Ibrahim Card Med J 2016; 6 (1&2): 67-70

Clinical Profile of Chronic Heart Failure in Hospitalized Type 2 Diabetic Patients

Shahana Parveen[1], AMB Safdar [2], Faria Afsana [3], AKM Mohibullah [4], Ramendra Nath Sarker [5]

ABSTRACT:

Objective: To see the clinical profile of chronic heart failure in hospitalized type 2 diabetic subjects.

Method: This cross-sectional study was carried out on a total of 100 type 2 diabetic patients with chronic heart failure, in the Department of Cardiology, BIRDEM, over a period of six months between July to December 2012.

Results: The mean age of the study subjects was 60.9 ± 11.7 years with male to female ratio being roughly 2:1. The mean duration of diabetes mellitus was 9.15 years. Among the study subjects 72% were on insulin and 18% on oral hypoglycemic agents; 10% were on combined insulin and oral hypoglycemic agent. Dyspnea and cough were invariably present. About 88% subjects had edema, 39% raised JVP, and 13% murmur. Bilateral basal crepitation was found in 56% cases. While mean fasting blood glucose (FBG), postprandial blood glucose (PPBG) level and HbA1C were 10 mmol/l, 16.7 mmol/l and 9.9% respectively, mean serum creatinine was 2.07 mg/dl. Among study subjects, raised ESR (48%), elevated WBC count (50%) and raised BNP level (64.6%) were seen. Chest X- ray revealed cardiomagaly (70%), reticulonodular shadow in both lung fields (11%) and septal thickening (15%). ECG findings of the patients were old infarct (72%), IHD (66%), RV hypertrophy (40%) and arrhythmia (17%). Most common echocardiographic findings of the subjects were regional wall motion abnormalities (78%), Mild LV systolic dysfunction (64%) with Grade-I diastolic dysfunction being 70% and moderate to severe pulmonary arterial hypertension being 40%.

Conclusion: Raised BNP level, presence of old infarct in ECG and regional wall motion abnormalities in echocardiography are the common clinical findings among patients with chronic heart failure.

Key points: Chronic Heart Failure, Clinical Profile, Type 2 Diabetes.

ORIGINAL ARTICLE

Introduction

Diabetes Mellitus is a chronic or persistent hyperglycemia due to either deficiency of insulin secretion or insulin action or both as a result of genetic & environmental factors leading to severe complications including cardiovascular disease, renal disease amd blindness.[1] Epidemiological evidence suggest that incidence of diabetes is increasing worldwide. Type 2 Diabetes Mellitus is now one of the most common non-communicable diseases globally.[2,3] The International Diabetic Federation estimates in 2010 that approximately 285 million people of the world have been affected by diabetes with adult diabetics being 4.3 billion. Currently in Bangladesh, 7.1 million (prevalence 7.4%) adult people are suffering from diabetes.[4]

Heart failure is a complex clinical syndrome that results from structural or functional cardiac disorder and impairs the ability of the ventricle to fill with or eject blood.[5] Extrapolated statistics revealed that in Bangladesh approximate prevalence of heart failure is 2.5 million among adult persons.[6] The manifestation of heart failure are dyspnea, fatigue, reduced exercise tolerance &

Authors' information:

[1] ***Dr. Shahana Parveen,*** *MBBS, DEM, DCMO, Medicine OPD, BIRDEM General Hospital, Bangladesh.*

[2] ***Dr. AMB Safdar,*** *MBBS, FCPS (medicine) Associate professor, Department of Cardiology, BIRDEM General Hospital, Bangladesh.*

[3] ***Dr. Faria Afsana,*** *MBBS, DEM, MD , Assistant professor, Department of Endocrinology, BIRDEM General Hospital, Bangladesh.*

[4] ***Prof. AKM Mohibullah,*** *MBBS, MD, FRCP, FCCP, FACC, Professor & Head, Department of Cardiology, BIRDEM General Hospital, Bangladesh.*

[5] ***Dr. Ramendra Nath Sarker,*** *D Card (BSMMU), Senior Consultant, (Cardiology), District Hospital, Gaibandha*

Address of correspondence: ***Dr. Shahana Parveen,*** *Cell Phone: +880 1716504101. Email:parveen_shahana@yahoo.com*

fluid retention leading to pulmonary congestion, peripheral edema. Important information concerning heart failure is suggested by the presenting symptoms.[7] Acute and sub-acute presentations (days to week) are characterized primarily by shortness of breath at rest and/or with exertion. Also common are orthopnea, paroxysmal nocturnal dyspnea (PND), Cheyne-stokes respiration sometimes associated with marked weight loss. In right heart failure, right upper abdominal pain is manifested due to acute hepatic congestion and raised JVP. Patients with atrial and/or ventricular tachyarrhythmia may complain of palpitations with or without light headedness.[8] Chronic presentation differs in that fatigue, anorexia, abdominal distention and peripheral edema may be more pronounced. Patients with advanced heart failure show evidence of a major decline in cardiac output and decrease in tissue perfusion. If severe left ventricular failure there is shifting of apical pulse and S3 gallop rhythm associated with left atrial enlargement.[9]

The prevalence of diabetes mellitus in heart failure population is close to 20% compared with 4-6% in control populations.[10] Framingham study established the epidemiological link between heart failure and diabetes, which is due to poor glycemic control.[11] There are different factors associated with heart failure in adult diabetic patients such as age, duration of diabetes, ischemic Heart Disease (IHD), elevated serum creatinine, microalbuminuria etc. The First demonstration of an increased risk of heart failure in patients with Type 2 DM was reported by Kannel and McGee based on data obtained from 20 years follow up of the Framingham Cohort. Long term follow up in UK prospective diabetes study (UKPDS) demonstrated that the incidence of heart failure in diabetic patients significantly co-relates with HbA1C levels.[12] Action to control cardiovascular risk in diabetes (ACCORD)[13] trial and Action in diabetes and vascular disease (ADVANCE)[14] study shows that tight glycemic control improve cardiovascular risk factors such as dyslipidemia, hypertension, hypercoagulability, obesity and inflammation that are part of insulin resistance. There is a strong link between the existence of heart failure and diabetes.[15] Both conditions are increasingly common. Hence the purpose of this study was to find the clinical features of chronic heart failure patients with type 2 diabetes mellitus.

Method:

This cross-sectional observational study was carried out to evaluate the clinical profile of 100 diabetic subjects suffering from chronic heart failure in the Department of Cardiology, BIRDEM General Hospital, Dhaka. The study included all consecutive type 2 diabetic patients aged > 40 years, admitted into BIRDEM hospital with chronic heart failure. Informations collected were the subject's age, gender, medical history, clinical history of chronic heart failure with diabetes. Clinical examination, X-ray chest, ECG & Echocardiographic tests were done to find type and features of chronic heart failure. The study was approved by Ethical Review Committee of BADAS. Data entry and analysis were done using SPSS for windows version 13.0.

In this study type 2 diabetes mellitus was considered when blood glucose in fasting state was ≥ 7.0 mmol/L and/or two hours after 75 gm oral glucose drink ≥ 11.1 mmol/L or random blood sugar ≥ 11.1 mmol/L and/or HbA1C ≥ 6.5%. Chronic heart failure was diagnosed when serum B-type natriuretic peptide (BNP) level was > 95 ng/L, along with venous congestion, pulmonary oedeama and cardiomegaly in chest X-ray and/or left ventricular hypertrophy, previous myocardial infarction evident in ECG and/or echocardiography showing decreased left ventricular compliance and decreased relaxation of heart, regional wall motion abnormality, ejection fraction < 55% (according to Framingham Diagnostic Criteria for Heart Failure).[11] Echocardiography was done by 2D method. Reference limits, values and partition values of left ventricular ejection fraction[16], and severity of pulmonary hypertension[17] were calculated by American Society of Echocardiography's guideline and Standard Committee.

Result:

The mean age of the study subjects was 60.9 ± 11.7 years (range: 47 – 64 years) (Table I). Males were predominant (66%) among the study subjects. The mean duration of diabetes mellitus was 9.1 years. Over one-third (38%) of the subjects had diabetes for more than 15 years. Other than diabetes, the study subjects had dyslipidemia (72%), hypertension (69%), history of IHD (66%) and CVD (19%). Over 60% were smoker. Over 70% of the study subjects were getting insulin, 18% were on oral hypoglycemic agents. Some 10% of the subjects were getting combined therapy (both insulin and oral hypoglycemic agents). Dyspnea and cough were invariably present. About 14% had complaints of chest pain and 6% presented with haemoptysis. Edema was predominant sign (88%), followed by bilateral basal crepitation (56%), raised JVP (39%), murmur (13%). Sixteen percent had crepitation in whole lung. Raised Troponin I level was observed in 12.9% (among 85 subjects) cases (Table II). Table III describes the different medicines that the study subjects were receiving for heart failure and Table IV describes the biochemical parameters

The chest X-ray findings (Figure 1) showed cardiomegaly to be 70%, prominent pulmonary conus 34%, prominent pulmonary arteries at both hila 40% and upper lobar diversion 20%. Reticulonodular shadow in both lung fields (11%) and septal thickening (15%) were also observed. Common ECG findings were old infarct (72%), IHD (66%), LV hypertrophy (40%), RV hypertrophy (10%), LA hypertrophy (6%), RA hypertrophy (4%) and arrthythmia (17%). Findings of echocardiography done by 2D method are described in Table V.

TABLE I. Age distribution of the study subjects (n=100)

Age (yrs)	Frequency	Percentage
< 50	19	19
50 – 60	48	48
> 60	33	33

Mean age = 60.9 ± 11.7 years; **range** (47 – 64) years.

TABLE II. Presenting symptoms & Signs of chronic heart failure (n = 100)

Symptoms & Signs	Frequency	Percentage
Symptoms		
Dysponea	100	100.0
Cough	100	100.0
Chest Pain	14	14.0
Haemoptysis	6	6.0
Signs		
Leg oedema	88	88.0
Bilateral basal crepitation	56	56.0
Whole lung crepitation	16	16.0
Raised JVP	39	39.0
Murmur in precordium	13	13.0

TABLE III. Medications received by the patients before admission (n = 100)

Type of drugs	Drugs	Frequency	Percentage
Antihypertensive	ACE inhibitor	52	52.0
	ARB	38	38.0
	Beta blocker	22	22.0
	Calcium channel inhibitor	05	5.0
Antiischemic	Glycerin trinitrate	90	90.0
	Trimetazidine	51	51.0
Antiplatelet	Aspirin	40	40.0
	Clopidogrel	50	50.0
	Combination of aspirin and clopidogrel	10	10.0
Diuretic	Furosemide	82	82.0
	Combination of furosemide and spironolactone	18	18.0
Antilipid	Atorvastatin	80	80.0
	Fenofibrate	20	20.0

TABLE IV. : Biochemical parameters of the study subjects

Biochemical variables	Mean ± SD	Minimum - Maximum
Cholesterol (mg/dl)	209±38.4	90 - 495
Triglyceride (mg/dl)	282±165	100 - 814
HDL (mg/dl)	34.22±12.67	13 - 57
LDL (mg/dl)	110±38.7	57.8 - 407
Serum creatinine	2.07±1.72	0.89 - 4.12
SGOT	36.64±19.25	14.67 - 58.38
SGPT	39.54±15.73	15.74 - 55.38
BNP	64.6±48.98	48.98 -113.58
Troponin I	2.9± 5.9	1.2 - 18.8

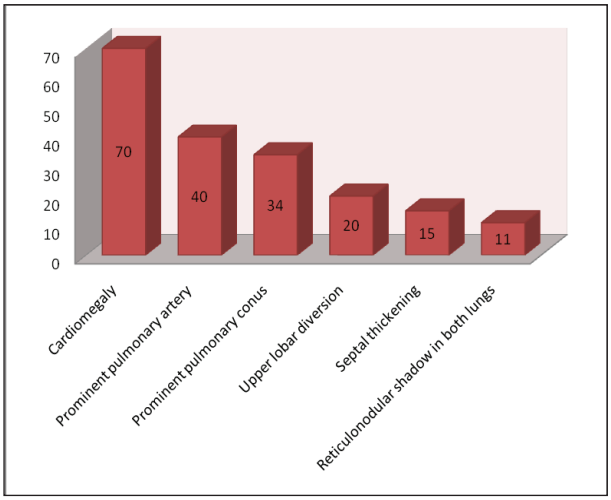

Figure 1: Common chest X-ray findings of the study subjects.

TABLE V. Common Echocardiographic findings of the patient (n=100)

ECHO findings (Common)		Frequency	Percentage
Regional wall motion abnormality		78	78
Presence of valvular lesion		28	28
LV systolic function			
Normal	≥ 55%	05	05
LV systolic dysfunction			
Mild	> 45-54%	64	64
Moderate	> 30-44%	19	19
Severe	≤ 30%	12	12
Diastolic dysfunction			
Grade I		70	70
Grade II		21	21
Grade III		09	09
Pulmonary hypertension (mPAP mmHg)			
Mild	25-40 mm of Hg	03	03
Moderate	41-55 mm of Hg	30	30
Severe	>55 mm of Hg	10	10

Discussion

Epidemiological studies have demonstrated an increased risk of heart failure in diabetic populations. Various mechanisms may link diabetes mellitus to heart failure: firstly, associated comorbidities such as hypertension may play a role; secondly, diabetes accelerates the development of coronary atherosclerosis; thirdly, experimental and clinical studies support the existence of a specific diabetic cardiomyopathy related to microangiopathy, metabolic factors or myocardial fibrosis. In addition, it has been suggested that the deleterious impact of diabetes may be especially marked in patients with ischemic cardiomyopathy.[3,15]

The causes of chronic heart failure are difficult to analyze due to challenges in diagnosis, differences in populations and changing prevalence of causes with age. A study on 13000 healthy adults (both diabetic and non-diabetic) in the United States (the National Health and Nutrition Examination Survey (NHANES I)[18] found ischemic heart disease (62%), cigarette smoking (16%) & hypertension (10%) as cause of heart failure. An Italian registry of over 6200 patients with heart failure showed ischemic heart disease (40%), dilated cardiomyopathy (32%) and hypertension (11%) to be the causes of heart failuure.[19] It was concluded in both studies that these risk factors demonstrated their significant presence in diabetic group than those in non-diabetic group in causing chronic heart failure. Dyslipidemia is often related to uncontrolled diabetes.[5,19]

Age and gender has effect on occurrence of chronic heart failure in diabetic subjects. A study reported that chronic heart failure occurs more in those over the age of 65 years.[20] The present study also shows comparable ages of study subjects. A study reported that knowledge of the diabetic status might help to define the optimal therapeutic strategy for heart failure patients.[21] Cornerstone treatments such as ACE inhibitors or beta-blockers appeared to be uniformly beneficial in diabetic and non-diabetic populations. However, in ischemic cardiomyopathy, the choice of the revascularization technique might differ according to diabetic status. Most of the diabetic subjects need diuretic drugs along with insulin or oral hypoglycaemic agents to control fluid overload and hyperglycaemia. Besides, they are prescribed antihypertensive, mostly ACE inhibitors, ARB, beta-blockers but calcium channel blockers are not prescribed usually as they cause fluid logging. When heart failure is associated with ischemic

heart disease anti-ischemic and antiplatelet drugs are given. The present study revealed the similar drug management schedule.

Pfeffer et al[22] reported that failure of the left ventricle causes congestion of the pulmonary vasculature and so the symptoms of chronic heart failure were predominantly respiratory in nature. The patients presented with dyspnea on exertion and in severe cases dyspnea at rest. Compromise of left ventricular forward function may result in symptoms of poor systemic circulation such as dizziness, confusion and cool extremities at rest. Dependent edema, pulmonary crepitation, increased jugular venous pressure were observed. Similar findings were observed in the present study where dyspnoea and cough were present in all subjects (100%).[23,24] Heart murmur may indicate the presence of valvular heart disease, either as a cause (e.g. aortic stenosis) or as a result (e.g., mitral regurgitation) of the heart failure.[21,25,26] This was also seen in echocardiographic findings of the present study (presence of valvular lesion in 28% subjects). Physical examination revealed pitting peripheral oedema, raised jugular venous pressure, and parasternal heave.[25] Similar signs were seen in the study. All these findings indicate significant compensatory increase in contraction strength of heart with fluid logging. Bilateral basal crepitation was observed in 56% of the subjects in this study. Long standing pulmonary edema and arteriolar atherosclerosis in pulmonary arteriole in diabetic subjects leads to pulmonary hypertension which might be mild to severe in characteristics.[23,24] This situation was reflected in our study where indirect signs of pulmonary hypertension was observed in chest X-ray as prominent pulmonary conus (34%), prominent pulmonary arteries at both hila (40%), upper lober diversion (20%) and direct signs as mild pulmonary arterial hypertension (31-50 mm of Hg) in 30% subjects and moderate (51-70 mm of Hg) pulmonary arterial hypertension in 10% subjects by echocardiography. A study[27] showed that anaemia, raised ESR, increased total WBC count and elevated C-reactive protein were the commonest laboratory findings in chronic heart failure subjects. Risk factors identification for chronic heart failure in diabetic subjects was beyond the scope of this study as this is a descriptive study and a case-control study is needed for identification of risk factors.

Conclusion

Most of the type 2 diabetic subjects with chronic heart failure presented with dyspnoea, cough, and complaints of chest pain and swelling of leg. Raised Troponin I, presence of old infarct in ECG and regional wall motion abnormalities in echocardiography are the common features found in patients of chronic heart failure with type2 diabetics.

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