

# Diagnostic Significance of Uric Acid, C Reactive Protein, Magnesium in Acute Myocardial Infarction

C (Mandava) Radha Mani<sup>1</sup>, Avapati Raja Sekhar<sup>2</sup>, Surya Kanth A<sup>3</sup>, T Jaya Chandra<sup>4</sup>

## ABSTRACT

**Introduction:** Study was undertaken to note the levels of high sensitive C-reactive protein (hs-CRP), serum uric acid, serum magnesium levels in acute myocardial infarction (MI).

**Material and methods:** This study was conducted in GSL Medical College, study was approved by institutional ethical committee. Participants were recruited by following inclusion and exclusion criteria. After getting detailed history of patient's blood samples were taken for hemoglobin, blood urea, serum creatinine, uric acid, serum electrolytes, hs CRP, serum uric acid, serum Magnesium. All the participants were subjected to ECG and ECHO cardiography. Fischer's exact Chi square test was to find statistical analysis,  $P < 0.05$  was considered as statistically significant.

**Results:** Of the 100 study participants, 39% participants' hs CRP levels were  $\leq 3$ mg/dl; statistically the difference was significant. When serum uric acid considered, 46% patients with uric acid levels were  $\leq 7$ mg/dl 66% participants' magnesium levels were  $\geq 1.4$ mg/dl; The difference was statistically significant.

**Conclusion:** The above findings showed a positive correlation of elevated hs CRP and uric acid; and low magnesium with various risk factors of MI.

**Keywords:** levels, Myocardial infarction, serum.

## INTRODUCTION

According to World Health Organization (WHO) in 2005 cardiovascular disease caused 17.5 million (30%) of the 58 million deaths that occurred world wide.<sup>1</sup> While the prevalence and mortality due to coronary heart disease is declining in developed nations<sup>2</sup> the same cannot be held true for developing countries. In India current prevalence of Ischemic Heart Disease is between 7% and 13% in urban<sup>3,4</sup>, and between 2% and 7% in rural populations.<sup>5,6</sup>

Previous studies have reported that high concentration of uric acid is a strong marker of an unfavorable prognosis of moderate to severe heart failure and cardiovascular disease.<sup>7,8</sup> Several investigations revealed that magnesium level in blood is decreased in first 48 hours following acute Myocardial Infarction (MI) and then increased steadily to reach normal in about 3 weeks. The heart muscle subjected to MI was found to contain low magnesium concentration which correlated with complications especially arrhythmias. Myocardial magnesium concentrations in patients with sudden death due to Ischemic heart disease were found to be very low. It has been shown that magnesium has a vital role in ventricular fibrillation which is a cause of sudden death in patients of Acute MI.<sup>9,10</sup>

The various complications of acute MI includes ischemic

(reinfarction, infarction extension), mechanical (heart failure, cardiogenic shock, papillary muscle dysfunction), arrhythmic (atrial or ventricular arrhythmias, sinus or atrioventricular nodal dysfunction) and embolic (central nervous system or peripheral embolization).<sup>11</sup>

This study was undertaken as there is need for more studies to identify different variables that can predict the morbidity and mortality in MI. This study was undertaken to note the levels of high sensitive C-reactive protein (hs-CRP), serum uric acid, serum magnesium levels in acute MI and to study the role of these as markers of short term mortality in patients with Acute MI.

## MATERIAL AND METHODS

This study was conducted in GSL Medical College, study was approved by institutional ethical committee. The acute MI Individuals aged  $\geq 30$  years were included in the study.

Patients who did not giving consent, patients with elevated serum uric acid, patients on treatment which increase serum uric acid, patients presenting with MI after 48hrs and those with previous history of MI, acute MI patients with elevated levels of CRP, patients with severe hypokalemia were excluded from the study.

A detailed history of patient's presenting complaint and history of hypertension, diabetes, and smoking were obtained. History suggestive of congenital, rheumatic or ischemic heart disease was enquired from each patient. All patients included in the study were subjected to complete physical examination finds were recorded.

Blood samples were taken for hemoglobin, blood urea, serum creatinine, uric acid, serum electrolytes, high sensitive C-reactive protein, serum Uric acid, serum Magnesium.

<sup>1</sup>Associate Professor, Department of General Medicine, GSL Medical College, Rajahmundry, <sup>2</sup>Associate Professor, Department of General Medicine, GSL Medical College, Rajahmundry, <sup>3</sup>Resident, Department of General Medicine, GSL Medical College, Rajahmundry, <sup>4</sup>Scientist Incharge, Central Research Lab and Associate Professor, Department of Microbiology, GSL Medical College, Rajahmundry, Andhra Pradesh, India

**Corresponding author:** Dr. Avapati Raja Sekhar, Associate Professor, Department of General Medicine, GSL Medical College, Rajahmundry, India

**How to cite this article:** C (Mandava) Radha Mani, Avapati Raja Sekhar, Surya Kanth A, T Jaya Chandra. Diagnostic significance of uric acid, C reactive protein, magnesium in acute myocardial infarction. International Journal of Contemporary Medical Research 2019;6(11):K1-K3.

**DOI:** <http://dx.doi.org/10.21276/ijcmr.2019.6.11.7>

Gender	CRP		Uric acid		Magnesium	
	≤3mg/dl (n=39)	>3mg/dl (n=61)	≤7mg/dl (n=46)	>7mg/dl (n=54)	≥1.4mg/dl (n=66)	<1.4mg/dl (n=34)
Male	17	44	23	39	35	27
Female	21	18	23	15	31	7
Statistical analysis	Significant (P<0.05)		Significant (P<0.05)		Significant (P<0.05)	

**Table-1:** Levels of various serum markers in gender; n = 100.

CRP was measured using turbidometric immunoassay method. Serum uric acid levels measured using uricase peroxidase method. Levels of serum magnesium measured using Xylidyl blue colorimetric method. All the participants were subjected to ECG and ECHO cardiography, findings were recorded. Fischer's exact Chi square test was to find statistical analysis,  $P < 0.05$  was considered as statistically significant.

## RESULTS

Of the 100 study participants, the mean age was  $58 \pm 11.46$  years. The male female ratio was 1.65. Among these, 39% participants hs CRP levels were  $\leq 3$ mg/dl; statistically the difference was significant (Table 1;  $P < 0.05$ ). When serum uric acid considered, 46% patients with uric acid levels were  $\leq 7$ mg/dl 66% participants magnesium levels were  $\geq 1.4$ mg/dl; The difference was statistically significant (Table 1;  $P < 0.05$ ).

## DISCUSSION

In this study 6% were in 30-40years age group, 22% in 41-50 years, 29% in 51-60 group, 25% in 61-70 years group and 18% in  $> 70$  years group. Sushma Pandey et al.,<sup>12</sup> also reported similar findings whereas Naaz Hamudlay et al.,<sup>13</sup> reported that 55% in  $> 60$  years age group.

In a study by Chanamma<sup>14</sup> reported that 92.5% acute MI in males whereas the prevalence of acute MI was 72% in males as per Vaidya et al.,<sup>15</sup> study. In various other studies also it was shown that MI was more predominant in males.

Serum levels are independent of age and ethnicity.<sup>16</sup> CRP is a hepatically derived marker of low grade systemic inflammation that largely reflects circulating cytokine formation. It is produced from Liver in response to cytokine stimulation by Interleukin 1 and 6. According to American heart Association CRP values are classified as: low hs CRP  $< 1$ mg/dl, average 1-3mg/dl and high hs CRP  $> 3$ mg/dl. So in this study patients were classified into two groups based on CRP values.

In this study 61% patients had increased hs CRP  $> 3$ mg/L at admission and 39% had low hs CRP  $\leq 3$ mg/L; these findings were similar to that of P Mishra et al.,<sup>17</sup> report. Age wise, hs CRP concentration was raised with age in this study. These findings were similar to that of Zhiquant Wang et al.<sup>18</sup> and Wener MH et al.<sup>19</sup> reports. In patients undergoing percutaneous coronary intervention, CRP levels may alert the interventional cardiologist for closer monitoring. Components of Metabolic syndrome correlate with increased plasma CRP levels.<sup>20</sup> Patients with very high levels of hs-CRP have highest risk because Arroyo Espliguers et al.<sup>21</sup> and Rasposeiras et al.<sup>22</sup> concluded that CRP is an independent

predictor of adverse cardiac events.

In this study, 39% male patients and 15% female patients had higher level of uric acid. The mean value of uric acid in males is  $7.3 \pm 1.81$ . The mean value in females is  $6.5 \pm 2.13$  ( $p = 0.019$ ). Lucia Barbieri et al.<sup>23</sup> reported that higher uric acid in 70% MI patients out of 3520 study patients, the mean value of uric acid in males was higher ( $6.33 \pm 1.7$ ) compared to females ( $5.8 \pm 1.9$ ). These findings also correlated with Pavan Kumar et al.<sup>24</sup> study. Previous studies have reported that a high concentration of uric acid is a strong marker of an unfavorable prognosis of moderate to severe heart failure and cardiovascular disease.<sup>25</sup> Uric acid may be elevated in heart failure and provide important prognostic information. Magnesium ion has emerged as a premier cardiovascular cation during the decade. It has been implicated in pathogenesis of acute MI and complications like arrhythmias. Magnesium is essential for activation of ATP which maintains sodium-potassium pump and also because of calcium blocking action Magnesium has been implicated in relation to arrhythmias after acute MI. In our study of 100 patients of acute MI 66% patients had serum magnesium  $\geq 1.4$ mg/dl and 34% patients serum magnesium was  $< 1.4$ mg/dl. In this report, the mean value of serum magnesium in diabetics was  $1.3 \pm 0.45$  and in non diabetics was  $1.78 \pm 0.44$  ( $p = 0.000$ ). In study conducted by AG Kulkarni et al.,<sup>26</sup> 42% of diabetics had low serum magnesium ( $< 1.4$ mg/dl), mean serum magnesium level in diabetics was  $1.96 \pm 0.54$  and  $2.375 \pm 0.44$  in non diabetics.

## CONCLUSION

The above findings showed a positive correlation of elevated hs CRP and uric acid; and low magnesium with various risk factors of MI.

## REFERENCES

1. Thomas AGaziano, AsafBitton, ShuchiAnand, Shafika Abrahams Gessel, Adriana Murphy. *CurrProbl Cardiol*. 2010; 35: 72 – 115.
2. Prevalence of Coronary Heart Disease- United States 2006-2010. *Morbidity Mortality weekly Rep (MMWR)* 2011; 60: 1377 – 1381.
3. Mohan V., Deepa R., Rani SS. Prevalence of Coronary Artery Disease and its relationship to lipids in a selected population in South India. *J Am Coll Cardiology*. 2001; 38: 682 – 687.
4. Gupta R., Gupata V.P., Sanna M. Prevalence of Coronary heart disease and risk factors in an urban Indian population: Jaipur Heart Watch-2. *India Heart Journal*. 2002; 54: 59 – 66.
5. Gupta A.K., Bharadwaj a, Ashotras. Feasibility and training of multipurpose workers in detection of Coronary artery disease in Apple belt of Shimla hills.

- South Asian.J.Prev.Cardiology. 2002; 6: 19 – 22.
6. Kumar R., Singh M.C., Ahlawat SK. Urbanization and Coronary heart disease: A study of urban-rural differences in northern India. *Indian Heart Journal*. 2006; 58: 126 – 130.
  7. Anker SD, Doehner W, Rauchhaus M, Sharma R, Francis D, Knosalla C, Davos CH, Ciccoira M, Shamim W, Kemp M, Segal R, Osterziel KJ, Leyva F, Hetzer R, Ponikowski P, Coats AJ. Uric acid and survival in chronic heart failure: Validation and application in metabolic, functional and hemodynamic staging. *Circulation* 2003; 107: 1991 – 1997.
  8. Levya F, Anker S, Swan JW, Godslan IF, Wingrove CS, Coats AJ. Serum uric acid as an index of impaired oxidative metabolism in chronic heart failure. *European Heart Journal* 1997; 18: 858 – 865.
  9. Burch GE, Gibbs HD. Importance of Magnesium deficiency in Cardiovascular disease. *American Heart J*.1977; 94: 649.
  10. Vernar et al. Magnesium Metabolism. Recent advances in clinical biochemistry. 2000; 1: 3.
  11. Adam W Grano, Sorin J Brener. Complications of Acute Myocardial Infarction. Cleveland Clinic publication. July 2014.
  12. Sushma Pandey, Suresh Pandey, Purushotam, Jhanwar, Anshul Jhanwar. A prospective study of MI patients admitted in a tertiary care hospital of South Eastern Rajasthan. *Int.J.Biol.Med.Res* 2012; 3: 1694 – 1696.
  13. Naaz M. Hamdulay, N.R.Rathod. Clinical profile of STEMI in females. *Indian Journal of Applied Research* 2015; 5: 17 – 19.
  14. G.Chanamma. Age and Gender distribution in patients with acute myocardial infarction. *MedicaInnovatica* 2016; 15: 16 – 17.
  15. Chirayu V Vaidya, Drusty K manjumdar. A study of clinical profile of acute STEMI patients from GMERS Medical College and hospital, Gandhinagar, Gujarat. *Int J Adv Med* 2014; 1: 113 – 116.
  16. Calabro P, Golia E, Yeh ET. Role of C-reactive protein in acute myocardial infarction and stroke: possible therapeutic approaches. *Curr Pharm Biotechnol* 2012; 13: 4 – 16.
  17. P.Mishra. Study of CRP as an indicator of prognosis in acute MI, GSVH medical college, Khanpur. *J Assoc Phu Ind* 2002; 50: 36.
  18. Zhiquant Wang, Wendy E Hoy. Populations distribution of CRP in aboriginal population with CAD. *Clin biochem J*. 2005; 38: 408 – 411.
  19. Wener MH, Daum PR, McQuillan GM. The influence of age, sex, race on upper reference limit of serum CRP concentration. *J Rheumatol* 2000; 27: 2351 – 2359.
  20. Packard RR, Libby P. Inflammation in atherosclerosis: from vascular biology to biomarker discovery and risk prediction. *ClinChem* 2008; 54: 24 – 38.
  21. Arroyo Espliguero R, Avanzas P, Quiles J, Kaski JC. Predictive value of coronary artery stenoses and C-reactive protein levels in patients with stable coronary artery disease. *Atherosclerosis* 2009; 204: 239 – 243.
  22. RaposeirasRoubi'n S, Barreiro Pardal C, Roubi'n-Camina F, Ocaranza Sanchez R, Alvarez Castro E, ParadelaDobarro B. High-sensitivity C-reactive protein predicts adverse outcomes after non-ST-segment elevation acute coronary syndrome regardless of GRACE risk score, but not after ST-segment elevation myocardial infarction. *Rev Port Cardiol* 2013; 32: 117 – 122.
  23. Lucia Barbieri, Monica Verdoia. Impact of sex on uric acid levels & its relationship with coronary artery disease: A single centre study. *Journal of atherosclerosis* 2015.
  24. Pavan Kumar, GuriRaj. Impact of serum Uric acid concentration on cardiovascular outcomes in MI. *Indian Journal of Applied Sciences* June 2016; Volume 6.
  25. Arroyo Espliguero R, Avanzas P, Quiles J, Kaski JC. Predictive value of coronary artery stenoses and C-reactive protein levels in patients with stable coronary artery disease. *Atherosclerosis* 2009; 204: 239 – 243.
  26. AG Kulkarni, Sachin K Shendge. Study of serum magnesium in type 2 diabetes mellitus & Hypertension. *ISR journal of Dental & Medical sciences*. 2014; 1: 115 – 119.

**Source of Support:** Nil; **Conflict of Interest:** None

**Submitted:** 28-09-2019; **Accepted:** 12-10-2019; **Published:** 11-11-2019