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Original Research Article

A clinical study of arrhythmias associated with acute myocardial infarction and thrombolysis

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ABSTRACT

Background: Arrhythmias are a common occurrence in ACS. This study was undertaken to analyze the incidence, frequency and type of arrhythmias in relation to the site of infarction to aid in timely intervention to modify the outcome in MI and to study the significance of Reperfusion arrhythmias.
Methods: 100 patients were evaluated. ECG and cardiac enzymes were studied. Arrhythmias complicating AMI in terms of their incidence, timing, severity, type, relation, reperfusion and results were studied.
Results: Of the 100 cases, 74% were males and 26% females of which incidence being common between 4th to 7th decades of life. AMI was common in patients with Diabetes and Hypertension (23% each). Incidence of AWMI (58%) is higher than IWMI (40%). Out of all arrhythmias, Ventricular Tachycardia was seen in 24% cases with 50% mortality and preponderance to Antero Lateral Myocardial Infarction. Sinus Tachycardia was seen in 23% of cases with preponderance to Antero Lateral Myocardial Infarction and persistence of Sinus Tachycardia was a prognostic sign, mortality being 22%. Complete Heart Block and Sinus Bradycardia were seen with IWMI, incidence being 53.8% and 100% respectively. Bundle Branch Block was common in AWMI (31%) than IWMI (10%). Among 64 thrombo-lysed cases, 21 had Reperfusion Arrhythmias without any mortality, whereas remaining 43 without Reperfusion Arrhythmias had mortality of 18.6%.
Conclusions: According to the study, Tachy-arrhythmias are common with Anterior Wall Myocardial Infarction and Brady-arrhythmias in Inferior Wall Myocardial Infarction. Reperfusion Arrhythmias are a benign phenomenon and good indicator of successful reperfusion.

Keywords: Acute myocardial Infarction, Arrhythmias

INTRODUCTION

With the introduction of intensive cardiac care unit in the management of acute myocardial infarction (AMI), arrhythmias have become one of the most modifiable complications of AMI. Cardiac monitoring in immediate post myocardial infarction period has helped in early diagnosis of dangerous and life threatening arrhythmias. Cardiac arrhythmias routinely manifest 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 (higher with ST-elevation myocardial infarction (STEMI) and lower with non-ST- elevation myocardial infarction (NSTEMI) and unstable angina pectoris (UAP), the clinician needs to be cautious with all patients in these categories for example, nearly 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.[1] Arrhythmias so often complicate AMI, that it is debatable, whether to consider them under complications

or under the clinical spectrum of AMI. The natures, frequency, as well as the timing of the arrhythmias are important factors in deciding the life expectancy and mortality of the patient.

There is increasing belief that less serious arrhythmias may serve as warning to herald the onset of complicated and potentially lethal arrhythmias. The vigorous treatment by means of drugs, D.C. shock or artificial pacing, if initiated early enough, may prevent many catastrophic situations. ACS patients, particularly those with STEMI, demand a rapid and multifaceted approach. Decisions regarding reperfusion strategy (e.g. Angioplasty versus thrombolysis), adjunctive medical therapy (e.g. Aspirin, heparin, beta- adrenergic blockade, nitrates and other medicines), and management of complicating factors [e.g. Congestive heart failure (CHF)] all compete for the clinician's attention. Concomitantly, the clinician has to be prepared to recognize arrhythmias and treat those that require intervention because they can exacerbate ischemia and lead to clinical instability. Further, with administration of thrombolytics, the clinician should be aware of common "reperfusion" arrhythmias and their potential significance.[1]

For this reason, an attempt has been made in this study, to collect specific information regarding the incidence, course, and prognosis of arrhythmias in AMI during the hospital stay of the patient, especially in the first 48hours.Also, a possible correlation between the type of arrhythmias and site of infarction has been looked into.

METHODS

It was a prospective observational study which was conducted in Emergency Medicine Department and CCU, D.Y. University, School of Medicine, Navi Mumbai, Maharashtra, India for 12 months from September 2015 to September 2016 with sample size of 100. An information sheet was given to the entire participating patient population. Informed consent from guardian or nearest kin of patients or who satisfy the inclusion criteria.

Inclusion criteria

- Age: 18-80years.
- Sex: Both Male and Female (Non Pregnant)

Symptoms of ischemia

- ECG changes indicative of new ischemia (new ST-T changes or new left bundle branch block {LBBB})
- Development of pathological Q wave in the ECG
- Imaging evidence of new loss of viable myocardium or new regional wall motion abnormality
- In case of sudden, unexpected cardiac death only those patients will be included whose ECG is suggestive of acute myocardial infarction.
- Detection of rise and/or fall of cardiac bio-markers (preferably troponin) with atleast one value above the 99th centile of upper reference limit (URL) together with evidence of myocardial ischemia with atleast one of the following.

Exclusion criteria

- Patients who don't fulfill the above inclusion criteria
- Age: below 18 or above 80yrs.
- Pregnant women
- Patient coming with non-cardiac chest pain

For all the patients coming with chest pain first 12 lead ECG was taken immediately after admission. Oxygen was given via mask, IV line was secured. Detailed history regarding chest pain, palpitation, sweating, vomiting, dyspnea, giddiness was asked, past personal and family history was asked. General and systemic examination was done.

Patient was connected to cardiac monitor. All patients was been evaluated for risk factors like diabetes, hypercholesterolemia, hypertension and smoking. The diagnosis of AMI was made on the basis of clinical presentation, ECG changes and serum enzymes (Troponin-T) levels. Serial ECG was taken. An enzymes study (Troponin-T & I, CPK-MB, and BNP) was done in all the cases.

Following standard treatment was given in Emergency: Oxygen via mask, Analgesic such as Paracetamol, Diclofenac sodium, Tramadol. Anti-platelets and Vasodilators such as Sublingual nitroglycerine, Tab. Aspirin (600mg), Tab. Clopidogrel (300mg), Tab. Atorvastatin (80mg) was given according to the ECG findings. Anticoagulant therapy such as low molecular weight heparin was given unless contraindicated.

Patients coming with cardiac failure and AMI treatment was inotropic support (e.g. Dopamine) and diuretics (e.g. furosemide) was started. ABC was secured in unconscious patients who came to ED with history of chest pain and ECG suggestive of Ischemia. Patient who came with Ventricular tachycardia or Ventricular fibrillation were given Defibrillation.

Patients coming with hypertension and AMI treatment were Sublingual nitrates, diuretics (e.g. furosemide), antihypertensive medication was given according to clinical presentation. Patient was defibrillated if patient has come with ventricular tachycardia or ventricular fibrillation.

Patient was attended by the cardiologist within 15mins of arrival patient was shifted from ED to CCU (within 10mins of arrival) on cardiac trolley with oxygen. Reperfusion therapy was given with one of the following medication in

CCU

Reperfusion therapy was given in patients who were indicated

Streptokinase: 1.5million IU (45ml NaCl) over 1 hour

Reteplase: 10units bolus over 2 minutes as soon as possible after onset of AMI, wait 30mins and repeat 10 units over 2mins concurrent with heparin.

Tenectaplase: 30-50mg IV bolus over 5seconds once (based of body wt.) concurrent with heparin<60kgs: 30mg

- 61-70kgs: 35mg
- 71-80kgs: 40mg
- 81-90kgs: 45mg
- >90kgs: 50mg.

Contraindications of reperfusion therapy

- Systolic BP ≥180 mm Hg, Hemodynamic instability which develops in individuals with NSTEMI, GI hemorrhage, Peptic ulcer, Abdominal Aortic aneurysm, Recent cerebrovascular accident, Known Intracranial aneurysm, Recent surgery within 2 weeks, and Financial constrain.
- Patients who did not receive reperfusion therapy because of contraindication, Anticoagulants, Anti-platelets and other supportive treatment were given.
- Patient was kept in CCU for a period of 2 days (or more in complicated cases). Routine investigations were dispatched.
- Cases was studied for arrhythmias complicating AMI, in terms of their incidence, timing, duration, severity, type, relation to the involved site, reperfusion and end result. Patient who showed arrhythmias on monitor, but whose arrhythmias couldn't be recorded on ECG paper due to the transient nature of the arrhythmias, was included in the study as a positive case.
- Patient having VF or any other arrhythmias, who died before recording could be done or in whom urgency of the situation prohibited the recording, was considered as positive cases of arrhythmias.

Statistical analysis

Descriptive statistical analysis was carried out. Chi-square/2x2, 2x3, 3x3, Fisher Exact test was used to find the significance of study parameters on categorical scale between 2 or more groups.

RESULTS

Table1 shows incidence of AMI in different age groups, number of males and females in each group and their respective percentage in that group. As indicated in the table, the maximum incidence of AMI was in 41-70years of age. Percentage of females is steadily rising from 41 years onwards and is equal to that of males in 71-80 years. There are only 5% cases below the age group of 40 years those too only males. Over all the number of male cases is highly significant (74%) as compared to females (26%).

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	4	4	0	100	0
41-50	30	28	2	93.3	6.7
51-60	19	13	6	68.4	31.6
61-70	29	19	10	65.5	34.5
71-80	16	8	8	50.0	50.0
81-90	1	1	0	100	0
Total	100	74	26	74	26

Table 2 and 3 shows a significant number of patients with a positive part of family history predisposing them to AMI. Both diabetes and hypertension had equal incidence 23%.Whereas 10% had a positive h/o angina and MI.

Table 2: Risk factors.

Diseases	Past H/o	In hospital diagnosed	Total
Diabetic	15	8	23
Hypertension	18	5	23
Past MI	4	-	4
Angina	6	-	6

Table 3: Family history.

Diseases	No. of cases	Percentage
Hypertension	10	10
Diabetes	8	8
IHD	7	7

Table 4: Symptoms.

Symptoms	No. of cases	Percentage
Chest pain	80	80
Sweating	64	64
Dyspnea	43	43
Vomiting	28	28
Palpitation	11	11
Epigastric pain	10	10
Pain in left arm	5	5
Syncope / giddiness	8	8

Table 4 shows the pattern and incidence of various symptoms of AMI. Chest pain was the most common presenting symptom which was present in 80% of patients and another 15% had all together epigastric pain

and pain in left arm alone. Sweating was 2nd most common symptom (64%) followed by dyspnea (43%). Vomiting was present in 28% and palpitation in 11%. Another 8% of patients presented with giddiness / syncope.

Table 5: Incidence of various myocardial infarction.

Site	No. of cases	Percentage
Anterior	25	25
Antero-lateral	17	17
Antero-septal	16	16
Inferior	29	29
Inferior + lateral	8	8
Inferior + right ventricular	2	2
Inferior + posterior	1	1
Inferior + anterior	1	1
Sub endocardial	1	1

Table 5 shows the pattern and incidence of various AMI, according to the site overall all together anterior wall (i.e anterior + anterolateral + antero-septal) predominates which was in 58% of patients followed by inferior wall (i.e. inferior + infero-lateral + inferior and right ventricular + inferior and posterior wall) occurred in 40% of patients.1% of patient had both anterior as well as inferior wall infarction and 1% had sub-endocardial infarction.

Table 6: Incidence of arrhythmias.

Types	No. of cases	Percentage
Sinus tachycardia	23	23
Sinus bradycardia	12	12
Atrial ectopics	1	1
Atrial fibrillation	2	2
SVT	3	3
VPB	8	8
VT	24	24
AV blocks I0and II0	19	19
AV block III0 (CHB)	22	22
Bundle branch block	22	22

Table 7: Sinus tachycardia (ST) with respect to site of infarction.

Site	No. of cases	No. of cases+ ST	Percentage
Anterior	25	8	32
Anterolateral	17	6	35.3
Anteroseptal	16	4	25
Inferior	29	4	13.8
Interolateral	8	1	12.5
Total		23	

Table 6 shows the incidence of various types of arrhythmias in AMI. Many of the cases presented with more than one type of arrhythmia. Ventricular arrhythmias were present in a total of 32% of patients of which 24% had VT and 8% had VPBs. Sinus tachycardia was present in 23% and sinus bradycardia in 12%. SVT was present in 3%, AF in 2% and atrial ectopic in 1%. Bundle branch block was seen in 22%, complete heart block in 13% and AV-block (I0and II0) in 19% of patients.

Table 7 shows the incidence of sinus tachycardia in relation to the site of infarction. The highest incidence was seen in anterior and lateral wall MI whereas lowest incidence in inferior wall MI.

Table 8: Incidence of sinus bradycardia (SB) in relation to the site.

Site	No. of cases	No. of cases with SB	Percentage
Inferior wall	29	10	34.5
Inferior wall with right ventricular extension	2	1	50
Inferior + posterior	1	1	100
Total		12	

Table 8 shows incidence of sinus bradycardia with over whelming majority in inferior wall.

Table 9: Incidence of complete heart block (CHB) (III^0) in relation to the site.

Site	No. of cases	No. of cases+ CHB	Percentage
Inferior wall	29	4	13.8
Inferior wall with right ventricular extension	2	1	50
Inferolateral	8	2	25
Anterior	25	4	16
Anterolateral	17	1	5.9
Sub-endocardial	1	1	100
Total		13	

Table 10: Incidence of I^0 and II^0AV block (AVB) in relation to the site.

Site	Total cases	No. of cases+ AVB	Percentage
Inferior wall	29	11	37.9
Inferior + posterior	1	1	100
Anterior wall	25	4	16
Antero-septal	16	3	18.7
Total		19	

Table 9 shows the incidence of complete heart block in relation to the site of infarction. Complete heart block shows high affinity for inferior wall. Table 10 shows the incidence of AV blocks in acute MI and the relation to the site of infarction. AV block shows a high affinity for inferior wall.

Table 11: Incidence of bundle branch block (BBB).

Type	No. of cases	Percentage
LBBB alone	8	8
RBBB alone	9	9
Bifascicular block	4	4
LAHB	1	1
Total		22

Table 11 shows over all incidence of bundle branch block being 2% where in incidence of RBBB alone was 9% and LBBB alone being 5%. Table 12 shows higher incidence of BBB in antero-septal MI than other MIs.

Table 12: Incidence of BBB in relation to wall.

Site	No. of cases	No. of cases + BBB	Percentage
Anterior wall	25	6	24
Antero-septal	16	8	50
Anterolateral	17	4	23.5
Inferior wall	29	2	6.9
Inferolateral	8	2	25
Total		22	

Table 13: Incidence of supraventricular arrhythmias.

Type	No. of cases	Percentage
SVT	3	3
Atrial fibrillation	2	2
Atrial ectopies	1	1
Total	5	

Table 13 shows total incidence of supraventricular arrhythmias being 6% in AMI.

Table 14: Incidence of ventricular arrhythmias.

Type	No. of cases	Percentage
Occasional VPB	8	8
Ventricular bigeminy	1	1
VT	24	24
Total	33	

Table 14 and 15 shows the overall incidence of ventricular arrhythmias being 33% of which VT was 24%, VPB, were 8% and ventricular bigeminy being 1%. Also overall incidence is more in anterior and lateral wall MI than inferior wall alone.

Table 15: Incidence of ventricular arrhythmias in relation to the site.

Site	Total cases	No. of cases + ventricular Arrhythmias	Percentage
Anterior wall	25	7	28
Antero-septal	16	8	50
Anterolateral	17	7	41.2
Inferior wall	29	4	13.8
Inferolateral	8	4	50
Inferior wall with right ventricular extension	2	1	50
Anterior + inferior	1	1	100

Table 16: Incidence of reperfusion arrhythmias.

Type	No. of cases	Self-termination	Cardioversion
Occasional VPB	14	14	-
Multiple VPB (Ventricular bigeminy)	2	2	-
AIVR	6	6	-
Sinus bradycardia	1	1	-
VT	1	-	1
CHB	1	1	-

Table 16 shows incidence of reperfusion arrhythmias in acute MI.VPB was the most common type of arrhythmia followed by AIVR. Most of the arrhythmias were transient and self terminating except for VT which had to be terminated with Cardio version.

Table 17: Mortality in *Streptokinase* (SK) and non-*Streptokinase* group.

Group	No. of cases	No. of Deaths	Percentage of deaths
Cases who received SK	64	8	12.5
a) SK with reperfusion arrhythmias	21	0	0
b) SK without reperfusion arrhythmias	43	8	18.6
Cases who did not receive SK	36	20	55.5
Total	100	28	

Table 17 shows mortality in patients who received SK, and its sub groups (with or without reperfusion arrhythmias RA) and mortality in patients who did not receive SK.

- Morality in SK group (12.5%) is lower than mortality in non-SK group (55.5%).
- No mortality was seen in patients who received streptokinase and developed reperfusion arrhythmias depicting successful reperfusion

DISCUSSION

Age and sex incidence

The maximum incidence of AMI as seen in this study was in the age group of 41-70 years (78%). Only 5% case was below the age group of 40 years age incidence of this study almost compares well with incidence being 85% between 35 and 75 years of age as reported by Martin TC et al.[3] Incidence of AMI in males was 74% and in females was 26% which compares well again with study done by Martin TC et al, where incidence was 72% in males and 28% in females.[3] The higher mortality rate in women (38.4%) as seen in present study very well correlates with study done by Berger JS et al which shows 37% incidence of mortality.[4]

Whereas study done by Trappolini M et al shows 24.4% mortality and study by Simon T et al shows 25% mortality in females.[5,6] This difference of mortality, in our study may be explained by associated complications in present cases. Women had a lower overall morbidity rate (26%), but this discrepancy diminished as the age progressed and was same as men (50%) in 71-80 years age group. Same observation was made in study done by Rosengren A et al.[7,8] Even study done by Ivanusa M et al shows incidence above 65 years of age as male 50.7% and female as 49.3%.[9]

Risk factors

Incidence of diabetes was 23% in the present study as compared to 19% in Svensson AM et al study.[10] In the present study 23% had hypertension showing higher prevalence of AMI in these groups, which is in agreement with Kokobo Y et al study.[11]

Arrhythmias

Sinus bradycardia (SB)

Brady-arrhythmias and hypotension are common in proximal occlusion of right coronary artery commonly leading to inferior myocardial infarction, because of reflexes arising from the ischemic right ventricle.[12] In the present study 12% had SB, out of which 10 were purely in inferior and 1each in inferior wall with right ventricular extension and inferior + posterior wall MI. In all these patients, SB was transient and majority of the patients had normal sinus rhythm (NSR) by the end of 1st day. All the patients had NSR at discharge. Similar observations were made by Swart G et al.[13] In the present study, there were no deaths in patients with SB and inferior wall MI, indicating a protective role of SB in inferior wall MI. Similar observations was made by Malla RR and Sayani A.[14]

Sinus tachycardia (ST)

In present study, ST was observed in 23 patients and it was most commonly associated with anterior (32%) and antero-lateral (35.3%) wall than inferior (13.8%) and inferolateral (12.5%) was MI. Same observation of anterior wall being commonly involved was made by Crimm A et al.[15] There is high mortality rate associated with ST making it as an adverse prognostic sign. In the present study the mortality rate in patients with ST was 22% which is again comparable to study done by Crimm A et al.[15]

Supraventricular tachy-arrhythmias

In the present study total of 6% of patients had supraventricular tachy-arrhythmias with SVT being 3%, atrial fibrillation (AF) 2% and atrial ectopics in 1% case. Incidence of atrial fibrillation very well correlates with study done by Novaro GM et al.[16] His study showed incidence of 4.7% in Asians. AF is associated with an increased in hospital mortality probably because it is associated with large infarcts and is seen more commonly in patients with cardiac failure, complex ventricular arrhythmias, advanced AV block, atrial infarction and pericarditis, as incidents increases with age. In present study 100% mortality was seen in cases with AF. AF has been predicted as independent risk factor for mortality in AMI as included by study done by Asanin M et al and Pizzetti F et al.[17,18]

AV blocks (Arterio-ventricular blocks)

Over all incidence of complete (III^0) AV block in present study was 13%, out of which all together in inferior MI (inferior, inferolateral and inferior with right ventricular extension) incidence was 18% and in anterior MI (anterior and anterolateral) was 12%. Almost same observation was made by Ben Ameur Y et al of incidence of CHB in inferior wall MI being 21.7%.[19] Other studies done by Rathore SS et al and Garcia C et al also showed increased incidence of CHB in inferior wall MI, the incidence being 7.3% and 12% respectively.[20,21] Though incidence is less as compared to present study but still more than any other site of AMI.

Present incidence is more as compared to them due to late presentation of the patients associated with other complications like hypotension. So fibrino-lytics were not used and patient progressed to complete heart block. In present study overall mortality was 46.2% in CHB patients which is very well comparable to 46.8%

mortality as shown by Spencer F et al in his study.[22] Also in present study mortality was more in CHB associated with anterior wall than inferior wall which is very well comparable to study done by Melgarejo Moreno A et al and Meine TJ et al.[23,24]

Whereas if mortality is compared among inferior wall with CHB and inferior wall with right ventricular extension with CHB, the mortality was high in inferior wall with right ventricular extension which is comparable to study done by Mavric Z et al.[25] In the present study, the combined incidence of I^0 and II^0. AV block was 19%, inferior wall (inferior and infero-posterior) having 40% and anterior wall (anterior and antero-septal) having 17% incidence. In the study done by Majumder AA et al the combined incidence of I^0 and II^0 A-V block was 15%, with inferior wall showing 30.3% incidence and anterior wall showing 4.45% incidence.[2] Though the incidence of both studies differ, both show an affinity of AV Blocks for inferior wall.

Bundle branch blocks (BBB)

In the present study, the incidence of BBB was 22% with more affinity for anterior wall MI than inferior wall.[1] In present study mortality was high in RBBB associated with anterior wall which is in well comparison with study done by Wong CK et al.[26,27] All the cases of LAHB, whether isolated or in association with RBBB as bifascicular block were seen in antero-septal MI which very well correlates with the study done by Elizari MV et al.[28]

Ventricular arrhythmias

In the present study, over all ventricular arrhythmias were seen in 33% patients of which VT were 24%, VPB 8% and 1% had ventricular Bigeminy. The frequency of VT was seen more in anterolateral MI than antero-septal MI, Which compares well with study done by Horvat D et al.[29] In present study mortality seen in patients with VT was 50% whereas study done by Metal GC and Al-Khatib S was 25.2% and 24% respectively.[30] This discrepancy could be explained by larger infarcts and older age in present study.

Reperfusion arrhythmias (RA)

A study bone by Gao R on 27 patients with AMI, in whom infarct related coronary artery, was occluded. Thrombolytic therapy or PTCA was performed in them. Reperfusion confirmed by immediate coronary angiography was achieved in 24 patients.

Reperfusion arrhythmias (RA) occurred in 19 (79.2%) of the patients, including ventricular arrhythmias in 13 (54.2%). Ventricular fibrillation (VF) and ventricular tachycardia (VT) developed in 2 (8.4%) and accelerate did ventricular rhythm (AIVR) in 5 (20.8%), the latter showed a reliable indicator of coronary artery recanalization. Transient sinus bradycardia or AV block occurred in 10 (66.7%) of the 15 patients with inferior posterior MI, which was an indicator of recanalization of coronary artery and salvage of myocardium in inferior-posterior MI. The patients with RA were treated with ordinary antiarrhythmic therapy; VF was converted by electric defibrillation. No death related to RA occurred.[32] In the present study 21 (32.8%) out of 64 patients were considered to be having RA on the basis of rapid clinical with non-involve marker (ST-segment resolution) following SKT as suggested by Osmaricik PP et al.[33]

In present study 14 cases had VPBs, 6 had AIVR 2 had ventricular Bigeminy and 1 had sinus bradycardia, VT and CHB each. There was no mortality in present study in cases with RA, which is very well in accordance with study done by AVG huran and AJ. Cann.[34] It shows VPC are usually a symptomatic and their presence in the pre-infarction period, regard less of frequency and complexity (bigeminy, multi-formity etc.) bears no relation to the mortality. AIVR is usually benign and has no adverse effect on mortality.[34] The present study also highlights this aspect.

CONCLUSION

According to the study, Tachy-arrhythmias are common with Anterior Wall Myocardial Infarction and Brady-arrhythmias in Inferior Wall Myocardial Infarction. Reperfusion Arrhythmias are a benign phenomenon and good indicator of successful reperfusion.

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