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Clinical Outcomes and Risk Factor in Patients with STEMI Treated with Percutaneous Coronary Intervention

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Abstract

This study was carried out to analyze risk factors and short-term clinical outcomes in different age groups of Indian patients with ST-elevation myocardial infarction who underwent percutaneous coronary intervention. This prospective, non-randomized, and observational study was carried out at a tertiary care hospital. The patients who were treated with primary percutaneous coronary intervention for ST-elevation myocardial infarction at study center from December 2011 to September 2012 were included in the study. Study population is divided into three groups: Group-I consisted of patients with age ≤ 40 years, Group-II consisted of patients with age between 41 - 60 years and Group-III consisted of patients with age > 60 years. The primary end-point of the study was occurrence of major adverse clinical outcomes which were a composite of death, reinfarct, repeat percutaneous coronary intervention, major bleeding and emergency coronary artery bypass grafting at 30-day follow-up. A total of 200 patients with ST-elevation myocardial infarction who underwent percutaneous coronary intervention were included in the study. Among study population, 10 (5%) patients constituted Group-I, 96 (48%) patients constituted Group-II and 94 (47%) patients constituted Group-III. Diabetes (0% vs. 35.4% vs. 43.6%) and hypertension (10% vs. 35.4% vs. 44.7%) were more prevalent in Group-III as compared to Group-II and Group-I. The prevalence of single vessel disease was significantly higher in the Group-I compared to Group-II and Group-III (80% vs. 41.66% vs. 17%). At 30-day clinical follow-up, the rate of occurrence of major adverse clinical outcomes in Group-I, Group-II and Group-III is 0%, 2% and 5.4%, respectively. The young ST-elevation myocardial infarction patients had lower incidences of diabetes and hypertension compared with elderly patients. The young age group had more favorable in-hospital and 30-day clinical outcomes.

Keywords

ST-Elevation Myocardial Infarction, Risk Factor, Clinical Outcomes, Epidemiological Study,

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1. Introduction

Acute myocardial infarction (AMI) is the leading cause of death of patients hospitalized for coronary artery disease (CAD) [1] [2]. The Framigham study reported a ten-year incidence rate of myocardial infarction (MI) 12.9 in men 30 - 34 years old and 5.2 in women of 35 to 44 years old [3]. However, literature search has showed that much attention has been focused on older patients due to the fact that age is independently associated with higher mortality [4].

AMI among young patients aged 40 years or younger is rare, accounting for approximately 2% to 6% of all cases [3] [5] [6]. The lifestyles of young people, characterized by high work stress, overwork, physical inactivity, unhealthy diet, smoking and drinking alcohol likely cause coronary atherosclerosis, which increases the incidence of AMI [7]. Thus, clinical interest has been increased to study this group because of the potential of premature death and long-term disability [8]. Moreover, they are an important group to examine with regard to risk factor modification and secondary prevention.

Studies which compared risk factors, angiographic profile and clinical outcomes in young patients with STEMI from the elderly counterparts showed higher prevalence of smoking, hyperlipidemia and family history as well as lower prevalence of hypertension and diabetes in young patients with STEMI. Moreover, young patients with STEMI were more likely to have single vessel disease [3] [9]-[12]. However, these studies which analysed risk factors and compared survival among young patients with ST-elevation myocardial infarction (STEMI) with their older counterparts enrolled either mixed MI population or conducted in the thrombolytic era [6] [13]. As there were differences in risk factors and prognosis in different age groups, the present study was carried out to study risk factors and short-term clinical outcomes in different age groups of real-world patients with STEMI who underwent percutaneous coronary intervention (PCI).

2. Material and Methods

2.1. Study Design and Patient Population

This was a prospective, non-randomized, and observational study. We included all the patients who were treated with primary PCI for STEMI in Pariyaram Medical College from December 2011 to September 2012. Study population is divided into three groups: Group-I consisted of patients with age ≤ 40 years, Group-II consisted of patients with age between 41 - 60 years and Group-III consisted of patients with age > 60 years. The protocol of the study was approved by institutional ethics committee before the commencement of the study.

The patients' demographic information, cardiovascular history and risk factors such as, smoking, dyslipidemia, hypertension, diabetes mellitus, and family history were recorded. Dyslipidemia was defined based on total cholesterol, high-density lipoprotein and low-density lipoprotein level or use of lipid-lowering therapy by the patient. Hypertension was considered if systemic blood pressure was ≥140/90 mmHg or if patient was receiving treatment for hypertension. Diabetes mellitus was defined as fasting blood sugar ≥ 120 mg/dl or the use specific treatment.

Pre-procedural ventricular functional assessment, mitral regurgitation and ventricular septal rupture were carried out in all patients by two-dimensional echocardiography. Significant coronary artery stenosis was defined as at least a 75% reduction in the internal diameter of the right, left anterior descending or left circumflex coronary arteries and their major branches, or a 50% reduction in the internal diameter of the left main trunk. Successful reperfusion was defined as the establishment of TIMI grade-III flow in the infarct-related artery on the final coronary angiography.

Primary end-point of the study was occurrence of major adverse clinical outcomes (MACO) defined as a composite of death, reinfarct, repeat PCI, major bleeding, Emergency Coronary artery bypass grafting (CABG) at 30-day follow-up.

2.2. Statistical Analysis

Continuous variables were presented as mean ± standard deviation (SD) and categorical variables as counts and

percentages. All data were analysed using the Statistical Package for Social Sciences (SPSS; Chicago, IL, USA) program, version 13.

3. Results

3.1. Baseline Characteristics

A total of 200 STEMI patients who underwent PCI were included in the study. The baseline clinical characteristics and risk factors in different age groups are depicted in **Table 1**. Among study population, 10 (5%) patients constituted Group-I (patients aged < 40 years), 96 (48%) patients constituted Group-II (patients aged between 40 - 60 years) and 94 (47%) patients constituted Group-III (patients aged > 60 years). Diabetes (0% vs. 35.4% vs. 43.6%) and hypertension (10% vs. 35.4% vs. 44.7%) were more prevalent in Group-III as compared to Group-II and Group-I.

3.2. Angiographic and Interventional Therapy Data

Angiographic findings as well as characteristics and results of coronary intervention have been shown in **Table 2** and **Table 3**, respectively. The prevalence of single vessel disease was significantly higher in Group-I as compared to Group-II and Group-III (80% vs. 41.66% vs. 17%). None of the patients in Group-I was treated for STEMI in the left main artery.

3.3. In-Hospital and 30-Day Clinical Outcomes

Table 4 shows in-hospital clinical outcomes and clinical outcomes during 30-day follow-up. During follow-up, 12 patients lost. None of the patients in Group-I experienced MACO at 30 day clinical follow-up during hospitalization. The rate of occurrence of MACO during hospitalization in Group-II and Group-III is 6.2% and 4.3%, respectively. At 30-day clinical follow-up, the rate of occurrence of MACO in Group-II and Group-III is 2% and 5.4%, respectively.

Table 1. Baseline clinical characteristics and risk factors of STEMI patients in different age groups.

Clinical characteristics	Age group of STEMI patients		
	Group-I n = 10	Group-II n = 96	Group-III n = 94
Age, mean ± SD	36.5 ± 3.4	54.3 ± 8.2	68.4 ± 7.2
Female, n (%)	2 (20%)	13 (13.5%)	20 (21.3%)
History of myocardial infarction, n (%)	2 (20%)	4 (4.2%)	0 (0%)
Risk factors			
Dyslipidemia, n (%)	2 (20%)	22 (22.9%)	15 (16%)
Diabetes, n (%)	0 (0%)	34 (35.4%)	41 (43.6%)
Hypertension, n (%)	1 (10%)	34 (35.4%)	42 (44.7%)
Smoker, n (%)	4 (40%)	48 (50%)	30 (31.9%)
Previous myocardial infarction	0 (0%)	4 (4.2%)	5 (5.3%)
Chronic kidney disease, n (%)	0 (0%)	0 (0%)	2 (2.1%)
Cerebrovascular accident, n (%)	0 (0%)	3 (3.1%)	2 (2.1%)
Peripheral vascular disease, n (%)	1 (10%)	3 (3.1%)	1 (1.1%)
KILLIP class 3/4, n (%)	1 (10%)	9 (9.4%)	16 (17.0%)
Severe left ventricular dysfunction, n (%)	0 (0%)	2 (2.1%)	3 (3.1%)
Ventricular septal rupture, n (%)	0 (0%)	1 (1%)	1 (1.1%)

Table 2. Angiographic findings of STEMI patients.

Angiographic findings	Age group of STEMI patients		
	Group-I n = 10	Group-II n = 96	Group-III n = 94
Number of vessel disease			
Single vessel disease, n (%)	8 (80%)	40 (41.66%)	16 (17%)
Double vessel disease, n (%)	2 (20%)	32 (33.3%)	52 (55.3%)
Tripe vessel disease, n (%)	0 (0%)	22 (22.9%)	23 (24.5%)
Treated coronary arteries			
Left main, n (%)	0 (0%)	2 (2.1%)	3 (3.2%)
Left anterior descending, n (%)	4 (40%)	54 (56.3%)	47 (50%)
Right coronary artery, n (%)	4 (40%)	28 (29.2%)	26 (27.7%)
Left circumflex, n (%)	2 (0%)	12 (12.5%)	18 (19.1%)

Table 3. Characteristics and results of coronary intervention of STEMI patients.

	Age group of STEMI patients		
	Group-I n = 10	Group-II n = 96	Group-III n = 94
Thrombus aspiration, n (%)	10 (100%)	94 (97.9%)	88 (93.6%)
Use of IABP, n (%)	0	2 (2.1%)	1 (1.1%)
Pre-procedural TIMI flow, no perfusion, n (%)	10 (100%)	96 (100%)	93 (98.9%)
Post-procedural TIMI flow, complete perfusion, n (%)	10 (100%)	90 (93.8%)	82 (87.2%)
Complications during procedure			
Accelerated idioventricular rhythm, n (%)	0 (0%)	1 (1%)	1 (1.1%)
Atrial fibrillation, n (%)	0 (0%)	2 (2.1%)	2 (2.1%)
Ventricular tachycardia, n (%)	0 (0%)	4 (4.2%)	2 (2.1%)
Ventricular fibrillation, n (%)	0 (0%)	1 (1%)	4 (4.3%)
Complete heart block, n (%)	1 (10%)	3 (3.1%)	2 (2.1%)
Cardiac arrest, n (%)	0 (0%)	2 (2.1%)	2 (2.1%)

4. Discussion

We carried out this study to analyse prevalence of conventional risk factors in different age groups of patients with STEMI who underwent PCI. In our study, there were 10 (5%) STEMI patients whose age was <40 years. The results of our study showed higher prevalence of diabetes (43.6% vs. 35.4% vs. 0%) and hypertension (44.7% vs. 35.4% vs. 10%) in older patients as compared to young patients. In addition, younger patients were more likely to have single vessel disease as compared to older patients. Thus, the results of our study are consistent with the results of previous studies [3] [9]-[12]. However, these studies enrolled mixed MI population.

Literature search revealed few studies which compared risk factors, angiographic profile and clinical outcomes in young patients with STEMI from the elderly counterparts. Differences in risk profile, clinical findings and severity of coronary disease in the young from the elderly counterparts are noted in these studies [7] [14]-[17]. Hosseini *et al.* evaluated clinical findings and in-hospital outcomes in 2028 patients with an acute STEMI of Cardiovascular Tehran Heart Center Registry (CVDTHCR) [15]. They found higher prevalence of smoking and family history of cardiovascular disease in young patients (109 patients aged < 40 years) as compared to old patients (1919 patients aged > 40 years). Similar findings were also found in young STEMI patients

Table 4. Clinical outcomes after successful triple-vessel angioplasty.

Clinical outcomes	Age group of STEMI patients		
	Group-I n = 10	Group-II n = 96	Group-III n = 94
In-hospital outcomes			
Death, n (%)	0 (0%)	2 (2.1%)	3 (3.2%)
Repeat PCI, n (%)	0 (0%)	1 (1%)	1 (1.1%)
Major bleeding, n (%)	0 (0%)	2 (2.1%)	0 (0%)
Emergency CABG, n (%)	0 (0%)	1 (1%)	0 (0%)
Major adverse clinical outcomes, n (%)	0 (0%)	6 (6.3%)	4 (4.3%)
Outcomes at 30-day follow-up			
Death, n (%)	0 (0%)	1 (1%)	1 (1.1%)
Repeat PCI, n (%)	0 (0%)	1 (1%)	2 (2.1%)
Major bleeding, n (%)	0 (0%)	0 (0%)	1 (1.1%)
Emergency CABG, n (%)	0 (0%)	0 (0%)	1 (1.1%)
Major adverse clinical outcomes, n (%)	0 (0%)	2 (2.1%)	5 (5.3%)

aged less than 35 years in the study carried out by Colkesen *et al*. [14]. However, low prevalence of diabetes, hypertension and dyslipidemia in young patients was reported by Hosseini *et al*. Similarly, Waziri *et al*. compared risk factors and short-term clinical outcomes in 1026 young (<45 years) patients and 15,659 old (>45 years) patients with STEMI who underwent primary PCI [18]. They found higher prevalence of smokers (71.2% vs. 44.2%, $p < 0.001$) and lower prevalence of hypertension (17.3% vs. 39.3%, $p < 0.001$), hyperlipidemia (18.0% vs. 23.8%, $p < 0.001$), diabetes (9.0% vs. 12.4%, $p < 0.001$) and previous myocardial infarction (6.9% vs. 12.2%, $p < 0.001$) in young patients with STEMI compared with older patients. Yunyun *et al*. concluded that fibrinogen and glycosylated haemoglobin are associated with young STEMI patients (individuals ≤ 44 years of age) apart from conventional risk factors (male sex, smoking and family history of early CAD) [7].

Several studies also compared clinical outcomes in younger patients and old patients with STEMI. In our study, MACO were lower in young patients as compared to old patients. Lee *et al*. also found favorable in-hospital outcomes (cardiac death, MI, repeated PCI or CABG) in younger Korean patients with STEMI [16]. However, after adjustment for the potential confounders, the clinical outcomes of patients in the young age group were not found superior by the authors to those of patients in the old age group at the one-year follow-up.

The major limitation of this study was smaller sample size. Statistical significance was not comparable with many studies as we had sample size of only 200 compared to many randomized. However, our study highlights difference in the prevalence of risk factor in different age groups.

5. Conclusion

The young STEMI patients had lower incidences of diabetes and hypertension compared with elderly patients. The young age group had more favorable in-hospital and 30-day clinical outcomes.

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