

## Evaluation of Clinical and Angiographic Profile of Patients Undergoing Primary Angioplasty: Differences by Age



### Cardiology

**KEYWORDS:** Primary angioplasty, age groups, STEMI, angiography

**Placid Sebastian**

Department of Cardiology, Sahakarana Hrudayalaya Pariyaram Medical College, Kannur, Kerala, India

**Ramakrishna C D**

Department of Cardiology, Sahakarana Hrudayalaya Pariyaram Medical College, Kannur, Kerala, India

**Venkatesh Radhakrishnan**

Department of Cardiology, Sahakarana Hrudayalaya Pariyaram Medical College, Kannur, Kerala, India

### ABSTRACT

**Aim** The main purpose of the study is to assess the risk factors and angiographic profiles associated with different age group that impacts the likelihood of the outcome after primary percutaneous angioplasty in patients with ST-elevation myocardial infarction. **Method** This was a prospective, observational, single-centre study conducted at Pariyaram Medical College from the period between December 2011 and September 2012. The patients admitted for ST-elevation myocardial infarction and undergoing primary angioplasty were included in the study. Patients were divided into three groups based on their age, <40 years, 40-60 years and >60 years. Data were collected pertaining to risk factors, angiographic profile, ECG parameters and echo variables and recorded. Door to balloon time was also precisely measured and recorded. The primary end-point of the study is 30-day major adverse cardiac events rate. It is combination of death, reinfarction, repeat PCI, major bleeding and emergency CABG. **Results** There were 10 (5%) patients in the age group less than 40 years, 96 (48%) patients belonged to the age group between 40-60 years and 94 (47%) patients belonged to the age group greater than 60 years. Number of diabetics (43.6%) ( $p = 0.022$ ) and hypertensives (44.7%) were more in the age group > 60 years of age as compared to other age groups. Smoking was significantly associated with age ( $p = 0.040$ ) and higher number of patients was found in the age group below 60 years. Younger patients with family history of MI had more chances of MI at an early age ( $p = 0.001$ ). Triple vessel disease was commonly observed in patients aged > 60 years (25.5%) as contrast to patients < 40 years (0%). The 30-day MACE was found to be 9.0%, which is a combination of 4.5 % death, 1.5 % re-infarction, 1.0 % major bleeds, 1.0% emergency CABG and 1.0% repeat PCI. **Conclusion** Age has a significant impact on outcomes after primary angioplasty owing to pre-morbid conditions at the time of presentation and diffused disease.

### Introduction

Primary angioplasty has proven to be the most effective treatment for ST-elevation myocardial infarction (STEMI) (Hartzler et al., 1983; Marco et al., 1987). However, variation in the short and long-term outcomes has been observed owing to the clinically heterogeneous subset of patients and influence of those subsets. Likewise, age is evidenced to be one of the independent risk factor following primary angioplasty for STEMI. Dated back to 1997, one of the studies which aimed to evaluate the quantitative aspect of restenosis and re-occlusion by quantitative coronary angiography in the patients undergoing primary angioplasty, found that age is an independent predictor of restenosis (van't Hof et al., 1998). The plausible explanation for this is in young individuals acute thrombotic occlusion occurs in much healthy coronary artery without much underlying coronary artery disease. Moreover, elderly STEMI population has significant comorbidities, delayed presentation, diffused multi-vessel or calcified disease and impaired left ventricular function (Holmes et al., 1999). Paradoxically, elderly patients also have far more benefits from primary angioplasty as it negates the risk of intracranial bleeding, re-ischemia and re-infarction (Bueno et al., 2011; O'Gara et al., 2013).

However, while many studies have been designed to demonstrate the outcomes of primary angioplasty in myocardial infarction, there are very few studies which studied the clinical and angiographic profiles of patients across whole range of age groups (Gottlieb et al., 2011; Mehta et al., 2001). Thus, the main purpose of the study was to assess the risk factors and angiographic profiles associated with different age group that impacts the likelihood of the outcome after primary percutaneous angioplasty in patients with ST-elevation myocardial infarction.

### Methodology

This was a prospective, observational, single-centre study conducted at Pariyaram Medical College from the period between December 2011 and September 2012. It enrolled patients admitted with ST-elevation myocardial infarction and undergoing primary

angioplasty. The study was conducted in accordance with the principles of Good Clinical Practice and Declaration of Helsinki. The institutional ethics committee approval was obtained and the informed consent was obtained from all the patients enrolled in the study.

### Inclusion and exclusion criteria

The study was not stringent and had minimum inclusion and exclusion criteria. All the patients above 18 years admitted for ST-elevation myocardial infarction and undergoing primary angioplasty were included in the study. The only exclusion criterion was refusal to give informed consent by the patient.

Data were collected pertaining to risk factors and recorded for each patient. Pre-procedural ventricular function, MR and VSR was carried out in all the patients by 2D echocardiography. Door to balloon time was also noted very precisely and reason for the delay above 90 minutes was elicited to be whether due to decision making or due to the lab being engaged. Angiographic profile of each of our patients was studied. Patients were divided into three groups based on their age, <40 years, 40-60 years and >60 years.

### Clinical outcomes and follow-up

The primary end-point of the study was 30-day MACE rate. MACE is a conglomeration of death, reinfarction, repeat PCI, major bleeding and emergency CABG.

### Statistical analysis

All the data were evaluated using Statistical Package for Social Sciences (SPSS; Chicago, IL, USA) program, version 15. Continuous variables are presented as mean  $\pm$  standard deviation while categorical variables are presented as counts and percentages. Comparisons between the categorical variables are done using chi-square test or fisher's exact test. A  $p$  value < 0.05 was considered as statistical significant.

### Result

**Baseline demographic and clinical characteristics**

Out of 200 total patients enrolled, there were 10 (5%) patients in the age group less than 40 years, 96 (48%) patients belonged to the age group between 40-60 years and 94 (47%) patients belonged to the age group greater than 60 years. In all three groups, male gender showed higher predisposition to STEMI compared to that females. Number of diabetics (43.6%) and hypertensives (44.7%) were more in the age group > 60 years of age as compared to other age groups, whereas dyslipidemia (23%) had higher incidence in age group between 40 – 60 years of age. Variables such as smoking (50%) and family history of MI (20%) were more prevalent in younger individuals rather than patients aged > 60 years. The detailed baseline characteristics are outlined in **table 1**.

**Table 1: Baseline demographic and clinical characteristics**

Characteristics	Age-group			p-value
	<40 years	40-60 years	>60 years	
Male	8 (80.0%)	83 (86.5%)	74 (78.7%)	0.365
Female	2 (20.0%)	13 (13.5%)	20 (21.3%)	
Hypertension	1 (10%)	34 (35.4%)	42 (44.7%)	0.070
Diabetes Mellitus	0 (0%)	34 (35.4%)	41 (43.6%)	0.022
Dyslipidemia	2 (20%)	22 (23%)	15 (16%)	0.480
Smoking	4 (40%)	48 (50%)	30 (31.9%)	0.040
Family history of MI	2 (20%)	4 (4.2%)	0 (0%)	0.001
Previous history of MI	0 (0%)	4 (4.2%)	5 (5.3%)	0.841
Chronic kidney disease	0 (0%)	0 (0%)	2 (2.1%)	0.317
Cerebrovascular accident	0 (0%)	3 (3.1%)	2 (2.1%)	1.000
Peripheral vascular disease	1 (10%)	3 (3.1%)	1 (1.1%)	0.195
<b>Killip classification</b>				
Class I	9 (90%)	79 (82.3%)	78 (83.0%)	0.957
Class II	0 (0%)	7 (7.3%)	4 (4.3%)	
Class III	0 (0%)	2 (2.1%)	2 (2.1%)	
Class IV	1 (10%)	8 (8.3%)	10 (10.6%)	

**Angiographic and procedural characteristics**

Various presentations of MI were observed and grouped accordingly. Majority of the patients had anterior wall myocardial infarction (92%), followed by inferior wall myocardial infarction 60%. Triple vessel disease was commonly observed in patients aged > 60 years (25.5%) as contrast to patients < 40 years (0%). Severe LV dysfunction was observed in patients with age > 60 years (2.1%) and in patients aged between 40-60 years (2.1%) of age. Door to balloon time of less than 90 minutes was achieved in 89.5% of the patients. Predilation was done in 93% patients and post dilation was done in 76.5% patients. The complete details of angiographic and procedural characteristics are described in table 2, 3, 4, 5 and 6.

**Table 2: ECG examination**

Characteristics	Age-group			p-value
	<40 years	40-60 years	>60 years	
ASMI	1 (10%)	2 (2.1%)	2 (2.1%)	0.855
AWMI	5 (50%)	44 (45.8%)	43 (45.7%)	
IWMI	2 (20%)	28 (29.2%)	30 (31.9%)	
IWMI + RVMI	2 (20%)	18 (18.8%)	14 (14.9%)	
True PWMI	0 (0%)	3 (3.1%)	2 (2.1%)	
LWMI	0 (0%)	1 (1%)	3 (3.2%)	

ASMI- anteroseptal myocardial infarction, AWMI - anterior wall myocardial infarction, IWMI - interior wall myocardial infarction,

RVMI – right ventricular myocardial infarction, PWMI – posterior wall myocardial infarction, LWMI – lateral wall myocardial infarction

**Table 3: ECHO examination**

Characteristics	Age-group			p-value
	<40 years	40-60 years	>60 years	
Mild LVD	3 (30%)	25 (26.0%)	20 (21.3%)	0.516
Moderate LVD	3 (30%)	10 (10.4%)	10 (10.6%)	
Severe LVD	0 (0%)	2 (2.1%)	2 (2.1%)	
Normal LV	4 (40%)	59 (61.5%)	62 (66.0%)	
Ventricular septal rupture	0 (0%)	1 (1.0%)	1 (1.1%)	1.000

LVD – left ventricular dysfunction

**Table 4: Time of presentation**

Characteristics	Age-group			p-value
	<40 years	40-60 years	>60 years	
<b>Window period</b>				
<6 hours	8 (80%)	76 (79.2%)	72 (76.6%)	0.106
6-12 hours	2 (20%)	16 (16.7%)	9 (9.6%)	
12-24 hours	0 (0%)	2 (2.1%)	11 (11.7%)	
>24 hours	0 (0%)	2 (2.1%)	2 (2.1%)	
Delayed patient response	2 (66.7%)	20 (80%)	18 (78.3%)	0.875
Delay in transportation	1 (33.3%)	5(20%)	5 (21.7%)	
<b>Door to balloon time</b>				
<90 minutes	8 (80%)	87 (90.6%)	84 (89.4%)	0.432
90-120 minutes	2 (20%)	3 (3.1%)	6 (6.4%)	
120-150 minutes	0 (0%)	3 (3.1%)	2 (2.1%)	
>150 minutes	0 (0%)	3 (3.1%)	2 (2.1%)	

**Table 5 : Angiographic and procedural characteristics**

Angiographic Characteristics	Age-group			p-value
	<40 years	40-60 years	>60 years	
CAG				0.247
LAD	4 (40%)	26 (27.1%)	20 (21.3%)	
LCx	0 (0%)	8 (8.3%)	4 (4.3%)	
RCA	4 (40%)	14 (14.6%)	11 (11.7%)	
IRA (DVD)	2 (20%)	30 (31.3%)	32 (34%)	
IRA (TVD)	0 (0%)	16 (16.7%)	24 (25.5%)	
LM + IRA	0 (0%)	2 (2.1%)	3 (3.2%)	
<b>Procedural characteristics</b>				
MVPCI during last procedure	0 (0%)	1 (10%)	0 (0%)	0.660
Staged PCI before discharge	0 (0%)	5 (50%)	9 (64.3%)	
Elective PCI	0 (0%)	4 (40%)	5 (35.7%)	
Temporary cardiac pacing	3 (30%)	13 (13.5%)	18 (19.1%)	0.314
Thrombus aspiration	10 (100%)	94 (97.9%)	88 (93.6%)	
Thrombus retrieval	5 (50%)	54 (56.3%)	56 (59.6%)	0.796
Intra-aortic balloon pumping	0 (0%)	2 (2.1%)	1(1.1%)	1.000
Direct stenting	2 (20%)	6 (6.3%)	5 (5.3%)	0.199
Predilation	9 (90%)	91 (94.8%)	86 (91.5%)	0.625
Post dilation	10 (100%)	77 (80.2%)	66 (70.2%)	0.053

CAG – coronary angiography, LAD – left anterior descending artery, LCx – left circumflex artery, RCA – right coronary artery, IRA – infarct related artery, DVD – double vessel disease, TVD – triple vessel disease, LM – left main

**Table 6: Procedural complications**

Procedural Complications	Age-group			p-value
	<40 years	40-60 years	>60 years	
Accelerated idioventricular rhythm	0 (0%)	1 (1.0%)	1 (1.1%)	1.000
Atrial fibrillation	0 (0%)	2 (2.1%)	2 (2.1%)	1.000
Ventricular tachycardia	0 (0%)	4 (4.2%)	2 (2.1%)	0.768
Ventricular fibrillation	0 (0%)	1 (1.0%)	4 (4.3%)	0.389
Complete heart block	1 (10%)	3 (3.1%)	2 (2.1%)	0.423
Cardiac arrest	0 (0%)	2(2.1%)	2 (2.1%)	1.000

**Clinical outcomes**

During the procedure several adverse events occurred among the patients. There was incidence of accelerated idioventricular rhythm (1%), atrial fibrillation (2%), ventricular tachycardia (3%), ventricular fibrillation (2.5%), complete heart block (3%) and cardiac arrest (2%). The 30-day MACE was found to be 9.0%, which is a combination of 4.5 % death, 1.0% re-infarction, 1.0% major bleeds, 1.5% repeat PCI and .1.0% emergency CABG. The detailed 30-day outcome is given in **table 7**.

**Table 7: Clinical outcomes**

Outcomes	Age-group			p-value
	<40 years	40-60 years	>60 years	
Death	0 (0%)	4 (2.0%)	5 (2.5%)	1.000
Reinfarction	0 (0%)	2 (1.0%)	0 (0%)	
Repeat PCI	0 (0%)	2 (1.0%)	1 (0.5%)	1.000
Major Bleed	0 (0%)	2 (1.0%)	0 (0%)	0.768
Emergency CABG	0 (0%)	2 (1.0%)	0 (0%)	0.389

PCI – percutaneous coronary intervention, CABG – coronary artery bypass grafting

**Discussion**

Several studies have been undertaken to evaluate prognosis of elderly patients with ST-elevated myocardial infarction. Of those, SCAAR registry, which aimed to evaluate the prognosis of elderly patients with ST-elevated myocardial infarction treated with primary angioplasty during the ten-year period demonstrated that despite of slight improvement in long term survival after early phase PCI due to change in patients and treatment characteristics over time, long term risk of adverse events increased with age. Simply, it emphasizes the need of risk stratification in patients with STEMI, especially in elderly patients (Velders et al., 2014). Thus, it is important to determine the detectable characteristics associated with increased chance of experiencing unwanted outcomes.

We attempted to determine the risk factors and angiographic profiles associated with different age group and likely to affect the outcome. We found that incidence was 10% in younger age group. This was in consistence with the study by Sharma et al., which aimed to evaluate the coronary angiographic profile in young and old patients with coronary artery disease. They found that incidence was 10 percent among people below 40 years of age (Sharma et al., 1990).

Studies have been undertaken to analyze the possible sex differences related to treatment by primary angioplasty with ST-segment elevation AMI. One of such studies revealed that women in the post-menopausal group were higher (Hurtado-Martinez et al., 2006). In our study, there were 17.5% females and majority of them belonged to post-menopausal age group. As expected, gender predisposition was more in male and older subsets above 40 years of age.

A quick rundown through the risk factor profile shows that diabetes mellitus was more prevalent and significantly associated with age ( $p$

= 0.022). Although not significantly associated with age, hypertension was as high as 38.5%. Smoking was significantly associated with age ( $p$  = 0.040) and higher number of patients was found in the age group below 60 years. Younger patients with family history of MI had more chances of MI at an early age ( $p$  = 0.001). Thus, we depict that pre-morbid conditions and advanced age affects the outcome. This has also been proved in a review of 27 studies performed by Vaccarino et al. However, it included only female patients unlike the present study, which included all the patients with ST-elevation myocardial infarction (Vaccarino et al., 1998).

In the present study, door to balloon time of less than 90 minutes was achieved in 89.5% of the patients. TRANSFER AMI trial shows that every minute of delay in treatment of patients with STEMI does affect 1-year mortality, not only in thrombolytic therapy but also in primary angioplasty. In fact, the risk of 1-year mortality is increased by 7.5% for each 30-minute delay (Cantor et al., 2008). Despite the demonstrated prognostic role of time delay to treatment in patients with STEMI treated by thrombolysis, its role in patients treated with primary angioplasty remains controversial. In a pooled analysis of all randomized trials that compared thrombolysis and primary angioplasty, Zijlstra et al. found that mortality linearly increased with time delay only in patients treated by thrombolysis, whereas it was relatively stable in patients treated by primary angioplasty (Zijlstra et al., 1993). Moreover, door-to-balloon time was not found to have age-dependent adverse outcomes.

Though post-dilation was contradictory to routine in primary PCI, we have used in our patients for stent optimization in 77% of the patients in whom we have stented. It was found to associate with age with younger patients more likely to undergo post dilation ( $p$  = 0.053). Also, patients receiving post dilation were less likely to have history of hypertension, history of hypercholesterolemia, more likely to receive drug-eluting stent, more likely to have lesions of thrombus, calcification, plaque ulceration, ostial and type C lesions (Zhang et al., 2010).

Evaluating the adverse events, death occurred in 4.5 % of patients, re-infarction in 1.0% of patients, repeat PCI in 1.5%, major bleeds were seen in 1% and emergency CABG in 1.0%. MACE was more common in the older age groups (9.0% vs 0% in younger groups).

**Conclusion**

Thus, we can conclude that age has a significant impact on outcomes after primary angioplasty. This age related differences can be attributed to prevalent pre-morbid conditions and diffused disease at the time of presentation.

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