

# Prognosis of primary percutaneous coronary intervention in elderly patients with ST-elevation myocardial infarction



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**Objective:** To evaluate the prognosis of primary percutaneous coronary intervention (PPCI) and medical therapy (MT) in elderly patients presenting with ST-elevation myocardial infarction (STEMI).

**Methods:** A total of 238 STEMI patients aged above 80 and treated with PPCI ( $n = 186$ ) and MT ( $n = 52$ ) at Harefield Hospital, London were included in this study. Patients who did not have true STEMI based on non-diagnostic electrocardiogram (ECG) for STEMI and negative troponin, who presented with left bundle branch block (LBBB) and had normal coronaries were excluded from this study. Primary PCI was defined as any use of a guidewire for more than diagnostic purposes in patients with STEMI, whereas conventional MT was defined as treatment of patients with anti-platelets and anti-thrombotic medications without thrombolysis.

**Results:** The survival rate of PPCI patients was 86% ( $n = 160$ ) at month 1 followed by 83.9% ( $n = 156$ ) at month 6, and 81.2% ( $n = 151$ ) at month 12. The survival rate of MT patients was 44.2% ( $n = 23$ ) at month 1 followed by 36.5% ( $n = 19$ ) at month 6, and 34.6% ( $n = 18$ ) at month 12. Compared to MT, significantly fewer comorbidities were found in the PPCI group. Ventricular fibrillation (VF) (4.8%) and consequent admission to intensive care unit (7%) were the major complications of the PPCI group.

**Conclusion:** PPCI has a higher survival rate and, compared to MT, fewer comorbidities were observed in the PPCI group of elderly patients presenting with STEMI.

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**Keywords:** Myocardial infarction, Coronary intervention, Survival rate

## Introduction

Cardiovascular disease (CVD) is the leading cause of death worldwide, and coronary artery disease (CAD) is the most prevalent

manifestation associated with high mortality and morbidity [1]. Heart failure is the end-stage of several cardiovascular diseases such as acute myocardial infarction (AMI), and it remains a major challenge for regenerative medicine because of

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its high prevalence and incidence in elderly patients [2]. However, the long-term incidence of heart failure (HF) in patients with ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI), or unstable angina (UA) is uncertain [3].

Studies report cardiovascular disease as the leading cause of death in the elderly and describe its direct correlation with aging [4]. The elderly may experience higher mortality from STEMI due to severe comorbidities, advanced CAD, as well as mechanical and electrical complications of AMI [5,6]. Further, several disorders often coexist in the elderly such as ischemic heart disease (IHD), hypertension, diabetes mellitus (DM), chronic obstructive pulmonary disease (COPD), chronic renal failure, digestive system disorders as well as joint and bone disorders, which occur more often in this group of patients [6–10]. Cardiologists are therefore increasingly confronted with the management challenges of elderly patients presenting with STEMI. Optional management of acute coronary syndromes in this population has been an area of uncertainty as there is a paucity of evidence-based data due to their exclusion and under-representation in clinical trials [11].

Primary percutaneous coronary intervention (PPCI) and pharmacologic therapy are widely used and constitute a vital treatment strategy for AMI [12–14]. PPCI therapy must be initiated prior to angiography (pretreatment), and continued during the procedure (periprocedural), recovery phase (in-hospital), and follow-up [15]. The purpose of this study is to evaluate the prognosis of PPCI and medical therapy (MT) in elderly patients presenting with STEMI.

Table 1. The demographic, BMI and hospital length of stay of the study population.

Variables	Angioplasty	Medical
<i>Gender</i>		
Male	80 (43%)	27 (52%)
Female	106 (57%)	25 (48%)
Total	186	52
<i>Age</i>		
80–85	128 (68.8%)	32
≥86–90	42 (22.58%)	14
≥91–95	14 (7.52%)	6
≥96	2 (1.07%)	0
<i>BMI</i>		
Male	24.4	24.3
Female	24.9	25.1
<i>Hospital length of stay</i>		
HLOS	3 (2–5 days)	4 (2–7 days)*

\* P = 0.039, Mann–Whitney test.

#### Abbreviations

PPCI	primary percutaneous coronary intervention
PCI	percutaneous coronary intervention
MT	medical therapy
STEMI	ST-elevation myocardial infarction
ECG	electrocardiogram
LBBB	left bundle branch block
VF	ventricular fibrillation
ICU	intensive care unit
CVDs	cardiovascular diseases
CAD	coronary artery disease
AMI	acute myocardial infarction
HF	Heart Failure
NSTEMI	non-ST-elevation myocardial infarction
UA	unstable angina
IHD	ischemic heart disease
DM	diabetes mellitus
COPD	chronic obstructive pulmonary disease
HLoS	hospital length of stay
BMI	body mass index
GUSTO-1	Global Utilization of Streptokinase and Tissue Plasminogen Activator to treat Occluded Arteries
t-PA	tissue plasminogen activator
PAMI-1	Primary Angioplasty in Myocardial Infarction

#### Methods

We conducted a retrospective study on 301 STEMI patients (aged ≥80) treated with PPCI and MT at Harefield Hospital, London during the period between January 2005 and February 2010. Sixty-three patients were excluded from the study as they did not have true STEMI based on non-diagnostic ECG for STEMI and negative troponin, or had presented with left bundle branch block (LBBB) and had normal coronaries.

ST-elevation myocardial infarction was defined as the presence of ST-elevation or new left bundle branch block on electrocardiography in addition to suspicion of ongoing ischemia. Primary PCI was defined as any use of a guidewire for more than diagnostic purposes in patients with STEMI. Conventional MT was defined as treatment with anti-platelets and anti-thrombotic medications without thrombolysis. The demographic variables, body mass index (BMI), comorbidities and hospital length of stay (HLoS) were also collected for analysis. The protocol of the study was approved by the research ethics committee of the hospital.

Data analysis was carried out using Microsoft Excel 2002 (Microsoft Corporation, Seattle, WA, USA), and the Statistical Package for Social Sciences version 16 (SPSS Inc., Chicago, IL, USA). Data were presented as percentage and mean ± standard error of mean. Chi-square test was used to compare the differences between comorbidities of PPCI and MT, while Mann–Whitney U test was used to compare the HLoS. P-value of <0.05 was considered statistically significant.

## Results

Demographics, BMI, and hospital length of stay of the study population are shown in Table 1. A total of 186 patients were treated with PPCI and 52 patients were treated with conventional MT. There were 107 (45%) males and 131 females (54%). The mean age of the PPCI group was 83.92 years and 84.76 years for the MT group ( $P > 0.05$ ). The MT group HLoS (four days) was higher than the PPCI group (three days),

( $P = 0.039$ ). The survival of the PPCI group is demonstrated in Fig. 1. The survival rate of PPCI patients showed 86% ( $n = 160$ ) at month 1 followed by 83.9% ( $n = 156$ ) at month 6, and 81.2% ( $n = 151$ ) at month 12. The survival rate of the MT group is demonstrated in Fig. 2. The survival rate of MT patients showed 44.2% ( $n = 23$ ) at month 1 followed by 36.5% ( $n = 19$ ) at month 6, and 34.6% ( $n = 18$ ) at month 12. The Kaplan-Meier survival curves of PPCI are shown in Fig. 3. The comorbidities of the PPCI and medical groups during

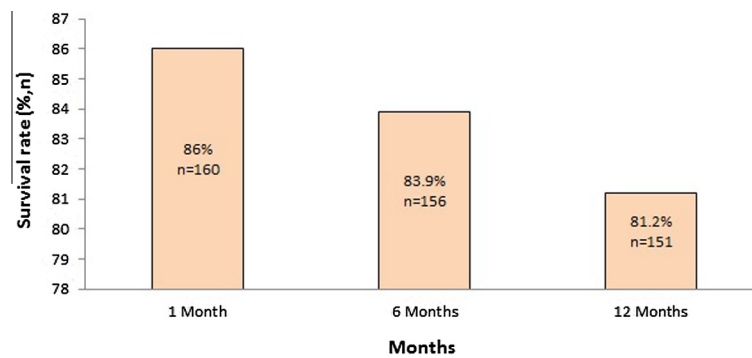


Figure 1. Survival rate (% , n) of primary percutaneous coronary intervention ( $n = 186$ ).

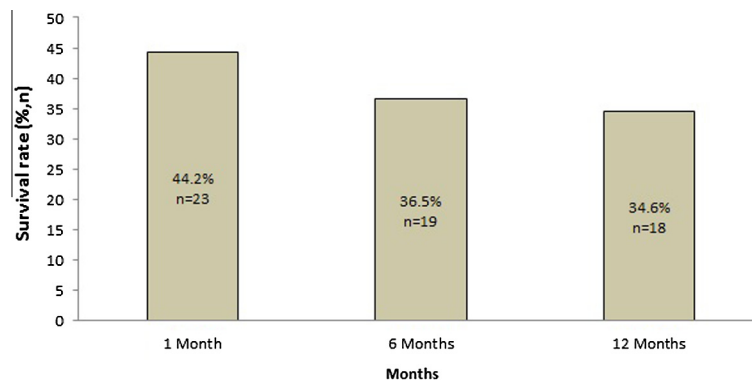


Figure 2. Survival rate (% , n) of medical therapy ( $n = 52$ ).

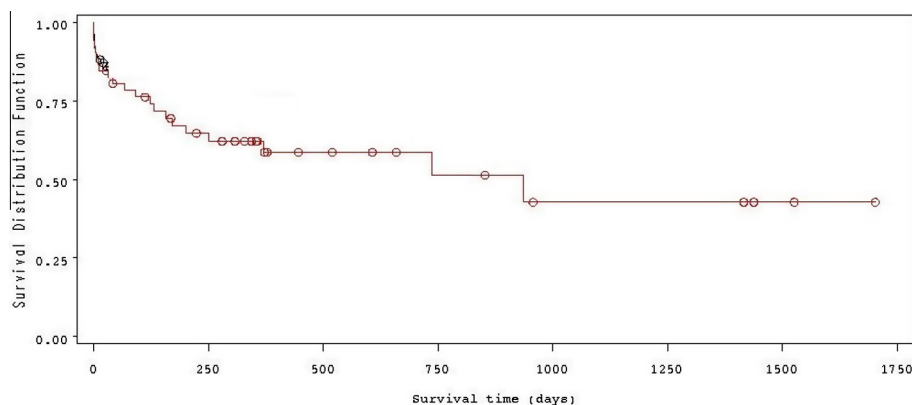


Figure 3. Survival curve: primary percutaneous coronary intervention patients.

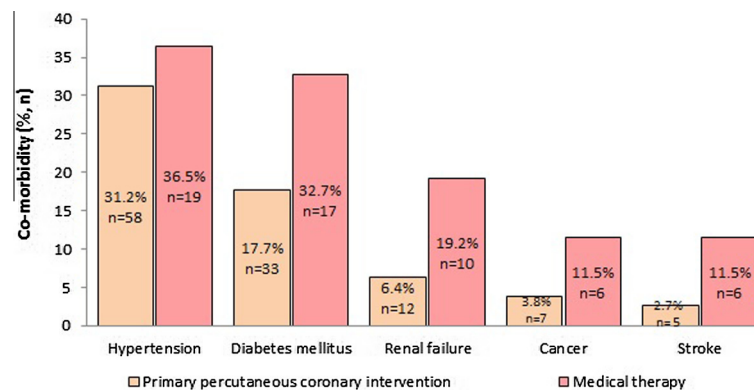


Figure 4. Comorbidity in primary percutaneous coronary intervention (n = 186) and medical therapy group (n = 52).

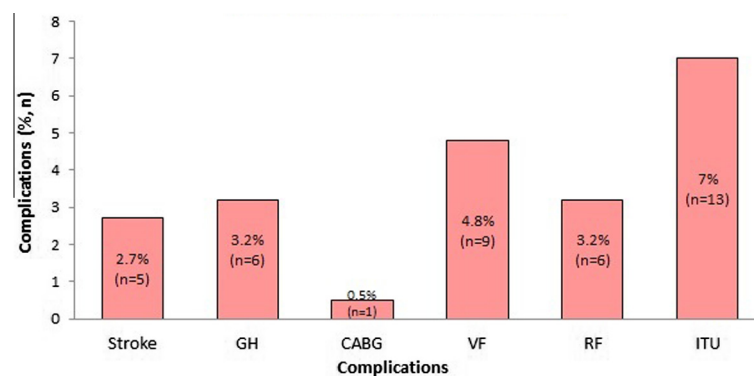


Figure 5. Complications of primary percutaneous coronary intervention patients (n = 186) during admission.

admission are shown in Fig. 4. Compared to stroke, Renal Failure (RF) and cancer, hypertension and DM were the major comorbidities in both groups. Compared to MT, significantly fewer comorbidities were found in the PPCI group. Complications related to PPCI during admission are shown in Fig. 5. Ventricular fibrillation (VF) (4.8%) and consequent admission to intensive care unit (7%) were the major complications of PPCI.

## Discussion

The Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries (GUSTO-1) trial demonstrated that the 30-day mortality rate for STEMI increased tenfold among the elderly, from 3.0% in the age group of <65 years to 30.3% among those >85 years of age [16]. This high mortality rate in the very elderly was also confirmed by several other studies [17–21]. On the other hand, several large multi-center trials have demonstrated that reperfusion therapy of STEMI, whether primary percutaneous coronary intervention (PCI) or fibrinolysis, improved mortality for elderly patients [5]. In the present

study, we also observed that treatment with PPCI was feasible and beneficial for patients with STEMI.

Limited research has been conducted on the prognosis of PPCI management of STEMI in the elderly. There are few trials comparing PPCI with fibrinolytic therapy, which enroll an adequate number of older patients. Existing subset analyses from trials, which randomized patients to primary PCI or fibrinolytic therapy, suggest that PCI is a preferred strategy in older patients. The PPCI in the Primary Angioplasty in Acute Myocardial Infarction (PAMI-1) study randomized patients to immediate PCI or fibrinolytic therapy, and observed that the greatest benefit was in patients over 65 years. There was no significant reduction in the combined endpoint of death/MI in patients under 65 years (0.8% mortality in both groups), but there was a marked reduction in the same endpoint in patients >65 (death/MI was 8.6% with angioplasty versus 20% with tPA) [22]. In the GUSTO-IIb trial, the largest randomized trial comparing angioplasty with thrombolytic therapy, 1138 patients were randomized to receive either accelerated tPA or primary angioplasty. Although

primary angioplasty resulted in better 30-day outcomes (death/MI (myocardial infarction) 1 stroke occurred in 9.6% versus 13.7% with tPA), there was no significant difference in death/MI at six months (13.3% versus 15%, respectively) [23]. The recent TRatamiento del Infarto Agudo de miocardio eN Ancianos (TRIANA) trial showed a trend towards improved outcomes for patients treated with PCI versus fibrinolysis with a combined end point of death, recurrent MI and disabling stroke at 30 days. PCI patients had marked improvement of recurrent ischemia. In the previous SENIOR-PAMI trial, similar results were obtained, but a subgroup analysis of patients >80 years of age showed no benefit of PCI over fibrinolysis [24]. The present study shows that the survival rate of PPCI patients was 86% ( $n = 160$ ) at month 1, followed by 83.9% ( $n = 156$ ) at month 6, and 81.2% ( $n = 151$ ) at month 12. It also suggests that patients treated with PPCI for STEMI have good prognosis if they survive the initial months. A recent study reported that PCI is the preferred treatment for patients with STEMI owing to improved vessel patency, decreased infarct size, lower rates of reinfarction, and improved survival compared to pharmacological reperfusion [25].

There is little in the literature to direct and guide STEMI therapy in elderly patients, especially those whose age is greater than or equal to 80 years [5]. Elderly patients usually have complex CAD with higher mortality and morbidity, and higher rates of complication following PPCI, such as stroke and renal failure [5,26–28]. Advanced age is an independent predictor of mortality after PPCI, and elderly patients show a larger prevalence of female gender, hypertension, and diabetes [17], which was confirmed in our study. We observed that hypertension and DM were the major co-morbidities of both the PPCI and MT groups. Overall, the patients treated with PPCI had fewer comorbidities compared to the patients treated with MT, which means that our hospital had selected the right patients for PPCI to ensure a better outcome. We also found a benefit in HLoS, which was shorter in the PPCI group. The MT group HLoS (four days) was higher than the PPCI group (three days).

Major limitations of this study were the relatively small number of patients, the limited number of risk factors examined, the study's retrospective nature, and that samples were from a single hospital. However, despite its retrospective nature, the present study is important in light of the paucity of evidence-based clinical outcome data due to research exclusion and under-representation

in the elderly STEMI patient group. In future, absolute and relative risks for efficacy and safety in age subgroups should be reported and trials should make an effort to enroll the elderly in proportion to their prevalence among the treated population. Outcomes of particular relevance to the older adult, such as quality of life, physical function, and independence should also be evaluated and geriatric conditions unique to this age group, such as frailty and cognitive impairment, should be considered for their influence on care and outcomes. With these efforts, treatment risks can be minimized and benefits can be placed within the health context of elderly patients.

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