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Original Research Article

A clinical study of hemodynamically significant arrhythmias and QTc interval associated with thrombolysed and non thrombolysed acute myocardial infarction patients

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ABSTRACT

Background: Arrhythmias are a common occurrence in acute myocardial infarction. Objectives of this study the hemodynamically significant arrhythmias and QTc interval in thrombolysed and non thrombolysed acute myocardial infarction patients.
Methods: Two hundred patients of AMI were enrolled. ECG and cardiac parameters were examined. Arrhythmias and its various parameters like its incidence, type, frequency associated with site of infarction were recorded in thrombolysed and non thrombolysed patients of AMI.
Results: AMI was more prevalent in the males (63.3%) and those with 41-50 years of age. Hypertension (35.7%), smoking (34.2%), and diabetes (23.1%) were the major risk factor. Incidence of AWMI (30.7%) is higher than IWMI (25.1%). Out of 200 subjects 130 were thrombolysed. Arrhythmias was observed in total 164 patients while 36 patients has no documentation of arrhythmias. Mean QTc was prolonged (546.88ms vs 404.33ms) in patients documented with arrhythmia compared with those who has no arrhythmia. Out of all arrhythmias, ventricular tachycardia was seen in 38% cases with 50% mortality and preponderance to antero lateral MI. Sinus Tachycardia was seen in 22% of cases with preponderance to Antero Lateral MI and persistence of Sinus Tachycardia was a prognostic sign, mortality being 12%. Complete Heart Block were seen with IWMI, incidence being 26%. Bundle Branch Block was common in AWMI (31%) than IWMI (10%).
Conclusion: Tachyarrhythmias are common with AWMI and bradyarrhythmia's in IWMI. Reperfusion arrhythmias are a benign phenomenon and good indicator of successful reperfusion.

Keywords: Acute myocardial Infarction, Arrhythmias, Electrocardiogram, Sinus Tachycardia, Tachyarrhythmias

INTRODUCTION

Acute myocardial infarction (AMI) is an event of myocardial necrosis due to an unstable ischemic syndrome. In practice, the disorder is diagnosed and assessed on the basis of clinical evaluation, the electrocardiogram (ECG), biochemical testing, invasive and noninvasive imaging, and pathological evaluation. Acute myocardial infarction is classified on the basis of the presence or absence of ST-segment elevation on the ECG and is further classified into six types. Infarction due to coronary atherothrombosis (type 1), infarction due to a supply–demand mismatch that is not the result of acute atherothrombosis (type 2), infarction causing sudden death without the opportunity for biomarker or ECG confirmation (type 3), infarction related to a percutaneous coronary intervention (PCI) (type 4a), infarction related to thrombosis of a coronary stent (type

4b), and infarction related to coronaryartery bypass grafting (CABG) (type 5).[1]

The usual initiating mechanism for acute myocardial infarction is rupture or erosion of a vulnerable, lipid-laden, atherosclerotic coronary plaque, resulting in exposure of circulating blood to highly thrombogenic core and matrix materials in the plaque.[2]

When heart rhythm becomes irregular, too fast (tachycardia) or too slow (bradycardia), or the frequency of the atrial and ventricular beats are different, this is called an arrhythmia. Patients may describe an arrhythmia as a palpitation or fluttering sensation in the chest. A frequent cause of arrhythmia is coronary artery disease because this condition results in myocardial ischemia or infarction. When cardiac cells lack oxygen, they become depolarized, which leads to altered impulse formation and/or altered impulse conduction. Arrhythmias can be either benign or more serious in nature depending on the hemodynamic consequence of the arrhythmia and the possibility of evolving into a lethal arrhythmia. Ventricular tachycardia is a serious condition that can lead to heart failure or evolve into ventricular fibrillation and cause death.[3]

QT interval is defined as the distance from the onset of QRS complex to the end of T wave on electrocardiogram. QT dispersion (QTd) is equal to longer QTc minus shorter QTc measured by 12-lead Electrocardiogram (ECG). QTd reflects inhomogeneity in myocardial and ventricular repolarization. Because of easy and fast measurement of QTd, it can be used to predict high-risk patients for arrhythmia after AMI.[4]

QTd is 30 - 60 milliseconds (ms) in healthy patients but increases to 60 - 80 ms in patients with Coronary Artery Disease (CAD). QTc dispersion >60 ms has independent predictive value for the severity of CAD. In addition, QTd increases after the acute phase of AMI. Increased QTd can cause ventricular arrhythmia, such as torsade de pointes.[5]

Thrombolytic therapy improves survival and preserves myocardial function. Successfully perfused patients have demonstrated lower incidence of early and late mortality, as well as a higher left ventricular ejection fraction with early therapy, compared with conventionally treated patients. Studies have also indicated that in-hospital and long-term benefits of thrombolysis are closely related to early re-establishment and maintenance of coronary blood flow.

METHODS

It was a prospective and controlled random study, carried out at Gandhi Medical College, Bhopal for a period of 18 months between September 2017 to March 2019. Before commencing this study, an approval from Institutional Ethics Committee and an informed and formal consent was secured from the subjects. In this study, 200 subjects both male and female were included.

Inclusion criteria

1. Age: 18-80years.
2. Sex: Both Male and Female (Non Pregnant)
3. 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.

Exclusion criteria

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

For all the subjects ECG was taken, cardiac biomarkers were recorded. Detailed history of chest pain, sweating, palpitation, vomiting, dyspnea etc. along with family history of MI was recorded. All subjects were investigated for the risk factors of MI mainly diabetes, hypertension, smoking and alcoholism. Enzymes study for CPK-MB was done for all subjects. Streptokinase (SK) as a thrombolytic medication was given to the subjects having indication for thrombolysis after myocardial infarction.

All the data were analysis using IBM SPSS ver. 20 software. Cross tabulation and frequency distribution was used to prepare the tables. Quantitative data was expressed as mean and categorical as percentage. Chi square test was used to compare categorical data whereas as one way AVOVA and independent sample t test was used to compare the means of variable. Level of significance was assessed at 5%.

RESULTS

MI was more prevalent in the male patients (63.3%) and age group of 41-50 years (26.6%) followed by 51-60 years (22.6%) and 31-40 years (18.6%).Hypertension (35.7%) followed by smoking (34.2%) and presence of diabetes (23.1%) were the most common risk factor for the development of MI. AWMI (30.7%) followed by IWMI (25.1%) were the most common affected location in MI patients.

Out of 200 MI patients 130 (57.8%) were thrombolysed. Out of 200 patients, death was reported in total 43 (21.5%) MI patients. Most common type of Arrhythmia in present study was VT (14.6%), CHB (13.6%), 2nd

degree AV Block (12.6%), LBBB (10.6%) and SB (9.5%).

Table 1 shows the incidence of various myocardial infarction with respect to site of infarction in thrombolysed and non thrombolysed patients Comparing the most common site involved in myocardial infarction in both the groups, the AWMI is the most common site have found to be involved. (p=0.002).

Table 2 shows Incidence of arrhythmias with respect to thrombolysis. Comparing the type and incidence of arrhythmias with thrombolysis status reveled the occurrence of different types of arrhythmias that is I & II DEG AV BLOCK (n=12), AF (n=3), CHB (n=18), LBBB (n=15), RBBB (n=8), SB (n=10), ST (n=14) and VT (n=25) are more common in patients underwent thrombolysis and compared to those who were not thrombolysed (p=0.001).

Table 1: incidence of various myocardial infarction with respect to site of infarction in thrombolysed and non thrombolysed patients.

Site	Total no of cases	Thrombolysed	Non thrombolysed	P value
ALWMI	34	23	11	0.002
ASWMI	30	21	9	
AWMI	57	38	19	
ILWMI	16	10	6	
IWMI+RVMI	5	3	2	
IWMI	50	30	20	
IWMI+AWMI	5	3	2	
IWMI+PWMI	3	2	1	
TOTAL	200	130	70	

AWMI: Anterior wall myocardial infarction, IWMI: Inferior wall myocardial infarction, RVMI: Right ventricular myocardial infarction, PWMI: posterior wall myocardial infarction. ALWMI: Antero lateral wall myocardial infarction, ILWMI: Inferolateral wall myocardial infarction, ASWMI: Anteroseptal wall myocardial infarction.

Table 2: Incidence of arrhythmias with respect to thrombolysis.

Type	Total no patients	Thrombolysed	Non thrombolysed	P value
1st& 2nddegree AV BLOCK	20	12	8	0.001
AF	4	3	1	
CHB	26	18	8	
LBBB	18	15	3	
RBBB	14	8	6	
SB	16	10	6	
ST	22	14	8	
SVT	6	4	2	
VT	38	25	13	
No Arrhythmia	36	21	15	
Total	200	130	70	

VT; Ventricular tachycardia, CHB; complete heart block, AF: atrial fibrillation, LBBB: Left bundle branch block, RBBB: right bundle branch block, SB: sinus bradycardia, ST: Sinus tachycardia, SVT: supraventricular tachycardia.

Incidence of sinus tachycardia was highest with the AWMI (15.79%) followed by ALWMI (13.04%).Incidence of sinus tachycardia with respect to site of infarction in non thrombolysed patients was highest with ASWMI (22.22%) followed by AWMI (21.05%).Incidence of sinus Bradycardia with respect to site of infarction in thrombolysed patients was highest with IWMI+RV (66.67%) followed by IWMI+PWMI (50%).Incidence of sinus Bradycardia with respect to site of infarction in non-thrombolysed patients was highest with IWMI (50%) followed by IWMI+RVWMI (25%).Incidence of Complete Heart Block with respect to site of infarction in thrombolysed patients was highest with IWMI (33.33%) followed by IWMI+RV (30%).Incidence of Complete Heart Block with respect to site of infarction in non-thrombolysed patients was highest with IWMI+RV (50%) followed by IWMI (20%).Incidence of I And II Degree AV Block with respect to site of infarction in thrombolysed patients was highest with IWMI (23.33%).Incidence of I and II Degree AV Block with respect to site of infarction in non-thrombolysed patients was highest with IWMI

(25%).Incidence of LBBB with respect to site of infarction in thrombolysed patients was highest with ASWMI (28.57%). Incidence of LBBB with respect to site of infarction in non-thrombolysed patients was highest with ASWMI (11.11%) followed by AWMI (10.52%).Incidence of RBBB with respect to site of infarction in thrombolysed patients was highest with ASWMI (9.52%) followed by AWMI (7.89%).Incidence of RBBB with respect to site of infarction in non-thrombolysed patients was highest with AWMI (15.78%) followed by ASWMI (11.11%). Incidence of ventricular tachycardia with respect to site of infarction in thrombolysed patients was highest with ASWMI (38%) followed by IWMI+AWMI (33.33%) and IWMI+RV (33.33%). Incidence of ventricular tachycardia with respect to site of infarction in non-thrombolysed patients was highest with ASWMI (55%) followed by ALWMI (27.27%).

Table 3: Mortality in thrombolysed and non thrombolysed patients and its correlation with reperfusion arrhythmias.

Group	N	Mortality	Mortality (%)
Cases who received SK	130	16	12.4
SK with reperfusion arrhythmias	94	4	4
SK without reperfusion arrhythmias	36	12	33
Cases who did not receive SK	70	27	38
Total	200	43	

SK; Streptokinase, N; no of patients

Table 4: Comparing various parameters with arrhythmias status.

Different parameter arrhythmia		N	Mean	SD	P value
Magnesium	Yes	164	1.90	0.37	<0.001
	No	36	2.50	0.31	
	Total	200	2.04	0.44	
QTc	Yes	164	546.88	379.31	0.002
	No	36	404.33	51.76	
	Total	200	513.76	338.43	
LVEF	Yes	164	40.88	10.64	0.487
	No	36	42.09	9.01	
	Total	200	41.16	10.28	

Table 3 shows mortality in thrombolysed and non thrombolysed patients and its correlation with reperfusion arrhythmias, comparing mortality among the patients who were thrombolysed with streptokinase with not thrombolysed patients revealed that out of 130 patients who received streptokinase, 16 (12.4%) died), of that mortality was more among the patients who did not get reperfusion arrhythmias (33%) as compared to those who got reperfusion arrhythmias. We also found that mortality was more among the patients who were not thrombolysed (38%) as compared to those who were thrombolysed (12.4%).

Table 4 shows comparison various parameters with arrhythmias status magnesium levels (mean=1.9084) was significantly low among the patients with arrhythmias, QTc was prolonged among the patients with arrhythmias (mean=546.88) (p=0.002).

DISCUSSION

Current study records that MI was more prevalent in the male patients (63.3%) and age group of 41-50 years (26.6%) followed by 51-60 years (22.6%) and 31-40 years (18.6%). This result are very much similar to the findings of Mhatre MA et al, in their study maximum incidence of AMI was in 41-70 years of age. There are only 5% cases below the age group of 40 years those too only males. Overall the number of male cases is highly significant (74%) as compared to females (26%).[6]

Similar observations were made by Martin TC et al, MI incidence recorded as 85% between 35 and 75 years of age, recorded prevalence of AMI was 72% in males and 28% in females which is similar to ours where AMI was 63.3% in male subjects and 33.7% in female subjects.

Present study records Hypertension (35.7%) as the major risk factor of AMI which is similar to the results of Mhatre MA et al, study i.e. 23% had hypertension recorded higher prevalence of AMI.[6] Similarly Kokobo Y et al, recorded the frequency of high-normal blood pressure as 12.2% and hypertension as 35.3% in CVD patients.[6]

In current study 34.2% subjects were smokers and experienced the AMI, this is similar to the findings of Teo KK e al, in their study they found that smoking was associated with a greater risk of non-fatal AMI (odds ratio [OR] 2.95, 95% CI 2.77-3.14, p<0.0001) compared with non-smoking; risk increased by 5.6% for every additional cigarette smoked.[7]

Current study records alcohol as risk factor in 30.7% subjects, which is substantiated by the result Sonia SA et al study which recorded 11.2% vs. 29.1% male patients of AMI were alcoholic.

In current study diabetes is recorded for 23.1% subjects as risk factor of AMI which is almost similar to Mhatre MA et al. which also recorded diabetes in 23% cases. [6] Similarly diabetes was found in 19% by Svensson AM et al, study.[8]

Current study found AWMI (30.7%) followed by IWMI (25.1%) were the most common affected location in MI patients. Similar observations were made by Mhatre MA

et al. where Anterior wall MI was found in 25% and Inferior wall MI in 29%.[6]

Similar observation made by another study by Rajhans R et al, who found Anterior wall MI was in 36% and Inferior wall MI in 24%.[9]

In present study out of 200 MI patients 130 (57.8%) were thrombolysed, reported death was in 43 (21.5%) MI patients, most common type of Arrhythmia in present study were VT (14.6%), CHB (13.6%), 2nd degree AV Block (12.6%), LBBB (10.6%) and SB (9.5%). Similar observation were made by Anjalee et al, who reported that 60.34% were thrombolysed, 56.64% had presented with chest pain were thrombolysed within 6 hours, ventricular tachycardia (16%) were commonest tachyarrhythmias and death was reported in 15%.[10] Sinus bradycardia in 68%, RBBB in 23% and LBBB in 18% were the commonest bradyarrhythmia's.

Present study records that the incidence of sinus tachycardia was highest with the AWMI (15.79%) followed by ALWMI (13.04%). Incidence of sinus tachycardia with respect to site of infarction in non-thrombolysed patients was highest with ASWMI (22.22%) followed by AWMI (21.05%). Similar observations were made by Sarala. H. T (2012), it records that the sinus tachycardia was present in 22% patients and associated with 9% AWMI compared to 3% IWMI.

During this study 16 (12.4%) died who were thrombolysed with streptokinase. [11] Similar death rate was recorded by Midgett AS, et al, i.e. among the 9155 patients with suspected acute anterior myocardial infarction, the mortality rate in the control group was 17.4%. [12] In contrast, patients treated with streptokinase had a 12.5% mortality.

QT interval prolongs from the opening of QRS complex to the end of T wave. Hence, it comprises the interval of ventricular depolarization (QRS) and repolarization (J point to end of T wave). It corresponds to the duration of cellular action potential. "long-" and "short"-QT intervals are considered as risk markers for cardiac arrhythmias and sudden death.

Present study record that the QTc were prolonged among the patients with arrhythmias (mean=546.88 ms) (p=0.002), similar observations were made by Michels G et al [13] where in in a group of 33 arrhythmias patients the mean corrected QT interval (QTc) was 532 ± 29 ms, with 530 ± 31 ms ($n = 14$) in men and 533 ± 28 ms ($n = 19$) in women ($p = 0.80$), respectively. Thus it is evident that the QT intervals gets prolonged din case of arrhythmias.

CONCLUSION

Current study conclude that MI is more prevalent among the male population than the female population, it impacts the working population significantly. Among risk factors hypertension smoking, and diabetes are the most common. Ventricular tachycardia is the most common type of Arrhythmia in MI. Anterior wall and Inferior wall MI are the most common affected location in MI patient. Tachyarrhythmias are common with AWMI and bradyarrhythmia's in IWMI. QTc interval is prolonged in patients having arrhythmias with decrease in mean magnesium level. Patients who are thrombolysed have less mortality and more incidence of reperfusion arrhythmia as compared to those who are not thrombolysis. And hence Reperfusion arrhythmias are a benign phenomenon and good indicator of successful reperfusion.

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