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Incidence of heart failure in patients of acute ST elevation myocardial infarction with impaired renal function

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Abstract

Ischemic heart disease is a common cardiac disorder and significant cause of mortality and morbidity worldwide. Effective risk stratification is integral to the management of patients with acute coronary syndromes and associated chronic kidney disease may adversely affect acute ST elevation myocardial infarction (STEMI) outcome. This prospective study was conducted in the Department of Cardiology, Chittagong Medical College Hospital after approval of the protocol for the study with duration of one year. For these purpose 100 patients of STEMI diagnosed by clinical, biochemical and ECG criteria were included in the study. After getting serum creatinine level, estimated glomerular filtration rate was calculated and if it is <60 ml/min then the patient was selected for the study. Among the 100 patients inferior MI was 34%, anterior MI was 20%, extensive anterior MI was 12%, antero-septal MI was 18%, infero-lateral MI was 10%, lateral MI was 2%, high lateral MI was 3% and antero-inferior was 1%. Of these patients heart failure was found in 21% of the patients. The association between incidence of heart failure patients and eGFR was statistically significant ($p < 0.05$). From this study, it was concluded that impaired renal function among MI patients plays a role for an adverse outcome. Early detection of renal impairment is necessary to avoid increased morbidity and mortality. **Key words:** STEMI, renal impairment, heart failure.

Introduction

Coronary heart disease is a worldwide health epidemic. Worldwide, 30% of all deaths can be attributed to cardiovascular disease of which more than half are caused by coronary heart disease. Globally of those dying from cardiovascular disease, 80% are from developing countries.[1] In 2001, it was estimated that worldwide coronary artery disease was responsible for 11.8% of all deaths in low income countries.[2]

Incidence of coronary artery disease in Bangladesh has increased from 3.3 per thousand to 14 per thousand from the year 1975 to 1985.[3] Acute ST elevation myocardial infarction (STEMI) is defined by at least two of the followings in which typical ECG changes is a must and any one either typical chest pain of cardiac origin or significantly raised troponin-I level.[4]

In STEMI cigarette smoking, male gender

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and a family history of cardiovascular and renal disease are associated with adverse prognosis in young patients, whereas dyslipidemia, hypertension and diabetes mellitus are associated with adverse prognosis in the elderly.[5] Impaired renal function is manifested by decreased estimated glomerular filtration rate (eGFR). Decreased eGFR is measured by increased serum creatinine or more preciously by reduced creatinine clearance (<60 ml/min). It is an independent risk factor for coronary artery disease (CAD) outcome.[6-7] Mild renal impairment is associated with an increased risk of CAD and stroke, suggesting that cardiovascular disease may develop early in the course of renal dysfunction.[8-9]

It is a time demand for a study to determine the incidence of heart failure in patients of acute STEMI with impaired renal function. Therefore, the aim of this study was to determine the incidence of heart failure in patients of acute STEMI with impaired renal function.

Materials and Method
This prospective observational study was conducted at Chittagong Medical College Hospital (CMCH) during a period of one year from January 2014 to December 2014 after the approval of Ethical Review Committee. For this purpose 100 patients of acute STEMI with impaired renal function were included in this study.

Inclusion criteria
Patient's of acute STEMI within twelve hours after the onset of chest pain who were eligible for thrombolysis, eGFR <60 ml/min (Cockcroft-Gault formula), and voluntarily gave consent to participate in the study.

Exclusion criteria
Non-STEMI, patients who are not eligible for thrombolysis, STEMI with previous history of MI, STEMI patients with history of vulvular heart disease, cardiomyopathy, congestive heart failure, patients with STEMI presenting with VT or VF, previous known case of diabetic nephropathy or known case of chronic kidney disease.

Operational definitions
STEMI was at least a 2 mm ST segment elevation in at least 2 contiguous leads in the precordium or at least 1 mm ST segment elevation in 2 contiguous limb leads. Renal impairment defines that eGFR <60 ml/min/1.73 m^2.

Informed consent
A patient with diagnosed case of MI or his/her legal guardian was thoroughly informed about the aims, objectives and detailed procedure of the study before examination. S/he was encouraged for voluntary participation and allowed freedom to withdraw from the study whenever s/he liked even after participation.

Procedure of data collection and analysis
From all eligible subjects after getting consent, clinical history was taken and clinical examination was done to elicit findings related to MI. Related investigations like blood sugar and serum creatinine were done. Blood was collected within two hours after admission of the patient in the hospital. If the patients' calculated eGFR is <60 ml/min and ECG criteria confirms the acute STEMI then s/he was included in the study as a case. The patients were followed up till discharge with special attention to serum creatinine and development of other complications. The researchers did not influence the ongoing hospital treatment. The endpoint of the study was sudden cardiac death or rise of serum creatinine double of the baseline value. All relevant data were noted in the pre tested data sheet. All data were checked and rechecked to avoid any error. All investigations were done in the Department of Biochemistry, CMCH, and if not possible, in the standard laboratories of Chittagong.

Data were processed and analyzed by using a computer based software Statistical Package for Social Science 19. Discrete or qualitative variables were analyzed by *Chi*-square test and continuous variables by *t*-test. The *p* value <0.05 was considered as statistically significant.

Results
Most of the patients (67%) were in between 41-60 years (Table 1). Among the patients, 77 were male and 23 were female (Table 2). Among the heart failure patients raised jugu-

Table 1. Age distribution of the patients, n = 100

Age in years	Frequency	%
<40	14	14.0
41-50	32	32.0
51- 60	35	35.0
61-70	19	19.0

n, number; mean ± SD was 52.8±8.4 years.

Table 2. Gender distribution of the patients, n = 100

Gender	Frequency	%
Male	77	77.0
Female	23	23.0

Table 3. Examination findings

Clinical examinations	Frequency	%
Raised jugular venous pressure	12	12.0
Gallop rhythm	10	10.0
Basal crepitations	21	21.0

Table 4: Distribution of investigation findings, n = 100

Investigations	Mean±SD
Left ventricular ejection fraction, %	50.8±10.0
Random blood sugar, mg/dl	222.8±72.2
Low-density lipoprotein-cholesterol	210.0±23.8
Serum creatinine	1.6±0.4

Table 5. Types of myocardial infarction among the study population

Types	Frequency	%
Inferior	34	34.0
Anterior	20	20.0
Extensive anterior	12	12.0
Antero-septal	18	18.0
Infero-lateral	10	10.0
Lateral	2	2.0
High lateral	3	3.0
Antero-inferior	1	1.0
Total	100	100.0

Table 6. Incidence of heart failure patients stratified by eGFR, n = 100

	eGFR, ml/min						p value
	60-30 (n = 71)		30-15 (n = 22)		<15 (n = 7)		
	n	%	n	%	n	%	
Heart failure, n = 21	11	15.5	6	27.3	4	57.1	0.026

n, number; eGFR, estimated glomerular filtration rate.

lar venous pressure was found in 12%, gallop rhythm in 10% and basal crepitation in 21% (Table 3).

The common risk factors were hypertension, dyslipidemia, smoking and diabetes mellitus (Table 4). Of these patients, the mean±SD of left ventricular ejection fraction (%) was found 50.8±10.0, random blood sugar was found in 222.8±72.2, serum creatinine was found 1.6±0.4. Among the patients, the inferior MI was 34%, anterior MI 20%, extensive anterior MI 12%, antero-septal MI 18%, infero-lateral MI 10%, lateral MI 2%, high lateral MI 3%, antero-inferior MI 1% (Table 5).

The incidence of heart failure was 21% (Table 6). Out of 21 heart failure patients, eGFR was 60-30 ml/min in 11 patients, 30-15 ml/min in 6 patients, <15 ml/min in 4 patients (Table 6). The association between incidence of heart failure patients and eGFR was statistically significant ($p < 0.05$).

Discussion

Acute myocardial infarction is one of the major health problems all over the world and the coronary artery thrombosis is the leading cause of it.[10] In the developing country like Bangladesh, urbanization is taking place at a rapid pace that is responsible for change in the lifestyle which adversely affects the metabolism thereby causing a large increase in the number of diabetic patients.[11]

In the present study, among 100 patients male was 77% and female 23%. Male to female ratio was 3.34:1. A higher prevalence of ischemic heart disease in male than female has been reported in a study from England.[11] Thus the present results are in agreement that male population is more prone to STEMI which may be linked to genetic/ hormonal difference. The present study showed among the 100 patients most of the patients were in age of 51-60 years (35%) next to which in 41-50 years (32%). The mean±SD of age was 52.8±8.4 years.

Regarding the evaluation of risk factors of STEMI, hypertension was found in 61%, smoking in 52%, dyslipidemia in 78%, diabe-tes mellitus in 31%, sedentary life style in 23%, obesity in 23% of total patients and family history of ischemic heart disease was found in 24% of patients. The results of the present study with reference to risk factors were similar to those published earlier that type 2 diabetic patients were more hypertensive than non diabetic.[12] It was reported that 48% patients were found hypertensive in the diabetic group whereas only 36% patients were found hypertensive in non diabetic group. All of the above findings are consistent with the earlier study.[13]

Of the 100 patients, inferior MI was 34%, anterior MI 20%, extensive anterior MI 18%, antero-septal MI 12%, infero-lateral MI 10%, lateral MI 2%, high lateral MI 3% and antero-inferior 1%. The present study found non-significant difference in the site of infarction among all patients. Inferior and anterior infarctions were common. In some studies lateral infarction was found common in diabetic group.[14] However, the present study was not similar which may be due to the small size of the study population.

Regarding analysis of complications and outcome, the mean±SD of hospital stay of the study patients was 4.5±0.8 days. Left ventricular ejection fraction (%) was found in 50.8±10.0 and random blood sugar was found in 222.8±72.2 mg/dl. Among the 100 patients, heart failure was found in 21%. These findings are as expected from the patients with STEMI.[15]

Regarding eGFR and different complications, more were found with low eGFR. The association between incidence of heart failure patients and eGFR was statistically significant. We have shown that in patients admitted with STEMI and across each STEMI grouping, creatinine clearance was an important independent predictor of hospital mortality. In our study, 4 cases died with low eGFR. A 10 ml/min decrease in creatinine clearance had the same adverse impact on hospital death rates as a 10 year increase in age. Increased renal dysfunction was observed more often in elderly (age >65

years) and female patients. It is well known that renal function decreases with age, and women are considerably older than men when they are admitted with an STEMI, which may partially explain the predominance of women with reduced renal function.[11]

Increased creatinine concentrations are common in older patients and are independently associated with an increased risk of death, cardiovascular disease, and congestive heart failure. It can be said that the increased risk of death begins with mildly elevated concentrations of serum creatinine.

Conclusion

From the present study findings, it can be concluded that increased incidence of heart failure occurs among MI patients with impaired renal function. Early detection of renal impairment is necessary to avoid increased morbidity and mortality.

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