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A Study of Serum Uric Acid and C-Reactive Protein in Acute Myocardial Infarction.

Mriganka Baruah[1], Chandan Kr Nath[2], Bikash Chaudhury[2], Runi Devi[2] and Anand Shaker Ivvala[1]

[1] Department of Biochemistry, Melmaruvathur Adhiparasakthi Institute of Medical Sciences & Research, Melmaruvathur, 603319, Tamilnadu, India

[2] Department of Biochemistry, GMC, Guwahati, Assam India

Email: drmriganka.b@gmail.com, ianandshaker@rediffmail.com

Abstract – Acute Myocardial Infarction (AMI or MI) is more commonly known as heart attack, a medical emergency and the leading cause of death for both men and women all over the world. Therefore this study was undertaken to access the role of Serum Uric Acid, C - Reactive protein (CRP) in AMI. The study population contained 66 subjects divided in two groups, 30 age and sex matched healthy controls and 36 patients with AMI (36-77 years). Serum Uric acid, CRP readings were taken on day 1, 3, 5 and at the time of discharge (8±1days) from the onset of symptoms, the results were found to be statistically significant on all the days as compared to control subjects. These patients had a very low HDL level and very high CRP & Uric acid levels when compared to control subjects. CRP & Uric acid shows a definite pattern presentation during AMI. Dyslipidemia, a conventional risk factor of AMI is also associated in this study. The current study is an attempt at better understanding the behavior and response of Uric acid, CRP in AMI patients. Hence, monitoring of these parameters would be beneficial following AMI and is highly recommended to improve patient's outcome.

Keywords – Acute Myocardial Infarction (AMI), *C* - reactive protein (CRP), Uric acid

1. Introduction

Acute Myocardial Infarction (AMI or MI), more commonly known as a heart attack, is a medical emergency, the leading cause of death for both men and women all over the world [1]. It is due to death of heart muscle from the sudden blockage of a coronary artery by a blood clot or coronary thrombosis [2]. Through ages it has astonished all with its sudden yet catastrophic outcome and has always been a challenge to every Physician.

Recent evidence suggests that uric acid may be an important causal agent in cardiovascular disease; both animal and human studies have recently shown that high uric acid levels may impair kidney function by causing glomerular damage and pre-glomerular arteriolosclerosis that ultimately result in arterial hypertension [3]. Large cohort studies have shown that uric acid is an important independent risk factor for cardiovascular mortality [4]. Xanthine oxidase activity [5] and uric acid synthesis [6] are increased in vivo under ischaemic conditions, and therefore elevated serum uric acid may act as a marker of underlying tissue ischaemia.

C-reactive protein is an emerging risk marker that is recommended to complement the assessment of patients at primary cardiovascular risk and, to a more limited extent, stable patients at secondary risk. Several trials have demonstrated strong predictive value of CRP in stable and unstable angina, independent of troponin [7] and the burden of atherosclerosis [8].

2. Materials and Methods

The present study was carried out at Gauhati Medical College and Hospital, Guwahati, Assam. The study protocol was approved by the Research and Ethical committee of GMC, Guwahati. Oral informed consent was obtained from the patients' relatives and normal subjects, prior to study. The study is conducted in a group of 66 individuals consisting of 30 normal healthy subjects as control (Control group) who were the staff and P.G residence and 36 diagnosed cases of Myocardial Infarction irrespective of age and sex taken randomly from the admitted patients (IPD) of Cardiology Department (Test Group).

The diagnosis of AMI was based on a history of Heavy, Squeezing or Crushing central chest pain, characteristic electrocardiogram (ECG) changes and elevated creatine kinase isoenzyme MB (CK-MB) and troponin- t within 12 hrs of onset of pain [9].

Patients having history of following diseases like Rheumatoid Arthritis, Rheumatic fever, Inflammatory Bowel disease, neoplastic disease, renal failure, Gout and Bacterial Infection which may interfere with the results of the present study were excluded from the current study.

All patients received antiplatelet therapy (aspirin or clopidogrel), unfractionated heparin, GP (Glycoprotein) IIb/IIIa inhibitors, beta blockers and if indicated oral ACE inhibitors. No anti-inflammatory drugs, except aspirin was administered. Taking all aseptic and antiseptic precautions, 10ml of blood is drawn from the Ante cubital vein of the patient. Serum uric acid is estimated by Uricase method (Trinder P, 1969) using the Crest Biosystems kits and Serum C-Reactive Protein was estimated by using the Turbidimetric Immunoassay method [10] manufactured by TULIP Diagnostic (P) LTD. Total cholesterol was estimated by cholesterol oxidase - peroxidase (CHOD- PAP) method [11], Triglyceride by glycerol phosphate oxidase - peroxidase (GPO - PAP) method [12], and HDL cholesterol by homogenous enzymatic colorimetric test [13].

All the biochemical tests were done using colorimetric principle using a Spectrophotometer (Chemito) and Autoanalyser. After the biochemical estimations, the results obtained was statistically analyzed by using statistical software SPSS 16.0 and then compared between different

groups of the study by applying students't' test. The results were expressed as Mean± SD and were taken as significant when the probability (p) is less than 0.05 as percentage of the observing values of 't' at a particular degree of freedom..

3. Results

Our results from table I show Demographic characteristic of the control and AMI subjects which has an elevated BMI, BP (SBP, DBP), which is statically significant. We also found Risk factors & Smoking percentage, was elevated in AMI group compared to control subjects. The control group comprised of 30 individuals (25 males and 5 females i.e. 83.3% and 16.6% respectively), age ranging from 38 years to 77 years with a mean of 53.4 years and median of 53.5 years. The test group, comprised of 36 individuals with AMI (28 males and 8 females i.e. 77.8% and 22.2% respectively), age ranging from 36 years to 77 years with a mean of 54.5 years and a median of 54 years. Most of test subjects were in the age group 50 to 70 years with a relative frequency of 0.58. In our study we found 11 patients had previous MI (6M, 5F) of which 4 female patients expired during the study. Out of 30 survived MI patients, 9 patients had a prolonged hospital stay due to infection & other complications and all of them had a high CRP & Uric acid at presentation and its level did not come down and it remain elevated but the rest 21 patients were discharge by 8±1day and had no further infection or complication and their CRP level gradually came down by 3rd day and Uric acid by 5th - 8±1th day as shown in Figure-I. Serum C - reactive protein and Uric acid readings were taken on day 1, 3, 5 and at the time of discharge (8±1) from the onset of symptoms, which were found to be statistically significant on all the days as compared to Control (Table 2 and 3) respectively. In term of Dyslipidemia our results show a significant elevated levels of Triglyceride and Total cholesterol and significant decreased levels of HDL cholesterol (Table 2).

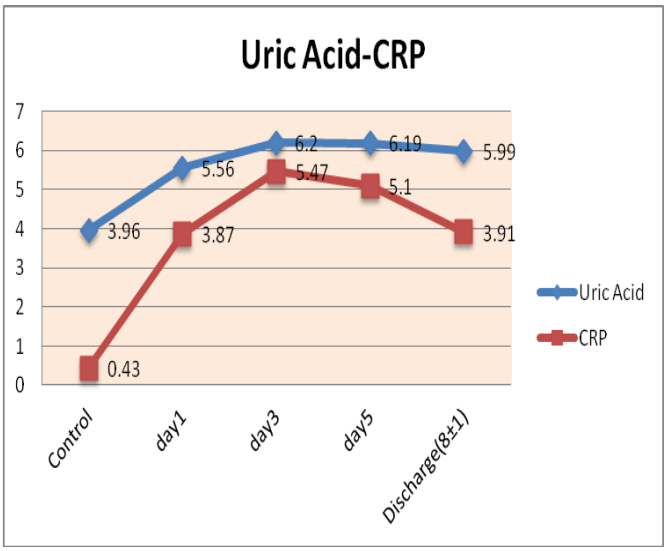

Figure 1. Comparison of Mean Uric acid & CRP against time.

4. Discussion

The present study showed that the frequency of Myocardial Infarction is higher in Males (77.8%) than in Females (22.2%) among the admitted patients which tally with Nadkar et al and Giuseppe et al [14][15]. In this Study 11 patients had previous MI (6 Males, 5 Females), of which 4 females patients died after 3rd day.

Previous studies have shown that elevated serum uric acid may act as a marker of underlying tissue ischaemia [5], serum uric acid level increases in cardiac failure [8, 16]. Studies also reveal that uric Acid Level as a Risk Factor for Myocardial Infarction [17]. In the present study, there is a statistically significant level of serum uric acid concentration in patients of AMI on day 1, day 3, day 5 and at the time of discharge as compared to controls ($P < 0.001$). This finding is in agreement with Nadkar, et al, 2008 [14].

Table 2. Comparison of biochemical changes between Control and AMI subjects on DAY 1

Parameter	**#Control Subjects**	**#AMI Patients**
CRP	0.43±0.19	3.88±2.81**
Uric Acid	3.94±1.10	5.56±1.56**
Fasting Glucose (mg /dl)	101±15.90	119±24.30*
Creatnine (mg /dl)	1.12±0.22	1.12±0.30^{NS}
Total cholesterol (mg/ dl)	154±10.7	231±21.8**
Triglyceride (mg/dl)	109.0±31.96	188.65±100.8**
HDL-cholesterol (mg /dl)	42.58±8.86	34.95±10.12*

Legend #Values are given as mean ± S.D from 30 subjects in each group. AMI patients compared with control subjects. (*p<0.05-Significant, ***p<0.01-Highly Significant, NS-Not significant)

Table 3. Comparison of CRP,Uric acid between Control and AMI subjects on DAY 3, DAY 5 and on date of Discharge(8+1).

	Parameter	#Control Subjects	#AMI Patients
DAY 3	CRP	0.43±0.19	5.47±3.21**
	Uric Acid	3.94±1.10	6.23±1.70**
DAY 5	CRP	0.43±0.19	5.12±3.05**
	Uric Acid	3.94±1.10	6.19±1.67**
DAY Discharge(8+1)	CRP	0.43±0.19	3.91±3.01**
	Uric Acid	3.94±1.10	5.99±1.54**

Legend #Values are given as mean ± S.D from 30 subjects in each group. AMI patients compared with control subjects. (*p<0.05-Significant, ***p<0.01-Highly Significant, NS-Not significant)

C-reactive protein is a marker of inflammatory processes [18]. C-reactive protein is an emerging risk marker that is recommended to complement the assessment of patients at primary cardiovascular risk. C-reactive protein appears to

provide predictive value for short-term prognosis in Acute myocardial infarction [19], apart from representing the inflammatory response to acute myocardial injury. In the current study serum CRP in AMI patient have a significantly higher value as compared to the control subjects ($p< 0.01$) on day 1, day 3, day 5, and at the time of discharge. This study showed that changes in CRP had a distinctive pattern, an acute phase response with persistent increasing trend with a peak CRP around 3rd day after onset of MI followed by a sustained and a gradual fall by 5th day, followed by decline not reaching baseline by 7th-9th day. The result obtained, matches with the result obtained by Kushner et al, 1998[17]. Because all patients received similar medical treatment it could be speculated that the intensity and pattern of the individual inflammatory response may be an independent pathogenic component of AMI.

Table 1. Demographic characteristics of control and AMI patients.

Parameter	#Control Subjects	#AMI Patients
Age (Mean ±S.D) years	54.5 ± 11.1	54.8 ± 10.1
Sex (Males %)	83.30%	77.80%
Body mass index (Mean ± SD), kg/m2	23.5± 1.7	28.9± 2.7**
Systolic blood pressure (mm of Hg)	111 ± 9	137 ± 18*
Diastolic blood pressure (mm of Hg)	82 ± 4	92 ± 10*
Risk Factors, %		
Hypertension	10%	32%
Cardiovascular disease	-	18%
Diabetes	-	12%
Sedentary lifestyle	8%	10%
Previous MI,%		
Total	-	30.6%
Males	-	16.6%
Females	-	13.9%
Smoking Status		
Current smoker	10%	16%
Physical inactivity/no exercise	15%	24%
Dietary Habits, %		
Non Veg	66.7%	77.8%

Legend #Values are given as mean ± S.D from 30 subjects in control group & 36 subjects in test (AMI patient) group. AMI patients compared with control subjects. (**p<0.01- Highly Significant, *p<0.05 Significant)

Out of 30 AMI patient in our study, 09 patient had prolonged hospital stay due to infections & other complications, all of them had a high CRP & uric acid at presentation and its level did not come down and it remain elevated but the rest 21 patient were discharge by 8±1day and had no further infection or complication and their CRP level gradually came down by 3rd day and Uric acid by 5th - 8±1th day. These might indicate a predictive role of CRP & Uric acid in AMI. Follow-up of the cases for a longer duration was not done which would have generally considered them as marker of long term prognosis.

Dyslipidemia , a conventional risk factor of AMI is also associated with this study with a significant higher Total cholesterol and Triglyceride in AMI patient compared to the control and lower HDL-cholesterol in AMI compared to the control which was statistically significant which matches with previous studies[20]

5. Conclusion

This study is an attempt at better understanding the behaviour and response of Uric acid and C-Reactive Protein in Acute Myocardial Infarction patients. Serum Uric acid and C-reactive protein is an easily available and inexpensive inflammatory and risk marker in AMI and provides predictive value in short term prognosis of acute myocardial infarction.

Thus the above study clearly illustrates about the fact that gradual monitoring of these parameters may be beneficial following Acute Myocardial Infarction and is highly recommended to improve the patient's outcome.

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