ORIGINAL ARTICLE

Chronic Kidney Disease Effect on Adverse Cardiac Events in Acute Myocardial Infarction patients

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ABSTRACT

Objective: To determine the chronic kidney disease effect on adverse cardiac events in acute myocardial infarction patients.
Study Design: Prospective cohort study
Place and Duration of Study: Mayo Hospital, Lahore. Study Period was 1st July 2017 to 30th December 2017.
Methodology: One hundred patients and age between 25 to 65 years were enrolled. Those patients were followed who were already diagnosed and confirmed for myocardial infarction through fourth universal definition. For each patient the GFR was calculated using the Modification of Diet in Renal Disease (MDRD) formulas. The main theme of the study was to compare the GFR of those patients >60 cc/min to those with ≤ 60 cc/min and identify any adverse cardiac event related with impaired kidney function. Patients were followed up to a year in terms of hospitalization, repeated GFR, repeat revascularization, Major Adverse Cardiovascular Events (MACE) and occurrences of death.
Results: The mean age was 42.9±12.75 years. There was a high frequency of males than female suffering from myocardial infarction. Non-ST Elevation Myocardial Infarction (NSTEMI) were significant risk factors for cardiovascular events (p value = 0.017). Those patients having a GFR level lower than 60 cc/min had a mortality rate of 16% through adverse cardiac events in comparison to 4% of those with a GFR above 60 cc/min. Patients with decreased GFR rates were having higher likelihood of MACE. The multivariate regression analysis presented diabetes mellitus, GFR and NSTEMI as significant risk indicators for cardiovascular events (p = 0.016, p = 0.015, p = 0.006 respectively).
Conclusion: There is a significant correlation between less GFR than 60 and increased cardiovascular events in patients suffering from myocardial infarction where age, gender and diabetes are high risk factors in escalating the mortality rates. There seemed to be a correlation between death and GFR.
Keywords: Chronic kidney disease, Effect, Acute myocardial infarction

INTRODUCTION

Acute myocardial infarction (AMI) is a public health concern, caused by obstruction/reduction in coronary blood flow and thus, leading to insufficient oxygen supply to heart. It is a widespread cause of morbidity and mortality all around the globe and this problem is usually multifactorial with atherosclerotic plaques, coronary artery embolism, coronary dissection, cocaine-induced ischemia and coronary vasospasm[1-3]. Apart from other factor, renal impairment also commonly coexists with in AMI patients and therefore, elevating the chances of cardiovascular events. Many studies highlighted the significant correlation of renal dysfunction severity with subsequent cardiovascular events [4, 5].

It has been proved that ~13% of US population is suffering from chronic kidney diseases (CKD) and its frequency was even higher in elder population[6]. Global Burden of Disease report of 2015 showed CKD as one of the five leading causes of mortality in several countries[7]. Data from Pakistan reports estimated prevalence of CKD to be in between 12-31%[8]. Patients with CKD are more vulnerable to cardiovascular diseases as compared to patients with normal renal-function. In addition, worsening renal function is already proved independent inversely graded correlation with all cause of mortality. Likewise, CKD is becoming a daunting public health issue as the incidence and prevalence of chronic kidney disease is steadily increasing especially from last few years[9].

Early identification and timely diagnosis is paramount for optimal management of CKD. It can negatively impact on therapeutic and diagnostic interventions during both short and long term stages of AMI[10]. Primary objective of the present study was to determine the prevalence of chronic kidney disease in acute myocardial infarction patients. Additionally, incidence rate of CKD on adverse cardiac events in AMI patients was also noted. By close examination of renal impairment and cardiovascular outcomes in acute myocardial infarction patients, present study aimed to enhance the understanding of adverse effects of renal dysfunction on the prognosis of patients with AMI.

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PATIENTS AND METHODS

This prospective cohort study was conducted at Mayo Hospital , Lahore. Study Period was 1st July 2017 to 30th December 2017. After ethical approval of the Institutional Review Board, a total number of 100 cases were enrolled wherein the sample size was estimated using a prevalence of myocardial infarction as 3.8% as observed globally in patients' people under 60 years of age[9]. The sample size was calculated using WHO available software for sample size generation which applies 80% power of test and 95% CI with 5% margin of error. A written informed consent was taken from all the patients enrolled in this study. Patients data was collected from a registry based in the hospital where the study was conducted including all patients between the age group of 25 to 65 years. Those patients were followed who were already diagnosed and confirmed for myocardial infarction through fourth universal definition. A patient sharing a heart failure history or those who denied to consent were excluded from the study. A well-structured questionnaire for entering the information regarding demographic details as well as clinical information, symptoms at the time of referral, myocardial infarction type and severity, and treatment details, glomerular Filtration Rate (GFR) calculated was designed. For each patient the GFR was calculated using the Modification of Diet in Renal Disease (MDRD) formulas. The main theme of the study was to compare the GFR of those patients >60 cc/min to those with ≤ 60 cc/min and identify any adverse cardiac event related with impaired kidney function. Patients were followed up to a year in terms of hospitalization, repeated GFR, repeat revascularization, Major Adverse Cardiovascular Events (MACE) and occurrences of death. The collected data was analyzed using SPSS version 26.0. Quantitative data were analyzed using t-tests and ANOVA tests, while qualitative variables were analyzed using the chi-square test, post-hoc analysis using the Tukey test. P-value <0.05 was taken statistically significant.

RESULT

The mean age of the patients was 42.9 ±12.75 years. There was a high frequency of males than female suffering from myocardial infarction. A significant number of cases having myocardial infarction were also suffering from hypertension followed by diabetes mellites. Non-ST Elevation Myocardial Infarction (NSTEMI) were significant risk factors for cardiovascular events (p value = 0.017).Left Bundle Branch Block (LBBB) was the least

reported type of myocardial infarction among patients. Variables such as sex, age, and HTN were not significant risk factors (Table 1)

Table 1: Demographic, clinical features of MI patients (n=100)

Variable	No.	%
Gender		
Males	69	69.0
Females	31	31.0
Diabetes Mellites	37 (37)	37.0
Hypertension	45 (45)	45.0
Hyperlipidemia	37 (37)	37.0
Smoking	24 (24)	24.0
MI type		
STEM I	62	62.0
NSTEM II	35	35.0
LBBB	1	1.0
Not known	2	20.0

This research elaborated a significant correlation between low GFR levels and increased mortality rates. Those patients having a GFR level lower than 60 cc/min had a mortality rate of 16% through adverse cardiac events in comparison to 4% of those with a GFR above 60 cc/min. Fig 1

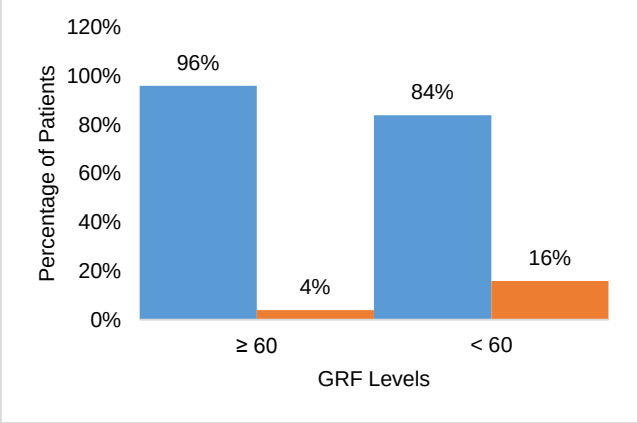

Fig. 1: Relationship between GFR level and patient survival

Patients with decreased GFR rates were having higher likelihood of MACE. There seemed to be a correlation between death and GFR as within the one year of follow up 9 persons died due to low GFR (r = -0.241, p < 0.0001) (Figure 2).

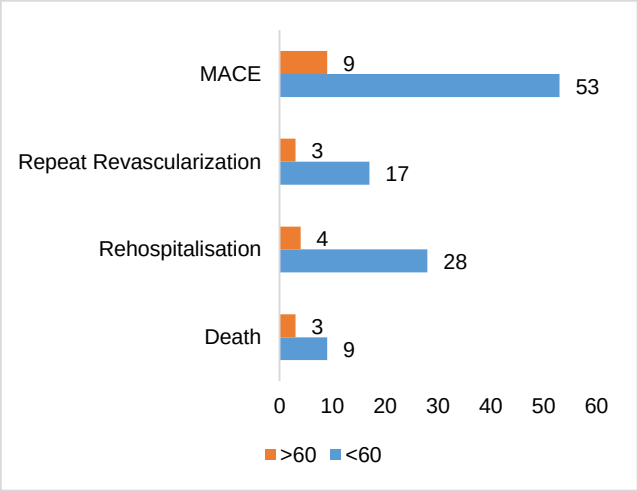

Fig. 2: Correlation between GFR and Adverse Cardiovascular events.

Gender, GFR, and Diabetes Mellitus (DM) were detected as noteworthy risk causes for MACE, while smoking, and Hypertension (HTN) did not show a significant association (Table 2).

Table 2: Association of risk factors with major adverse cardiovascular events (MACE)

Parameter	With MACE		Without MACE		P value
	≥ 60	< 60	≥ 60	< 60	
Age ≥ 60 year	6	13	14	18	0.004
Male	13	8	32	13	0.034
Female	2	10	4	13	
Smoking	5	2	12	3	0.863
Diabetes mellitus	4	8	9	10	0.039
Hyperlipidemia	4	6	11	13	0.518
Hypertension	6	11	13	16	0.136

The multivariate regression analysis presented diabetes mellitus, GFR and NSTEMI as significant risk indicators for cardiovascular events (p = 0.016, p = 0.015, p = 0.006 respectively). Hyperlipidemia was also associated as a risk factor of cardiovascular event. Table3

Table 3: Multivariate Regression Analysis of Risk Factors for Cardiovascular Events.

Variable	Regression coefficient	Odd ratio	Minimum	Maximum	P value
Hypertension	0.113	1.11	0.811	1.556	0.518
Diabetes mellitus	0.380	1.41	1.081	1.999	0.016
Hyperlipidemia	-0.470	0.62	0.500	0.881	0.005
STEMI vs NSTEMI	-0.413	0.65	0.510	0.886	0.006
Sex	0.260	1.4	0.900	1.812	0.129
Age	0.411	1.3	0.991	1.011	0.516
Glomerular filtration rate	0.418	1.53	1.082	2.121	0.015

DISCUSSION

Chronic kidney disease is associated with an increased risk of adverse cardiac events such as recurrent myocardial infarction, heart failure, arrhythmias, and cardiovascular mortality in patients with AMI. The presence of CKD often signifies a higher burden of atherosclerosis, inflammation, and endothelial dysfunction, predisposing these patients to a greater risk of cardiovascular complications.Patients with CKD often have impaired renal function, which can affect the metabolism and clearance of medications used in the management of AMI, such as antiplatelet agents, anticoagulants, and certain cardiac medications [11-14]. The present study was designed to determine the prevalence and association of chronic kidney disease effect on adverse cardiac events in acute myocardial infarction patients.

Glomerular filtration rate (GFR) usually measures the estimation of amount of blood filtered by kidneys. In the present study, GFR was used instead of serum creatinine for the assessment of kidney functions. It is a more precise method that reflects the kidney's ability of removal of waste products and blood filtration rate [15]. It also allows the classification of patients based on CKD stages and GFR <15 indicate end stage kidney disease [16]. Preset study finds a strong correlation between mortality rate and GFR value. These findings are consistent with already available literatures which underscore the same relation [17-19].

Along with mortality, the present study also investigated major risk factors associated with adverse cardiovascular events. Advanced age and type 2 diabetes are add-on risk factors that escalate the chances of cardiovascular diseases in CKD patients [20]. Findings of present study highlight the significance of managing risk factor to mitigate the chances of health outcomes and cardiovascular diseases. This may also involve lifestyle modification including regular physical activity, balanced diet, smoking cessation as well as regular monitoring of normal kidney function[21,22].

CONCLUSION

There is a significant correlation between GFR levels less than 60 and increased cardiovascular events in patients suffering from myocardial infarction where age, gender and diabetes are high risk factors in escalating the mortality rates.There seemed to be a correlation between death and GFR. Patients with reduced GFR levels are having higher likelihood of MACE.

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