Original Research Article

Arrhythmia pattern in patients with acute myocardial infarction

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Abstract

Background: Acute myocardial infarction is characterized by generalized autonomic dysfunction that results in enhanced automaticity of the myocardium and conduction system.
Objectives: To assess the incidence of tachy- and bradyarrhythmic episodes in patients with acute myocardial infarction, to find out whether incidence of arrhythmias is higher in STEMI compared to NSTEMI and to evaluate are there any specific arrhythmias responsible for the increased mortality in acute MI.
Materials and methods: Hundred patients admitted consecutively into PIMS CCU with the diagnosis of MI were studied. All of them had electrocardiographic evidence of infarction in case of STEMI. They also had electrocardiographic evidence of infarction and positive cardiac troponin I in case of NSTEMI.
Results: 30% of study population had valvular heart diseases whereas 70% were free of any valvular disease. 92% of study population was TROP I positive and 8% were TROP I negative. 11% of study population underwent thrombolysis and 6% underwent angioplasty. 83% of study population had NSTEMI and 17% had STEMI. 9% of study population had heart failure and 91% were devoid of heart failure.
Conclusion: 58% of study population had arrhythmias. 75.9% of arrhythmias were single and 24.1% were multiple 69% of arrhythmias were major and 31% were minor. There was no significant association between incidence of arrhythmias/ multiple arrythmias / major arrhythmias with valvular heart disease/ heart failure/ TROP I/ procedure/ Killips groups.

Key words

Acute Myocardial Infarction, Arrhythmia, Tachycardia, Heart failure.

Introduction

AMI is characterized by generalized autonomic dysfunction that results in enhanced automaticity of the myocardium and conduction system. Electrolyte imbalances (e.g., hypokalemia and hypomagnesemia) and hypoxia further contribute to the development of cardiac arrhythmia. The damaged myocardium acts as substrate for re-entrant circuits, due to changes in tissue refractoriness [1]. Enhanced efferent sympathetic activity, increased concentrations of circulating catecholamines, and local release of catecholamines from nerve endings in the heart muscle itself have been proposed to play roles in the development of peri-infarction arrhythmias. Furthermore, transmural infarction can interrupt afferent and efferent limbs of the sympathetic nervous system that innervates myocardium distal to the area of infarction. The net result of this autonomic imbalance is the promotion of arrhythmias [2, 3]. The importance of accelerated idioventricular rhythm, ventricular fibrillation or tachycardia, atrial fibrillation or flutter and bradycardias is considered in prognostic impact. The value of the presence of AIVR as a marker of reperfusion is small, but in combination with other non-invasive markers (ST-segment resolution), its presence relates to a high probability of successful reperfusion [4]. Studies have shown that cardiac arrhythmias are the most common cause of death during acute myocardial infarction. Cardiac arrhythmias and conduction abnormalities complicating acute myocardial infarction (AMI) have been associated with adverse prognosis in numerous reports [5, 6]. The rationale behind this study was to assess the incidence of tachy- and bradyarrhythmic episodes in patients with acute myocardial infarction, to find out whether incidence of arrhythmias is higher in STEMI compared to NSTEMI, to study any specific arrhythmias responsible for the increased mortality in acute MI or not. The mortality rates of arrhythmias above and below the atrioventricular node were compared.

Materials and methods

Study design: Prospective study/ cross sectional analytic study.

Study population: 100 Patients admitted with acute MI within 14 days of the index event in PIMS CCU

Study Duration: from January 2014 to November 2015.

Exclusion criteria: Severe valvular heart disease, Pregnancy, previous ICD implantation.

Sampling Technique: Consecutive sampling technique.

Sample Size: 100 patients with acute MI.

Study tool: Pre- structured, pilot tested questionnaire was used for data collection containing demographic details and markers.

Methodology

After ethical approval and informed consent was taken, hundred patients admitted consecutively into PIMS CCU with the diagnosis of MI were studied. All of them had electrocardiographic evidence of infarction in case of STEMI. Clinical features with electrocardiographic evidence of infarction and positive cardiac troponin I at any time during the index admission in case of NSTEMI.

All patients were underwent continuous ECG monitoring throughout their stay in the CCU. The arrhythmias were classified to major/minor, brady/tachy, supraventricular/ventricular. The cases also be classified to lone / multiple arrhythmias. Cases are classified according to 'Killip' classification into four groups:

Class I: No signs of pulmonary or venous congestion;

Class II: Moderate heart failure as evidenced by rales at the lung bases, S_3 gallop, tachypnea, or signs of failure of the right side of the heart, including venous and hepatic congestion;

Class III: Severe heart failure, pulmonary edema;

Class IV: Cardiogenic shock

Cardiogenic shock was diagnosed in the presence of a systolic blood pressure of less than 80 mmHg, together with cyanosis, cold extremities, and diminished or absent peripheral pulses.

Arrhythmias were divided into major and minor. Major arrhythmias were those which were thought to be potentially serious namely atrial fibrillation, supraventricular tachycardia (including atrial flutter), nodal tachycardia, ventricular tachycardia, ventricular fibrillation, second- and third-degree atrioventricular block, and new conduction disturbance of left or right bundle-branch block. The minor arrhythmias namely ventricular bigemini, ventricular extrasystole, supraventricular extra systole, sinus bradycardia and sinus tachycardia were also to be studied.

Statistical Analysis

Data were consolidated and entered a Microsoft Excel spreadsheet and then transferred to Epi info version (7.1.3.0. centre for disease control and prevention, Atlanta, Georgia, USA, 2013) software for analysis. Frequency tables and chi-square test was used as test of significance to determine association.

Results

In the present study, 71% of the study population was males and 29% were females. The most common age group in the present study to get the attacks of MI was 60-69 years in 41% of participants were seen followed by 50-59 years comprising 23% (**Table – 1**).

Table – 1: Distribution of participants according to Age and Sex.

Age (Years)	Count	Percent
< 40	2	2.0
40 – 49	4	4.0
50 – 59	23	23.0
60 – 69	41	41.0
70 – 79	19	19.0
80 – 89	10	10.0
90 – 99	1	1.0
Male	71	71.0
Female	29	29.0

According to **Table - 2**, participants were distributed according to multiple comorbidities. The most common among them was DM, HTN together forming 23%. Followed by DM, HTN, DLP in 20%. Around 15% of participants didn't have any kind of comorbidity.

Table – 2: Distribution according to Multiple Comorbidities.

Comorbidity	Count	Percent
No comorbidity	15	15.0
DM alone	20	20.0
HTN alone	7	7.0
DLP alone	6	6.0
DM, HTN	23	23.0
DM, DLP	4	4.0
HTN, DLP	5	5.0
DM, HTN, DLP	20	20.0

Table – 3: Distribution according to Valvular Heart Disease, Diagnosis, Trop -I, and Procedure.

VHD	Count	Percent
Yes	30	30.0
No	70	70.0
Trop I		
Positive	92	92.0
Negative	8	8.0
Procedure		
No procedure	83	83.0
Thrombolysis	11	11.0
Angioplasty	6	6.0
Diagnosis		
STEMI	17	17.0
NSTEMI	83	83.0

As per **Table - 3**, 30% of study population had valvular heart diseases whereas 70% were free of any valvular disease. 92% of study population were TROP I positive. 11% patients underwent thrombolysis and 6 % patients underwent angioplasty. 83% of study population had NSTEMI and 17% had STEMI.

Table - 4 shows around 58% of participants had arrythmia in which sinus bradycardia and sinus tachycardia were the most common types followed by right bundle branch block (RBBB), 1st degree AVB and atrial flutter (AF).

Table – 4: Distribution according to Arrhythmia and its Types.

Arrhythmia	Count	Percent
Yes	58	58.0
No	42	42.0
TYPE		
AF	6	
AFl	1	
VT	2	
PSVT	3	
SVE	1	
VPC	4	
Ist Degree AVB	8	
2nd Degree AVB	2	
AIVR	1	
LBBB	5	
RBBB	6	
CHB	5	
SINUS BRADY	10	
SINUS TACHY	10	
JUNCTIONAL RHYTHM	2	
LAFB	1	
IVCD	1	

Table – 5: Distribution according to KILLIPS.

KILLIPS	Count	Percent
KILLIPS 1	84	84.0
KILLIPS 2	12	12.0
KILLIPS 3	2	2.0
KILLIPS 4	2	2.0

84% of study population belonged to Killips 1, 12% in Killips 2, 2% in Killips 3 and 2% in Killips 4 (**Table – 5**).

Of the 30 patients with valvular heart disease 70% had arrhythmias. Of the 70 non valvular heart disease patients 52.9% had arrhythmias. There was no significant association between arrhythmias and valvular heart disease (P>0.05) as per **Table - 6**.

Of the 92 patients with positive TROP I values, 59.8% had arrhythmias. Of the 8 patients with negative TROP I values, 37.5% had arrhythmias. There was no significant association between TROP I positivity and arrhythmias (**Table – 7**).

Table – 6: Association of Arrhythmia with Valvular Heart Disease (VHD).

VHD	Yes		No		χ^2	p
	Count	Percent	Count	Percent		
Yes	21	70.0	9	30.0	2.53	0.111
No	37	52.9	33	47.1		

Table – 7: Association of arrhythmia and Trop I.

Trop I	Yes		No		χ^2	p
	Count	Percent	Count	Percent		
Positive	55	59.8	37	40.2	1.50	0.221
Negative	3	37.5	5	62.5		

Table – 8: Association of arrhythmias and KILLIPS class.

KILLIPS	Yes		No		χ^2	p
	Count	Percent	Count	Percent		
KILLIPS 1	47	56.0	37	44.0	2.02	0.569
KILLIPS 2	8	66.7	4	33.3		
KILLIPS 3	2	100.0	0	0.0		
KILLIPS 4	1	50.0	1	50.0		

Table – 9: Association arrhythmias and Procedure.

Procedure	Yes		No		χ^2	p
	Count	Percent	Count	Percent		
No procedure	50	60.2	33	39.8	1.72	0.422
Thrombolysis	6	54.5	5	45.5		
Angioplasty	2	33.3	4	66.7		

Table – 10: Association arrhythmias and Heart failure.

HF	Yes		No		χ^2	p
	Count	Percent	Count	Percent		
Yes	7	77.8	2	22.2	1.59	0.208
No	51	56.0	40	44.0		

84 patients were in Killips class 1 followed by 12 patients in Killips 2, 2 patients in Kiliip 3 and 2 patients in Killips 4. 56% of Kiilips 1 had arrhythmias whereas 66.7% of Killips 2 had arrhythmias. Subjects belonging in Killips 3 and Killips 4 were only 4% put together. But the association was not significant (**Table – 8**).

Of the 83 patients who underwent no procedural interventions 60.2% had arrhythmias. Of the 17 patients who underwent either angioplasty or thrombolysis, 8 patients developed arrhythmias. There was no significant correlation between arrhhthmias and procedural interventions (**Table – 9**).

Of the 9 patients with heart failure 77.8% had arrhythmias, whereas of the 91 patients with no evidence of heart failure 56% had arrhythmias. There was no significant association between arrhythmias and heart failure (**Table – 10**).

Discussion

100 Patients admitted with acute MI within 14 days of the index event in PIMS CCU who satisfied the inclusion criteria were analysed for occurrence of arrhythmias. The arrhythmias were classified in to major/minor, brady/tachy arrhythmia, supraventricular/ventricular arrhythmia. The cases were classified into single / multiple arrhythmias. Cases were classified according to 'Killips' classification into one of the four Killips groups. Major proportion of the study population was between 50-79 years of age (83%). 71% of the study population were males and 29% were females. 67% of study population were diabetics, 55% were hypertensives, 35% were dyslipidemics and 36% had a previous history of myocardial infarction. 23% of study population were having both diabetes and hypertension. 20% of study population were having diabetes, hypertension and dyslipidemia. 30% of study population had valvular heart diseases whereas 70% were free of any valvular disease. 92% of study population were TROP I positive and 8% were TROP I negative. 11% of study population underwent thrombolysis and 6% underwent angioplasty. 83% of study population had NSTEMI and 17% had STEMI. 9% of study population had heart failure and 91% were devoid of heart failure [7]. 84% of study population belonged to Killips 1, 12% in Killips 2, 2% in Killips 3 and 2% in Killips 4. 58% of study population had arrhythmias. 75.9% of arrhythmias were single and 24.1% were multiple. 69% of arrhythmias were major and 31% were minor. 43.1% of arrhythmias were tachy-arrhythmias and 36.2% were brady-arrhythmias. There was no significant correlation between arrhythmias and valvular heart disease/ heart failure/ TROP I/ procedure/ Killips groups. The results of the present study were like the study conducted by Alpman, Hindman and Lie KI [8, 9, 10].

68% of patients who underwent no procedure had major arrhythmias. 66.7% of thrombolysed patients had major arrhythmias whereas all

patients who underwent angioplasty had major arrhythmias. Among patients with heart failure 57.1% had major arrhythmias whereas 70.6% of patients without heart failure had major arrhythmias [11, 12]. There was no correlation between major arrhythmias and valvular heart disease/ heart failure/ TROP I/ procedure/ Killips groups which is like the present study [13, 14].

Conclusion

58% of study population had arrhythmias. 75.9% of arrhythmias were single and 24.1% were multiple. 69% of arrhythmias were major and 31% were minor. 43.1% of arrhythmias were tachy-arrhythmias and 36.2% were brady-arrhythmias. There was no significant association between incidence of arrhythmias/ multiple arrythmias / major arrhythmias with valvular heart disease/ heart failure/ TROP I/ procedure/ Killips groups.

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