

## THE STUDY OF ARRHYTHMIAS FOLLOWING MYOCARDIAL INFARCTION OCCURRING WITHIN ONE WEEK

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**ABSTRACT: OBJECTIVES:** Acute myocardial infarction continues to be a major health problem. 50% of deaths with acute myocardial infarction is said to occur within first 24 hours after myocardial infarction and is attributed to arrhythmias. Arrhythmic deaths remain the major cause of death with reduced left ventricular ejection fraction or frequent ventricular premature beats. The objective of this study is to assess various arrhythmias following myocardial infarction within one week and to study the association of these arrhythmias with left ventricular dysfunction. **METHODS:** Minimum of 100 cases diagnosed as acute myocardial infarction (European/ ACC Guidelines 2000) with arrhythmias collected by simple random sampling. Data was collected in a pre-tested proforma by meeting objectives of the study, detailed history, physical examination, ECG changes from day 1 to day 7 and whenever necessary, echocardiography to assess ejection fraction, and serum enzyme levels. **RESULTS:** Male to female ratio with 4:1, mortality was more in the group with risk factors of hypertension, smoking and diabetes. Commonest arrhythmias noticed in this study were VPBs – 23%, ST-22%, BBB -20%, SB-19%, VT -6%, and AF-4%. In 17 out of 69 patients, thrombolysis therapy developed reperfusion arrhythmias of which VPBs being commonest. In addition to commonest arrhythmias there was a significant association between VT, AF and LV dysfunction. **CONCLUSION:** The commonest arrhythmias encountered were ventricular premature beats followed by sinus tachycardia, sinus bradycardia, bundle branch block and ventricular tachycardia. SB & BBB were more common in IWMI where as ST, VPBs, AF and flutter were more common with AWM. In addition to arrhythmias, LV dysfunction added to the mortality. **KEY WORDS:** Myocardial infarction; Arrhythmias.

**INTRODUCTION:** There has been a substantial reduction in deaths from cardiovascular causes during the past 40-50 years, but cardiovascular disease remains the single most important cause of natural deaths in all developed countries of the world.

Deaths from arrhythmias in the setting of myocardial infarction (MI) have been one of the most frequent causes of sudden cardiac death. 60% of all deaths associated with acute myocardial infarction (AMI) occur within 1<sup>st</sup> hour and are attributable to ventricular arrhythmias, in particular ventricular fibrillation<sup>1</sup>. Recent improvement in arrhythmia detection and treatment have had a major impact on the outcome of myocardial infarction.

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There is good correlation between the site of infarct and type of arrhythmias. Sinus bradycardia, sinoatrial, escape rhythms, complete heart block and Wenchebach type are usually associated with inferior wall myocardial infarction. Atrial and ventricular premature beats are more often seen in anterior wall myocardial infarction.<sup>2</sup>

There is a view that the cascade leading to sudden death from arrhythmias can be predicted by certain interactions among structural and functional abnormalities and search for new tools for prediction, the refinement of the existing tools, and the initiation of well designed intervention trials are the steps that must be taken towards the more efficient prevention of premature deaths from arrhythmias.<sup>3,4</sup> Hence this study is undertaken to assess the commonest types of arrhythmias following myocardial infarction within one week and relation of these arrhythmias with site of infarction. Study is also undertaken to assess the association of most commonly occurred arrhythmias with LV (Left Ventricular) dysfunction.

**METHODS:** All patients diagnosed of acute myocardial infarction according to a consensus document of the Joint European Society of Cardiology/ American College of Cardiology Committee for the redefinition of myocardial infarction, guideline, 2000 with arrhythmias admitted to K.R. Hospital attached to Mysore Medical College and Research Institute, Mysore during period from 1<sup>st</sup> January 2007 to 31<sup>st</sup> July 2008 were recruited for the study. Each patient gave written, informed consent to participate in the study and the study protocol was approved by the institutional review board including ethical issues.

**SAMPLE SIZE:** Minimum of 100 cases diagnosed as acute myocardial infarction with arrhythmias were taken for the study by simple random sampling.

**INCLUSION CRITERIA:** Patients diagnosed as AMI as per – A consensus document of the Joint European Society of Cardiology/ American College of Cardiology Committee for the Redefinition of Myocardial Infarction.

**CRITERIA FOR ACUTE MI, EVOLVING OR RECENT MYOCARDIAL INFARCTION:** Typical rise and gradual fall (troponin) or more rapid rise and fall [CK(MB)] and biochemical markers of myocardial necrosis with one of the following.

Ischemic symptoms

Development of pathological Q waves

ECG changes indicative of ischemia (ST elevation or depression)

**CRITERIA FOR ESTABLISHED MI:** Development of new pathologic Q waves on serial ECGs.

**EXCLUSION CRITERIA:** Patients with,

- (1) Previous history of documented arrhythmias
- (2) Old MI
- (3) History of MI more than one week.

Data was collected in a pre-tested proforma by meeting objectives of the study, detailed history, physical examination, thorough cardiovascular and other systemic examination and necessary investigations like ECG changes, echocardiography and serum enzyme levels. First ECG was taken immediately after admission. Patients were connected to cardiac monitor for a minimum of 48 hours and more if needed. Repeated ECGs were taken from day one to day seven whenever necessary and on occurrence of arrhythmias.

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All patients were evaluated for risk factors like diabetes mellitus, hypercholesterolemia, hypertension and smoking. Routine investigations were restricted to the patients who really needed them. Enzyme studies were done in most of the cases. Patients were kept in the ICCU for a period of five days and more in complicated cases.

**RESULTS:** A total of 100 patients with male and female ratio of 4:1, with AMI were included in the study. The maximum number of patients were found in the age group of 61-70 years (35%), followed by 51-60 years (25%), 41-50 years (19%), 31-40 years (10%), 71-80 years (7%), 21-30 years (3%), and 81-90 years (1%).

In the study group, 48% of patients had history of hypertension, 38% of patients had smoking as a risk factor, 36% of patients had diabetes and 18% of patients had alcoholism as a risk factor.

The commonest symptom presented by patients was chest pain 95%, followed by exertional breathlessness in 31%, sweating in 16% of cases, vomiting in 8% of cases, 4% of cases palpitation and 2% of cases epigastric pain.

Most of patients (83%) had ST segment elevation MI of which 34% had extensive anterior wall MI, 23% had inferior wall MI, 14% had anteroseptal wall MI, 6% had inferior wall with RV extension, 3% had lateral and anterolateral wall MI each, and non-ST elevation MI patients were 17%.

The prevalence of various types of arrhythmias in acute myocardial infarction in relation to site of infarction is shown in table 1. In arrhythmias of which ventricular arrhythmias were more common, 23% of cases had ventricular premature beats (VPBs), 6% of patients had ventricular tachycardia (VT), 2% of cases had ventricular fibrillation (VF) followed by sinus tachycardia (ST) in 22% of cases, 20% of patients had bundle branch block (BBB), 19% of patients had sinus bradycardia (SB), 4% had atrial fibrillation (AF), 2% had atrial flutter, 1% had couplets and nodal ectopics each.

In total of 22 cases, 8 cases of sinus tachycardia were seen in extensive anterior wall. In total of 19 cases, 12 cases of sinus bradycardia were seen in inferior wall MI. Total out of 23 cases, 13 cases of ventricular premature beats were seen in extensive anterior wall MI. Out of 100 cases, 38 cases of arrhythmias were seen in extensive anterior wall MI.

Prevalence of arrhythmias from day 1 to day 7 was studied. According to this most of the patients presented with symptoms after 1 day or 3 days. The presence of arrhythmia was taken as on day 1 or day 3, etc. According to the study, ventricular tachycardia, ventricular fibrillation and ventricular flutter occurred within 24 hours. VPBs occurred after 24-48 hours.

Sinus tachycardia and sinus bradycardia present on the first day at presentation of patient symptoms had reverted back to normal sinus rhythm. Bundle branch block occurred from day 1 to day 4 it was usually left bundle branch block (LBBB) or right bundle branch block (RBBB). Prevalence of arrhythmias is shown in table 2.

Table 3 shows 47.6% of inferior wall myocardial infarction patients had bundle branch block, followed by 23.8% of anteroseptal wall myocardial infarction patients had blocks and 19.04% of extensive anterior wall myocardial infarction had blocks. Total of 21% patients had one or the other type of atrioventricular blocks. The most commonest type of blocks encountered was LBBB (38.09%) followed by 28.57% RBBB, 19.04% cases had complete heart block, 4.76% cases in bifascicular block, III<sup>o</sup> AV block and II<sup>o</sup> AV block respectively.

Mortalities in reperfusion arrhythmias occurred of which ventricular premature beats were more common and were self terminated. One patient with VF after reperfusion expired after cardioversion. Details of reperfusion arrhythmias is shown in table 4.

Chi-square test was used to assess the association of arrhythmias in relation to left ventricular dysfunction (Table 5). Most of the patients with sinus tachycardia, atrial fibrillation, ventricular tachycardia and bundle branch block had less ejection fraction (<40%), compared to patients with sinus bradycardia and VPBs (>40%). The association of arrhythmias with left ventricular dysfunction was significant in patients with atrial fibrillation and ventricular tachycardias with 'p' value of 0.018.

3 patients each with AF and VT had the least ejection fraction of 20-30%, followed by patients with bundle branch block had EF of 31-40%. Patients with VPBs and SB had near normal ejection fraction (EF) of 41-50%, followed by patients with sinus tachycardia had an EF of 40%.

**DISCUSSION:** The maximum incidence of acute myocardial infarction seen in this study was in the age group of 41 - 70 years (79%), of this 35% patients belong to 61 - 70 years group. Only 3% of cases were below the age of 30 years. Age incidence in this study is almost similar to the studies done by Marthin TC et al.<sup>5</sup> and Kakade SV et al.<sup>6</sup> where 85% patients were between 35 and 75 years old. Age incidence is probably more common because of life style, economic status and multiple risk factors and life expectancy.

Incidence of acute myocardial infarction in this study was 80% in males which was more as compared to females (20%). The study done by Kock HL et al.<sup>7</sup> showed 72% male and 24% females. It is more common because of life style and more risk factors like hypertension, smoking, diabetes mellitus and alcohol.

In the present study, incidence of hypertension was 48% and incidence of smoking 38%, 36% had diabetes mellitus and 18% alcoholism. Mortality was more in the group with risk factors of hypertension, smoking and diabetes.

Sinus bradycardia was most commonly associated with inferior wall myocardial infarction. In the present study, 19 patients had sinus bradycardia, out of which 12 were of inferior wall MI. Similar observations were made by Michel Rotman et al.<sup>8</sup> (10 - 30%), Philip J Podrid,<sup>9</sup> where 16% to 25% patients had sinus bradycardia particularly of inferior wall MI and posterior wall MI. It was most often transient.

In the present study, no deaths occurred in patients with sinus bradycardia and IWMI which is same as in the study done by Mall RR and Sayami A.<sup>10</sup>

In the present study, sinus tachycardia was present in 22% patients and commonly associated with anterior wall MI (9% cases) compared to inferior wall MI (3% cases). It represents an appropriate physiological response to left ventricular dysfunction, congestive heart failure (CHF) or stimulation and over activity of the sympathetic nervous system. This study compares well with the study done by Philip J Podrid.<sup>9</sup>

Atrial fibrillation (4% cases) and atrial flutter (2% cases) were seen in extensive anterior wall MI as most commonly in those who had significantly left ventricular dysfunction and CHF, and had increased mortality not because of arrhythmia itself, but to factors associated with it, particularly LV dysfunction and shock. Study done by Philip J Podrid<sup>9</sup>, Galcera Thomas J et al<sup>11</sup> and Pizzetti F<sup>12</sup> et al showed AF and flutter was associated with increased mortality in patients with LV dysfunction.

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Nodal ectopic was seen in 1% of cases and is similar to the study done by Galcera Thomas J et al.<sup>11</sup> with 1% cases of nodal ectopic.

20% of patients had bundle branch block. In the study done by Keith Newby et al.<sup>13</sup> was 8 – 18% bundle branch block. In the present study, out of 20 cases, 8% cases seen were LBBB, 6% cases RBBB. The overall mortality rate was high compared to other patients in the present study. The study conducted by Keith Newby et al.<sup>13</sup> shows high mortality.

Ventricular arrhythmias were seen in 31 cases of which VPBs in 23 cases, VT in 6 cases, VF in 2 cases. Study conducted by Julain Villacastin<sup>14</sup> showed total incidence of VPB 12% and VT 18% and Mossimo Zoni Berisso et al.<sup>15</sup> showed 19.7% VPBs and VT 6.8%.

In the present study, total incidence of reperfusion arrhythmias was 17 cases, out of which, VPBs in 9 cases, couplets 1 case, VF 1 case and VT 3 cases. In a study done by Mohamed Majidi et al.<sup>16</sup> reperfusion arrhythmias in 157 patients were VF 4% VPB 10% and couplets 2%.

In our study, one patient developed VF after reperfusion expired. In another study done by Ghuran AV<sup>17</sup> and Lokas DRC et al.<sup>18</sup> VPBs are usually asymptomatic and their presence in the infarction period, regardless of frequency of complexity (bigeminy, trigeminy, etc.) has no relation to the mortality.

In the present study, about 60 patients showed varying ejection fraction in different types of arrhythmias. The ejection fraction found by echocardiography was least in AF and VT (20 – 30%) compared to BBB and ST (40%) and EF was better in sinus bradycardia (>40%) showing less ventricular dysfunction over transient clinical outcome. There was also a significant association of arrhythmias with left ventricular dysfunction in patients with atrial fibrillation and ventricular tachycardias. This is in accordance with study conducted by Joaguin F Pombo<sup>19</sup> and Pfisterer M<sup>20</sup> in which 127 patients echocardiography reading shows incidence of severe ventricular arrhythmias was significantly higher with isolated right and left ventricular dysfunction compared with normal function. It was highest in VT and AF.

**CONCLUSION:** The commonest arrhythmias encountered were ventricular premature beats followed by sinus tachycardia, sinus bradycardia, bundle branch block and ventricular tachycardia. Most of the arrhythmias were seen in the first 48 hours. Mortality was more in the group with risk factors of hypertension, smoking and diabetes.

SB & BBB were most commonly seen in IWMI where as ST, VPBs, AF and flutter were commonly seen in AWWMI. ST, AF, flutter, VT and BBB were more commonly associated with LV dysfunction. There was a significant association of arrhythmias with LV dysfunction in patients with AF and VT. AF, BBB and flutter were associated with increased mortality in patients with LV dysfunction.

Further studies with larger sample size are needed to confirm the possible mechanisms between association of arrhythmias and LV dysfunction.

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**Table 1 : Types of arrhythmias in relation to site of infarction**

Arrhythmias	Site of infarction							Total
	Inferio	Inferio r wall + RV	Extensi ve anterio	Antero	Lateral	Antero lateral	Non - STEMI	
Ventricular premature beats	2	-	13	5	-	-	3	23
Sinus tachycardia	3	-	8	2	2	-	7	22
Bundle branch block	9	1	3	5	-	-	2	20
Sinus bradyardia	-	-	5	1	-	-	-	6
Atrial fibrillation	1	-	2	-	-	1	-	4
Atrial Flutter	-	-	1	-	-	1	-	2
Ventricular fibrillation	-	-	1	-	-	-	1	2
Couplets	-	-	1	-	-	-	-	1
Nodal ectopic	-	-	1	-	-	-	-	1
Supraventricular tachycardia	-	-	-	-	-	-	-	-

**Table 2: Types of arrhythmias from day 1 to day 7**

Arrhythmias	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Ventricular premature beats	-	7	7	5	1	1	2
Sinus tachycardia	7	6	6	2	1	-	-
Bundle branch block	5	6	6	3	-	-	-
Sinus bardycardia	9	9	1	-	-	-	-
Ventricular tachycardia	6	-	-	-	-	-	-
Atrial fibrillation	4	-	-	-	-	-	-
Atrial flutter	2	-	-	-	-	-	-
Ventricular fibrillation	2	-	-	-	-	-	-
Couplets	-	1	-	-	-	-	-
Nodal ectopic	-	1	-	-	-	-	-
Others	-	-	-	-	-	-	-
Total	35	30	20	10	2	1	2

**Table 3: Types of blocks in relation to site of infarction**

Site of infarction	Type of block						Total	
	RBBB	LBBB	Bifascicular block	Complete heart	III AV block	II AV block	No.	%
Inferior wall	2	5	-	2	-	1	10	47.6%
Anteroseptal	1	2	-	2	-	-	5	23.8%
Extensive anterior wall	2	1	1	-	1	-	4	19.04%
Inferior wall + RV extension	-	-	-	-	-	-	1	4.76%
Non - STEMI	1	-	-	-	-	-	1	4.76%
Lateral	-	-	-	-	-	-	-	-
Anterolateral	-	-	-	-	-	-	-	-
<b>Total</b>							<b>21</b>	

**Table 4: Reperfusion Arrhythmias**

Type	Number of cases	Self termination	Mortality
Occasional VPBs	7	7	-
Multiple VPBs	2	2	-
Couplets	1	-	1
Atrial flutter	1	-	1
Ventricular tachycardia	3	1	2
Ventricular bigeminy	1	1	-
Ventricular fibrillation	1	-	1
AV dissociation	1	1	-



**Table 5: Association of arrhythmias with left ventricular dysfunction**

Types of arrhythmias	Ejection fraction		P Value
	<40%	>40%	
Sinus tachycardia	10 (62.5%)	6 (37.5%)	<b>0.018</b>
Sinus bardycardia	2 (20%)	8 (80%)	
Atrial fibrillation	3 (100%)	0 (0%)	
VPBs	7 (41.2%)	10 (58.8%)	
Ventricular tachycardia	3 (100%)	0 (0%)	
Bundle branch block	8 (80%)	2 (20%)	
Nodal ectopic	0 (0%)	1 (100%)	
<b>Total</b>	<b>33</b>	<b>27</b>	

Chi-square value: 15.28, Degree of freedom: 6.

