Original Research Article

Assessment of primary percutaneous coronary intervention outcomes in elderly and very elderly patients

Abstract:

Background: To date, data regarding safety and efficacy of primary percutaneous coronary intervention (P-PCI) in elderly patients are scarce. We aimed to assess the outcomes of P-PCI in the elderly subgroup, and to evaluate whether the advantages of P-PCI diminish with advanced ages.

Methods: This retrospective study included elderly patients who underwent P-PCI for acute STEMI. Patients were subgrouped according to their age into three groups (Group A: aged 75-84, Group B: aged ≥85 and control Group C: aged 65-74). The primary endpoint was in-hospital and 30-day all-cause mortality, and secondary endpoints were MACE (death, stroke, MI or re-PCI), stroke, vascular complication, bleeding and transfusion, target vessel re-intervention, contrast induced acute kidney injury (CI-AKI) and gastrointestinal (GI) bleeding.

Results: A total of 1111 patients were included with 339 patients in group A, 95 patients in group B and 677 patients in the control group C. In terms of the primary endpoint of our study, no significant difference could be detected between the studied groups. CI-AKI was the only secondary outcome to show a significant difference (P =0.005). Arterial hypertension and a previous history of chronic kidney disease (CKD) were independent predictors of in-hospital mortality, with OR 5.336, 95% CI 1.187 – 23.998 and OR 11.024, 95% CI 2.104 – 57.756, respectively. Additionally, final TIMI flow less than 3 (OR 42.322, 95% CI 5.674 – 315.667) and bleeding that required blood transfusion (OR 87.144, 95% CI 3.086 – 2460.628) showed higher risk of in-hospital MACE.

Conclusion: our study revealed that outcomes of P-PCI for STEMI in elderly population (≥75) are favourable and comparable to younger patients. Therefore, P-PCI should be offered to every elderly patient presenting with acute STEMI, after considering risk factors for mortality and MACE in this special age group.

Key words: acute ST-elevation myocardial infarction, primary percutaneous coronary intervention, PCI complications, elderly, prognosis.

Introduction:

Coronary artery disease (CAD) is the leading cause of death worldwide, with over seven million people every year die from CAD.(1) Primary percutaneous coronary intervention (P-PCI) is the standard strategy for treating patients with acute ST-segment elevation myocardial infarction (STEMI).(2)

Although, elderly patients form a rapidly growing cohort in all countries and, in real life practice, P-PCI is increasingly performed in patients aged ≥75 years, the advantages of P-PCI in those patients continue to be debatable. Previous studies suggest that older patients are under-represented in clinical research and particularly patients having co-morbidities rendering them frail are even less likely to receive state-of-the-art medications and standard medical interventions.(3)

Accordingly, there remains a dichotomy of belief amongst interventional cardiologists who undertakes primary angioplasty, and presumably a difference in practice, regarding the benefit of P-PCI in the elderly and the very elderly patients. One camp believes that P-PCI improves the outcomes in the elderlies no matter how old the patient is and this belief is strongly held, despite the evidence being circumstantial.(4) The second group believes that the benefit of P-PCI subsides with increasing age because of the greater prevalence of co-morbidities, greater watershed infarction and so bigger infarcts amongst other causes.(5)

Current study aimed to assess the outcomes of primary PCI in the elderly patients who presented to the hospital with acute STEMI, and to assess whether the advantages of P-PCI diminish with increasing age through comparing these results to younger patients with similar presentation.

Materials and Methods:

Study population and design:

It was mainly a retrospective study. Inclusion criteria were elderly (≥65 years) patients presented by STEMI and had undergone P-PCI at Tanta University hospitals, a tertiary referral center in Egypt and at Wrightington, Wigan and Leigh (WWL) NHS Foundation Trust, in the United Kingdom (UK). Exclusion criteria were patients diagnosed with non-ST-elevation acute coronary syndrome (NSTE-ACS), mechanically ventilated patients, and patients diagnosed with or under treatment of cancer.

Diagnostic criteria for STEMI were at least two contiguous leads with ST segment elevation ≥2.5mm in men < 40 years, ≥2mm in men ≥ 40 years, or ≥1.5mm in women in leads V2–V3 and/or ≥ 1mm in the other leads or new left bundle branch block (LBBB) on ECG.(2) All primary PCIs were performed using standard techniques and according to recent practice guidelines.(2,6)

Patients were divided into three groups according to their age; Group A (elderly group) included patients aged between 75 and 84 years old, Group B (very elderly group) included patients aged ≥85 years old and Group C (control group) included patients aged between 65 and 74 years old.

Patient demographics and procedural details were collected from the hospital medical records and from the UK national registry, the British Cardiovascular Interventional Society (BCIS) database. All the patients were followed- up by telephone consultations. The study complied with the Declaration of Helsinki, and both centers' institutional review boards approved the research protocol.

Study endpoints:

The primary endpoint of our study was in-hospital as well as 30-day all-cause mortality. The secondary endpoints were in-hospital MACE (death, stroke or re-infarction and re-PCI), stroke including transient ischemic attack (TIA), vascular complication (hemorrhage, hematoma, false aneurysm), major bleeding, target vessel re-intervention, contrast induced acute kidney injury (CI-AKI) and gastrointestinal (GI) bleeding. Major bleeding events were defined as fatal bleeding or causing a fall in hemoglobin level to < 10 g/L, or requiring transfusion of ≥ 1 units of red cells.

Statistical analysis:

Categorical variables were expressed as percentage or frequencies, while quantitative data were described using range (minimum and maximum), mean, standard deviation. Chi-square test was used for categorical variables, to compare between diverse groups. Fisher's Exact (FE) or Monte Carlo (MC) correction for Chi-square when more than 20% of the cells have expected count less than 5. F-test (ANOVA) for normally distributed quantitative variables, to compare between more than two groups, and Post Hoc test (Tukey) for pairwise comparisons. Finally, regression was used to detect the most independent factor affecting mortality and MACE. All p-values will be quoted to 3 decimal places and a p value of <0.05 will be considered statistically significant. Data were fed to the computer and analyzed using IBM SPSS software package version 20.0**. (**Armonk, NY: IBM Corp**).**

Results:

Patient clinical characteristics:

From January 2017 to December 2020, a total of 1111 consecutive patients (779 from WWL Trust and 332 from Tanta university hospitals) aged ≥ 65 years old diagnosed with STEMI and underwent P-PCI were included in the study, 339 (30.5%) patients were classified into group A, 95 (8.5%) patients were classified into group B and 677 (61%) patients were classified into group C.

When compared to their younger counterparts in group C, the elderly patients in groups A and B had more female patients. Additionally, history of CKD and prior CABG was significantly higher among elderly patients in comparison to the control group, while smoking tended to be more common in younger patients. Patient in group B showed a lower body mass index (BMI) when compared to patients in the control group. Baseline clinical demographics have been presented in **Table I.**

Procedural Characteristics:

As shown in **Table II**, the incidence of multiple vessel disease (MVD) was higher in the elder groups A and B compared to the non-elder control group C. Usage of glycoprotein IIb/IIIa inhibitors was significantly higher in the control group C despite the fact that more graft procedures were performed in the elderly groups.

No significant differences existed between the studied groups in all other procedural characteristics including time between STEMI diagnosis and wire crossing the lesion, arterial access, baseline and final TIMI flow.

Clinical Outcomes:

Table III summarizes the clinical outcomes of the study population. There were no statistically significant differences between the studied groups as regard the incidence of in-hospital mortality as well as 30-day mortality. However, the incidence of in-hospital MACE in the very elderly group

(≥85) was markedly higher compared to the youngest group, (23.1% vs 1.8%, P < 0.001). Similarly, the incidence of post P-PCI arrythmia was significantly higher in the former group (12.6% vs. 3%, P < 0.001). When compared to the non-elderly patients of group C, incidence of contrast induced acute kidney injury (CI-AKI) was significantly higher among the patients of the elderly groups A and B. The mean length of hospital stay and rates of cerebrovascular accidents (ischemic/hemorrhagic) were similar in the three groups. Finally, the 3-month ECHO follow up showed a significantly lower left ventricular ejection fraction (LVEF) in the elderly patients compared with patient in group C.

Of note, very elderly patients in group B tended to have more vascular complications than control group patients. A subgroup analysis for the correlation between vascular complications and arterial access revealed that most of the complications were recorded in patients who had angioplasty through femoral access**.** Significantly, no vascular complications were recorded in 99% (880) of patients who had P-PCI via radial access (n=891) versus 81% (102) of patients operated through femoral access (n=126) (P<0.001) **(Supplementary data).**

Multivariate logistic regression analyses models were used to detect potential clinical and procedural risk factors associated with in-hospital all-cause mortality as well as in-hospital MACE. Arterial hypertension (OR 5.336, 95% CI 1.187 – 23.998) and CKD (OR 11.024, 95% CI 2.104 - 57.756) were independent predictors of in-hospital death (**Table IV**). Moreover, a final TIMI flow less than 3 (OR 42.322, 95% CI 5.674 – 315.667) and bleeding that needed blood transfusion (OR 87.144, 95% CI 3.086 – 2460.628) have been linked to a higher risk of in-hospital MACE **(Table V).**

Discussion:

As population ages, there is an increasing number of elderly patients presented to our hospitals with STEMI. Those patients have multiple comorbidities and variable degrees of fragility, which contribute to their special degree of vulnerability being at higher than average risk of bleeding and other complications.(7) Immediate reperfusion was proved to be beneficial in STEMI patients in previous studies; however, older patients were usually underrepresented in ACS clinical trials, and there is very limited evidence in the recommendation of the reperfusion strategies for elderly STEMI patients.

Although, the latest ESC guidelines for management of acute STEMI stated that P-PCI has no upper age limit, this was relying only on one trial that was interrupted as the estimated sample size could not be achieved. Consequently, the safety and efficacy of P-PCI remains uncertain in that particular age-group of patients.(8,9)

Accordingly, this study aimed to evaluate the outcomes of P-PCI in patients aged ≥75-year-old presenting with acute STEMI in comparison to similar outcomes in their younger counterparts.

Overall, the study population showed male predominance that was matching with almost all ACS trials.(4,10–12); however, it is worth mentioning that elderly groups tended to have more female patients.(13,14) In addition, aged patients were more likely to have history of impaired renal function, prior CABG and low BMI, but were less likely to be smokers.(15)

Regarding the location of infarction, most of the study population presented with lateral STEMI which was discordant with most of the stablished STEMI trials, in which anterior location was the most common site of infarction in their studied populations.(4,10,16,17)

Significantly higher proportion of elderly patients enrolled in this study, were found to have MVD when compared to their younger counterparts, which was consistent with prior studies(18,19) and with the fact that atherosclerosis is a chronic progressive inflammatory condition.(20–22)

On one hand, regarding mortality, our study demonstrated comparable figures of P-PCI in elderly patients to lower age control group, excluding age as an independent risk factor for mortality

after P-PCI, there were no significant differences between groups regarding the study primary endpoint (in-hospital and 30-day death). These results are consistent with prior studies, further supporting an invasive revascularization approach in elderly patients.(4,11,19)

On the other hand, incidence of in-hospital MACE (death, stroke or re-infarction and re-PCI) was found to be significantly higher in very elderly patients (≥85 years old) compared to other groups.

Of note, incidence of mortality in the current study was lower than that of most of similar previously conducted studies; however, it is approximately compatible with the results of Reza Faze et al.(23) who conducted a systematic review analysis of 31 contemporary trials.

Although it is believed that the risk of bleeding is consistently increasing with age,(15) our study did not show any significant difference among the studied groups as regard post P-PCI bleeding. Our results came in agreement with data from previous studies.(11,12,19)

It was noted that incidence of bleeding complications occurred mainly with pharmaco-invasive strategy and those managed through femoral arterial access. However, number of patients managed through pharmaco-invasive approach were too small to get significant statistical results.

A subgroup analysis of the relation between vascular complications and arterial access revealed that access-related complications were more consistent with trans-femoral approach. This came on agreement with previous studies comparing between trans-radial and trans-femoral accesses, which demonstrated that trans-radial access is associated with better clinical outcome than trans-femoral access; therefore, age should not be a barrier to trans-radial access for PCI.(24–26)

The effect of GP IIb/IIIa inhibitors in older patients stills controversial, and its association with increased bleeding risk in older patients needs to be observed.(27) However, it is worth mentioning that, our study did not reveal any potential relation between usage of GP IIb/IIIa inhibitors in elderly patients and bleeding complications.

Incidence of contrast induced acute kidney injury (CI-AKI) was significantly higher in elderly patients, which is consistent with prior studies.(4,28,29) This could be explained as the kidney

function usually deteriorates with aging and elderly population usually had a worse renal function than the younger ones, so the contrast used in P-PCI might increase the risk of renal impairment and CI-AKI.

Arterial hypertension and CKD were the only variables demonstrated to be independent risk factors for in-hospital mortality after P-PCI in elderly patients with STEMI. Findings were consistent with previous studies that demonstrated that absence of hypertension and low creatinine levels could provide better clinical outcomes.(11,29,30)

Although several studies reported that age is an independent risk factor for in-hospital mortality,(31−33) age failed to demonstrate any statistical significances as an independent risk factor for in-hospital mortality after P-PCI, and the use of an invasive strategy is still favourable approach for good prognosis in such patients. Matching figures for age were found in prior studies,(12,30,34) where statistical analysis for age was not significant.

Similarly, high Killip class (III & IV) did not show statistically significant data as independent risk factor for in-hospital mortality after P-PCI in elderly population. Those figures were not matching with data for Killip III & IV from previous studies.(30,34) However, it could be argued that the population sample of those studies were smaller and younger than the present study.

In the current report, analysis of independent risk factors of in-hospital MACE has demonstrated that the final TIMI flow and bleeding that required transfusion were the only variables that showed significant relation. Similar results were obtained in previous studies(35)**,** which reported that age and other co-morbidities were not independent predictors of MACE in elderly population after primary PCI; nevertheless, one study(12) documented that advanced age and previous history of angina may be associated with high incidence of MACE in such age group of patients.

In short, it is necessary to strengthen in daily clinical practice that any patient admitted with STEMI must always be considered to perform a P-PCI after balancing the cost benefit equation without excluding anyone by age. As the results of the present study would support the

indication of P-PCI as the treatment of choice for ≥75-year-old patients presented with acute STEMI.

Study limitations:

This current study provides well-needed data suggesting that the invasive treatment of patients with acute STEMI aged ≥75 years results in a good prognosis and comparable outcomes to younger patients. However, there were a number of limitations in this study: Firstly, it was mainly a retrospective study, which might have limited general applicability. Secondly, due to the lack of guidance, selection of an invasive strategy or a conservative strategy mainly depended on the clinicians' experience and the wishes of patient's family, which might have resulted in selection bias. Thirdly, outcome was limited to in- hospital and 30 days duration only and it would be better if outcome for six months and one year were also evaluated. Finally, frailty scores, cognition measures, co-morbidity indices and questionnaires on quality of life were not investigated during our study for the participant, because it was mainly a retrospective study and such information were difficult to obtain. We believe such data would be really valuable for accurate assessment and deciding which management plan should be selected for those patients. Therefore, further randomised trials with larger sample sizes are required in the future, taking into consideration the above-mentioned factors about the elderlies' life.

Conclusion:

Our study revealed that the outcomes of P-PCI in elderly population (75 or more) presented with acute STEMI are favourable and comparable to younger patients; however, the incidence of in-hospital MACE may be higher only in patients aged 85 or more. Accordingly, P-PCI should be offered to every elderly patient presenting to any hospital with well-equipped Cath lab and experienced staff, taking into consideration the independent risk factors for both mortality and MACE in this special age group.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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Supplementary Table I: Relation between Access and Vascular complication in total sample

Vascular complication	Access				
	Radial (n= 891)		Femoral (n= 126)		^{FE}p
	No.	%	No.	%	
No	880	98.8	102	81.0	<0.001*
Hemorrhage	2	0.2	2	1.6	0.077
Hematoma	9	1.0	21	16.7	<0.001*
Aneurysm	0	0.0	1	0.8	0.124
(^{MC}p)			(<0001*)		

χ^2: **Chi square test** MC: **Monte Carlo** FE**: Fisher Exact**
p: p value for comparing between the studied groups
*: Statistically significant at $p \leq 0.05$

Tables:

Table I: Baseline clinical characteristics

Variable	Group A (75-84, N=339)	Group B (≥85, N=95)	Group C (65-74, N=677) (Control group)	P-value
Sex, male	215 (63.4%)	56 (58.9%)	496 (73.3%)	**0.001***
Smoking, current	39 (11.5%)	4 (4.2%)	117 (17.3%)	**0.001***
Diabetes Mellites	81 (23.9%)	29 (30.5%)	178 (26.3%)	0.402
Hypertension	283 (83.5%)	82 (86.3%)	559 (82.6%)	0.648
Family history	61 (18%)	9 (9.5%)	223 (32.9%)	**<0.001***
PAD	12 (3.5%)	1 (1.1%)	10 (1.6%)	0.120
Dyslipidemia	285 (84%)	83 (87.4%)	555 (82%)	0.356
BMI	**(n=326)** 27.69 ± 7.12	**(n=92)** 12.60 – 34.70	**(n=611)** 10.10 – 61.60	**<0.001***
Chronic kidney disease				**^{MC}p= 0.009***
CKD on medical	24 (7.1%)	6 (6.3%)	23 (3.4%)	
CKD on Dialysis	5 (1.5%)	1 (1.1%)	2 (0.3%)	
Previous MI	82 (86.3%)	16 (16.8%)	144 (21.3%)	0.270
Previous PCI	257 (75.8%)	78 (82.1%)	485 (71.6%)	0.057
Previous CABG	298 (87.9%)	82 (86.3%)	192 (28.4%)	**<0.001***
Location of infarction				
Anterior	55 (16.3%)	25 (26.3%)	84 (12.6%)	
Inferior	65 (19.2%)	5 (5.3%)	187(28.1%)	
Lateral	205 (60.7%)	64 (67.4%)	343 (51.6%)	**<0.001***
Isolated posterior	1 (0.3%)	0	19 (2.9%)	
Other	12 (3.6%)	1 (1.1%)	32 (4.8%)	
Systolic BP, mmHg	135.01 ± 20.79	135.16 ± 19.62	132.88 ± 19.88	0.217
Diastolic BP, mmHg	82.74 ± 15.13	83.79 ± 14.16	82.22 ± 14.41	0.580
Heart rate, bpm	81.73 ± 22.25	84.34 ± 19.68	83.15 ± 22.77	0.499
Rhythm				0.785
Normal sinus	276 (81.4%)	76 (80%)	559 (82.6%)	
Other	63 (18.6%)	19 (20%)	118 (17.4%)	
Killip class				
I	232 (69.7%)	69 (72.6%)	456 (67.4%)	
II	38 (11.4%)	11 (11.6%)	77 (11.4%)	0.734
III	63 (18.9%)	15 (15.8%)	144 (21.3%)	
IV	6 (1.5%)	1(1.1%)	5 (1%)	^{MC}p=0.740

Values are mean ± SD, or n (%).
χ^2: **Chi square test** MC: **Monte Carlo** **F**: **F for ANOVA test**
p: p value for comparing between the studied groups
p_1: p value for comparing between **Control and each other group**
*: Statistically significant at $p \leq 0.05$

Table II: Baseline procedural characteristics.

Variable	Group A (75-84, N=339)	Group B (≥85, N=95)	Group C (65-74, N=677) (Control group)	P-value
Mode of reperfusion				
P-PCI in 60 min	130 (38.3%)	37 (38.9%)	271 (40%)	0.469
P-PCI in 60-90 min	58 (17.1%)	15 (15.8%)	126 (18.6%)	
P-PCI >90 min	150 (44.2%)	43 (45.3%)	271 (40%)	
Pharmaco-invasive	1 (0.3%)	0	9 (1.3%)	
Stent				
No	2 (0.8%)	0	4 (0.8%)	$^{MC}p=$
BMS	10 (4.2%)	3 (4.2%)	23 (4.6%)	0.993
DES	228 (95.0%)	68 (95.8%)	475 (94.6%)	
Number stents	82.74 ± 15.13	83.79 ± 14.16	82.22 ± 14.41	0.580
Gp IIb/ IIIa inhibitors	8 (2.4%)	1 (1.1%)	43 (6.4%)	**0.004***
Thrombus aspiration	8 (2.4%)	1 (1.1%)	17 (2.5%)	0.678
Longest stented segment	27.74 ± 17.90	34.04 ± 25.44	28.64 ± 21.97	0.051
Access	**(n=338)**	**(n=93)**	**(n=668)**	
Femoral	54 (16.0%)	12 (12.9%)	89 (13.3%)	
Radial	271 (80.2%)	75 (80.6%)	565 (84.6%)	0.087
Both	13 (3.8%)	6 (6.5%)	14 (2.1%)	
MVD	167 (49.3%)	50 (52.6%)	270 (39.9%)	**0.003***
Vessels attempted				
Graft	18 (5.5%)	10 (10.9%)	8 (1.3%)	**<0.001***
LM	8 (2.5%)	2 (2.2%)	12 (2%)	0.885
LAD proximal	59 (18.1%)	14 (15.2%)	117 (19.1%)	0.649
LAD distal	83 (25.5%)	26 (38.3%)	197 (32.2%)	0.091
LCX	95 (29.1%)	21 (22.8%)	163 (26.7%)	0.451
RCA	107 (32.8%)	24 (26.1%)	171 (28.0%)	0.233
Ramus	11 (3.4%)	3 (3.3%)	40 (6.5%)	0.078
Baseline Stenosis	96.92 ± 5.20	98.03 ± 3.91	96.29 ± 6.58	0.018*
Baseline TIMI flow				
0	317 (93.5%)	89 (93.7%)	619 (91.4%)	
1	12 (3.5%)	1 (1.1%)	28 (4.1%)	0.642
2	7 (2.1%)	4 (4.2%)	22 (3.2%)	
3	3 (0.9%)	1 (1.1%)	8 (1.2%)	
Final TIMI flow				
0	5 (1.5%)	0 (0.0%)	6 (0.9%)	
1	1 (0.3%)	1 (1.1%)	4 (0.6%)	0.722
2	8 (2.4%)	2 (2.1%%)	23 (3.4%)	
3	325 (95.9%)	92 (96.8%)	644 (95.1%)	

Values are mean ± SD, or n (%).

χ^2: **Chi square test** MC: **Monte Carlo** **F**: **F for ANOVA test**

p: p value for comparing between the studied groups

p_1: p value for comparing between **Control and each other group**

*: Statistically significant at $p \leq 0.05$

Table III: Comparison between the different studied groups according to procedural outcomes

Variable	Group A (75-84, N=339)	Group B (≥85, N=95)	Group C (65-74, N=677) (Control group)	P-value
In-hospital mortality	8 (2.4%)	4 (4.2%)	12 (1.8%)	0.296
30-days mortality	8 (2.4%)	6 (6.3%)	18 (2.7%)	0.108
In-hsopital MACE	9 (2.7%)	22 (23.1%)	12 (1.8%)	<0.001
Dissection	7 (2.1%)	4 (4.2%)	9 (1.3%)	0.129
Perforation	2 (0.6%)	1 (1.1%)	5 (0.7%)	^{FE}p=0.738
Tamponade	0	0	2 (0.3%)	^{FE}p=0.624
Re-infarction	2 (0.6%)	2 (2.1%)	4 (0.6%)	^{FE}p=0.246
CVS				
Ischemic	2 (0.6%)	3 (3.2%)	4 (0.6%)	^{MC}p=0.117
Hemorrhagic	0	0	2 (0.3%)	
CIN	**(n=393)**	**(n=95)**	**(n=676)**	
Dialysis	4 (16.0%)	1 (11.1%)	6 (25.0%)	0.005*
No dialysis	21 (84.0%)	8 (88.9%)	18 (75.0%)	
Limb ischemia	12 (3.5%)	1 (1.1%)	28 (4.1%)	^{FE}p=1.000
Hemorrhage				
Minor	3 (0.9%)	2 (2.1%%)	7 (1%)	^{MC}p=0.274
Major	0	1 (1.1%)	2 (0.3%)	
Heart failure	52 (15.3%)	16 (17.0%)	112 (16.5%)	0.865
Cardiogenic shock	5 (1.5%)	2 (2.1%)	13 (1.9%)	0.856
Arrythmia	13 (3.8%)	12 (12.6%)	20 (3.0%)	<0.001*
Vascular complications	**(n=326)**	**(n=92)**	**(n=611)**	
Hemorrhage	1 (0.3%)	0	3 (0.5%)	^{MC}p <0.001*
Hematoma	9 (2.8%)	11 (12%)	10 (1.6%)	
Aneurysm	0	1 (1.1%)	0	
Bleeding and Transfusion	2 (0.6%)	0	3 (0.5%)	^{MC}p=1.000
GI Bleeding	2 (0.6%)	2 (2.2%)	2 (0.3%)	^{MC}p=0.091
Length of hospital stay	1.86 ± 1.07	1.96 ± 1.24	2.03 ± 1.31	0.124

Values are mean ± SD, or n (%).
χ^2: **Chi square test** MC: **Monte Carlo** **F**: **F for ANOVA test**
p: p value for comparing between the studied groups
p_1: p value for comparing between **Control and each other group**
*: Statistically significant at $p \leq 0.05$

Table IV: Multivariate logistic regression analysis of factors associated with in-hospital and 30-days death

Variable	Univariate		Multivariate	
	OR (95% CI)	***P-value***	**OR (95% CI)**	***P-value***
Age ≥85 (years)	2.789 (0.943 – 8.247)	0.064		
Sex, Female	1.692 (0.583 – 4.915)	0.333		
Diabetes Mellites	2.279 (0.773 – 6.720)	0.135		
Hypertension	0.324 (0.105 – 0.997)	0.049*	**5.336 (1.187 – 23.998)**	**0.029***
PAD	6.152 (1.227 – 30.846)	0.027	0.331 (0.001 – 92.500)	0.700
Chronic kidney disease				
CKD on medical	8.644 (2.695 – 27.730)	<0.001*	**11.024 (2.104 – 57.756)**	**0.005***
CKD on Dialysis				
Previous MI	0.256 (0.033 – 1.983)	0.192		
Previous CABG	0.533 (0.068 – 4.155)	0.548		
Systolic BP, mmHg	1.005 (0.979 – 1.032)	0.697		
Heart rate, bpm	1.015 (0.991 – 1.038)	0.221		
Killip class				
I	***Ref***	***Ref***	***Ref***	***Ref***
II	2.092 (0.410 – 10.674)	0.375	1.373 (0.224 – 8.419)	0.732
III	4.097 (1.284 – 13.077)	0.017*	2.342 (0.512 – 10.706)	0.272
IV	8.040 (0.859 – 75.284)	0.068		
Mode of reperfusion				
P-PCI in 60 min	***Ref***	***Ref***		
P-PCI in 60-90 min	2.343 (0.462 – 11.893)	0.304		
P-PCI >90 min	2.364 (0.617 – 9.059)	0.209		
Anterior infarction	2.548 (0.830 – 7.821)	0.102		
MVD	0.743 (0.253 – 2.178)	0.588		
Final TIMI flow				
0 or 1 or 2	18.889 (5.495 – 64.932)	<0.001*	5.313 (0.875 – 32.268)	0.070
3	***Ref***	***Ref***	***Ref***	***Ref***
Re-infarction	10.692 (1.041 – 109.842)	0.046*	4.690 (0.351 – 62.697)	0.243
Post PCI cardiogenic shock	13.833 (2.434 – 78.605)	0.003*	13.417 (0.840 –214.320)	0.066
Arrythmia	4.934 (1.283 – 18.972)	0.020*	4.886 (0.851 – 28.061)	0.075
Length of hospital stay	0.501 (0.187 – 1.341)	0.169		

OR: Odd`s ratio, TIMI: Thrombolysis in Myocardial Infarction, PVD: peripheral vascular disease, HTN; Hypertension, C.I: Confidence interval, LL: Lower limit, UL: Upper Limit
All variables with p<0.05 was included in the multivariate
*: Statistically significant at p ≤ 0.05

Table V: Multivariate logistic regression analysis of factors associated with MACE

Variable	Univariate	Multivariate

	OR (95% CI)	*P-value*	OR (95% CI)	*P-value*
Age ≥85 (years)	4.012 (1.840 – 8.751)	<0.001*	3.660 (0.819 – 16.361)	0.089
Sex, Female	1.081 (0.493 – 2.370)	0.845		
Diabetes Mellites	2.357 (1.078 – 5.154)	0.032*	1.974 (0.365 – 10.680)	0.430
Hypertension	0.861 (0.316 – 2.348)	0.770		
Dyslipidemia	0.288 (0.126 – 0.656)	0.003*	0.973 (0.132 – 7.188)	0.978
CKD on medical treatment	5.464 (2.106 – 14.175)	<0.001*	1.723 (0.125 – 23.727)	0.684
Previous CABG	0.835 (0.243 – 2.866)	0.775		
Systolic BP, mmHg	0.998 (0.980 – 1.017)	0.839		
Stents				
DES	***Ref***	***Ref***	***Ref***	***Ref***
BMS	10.938 (3.211 – 37.258)	<0.001*	1.167 (0.020 – 68.819)	0.941
Vessel attempted, LM	5.118 (1.017 – 25.773)	0.048*	10.541 (0.344 – 323.185)	0.177
Femoral access	1.473 (0.573 – 3.784)	0.421		
Final TIMI flow				
3	***Ref***	***Ref***	***Ref***	***Ref***
0 or 1 or 2	17.644 (6.156 – 50.572)	<0.001*	**42.322 (5.674 – 315.667)**	**<0.001***
Bleeding and transfusion	19.800 (1.194 – 328.209)	0.037*	**87.144 (3.086 – 2460.628)**	**0.009***
CIN	1.500 (0.428 – 5.256)	0.526		
Length of hospital stay	1.464 (1.149 – 1.864)	0.002*	1.001 (0.528 – 1.899)	0.997

OR: Odd`s ratio, C.I: Confidence interval
All variables with
p<0.05 was included in the multivariate
*: Statistically significant at $p \leq 0.05$