" STUDY OF REPERFUSION ARRYTHMIAS IN POST-THROMBOLYTIC THERAPY IN ACUTE MYOCARDIAL INFARCTION "

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ABSTRACT:
Objective: Early intervention in myocardial infarction leads to decrease in mortality. The main treatment methods used today to provide myocardial reperfusion are thrombolytic therapy and percutaneous coronary intervention. current study aims at studying prevalence of Reperfusion arrhythmias by electrocardiogram during and within 48 hours of thrombolysis and its relation to mortality.
Methods:100 Patients admitted with acute STEMI in DR PSIMS & RF who are more then 18 yrs of age including both males and females, with features suggestive of acute myocardial infarction who have underwent thrombolytic therapy are selected for the study. Assessment of reperfusion arrhythmias during and within 48 hrs of thrombolytic therapy using ECG is performed. The relation between reperfusion arrhythmias and survival outcome after thrombolytic therapy were assessed.
Results: In this study Maximum incidence of acute STEMI was seen between 45-75 years with male predominance. There was no statistically significant difference between the two groups in the frequency of reperfusion arrhythmias ($P = 0.014$). Although angiographic vessel patency was higher in patients undergoing percutaneous coronary intervention, there was no significant difference between the patency rates of each group with and without reperfusion arrythmias.
Conclusion: There is no significant relation between mortality and reperfusion arrhythmias, there was no significant p value between them, indicating Reperfusion arrhythmias are benign, and should be used as a marker of successful thrombolysis. Thus RA is not an event of serious concern as they are usually well tolerated and are amenable to treatment. Early streptokinase therapy has a favorable impact on mortality in Ml and hence should be tried in all the Acute MI patients who do not have contraindications for streptokinase therapy.
Keywords: ST segment elevation MI(STEMI), Ventricular Tachycardia(VT), Ventricular Fibrillation(VF), Reperfusion Arrythmias(RA), Thrombolytics.

INTRODUCTION

Rapid rise is seen in the incidence of non communicable diseases after a decline in the incidence of communicable diseases. At the beginning of third millennium, the prevalence of non communicable diseases is rising across the globe. By 2020, non communicable disease will cause 70% of deaths in developing countries. The major non- communicable diseases are cardiovascular disease (ischemic heart disease-IHD and hypertension), diabetes, cancer and chronic pulmonary disease, these conditions affects countries worldwide but with a growing trend in developing countries. Diabetes and hypertension, apart from other disabilities, can lead to IHD. IHD is the most common. serious, chronic, life-threatening illness in the United States, where 13 million persons have IHD of which >6 million have angina pectoris, and >7 million have sustained myocardial infarction [1]

These conditions are also a major cause of mortality and morbidity in the Asia-Pacific region and account for around half of the global burden i.e. around seven million deaths and 129 million disability-adjusted life years (DALYs) annually from 1990 to 2010. (WHO) [2] [3] [4] [5] [6] .The epidemiologic characteristics of acute myocardial infarction(AMI) have changed dramatically over the past three to four decades. Since 1987, the adjusted incidence rate of hospitalization for acute myocardial infarction or fatal coronary artery disease in the United States has declined by 4 to 5% per year [7] [8] Nevertheless, approximately 5,50,000 first episodes and 200,000 recurrent episodes of acute myocardial infarction occur annually. Globally, ischemic heart disease has become the leading contributor to the burden of disease as assessed on the basis of disability-adjusted life-years. [9] Use of thrombolytic strategies like Streptokinase has been prevalent since decades, and there was significant reduction of mortality after the thrombolytic therapy. Reperfusion arrhythmias has been considered as successful markers of reperfusion. And the studies regarding consideration of

reperfusion arrhythmias as a marker of reperfusion has been going on since decades. So the main aim of this study is regarding whether reperfusion arrhythmias can be considered as prognostic indicators for thrombolysis or not. Thus aim of this study is to know the prevalence of reperfusion arrhythmias during and within 48 hrs of i.v streptokinase therapy. To assess the prognosis of MI secondary to thrombolytic therapy, To assess whether reperfusion arrhythmias are the non invasive markers of successful thrombolysis by means of the electrocardiogram.

Material and Methods

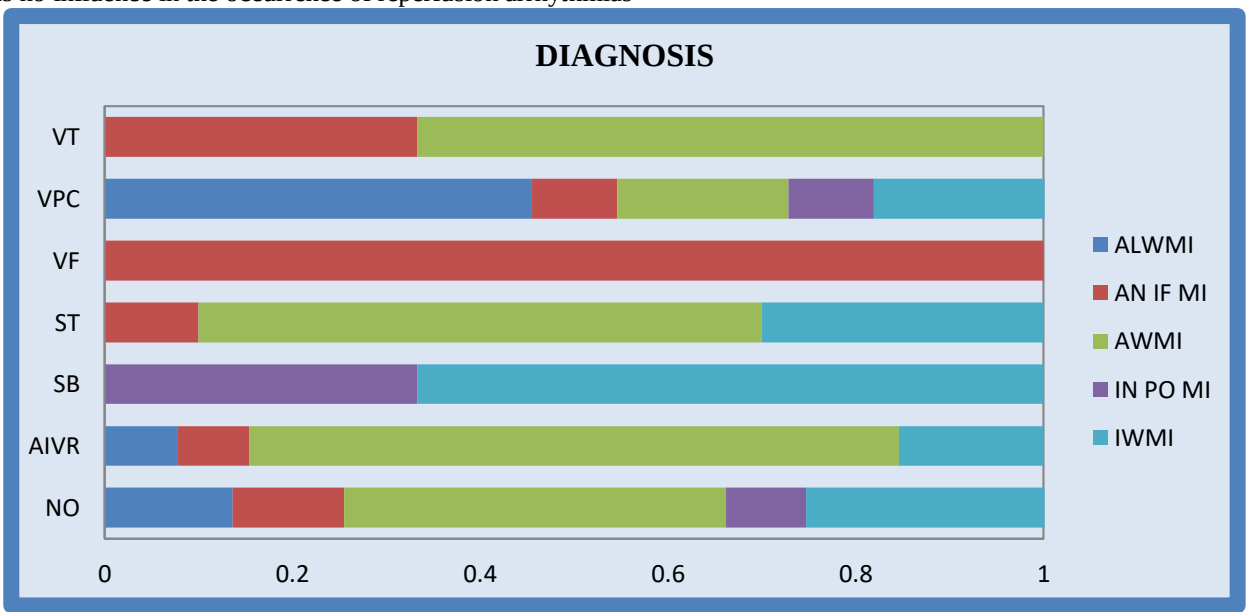
The data of patients treated by either thrombolysis or percutaneous coronary intervention with a diagnosis of acute ST elevation myocardial infarction followed in Dr.Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation, Chinnaoutpalli tertiary care, teaching hospital in South India between the years November 2015and November 2017, 100 patients were evaluated retrospectively in this study. Patients with non-ST elevation myocardial infarction, unstable angina pectoris, cardiac conduction system disorders, permanent pacemakers, mechanical ventilation support, cardiogenic shock, and survivors of cardiac arrest due to acute myocardial infarction were excluded from the study group in addition to the individuals to whom rescue PCI was performed following the first 24 hours of thrombolytic therapy. The diagnosis of STEMI was based on recently published criteria of the European guidelines [4]. Time of diagnosis, patient age, gender, height, weight, hypertension, diabetes mellitus, history of previous MI, smoking, ECG, lipid profile, urea, creatinine, blood glucose, troponin I, and potassium values were recorded. Assessment of reperfusion arrhythmias during and within 48 hrs of thrombolytic therapy using ECG.

RESULTS

Total numbers of patients were 100 and were divided into 5 age groups and each age group to two sex groups. 35-45,46-55,56-65,66-75 and 76-85years. Relation of reperfusion arrhythmias with age groups in study group. There was no relation as p value is insignificant, age, sex, smoking, alcohol consumption, diabetes, hypertension, with window period and types of MI has no influence in the occurrence of reperfusion arrhythmias

DIAGNOSIS	Reperfusion Arrythmias				Total	
	No		Yes			
	Count	%	Count	%	Count	%
ALWMI	8	13.6%	6	14.6%	14	14.0%
AN IF MI	3	5.1%	2	4.9%	5	5.0%
AN INF MI	4	6.8%	3	7.3%	7	7.0%
AWMI	24	40.7%	19	46.3%	43	43.0%
IN PO MI	5	8.5%	1	2.4%	6	6.0%
IN POSTMI	0	0.0%	1	2.4%	1	1.0%
IWMI	15	25.4%	9	22.0%	24	24.0%
Total	59	100.0%	41	100.0%	100	100.0%
Chi-square value = 3.24; df= 6; P=0.778						

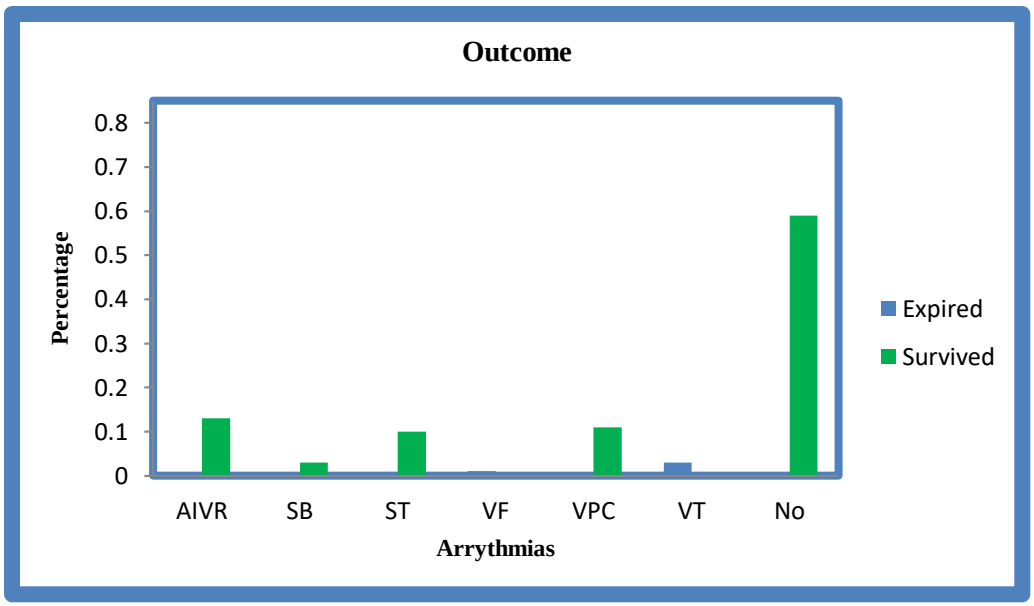
Table 1: Relation of reperfusion arrhythmias with Type of MI in study group. There was no relation as p value is insignificant, Type of Ml has no influence in the occurrence of reperfusion arrhythmias



Graph 1: Distribution of various reperfusion arrhythmias in different types of Myocardial infarction

Table 2: Distribution of various reperfusion arrhythmias in different types of Myocardial infarction

DIAGNOSIS	ARRYTHMIAS														Total	
	N		AIVR		SB		ST		VF		VPC		VT			
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
ALWMI	8	13.6%	1	7.7%	0	0.0%	0	0.0%	0	0.0%	5	45.5%	0	0.0%	14	14.0%
AN IFMI	7	11.9%	1	7.7%	0	0.0%	1	10.0%	1	100.0%	1	9.1%	1	33.3%	12	12.0%
AWMI	24	40.7%	9	69.2%	0	0.0%	6	60.0%	0	0.0%	2	18.2%	2	66.7%	43	43.0%
IN POMI	5	8.5%	0	0.0%	1	33.3%	0	0.0%	0	0.0%	1	9.1%	0	0.0%	7	7.0%
IWMI	15	25.4%	2	15.4%	2	66.7%	3	30.0%	0	0.0%	2	18.2%	0	0.0%	24	24.0%
Total	59	100.0%	13	100.0%	3	100.0%	10	100.0%	1	100.0%	11	100.0%	3	100.0%	100	100.0%



Graph 2: Types of Reperfusion Arrhythmias and their relation to outcome in study group

OUTCOME	Reperfusion Arrythmias				Total	
	No		Yes			
	Count	%	Count	%	Count	%
Expired	0	0.0%	4	9.8%	4	4.0%
Survived	59	100.0%	37	90.2%	96	96.0%
Total	59	100.0%	41	100.0%	100	100.0%
Chi-square value = 5.99; df= 1; P=0.014						

Table 3: Relation of reperfusion Arrhythmias to out come in study group.
There was significant relation to reperfusion arrhythmias and outcome of the study group as P value was significant.

DISCUSSION

Arrhythmias and conduction disturbances are common during the early hours after an acute MI and a major cause of death in the pre-hospital phase. The occurrence at greatest frequency before or during thrombolysis indicates that ongoing myocardial ischemia and reperfusion injury are major determinants for arrhythmias and conduction disturbances.

STEMI is treated during early window period of 8hrs with streptokinase or primary percutaneous intervention. Early thrombolysis is associated with good prognostic outcome of Acute MI. According to various studies and literature reperfusion arrhythmias during and within 48 hrs of thrombolysis is associated with good prognosis.

This study was done to show prevalence of reperfusion arrhythmias in STEMI during and within 48hrs of streptokinase therapy in different age and sex groups. The study population were divided into 5 different age groups. 35-45,46-55,56-65,66-75,76-85 age groups. 28% of people belong to 46-55,26% to 66-75,16% belongs to 56-65,15% to 35-45 and 76-85 years. This is comparable with study done by Kakade SV et al. [10]The Maximum incidence of acute STEMI was seen between 45-75 years was 70%. Incidence of this study almost compares well with incidence being 85% between 35 years and 75 years of age as reported by Martin TC et al in 2007) Age incidence is probably more common because of life style, economic status and multiple risk factors and life expectancy,
In this study there are 57% males and 43% females in contrary with study done by [11] Martin TC et al, where incidence was 72% in males and 28% in females, and by Kock HL et al [12] where 72% were males and 24% were females. It is more common among males because of life style and more risk factors like hypertension, smoking, diabetes mellitus and alcohol.
In this study 70% of patients presented with chest pain, 15 % with SOB, 15% with both. It is compared to study by Mhatre MA et al. [13] which shows the pattern and incidence of various symptoms of acute MI in which 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.

RISK FACTOR AND MI

Incidence of type 2 diabetes mellitus was 38% in the present study as compared to 19% in Svensson AM et al [14]study of 2007, study shows a higher incidence of Type2 DM in Acute Ml pts, indicating DM is a major risk factor in MI. In the present study, 53% had hypertension showing higher prevalence of Acute MI in disease groups which is in agreement with Kokubo Y et al [15] study in 2008. According to study done by DUNN 1983. Both systolic and diastolic hypertension increase the risk of a myocardial infarction and the higher the pressure, the greater the risk. Even when other major risk factors are absent, the increased risk still exists. The immediate and long-term mortality after infarction in patients with hypertension is increased. 23% of patients are associated with Smoking, which is a risk factor for acute MI, 38% are associated with alcohol consumption, however several studies show that mild alcohol consumption has a protective role in ACS(Acute Coronary Syndrome) where as large amounts and binge intake is associated with acute MI. Role of alcohol as a risk factor is still controversial.

TYPES OF MI

5 different groups of STEMI -AWMI -43%,IWMI- 24% ALWMI-14%, AN INF MI-12%, IN PO MI-7% are in our study grop. When compared to study done by Sarala. H. Tippannavar [16] in which most of patients (83%) had ST segment elevation MI of which 34% had extensive anterior wall MI, 23% had inferior wall MI, 14% had anteroseptal wall MI, 6% had inferior wall with RV extension, 3% had lateral and anterolateral wall MI each, and non-ST elevation MI patients were 17%.
All patients in the study group were given streptokinase 1.5 million units i.v for thrombolysis after excluding the contra indications and were monitored during and at 48 hrs for arrhythmias, limitation of study was it doesn't includes all the types of MI, like lateral septal MI
Due to random sample collection, percentage of people in the groups were also not the same.

REPERFUSION ARRYTHMIAS AND THROMBOLYSIS

The term, reperfusion arrhythmias, was used in the first studies of thrombolytic therapy guided revascularization in acute myocardial infarction. To confirm the presence of vessel patency and successful reperfusion of the myocardium following thrombolytic therapy, electrocardiographic data in addition to clinical and laboratory measures are used by the clinicians. These include normalization or more than 50% regression of ST elevation, T-wave inversion, and any other arrhythmia observed in electrocardiography. The most frequently observed arrhythmias that are defined as reperfusion arrhythmias are ventricular premature contractions, sustained or non sustained episodes of ventricular tachycardia, accelerated idioventricular rhythm, atrial fibrillation, and ventricular fibrillation. These arrhythmias are thought to be indicators of successful reperfusion.

According Jurkovicová O, Cagán S [17] study, Reperfusion arrhythmias originate as a consequence of the complex of cellular and humoral reactions accompanying the opening of coronary artery. As the primary cause of their generation are considered the chemically defined substances that are produced and accumulated in myocardium during reperfusion. The key role is oxygen radicals but of importance are also other substances such as calcium, thrombin, platelet activating factor, inositol triphosphate, angiotensin II and others. ascribed to free These chemical mediators of reperfusion arrhythmias operate as modulators of cellular electrophysiology causing the complex changes at the level of ion channels.
It is supposed that in the genesis of reperfusion arrhythmias unlike ischemic arrhythmias operate nonreentrant mechanisms such as abnormal or enhanced automaticity and triggered activity due to after depolarizations. Reperfusion arrhythmias are an important noninvasive marker of successful recanalization of infarction-related coronary artery.

INCIDENCE AND RISK FACTORS RELATION

In this study, incidence of REPERFUSION ARRHYTHMIAS are 41% As compared to Ersan Tatli et al study [18] which shows (88.7%) reperfusion which were lesser incidence in this study group, the maximum incidence of reperfusion arrhythmias was present in age group of 46-55 years i.e 28% followed by 66-75 i.e 26%,56-65-16%, 35-45 and 76-85-15%, and the p value for age groups was not significant. This study shows there was no statistical significance between age group and arrhythmias.

RA is present in 57% males and 43% females the p value was not significant for sex, there was no statistical significance between sex group and arrhythmias. Where as reperfusion arrhythmias in diabetics are 38%, the p value was significant for DM. This study shows there was statistical significance between Diabetics and arrythmias. Incidence of RA in hypertension are 53%, although HTN is a risk factor for MI, the p value was not significant between reperfusion arrhythmias and HTN, hence no statistical significance. In alcoholics the incidence of RA was 9%, and the p value was not significant, in Smokers are 34%, and the p value was not significant between reperfusion arrhythmias and smoking. In this study type of Ml and window period of hospital presentation and arrythmias have no statistical significance

TYPES OF ARRYTHMIAS

ACCELERATED IDIO-VENTRICULAR RYTHMN(AIVR)

In this study 13% of patients develops AIVR. It is most common type of reperfusion arrhythmias in this study group. it is most common in AWMI Accelerated Idioventricular Rhythm (AIVR) was defined as ventricular rhythm with a rate of 60 to 125 beats/minute and frequent episodes of "slow ventricular tachycardia,"

As compared to Ersan Tatli et al [19] where there was 73.3% of AIVR in patients with thrombolytic group, in this study although the percentage is low, but it was most common arrhythmias noted in study group. In a study by Terkelsen et al., the most common arrhythmia observed was AIVR (42%). In a study by Chiladakis, [20] the presence of AIVR combined with normalization of ST segments was demonstrated to indicate successful reperfusion in patients treated with Thrombolytics

However [21] Gore et al and [22] Hacket et al. does not find AIVR to be associated with successful reperfusion indicating ventricular rhythm may be a marker of early reperfusion and continuing arterial patency. In a previous study, the presence of accelerated idioventricular rhythm combined with normalization of ST segments was demonstrated to indicate successful reperfusion in patients treated with thrombolytics and there was no requirement for emergency coronary angiography and rescue percutaneous coronary intervention (PCI) in this group of patients. Among these, AIVR was the most sensitive and specific arrythmia in cases of successful reperfusion.

	Ersan Tatli et al	Terkelsen et al	Present study
AIVR	73.3%	42%	13%

Table 4: AIVR incidence post thrombolysis comparison studies in ST elevation MI

SINUS TACHYCARDIA

In this study sinus tachycardia was present in 10% which is mostly seen in AWMI-6% IWMI-3%,as compared to Sarala. H. Tippannavar, study [16] where the incidence is 22%, it was so low in this study, there is no mortality in this patients with sinus tachycardia, in contrary to CrimmA et al [23] were the mortality incidence was 23.72%,in which it was shown that sinus tachycardia is associated with adverse outcomes.

SINUS BRADYCARDIA

Sinus bradycardia was most commonly associated with inferior wall myocardial infarction. In the present study, 3%had sinus bradycardia, out of which 2% were of inferior wall MI

Where as in study made by Michel Rotman et al. 1 (10-30%), Philip J Podrid, [24] where 16% to 25% patients had sinus bradycardia particularly of inferior wall Ml and posterior wall MI. It was most often transient. 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. In the present study 3% had SB, out of which 2 were purely in inferior and 1 in inferior + posterior wall Ml. In all these patients, SB was transient and majority of the patients had normal sinus rhythm (NSR) by the end of 1 st day. All the patients had NSR at discharge. Similar observations were made by Swart G et al. [25] 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. [26] Occasionally they may progress to complete heart block, treatment with atropine and i.v fluids and inotropes may be needed, occasionally may need pacemaker implantation

VENTRICULAR ARRHYTHMIAS

In this study over all 15% Ventricular arrhythmias are seen, VF 1%, VT 3%, VPC-11%, when compared to [27] Henkel DM, Witt BJ et al studies the incidence

was low In Ravi Kumar Navsk study 2015, ba Ventricular arrhythmias were present in 32% of them of which 24% had Ventricular Tachycardia (VT) and 28% had Ventricular Premature Beats (VPB). In Sarala. H. Tippannavar et al [16] Ventricular arrhythmias were seen in 31 cases of which VPBs in 23 cases, VT in 6 cases, VF in 2 cases. Study conducted by Julain Villacastin [28] showed total incidence of VPC 12% and VT 18% and Mossimo Zoni Berisso et al[29] showed 19.7% VPCs and VT 6.8%. Mhatre MA et al. [13] shows the overall incidence of ventricular arrhythmias being 33% of which VT was 24%, VPC, were 8% and ventricular bigeminy being 1%. Also overall incidence is more in anterior and lateral wall MI than inferior wall alone

VENTRICULAR PREMATURE COMPLEXES

Data from the Gruppo Italiano per lo Studio della Sopravvivenza dell'infarto Miocardico study demonstrated that 64% of patients who had MI then had ventricular arrhythmia and 20% of patients had more than 10 VPCs per hour when 24-h Holter monitoring was used.

In this study, VPC s are present in 11% population, with 5% in ALWMI,2%IWMI and AWMI each, 1% in IN PO MI, AN IF MI. Which was of low incidence compared to Mohit J Shah et alla study in which VPCs were observed in 31% of the patients when they occurred alone. In Anterior wall MI VPCs were observed in 36.23% of the patient while 23.1% of the patients with Inferior wall MI had VPCs. There is no mortality in VPC s in this study group, which indicates VPC is has a good prognostic significance.

VENTRICULAR TACHYCARDIA

In this study incidence of VT is 3%,2% in AWMI, 1% in AN IF MI. in contrary to study done by Horvat D et al [30]. Where VT was seen more in anterolateral MI than antero-septal MI, In another study, Gibson et al. [31] exhibited the development of VT and VF in 3491 patients with STEMI after thrombolytic therapy, mortality seen in patients with VT was 100% whereas study done by Metal GC and Al-Khatib S [32] was 25.2% and 24% respectively. This discrepancy could be explained by larger infarcts and older age in present study. In this study patients was given i.v lignocaine and D.C SHOCK, but patients didn't survive.

VENTRICULAR FIBRILLATION

In the Framingham Heart Study, the proportion of sudden CAD deaths was 62% in men aged 45-54 years, decreasing to 58% in men aged 55-64 years and to 42% in men aged 65-74 years. According to Kuller, 31% of deaths are sudden in people aged 20-29 years. In this study incidence of VF is 1% AN IF MI, the mortality is 1% Which Indicates that VF is associated with bad prognosis in relation to reperfusion in this study. In the study by Sarala. H. Tippannavarone patient developed VF after reperfusion expired This is consistent with Masood et al. Study that showed the worst arrhythmia after SK injection is ventricular fibrillation 1 Mohit J Shah etal ventricular fibrillation occurred only in 2 of the 100 patients, however with 100% mortality. This study shows a total mortality of 4% i.e associated with VT/VF as compared with the study by [33] Newby KH et al., showed that sustained VT and VF occur in up to 20% of patients with AMI and have been associated with poor prognosis, It is an established fact that primary VF, irrespective of timing, is an independent predictor of in hospital mortality. In the study by [34] Behar S et al., the incidence of secondary VF complicating AMI was 2.4%.

In conclusion there was no significant relation between mortality and reperfusion arrhythmias, there was no significant p value between them, indicating Reperfusion arrhythmias are benign, and was a marker of successful thrombolysis which was comparable with the study done by AVG huran and AJ. Cann. [35]. Thus RA is not an event of serious concern as they are usually well tolerated and are amenable to treatment. They infarct indicate an effective reperfusion when present. Early streptokinase therapy has a favorable impact on mortality in Ml and hence should be tried in all the Acute MI patients who do not have contraindications for streptokinase therapy.

STUDY LIMITATIONS

The major limitation of the study was that it was conducted in small population that may not represent entire population. The study was conducted in those population visiting hospital, Age groups were taken randomly in this study, so the mortality was shown in random sample distribution was not equal among different age groups.

SUMMARY & CONCLUSION

Out of 100 Cases of Acute MI admitted in the present study, 57% were males and 43% were females. Maximum incidence of Acute MI was seen between 4th to 7th Decade of life. Most predominant presenting symptoms are Chest pain (70%). Anterior wall MI(43%)was the most common MI seen in the study group. Inferior wall 24%, Anterolateral 14%, Antero inferior 12%, Infero-posterior 7%. Incidence of diabetes 38%, HTN 53%, Smoking 23% and alcohol 38% each. Reperfusion Arrythmias shows significant correlation with DM, and no relation to HTN, alcohol, smoking, age groups and window period. Reperfusion arrhythmias were observed in 41% patients. AIVR 13% Most common, VPC 11%, Sinus tachycardia 10%, sinus bradycardia 3%, VT 3%, VF 1%. The Incidence of reperfusion arrhythmias were more in Anterior wall MI 19 Cases, Inferior wall MI 9 Cases, ALWMI 6 cases, Antero Inferior 5, Infero-posterior 2 cases. Mortality was seen in 4 Cases who had 3 VT and 1 VF. All patients who developed VT and VF were expired in this study, showing 100% mortality for these arrhythmias occurring commonly in AWMI and AN INF wall MI occurrence of these ventricular arrhythmias are associated with poor prognosis during and post thrombolytic therapy and should be intervened immediately. Patients who developed other arrhythmias like AIVR, VPC, ST, Sinus Bradycardia were reverted to normal without any intervention and survived, indicating these arrhythmias occurring in thrombolytic therapy are benign. In this study there was statistical significance between survival outcome and reperfusion arrhythmias showing an inference that reperfusion arrhythmias occur during and post thrombolytic therapy were mostly benign and indicate successful thrombolysis.

RFRENCES:

1.Elliott M. Antman, Joseph. Loscalzo. Ischemic Heart Disease.Harrison's principles of Internalmedicine.19 edition. chapter293, USA:McGraw-Hill Companies.2015:p. 1578-1579.

2. Daivadanam M. Pathways to catastrophic health expenditure for acute coronary syndrome in Kerala: 'Good health at low cost? BMC Public Health. 2012;12(1):306

3. Dalvadanam M. Thankappan KR, Sarma PS, Harikrishnan S. Catastrophic health expenditure & coping strategies associated with acute coronary syndrome in Kerala, India. The Indian joumal of medical research. 2012 Oct;136(4):585.

4.Ohira T, Iso H. Cardiovascular disease epidemiology in Asia. Circulation Journal. 2013;77(7):1646-52.

5.Huo Y, Thompson P, Buddhari W, Ge J, Harding S, Ramanathan L, Reyes E, Santoso A, Tam LW, Vijayaraghavan G, Yeh HI. Challenges and solutions in medically managed ACS in the Asia-Pacific region: expert recommendations from the Asia-Pacific ACS Medical Management Working Group. International joumal of cardiology. 2015 Mar 15:183:63-75.

6. Vedanthan R. Seligman B. Fuster V. Global Perspective on Acute Coronary Syndrome. Circulation research, 2014 Jun 6;114(12):1959-75.

7. Thygesen K. Alpert JS. Jaffe AS, Simoons ML. Chaitman BR, White HD. Writing Group on behalf of the Joint ESC/ACCF/AHA/WHF Task Force for the Universal Definition of Myocardial Infarction, Authors/Task Force Members Chairpersons, Thygesen K, Alpert JS, White HD. Third universal definition of myocardial infarction, European heart journal. 2012 Aug 24:33(20):2551-67.

8. Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, Das SR, de Ferranti S, Després JP, Fullerton HJ, Howard VJ. Heart disease and stroke statistics-2016 update. Circulation, 2016 Jan 26,133(4):e38-60.

9.Murray CJ, Barber RM, Foreman KJ, et al. Global, regional, and national disability adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990-2013: quantifying the epidemiological transition. Lancet 2015; 386: 2145-91.
10.Kakade SV, Tyagi NK, Kadam RN. Application of logistic regression to estimate prognosis in acute myocardial infarction, Indian joumal of community medicine. 2006 Apr 1;31(2):69,
11.Martin TC, Van Longhuyzen H. Bennett B. Peterson S, Beazer C, Thomas CV. The age-specific incidence of admission to the intensive care unit for acute myocardial infarction in Antigua and Barbuda. West Indian Medical Journal. 2007 Sep;56(4):326-9.
12.Koek HL, De Bruin A, Gast A, Gevers E, Kardaun JW, Reitsma JB, Grobbee DE, Bots ML. Incidence of first acute myocardial infarction in the Netherlands. Neth J Med. 2007 Dec 1:65(11):434-41.

13.Mhatre MA, Sirur FM, Rajpal DR, Shah MR. A clinical study of arrhythmias associated with acute myocardial infarction and thrombolysis. International Journal of Research in Medical Sciences. 2016 Dec 19:5(1):335-43.

14.Svensson AM, Dellborg M, Abrahamsson P, Karlsson T, Herlitz J, Duval SJ, Berger AK, Luepker RV. The influence of a history of diabetes on treatment and outcome in acute myocardial infarction, during two time periods and in two different countries. International journal of cardiology. 2007 Jul 31;119(3):319-25.
15.Kokubo Y, Kamide K, Okamura T, Watanabe M, Higashiyama A, Kawanishi K, Okayama A, Kawano Y. Impact of High-Normal Blood Pressure on the Risk of Cardiovascular Disease in a Japanese Urban Cohort. Hypertension. 2008 Oct 1;52(4):652-9.
16.Sarala, H. Tippannavar, Maharudra, S. Shekhanawar. N. Gunasheelan THE STUDY OF ARRHYTHMIAS FOLLOWING MYOCARDIAL INFARCTION OCCURING WITHIN ONE WEEK : Journal of Evolution of Medical and Dental Sciences/December-2012/Volume 1/Issue 6.
17.Jurkovicová O, Cagán S. Bratisl Lek Listy. Review Slovak 1998 Mar-Apr:99(3- 4):162-71.
18.Ersan Tatli, 1,2 Güray Alicik, 1 Ali Buturak,3 Mustafa Yilmaztepe, 1 and Meryem Aktoz1Arrhythmias following Revascularization Procedures in the Course of Acute Myocardial Infarction: Are They Indicators of Reperfusion or Ongoing Ischemia?The Scientific World Journal Volume 2013, Article ID 160380, 7 pages.
19.Yavagal S.T., Rangarajan R. and Prabhavathi, "Clinical profile of acute myocardial infarction in women.. JIMA, 1993; 92(9)283-284.
20.Chiladakis JA, Vlachos N, Patsouras N, Mazarakis A, Manolis AS. Usefulness of reperfusion ventricular arrhythmias in non-invasive prediction of early reperfusion and sustained coronary artery patency in acute myocardial infarction. Journal of thrombosis and thrombolysis, 2001 Dec 1:12(3):231-6.
21.Gore JM, Ball SP, Corrao JM, Goldberg RJ. Arrhythmias in the assessment of coronary artery reperfusion following thrombolytic therapy. Chest. 1988 Oct 31:94(4):727-30.
22.Hackett D. McKenna W. Davies G. Maseri A, Lowe T. Aber V. Reperfusion arrhythmias are rare during acute myocardial infarction and thrombolysis in man. International journal of cardiology. 1990 Nov 1:29(2):205-13.
23. Crimm A, Severance HW, Coffey K. Mckinnis R, Wagner GS, Califf RM. Prognostic significance of isolated sinus tachycardia during first three days of acute myocardial infarction. The American journal of medicine. 1984 Jun 1:76(6):983-8.
24. Podrid PJ. OArrthymias after acute myocardial infarction. Postgraduate Medicine 1997;102(5):679-88.
25.Swart G. Brady WJ, DeBehnke DJ, John O, Aufderheide TP. Acute myocardial infarction complicated by hemodynamically unstable bradyarrhythmia: prehospital and ED treatment with atropine. The American journal of emergency medicine. 1999 Nov 1:17(7):647-52.
26. Malla RR, Sayami A. In hospital complicationsand mortality of patients of inferior wallmyocardial infarction with right ventricular infarction. JNMA J Nepal Med Assoc. 2007;46(167):99-102.
27.Henkel DM, Witt BJ, Gersh BJ, Jacobsen SJ, Weston SA, Meverden RA, Roger VL. Ventricular arrhythmias after acute myocardial infarction: a 20-year community study. American heart journal. 2006 Apr 30:151(4):806-12.
28.Villacastin J. Almendral J. Arenal A. Albertos J. Ormaetxe J. Peinado R Bueno H. Merino JL. Pastor A. Medina O. Tercedor L. Incidence and clinical significance of multiple consecutive, appropriate, high-energy discharges in patients with implanted cardioverter-defibrilators. Circulation. 1998 Feb 15;93(4):753-62.
29.Zoni-Berisso M, Molini D. Mela GS. Vecchio C. Value of programmed ventricular stimulation in predicting sudden death and sustained ventricular tachycardia in survivors of acute myocardial infarction. The American journal of cardiology. 1996 Apr 1:77(9):673-80.
30. Horvat D, Grman-Fanfani A, Kupres V, Grman J, Šporčić-Jelić V. Frequency of ventricular premature beats and ventricular tachycardia in STEMI treated with fibrinolytics. Collegium antropologicum. 2008 May 8:32(1):99-102.
31.Gibson CM, Pride YB, Buros JL. Lord E. Shui A, Murphy SA, Pinto DS, Zimetbaum PJ, Sabatine MS, Cannon CP, Josephson ME. Association of impaired thrombolysis in myocardial infarction myocardial perfusion grade with ventricular tachycardia and ventricular fibrillation following fibrinolytic therapy for ST-segment elevation myocardial infarction. Journal of the American College of Cardiology. 2008 Feb 5:51(5):546-51.
32.Al-Khatib SM. Stebbins AL. Califf RM. Lee KL. Granger CB. White HD. Armstrong PW, Topol EJ, Ohman EM. Sustained ventricular arrhythmias and mortality among patients with acute myocardial infarction: results from the GUSTO-III trial. American heart journal. 2003 Mar 1;145(3):515-21.
33.Newby KH, Thompson T. Stebbins A, Topol EJ, Califf RM, Natale A. Sustained ventricular arrhythmias in patients receiving thrombolytic therapy. Circulation. 1998 Dec 8:98(23):2567-73.
34.Behar S, Reicher-Reiss H, Shechter M, Rabinowitz B, Kaplinsky E, Abinader E, Agmon J, Friedman Y, Barzilai J, Kauli N, Kishon Y. Frequency and prognostic significance of secondary ventricular fibrillation complicating acute myocardial infarction. The American journal of cardiology. 1993 Jan 15;71(2):152-6.
35.Ghuran AV, Camm AJ. Ischaemic heart disease presenting as arrhythmias. British medical bulletin. 2001 Oct 1:59(1):193-210.