statistics, 1999.

3.    Murry CJ, Lopez AD, KJauder E, Mortality by cause for eight regions of the world : burden of disease study Lancet 1997,349: 1269-1276.

4.    Mitra SN, Sabir A , Cross AR et al. Bangladesh demographic and health survey 1996-97,National Institute of Population Research and Training (NIPORT),Dhaka ,Bangladesh.

5.    Bhopal CN, Whitic M, Yalllop H et al. Heterogenecity of coronary heart disease, risk factors in India, Pakistan ,Bangladesh and European origin population. BMJ 1999, 319:215-20.

6.    Acute Coronary Syndrome: Guidelines for management, Bangladesh Cardiac society, Dhaka, Bangladesh 2004

7.    Islam MN, Ali MA, Ali M. Spectrum of cardiovascular disease: The current scenario in Bangladesh, Bangladesh Heart Journal 2004, 19:1-7.

8.    Bangladesh bureau of statistics : Health, Family planning and Social statistics ,cat.no 13:20, BBS , Dhaka ,2007

9.    Mihai G. George S. Jhon DP et al. Navigating the crossroad of coronary artery disease and heart failure. Circulation. 2006; 114:1202-1213.

10.   Burch GE, Giles TD et al. Ischemic cardiomyopathy. American Heart Journal. 1970; 79: 291 - 292.

11.   Hokki, Anderson KM, Kannel WB, Grossman  W, Levy D. Survival after the onset of congestive heart failure in Framingham heart study subjects. Circulation.1993;88:107-115

12.   McKay RG,Pfeffer MA,Pasternak RC,et al. left ventricular remodeling  after myocardial infarction : a corollary to infarct expansion. Circulation. 1986;74:693-702.

13.    Mitchell GF, Lamas GA, Vaughan DE, et al.left ventricular remodeling in the year after myocardial infarction: a quantitative analysis of contractile segment lengths and ventricular shape. J Am Coll Cardiol .1992;19:1136-1144.

14.   Pinto YM, van Gilst WH , Kingma JH, Schunkert H, for the captropril   thrombolysis study investigators.Deletion type allele of the angiotensin converting enzyme gene is associated with progressive ventricular dilatation after anterior myocardial infarction. J Am Coll Cardiol. 1995; 25: 1622-1626.

15.   Raynolds MV,Bristow MR, Bush EW,et al. angiotensin-converting enzyme DD genotype in patients with ischemic or idiopathic cardiomyopathy .Lancet.1993;342:1073-1075.

16.   Mann DL, Bristow MR. Mechanisms and models in heart failure: the biomedical model and beyond. Circulation .205;111:2837-2849.

17.   Gerdes AM, Kellerman SE, Moore JA, et al. structural remodeling of  cardiac myocytes from patients  with chronic ischemic heart disease. Circulation .1992;86:426-430.

18.   Fransciosa JA, Wilen M. Ziesche S, Cohn JN. Survival in men with severe chronic left ventricular failure due to either,coronary heart disease or idiopathic dilated cardiomyopathy. American Jour of  Cardiology. 1983; 51: 831 – 836.

19.   Likoff M, Chandler S, Kay H. Clinical determinants of mortality in chronic congestive heart failure secondary  to  idiopathic  or   ischemic cardiomyopathy. American Jour of Cardiology. 1987; 59: 634 – 638.

20.   Fuster V, Gersh BJ et al. The natural history of idiopathic dilated cardiomyopathy. American Jour of  Cardiology. 1981; 47: 497 – 508 .

21.   Brody W and Criley JM. Intermittent severe mitral regurgitation. Hemodynamic studies in a patient with recurrent acute left sided heart failure. New England Journal of Medicine. 1970; 283: 673 – 676.

22.   Baxely WA, Jones WB and Dodge HT. Left ventricular anatomical and functional abnormalities in chronic post infarction heart failure. Journals of Internal Medicine. 1971; 74: 499 – 508.

23.   Raftery EB, Banks DC, Oram S: Occlusive disease of the coronary arteries presenting as primary congestive cardiomyopathy .Lancet. 1969; 2: 1147-1150.

24.   Fisher LD, Maynard C, Rademark AW, Alderman EL, Mock M: Age variation in association between angiographic coronary artery disease and angina from the coronary artery surgery study (CASS). International Jour of Cardiology. 1989; 24: 317-326.

25.   Chaitmann BR, Bourassa MG, Davis K, Rogers WJ, Tyraas DH, Berger R, Kennedy JW, Fisher L, Judkins MP, Mork M, Kitrip T. Angiographic prevalence of high

risk coronary artery disease in patients subjects (CASS) Circulation. 1981; 64: 360 –367.

26. R Lapu-Bula, Robert A, Kock M De et al. Risk stratification in patients with dilated cardiomyopathy: contribution of Doppler derived left ventricular filling. American Jour of Cardiology. 1998 (82); 779-785.

27. European Coronary Surgery group: Long term results of prospective randomized study of coronary 295: 731 – 739 artery bypass surgery in stable angina pectoris . Lancet. 1982; 2: 1174-1180.

28. Shoaib AZ, Rabbani MU, Parvez A. 2-D Echo and doppler evaluation in ischemic cardiomyopathy. JK-Practitioner 2012; 17(1-7):5-9.

29. Mantzian L,Ziakas A, Ventoulis I,Kemperidis Differences in Clinical Presentation and Findings between Idiopathic Dilated and Ischemic Cardiomyopathy in an Unselected Population of Heart Failure Patients. The open cardiovascular medicine Journal, 2012; 6, 98-105.

30. The comparative analysis of of ECG between ischemic cardiopathy and dilated cardiomyopathy. http://heart.bmj.com/content/98/Suppl_2/E167.3

31. Virendra CP,Neeraj D,Chetan G.Clinical and echocardiogram profile of cardiomyopathy at tertiary care Centre.Journal of cardiovascular disease research,2014;5(1):34-43.

32. Banerjee SK, Rahman F, Salman M, Siddique MA. Idiopathic dilated cardiomyopathy: clinical profile of 100 patients. University Heart Journal. 2010; 6(1):9-12.