

**Original article:**

## **Impact of blood urea and serum creatinine level on ejection fraction in acute myocardial infarction patient**

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### **ABSTRACT**

Role of the kidney in outcome of heart failure patients has been a topic of extensive research. Many studies showed that progressive renal dysfunction is often due to decreased blood supply to the kidney which in turn is due to progressive impairment of cardiac function. Most of the studies tried to find out the role of renal dysfunction by estimating serum creatinine and blood urea but none had been succeeded. So clinicians are still in search of a reliable prognostic factor for the heart failure patients. In this longitudinal, self control, interventional study, Ejection Fraction (EF) of 52 patient of AMI was measured by echocardiography before and after angioplasty. Statistical software IBM SPSS trial version 16 was used for analysis of data. We found that as blood urea level increases, improvement in EF decreases. Serum creatinine showed a positive correlation with improvement in EF. It can be hypothesized that patients with higher blood urea showed adverse outcome after PCI while increasing serum creatinine levels showed improvement in EF after percutaneous intervention (PCI) in AMI patients. Increased blood urea level is associated with poor prognosis while an increased serum creatinine level is associated with improved prognosis after PCI in AMI patients.

**Key words** –Percutaneous intervention, Body mass index, Echocardiography.

### **INTRODUCTION**

The kidney is sensitive to haemodynamic changes and ejection fraction is one of the important factors which determine the renal impairment in cardiac failure patients.<sup>5, 7, 16</sup> For many years, researchers are trying to establish the relationship between the heart and the kidneys. When cardiac output decreases progressively, it leads to deterioration of renal function.<sup>9, 21</sup> Cardiac failure and chronic kidney disease (CKD) coexist frequently which is due to common risk factors, e.g. hypertension, atherosclerosis and diabetes, as well as due to common pathogenic mechanisms, like sympathetic nervous system over-activity, renin–angiotensin system and oxidative stress. Prolonged activation of RAAS affects the functioning of kidney. It also stimulates the inflammatory

pathways and leads to fibrosis and endothelial dysfunction. So CKD can worsen outcome after coronary angioplasty.<sup>10</sup>

Increased serum creatinine level might be found in 20–40% of heart failure patients.<sup>2,13</sup> It has been found that those patients who had increased creatinine level had a longer hospital stay, increased chance of readmission in hospital and increased mortality.<sup>3,15,20</sup> However, some researchers did not find a significant association between increased serum creatinine and outcomes.<sup>18,19,25,26</sup> Increased serum creatinine indicates further deterioration in renal function and the development and progression of CKD which further worsens cardiac failure.<sup>4</sup> Serum creatinine is a 'gold standard' criterion for assessment of acute kidney injury (AKI). At present, serum creatinine is the most commonly used biomarker of renal function and it helps in recognizing and staging AKI. Blood urea is also an important indicator for assessing morbidity and mortality in patients of AMI. Some studies suggested that it is more reliable indicator than serum creatinine.<sup>1, 8, 11, 12,</sup> However some researchers found that the role of blood urea as a significant indicator also depends on other variables like protein intake and nitrogen production.<sup>24</sup>

The incidence of cardiac failure and CKD has been increasing day by day. This can be attributed to ageing of the general population and improved treatment methods of acute cardiac and renal diseases. The cardiac failure patients may develop various complications, so they need extra care. Hanberg et al. (2016) had done the ESCAPE trial to find out relation between cardiac output and renal function. They studied correlation between cardiac index and renal function. They found no correlation between cardiac index and renal function.<sup>14</sup> These study indicate that serum creatinine may have a prognostic value in some patients but not in all patients.

The aim of this study was to evaluate the role of blood urea and serum creatinine in patients of acute myocardial infarction (AMI) after angioplasty and to evaluate the efficacy of percutaneous intervention (PCI) as well as to predict the prognosis because the role of blood urea and serum creatinine is not well established.

## **MATERIAL AND METHOD**

In this study, we have taken 52 male patients with AMI admitted in Lari cardiology, KGMU, Lucknow. This was a longitudinal, interventional study. Exclusion of patients from study was done on the basis of presence of anaemia, cardiac tamponade, valvular heart disease, myocarditis, endocrinal disorders like pericardial effusion, thyroid dysfunction, vitamin B<sub>1</sub> deficiency, because these conditions may influence the outcome after PCI. This study was done after obtaining approval from the ethical committee of KGMU, Lucknow and written, informed consent from the patients.

Blood urea and serum creatinine level were measured after admission in the Cardiology Emergency. In general examination anthropometric parameters and blood pressure (Sphygmomanometer) were measured. Ejection fraction was measured with the help of Echocardiography (ECHO). Patients underwent coronary angioplasty (PCI) after coronary angiography. Ejection fraction was again measured after angioplasty with the help of echocardiography. The EF obtained before and after PCI was compared and analysed.

WHO criteria of BMI for Indian population has been taken into account; underweight (<18.5 kg/m<sup>2</sup>), normal BMI (18.5-22.9 kg/m<sup>2</sup>), overweight (23–24.9 kg/m<sup>2</sup>) and obese ( $\geq$  25 kg/m<sup>2</sup>). Patients were divided into two groups according to their age; Group I (21-50 yrs), Group II (51-80 yrs).

In these patients absence of chest pain and increment in EF have been considered as improvement. Statistical software Statistical Package for Social Sciences (SPSS) trial version 16 was used for analysis of data. A "p" value of less than 0.05 was considered significant statistically at two tailed test.

**RESULTS**

We have enrolled 52 male patients in this study who had been diagnosed as a case of AMI, with a mean age of  $57.92 \pm 10.68$  and data from all the 52 patients were collected and used for analysis. Hypertension, obesity and tachycardia were present in 21 (40.39 %), 19 (36.54 %) and 8 (15.39 %) patients respectively. The measurements of ejection fraction of patients were done by ECHO within 6-8 hours of diagnosis of acute MI and after coronary angioplasty. 50 % patients had BP within normal range while 40.4 % were hypertensives. Only 5 patients had hypotension at the time of admission.

It has been found that advancing age has adverse effect on improvement in EF ( $r = - 0.08$ ). The patients who have normal BMI showed more improvement in EF after PCI while overweight and obese showed less improvement.

**Table-1: Baseline characteristics of patients:**

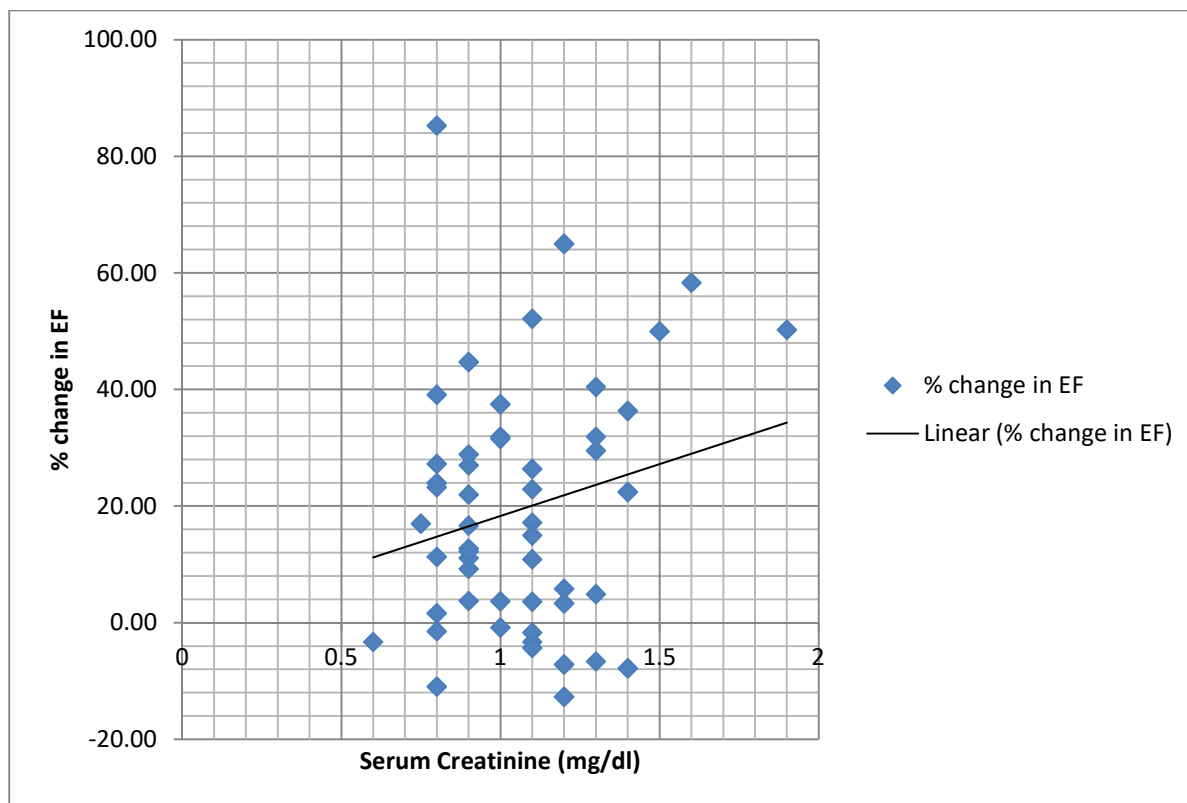
Variables		Total No. Of cases
1. BMI ( $\text{Kg/m}^2$ )	<18.5 (underweight)	04
	18.5-22.9 (Normal weight)	15
	$\geq 23$ (Overweight and obese)	33
2. Age group (yrs)	21-50	15
	51-80	37

**Table-2: Blood urea and serum creatinine of patients categorized by improvement in EF after PCI:**

Variables		Improved cases	Not improved cases	Total No. Of cases	$\chi^2$	p value
1. B. Urea (mg/dl)	<15	01 (100%)	00 (0%)	01 (1.9%)	2.38	0.31
	15-45	38 (80.9%)	09 (19.1%)	47 (90.4%)		
	>45	02 (50%)	02 (50%)	04 (7.7%)		
2. S. Creatinine (mg/dl)	<0.7	00 (0%)	01 (100%)	01 (1.9%)	3.84	0.15
	0.7-1.3	36 (80%)	09 (20%)	45 (86.5%)		
	>1.3	05 (83.3%)	01 (16.7%)	06 (11.4%)		

Table 2 shows that maximum numbers of patients (90.4 %) have normal blood urea level, while only 4 cases (7.7 %) have increased B. Urea level and only one case (1.9 %) has decreased B. Urea level. On comparing blood urea level with improvement in EF, it is found that as B. urea level increases, improvement decreases ( $r = 0.27$ ;  $p = 0.31$ ). The patients having normal blood urea level, 80.9 % showed improved EF, while only 50 % patients having raised blood urea level showed improved EF. Only 1 patient had decreased blood urea level and he showed improvement in EF.

**Graph-1: Graph showing relation between S. Creatinine and % change in EF:**



It is also evident that most of the patients (86.5 %) have normal serum creatinine level, while 11.4 % cases have increased S. Creatinine level and only one case (1.9 %) has reduced S. Creatinine level. It is found that as serum creatinine level increases, improvement in EF also increases ( $p=0.15$ ). 80 % of patients who have normal serum creatinine level showed improvement in EF after PCI while 83.3 % of patients having raised serum creatinine level showed improvement in EF. One patient who had decreased serum creatinine level showed no improvement in EF.

**DISCUSSION**

After analyzing the collected data, we found that EF is affected by the blood urea and serum creatinine level, though this correlation is statistically not significant.

In heart failure patients blood supply to the kidney is affected and it has a crucial role on outcome. Damage to the renal function leads to increase in various biomarkers and the most important is serum creatinine. So we can say that serum creatinine is an important biomarker for assessment of outcome after PCI. Some studies supported this fact.<sup>23</sup> In our study we found that as serum creatinine level increases, improvement in EF after PCI increases. The probable cause may be that when there is renal insult there is delayed increase of serum creatinine and a positive fluid balance influence the volume of distribution of creatinine. Also in old age and underweight patients, the serum creatinine cannot appropriately assess the renal function. So it is better to find out some other measure to assess appropriately the renal function in heart failure patients.

Assessing blood urea level is another method to predict outcome in AMI patients after PCI. High blood urea can be caused by low blood flow to the kidneys which may be due to dehydration or heart failure. Other causes of

raised blood urea are decreased glomerular filtration rate and increased tubular reabsorption of urea.<sup>22</sup> In present study we found that as blood urea level increases, improvement in EF decreases.

Our study is an exploratory study and based on our findings, we suggest that there is a need to develop some other method to accurately assess the prognosis of heart failure patients with renal function derangement. Currently some researchers are trying to establish blood urea nitrogen (BUN) to serum creatinine ratio as a reliable marker to predict the outcome after PCI in AMI patients with renal derangements.<sup>17</sup>

Limitations of this study are less number of subjects. We have only 52 patients for performing this study. Future studies with large number of patients might help in establishing good prognostic criteria for such patients.

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