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A Study on Cardiac Rhythm Abnormalities in the First 48 Hours Following Acute Myocardial Infarction

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Abstract: Acute myocardial infarction is a major public health problem in developing countries. The incidence of coronary artery disease varies from 20-30 % of the cardiac cases admitted in any general hospital. Cardiac arrhythmias are frequent, serious complications of acute myocardial infarction and are associated with a 7 to 17 % increase in mortality. The extent to which arrhythmias are a direct cause of death in acute myocardial infarction has been estimated from clinical and pathological studies, but there has been little electrocardiographic documentation of the immediate pre-terminal rhythms. Despite several breakthrough treatment modalities have emerged, Arrhythmias is major cause of death in Acute Myocardial infarction(AMI), it still remains as a major cause of mortality and morbidity. The study aimed to study the nature and the types of arrhythmias occurring in the first 48 hours of acute myocardial infarction and to know the site of AMI. This descriptive observational study was conducted in the Cardiac ICU (coronary care unit) at Mahatma Gandhi Medical college Aurangabad, Maharashtra, India. 110 patients who presented with Acute Myocardial Infarction were studied. Detailed history was taken for each of these patients which included onset, nature of chest pain, aggravating relieving factors, risk factor, usage of oral contraceptives among females. Clinical examination in detail including ECG was recorded at the time of admission, hourly for first 6hours then 4 hourly for the next 42 hours. The various arrhythmias presented by the patients were documented. The central monitoring system was used to collect data among high risk patients. Routine investigations like complete blood count(CBC), blood sugar levels, fasting lipid profile were done. Specific investigations like CPK-MB (I&II) and TROPONIN-T & 2-D ECHO were carried out in selected cases.Patients with other complications of AMI and those with other cardiac pathologies were excluded from the study. Out of the 110 patients studied 85 were males and 25 were female with male: female ratio of 3.4:1 **.**Majority(80%) of patients with AMI were in the 5^{th} to 7^{th} decade and the incidence of arrhythmias as a complication of AMI was seen to increase with advancing age . In this study Anterior wall myocardial infarction(AWMI) was more common i.e, 48.17 % (n-53) than Inferior wall myocardial infarction (IWMI) 32.7% (n-36). Extensive Anterior is more common when compared to other AWMI. Incidence of cardiac arrhythmias increases with risk factors. Hypertension followed by smoking and were the most important risk factors both for AMI and arrhythmias. Brady-arrhythmias are more common in IWAMI 84.61% (n-11), while tachyarrhythmias are more common in AWAMI. AV block and Complete heart block(CHB) are more common with IWMI. The initial few hours post MI is critical for the development of arrhythmias with most of them occurin in the first 6 hours and two thirds in the first 12 hours post AMI. higher mortality is present in killip's class IV patients. Thus, killip's classification is good indicator to predict the prognosis of AMI patients. A major proportion of patients with AMI had arrhythmias of which majority presented in first 12 hours, implying the importance of monitoring in the first 48 hours**.** The patient who developed cardiac arrhythmias had deleterious ramifications on morbidity. Killip's classification is good indicator to predict the prognosis of AMI patients.
Keywords:myocardial infarction, tachyarrhythmias, Killip's classification.

INTRODUCTION

Acute myocardial infarction is a major public health problem in developing countries. The incidence of coronary artery disease varies from 20-30 percent of the cardiac cases admitted in any general hospital. Cardiac arrhythmias are frequent, serious complications of acute myocardial infarction (AMI) and are associated with a 7 to 17 % increase in mortality due to AMI[1-5]. The extent to which arrhythmias are a direct cause of death in AMI has been estimated from clinical and pathological studies, but there has been little electrocardiographic documentation of the immediate pre-terminal rhythms [1,2,6]. Documentation of possible transient disturbances of rhythm before the terminal arrhythmias has also been limited. Detection and documentation of arrhythmias has been possible due to continuous electrocardiographic monitoring [1,7].

In India an evidence of increased incidence of ischemic heart disease (IHD) is found. This has a major impact on Indians psychologically and economically. Arrhythmias continue to remain a major cause for mortality and morbidity following Acute myocardial infarction[5]. Complicated MI mainly includes secondary pump failure, sudden cardiac arrest and electrical abnormality of the heart[8,9].

Nearly all patients with acute MI have some form of arrhythmias. Some of these arrhythmias are mild with no hemodynamic prognostic significance but many are life threatening like ventricular fibrillation, Supra ventricular tachycardia(SVT) and hence require urgent recognition and treatment [6]. About 50% deaths associated with acute MI occur within 1 hour of onset of acute MI and are attributable to arrhythmias. Ventricular fibrillation is the major cause of sudden death in those who die before receiving medical attention[5]. Thus early recognition and treatment of cardiac arrhythmias is one of the main foundation on which the policy of acute coronary care is built thereby reducing the morbidity and mortality.

Although (CORONARY CARE UNIT) have been introduced in 1960 in India this facility is not easily available to the common man staying in remote village till today[10].Many of the patients could be benefited, if the primary prevention and management of such arrhythmias is done on the spot with aggressive reperfusion therapies, prophylactic use of newer anti arrhythmic agents, defibrillator, Pacing and knowledge of electrophysiological changes of the arrhythmias[3,4,11,9]. Twenty four to forty eight hour electrocardiographic monitoring increased the accuracy of arrhythmia prediction[12] Electrophysiological testing has become an important standard for identifying high-risk patients who have non sustained VT, such as those with previous MI and Left Ventricular dysfunction[13-15]. Inducible, sustained, mono-morphic VT predicts substantial risk for subsequent, spontaneous, clinically sustained VT and ventricular fibrillation (VF)[8] Complex ventricular ectopic and left ventricular aneurysms have also been associated with VT. Advanced signal processing of the ECG accurately identified the patients in the study with VT after myocardial infarction[15].Also we can use Holter monitoring to accurately identify and for recording purpose[16].

Therefore an attempt has been made to find out the frequency and type of arrhythmias noted in the first 48 hours of Acute myocardial infarction .This study can be of much practical importance since an understanding of the occurrence and identification and prompt management of arrhythmias is of paramount importance in every case of AMI. It helps to decrease mortality following AMI as end result[7].

PRIMARY AIM

- To study the prognosis of patients who developed arrhythmia in the first 48 hours of Acute Myocardial Infarction.

OBJECTIVES

- To study the nature and type of arrhythmias occurring in the first 48 hours of AMI
- To study the site of AMI

MATERIALS AND METHODOLOGY-

This descriptive observational study was conducted in the Cardiac ICU (coronary care unit) at Mahatma Gandhi Medical college Aurangabad, Maharashtra, India. 110 patients who presented with Acute Myocardial Infarction were included in this study. Patients with other complications of AMI and those with other cardiac pathologies were excluded from the study. Detailed history was taken for each of these patients which included onset, nature of chest pain, aggravating relieving factors, risk factor, usage of oral contraceptives among females. Clinical examination in detail including ECG was recorded at the time of admission, hourly for first 6hours then 4 hourly for the next 42 hours. The various arrhythmias presented by the patients were documented. The central monitoring system was used to collect data among high risk patients. Routine investigations like complete blood count (CBC), blood sugar levels, fasting lipid profile were done. Specific investigations like CPK-MB (I&II) and TROPONIN-T & 2-D ECHO were carried out in selected cases.

RESULTS

110 patients of Acute Myocardial Infarction admitted in the Mahatma Gandhi Medical College Aurangabad CCU were studied between August 2016 to July 2018. The following observations were made from the study.

Table-1: Age distribution- shows patients of Acute Myocardial Infarction were more common in 5th to7th decade (80%) and the incidence of arrhythmias as a complication of Acute MI increases with advancing age

Age(years)	Total no. of patients with AMI(percentage)	No. of patients with Arrhythmia (percentage)
21-30	2(1.8%)	0 (0%)
31-40	7(6.4%)	3(42.8%)
41-50	23(20.9%)	16(69.5%)
51-60	46(41.8%)	37(80.4%)
61-70	19(17.3%)	15(78.9%)
71-80	11(10.8%)	8(72.7%)
>81	2(1.8%)	2(100%)
Total	110(100%)	81(73.6%)

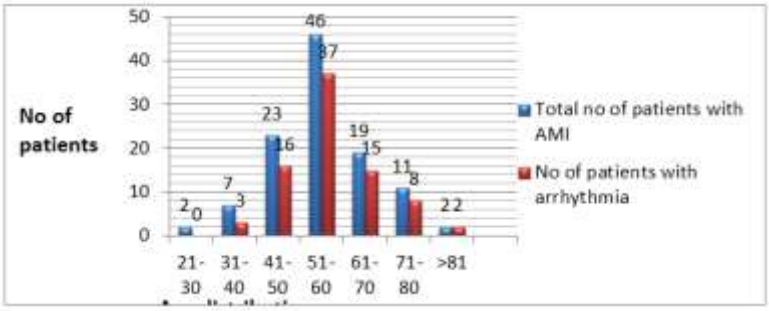

Fig-1: Age distribution

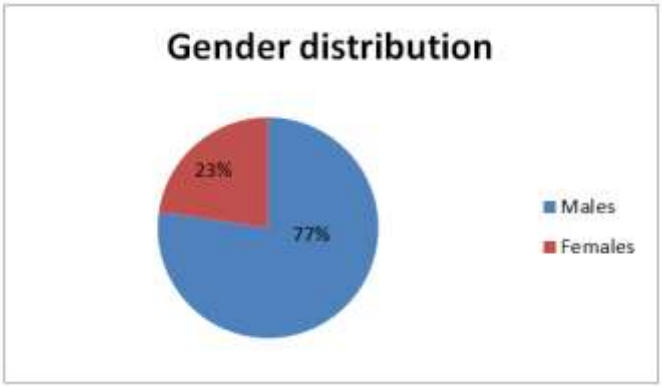

Fig-2: Gender distribution- Figure 2 shows Incidence of Acute MI in males 77 % (n-85) was more than females 23 % (n-25). The male: female ratio of Acute MI was 3.4:1. There was a male preponderance (58 %) for arrhythmias in Acute MI

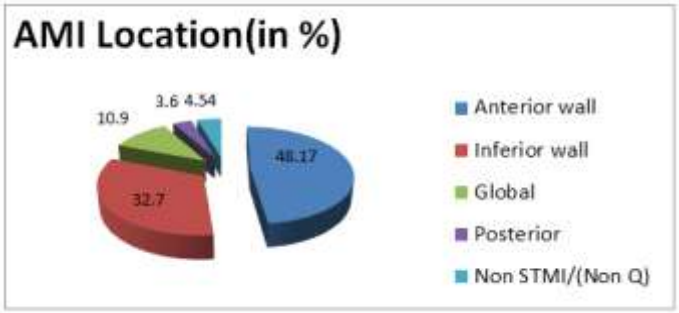

Fig-3: Acute myocardial infarction location-it shows that Anterior Wall MI 48.17 % (n-53) is more common than inferior wall MI 32.7% (n-36)

Table-2: shows that among AWMI the extensive anterior is more common compared to other AWMI

Site of anterior wall AMI	No of cases	Percentage
Antero-septal	14	12.72
Anterolateral	11	10.0
Extensive anterior	28	25.45
Total	53(48.17% of AMI)	

Table-3: Indicates that cardiac risk factors are important determinants of myocardial infarction as well as development of arrhythmias. The incidence of AMI and arrhythmias increases with increasing the risk factors

Risk factors	Total no. of patients with AMI No.(percentage) %	Total no. of patients with Arrhythmias. (percentage %)
No risk factor	20 (18.2)	12 (60.0)
One risk factor	18 (16.3)	13 (72.2)
Two or more risk factor	72 (65.5)	56 (77.8)
Total	110 (100)	81 (73.6)

Table-4: shows that above dynamic and modifiable risk factors have the direct bearing upon the incidence of acute myocardial infarction as well as cardiac arrhythmias. The primordial and primary prevention of these risk factors is the cornerstone of preventive strategy

Risk factors	Total no. of patientswith AMI No.(percentage) %	Total no. of patientswith ArrhythmiasNo. (percentage %)
Hypertension	36(32.7)	26(72.2)
Diabetes mellitus	21(19.1)	14(66.7)
Past H/O IHD	15(13.6)	11(73.3)
Alcoholism	30(27.2)	21(70.0)
Smoking	48(43.6)	36(75.0)
Obesity	17(15.5)	11(64.7)
Family H/O CAD	10(9.0)	7(70.0)

Table-5: Above table shows that brady-arrhythmias are more common in Inferior Wall acute MI 84.61% (n-11). While tachyarrhythmia are more common in Anterior wall acute MI. VPC is the most common observed arrhythmia in all type of AMI. Overall Arrhythmias in AWMI are more common as compared to IWMI

Types of Arrhythmias	Site of myocardial infarction					Total No. (%)Out of 110 Pts.
	Anterior wall No.	Inferior wall N	Global No	Post.Wall No	Non-Q wave No	
Sinus Bradycardia	1	11	1	-	-	13 (11.8)
Sinus Tachycardia	14	5	1	-	1	21 (19.1)
Atrial Ectopics	3	1	-	-	-	4 (3.6)
Atrial Fibrillation	1	3	1	-	-	5 (4.5)
VPCs	35	15	5	2	1	58 (52.7)
Junctional (Nodal)Rhythm	-	2	-	-	-	2 (1.8)
Idio-Vent. Rhythm	2	-	1	-	-	3 (2.7)
Atrio-Ventricular Block	2	8	2	-	-	12 (7.27)
SVT	5	2	2	-	-	9 (8.2)
Ventricular Tachycardia	3	1	2	-	-	6 (5.5)
Ventricular Fibrillation	4	1	2	-	-	7 (6.3)
TDP	1	-	-	-	-	1 (0.9)
Total	71	49	17	2	2	

Table-6: Shows that Inferior wall Acute MI is one of the important culprit for development of almost all types of AV block. CHB is more common in Inferior wall AMI

Type of AV-Block	Site of myocardial infarction					Total No(%) Out of 110 patients
	Anterior wall No(%)	Inferior wall No(%)	Global No(%)	Posterior wall No(%)	Non-Q wave No(%)	
I° AV B	-	3 (2.7)	1 (0.9)	-	-	4 (3.6)
II° AV B						3 (2.7)
MB -1	-	2 (1.8)	-	-	-	2 (1.8)
MB-11	1 (0.9)	-	-	-	-	1 (0.9)
III° AV B	1 (0.9)	3 (2.7)	1 (0.9)	-	-	5 (4.5)
Total	2 (1.8)	8 (7.2)	2 (1.8)	-	-	12(10.8)

Table- 7: Incidence of individual bundle branch block (BBB) in relation to the site of myocardial Infarction- it shows that incidence of bundle branch blocks is more common in acute myocardial wall infarction especially RBBB 63% (n=12). Incidence of BBB is insignificant in posterior & non-Q wave AMI

Bundle Branch Block	Site of myocardial infarction					Total No. (%) of patients
	Anterior pts. wall No. (%)	Inferior wall No. (%)	Global No. (%)	Posterior wall No. (%)	Non-Q wave No. (%)	
RBBB	4 (3.6)	1 (0.9)	1 (0.9)	-	-	6 (5.5)
RBBB + LAHB	4 (3.7)	-	1 (0.9)	-	-	5 (4.5)
RBBB + LPHB	-	-	1 (0.9)	-	-	1 (0.9)
LAHB	3 (2.7)	1 (0.9)	-	-	-	4 (3.6)
LBBB	2 (1.8)	1 (0.9)	-	-	-	3 (2.7)
Total	13	3	3	-	-	19 (17.2)

Table-8: Shows that most of arrhythmias develop in initial first 48 hours after acute myocardial infarction. Among these most episodes occurs within first 6 hrs and almost two third of arrhythmias developed within 12 hrs of AMI. Therefore initial hours after AMI are most crucial period

Type of arrhythmias	**Time since admission**			**Total No**
	0-6 hrs	**6-12hrs**	**12-48hrs**	
Sinus Bradycardia	11	2	-	13
Sinus Tachycardia	16	2	3	21
Atrial Ectopics	3	1	-	4
Atrial fibrillation	1	2	2	5
Nodal (Junctional) rhythm	1	1	-	2
SVT	7	2	-	9
VPC's	40	10	8	58
Idio-Ventricular rhythm	3	-	-	3
Ventricular Tachycardia	5	-	1	6
Ventricular fibrillation	5	-	2	7
T-D-P.	1	-	-	1
AV Blocks	8	1	3	12

Table-9: Morbidity in terms of hospital stay with arrhythmias- It is seen from above table that the patient who developed cardiac arrhythmias had deleterious ramifications on morbidity of the patients

Patients with	***Mean hospital stay in days.***
AMI without Arrhythmias	7.41 +_ 2.97
AMI with Arrhythmias	9.48 +_ 4.60

Table-10: Mortality in relation to the site of MI-this table shows that maximum mortality occurs in Global(33.3%) and Anterior Wall Myocardial Infarction (24.5%).

SITE of MI	Total No. of pts.	Patients Died	Percentage (%)
Anterior	53	13	24.5
Inferior	36	6	16.7
Global	12	4	33.3
Posterior	4	1	25.0
Non Q wave	5	-	-
Total	110	24	21.8

Table-11: Distribution of AMI patients according to killip's classification and mortality: It shows that higher mortality is present in killip's class IV patients. Thus, killip's classification is good indicator to predict the prognosis of AMI patients

Killip's Class	No. of AMI patients	No. of patients died
Class I	48(43.6)	4(8.3)
Class II	29(26.4)	4(13.8)
Class III	16(14.5)	6(37.5)
Class IV	17(15.5)	10(58.8)
Total	110	24

Table-12: shows that mortality rate is higher in ventricular arrhythmias and complete heart block hence they are prognostically significant. Mortality is 100% in pt. of Torsades-de pointes.

Type of arrhythmias	Total No. of patients	Patients Died	Percentage(%)
Ventricular Tachycardia	6	4	66.6
Ventricular Fibrillation	7	4	57
Torsades de Pointes	1	1	100
Supra-Ventricular Tachycardia	9	2	22.2
Atrial Fibrillation	5	-	-
Sinus Bradycardia	13	4	30.7
Sinus Tachycardia	21	2	9.5
A-V Block	12	4	33.3
Bundle Branch Block	19	1	5.2

DISCUSSION

The study is a observational descriptive study and included 110 patients. Patients data was collected after a complete evaluation. The pattern of cardiac arrhythmias was studied within 48 hours of hospital admission for acute myocardial infarction. A detailed hospital based study on AMI has its importance with regard to the incidence of mortality which varies with different types of AMI and also due to the higher mortality among Indians as compared to other ethnic groups[17].

Male preponderance was noted in our study where AMI was 3 times commoner in males, this corresponds with the Framingham Heart study[18].A similar finding was noted in a study by Kumar *et al*.[19]. Our study shows an increase in the incidence of AMI in the 5^{th} to 7^{th} decade, this correlates with the study by Rask-Maden C *et al*. which had patients aged >70yrs account for 30 to 50 percent of AMI patients admitted in hospital [20]. A trend towards increase in rates of arrhythmias complicating AMI with age, similar results were found in a study by White HD *et al*. [21]. In the present study 73.6% patients with AMI had arrhythmias of some form in the first 48 hours, a similar observation was made in the study by Kumar et al with 78% AMI patients had arrhythmias[19]. Most arrhythmias developed in the initial 48 hours after acute myocardial infarction. Of these most episodes occur within first 6 hrs and almost two thirds of arrhythmias developed within 12 hrs of AMI. The study by Kumar et al shows majority arrhythmias occurred within the first hour of hospitalization [19]. However on 25% had rhythm abnormalities in the first 24hours of AMI in the study by Aufderheide TP *et al*. [17].

Among region involved, Anterior wall (48.17 %) followed by inferior wall (32.7%) MI were the most common types of acute myocardial infarction, similarly 36 percent had anterior wall MI and 24% had inferior wall MI in a study by Raj hans R *et al*.[22].

Cardiac risk factors are important determinants of myocardial infarction as well as development of arrhythmias. Among risk factors studied namely past and family history of ischemic heart disease, hypertension, diabetes mellitus, smoking, alcoholism and obesity; Smoking history was present in 43.6% of AMI patients and 75% of them had arrhythmias making it the most important risk factor for both AMI and arrhythmias complicating AMI. Also the Framingham

heart study states smoking as the most important risk factor[18].

Overall Arrhythmias AWMI are more common as compared to IWMI. Brady-arrhythmias are more common in Inferior wall acute myocardial infarction (84.61%), while tachyarrhythmias are commoner in Anterior wall AMI. Ventricular premature contractions(VPC's) is the most common observed arrhythmia in all type of AMI, this correlates with the study by Campbell RW et al where VPCs were seen in about 90% AMI patients study by Campbell RW[23].

IWAMI is one of the important culprits for development of almost all types of AV block. CHB is more common in Inferior wall AMI. Incidence of bundle branch blocks is more common in acute myocardial wall infarction especially RBBB 63% (n-12). However incidence of BBB is insignificant in posterior & non-Q wave AMI

Maximum mortality occurs in Global (33.3%) and Anterior Wall Myocardial Infarction (24.5%). Mortality rate is higher in ventriculararrhythmias and complete heart block hence they are prognostically significant. Mortality is 100% in pt. of Torsades-de pointes.Higher mortality is present in killip'sclass IV patients.Thus, killip's classification is good indicator to predict theprognosis of AMI patients.

CONCLUSION

A major proportion of patients with AMI had arrhythmias of which majority presented in first 12 hours, implying the importance of monitoring in the first 48 hours. Ventricular premature contractions are the most prevalent rhythm abnormality following AMI and can occur in associations with other form of arrhythmias. The patient who developed cardiac arrhythmias had deleterious ramifications on morbidity. Killip's classification is good indicator to predict the prognosis of AMI patients.

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