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Original Research Article

Assessment of arrhythmias in 50 patients of ST-elevation myocardial infarction after thrombolysis: a 24 hour Holter study

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ABSTRACT

Background: Acute coronary syndrome represents a global epidemic. The purpose of this study was to evaluate the incidence of cardiac arrhythmias in acute myocardial infarction (AMI) in the first 24 hours of hospitalization post thrombolysis.
Methods: 50 patients of AMI satisfying the inclusion criteria were included for this observational study. Philips Digitrak Holter was attached to the patient's chest for 24 hours and arrhythmias were noted.
Results: In the study group 70% of cases were males, rest 30% females. Maximum incidence of AMI was seen between 4th and 7th decade of life. Incidence of diabetes and hypertension were 54% and 66% respectively either alone or in combination. Overall incidence of anterior wall was higher 56% than inferior wall which was 44%. Sinus tachycardia was seen in 54% of cases with higher incidence in anterior wall MI. Among the reperfusion arrhythmias incidence of frequent VPCs was highest with 66% followed by AIVR (42%) and NSVT (30%). AF was found in 3 cases i.e. 6% of which one died. One patient had VF to which she succumbed.
Conclusions: It is a matter of debate whether arrhythmias being so common in AMI, should be considered under clinical spectrum or complication of AMI. An increasing belief that less serious arrhythmias may serve as a warning sign for potentially life threatening arrhythmias and timely intervention by drugs, D.C. shock or pacemakers can prevent mortality in these sets of patients.

Keywords: AMI, Arrhythmias, NSVT, Ventricular fibrillation, VPC

INTRODUCTION

Cardiovascular diseases occupy the first rank in worldwide mortality. Much of which is due to heart disease caused by ischemia, usually caused by the obstruction of a coronary artery secondary to the rupture of an atherosclerotic plaque. As per a report of World Health Organization (WHO) in 2005, cardiovascular disease (CVD) caused 17.5 million (30%) of the 58 million deaths that occurred worldwide.[1] While the prevalence and mortality due to CAD is declining in the developed nations the same held is not true for developing countries.[2] An alarming increase over the past two decades in the prevalence of CAD and cardiovascular mortality in India and other south Asian countries has been noticed. India is going through an epidemiologic transition as though burden of communicable diseases has declined, that of non-communicable diseases (NCD) has risen rapidly, thus leading to a dual burden. With the advent of intensive cardiac care unit, arrhythmias have become one of the most modifiable complications of acute myocardial infarction management. Continuous cardiac monitoring post myocardial infarction has helped in early diagnosis and subsequent treatment of potentially life threatening arrhythmias. Arrhythmias manifest routinely during or following an acute coronary

syndrome (ACS). Although the incidence of arrhythmia is directly related to the type of ACS the patient is experiencing. Arrhythmias are more frequent in STEMI than NSTEMI and UA, and a clinician has to be cautious. For example, about 90% of patients who experience acute myocardial infarction (AMI) develop some cardiac rhythm abnormality and 25% have a cardiac conduction disturbance within 24 hours of infarct onset. Here, the incidence of serious arrhythmias, such as ventricular fibrillation (4.5%), is greatest in the first hour of an AMI and declines rapidly thereafter.[3]

Prolonged ischemia in AMI can lead to irreversible myocardial damage and cell death, and it has been demonstrated that if ischemia is quickly reversed, myocardial tissue can be salvaged. Time is muscle. Therapeutic efforts like PCI and thrombolysis are aimed to achieve the restoration of blood flow to ischemic myocardial tissue, termed as 'reperfusion'.[4] It is a matter of debate whether arrhythmias being so common in AMI, should be considered under clinical spectrum or complication of AMI. An increasing belief that less serious arrhythmias may serve as a warning sign for potentially life threatening arrhythmias and timely intervention by drugs, D.C. shock or pacemakers can prevent mortality in these sets of patients.

A multifaceted approach is needed for ACS patients specially STEMI. Decision making regarding reperfusion options-thrombolysis or angioplasty, medical therapy (aspirin, beta blockers, heparin, nitrates etc.) and treating complications (heart failure, shock) are of utmost importance. Furthermore, one has to be prepared for treating subsequent life threatening arrhythmias including a careful watch on reperfusion arrhythmias and their potential significance.[3] Here we have made an attempt to collect information regarding overall incidence, course and prognosis of arrhythmias post thrombolysis in a patient of STEMI especially for the first 24 hours using Holter monitor.

METHODS

From December 2014 to August 2016, 50 patients with acute myocardial infarction coming to emergency department of Mahatma Gandhi Medical College and Research Institute, a tertiary care hospital, were included in the study. It was a descriptive case series. All patients were explained about the study in their own language and a written informed consent was obtained from them. The study was approved by ethical committee of Mahatma Gandhi College and Research Institute.

All patients of both sexes sustaining ST elevation MI with acute presentation coming within the time frame of thrombolysis were included in the study. Patients with old conduction defects based upon old medical records, patients with advanced heart failure, renal failure and prior coronary artery bypass grafts were excluded from the study.

AMI was diagnosed on the basis of ACC/AHA/ESC guideline of myocardial infarction. A brief history was obtained from each patient with presenting symptoms (chest pain, dyspnea, giddiness, etc.) including risk factors like diabetes, smoking, hypertension and previous history of ischemic heart disease. A thorough clinical examination was done with signs of cardiac failure. Standard 12-lead electrocardiogram was done and blood samples for cardiac enzymes, complete blood count, renal function were sent. All patients were considered for thrombolytic therapy in the absence of any contraindications and were managed according to standard treatment protocols. Philips Digitrak Holter was attached to the chest of the patient for a period of 24 hours. ECG were taken just after thrombolysis and 6 hours post thrombolysis. All patients were admitted in ICU with continuous cardiac monitoring at least for a period of 48 hours. Additional recordings were made in the event of any arrhythmia or occurrence of any conduction defect or recurrent chest pain. In the event of any life-threatening arrhythmias adequate management either with antiarrhythmic drugs or cardioversion was initiated. Baseline clinical data including all study variables were recorded on a predesigned research proforma. The Holter was analysed with the Holter software and any arrhythmias which occurred were noted.

SPSS software was used to analyse data. Frequency and percentages were calculated for variables like gender, risk factors, symptoms, types of myocardial infarction and various arrhythmias. The association of certain variables like types of MI and various arrhythmias along with statistical significance were calculated using Pearson Chi Square tests. The data was compared and p-values calculated using student's t test.

RESULTS

Table 1 shows incidence of MI in different age groups and, number of males and females in each group with percentage. As seen above, maximum incidence of AMI is in between 4th to 7th decade of life. Below the age group of 40 only 2 cases out of total 50 cases and only males. The overall incidence in male is greater than females.

Table 1: Age and sex incidence.

Age (years)	No. of patients	Male	Female	% of males	% of females
21-30	1	1	0	100	0
31-40	1	1	0	100	0
41-50	8	5	3	62.5	37.5
51-60	21	14	7	66.7	33.3
61-70	15	11	4	73.3	26.7
71-80	4	3	1	75	25
Total	50	35	15	70	30

Table 2: Risk factors.

Risk factors	No. of patients	Percentage
Diabetes (DM)	3	6
Hypertension (HTN)	10	20
Dyslipidemia (DLP)	1	2
DM+HTN+DLP	11	22
DM+HTN	12	24
DM+DLP	1	2
No risk factors	12	24

Table 2 shows the incidence of risk factors in the patients presenting with MI. As we can see that almost 76 % of patients have one risk factor or other even combination of risk factors.

Table 3: Symptoms.

Presenting complaint	No. of cases	Percentage
Chest pain	33	66
Dyspnoea	5	10
Giddiness/syncope	8	16
Epigastric pain	3	6
Palpitation	1	2
Total	50	100

Table 3 shows the percentage and incidence of different symptoms the patient presents with emergency diagnosed as MI. It is evident that commonest presenting is chest pain in a patient presenting with MI.

Table 4: Incidence of various myocardial infarction.

Site	No. of cases	Percentage
Inferior wall	12	24
Inferior+posterior wall	5	10
Inferior+posterior+right ventricle	5	10
Anterior wall	18	36
Antero lateral wall	4	8
Anteroseptal wall	6	12

Table 5: Incidence of arrhythmias.

Types	No. of cases	Percentage
AIVR	21	42
Ventricular bigemini/couplet	15	30
VPB	33	66
Nonsustained VT	15	30
Sustained VT	4	8
VF	1	2
AF	3	6
BBB	7	14
AV Blocks	5	10
Sinus tachycardia	27	54
Sinus bradycardia	18	36
SVT	1	2

Table 4 shows the incidence and pattern of various AMI, according to the site. Overall the incidence of anterior wall (anterior+anterolateral+anteroseptal) is 56% which is commoner than inferior (44%) taken together.

Table 5 shows the incidence of arrhythmias in AMI over a period of 24 hours. Many cases presented with more than one type of arrhythmia. VPB (66%) and AIVR (42%) were the most common arrhythmias followed by NSVT and Ventricular bigeminy/couplets. AF was present in 3 cases 1 of which died and was reverted back to sinus rhythm. One patient each of VF and SVT was there and VF patient expired. Sinus tachycardia was present in 27 (54%) of the cases while bradycardia in 18 (36%) of the cases.

Table 6: Sinus tachycardia vs diagnosis.

Diagnosis	Present (%)	Absent (%)	Total
Inferior wall	2 (16.7)	10 (83.3)	12 (100)
Inferior+posterior	2 (40)	3 (60)	5 (100)
Inferior+posterior +right ventricle	4 (80)	1 (20)	5 (100)
Anterior wall	11 (61.1)	7(38.9)	18 (100)
Anterolateral wall	4 (100)	0 (0)	4 (100)
Antero septal wall	4 (66.7)	2 (33.3)	6 (100)
Total	27 (54)	23 (66)	50 (100)

Pearson chi square-12.650, df-5, p=0.027.

Here in Table 6 shows a cross tabulation of sinus tachycardia versus the types of MI. The p-value was <0.05 and hence is significant showing an association between the various types of MI with sinus tachycardia.

Table 7: Sinus bradyacrdia vs. diagnosis.

Diagnosis	Present (%)	Absent (%)	Total
Inferior wall	8	4	12
Percent	66.7	33.3	100
Inferior+posterior	4	1	5
Percent	80	20	100
Inferior+posterior+right ventricle	3	2	5
Percent	60	40	100
Anterior wall	2	16	18
Percent	11.1	88.9	100
Anterolateral wall	0	4	4
Percent	0	100	100
Antero septal wall	1	5	6
Percent	16.7	83.3	100
Total	18	32	50

Pearson chi square-19.659, df-5, p-0.033.

In Table 7 a cross tabulation between sinus bardyacrdia and various MI has been put which shows a positive correlation between IWMI and sinus bradycardia. While

bradycardia is less common in AWMI. Here, the p-value was <0.05 which supports our view.

Table 8: VPC vs diagnosis.

Diagnosis	Present	Absent	Total
Inferior wall	4	8	12
Percent	33.3	66.7	100
Inferior+posterior	1	4	5
Percent	20	80	100
Inferior+posterior+right ventricle	4	1	5
Percent	80	20	100
Anterior wall	16	2	18
Percent	88.9	11.1	100
Anterolateral wall	3	1	4
Percent	75	25	100
Antero septal wall	5	1	6
Percent	83.3	16.7	100
Total	33	17	50
Percent	66	34	100

Pearson chi square-16.008, df-5, p-0.007.

In Table 8 the association between VPB and MI have been shown. The p-value <0.05 shows there is significant association between various MI and VPC and VPBs are common in anterior wall MI rather than inferior wall.

Table 9: Non sustained VT vs diagnosis.

Diagnosis	Present	Absent	Total
Inferior wall	1	11	12
Percent	8.3	91.7	100
Inferior+posterior	0	5	5
Percent	20	80	100
Inferior+posterior+right ventricle	2	3	5
Percent	40	60	100
Anterior wall	5	13	18
Percent	27.8	72.2	100
Anterolateral wall	3	1	4
Percent	75	25	100
Antero septal wall	4	2	6
Percent	66.7	33.3	100
Total	15	35	50
Percent	30	70	100

Pearson chi square-12.804, df-5, p-0.025.

Here, again in table 9 an association can be seen in between nonsustained VT and different MIs. With p-value being significant i.e. <0.05.

Table 10 clearly shows there is no association between various MIs and sustained VT.

Similarly Table 11 shown no association between AF and diagnosis.

Table 10: Sustained VT vs. diagnosis.

Diagnosis	Present	Absent	Total
Inferior wall	0	12	12
Percent	0	100	100
Inferior+posterior	0	5	5
Percent	0	100	100
Inferior+posterior+right ventricle	0	5	5
Percent	0	100	100
Anterior wall	2	16	18
Percent	11.1	89.9	100
Anterolateral wall	0	4	4
Percent	0	100	100
Antero septal wall	2	4	6
Percent	33.3	66.7	100
Total	4	46	50
Percent	8	92	100

Pearson chi square-7.729, df-5, p-0.172.

Table 11: AF vs diagnosis.

Diagnosis	Present	Absent	Total
Inferior wall	2	10	12
Percent	16.7	83.3	100
Inferior+posterior	0	5	5
Percent	0	100	100
Inferior+posterior+right ventricle	1	4	5
Percent	20	80	100
Anterior wall	0	18	18
Percent	0	100	100
Anterolateral wall	0	4	4
Percent	0	100	100
Antero septal wall	0	6	6
Percent	100	100	100
Total	3	47	50
Percent	6	94	100

Pearson chi square-6.265, df-5, p-0.281

Table 12: AIVR vs diagnosis.

Diagnosis	Present	Absent	Total
Inferior wall	4	8	12
Percent	33.3	66.7	100
Inferior+posterior	3	2	5
Percent	60	40	100
Inferior+posterior+right ventricle	1	4	5
Percent	20	80	100
Anterior wall	9	9	18
Percent	50	50	100
Anterolateral wall	1	3	4
Percent	25	75	100
Antero septal wall	3	3	6
Percent	50	50	100
Total	21	29	50
Percent	42	58	100

Pearson chi square-3.134, df-5, p-0.679.

Above Table 12 shows no association between AIVR and various MIs.

Table 12: Ventricular bigeminy/couplets vs. diagnosis.

Diagnosis	Present	Absent	Total
Inferior wall	1	11	12
Percent	8.3	91.7	100
Inferior+posterior	0	5	5
Percent	0	100	100
Inferior+posterior+right ventricle	1	4	5
Percent	20	80	100
Anterior wall	10	8	18
Percent	55.6	44.4	100
Anterolateral wall	2	2	4
Percent	50	50	100
Antero septal wall	1	5	6
Percent	16.7	83.3	100
Total	15	35	50
Percent	30	70	100

Pearson chi square-11.931, df-5, p-0.036

In Table 13 a clear association between ventricular bigeminy and the diagnosis of MI is clearly seen as p-value was significant.

DISCUSSION

Age and sex incidence

In this study the maximum incidence of AMI was in the age group of 41-70 years (88%) only 2% of the cases were below 40 years of age. A study done in 2007, Martin TC et al showing incidence of 85% between ages 35 to 75 years compares well with our findings.[5] Incidence of AMI in males was 72.4 % and female was 28.6 % which again compares well with the same study Martin TC et al showing incidence of 74% in males and 24% in females.[5] The higher mortality rate in females-6% compared to males-2.8% is proved in our study which correlates with a study done by Berger JS et al but the incidence being lower than which is as high as 37%.[6] This disparity in incidence can be attributed to the small sample size in our study.

The overall morbidity rate was 30% in women with advancing age also this discrepancy remained and rather decreased to 25%. Studies like Ivanusa M et al and Rosengren A et al support our first observation but with advancing age (>65 years) the incidence among male and female is almost equal i.e. 50%.[7,8] The latter discrepancy arises due to a smaller sample size in our study.

Risk factors

Incidence of diabetes was 54 % in our study compared to a study Svensson AM et al in 2007 (19%) which was higher and incidence of hypertension was 68% which again was higher compared to a study Kokobo Y et al in 2008.[9,10] These higher incidences can be attributable to poor life style of the people in Indian subcontinent.

Arrhythmias

Bradyarrhthmias and hypotension are common in proximal occlusion of coronary artery leading to inferior myocardial infarction.

In present study 36% (18 cases) of patients had sinus bradycardia, out of which 83%was associated with inferior wall MI and only 17% in anterior wall MI. The incidence of bradycardia varies from 15-19.4% in various studies.[11,12] In all the patients whoever had sinus bradycardia it was transient and by the end of the 1st day majority had normal sinus rhythm. The association with inferior wall MI was significant and no death was reported and hence indicating a protective role of SB in MI. Similar findings were there in Malla RR and Sayani A.[13] The increased incidence may be due to the method of collection as patient had Holter attached to them for 24 hrs rather than relying only on ECG.

Sinus tachycardia was observed in 54% of the cases but more in cases of anterior wall MI (70%) than inferior wall (30%). Again, the association between sinus tachycardia and anterior wall was statistically significant. Same observation of anterior wall being commonly involved is shown by Crimm et al.[14] In present study APC was found in 30% of cases, AF in 6% and SVT in 2% of cases.

Incidence of AF correlates with the finding of Novaro GM et al study where incidence of AF was 4.7-7.6%.[15] AF is associated with increased incidence of hospital mortality as it is associated with large infarcts. Here, AF was associated with 33% mortality rate which is lower than a study showing 100% mortality rate.[16] As in one patient the AF was reverted to normal sinus rhythm. Smaller sample size is also a factor for the discrepancy found in the mortality incidence.

In AV blocks the total incidence was 8 % compared to other studies like Majumder et al showing conduction disturbance almost double i.e. 15%.[17] There were no cases of complete heart block in our study but only first and second degree heart block. This decreased incidence of conduction block and absence of complete heart block can be attributed to timely thrombolytic therapy.

Similar was the case with BBB which showed total of 14% but lesser in compared to a study done by Perron and Sweeney, attributable to the institution of thrombolytic therapy.[3] BBB was commoner in anterior wall MI.[3] In most of the cases it was transient and except one case patient had no BBB after a period of 24 hours.

Ventricular arrhythmias were very common and incidences were AIVR-42%, VPCs-66%, NSVT-30%,

sustained VT-8%, VF-2% and ventricular couplets with bigeminy in almost 30% of cases. Reperfusion arrhythmias mainly are AIVR, ventricular couplets, ventricular bigeminy, sinus bradycardia the latter already discussed.[18] Except sinus bradycardia all are of ventricular origin.

The incidence of non-sustained VT being 30% which was more than sustained VT-8%, NSVT terminated on itself within 30 sec, while 3 of sustained VT patients required either drugs or electrical cardioversion. One of the VT expired culminating into VF. In present study the mortality is seen in 25 % of patients sustaining VT which goes well with two other studies-Gibson CM et al and Al-Khatib SM et al showing mortality incidence of 25.2 and 24% respectively.[19,20]

In a study Tatli et al 151 patients with ST elevation MI were divided in two groups- thrombolytic therapy was instituted in 97 patients while in 54 patients percutaneous coronary intervention (PCI) was done and arrhythmias were noted by ECG monitoring system. Reperfusion arrhythmias in both the groups significant statistical differences were not found (88.7% for thrombolytics and 83.3% for PCI group). While evaluating the arrhythmias the incidence rate of AIVR was higher in thrombolytic group 73.2% (71 cases) compared to 50%(27 cases) in the PCI group. They concluded nonsustained VT, AIVR, and frequent VPC were the most frequently occurring reperfusion arrhythmias (RA) and that reperfusion arrhythmias are noninvasive indicators of myocardial cell damage.[21]

In my study the incidence of AIVR was 42%. As the above study is done for a period of 48 hours and ours was for 24hours the discrepancy can be attributed to the time period. The incidence of VPC were maximum with 66%(33 cases) and incidence of ventricular bigeminy and couplets include was 30% (15 cases). There was no mortality in the cases showing RA which goes well with a study done by Ghuran AV and Cann AJ.[22]

Limitation of the study is its sample size of 50 which was done with the available Holter and the required software. A larger sample size will give more insight about the arrhythmias and their clinical significance pertaining to reperfusion and mortality.

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