RESEARCH PAPER

A Comparative Evaluation of Thrombolytic Therapy in Myocardial Infarction in Adults Aged <40 Years Versus >40 Years in Relation to Angiographic Findings

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ABSTRACT

Introduction: The greater incidence of heart attack in younger population in the past decade demands that the comparison of thrombolytic therapy in young versus older population in relation to their angiographic characteristics and risk profiles is critical to measure the therapeutic outcome and overall quality of life of the patient. The aim of this study is to evaluate the thrombolytic therapy and compare the differences in the angiographic characteristics and conventional risk factors in MI patients aged <40 years with patients aged >40 years.

Methods: Prospective observational single-center study was conducted over a period of a year, at Mahavir Hospital and Research Center, Hyderabad, Telangana, India. A total of 200 subjects were enrolled for the study. Association between the variables like therapeutic approach, risk factor profiles, and angiographic parameters with the continuous parameter (age) was calculated using Pearson's chi-square test.

Results: Coronary intervention was more common in the age group >40 years. Young patients more often had angiographically normal coronary arteries and single vessel disease than older patients.

Conclusion: MI in young patients is mainly seen in males. Smoking and obesity are the leading modifiable risk factors in individuals <40 years of age. The traditional risk factors like diabetes and hypertension are most common in elder population. Younger population were less likely to undergo surgeries like stents and grafting and were more often to have better prognosis with thrombolytics alone compared to that with older population.

Keywords: Angioplasty, Cardiac imaging, Coronary artery bypass grafting, Heart attack, Treatment, Percutaneous intervention, Streptokinase.

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INTRODUCTION

MI is the irreversible necrosis of the myocardium caused by prolonged ischemia, resulting from a ruptured atherosclerotic plaque and an intracoronary thrombus. [1] Recent studies have shown that Asian countries have the highest recorded MI cases in patients <45 years of age compared to those >60 years. [2] Young and elderly MI patients has different underlying pathophysiological characteristics, atherosclerotic plaque morphology, and risk factors profiles. Young patients frequently have unusual atherosclerotic plaques with inflammatory characteristics, but fewer lesions than older patients [3] Risk factors in MI patients are often categorized as modifiable (treatable) and non-modifiable (cannot be changed) risk factors which include Premature coronary heart disease in the family, Age (elderly), Gender (male). [4] *Treatment of MI:* Risk stratifies the patient and select reperfusion strategy *Fibrinolytic/thrombolytic therapy:* Reperfusion therapy is considered when clinical evidence of reduced blood supply to the heart. [5] If treatment with surgical stents is not possible within 90 minutes of

administration of fibrinolytic therapy, then it can be administered within 12 hours when the patient-first experiences signs of MI [6] *Percutaneous intervention (PCI):* PCI or balloon angioplasty, is performed in patients receiving reperfusion through fibrinolytic therapy when the patient is in the ambulance. The death rate in PCI patients is considerably lower when compared to patients treated only with fibrinolytic/antiplatelets. *Coronary artery bypass grafting (CABG):* Bypass grafts are urgently needed in patients in whom considerable improvement is not seen even after primary stent angioplasty and the patient's condition deteriorates. [7] The commonly grafted arteries are LAD, RCA, LCX, and PDA. [8] Patients for whom grafts have opted have better long-term clinical outcomes when compared to those receiving thrombolytic or stent angioplasty; it helps prevent morbidity by relieving the patient's condition and improving their prognosis. [9]

METHODOLOGY: This study was a hospital-based prospective observational single-center study conducted in 200 subjects with Myocardial Infarction receiving Thrombolytic therapy in the cardiology department of south Indian teaching hospital in Hyderabad, Telangana State (India) after obtaining the approval from Institutional ethics committee. This study was carried out for planned enrolment duration – of a year. The subject's information (demographics details, lab reports, and therapeutic management data) was gathered in a data collection form. To analyze the data collected, SPSS software version 28.1.1 is used. The definite parameters of the patient were interpreted using their descriptive frequencies. Association between the variables with the continuous parameter (age) was calculated using Pearson's chi-square test.

RESULTS:

Out of 200 patients, 70% (n=140) patients were aged more than 40 years, while 30% (n=60) patients were within 40 years of age. Males represented 73.5% (n=147) of patients with myocardial infarction, while 26.5% (n=53) were females. Among the 200 patients, there was a predominance of males, with 105 patients in the age group of >40 years, followed by 42 male patients less than 40 years. The female population was less when compared to males, with 35 patients in the age group of >40 years and 18 patients <40 years of age. 76% (n=152) of patients recorded an average healthy weight, with 10.5% (n=21) being overweight. The obese patients were further classified into 5.5% (n=11) patients in obese class I, followed by 4.5% (n=9) in obese class II, and 3.5 (n=7) in obese class III.

Table 1: Distribution of subjects according to patient's social history:

Social History	Frequency (n=200)	Percentage (%)
No history	81	40.5
Smoking	47	23.5
Alcoholism	13	6.5
Tobacco chewer	14	7.0
Multiple	45	22.5

40% (n=81) of patients had no social history. Smoking in 23.5% (n=47) patients was recorded to be the most common type of social history, followed by tobacco with either tobacco chewing or alcoholism in about 22.5% (n=45) patients, alcoholism was found in 6.6% (n=13) patients, and tobacco chewing in 7% (n=14) of patients.

Table 2: Distribution of subjects according to patient's medical history:

Medical History	Frequency (n=200)	Percentage (%)
No history	61	30.5
Diabetes mellitus	21	10.5
Hypertension	29	14.5
Diabetes mellitus and hypertension	41	20.5
Other diseases	18	9
More than 3 diseases	30	15

In 30% (n=61) of patients, there was no medical history. Diabetes mellitus, along with hypertension, was found to be the most common co-morbidity in about 20.5% (n=41) of patients, followed by Diabetes

and hypertension with other diseases like anemia/ chronic kidney disease/hypothyroidism/ liver diseases/ chronic obstructive pulmonary disease/asthma in 15% (n=30) patients. Hypertension alone was found in 14.5% (n=29) patients, and diabetes in10.5% (n=21) of patients. In about 9% (n=18) of patients, diseases other than Diabetes and hypertension like urosepsis, hepatic dysfunction, cancer, hypothyroidism, atherosclerosis, chronic obstructive pulmonary disease, and seizures were found.

Table 3: Distribution of subjects according to risk factors:

Risk factors	Frequency (n=200)	Percentage (%)
No risk	13	6.5
Risk score=-I	67	33.5
Risk score=II	78	39
Risk score=III	34	17
Risk score=IV	6	3
Risk score=V	2	1

Among the 200 patients, 39% (n=78) of patients had a risk score of 2 which means these patients had at least two risk factors commonly present in a patient with MI, followed by 33.5% (n=67) patients having a risk score of 1. A risk score of 3 is recorded in 17% of patients, and about 6.5% (n=13) of patients showed no risk factors. 3% (n=6) of patients showed a risk score of 4, and 1% (n=2) of patients had five risk factors making the risk score 5.

Table 4: Distribution of subjects according to type of infarct:

Type of infarct	Frequency (n=200)	Percentage (%)
Anterior	99	49.5
Anteroseptal	5	2.5
Anterolateral	17	8.5
Inferior	56	28
Posterior	2	1
Inferior posterior	18	9
Inferior anterior	3	1.5

Anterior infarct was found in 49.5% (n=99) of patients, followed by inferior infarct in 28% (n=56) of patients. In 9% (n=18) of patients, inferior posterior infarct was seen, while anterolateral infarct in 8.5% (n=17) of patients, followed by anteroseptal in 2.5% (n=5) patients, inferior anterior in 1.5% (n=3) patients, and 1% (n=2) in patients with posterior infarct.

Table 5: Distribution of subjects according to the type of vessel disease:

Type of vessel disease	Frequency (n=200)	Percentage (%)
Normal	48	24
SVD	72	36
DVD	39	19.5
TVD	41	20.5

Single vessel disease was the most common type of vessel disease in 36% (n=72) 0f patients. Normal coronaries with no vessel type of disease were seen in 24% (n=48) of patients, whereas 20.5% (n=41) of patients showed triple vessel disease, and 19.5% (n=39) patients had double vessel disease.

Table 6: Distribution of subjects according to the type of thrombolytic therapy:

Type of thrombolytic therapy	Frequency (n=200)	Percentage (%)
No	3	1.5
Streptokinase	163	81.5
Reteplase	21	10.5
Urokinase	1	0.5
Tenecteplase	12	6

In almost 81.5% (n=163) of patients, Streptokinase was the most common thrombolytic used, followed by Reteplase in 10.5% (n=21) patients, Tenecteplase in 6% (n=12) patients, and urokinase in 0.5% (n=1) of patients. 3 patients (1.5%) were not treated with any thrombolytic therapy.

Table 7: Distribution of subjects according to the type of angioplasty:

Type of angioplasty	Frequency (n=200)	Percentage
Normal	117	58.5
CABG LAD	5	2.5
PTCA LAD	31	15.5

PTCA RCA	12	6
PTCA LAD RCA	11	5.5
PTCA LAD RCA LCX	2	1
PTCA LAD LCX	5	2.5
PTCA LCX	3	1.5
CABG TVD	10	5
PTCA RCA LCX	4	2

Coronary angiographic characteristics among these patients revealed 58.5% (n=117) had normal angiogram. In 68 patients (34%) who underwent PTCA, 15.5% (n=31) of patients had LAD as the target vessel, in 12 patients (6%) RCA was the target vessel, followed by 5.5% (n=11) with LAD and RCA as target vessel, stents in LAD and LCX in 2.5% (n=5) patients, with target vessel as RCA and LCX in 2% (n=4) patients, and LCX in 1.5% (n=3) of patients, LAD, RCA and LCX was the target artery in 1% (n=2) patients. CABG with grafting at three arteries was found in 5% (n=10) patients, and CABG at LAD was found in 2.5% (n=5) of patients.

Table 8: Association of age groups with risk factor profile and angiographic characteristics:

Parameters	**Age (in years) (n=200)**		**p-value**
	<40	**>40**	
Angioplasty			
Yes	18	42	0.01
No	67	73	
Type of infarct	27	72	
Anterior	3	2	
Anteroseptal	4	13	
Anterolateral	22	34	0.2
Inferior	0	2	
Posterior	3	15	
Inferior posterior	1	2	
Inferior anterior			
Ejection fraction	1	3	
Normal	51	108	
Mild	7	29	0.2
Moderate	1	0	
Severe			

The association of age as a continuous factor with the dependent variable as acute MI was determined by adjusting the various parameters like risk factors, type of vessel disease, kind of infarct, ejection fraction, and the kind of angioplasty in these patients. The related terms were entered to compare the strength of association between age and the various parameters, and the p-value for these terms was calculated. For associations, a p-value of less than 0.05 was regarded as significant. The association between age as a continuous factor and angioplasty was highly significant, with a *p*-value of 0.01. Only 18 patients below the age group of 40 had undergone angioplasty, and 42 patients aged >40 years. Anterior type of infarct was the most common in both the age groups with a *p*-value of 0.2; the kind of infarct showed no significant association with the age. The ejection fraction was found to be majorly falling within 40%-49% in both the age groups. No significant association (p=0.2) was found between the age of the patient and the ejection fraction recorded in the angiogram.

Table9: Association of age groups with risk factor and vessel type

Parameters	**Age (in years) (n=200)**		**p-value**
	<40	**>40**	
Vessel type			
Normal	20	28	
Single vessel disease	28	44	0.002
Double vessel disease	6	33	
Triple vessel disease	6	35	
Risk factor			
No risk	9	4	
Risk score I	19	48	
Risk score II	22	56	
Risk score III	7	27	0.0006
Risk score IV	1	5	
Risk score V	2	0	

The type of vessel disease and age showed a highly significant association with a *p*-value of 0.002. Based on the type of the vessel disease, a more substantial population showed single vessel disease followed by triple vessel disease. Our study showed that the least number of patients have DVD. Furthermore, 48 patients had normal coronary arteries. There showed a significant association between the risk factors in the two age groups. Individuals aged >40 years were found to have a higher risk of MI and subsequent

hospital admission. Most patients had at least two risk factors recorded to influence heart attack. Diabetes presented with hypertension was frequently seen at risk in the age group >40 years. Although type of infarct is an important parameter for the selection of therapy, it's association was not found to be statistically significant. The therapeutic approach showed a significant association with the risk factor profile and the type of vessel disease, where the individuals aged <40 years had a comparatively lower risk and angiographically normal coronary arteries which influenced the selection of therapy. Hence, reperfusion through surgical intervention were less common in these patients.

DISCUSSION:

L Chouhan et al [10] , in their study, recorded 62 patients to be above 35 years of age, contrary to this in our research, 70% (140) were found to be older than 40 years, shows similarity to the study conducted by Sadiq et al [11] , in which 84% (236) were >40 years. Majority of the patients in our study were found to have more than one risk factor associated to MI. In our study, diabetes with hypertension is the most common risk factor 20.5% (41), which is similar to the survey conducted by Srinivasa J et al [12] , where hypertension along with diabetes is the primary risk factor (20%). Smoking was the most common 23.5% (47) preventable risk factor in the patients, especially in the younger population; this was the study conducted by Santosh et al [13]. Single vessel disease was frequently seen in our study 36% (72), similar to the survey conducted by Santosh et al., where SVD was found in 61% (58) of patients. AWMI in 49.5% (99) of patients was found to be the most common type of MI reported by Rajeev et al [14]. where AWMI was seen in 88 patients (70.9%) All of the 200 patients in the study received thrombolytic therapy, with the majority, 81.5% (163), receiving Streptokinase as the thrombolytic therapy. The target vessel that was majorly seen among the patients was LAD 15.5% (31), similar to the study conducted by Rajeev et al. Thrombolytic therapy was found to be effective in individuals aged <40 years owing to their comparatively normal angiographic characteristics, as only 9% of these patients were followed for reperfusion through angioplasty. The differences in the risk factor profiles and angiography reports influence treatment selection, as reported by L. Chouhan et al.; in their study. Angioplasty was most common in the age group >40 years.

CONCLUSION

There was a progressive increase in age-related hospital admissions after MI. More often than not, MI in younger people is mainly seen in males. Smoking and obesity are the leading modifiable risk factors in individuals <40 years of age. There is a difference in the pattern of risk profile and angiographic findings in older patients. The traditional risk factors are more common. Single vessel disease (SVD) is most commonly seen in both the populations followed by DVD and TVD. AWMI, anterior infarcts are most commonly seen in those below 40 years of age. Younger patients were less likely to undergo pharmaco invasive strategies like stents and grafting owing you their lower risk of MI and relatively normal angiographic profiles. With this prevalence rate in the younger population, every individual needs to take precautionary steps. There must be enough awareness and education about the risk factors commonly presented in MI patients, which may allow for better prevention strategies of cardiovascular disease, provide counseling on smoking cessation and lifestyle modification, and grow awareness about the early diagnosis and treatment as most of the patients present late in the disease state.

Conflict of interest: We have no conflict of interest to disclose.

Ethical considerations: All 200 participants were provided informed consent form before the Commencement of the study. The institutional ethics committee of Mahavir hospital and research center, with moral support (Reg No: ECR/450/Inst/AP/2013), granted the ethics approval. Permission was also obtained from the cardiology inpatient ward. Confidentiality of the acquired patients' information was maintained throughout the study.

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