CLINICAL PROFILE OF TACHYARRHYTHMIAS IN ACUTE MYOCARDIAL INFARCTION AT VIMS, BELLARY

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ABSTRACT: BACKGROUND AND OBJECTIVES: In today's competitive strain full world, AMI continues to be a major public health problem, despite impressive strides in diagnosis and management over the past three decades, AMI is becoming an increasingly important problem in developing countries. An attempt has been made in this study to know the incidence, diagnosis and management of various tachyarrhythmias that occur in the first week of MI and their impact on subsequent prognosis.

AIMS AND OBJECTIVES:

1. To study the incidence of various tachyarrhythmias following AMI.
2. To assess the impact of various tachyarrhythmias on prognosis and mortality

MATERIAL AND METHODS: The study was conducted for a period of 1 year starting from November 2006 to October 2007. Total of 100 cases of AMI admitted to ICCU of VIMS, Bellary were studied with special reference to tachyarrhythmias

RESULTS & CONCLUSION: Incidence of AMI was higher in 6th decade, male preponderance with M:F = 3.7:1, most common risk factors being smoking -60%, HTN - 44% and Hyperlipidemia - 35%. Most common type of MI was AAMI (58%), followed by IAMI (35%). Tachyarrhythmias were the most common complications during first week of AMI (62%), LVF (35%) and cardiogenic shock 11%. Sinus tachycardias, VPB, VT and VF were common in AAMI, among them Ventricular premature beats were the commonest tachyarrhythmias following AMI followed by sinus tachycardia, which was followed by ventricular tachycardia. Overall mortality was 21%, tachyarrhythmias contributed to 42.85% of total mortality. Among tachyarrhythmias highest mortality was with VF (100%) followed those with VT (27.3%).

KEY WORDS: AMI, HTN, Ventricular tachyarrhythmias, Cardiogenic Shock, LVF, VF, VPC

INTRODUCTION: - ACUTE MYOCARDIAL INFARCTION: In today's competitive strain full world, AMI continues to be a major public health problem, despite impressive strides in diagnosis and management over the past three decades, AMI is becoming an increasingly important problem in developing countries.^{1, 2}

Although the death rates from AMI have declined by about 30% over the past decade, its development is still a fatal event in approximately one third of the patients. About 50% of deaths associated with AMI occur within one hour of the event and are attributable to arrhythmias, most often ventricular tachyarrhythmias.² Because AMI may strike an individual during the most productive years of one's life it can have profoundly deleterious psychosocial and economic manifestations.³

The introduction of ICCU's, primarily meant for reducing the mortality in early stages of AMI, by early detection of complications with the help of continuous monitoring, timely intervention and institution of proper treatment has shown to save many precious lives.⁴

An attempt has been made in this study to know the incidence, diagnosis and management of various tachyarrhythmias that occur in the first week of MI and their impact on subsequent prognosis.⁵

AIMS AND OBJECTIVES

1. To study the incidence of various tachyarrhythmias following AMI.
2. To assess the impact of various tachyarrhythmias on prognosis and in hospital mortality in patients with AMI.

REVIEW OF LITERATURE

Complications of acute myocardial infarction: ^{2, 3}

1. Mechanical complications:
2. Ischemic complications:
3. Embolic complication.
4. Inflammatory
5. Early pericarditis
6. Late pericarditis (Dressler syndrome)
7. Right ventricular infarction
8. Carcinogenic shock
9. Arrhythmia: ^{6,7,8,9}
 - a. Tachyarrhythmia
 - b. Bradyarrhythmia

MECHANISM OF TACHYARRHYTHMIA: ^{7, 8, 9} can be divided into

1. Disorders of impulse formation.
 - a. Enhanced automaticity.
 - b. Triggered activity
2. Disorders of impulse propagation – Re-entry

a. ENHANCED AUTOMATICITY: ^{7, 8, 9} In addition to SAN, automatic pacemaker activity can be observed in specialized atrial fibers, fibers of AV junction and purkinje fibers.

Enhancement of normal automaticity in latent pacemaker fibers or the development of abnormal automaticity, due to partial depolarization of resting membrane occurs as a consequence of variety of pathophysiological states, ⁷

1. Increased endogenous or exogenous catecholamines
2. Electrolyte disturbances e.g. hypokalemia
3. Hypoxia or ischemia
4. Mechanical effects e.g. Stretch
5. Drugs e.g. digitalis

These arrhythmias cannot be stopped or started by pacing.⁸

b. TRIGGERED ACTIVITY: ⁸ Rhythms due to triggered activity are events that do not occur spontaneously but require a change in cardiac electrical frequency as a trigger. Triggered activity may be caused by,

1. Early after depolarization (EAD), which occur during phases 2 and 3 of action potential or
2. Delayed after depolarization (DAD), which occurs following completion of phase 3 of action potential.

RE-ENTRY: ^{7,9} The requirements for initiating re-entry includes,

1. Electrophysiological inhomogeneity i.e. differences in conduction and / or refractoriness in two or more regions of the heart, connected with each other to form a potentially closed loop
2. Unidirectional block in one pathway
3. Slow conduction over an alternate pathway, allowing time for the initially blocked pathway to recover excitability
4. Re-excitation of the initially blocked pathway to complete loop of activation.

Reentry arrhythmias can be reproducibly initiated and terminated by pacing and rapid stimulation. ⁷

Mechanism of Reentry

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Diagram of re-entry caused by dispersion in refractory periods. A ring of cardiac tissue is shown, and the pattern of conduction is indicated by the arrows. Action potentials with different durations located in different regions of the ring are diagrammed

MATERIALS AND METHODS: The study was conducted for a period of 1 year starting from November 2006 to October 2007. Total of 100 cases of AMI admitted to ICCU of VIMS, Bellary, during the study period, were considered with special reference to various tachyarrhythmias occurring during the hospital stay and its impact on subsequent prognosis and in hospital mortality.

INCLUSION CRITERIA: Patients who had at least two out of following three criteria for AMI as defined by WHO were taken for the study.

1. Patients with history of ischemic type of chest discomfort.
2. ECG changes of ST elevation > 2 mm in chest leads and >1 mm in limb leads.
3. Rise in serum cardiac enzyme markers to more than twice the upper limit of normal.

EXCLUSION CRITERIA: Patients with congenital and valvular heart diseases.

SAMPLE SIZE - 100 patients

METHOD OF COLLECTION OF DATA: A detailed case history was taken in all patients and meticulous examination was done as per the Proforma.

- i. Information was collected through prepared proforma which included detailed history and physical examination of each patient. Additional information was collected from hospital records. Reports of laboratory studies were collected.
- ii. Both the group of patients, thrombolysed as well as non thrombolysed were taken for the study.
- iii. Other therapies were given, depending on the patient's condition and need.
- iv. 12 lead ECG was taken immediately after the admission and four right precordial leads were recorded when RVMI was suspected. Patient was continuously monitored with the help of multipara monitors.
- v. Patients were followed up during hospital stay for the development of tachyarrhythmias – atrial, junctional and ventricular. ECG was repeated subsequently each day and additional ECG's were taken as and when tachyarrhythmias developed and patient were followed up following theses arrhythmias.

Routine blood and urine investigations, serum cardiac markers, blood urea, serum creatinine, blood sugar, lipid profile and chest X-ray were done for all patients.

Evaluation of hemodynamic status was done daily by monitoring pulse, blood pressure, JVP, cyanosis, urine output and auscultation of cardia and lungs. Average stay of patients in ICCU was 5 days. Their stay in ICCU was extended if any complications developed.

STATISTICAL METHODS: Chi-square and Fisher exact test have been used to test the significance of study parameters between Group A and Group B. Odds Ratio has

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been used to find the strength of relationship between study parameters and the groups. Student t test (independent samples) has been used to find the significance of investigations between the two groups.

1. Chi-Square Test

$$\chi^2 = \frac{\sum (O_i - E_i)^2}{E_i}, \text{ Where } O_i \text{ is observed frequency and } E_i \text{ is Expected frequency}$$

2. Fisher Exact Test

	Class1	Class2	Total
Sample1	A	B	a+b
Sample2	C	D	c+d
Total	a+c	b+d	n

$$\text{Fisher Exact Test statistic} = \sum p = \frac{(a+b)!(c+d)!(a+c)!(b+d)!}{n!} \frac{1}{\sum a!b!c!d!}$$

3. Odds Ratio OR=ad/bc

4. Student t test (Independent)

Objective: To investigate the significance between the means of two populations

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{s^2 (1/n_1 + 1/n_2)}}$$

$$\text{Where } s^2 = \frac{(n_1 - 1) \sum_{i=1}^{n_1} (x_1 - \bar{x}_1)^2 + (n_2 - 1) \sum_{i=1}^{n_2} (x_2 - \bar{x}_2)^2}{n_1 + n_2 - 2}$$

STATISTICAL SOFTWARE: The Statistical software namely SPSS 11.0 and Systat 8.0 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

OBSERVATION AND ANALYSIS: The following were the observation made from the study of 100 cases of MI admitted to ICCU, VIMS Bellary.

TABLE 1: Showing age distribution

Age interval years	Female	Male	Total	Percentage
<30	1	2	3	3
31-40	-	7	7	7
41-50	2	23	25	25
51-60	5	30	35	35
61-70	4	11	15	15
> 70	2	3	5	5
Total	14	86	100	100

TABLE 2: Showing sex distribution

Sex		No. of cases	Percentage
Male		86	86
Female	Pre-menopausal	1	1
	Post menopausal	13	13

Table 3: Showing coronary risk factors:

Risk factors	No. of cases	Percentage
Smoking	60	60
Hypertension	44	44
Hyperlipidemia	35	35
Diabetes mellitus	26	26
Obesity	10	10
Family history of IHD	14	14

TABLE 4: Showing the symptoms at the time of presentation:

Symptoms	No. of patients	Percentage
Chest pain	80	80
Sweating	55	55
Breathlessness	25	25
Palpitations	15	15
Nausea / vomiting	14	14
Giddiness	10	10
Pain abdomen	2	2

TABLE 6: Showing time interval between onset of symptoms and hospitalization

Duration in hrs	No. of patients	Percentage
<6	35	35
7-12	46	46
13-24	15	15
>24	4	4

TABLE 9: Showing incidence of tachyarrhythmias:

Tachyarrhythmias	No. of patients	Percentage
Present	60	60
Absent	40	40
Total	100	100

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TABLE 10: Showing time of appearance of arrhythmia after admission:

Time of appearance	No. of patients	Percentage
<12 hrs	25	40.3
12-24 hrs	19	30.4
24-48 hrs	10	20.1
48-72hrs	6	10.4

TABLE 11: Showing type of tachyarrhythmia:

Type of tachyarrhythmia	No. of patients
Sinus tachycardia	15
Ventricular premature beats	20
Atrial premature beats	1
Atrial fibrillation (AF)	2
Supraventricular tachycardia	5
Ventricular tachycardia	11
Ventricular fibrillation	6
Total	60

TABLE 13: Incidence of risk factors and their relation to arrhythmias:

Risk factors	No. of patients	Incidence of arrhythmia	Percentage
Smoking	60	50	90.9
Hypertension	44	30	68.8
Hyperlipidemia	35	32	71.1
Diabetes mellitus	26	22	68.75

TABLE 14: Incidence of reperfusion arrhythmias during thrombolytic therapy:

Reperfusion arrhythmia	No. of patients	Percentage
VPB's	20	80%
AIVR	1	4%
NSVT	4	16%

TABLE 15: Mortality in relation to complications:

Complications	No. of patients	No. of deaths	Percentage
Cardiogenic shock	11	7	33.3
LVF	37	3	8.10
VF	6	6	28.7
VT	11	3	14.2
Others	10	2	9.5
Total		21 deaths	

TABLE 16: Relationship between mortality and age groups:

Age interval in years	No. of deaths	percentage
61 – 70	4	26.6
51 – 60	12	37.3
41 -50	4	18.18
31 – 40	-	-
< 30	1	33.3

TABLE 19: Showing relation between mortality and time after admission:

Duration on hours	No of deaths	Percentage
<24 hours	14	66.6
24 – 48 hours	4	19.2
>48 hours	3	14.2

TABLE: 20: Relationship between mortality and type of arrhythmia:

Tachyarrhythmia	Total no of cases	No of deaths	Percentage
Sinus tachycardia	15	-	-
Atrial fibrillation	1	-	-
SVT	5	-	-
VPB	20	-	-
VT	11	3	27.2
VF	6	6	100

DISCUSSION: A study of 100 cases of AMI admitted in ICCU of VIMS hospital was taken up. This study was with special reference to tachyarrhythmias occurring during the hospital stay and their impact on the outcome of the patients and in hospital mortality. Cases admitted from November 2006 to October 2007 were selected. All the cases were analyzed with respect to clinical, biochemical and electro-cardiac evaluation. The observations made are discussed with special emphasis on tachyarrhythmias.

Age:

- In the present study maximum incidence of AMI (58%) occurred in 6th decade.
- Julian D.G ¹⁰ and Rajagopalan ¹¹ have observed higher incidence of AMI in the same age groups (32% and 33.2% respectively).

Sex:

- The male to female ratio in the present study is 3.7:1. The ratio has been found to vary from 3.1:1 (Julian D.G) ¹⁰ to 10.9:1 (Rajagopalan) ¹¹

Risk Factors:

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TABLE 21: Showing the comparison of present study with other studies with respect to coronary risk factors (in percentage):

Risk factors	Kundu ¹² (1982)	Meher ¹³ (1991)	Passey M.N ¹⁴ ,	Pais (1986)	Sharma S.K (1986) ¹⁵	Subramanhya (1984) ¹⁶	Present study
Smoking	51.4	50	57	66	52.69	41.5	60
HTN	22.5	27.4	32	37	22.06	24.9	44
Hyperlipidemia	60.95	60.4	57	-		55.5	35
DM	15.2	32.9	20	-	19.54	21.5	26
Obesity	-	24.7	-	-	13.37	-	10
Family h/o IHD	-	17	13	-	12.95	-	14

TABLE 22: Showing comparison of present study with other studies with respect to symptoms during the time of admission (in percentage):

Symptoms	Meher (1989)	Subramanhya (1984)	Jacob (1962) ¹⁷	Present study
Chest pain	88.88	94	91	80
Sweating	43.11	-	63	55
Breathlessness	-	56	19	25
Palpitation	-	29	-	15
Nausea/vomiting	-	-	11	14
Giddiness	43	16	14	10
Pain abdomen	-	-	3	2

TABLE 23: Comparing the time interval between onset of symptoms and admission by various authors with present study (in percentage)

Duration in hrs	Kundu	Jacob D.G	Present study
0-6	49	57.7	35
7-12	10.2	22.89	41
13-29	11.56	18.58	19
> 24 hrs	29	-	8

TABLE 26: Showing Incidence of tachyarrhythmias noted in various studies

Rajgopalan ¹¹	67%
Sharma ¹⁵	69%
Jewit D.E ¹⁹	73%
Kundu S.C ¹²	73.44%

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TABLE 27: Showing different types of tachyarrhythmias by various authors

Tachyarrhythmia	Julian ¹⁰	Bahl ¹⁸	Rajgopalan	Kundu	Jacob	Present study
Sinus tachycardia	43	43.7	-	20.3	31	15
Atrial premature beat	25	-	11.6	3.9	5	1
Atrial fibrillation	6	2.7	1.21	2.6	1	2
Supra Ventricular Tachycardia	4	9.3	6	-	-	5
Ventricular premature beat	67	23.7	33.7	62.4	53	20
Ventricular tachycardia	6	2.6	8	4.2	4	11
Ventricular fibrillation	10	0.27	9.2	3.6	4	6

TABLE 28: Incidence of risk factors and their association with tachyarrhythmias in the present study is compared with other studies.

Risk factor	Present study	Present study patients with tachyarrhythmia	Percentage	Sharma S.K
No risk factor	14	6	42.85%	76.4
Smoking	60	50	90.9%	76.4
HTN	44	30	68.2%	76.6
Hyperlipidemia	35	32	80%	69.3
DM	26	22	81.4%	71.7

TIME OF APPEARANCE OF TACHYARRHYTHMIA (REFERENCE TABLE NO 10): Most of the tachyarrhythmia's appeared within 48hrs after AMI. In the present study 39% patients developed tachyarrhythmia within 24hrs of onset of AMI, 13% on 2nd day, 7% patients developed on 3rd day, similar to the study of Sharma.¹⁵

REPERFUSION ARRHYTHMIAS (REFERENCE TABLE NO 14):

- In the present study 66% patients were thrombolysed with SK. The reperfusion tachyarrhythmias like VPB's are developed in 20%, AIVR in 1 and NSVT in 4%. Is similar to the study of Rajagopalan.¹¹
- All of them were transient during reperfusion and no specific treatment was given.

TABLE 29: Mortality in comparison with respect to other studies

Complication	No. Of deaths	Passey ¹⁴	Present study
Cardiogenic shock	7	49%	38%
LVF	3	21%	14.3%
VT + VF	9	19%	42.85%
Cardiac arrest	2	9%	9.52%

TABLE 30: Comparison of the present study with respect to ventricular tachyarrhythmias with various studies

Tachyarrhythmia's	No of patients	No of deaths	Bahl	Agarwal ²⁰	Present study
VT	11	3	60%	83.3	27.3
VF	6	6	100	100	100

SUMMARY

- Cases of AMI who were admitted to ICCU of VIMS hospital were selected and followed up for development of tachyarrhythmias.
- Incidence of AMI was higher in 6th decade.
- There was male preponderance of AMI with M:F = 3.7:1
- 89% of patients had one or the other risk factors for IHD, most common risk factors being smoking -60%, HTN – 44% and hyperlipidemia - 35%.
- Chest pain was the most common presenting complaint in 80% of patients.
- 81% of patients were admitted within 12 hrs of onset of symptoms, 35% of patients were admitted within 6hrs of onset of symptoms.
- Most common type of MI was AWTMI (58%), followed by IWTMI (35%) and RVMTI was seen in 8 patients with IWTMI.
- Tachyarrhythmias were the most common complications during first week of AMI (62%), LVF (35%) and cardiogenic shock 11%.
- Tachyarrhythmias were more common in patients with AWTMI+ IWTMI (100%), followed by those with AWTMI (81.3%), IWTMI (28.57%). Sinus tachycardias, VPB, VT and VF were common in AWTMI.
- Most tachyarrhythmias appeared within 48 hours after AMI. Among them 60.9% appeared within 24hours.
- Incidence of tachyarrhythmias was higher in those with multiple risk factors.
- Patients who developed tachyarrhythmias during hospital stay had lower LVEF and were complicated by LVF.
- Overall mortality was 21%, tachyarrhythmias contributed to 42.85% of total mortality. Among tachyarrhythmias highest mortality was with VF (100%) followed those with VT (27.3%).
- Most of the deaths which occur prior to hospitalization following AMI are due to ventricular tachyarrhythmias. These cases could not be included in the study.
- Patients were connected to continuous multipara monitors, the development of tachyarrhythmias were noted only if patients were symptomatic. If the event recorders were used, the study might have yielded refined data.
- The cause and effect relationship between tachyarrhythmias and other complications like cardiogenic and LVF could not be known i.e, whether cardiogenic shock and LVF led to tachyarrhythmias or tachyarrhythmias per se led to cardiogenic shock.

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