



Study of various cardiac arrhythmias in patients of acute myocardial infarction

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Abstract

Background: Myocardial infarction is one of the major causes of sudden death in present era and cardiac arrhythmias are common complications of it.

Material and methods: Present study was conducted at intensive coronary care unit (I.C.C.U.) of tertiary care hospital, Ahmedabad on 100 cases of acute myocardial infarction to study the incidence of arrhythmia and their nature in relation with the site of infarction and to evaluate prognostic value of arrhythmias in Acute Myocardial Infarction (AMI).

Results: Incidence of various arrhythmias was 76% in present study. S. tachycardia was more common (68%) than S. bradycardia (19%). S. tachycardia and tachyarrhythmia occurred more commonly with anterior wall myocardial infarction, while S. bradycardia and bradyarrhythmia with inferior wall myocardial infarction.

Conclusion: Study of incidence of various cardiac arrhythmias, their nature and relation to site of infarction as well as prognostic value in patients of acute myocardial infarction is very useful in proper treatment.

Key words

Cardiac arrhythmias, Acute myocardial infarction, Risk factors, SA node, Anatomical site.

Introduction

Every life has an end on one day [1] and death due to myocardial infarction is routine to hear among all. Myocardial infarction can be one of

the causes of sudden death [2]. Sedentary lifestyle and physical inactivity is associated with obesity and cardiovascular disease risk [3]. Hypertension and its complications remain a major health problem, causing high mortality



and morbidity all over the world [4]. Cardiac arrhythmias are one of the major complications in patients of acute myocardial infarction. Aim of study was to find out incidence of various cardiac arrhythmias in patients with Acute Myocardial Infarction (AMI) along with to study the incidence of arrhythmia and their nature in relation with the site of infarction and to evaluate prognostic value of arrhythmias in Acute Myocardial Infarction.

Material and methods

The present study was conducted at intensive coronary care unit (I.C.C.U.) of tertiary care hospital, Ahmedabad on 100 cases of acute myocardial infarction who were admitted irrespective of past history of ischemic heart diseases (IHD), age, sex etc.

Inclusion criteria

- Presence of classical ECG changes of hyper-acute or acute MI with transient rise in cardiac enzyme levels.
- Presence of pathological q waves accompanied by ST segment elevation and symmetrical inversion of T waves with rise in cardiac enzyme levels.
- Presence of fresh onset left bundle branch block (LBBB) with rise in cardiac enzyme levels.
- Wall motion abnormalities e.g. hypokinesia as per 2D echo.

A detailed history was taken regarding the onset of the symptoms, duration, presence of risk factors, past history of IHD and family history of coronary artery diseases (CAD). Physical examination of patients was done to assess the hemodynamic stability, congestive cardiac failure, and cardiogenic shock. All patients were undergone continuous cardiac monitoring and serial ECG were taken at regular intervals of 1, 2, 3, 6, 12, 24, 48 and 72 hours after admission and

as and when necessary. Various investigations were done like complete blood count (CBC), random blood sugar (RBS), cardiac enzyme levels (CPK-MB, TROP-I) serum creatinine, blood urea nitrogen (BUN), serum electrolytes, serum cholesterol and X-ray chest (PA view). All the patients were kept in intensive cardiac care for varying periods ranging from 2 to 10 days as indicated and thereafter shifted in ward before discharge [5].

Results

In present study, complicated MI in form of arrhythmia occurred in 76 cases while 24 cases did not develop arrhythmia as per **Table - 1**. In the present study, incidence of arrhythmias was highest in 3rd decade (21-30 years) and in 6th decade (61-70 years) and above. Minimum arrhythmias occurred in the 5th decade (51-60 years). Incidence in females was less in early decades, but in later ages, sex didn't offer any advantage either in the incidence of AMI or arrhythmias. Overall occurrence of arrhythmias was 77.6% (59 out of 76) in males and 70.8% (17 out of 24) in females as per **Table - 2**.

In present study, the incidence of the arrhythmias in recent MI was highest (92.3%) in patients with past history of ischemic heart disease (IHD). Smoking was the most significant risk factor (57 cases) in our study, followed by hypertension (36 cases), serum cholesterol (32 cases), past history of ischemic heart disease (26 cases), obesity (24 cases), family history of coronary artery disease (CAD) (22 cases), Diabetes Mellitus (DM) (20 cases) and Alcohol (10 cases) as per **Table - 3**. In the present study, arrhythmias were observed in 88.5% (46 out of 52) cases with anterior wall MI (AWMI) while it was 60% (15 out of 25) with inferior wall MI (IWMI). Both the cases of global MI developed arrhythmia with an incidence of 100%. Arrhythmias were more common with AWMI as per **Table - 4**.

In the present study, S. tachycardia was more common (68 cases) than S. bradycardia (19 cases). S. tachycardia occurred more commonly with anterior wall and associated MI, while S. bradycardia with inferior wall MI as per **Table - 5**. In present study, the most common tachyarrhythmia developed were VPCs (56 cases), most common in anterior wall and Global MI. Maximum arrhythmias occurred with global MI. Least arrhythmias occurred with Inferior wall + RV MI. VT occurred in 7 patients, and VF in 6 patients as per **Table - 6**. In present study, the inferior wall was the leading site for developing bradyarrhythmia. The most common bradyarrhythmia developed was complete heart block (6 cases) as per **Table - 7**. In present study, mortality in the patients with arrhythmias was 7.9%, as compared to overall mortality of 6% as per **Table - 8**.

Discussion

Wenckebach, in 1899, first detected AV block in conducting system, which were further classified by Mobitz in 1924. Oppenheimer and Rothschild reported the ECG changes associated with coronary artery disease in 1917. Salacedo Solnger, in 1935, first showed the presence of arrhythmias in AMI. In 1947, Claude Beck developed a direct defibrillator on open heart during surgery. Paul Zou et al, in 1956, reverted VF to sinus rhythm through a closed chest wall defibrillator and in 1962, Lown et al confirmed the preferability of direct current over alternate current for doing so [6].

S. bradyarrhythmia is commonly associated with inferior and posterior wall Infarction [7]. It is seen in 25-40% cases of AMI within first hour. It is due to the stimulation of cardiac vagal receptors which are distributed more commonly distributed more commonly in inferoposterior than anterolateral portion of left ventricle. This is the Bezold Jarisch reflex [8] also occurring during reperfusion of right coronary artery [9]. It

is characterized by normal P-QRS-T complex, which are recorded in slow succession i.e. less than 60 per minute.

Complete heart block occurs in 5% of all patients with AMI, with a higher incidence in right ventricular infarction [9, 10]. Incidence is 3.5% for VT and 2.7% for combined VT and VF [11]. Primary Ventricular Fibrillation occurs suddenly and unexpectedly in patents with no signs of left ventricular failure (LVF) [12]. Atrial flutter (AFI) is the least common (1 - 2%) major atrial arrhythmia associated with AMI. It is usually transient. It is characterized by Saw – toothed base line, visible flutter (F) waves and constant R – R interval. Atrial fibrillation (AF) is more common occurring in 10%-20% patients with AMI [13, 14].

Diabetes Mellitus (DM) may cause microangiopathies in small coronary vessels [15, 16] and hyper insulinemia may promote the development of atherosclerosis by stimulating the proliferation and migration of arterial smooth muscle cells.

In Present study, arrhythmia occurred in 76% of cases which was less than those reported in Aufderheide TP [17] study (90%). The low incidence of arrhythmia in this study may be due to early institution of β -blocker, delayed hospitalization of patients and hence delayed thrombolysis and better management of patients with aspirin, nitrates, β -blockers etc.

In the present study, S. tachycardia developed in 68% of cases, of which 42 occurred with AWM. Rajgopalan [18] observed S. tachycardia in 72% of cases. S. tachycardia was common in AWM due to sympathetic over activity, hypotension and underlying left ventricular dysfunction secondary to large infarct size. S. bradycardia developed in 19% of cases, of which 12 occurred in association with IWM. Rajgopalan [18]



observed S. bradycardia in 5.6% of cases. S. bradycardia was common in IWMI due to parasympathetic over activity.

Supraventricular tachyarrhythmias include atrial premature contractions (APCs), supraventricular tachycardia (SVT), atrial flutter/fibrillation (AFI/AF). The incidence of these arrhythmias was APC (7), SVT (1) AFI/AFI (1) i.e. a total of 9% of all patients of AMI, similar to that observed by Michael [19] and coworkers as per **Table - 9**. AF in AMI occurs due to atrial infarction, pericarditis and irritation of SA node and LVF leading to dilation of left atrium. VPCs were observed in 56% of cases. Out of 56 patients, 42 had AWMI and 4 had IW MI. VPCS were observed in 56% cases in GISSI – 2 [20] trial as per **Table - 9**. In present study, VT occurred in 7% of patients with AMI. The incidence was maximum in patients with AW and associated MI i.e. 6 out of 7 patients. It was due to large infarct size, depressed LV function and cardiogenic shock associated with AW MI. Incidence was similar to the observation in Gusto – I [11] trial as per **Table - 9**. 3 patients had sustained VT with VF. The incidence of VF in present study was 6%. This was nearly to that in the Gusto-I [11] trial as per **Table - 9**. Similar to this study, the incidence of VF was maximum in patients with AW MI (3 out of 6) and Global MI (1 out of 2) associated with large infarct size and poor LV function. The mortality was 3 out of 6 patients i.e. 50% were similar to that of Gusto-I trial [11].

In the present study, 1st degree block occurred in 4% of cases. Out of the 4 patients, 3 had IWMI and 1 had AWMI. The incidence was comparable to study of Rotman [21] as per **Table - 10**. 2nd degree block occurred in 5% of cases in this study, similar to that observed by Roman [21]. Out of 5 patients, 4 had IWMI and 1 had AWMI. One patient of 2nd degree block with IWMI + RVMI developed CHB and died. Incidence of CHB

is 6% in the present study which is similar to that observed by Harpez [10] and coworkers as per **Table - 10**. Out of 6 patients, 4 had IWMI and 2 had AWMI. One patient of CHB with IWMI died. Rest all were treated by temporary followed by permanent pacemaker implantation.

In arrhythmias, increased mortality was due to VT, VF, precipitation of acute failure and cardiogenic shock leading to under perfusion of vital organs and marked under perfusion of coronary vessels, leading to extension of the infarct area.

Conclusion

Incidence of various arrhythmias was 76% in present study. S. tachycardia was more common (68%) than S. bradycardia (19%). S. tachycardia occurred more commonly with AW and associated MIs, while S. bradycardia with IWMI. Tachyarrhythmia like VPCs, VT, VF were more commonly observed in AW MI, while bradyarrhythmia like 2nd degree block and 3rd degree block were more commonly seen in IW MI. The commonest arrhythmias observed were VPCs (56%). Incidence of other arrhythmias in order of frequency was: AIVR (15%), APCs (7%), VT (7%), VF (6%), CHB (6%), 2nd degree block (5%), 1st degree block (4%), and SVT and AF (1%) each. Mortality in patients with arrhythmias was higher (7.9%) compared with overall mortality of 6%.

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Table – 1: Incidence of arrhythmias in acute myocardial infarction (AMI).

Total No. of patients with AMI	No. of patients with arrhythmia	Percentage (%)	No. of patients without arrhythmia	Percentage (%)
100	76	76	24	24

Table – 2: Incidence of arrhythmias in relation to age and sex in AMI.

Age in years	Total Cases			Cases with arrhythmia			Percentage of arrhythmia		
	M	F	T	M	F	T	M	F	T
21 – 30	3	0	3	3	0	3	100	0	100
31-40	7	0	7	6	0	6	85.7	0	87.5
41-50	34	2	36	21	1	22	61.7	50.0	61.1
51-60	28	18	46	25	12	37	89.3	66.7	80.4
61-70	2	2	4	2	2	4	100	100	100
Above 70	2	2	4	2	2	4	100	100	100
Total	76	24	100	59	17	76	77.6	70.8	76

Table – 3: Incidence of various risk factors in AMI with arrhythmias.

Risk Factors	Cases of AMI with risk factors		Cases with arrhythmias	
	No. of cases	Percentage (%)	No. of cases	Percentage (%)
Smoking	57	57	50	87.7
Hypertension	36	36	31	86.1
S. Cholesterol (>250 mg)	32	32	28	87.5
P/H of IHD	26	26	24	92.3
Obesity	24	24	21	87.5
F/H of CAD	22	22	19	86.4
Diabetes mellitus	20	20	17	85.0
Tobacco chewing	17	17	5	29.4
Alcohol	10	10	7	70.0

Table - 4: Incidence of arrhythmias in relation to anatomic site of MI.

Anatomic site	No. of cases	Cases with arrhythmia	Percentage (%)
Anterior wall	52	46	88.5
Inferior wall	25	15	60.0
I/W+RV	15	8	53.3
A/W+I/W	6	5	83.3
A/W+I/W+RV	2	2	100.0
Total	100	76	76.0

Table - 5: Relationship of rate disturbances developed at SA node to anatomical site of MI.

Anatomical site	No. of cases	S. Tachycardia		S. bradycardia	
		No.	%	No.	%
Anterior Wall	52	42	80.7	0	0
Inferior Wall	25	6	24.0	12	48.0
I/W+RV	15	3	20.0	7	46.7
A/W+I/W	6	4	66.7	0	0
A/W+I/W+RV	2	2	100.0	0	0
Total	100	68	68.0	19	19.0

Table - 6: Incidence of various tachyarrhythmias in relation to anatomical site of MI.

AS	N	Tachyarrhythmias													
		VPC	%	AIVR	%	VT	%	APC	%	VF	%	AF + AFI	%	SVT	%
AW	52	42	80.8	12	23.1	2	3.8	4	7.7	3	11.5	1	1.9	1	1.9
IW	25	4	16.0	1	4	1	4	2	8.0	1	4.0	-	-	-	-
IW + RV	15	4	26.7	-	-	-	-	-	-	-	-	-	-	-	-
AW + IW	6	4	66.7	-	-	2	100	1	16.6	1	50.0	-	-	-	-
AW+ IW + RV	2	2	100	2	100	1	50	-	-	1	50	-	-	-	-
Total	100	56	56.0	15	15.0	7	7.0	7	7.0	6	6.0	1	1.0	1	1.0

Table - 7: Incidence of various brady arrhythmias in relation to anatomic site of MI.

Anatomic Site	Total No. of cases	Bradyarrhythmia									
		CHB	%	1° AV Block	%	2°-I Block	AC	%	2°-II Block	AV	%
AW	52	2	3.8	1	1.9	1	1.9	-	-	2	
IW	25	4	1	2	8	-	-	-	-	4	
IW + RV	15	-	-	1	6.7	2	13.3	2	-	-	
AW + IW	6	-	-	-	-	-	-	-	-	-	
AW + IW + RV	2	-	-	-	-	-	-	-	-	-	
Total	100	6	6	4	4	3	3.0	2	2	2	

Table – 8: Mortality in AMI complicated by arrhythmias.

Anatomic site	Total cases	Cases with arrhythmias	Patients expired	% mortality
Anterior wall	52	46	2	4.3
Inferior wall	25	15	1	6.7
IW + RV	15	8	-	-
AW + IW	6	5	1	20.0
AW + IW + RV	2	2	2	100.0
Total	100	76	6	7.9%

Table – 9: Comparison of various tachyarrhythmia.

	Supraventricular tachyarrhythmia	VPCs	VT (%)	VF (%)
GISSI – 2 [20]	-	56	-	-
Michael [19]	9.9%			
Gusto – I [11]	-	-	6.2	6.8
Present study	9	56	7	6



Table – 10: Comparison of various bradyarrhythmia.

	First degree AV block	Second degree AV block	CHB
Rotman [21]	6%	5%	14%
Harpez [10]	-	-	6%
Present study	4%	5%	6%

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