Original Research Article

Management of Coronary Bifurcation Lesions in the Setting of Acute Myocardial Infarction

Abstract

Background: Coronary bifurcation lesions (CBLs) encompass stenotic segments of the coronary artery that are situated near or encroach upon the origin of a major side branch. These lesions are implicated in nearly 20% of all percutaneous coronary interventions
The objective of this study was to evaluate the clinical and interventional methodologies applied to patients with CBL in the context of AMI. Furthermore, it sought to compare the immediate outcomes and six-month follow-up results between the single-stent and dual-stent approaches for managing CBL in AMI patients
Methods: This prospective study included 100 patients with a true CBL in the setting of AMI, at the Cardiology Department, Benha University Hospitals and International Medical Center Hospital. Patients were divided into 2 equal groups: Group I included patients planned one-stent (provisional one-stenting) and Group II included patients with planned two-stents. All studied cases underwent complete clinical examination, laboratory investigations, complete 12-leads electrocardiography and echocardiography.
Results: Type of drug eluting stent was significantly different between both groups (P=0.001). Group 2 had significantly longer procedural and fluoroscopy time than group 1 (P<0.001). Follow up in hospital (MACCE, cardiac death, target lesion revascularization, MI, and ejection fraction) and follow up at 6 months (MACCE, cardiac death, target lesion revascularization, MI, ejection fraction, stent technique, and degree of mitral regurgitation) were insignificantly different between both groups. **Conclusion:** Despite

the greater complexity, extended fluoroscopy duration, and increased contrast volume associated with the two-stent strategy in STEMI cases, the procedural success rate and the incidence of MACE were found to be similar to those observed with the single-stent approach during medium-term follow-up.

Keywords: Coronary; Bifurcation; Acute Myocardial Infarction; Two-stent strategy.

Introduction

A coronary bifurcation lesion (CBL) refers to the stenosis of a coronary artery occurring near or at the origin of a substantial side branch (SB). Its characterization is frequently reliant on the interventionalist's subjective assessment, often lacking a standardized definition (1). Coronary bifurcation lesions are commonly encountered in routine clinical practice, comprising as much as 20% of all PCI (2). PCI for managing coronary bifurcation lesions is considered a high-risk undertaking, characterized by reduced procedural success, an elevated incidence of periprocedural complications, and an increased propensity for in-stent restenosis when compared to interventions targeting non-bifurcated lesions (3).

The likelihood of stent thrombosis has been notably heightened with the utilization of the two-stent technique. Consequently, provisional stenting is advocated as the preferred initial strategy for addressing bifurcation lesions (4). Nonetheless, provisional stenting carries an inherent risk of jeopardizing the side branch following stent deployment in the main vessel.

Extensive randomized controlled trials have meticulously examined the efficacy of various intervention strategies for bifurcation lesions, consistently indicating that the systematic application of the two-stent technique does not confer any clinical superiority when compared to the approach of main branch stenting with contingent

side branch stenting (5). Moreover, the two-stent technique is associated with increased procedure duration, greater contrast volume, elevated radiation exposure, and higher costs (6). Acute coronary syndrome (ACS), on the other hand, carries a significant risk of both short- and long-term mortality (1 , 7). In patients with ACS who present with bifurcation culprit lesions, particularly when a substantial SB is involved, extensive regions of myocardial ischemia are often observed (1). Here's a sophisticated paraphrase of your text:
Consequently, therapeutic focus must be directed toward both the main and secondary branches. In cases of ACS, achieving optimal or comprehensive revascularization of the affected myocardium via a two-stent strategy (2SS) might be linked to improved short- and long-term clinical outcomes, notwithstanding the complexities involved in executing PCI on genuine CBL.

The aim of this study was to evaluate the clinical and interventional approaches utilized for managing patients with CBL in the context of AMI. The study additionally aimed to evaluate and contrast the immediate outcomes and six-month follow-up results of employing the one-stent versus the two-stent techniques in the management of CBL among patients with AMI.

Patients and methods

This prospective cohort investigation encompassed 100 patients diagnosed with genuine CBL amidst AMI. The study was carried out within the Cardiology Department of Benha University Hospitals and the International Medical Center Hospital over the period from May 2021 to December 2023.

Informed written consent was secured from each participant, with a thorough explanation provided regarding the study's objectives. Each patient was assigned a confidential code number to ensure privacy. The research was conducted following the approval of the

Research Ethics Committee at the Faculty of Medicine, Benha University.

The inclusion criteria encompassed patients presenting with AMI, which included both NSTEMI and STEMI, characterized by a discernible fluctuation in cardiac troponin levels, with at least one value exceeding the 99th percentile URL. Additionally, eligible patients were required to demonstrate one or more of the following: the development of pathological Q waves, clinical manifestations suggestive of ischemia accompanied by new ECG changes, a novel regional wall motion abnormality consistent with an ischemic etiology or imaging evidence of recent myocardial viability loss, or the detection of a coronary thrombus via angiography, including findings from intracoronary imaging or autopsy (8). Additionally, the presence of true CBL was mandatory for inclusion.

Exclusion criteria: patients with cardiogenic shock, extensive thrombus burden, non-true bifurcation, vessel diameter <2.5 mm, life expectancy less than 1 year, lost at follow up or end stage renal disease and liver disease were excluded.

Grouping: Patients were enrolled and stratified into two cohorts based on the stenting strategy employed: Group I (N=50) consisted of individuals with acute myocardial infarction who were scheduled for a single-stent approach (provisional one-stenting), while Group II (N=50) comprised those with AMI who were designated for a planned two-stent technique.

All studied cases were subjected to the following: Demographic data collection, including [age, sex, occupation, residence, and marital status]. **Complete history taking including [**hypertension, diabetes mellitus, dyslipidemia, positive family history of premature CAD, smoking, drug medications, peripheral vascular disease, COPD, congestive heart failure & prior vascular disease]. **Complete clinical examination including** [general examination as measurement of temperature, pulse, heart rate, systolic and diastolic

blood pressure. Local examination to detect the presence or absence of associated cardiac or systemic diseases, hemodynamic instability, and indications of LV dysfunction **Routine laboratory investigations [**complete blood count, Cardiac enzymes as troponin, lipid profile test, kidney and liver function tests] and **Application of CRUSADE bleeding risk score:** The final model's coefficient was reflected in the CRUSADE bleeding score, which was calculated by assigning a weighted integer to each independent predictor. The aggregate total for each patient is determined by adding up these weighted integers, with a possible range of 1 to 100 points (9). **Complete 12-leads electrocardiography:** A 12-lead ECG was conducted upon the patient's initial admission and subsequently repeated promptly following their transfer to the ICU.

Echocardiography:

The Philips IE33 and GE VIVID E9 systems, which were equipped with 2.5 MHz transducers, were used to conduct echocardiographic assessments for all participants. The modified Simpson's method was employed to ascertain the LVEF from the two-dimensional apical four-chamber view. Images obtained included 2D, color, and pulsed-wave and continuous-wave Doppler. Measurements were averaged over three consecutive cardiac cycles, and all Doppler echocardiographic recordings were acquired at a scan speed of 50–100 mm/s−1. In order to ensure that the measurements were taken perpendicular to the ventricular long axis, the left ventricular diameters and wall thicknesses were assessed in the left parasternal long-axis view at the mitral valve extremities (10).

Conventional echocardiography: In the left lateral decubitus position, a comprehensive transthoracic echocardiographic examination was conducted using a Vivid E95 ultrasound system (M5Sc-D probe) with a contemporaneous ECG signal gating (Lead II). Echocardiographic examinations were acquired and archived for offline analysis. Tissue Doppler Imaging (TDI) was performed by activating the TDI function. Using tissue Doppler imaging,

segmental myocardial velocities were assessed at the basal segments of the longitudinal walls in conformance with the protocols established by the American Society of Echocardiography and the European Association of Cardiovascular Imaging (11).

Procedures:

All patients received pre-treatment with a 300 mg dose of aspirin and a loading dose of either 300 mg or 600 mg clopidogrel, or alternatively, 180 mg of ticagrelor prior to undergoing their interventional procedures. A heparin dose of no less than 70 units per kilogram of body weight was administered. Subsequently, all participants were initiated on a maintenance regimen comprising daily aspirin at 100 mg, in conjunction with either 75 mg of clopidogrel or 90 mg of ticagrelor administered bi-daily, to be continued for a minimum period of 12 months. The operative physician had discretion over the selection and quantity of stents, the employment of aspiration catheters, glycoprotein IIb/IIIa inhibitors (GPI), and post-stent deployment kissing balloon inflation, as well as the decision to utilize a straightforward or complex stenting approach. Coronary interventions were carried out within 24 hours of hospital admission using either 6 or 7-Fr diagnostic and guiding catheters, with access achieved through radial or femoral approaches. Each bifurcation lesion underwent quantitative coronary angiography (QCA), which involved detailed assessment of the proximal and distal segments of the main vessel and the side branch. A minimum of two orthogonal angiographic views were captured for the quantitative evaluation. In the STEMI cohort, post-revascularization measurements included lumen DS, MLD, and reference diameter in both the main and side branches. Conversely, the non-STEMI cohort underwent these measurements prior to PCI.

Primary PCI to STEMI and early invasive strategy to NSTEMI:

Emergency PCI involving balloon angioplasty, stent deployment, or the use of other approved devices was conducted in the IRA without prior fibrinolytic therapy. In the event of hemodynamic or electrical instability, or worsening ischemia at any point during treatment, an urgent PCI was promptly instituted in the event of fibrinolytic therapy failure, which is defined as less than 50% ST-segment resolution within 60-90 minutes. Coronary angiography with PCI of the IRA is performed if indicated, between 2 and 24 hours, following successful fibrinolysis (ST-segment resolution > 50% in 60–90 minutes, typical reperfusion arrhythmia, and the discontinuation of chest pain).

Clinical follow-up (In hospital and after 6 months):

Major adverse cardiac events (MACE-TLF) were delineated as comprising mortality, non-fatal myocardial infarction, and TLR, all of which were directly attributable to the target lesion and indicative of target lesion failure. TLR was characterized by the necessity for repeat CABG or PCI specifically for the target lesions. A subsequent PCI or CABG involving the previously treated vessel was classified as TVR. Stent thrombosis (ST) was characterized as a myocardial infarction induced by the target vessel, corroborated by angiographic evidence of thrombus formation or total occlusion at the target site.

Statistical analysis

Statistical evaluations were executed utilizing SPSS version 28 (IBM Inc., Armonk, NY, USA) for comprehensive data analysis. The comparison of quantitative variables between the two cohorts was carried out utilizing the unpaired Student's t-test, with results

presented as means and standard deviations (SD). Qualitative data were analyzed employing either the Chi-square test or Fisher's exact test, contingent on the appropriateness, and were expressed as frequencies and percentages (%). Statistical significance was inferred when a two-tailed P value fell below the 0.05 threshold. The Kaplan-Meier survival analysis was employed to graphically represent the temporal progression to events such as cardiac mortality, MACCE, MI, and TLR.

Results

Demographic data (age, sex, weight, height, and BMI), prevalence of comorbidities (HTN and DM), risk factors (smoking, family history and dyslipidemia) and prior history of (AF, angina, previous MI, prior PCI, prior CABG, and medications) and laboratory investigations (Hb, WBCs, platelets, INR, PTT, TG, HDL, LDL, total cholesterol, troponin, CPK, CKMB, AST, ALT, creatinine, and BUN) exhibited no statistically significant disparity between the two groups **Table 1**

The general examination parameters, including HR, SBP, DBP, and the CRUSADE risk score, revealed no statistically significant differences between the two groups. However, the distribution of lesion locations exhibited a significant variance between the groups (P<0.001). Proximal LAD and LCX in group 1 and Proximal LAD and Mid LCX were the most common sites in group 2. **Table 2**

The type of drug eluting stent was significantly different between both groups (P=0.001). Branch vessel, lesion characteristics, mean lesion length, medina classification, GPIIb IIIa, and intravascular ultrasonography were insignificantly different between both groups. Group 2 had significantly longer Procedural time and Fluoroscopy time compared to group 1 (P<0.001). Maximal inflation pressure, balloon diameter for KBI, reference vessel diameter, angiographic success, stenosis diameter, minimum lumen diameter, hospital stay,

and degree of mitral regurgitation were insignificantly different between both groups. **Table 3**

Follow up in hospital (MACCE, cardiac death, target lesion revascularization, MI, and ejection fraction) and follow up at 6 months (MACCE, cardiac death, target lesion revascularization, MI, ejection fraction, stent technique, and degree of mitral regurgitation) were insignificantly different between both groups. **Table 4**
The mean duration until the occurrence of cardiac mortality exhibited no statistically significant divergence between the two cohorts (P=0.502) (HR=1.64 (95% CI: 0.3869 to 6.9512)). Similarly, the average time to MACCE did not reveal a statistically significant disparity between the groups (P=0.53) (HR=0.67 (95% CI: 0.1919 to 2.3387)). Furthermore, the mean time to myocardial infarction (MI) was also statistically indistinguishable between the two groups (P=0.428) (HR=1.926 (95% CI: 0.3816 to 9.7213)). Likewise, the average interval for target lesion revascularization displayed no significant difference between the groups (P=0.105) (HR=0.4362 (95% CI: 0.1601 to 1.1885)).

Discussion

Bifurcation lesions account for about 15% to 20% of coronary artery stenosis managed by PCI. The best strategy for treating bifurcation lesions remains controversial. Factors that influence treatment decisions include target vessel size, nature and angle of the side branch, whether the ostium is involved, plaque volume, and likelihood of plaque shifting (12).

In the present study, it was found that demographic data (age, sex, weight, height, and BMI) were insignificantly different between both groups.

Milejski et al. (13) investigated the impact of clinical diagnoses on post-PCI outcomes. Among the 528 PCI procedures analyzed, 306 involved the treatment of bifurcation lesions. Within this subgroup,

113 patients were diagnosed with AMI, comprising 31 cases of STEMI and 82 cases of NSTEMI. The results showed that there were insignificant differences between both groups regarding (age, sex, and BMI).

In the present study, it was found that the prevalence of comorbidities (HTN, and DM) was insignificantly different between both groups.

Shanmugam et al. (14) reported that there was insignificant difference between both groups regarding comorbidities (HTN, and DM).

In this study, it was ascertained that the prevalence of risk factors—such as familial predisposition, dyslipidemia, and smoking habits—demonstrated no substantial divergence between the two cohorts.

Kwan et al. (15) reported that no statistically significant disparities were observed between the two groups concerning smoking status and dyslipidemia.

In the present study, it was found that prior history (AF, prior PCI, angina, previous MI, prior CABG, and medications) was insignificantly different between both groups.

According to Choi et al (16) no statistically significant distinctions were observed between the two cohorts with respect to prior PCI, antecedent AMI, left ventricular ejection fraction, or the scope of multivessel PCI interventions.

In the present study regarding lesion location, it was found that proximal LAD and LCX were the most common locations in group 1 (20%, 16% of patients respectively) and proximal LAD and mild LCX were the most common locations group 2 (each found in 36% of patients).

Milejski et al. (13) demonstrated that the most frequent sites of culprit lesions in both cohorts were the LM, LAD, Cx, and RCA.

In the present study, it was found that type of drug eluting stent was significantly different between both groups (Onyx was the most common in group 1 and 2 (68% and 78% of patients respectively)). Resolute, Xience, Ultimaster, and Promus was found in 4%, 20%, 4%, and 0% respectively in group one and found in 12%, 0%, 0%, and 10% respectively in group 2. Branch vessel, lesion characteristics, mean lesion length, medina classification, GPIIb IIIa, and intravascular ultrasonography were insignificantly different between both groups. Diagonal branch was the most common in group 1 and 2 (48% and 46% of patients respectively). Focal type was the most common lesion characteristics in group 1 and 2 (48% and 62% of patients respectively). Medina classification 1.1.1 was the most common in group 1 and 2 (64% and 50% of patients respectively).

According to shanmugam et al (14) dual wiring was implemented in 79.1% of PPCI cases, which encompasses both the main vessel and the lateral branch. Drug-eluting stents (DES) were implemented in 47.3% of the patients in the bifurcation group, while they were implemented in 38.8% of the patients in the non-bifurcation group ($p = 0.209$). A total of 24.8% of the cases involved the deployment of first-generation DES, while 14.8% of the instances involved their use ($p = 0.113$). While second-generation DES were implemented in 22.5% of the instances, they were employed in 24.0% of the cases ($p = 0.883$). With an average stent diameter of 3.0 ± 0.5 mm and a stent length of 20.1 ± 6.3 mm, 1.3 ± 0.7 stents were implemented in the context of bifurcation lesions. However, none of these metrics exhibited statistical significance when compared to the related non-bifurcation group. While the frequency of aspiration thrombectomy and/or intravenous glycoprotein inhibitors (GPI) was comparable between the two groups, the overall utilization was somewhat modest.

In the present study, it was found that group 2 had significantly longer Procedural time and Fluoroscopy time compared to group 1

(P<0.001). Maximal inflation pressure, balloon diameter for KBI, minimum lumen diameter, stenosis diameter, angiographic success, reference vessel diameter, hospital stay, and degree of mitral regurgitation were insignificantly different between both groups.

Milejski et al (13) revealed that a comparative examination of procedural attributes demonstrated that PCI in the AMI cohort was more commonly associated with pre-dilatation, the utilization of second-generation DES, and the implementation of elevated maximal inflation pressures. Provisional T-stenting was the most frequently employed technique (77%), with the LAD being the primary target in the context of AMI (76%). In 68% of cases, SB protection was employed, while 27% of patients underwent SB stenting, 21% underwent final kissing balloon inflation, and 24% underwent POT.

There were no statistically significant differences between the groups in terms of antithrombotic regimens. In AMI cases, dual antiplatelet therapy (DAPT) was administered in 99% of cases, while it was administered in 100% of non-AMI cases (p = 0.70). Additionally, triple antithrombotic therapy (TAP) was employed in 9.7% of cases, compared to 9.3% in non-AMI cases (p = 0.91). Provisional T-stenting was implemented in 17 (23% of the cases), the Crush technique in 21 (23%), V-stenting in 4 (4.4%), and T-stenting in 44 (48%) of the SB stenting scenarios. SB stenting was implemented in 91 instances (30%). Additionally, 16 patients (18%) underwent the implantation of a specialized stent. The kissing balloon technique was initially implemented in 11 (12%) cases, and the procedure concluded with kissing balloon inflation in 42 (46%) cases.

Amrawy et al. (17) elucidated that the mean duration of fluoroscopic imaging (23.96±8.90 minutes versus 17.81±5.72 minutes) and the volume of contrast medium administered (259.23±59.45 ml versus 232.58±96.18 ml) exhibited a statistically significant increase in the cohort undergoing two-stent implantation relative to the single-stent

cohort (p=0.049). Conversely, the angiographic success rates—operationally defined as residual stenosis of ≤30% and the achievement of TIMI flow grades II or III—were found to be comparable between the two groups (96.8% versus 99%, MC p=0.151).

In the present study, it was found that follow up in hospital and at 6 months (MACCE, cardiac death, target lesion revascularization, MI, ejection fraction, stent technique, and degree of mitral regurgitation) were insignificantly different between both groups. However, MACCE and Target lesion revascularization were higher in group 2. Cardiac death and MI were higher in group 1. Regarding the degree of mitral regurgitation, 0 and 2 degrees were the most common in group 1 (82% and 10% of patients respectively) and group 2 (94% and 6% of patients respectively). Also, the mean time to cardiac death and MI was insignificantly different between both groups.

Amrawy et al. (17) reported that the two groups did not exhibit a significant difference in the overall incidence of MACCE six months post-procedure (13.9% vs. 16.9%). Furthermore, there were no significant distinctions between the numerous bifurcation stenting techniques that were employed in patients who underwent dual-stent management. Ford et al. (18) determined that there was no discernible difference in the incidence of MACE between the treatment cohorts (15.8% vs. 15.4%; RR=1.04; 95% CI, 0.76–1.43; P=0.79; I^2=66%), nor was there a significant disparity in the incidence of MI (4.8% vs. 5.5%; RR=0.85; 95% CI, 0.52–1.38; P=0.51; I^2=37%). Eight of the nine randomized controlled trials examined in the study were documented to have these secondary endpoints, which were assessed at a minimum of 12 months post-intervention.

Conclusion

While the two-stent strategy in the context of STEMI entails greater procedural complexity, extended fluoroscopy exposure, and higher contrast volume, the success rate of the intervention and the occurrence of MACE were found to be on par with those of the single-stent approach over medium-term follow-up.

Ethical Approval:

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

Consent

As per international standards or university standards, patient(s) written consent has been collected and preserved by the author(s).

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Table 1: Demographics, Comorbidities & risk factors, and laboratory investigations of the studied groups

		Group 1 (N=50)	Group 2 (N=50)	P value
Age (years)	**Mean ± SD**	62.2 ± 10.59	64.7 ± 11.21	0.258
	Range	43 - 82	45 - 82	
Sex	**Male**	45 (90%)	42 (84%)	0.375
	Female	5 (10%)	8 (16%)	
Weight (Kg)	**Mean ± SD**	77.7 ± 10.73	76.6 ± 9.35	0.600
	Range	58 - 95	61 - 95	
Height (m)	**Mean ± SD**	1.7 ± 0.07	1.7 ± 0.07	0.532
	Range	1.55 - 1.79	1.54 - 1.8	
BMI (kg/m^2)	**Mean ± SD**	28.2 ± 4.43	27.6 ± 4.3	0.473
	Range	19.27 - 37.18	19.69 - 39.64	
Comorbidities	**HTN**	30 (60%)	26 (52%)	0.420
	DM	22 (44%)	19 (38%)	0.541
Risk factors	**Smoking**	21 (42%)	27 (54%)	0.229
	Family history	15 (30%)	11 (22%)	0.361
	Dyslipidaemia	18 (36%)	13 (26%)	0.279
	AF	16 (32%)	19 (38%)	0.529
	Angina	13 (26%)	11 (22%)	0.639
	Previous MI	10 (20%)	14 (28%)	0.349

	Prior PCI	15 (30%)	12 (24%)	0.499
	Prior CABG	11 (22%)	15 (30%)	0.361
Medications	**ASA Ticagrelor**	29 (58%)	22 (44%)	0.161
	ASA Clopidogrel	21 (42%)	28 (56%)	
Laboratory investigations				
Hb (g/dL)	**Mean ± SD**	12.7 ± 1.11	12.9 ± 1.1	0.498
	Range	11.1 - 14.5	11.4 - 14.8	
WBCs (x 10^9)	**Mean ± SD**	6.4 ± 1.29	6.6 ± 1.09	0.605
	Range	4.5 - 8.5	4.6 - 8.7	
Platelets (x 10^9)	**Mean ± SD**	261 ± 50.24	263.9 ± 58.85	0.793
	Range	176 - 347	170 - 350	
INR	**Mean ± SD**	1 ± 0.1	1 ± 0.11	0.644
	Range	0.9 - 1.2	0.9 - 1.3	
PTT (Sec)	**Mean ± SD**	30 ± 3.76	29.4 ± 3.34	0.371
	Range	25 - 36	24 - 35	
TG (mg/dL)	**Mean ± SD**	160.5 ± 107.72	163.5 ± 104.59	0.889
	Range	47 - 478	45 - 475	
HDL (mg/dL)	**Mean ± SD**	51.7 ± 8.94	49.2 ± 9.49	0.171
	Range	36 - 64	35 - 65	
LDL (mg/dL)	**Mean ± SD**	148.7 ± 68.31	150.4 ± 69.72	0.120
	Range	70 - 276	56 - 299	
Total cholesterol (mg/dL)	**Mean ± SD**	210.2 ± 81.45	217.9 ± 80.38	0.634
	Range	76 - 342	78 - 345	

Troponin (ng/mL)	**Mean ± SD**	1.4 ± 1.73	1.4 ± 1.59	0.959
	Range	0.07 - 6	0.06 - 6	
CPK (mcg/L)	**Mean ± SD**	553.9 ± 665.66	457.5 ± 512.05	0.419
	Range	60 - 2426	16 - 2261	
CKMB (IU/L)	**Mean ± SD**	46.2 ± 65.32	66.5 ± 85.25	0.184
	Range	1 - 241	1.3 - 270	
AST (U/L)	**Mean ± SD**	38.2 ± 14.28	40.3 ± 18.3	0.512
	Range	15 - 70	15 - 70	
ALT (U/L)	**Mean ± SD**	40 ± 15.93	43.8 ± 14.94	0.219
	Range	15 - 66	17 - 70	
Creatinine (mg/dL)	**Mean ± SD**	1.1 ± 0.31	1.1 ± 0.28	0.498
	Range	0.8 - 1.8	0.7 - 1.6	
BUN (mg/dL)	**Mean ± SD**	29.1 ± 7.03	27.3 ± 7.75	0.217
	Range	16 - 43	15 - 40	

BMI: Body mass index, HTN: Hypertension, DM: Diabetes mellitus, AF: Atrial fibrillation, MI: Myocardial infarction, PCI: Percutaneous coronary intervention, CABG: Coronary artery bypass graft, Hb: Hemoglobin, INR: International normalized ratio, PTT: Partial thromboplastin time, TG: Triglycerides, HDL: High-density lipoprotein cholesterol, LDL: Low-density lipoprotein cholesterol.

Table 2: General examination, CRUSADE risk score and lesion locations of the studied groups

		Group 1 (N=50)	Group 2 (N=50)	P value
General examination				
HR (Beats/min)	**Mean ± SD**	84.6 ± 7.19	83 ± 6.91	0.271
	Range	72 - 95	70 - 94	
SBP (mmHg)	**Mean ± SD**	127.4 ± 12.26	128.4 ± 13.9	0.704
	Range	110 - 150	110 - 150	
DBP (mmHg)	**Mean ± SD**	77 ± 9.74	76.4 ± 11.39	0.778
	Range	60 - 80	60 - 90	
CRUSADE risk score	**Mean ± SD**	23.7 ± 10.15	23.5 ± 8.76	0.925
	Range	10 - 52	13 - 50	
Lesion locations	**LAD**	7 (14 %)	5 (10 %)	**<0.001***
	LCX	8 (16 %)	0 (0%)	
	LM	2 (4 %)	5 (10 %)	
	Mid LAD	6 (12 %)	0 (0%)	
	Mid LCX	4 (8 %)	18 (36 %)	
	Proximal LAD	10 (20 %)	18 (36 %)	
	Proximal LCX	4 (8 %)	0 (0%)	

HR: Heart rate, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, RCA: Right coronal artery, LAD: Left anterior descending artery, LCX: Left circumflex artery, LM: Left main coronary artery, OM: obtuse marginal arteries, *: statistically significant as p value <0.05.

Table 3: Angiographic and procedural characteristics and Quantitative angiographic analysis of the pre-bifurcation main vascular segment of the studied groups

		Group 1 (N=50)	Group 2 (N=50)	P value
Branch vessel	**Diagonal**	24 (48%)	23 (46%)	0.861
	OM	19 (38%)	18 (36%)	
	LCX	7 (14%)	9 (18%)	
Lesion characteristics	**Diffuse**	22 (44%)	14 (28%)	0.249
	Focal	24 (48%)	31 (62%)	
	Tubular	4 (8%)	5 (10%)	
Medina classification	**0.1.1**	16 (32%)	22 (44%)	0.366
	1.0.1	2 (4%)	3 (6%)	
	1.1.1	32 (64%)	25 (50%)	
Mean lesion length (mm)	**Mean ± SD**	37.7 ± 14.83	33.6 ± 11.73	0.130
	Range	18 - 80	18 - 78	
GPIIb IIIa	**Yes**	4 (8%)	7 (14%)	0.337
	No	46 (92%)	43 (86%)	
Intravascular ultrasonography	**Yes**	5 (10%)	10 (20%)	0.161
	No	45 (90%)	40 (80%)	
Type of drug eluting stent	**Onyx**	34 (68%)	39 (78%)	**0.001 ***

	Resolute	4 (8%)	6 (12%)	
	Xience	10 (20%)	0 (0%)	
	Ultimaster	2 (4%)	0 (0%)	
	Promus	0 (0%)	5 (10%)	
Quantitative angiographic analysis of the pre-bifurcation main vascular segment				
Maximal inflation pressure (mmHg)	**Mean ± SD**	18 ± 2.08	18.4 ± 1.77	0.217
	Range	14 - 20	16 - 20	
Balloon diameter for KBI (mm)	**Mean ± SD**	3 ± 0.39	2.8 ± 0.48	0.116
	Range	2 - 3.5	2 - 3.5	
Procedural time (min)	**Mean ± SD**	56.1 ± 26.82	93.9 ± 6.39	**<0.001***
	Range	30 - 156	70 - 104	
Fluoroscopy time (min)	**Mean ± SD**	27.3 ± 12.08	47.3 ± 7.33	**<0.001***
	Range	12 - 62.4	34 - 61.8	
Angiographic success	**Yes**	46 (92%)	47 (94%)	0.337
	No	4 (8%)	3 (6%)	
Reference vessel diameter (mm)	**Mean ± SD**	3.5 ± 0.56	3.7 ± 0.8	0.281
	Range	2.5 - 4.5	2.5 - 5	
Minimum lumen diameter (mm)	**Mean ± SD**	0.4 ± 0.13	0.4 ± 0.12	0.099
	Range	0.2 - 0.8	0.3 - 0.7	
Stenosis diameter (mm)	**Mean ± SD**	0.9 ± 0.06	0.9 ± 0.06	0.091
	Range	0.8 - 1	0.74 - 1	

Hospital stay (Days)	**Mean ± SD**	4.1 ± 1.72	4.6 ± 2.14	0.152
	Range	2 - 8	1 - 8	
Degree of mitral regurgitation	**0**	38 (76%)	38 (76%)	0.232
	1	8 (16%)	6 (12%)	
	2	2 (4%)	6 (12%)	
	3	2 (4%)	0 (0%)	

LCX: Left circumflex artery, OM: obtuse marginal arteries, KBI: Kissing balloon inflation.

Table 4: Follow up in hospital and at 6 months of the studied groups

		Group 1 (n=50)	Group 2 (n=50)	P value
In hospital				
MACCE	**Yes**	6 (12%)	9 (18%)	0.401
	No	44 (88%)	41 (82%)	
Cardiac death	**Yes**	2 (4%)	1 (2%)	0.557
	No	48 (96%)	49 (98%)	
Target lesion revascularization	**Yes**	5 (10%)	8 (16%)	0.646
	No	45 (90%)	42 (84%)	
MI	**Yes**	1 (2%)	0 (0%)	0.319
	No	49 (98%)	50 (100%)	
Ejection fraction (%)	**Mean ± SD**	47.1 ± 6.63	49.5 ± 5.74	0.056
	Range	35 - 55	40 - 55	
Follow up at 6 months				
MACCE	**Yes**	9 (18%)	14 (28%)	0.234
	No	41 (82%)	36 (72%)	
Cardiac death	**Yes**	5 (10%)	3 (6%)	0.461
	No	45 (90%)	47 (94%)	
Target lesion revascularization	**Yes**	6 (12%)	12 (24%)	0.118
	No	44 (88%)	38 (76%)	
MI	**Yes**	4 (8%)	2 (4%)	0.512

	No	46 (92%)	41 (82%)	
Ejection fraction (%)	**Mean ± SD**	50.9 ± 5.17	52.5 ± 3.68	0.067
	Range	40 - 60	44 - 59	
Stent technique	**DK crush**	0 (0%)	5 (10%)	----
	mini crush	0 (0%)	6 (12%)	
	T Stenting	0 (0%)	27 (54%)	
	Tap	0 (0%)	12 (24%)	
Degree of mitral regurgitation	**0**	41 (82%)	47 (94%)	0.085
	1	4 (8%)	0 (0%)	
	2	5 (10%)	3 (6%)	
	3	0 (0%)	0 (0%)	

MACCE: Major adverse cardiac and cerebrovascular events, MI: Myocardial infarction, DK: Double kissing.