

# Frequency of Primary Percutaneous Coronary Intervention (PPCI) Use as Reperfusion Strategy in Patients with STEMI and Hospital Outcome

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## ABSTRACT

**Objective:** To determine the frequency of primary percutaneous coronary intervention (PPCI) use as reperfusion strategy in patients with STEMI and in-hospital outcomes.

**Study Design:** Cross-sectional study

**Place and Duration of Study:** Department of Cardiology, National Institute of Cardiovascular Disease, Karachi from 1<sup>st</sup> January 2020 to 30<sup>th</sup> June 2020.

**Methodology:** Three hundred and seventy-one patients were enrolled. Patients with unstable angina or non-ST-elevation myocardial infarction (NSTEMI) were excluded. Data regarding demographics, clinical features, and duration of signs& symptoms, the treatment was given was recorded.

**Results:** There were 300 (80.86%) males and 71 (19.34%) females with a mean age were 51.42±6.75 years and the mean duration of symptoms was 97.20±76.92 minutes. More than half of all patients (53.1%) belonged to urban areas; the other one-third (32.3%) were from peri-urban areas while those from rural areas were only 14.6%. One-third (35.6%) were smokers, one quarter (24.8%) were obese, the other 12.7% had diabetes mellitus, 18.3% had hypertension while 8.6% of patients had a positive family history of CAD.

**Conclusion:** The survival rate among patients treated with primary PCI is more than those treated with pharmacological therapy alone. Some influencing factors are age, gender, duration of reaching the tertiary care hospital, and residence of patients.

**Keywords:** Acute STEMI, Primary PCI, Revascularization, Myocardial Infarction, Percutaneous coronary intervention

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## INTRODUCTION

The burden of cardiovascular disease is increasing worldwide. Earlier it was thought of as a problem of industrialized nations but the current scenario is contrary to this belief.<sup>1</sup> Now in low and middle income especially Asian countries, cardiovascular morbidity and mortality are rising.<sup>1</sup> It is an astonishing fact that more than 75% of all cardiovascular deaths in the world are occurring in two south Asian nations i.e. India and Pakistan.<sup>2</sup> Acute myocardial infarction (AMI) or heart attack is the most common reason for these deaths.<sup>3</sup>

Treatment for acute myocardial infarction depends upon the level of involvement of three major cardiac vessels and the area of the myocardium which is affected by occlusion of these vessels. There are three components of the current treatment strategy for vascular reperfusion in AMI patients which are underuse for a long period.<sup>4</sup> One of these is medical therapy, the other two interventional modalities include surgical revascularization (coronary artery bypass grafting), and percutaneous coronary intervention (PCI). Primary PCI is an initial approach to reperfusion for patients in the acute phase of ST-elevation myocardial infarction (STEMI) with the aim of rapid revascularization and restoration of cardiac function.<sup>5</sup>

Although there are no exact figures available it is thought that the use of primary PCI is also increasing in Pakistan rapidly and it has become a preferable treatment in ST-elevation myocardial infarction.<sup>6</sup> It also reduces the risk for re-infarction and stroke significantly.<sup>7</sup> Chopra<sup>8</sup> reported that fibrinolysis, primary PCI reduced death by 25%, reinfarction decreased by 64%, cerebral

haemorrhage decreased by 95% and stroke decreased by 53% respectively.

Overall, treatment with primary PCI has better results, and the in-hospital outcome when measured was survival of 97% of patients at first 30 days and found that in-hospital survival among patients who underwent PPCI was 91.5%.<sup>9</sup>

## MATERIALS AND METHODS

This cross-sectional study was conducted at the Department of Cardiology, National Institute of Cardiovascular Disease, Karachi from 1<sup>st</sup> January 2020 to 30<sup>th</sup> June 2020 and comprised 371 patients. Patients of age more than 18 to 65 years having a definite diagnosis of ST-elevation myocardial infarction as per operational definition, attended in ER within 12 hours of symptoms onset were included whereas patients with unstable angina or non-ST-elevation Myocardial Infarction (NSTEMI), unwilling to participate in the study, cannot give a proper history and who received thrombolytic therapy during hospital admission were excluded. The respondents were assured of the confidentiality of the information that they will provide.

All the patients brought to the Emergency Department of NICVD, who are diagnosed with ST-elevation MI and comply with inclusion criteria, were asked to participate in the study. The demographics, clinical features, and duration of signs& symptoms, the treatment given were noted. Patients were observed for 24 hours post PPCI procedure and outcome in terms of survival was also noted. Data on comorbidity like smoking, obesity, diabetes mellitus, hypertension, and family history were noted. The

data was entered and analyzed through SPSS-20. The Chi-square test was applied to analyze the difference between the categories. A p-value of <0.05 was deemed significant.

**RESULTS**

The mean age was 51.42±6.75 years and the mean duration of symptoms was 97.20±76.92 minutes. The majority of patients 300(80.86%) were males and 71 (19.14%) were females. It was seen that duration of symptoms was seen in 63 (17%) patients for 30 minutes, 106 (28.6%) for 31-60 minutes, 142 (38.3%) 61-120 minutes while those who took more than 2 hours were 60 (16.2%). More than half of all patients (53.1%) belonged to urban areas, the other one-third (32.3%) were from peri-urban areas while those from rural areas were only 14.6%. Almost all patients had one or another comorbidity or family history of cardiovascular diseases. Accordingly; one-third (35.6%) were smokers, one-quarter (24.8%) were obese, the other 12.7% had diabetes mellitus, 18.3% had hypertension while 8.6% of patients had a positive family history for cardiovascular diseases.

The symptoms with which these patients presented were as under; dyspnoea only in 8.9%, sweating in 12.4% only, chest pain only in 22.9%. Among 55.8% of patients, all these symptoms were positive. The primary outcome variable of this study was the frequency of primary PCI in patients of acute STEMI which was 65 (17.52%) and 306 (82.47%) patients were treated with pharmacological treatment. Further, it was noted that overall 98.12% responded to these treatment options and survived (Table 1).

Table 1: Demographic information of the patients (n=97)

Variable	No.	%
<b>Gender</b>		
Male	300	80.86
Female	71	19.14
<b>Age (years)</b>		
≤40	11	3.0
41- 50	131	35.3
51 - 60	176	47.4
61 - 65	53	14.3
<b>Residence</b>		
Urban	197	53.1
Peri-urban	120	32.3
Rural	54	14.6
<b>Duration of presenting symptoms (minutes)</b>		
Upto 30	63	17.0
31 – 60	106	28.6
61 – 120	142	38.3
121 – 240	30	8.1
241 – 360	30	8.1
<b>Comorbidities among all patients</b>		
Family	32	8.6
Diabetes	47	12.7
Hypertension	68	18.3
Obesity	92	24.8
Smoking	132	35.6
<b>Presenting symptoms</b>		
Dyspnoea only	33	8.8
Sweating	46	12.4
Chest pain only	85	22.9
All	207	55.8
<b>Primary PCI(or other treatment given to patients)</b>		
PPCI	305	82.47
Pharmacologic only	66	17.78
<b>Survival at 24 hours after Primary PCI</b>		
Survival	364	98.12
Death	7	1.88

Table 2: Effect modification of treatment option by the duration of presenting symptoms (n = 371)

Duration of symptoms (minutes)	Treatment opted		P-value
	Primary PCI	Pharmacologic only	
Upto 30	15(23.80%)	48(76.19%)	0.000
31 - 60	21(19.81%)	85(80.18%)	
61 – 120	24(16.90%)	118 (83.09%)	
121 - 240	3(10%)	27(90%)	
241 - 360	2(6.66%)	28(93.33%)	

Table 3: Effect modification of survival after primary PCI by age, gender, comorbidity, duration of presenting symptoms, residence, and treatment of patients (n = 371)

Variable	Survival after primary PCI		P-value
	Yes	No	
<b>Age (years)</b>			
Upto 40	11(100%)	-	0.005
41 - 50	130(99.23%)	1(0.77%)	
51 - 60	173(98.30%)	3(1.70%)	
61 - 65	50(94.33%)	3(5.67%)	
<b>Gender</b>			
Male	296(98.67%)	4(1.33%)	<0.541
Female	68(95.77%)	3(4.22%)	
<b>Comorbidity</b>			
Smoking	129(97.73%)	03(2.27%)	0.432
Obesity	90(97.83%)	02(2.17%)	
Diabetes	46(97.87%)	01(2.13%)	
Hypertension	67(98.63%)	01(1.47%)	
Family history	32(100%)	00(00%)	
<b>Duration of presenting symptoms (minutes)</b>			
Upto 30	63(100%)	-	0.675
31 – 60	105(99.05%)	1(0.94%)	
61 – 120	140(98.59%)	2(1.40%)	
121 – 240	29(96.67%)	1(3.33%)	
241 - 360	27(90%)	2(10%)	
<b>Residence</b>			
Urban	196 (98.98%)	2(1.02%)	0.622
Peri-urban	117(98.31%)	2(1.68%)	
Rural	51(94.44%)	3(5.56%)	
<b>Treatment given</b>			
PPCI	64(98.46%)	1(1.54%)	<0.000 1
Pharmacologic only	300(98.03%)	6(01.97%)	

It was more in those who presented within 120 minutes than the patients who came after 120 minutes of duration of symptoms (P=0.000). The study significantly found that survival with primary PCI was more (98.46%) than with only pharmacological treatment (98.03%; P=0.000)[Table 2].

The frequency of survival after primary PCI was also affected by the duration of presenting symptoms (actually the time of onset of symptoms). Accordingly; for those who presented within the initial 60 minutes (two hours) of onset of presenting symptoms the frequency of survival was more (upto100%) than those who presented after two hours (90%). This finding was not significant (P<0.675). The age of the patient was a significant effect modifier for survival among patients after primary PCI. It was noted that with the increasing age the frequency of survival decreased such that it was 100% among patients of age up to 40 years which declined up to 94.33% among patients of age 61-65 years (P=0.005). Although statistically not significant it was noted that the frequency of survival was more in male patients than in female patients 98.67% versus 95.77% respectively (P<0.541). No significant difference was noted with one or other comorbidity on the frequency of survival after primary PCI among these patients (P<0.432). The higher frequency of survival after primary PCI was noted

within urban resident patients (98.98%) as compared to peri-urban (98.31%) and least was with rural (94.44%) resident patients. The finding was not significant ( $P < 0.622$ ) [Table 3].

## DISCUSSION

Due to a sedentary lifestyle and lack of knowledge of risk factors and preventive habits, the incidence of ischemic coronary artery disease (CAD) especially acute ST-elevation myocardial infarction is on all over the world.<sup>10</sup> Currently; it has three components of treatment strategy namely; medical therapy, surgical revascularization, and percutaneous coronary intervention (PCI). All these three choices of MI treatment are continuously changing. Overall much of the literature suggests that revascularization with primary PCI provides better outcomes as compared to pharmacological treatment.<sup>11</sup>

The third and most favored choice nowadays i.e. is the preferred method of revascularization in most patients with ischemic CAD in the absence of left main or complex multi-vessels CAD.<sup>11</sup> It includes management by any of various catheter-based techniques, such as percutaneous transluminal coronary angioplasty, atherectomy, angioplasty using the excimer laser, and implantation of coronary stents and related devices.<sup>12</sup>

The recent past has seen a dramatic expansion of the use of PCI to treat ischemic CAD (since the last three decades). Annually in the United States, the anticipated 1,000,000 PCI operations now outnumber the number of CABG procedures. Over the past few years, however, PCI growth decreased as a result of the success of change of the risk factor, avoidance of drug restenosis (DES), and greater understanding of revascularizing patients.

To investigate the frequency of use of primary PCI on patients with acute STEMI and its success rate in terms of survival of the patients in the National Institute for Cardiovascular Disease, the current study was conducted. The study noted that the frequency of primary PCI performed on patients of acute STEMI was 17.52%. Studies from the west have described that the frequency of primary PCI is from 40% to 60%.<sup>14</sup> Thus results of the current study show a lower rate of primary PCI in our setup. Daily many cases of CAD are brought to the emergency departments that are eligible for primary PCI. Due to the expensiveness of procedures in private hospitals majority of these patients are brought to public hospitals like NICVD. It is reasonable to think that due to the limited number of trained cardiologists, staff, and availability of equipment not many of these patients of acute STEMI are treated with primary PCI in our institute. None of three local studies stated the proportion of primary PCI performed on patients of acute STEMI.<sup>15,16</sup>

The outcome of primary PCI performed on acute STEMI patients was assessed by this study. It was seen that overall 98.12% survived when treated either with primary PCI or with pharmacologic therapy only. When compared to the two modes of treatment; the survival rate was more with primary PCI (98.46%;  $P = 0.000$ ) than pharmacologic alone (98.03%).

In international literature, there is debate over the potential increases in survival rate with Primary PCI

compared to pharmacologic therapy. Some studies found that there is no difference in survival rate between the two modes of treatment.<sup>17,18</sup> An assessment of 13 studies found no benefits of PCI over medical treatment from the individual endpoints of death all-cause, cardiac death, MI, or nonfatal MI in 5442 individuals with non-acute CAD. PCI has been assessed. An assessment of 13 studies found no benefits of PCI over medical treatment from the individual endpoints of death all-cause, cardiac death, MI, or nonfatal MI in 5442 individuals with non-acute CAD. PCI has been assessed.<sup>19</sup> Similarly, assessment of 61 PCI trials over multiple years showed that PCI hasn't been shown to lower death or IM risk in patients without recent ACS, despite advancements in PCI technology and medication.<sup>11</sup> Local studies also evaluated the role of PCI and found that survival ranged from 93-97%.<sup>7,8</sup> The rate which the current study found was higher than the previously stated rate in local studies and it proves that favourable outcomes can be achieved in a tertiary care public sector hospital in Pakistan. The high rates of initial success and TIMI 3 flow found in the current study were also comparable to western data.<sup>20</sup>

It is a universal fact that age is a strong determinant of short and long-term prognosis in patients with acute myocardial infarction. In the era before reperfusion elderly patients >65 years of age had one-month and one-year mortality rates of 30% and 75%, respectively. Despite contemporary interventional techniques, mortality exponentially increases in patients after 65 years of age.<sup>2</sup> This fact was evident in the results of the current study as well. We significantly found that in patients of age up to 40 years the survival rate after primary PCI was highest and it was lowest among the patients of age 61-65 years ( $P = 0.005$ ). Similarly, there was some gender difference in survival after primary PCI in the current study wherein survival in males was more than females. ( $P = 0.541$ )

History of smoking was most prevalent among our patients while the family history of ischemic heart disease was least. Other comorbidities recorded in our patients were the presence of obesity, diabetes mellitus, and hypertension. We found that each of these comorbidities was found in at least three-quarters of surviving patients ( $P = 0.432$ ). Most common chronic diseases like diabetes mellitus and hypertension and health-related most dangerous habit of smoking continue to because of CAD as well as associated with considerably increased long-term mortality after acute myocardial infarction.<sup>21</sup> In addition, the other is exacerbated by each pathophysiological illness entity.<sup>22</sup> Earlier thrombolytic studies reveal that DM is a separate mortality risk factor for the post-MI, and other researchers have demonstrated that hypertension is also related to a worse post-MI prognosis. Despite this consensus, there is very little knowledge about the combined impact of hypertension and DM on the outcome after acute MI, especially during the period of PCIs, although the broad spectrum of patients with acute PCIs about the history of hypertension or DM alone or a twin has been described.<sup>23</sup>

Studies have found that PCI remains highly effective if it is performed within 2 hours of the onset of symptoms of ACS. The door to the balloon is also a factor that

determines the effectiveness in terms of the success of the procedure and final outcome.<sup>24</sup> In this regard we found that almost half of the patients (45%) reached the hospital within 60 minutes while other those who reached within initial 120 minutes (2 hours) of onset of symptoms were 84% cumulatively. The majority of these patients were treated with primary PCI (excluding those in whom primary PCI was contraindicated) and survival in these patients was higher than those who reached the hospital beyond the duration of 120 minutes (2 hours). ( $P = 0.000$  &  $0.675$ ) This delay in reaching may have many reasons but one factor which we found was the residence of patients. We noted that those who lived in urban and peri-urban areas of Karachi reached early those few patients who were referred from distant rural areas. In patients of rural areas frequency of primary PCI as well as survival after it was lower. ( $P = 0.622$ ).

The study has certain limitations. If it would have been conducted taking RCT as a study design then we think the results would have been more elaborate. Secondly, we did not include the patients of CABG which could have come up with a difference in the frequency of survival of patients and have given a more comprehensive comparison with primary PCI. Nonetheless, the study has explored the magnitude of primary usage in a public sector hospital as well as provides results on the survival ratio of acute STEMI patients following primary PCI.

## CONCLUSION

The survival rate among patients treated with primary PCI is more than those treated with pharmacological therapy alone. Some influencing factors are age, gender, duration of reaching the tertiary care hospital, and residence of patients. Unless contraindicated otherwise, PCI should be considered as the preferred treatment of acute STEMI patients.

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