

A STUDY OF ARRHYTHMIAS DURING THE FIRST 48 HOURS OF HOSPITALIZATION IN ACUTE CORONARY SYNDROME AND ITS CORRELATION WITH SERUM URIC ACID AND CRP

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Abstract

Background: The acute coronary syndrome causes significant metabolic and electrophysiological alterations, including life-threatening arrhythmias. The C-reactive protein (CRP) and serum uric acid have been reported as predictors of arrhythmias. Hence, the present study was performed to study arrhythmias during the first 48 hours of hospitalization in acute coronary syndrome and its correlation with serum uric acid and CRP. **Materials and Methods:** This prospective observational study was conducted in the Department of general medicine at Thoothukudi medical college from January 2020 to January 2021. The detailed history and physical examination of all patients were noted. Each patient was subjected to 12 lead ECGs with serial monitoring. Each patient was put on Cardiac Monitor for 48 hours following admission to ICCU and monitored serially. All routine blood investigations were tested, including cardiac markers, serum uric acid and CRP. **Result:** Male predominance was reported (59.5%) in the study. Maximum patients were reported in the age group of 51 to 60 (45%). Smoking was a major risk factor (65%), followed by caffeine (34.5%). In our study, anterior wall MI was found with the highest incidence of 27%. 62% of the patients were presented with STEMI, whereas 38% of patients were found with NSTEMI. The arrhythmia was reported in 61% of patients, and the VPC type was observed highest (31.1%). Increased CRP level and serum uric acid levels are associated with cardiac arrhythmias risk. **Conclusion:** High incidences of arrhythmia were observed in the present study. The increased level of CRP and uric acid were reported with high incidences of cardiac arrhythmias.

INTRODUCTION

Acute coronary syndromes refer to acute myocardial ischemia and necrosis resulting from severe coronary artery occlusion. It is caused by intra-coronary plaque rupture, vasospasm, stenosis and occlusion due to platelet adhesion, aggregation and secondary thrombus formation.^[1]

Acute coronary syndrome is the leading cause of death worldwide. Indians also had a higher incidence of mortality and morbidity due to acute coronary syndrome. It causes 3 million deaths annually, which accounts for 20-25% of mortality in India.^[2] The development of arrhythmias during the period of myocardial infarction is responsible for the majority of deaths. Within 24 to 48 hours of infarct onset, about 25% of patients experience cardiac

symptoms.^[3] Acute coronary syndrome can cause any type of rhythm abnormality, including bradyarrhythmias, tachyarrhythmias, and atrioventricular block. This is a critical time to remain vigilant to avoid more death.^[4]

The acute coronary syndrome causes significant metabolic and electrophysiological alterations, including life-threatening arrhythmias that are either silent or symptomatic. The most common result is sudden cardiac death. Still, many patients survive the early stages of myocardial infarction if they arrive at a medical facility sooner, where infarction management must include continuous electrocardiographic (ECG) and hemodynamic monitoring and prompt therapeutic response to arrhythmias.^[5]

Acute myocardial infarction can cause both atrial and ventricular arrhythmias, and sustained ventricular tachyarrhythmias can lead to circulatory collapse and death. When the ventricular rate is accompanied by hemodynamic instability, atrial fibrillation may require immediate treatment. C-reactive protein and serum uric acid in cardiovascular disease are predictors of vascular events.^[6]

Following acute coronary syndrome, elevated levels of these markers are prognostic predictors for arrhythmias. Because of the likelihood of a link to inflammation, these biomarkers have been discovered in recent studies. According to prior research, these indicators are linked to cardiac arrhythmias.^[7-8] Coronary artery disease is caused by various factors, i.e. advancing age, gender, diabetes, hypertension, dyslipidaemia, smoking, and alcohol consumption.

This research looks at the frequency, clinical characteristics, and electrocardiographic profile of cardiac arrhythmias in patients with the acute coronary syndrome in the first 48 hours of hospitalisation. And this study tries to validate the prognostic significance of serum uric acid and C-reactive protein in patients with the acute coronary syndrome with arrhythmias.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of general medicine at Thoothukudi medical college from January 2020 to January 2021.

A minimum of 200 patients admitted to ICCU with a diagnosis of acute coronary syndrome were taken for the study considering the inclusion and exclusion criteria. Institutional ethical committee approval and written consent were taken before the start of the study.

Inclusion Criteria

Patients of either sex, more than 18 years of age with documented MI based on ECG findings suggesting STEMI (ST-segment elevation myocardial infarction) or NSTEMI (Non-ST segment myocardial infarction) and elevated cardiac markers (troponin I, CPK-MB) during first 48 hours of hospitalisation were included.

Exclusion Criteria

Patients younger than 18 years of age have congenital heart disease, valvular heart disease, electrolyte imbalance and septicaemia. Patient with more than 48 hours of hospitalisation, taking drugs like allopurinol, pro-arrhythmogenic drugs, previous history of arrhythmias, autoimmune and connective tissue disorders. Patients with known gout, chronic kidney disease and arthritis were excluded.

The patient was put on a Cardiac Monitor and followed for 48 hours, and a pattern of Arrhythmias was noted during the stay in ICCU. Information is collected through a pre-tested and structured proforma for each patient. The study was carried out on patients with clinical features and ECG findings suggestive of the acute coronary syndrome. The selected patient's detailed history and physical examination were noted. Each patient was subjected to 12 lead ECGs with serial monitoring. Each patient was put on Cardiac Monitor for 48 hours following admission to ICCU and monitored serially. All routine blood investigations were tested, including cardiac markers, serum uric acid and CRP.

The blood samples were collected from the patient after admission and taken to the laboratory. In our laboratory, serum acid estimation is done by the Uricase method by the auto analyser. Uricase is the enzyme that catalyses the oxidation of uric acid and allantoin at 293nm. The absorbance difference before and after uricase incubation is proportional to the uric acid concentration. In our laboratory, normal range values estimated for an adult male was 3.5 to 7.2 mg/dl, and for an adult female was 2.6 to 6.0 mg/dl.

In our laboratory, CRP is measured by the CRP LATEX method. It is the direct latex agglutination test. The fresh blood samples are collected from the patients, mixed with latex reagent, and allowed to come at room temperature. Rock the slide and observe for agglutination for 2 minutes. The highest dilution shows a positive reaction within 2 mins indicating the CRP titre. The approximate CRP concentration can be obtained by multiplying the titre by the test's sensitivity. A high sensitivity CRP of more than 3 mg/dl is considered elevated CRP.

The collected data was entered in Microsoft Excel (windows 10) and analysed using the statistical package for social sciences (SPSS-19). To find an association between two categorical variables Pearson chi-square test was used. The value of $P < 0.05$ is considered statically significant.

RESULTS

A total of 200 Patients of either sex, aged more than 18 years, with documented myocardial infarction (MI) based on ECG findings within 48 hours of hospitalization were selected for the study. Male predominance was reported (59.5%) in the study. Maximum patients were reported in the age group of 51 to 60 (45%). Smoking was a major risk factor (65%), followed by caffeine (34.5%). Our study found anterior wall MI with the highest incidence (27%). 62% of the patients presented with STEMI, whereas 38% were found with NSTEMI. The arrhythmia was reported in 61% of patients, and the VPC type was observed highest (31.1%) [Table 1].

Table 1: Demographic and other variables of patients

Particulars	Observations N (%)	
	Gender	Male
	Female	81 (40.5%)

Age Group (years)	<30	2 (10%)
	31-40	10 (5%)
	41-50	46 (23.0%)
	51-60	90 (45.0%)
	61-70	40 (20.0%)
	>71	12 (6.0%)
Co-morbidity	DM	59 (29.5%)
	DM and HT	49 (24.5%)
	HT	29 (14.5%)
Smoking	Nil	63 (31.5%)
	No	70 (35.0%)
Alcohol	Yes	130 (65.0%)
	No	137 (68.5%)
Tobacco chewing	Yes	63 (31.5%)
	No	183 (91.5%)
Caffeine	Yes	17 (8.5%)
	No	13 (165.5%)
Type of MI	Anterolateral wall MI	69 (34.5%)
	AWMI	11 (5.5%)
	Extensive AWMI	54 (27.0%)
	IWMI	12 (6.0%)
	IWMI & posterior wall MI	25 (12.5%)
	IWMI & RVMI	6 (3.0%)
	Lateral wall MI	9 (4.5%)
	NSTEMI	3 (1.5%)
	Posterior wall MI	76 (38.0%)
STEMI / NSTEMI	RVMI	1 (0.5%)
	STEMI	3 (1.5%)
Arrhythmia	NSTEMI	124 (62.0%)
	No	76 (38.0%)
Type of arrhythmias	Yes	78 (39.0%)
	2:1 AV block	122 (61.0%)
	AF	7 (5.7%)
	Complete heart block	22 (18.0%)
	First-degree AV block	8 (6.6%)
	Sinus bradycardia	10 (8.2%)
	Sinus tachycardia	13 (10.7%)
	SVT	13 (10.7%)
	VPC	2 (1.6%)
	VT	38 (31.1%)
	9 (7.4%)	

DM: Diabetes mellitus; HT: Hypertension; AWMI: Anterior wall myocardial infarction; IWMI: Inferior wall myocardial infarction; RVMI: Right ventricular myocardial infarction; NSTEMI: Non ST-Elevation Myocardial Infarction; STEMI: ST-Elevation Myocardial infarction; AV block: Atrioventricular block; AF: Atrial fibrillation; SVT: Supraventricular tachycardia; VPC: Ventricular premature complex; VT: Ventricular tachycardia
The mean CRP value of 8.03 ± 8.09 or more was associated with a higher incidence of arrhythmias with significant effect ($p < 0.01$). The VT was reported with the highest mean CRP value, 20.22 ± 8.26 [Table 2, Figure 1].

Table 2: Observation of CRP and Uric acid level in correlation with the incidence of arrhythmia among patients

Arrhythmia	CRP		P value
	Mean	Standard Deviation	
N	2.47	1.37	<0.0001
Y	8.03	8.09	
Arrhythmia	Uric acid		<0.0001
N	4.96	0.78	
Y	5.76	1.47	

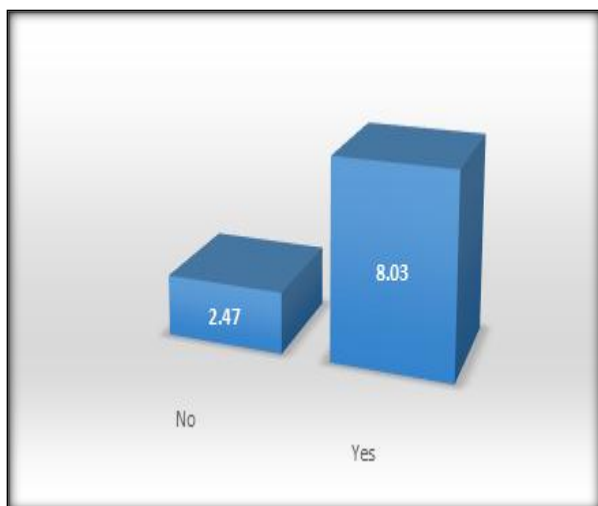


Figure 1: Observation of CRP level in correlation with the incidence of arrhythmia among patients

DISCUSSION

In this study, out of 200 patients included, 119(59.5%) are male, and 81(40.5%) are female. Analysis of age-wise distribution showed the highest prevalence in the age group of 51-60 years 90(45%). The lowest majority is noted in the age group under 30, 2(1%). This result is similar to that of the Patil et al. study results, which showed male predominance (77.50%) than female (22.50%) in MI.^[1]

This study also proved that the age group of 50-60 years (36.27%) showed the highest prevalence of MI. Other studies have also confirmed this male preponderance expressed in our research by Despande et al. (77.50%).^[9] Alam et al. study revealed 38% of patients of MI occurred in the age group of 51-60 years, which is in concordance with our study.^[10]

In our study, smoking (65%) is the main risk factor for the acute coronary syndrome, followed by caffeine consumption. Patil et al. study show 52.90% of smokers are prone to myocardial infarction.^[1]

Another study by Alam et al. also proved that about 76% of patients with chronic smokers are prone to myocardial infarction.^[10] But in contradiction to our findings, Marangmei et al. study showed a high preponderance for alcoholics (64%) rather than smokers (47%).^[11]

On analysing the relationship of co-morbidities to the occurrence of ACS, diabetes mellitus was the commonest risk factor for ACS (29.5%), followed by both diabetes and hypertension (24.5%). The least common risk factor was hypertension (14.5%). But the study by Alam et al. showed hypertensive (64%) had more risk than diabetes (40%).¹⁰ Rajhans et al. study also showed hypertensive (66%) and diabetic (54%) had risk factors for MI.^[12]

Of patients with classical angina 200 patients, 124(62%) of them show STEMI, and 76(38%) show NSTEMI changes. In STEMI, anterior wall myocardial infarction (27%) is the most common

Increased serum acid level is associated with a risk of cardiac arrhythmias with a significant p-value (<0.0001). Elevated serum uric acid is correlated with atrial and ventricular tachyarrhythmia with mean values of 7.40 and 7.76, respectively [Table 2, Figure 2].

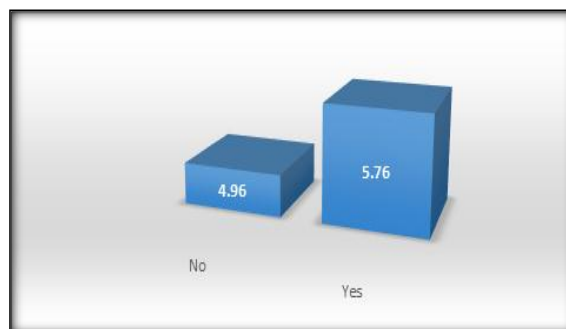


Figure 2: Observation of uric acid level in correlation with the incidence of arrhythmia among patients

presentation, and inferior wall myocardial infarction (12.5%) is the second most common. The study by Hreybe et al. shows anterior or lateral wall MI (30.2%) is more common than inferior or posterior wall MI (29%).^[13]

Out of 200 ACS patients, 122(61%) had arrhythmias. In a study by Kumar et al., arrhythmia was detected in 78% of the patients.^[3] In a study by Aufderheide et al., 90% of patients with acute myocardial infarction have some cardiac rhythm abnormality during the first 24 hours following infarct onset.^[4] The study by Stock et al. studied 200 patients of MI. They noted that 165 patients (82.5%) had arrhythmias.^[14] Our results are similar to the study by Sathyanarayana et al., which revealed 68% of patients developed arrhythmias in 100 patients.^[15]

In our study, the most common presentation of arrhythmia is VPCs (31.1%). In a study by Campbell et al. VPCs of various frequencies were observed in up to 90% of patients with MI.¹⁶ In A study by Volpi et al., about 36% of patients with acute MI presented with less than one premature ventricular beat per hour in Holter, whereas almost 20% of patients showed frequent VPCs.^[17]

In heart block, 8.2% are first-degree heart block, 6.6% are complete heart block, and 5.7 % are 2:1 AV block. In our study, 10.7% of the patient had sinus bradycardia, and 10.7% had sinus tachycardia. In a study by Kumar et al., sinus bradycardia was observed in 23% of the patients, first-degree heart block along with sinus bradycardia in 2.5%, second-degree heart block in 8.3% of the patients, complete heart block presenting alone in 2.5% of the patients.^[3] In our study, 9 (7.4%) patients developed ventricular tachycardia, and patients (1.6%) had supraventricular tachycardia. In a study by Echt DS et al. and the CAST investigators, 20% of patients had Non-sustained VT, and only 10% had more than one run of VT in 24 hours. Alam et al. study shows the incidence of VT is 19.3%.¹⁰ Another study by Marangmei et al. shows 7% of the incidence of VT

followed by MI.11 Chu et al. study conducted out of 83 patients 19.3% developed SVT, and 2.1% of patients developed ventricular arrhythmias.^[12]

In our study, patients with high CRP had a risk of developing arrhythmias with statistical significance. Patients with elevated CRP levels have a risk of developing AF (mean value of 18.59), ventricular tachycardia (mean value of 20.22), and supraventricular tachycardia (mean value of 13.5) with significant effect ($p < 0.001$). Malouf et al. show that compared with patients with Normal sinus rhythm, patient with AF shows elevated CRP level. It also says that the future risk of developing AF is higher in a patient with elevated CRP levels.^[19] Dernellis et al. demonstrated mean concentrations of CRP correlated with the risk of recurrence of AF. The study also showed that atorvastatin reduces both CRP and paroxysmal AF in 80 patients with high CRP levels. Studies done by Aviles RJ et al. support the statement that inflammatory markers are good predictors for the occurrence and recurrence of AF.^[20]

In the present study, elevated serum uric acid correlated with the risk of developing arrhythmias (mean value 5.76) with statistically significant ($p < 0.0001$). Hyperuricemia correlates with the risk of developing ventricular tachyarrhythmia (mean value-7.76) and atrial fibrillation (mean value-7.40) with a statistically significant effect ($p < 0.0001$). Hu et al. show that increased serum uric acid had a higher prevalence of developing AF.^[21] Zhang et al. also support our study reports showing that hyperuricemia is associated with risk for AF.^[22] A study by Yamada et al. implies that increased serum uric acid had a risk of developing ventricular tachycardia in patients with left ventricular hypertrophy. Serum uric acid has the strongest association with the occurrence of VT, independent of renal dysfunction. This study also says that oxidative stress and inflammatory mediators induce structural and electrophysiological remodelling of the atrium and ventricle.^[23]

CONCLUSION

The incidence of cardiac arrhythmias among patients of ACS Noted is high in our study. Patients with Diabetes mellitus and smokers are more prone to the acute coronary syndrome. The most common arrhythmia developed during the first 48 hours of hospitalization is VPC, followed by AF, sinus bradycardia, sinus tachycardia and VT. Elevated CRP and urea levels are associated with an increased risk of arrhythmia. The most common arrhythmia with raised CRP is AF, and the most common arrhythmia associated with hyperuricemia is AF.

Limitations

The prospective observational study was conducted on a modest number of patients, which may limit extrapolation of the results to the general population. Also, long-term follow-up is required, which may not

be possible in all patients in our study. Technical difficulties and limited resources were major constraints that may limit this study.

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