



Manuscript ID:ZUMJ-2508-4135

DOI:10.21608/zumj.2025.418231.4135

## Original article

# Prevention of Side Branch Compromise by Partial Side Branch Predilatation in Patients Undergoing Provisional Stenting during Primary Percutaneous Coronary Intervention

Abdelrahman Ahmed Adel, Tarek Ahmed Naguib, Abdallah Fathullah Yousuf AL Zayat\*, Islam Ghanem Ahmed

Cardiology Department, Faculty of Medicine, Zagazig University, Egypt.

### \*Corresponding

author: Abdallah

Fathullah Yousuf AL  
Zayat

### Email:

[abdalla44442000@yahoo.com](mailto:abdalla44442000@yahoo.com)

Submit Date: 29-08-2025

Revise Date: 15-09-2025

Accept Date: 27-09-2025

## ABSTRACT

**Background:** During primary percutaneous coronary intervention (PPCI), coronary bifurcation lesions continue to present technical challenges. Compromise of the side branch (SB) during main vascular stenting may result in ischemia, inadequate flow and adverse outcomes. Partial side branch predilatation has been proposed as a simple strategy to reduce SB compromise without increasing procedural complexity. Therefore, our goal was to evaluate the effectiveness of predilatation of the diseased side branch in ST-elevation myocardial infarction (STEMI) patients undergoing main artery stenting.

**Methods:** 48 STEMI patients who received PPCI participated in this randomized controlled clinical trial, which was carried out at Zagazig University's Catheterization Laboratory, Cardiology Department, Faculty of Medicine. Participants were split up into: Twenty-four patients in Group I received DILATATION BALLON treatment (D) in the diseased side branch and group II consisted of 24 patients treated with NON-DILATATION BALLON (ND) in the diseased side branch.

**Results:** Analysis of side branch dissection demonstrated no statistically significant difference between two groups, although a non-significant numerical trend toward fewer dissections was observed in the PD cohort. Marked difference emerged in side branch recrossing, with 50% of patients in the NPD group requiring recrossing through provisional stent compared with 16.7% in PD group. Conversely, side branch stenting rates did not differ Statistically significantly between groups.

**Conclusion:** In STEMI patients undergoing provisional stenting, diseased side branch predilatation was associated with statistically significant reduced contrast utilization, shorter procedure time, lower fluoroscopy exposure, and a decreased need for recrossing through the provisional stent to the side branch.

**Keywords:** Coronary bifurcation, Side branch compromise, Provisional stenting, Primary PCI, Predilatation.

## INTRODUCTION

Acute coronary syndrome (ACS) is a major health and financial burden on international society, with an estimated 7 million people were diagnosed with it annually. The substantial morbidity and mortality linked to ACS is demonstrated by the fact that nearly half of all coronary heart disease fatalities follow an ACS [1,2]. When ACS patients have primary percutaneous coronary intervention

(PPCI), coronary bifurcation lesions (CBL) are commonly observed. With numerous research revealing different Stenting methods, PCI for CBL remains a contentious topic. Compared to non-bifurcation lesions, PCIs for bifurcation lesions are associated with a higher rate of restenosis, a higher frequency of procedural difficulties, and inferior clinical results. Compared to non-bifurcation PCI, bifurcation PCI has more cardiovascular events and inferior

procedural success rates. Additionally, coronary bifurcation lesions are common and account for 15–20% of all PCIs [3].

According to the Bifurcation Academic Research Consortium (Bif-ARC) consensus, side branch SB should be categorized as "relevant" if the reference vessel diameter is  $\geq 2.0$  mm and constitutes a Statistically significant portion ( $>10\%$ ) of the myocardium that affects prognosis [4].

To help anticipate side branch occlusion, one of the numerous characteristics that potentially predict SB occlusion, a risk stratification score system known as the RESOLVE [Risk prediction of Side branch occlusion in coronary bifurcation intervention] score was created. Thrombolysis in Myocardial Infarction (TIMI) flow grade of the MV prior to stenting, preprocedural diameter stenosis of the bifurcation core (%), bifurcation angle, diameter ratio between MV/SB, and diameter stenosis of the SB prior to MV stenting (%) are some of the independent variables that are included in this score, each of which has a different weight in the model. With a roughly 20% chance of SB blockage, patients with a score of at least 10 are deemed high-risk [5].

The most common method for treating coronary bifurcation lesions is provisional stenting. This strategy is often known as the "simple approach," however in as many as 6–18% of instances, the side branch (SB) may occlude following main vascular (MV) stenting. Despite the anatomical suitability for stepwise provisional stenting, operators may choose to use an elective two-stent method because of anxiety of dealing with the challenge of restoring SB patency. Side branch flow can be preserved and restored in a variety of methods [6].

## METHODS

48 STEMI patients receiving primary percutaneous coronary intervention (PPCI) participated in this randomized controlled clinical trial, which was carried out at the Cath. Lab unit, Cardiology Department, Faculty of Medicine, Zagazig University Hospital. Twenty-four patients in group I received

DILATAION BALLON (PD) in the diseased side branch, whereas twenty-four patients in group II received treatment for NON DILATAION BALLON (ND) in the same side branch.

Before the intervention, all patients provided written informed permission. The institutional review board granted approval (IRB: 441/4-June 2024) in the Zagazig University Hospital. All participants were monitored for adverse events throughout the study period via scheduled clinical evaluations. Any reported or observed adverse events were recorded, assessed for severity, and managed in accordance with ethical and clinical guidelines.

### Inclusion criteria:

- Patient was admitted with ACS (STEMI) managed by primary PCI.
- Target side branch diameter more than or equal 2mm.
- Cross over the side branch during provisional stenting.
- Osteal stenosis of side branch  $>50\%$ .

### Exclusion criteria:

- Chronic total occlusion (CTO)
- Ostial LAD, Ostial LCX or distal LM stenosis as the Culprit of STEMI
- Chronic coronary syndromes
- No side branch lesion
- Sever renal or liver impairment

Every patient had their complete medical history taken, including information on risk factors (dyslipidemia, smoking, DM, and HTN) ischemic symptoms, prior MI, prior coronary intervention (CABG & PCI) and Drug history. Every patient underwent a clinical evaluation, which included a review of cardiovascular risk factors.

Electrocardiogram (12 leads surface ECG) was done within 10 minutes of arrival. to detect ST segment elevation and arrhythmia [7]. Biochemical tests included renal function (creatinine – urea), complete blood count (CBC), International Normalized Ratio (INR), prothrombin time (PT), Partial thromboplastin time (PTT), LFT (liver function test), random blood sugar (RBS), glyselated hemoglobin (HBA1C) and hepatitis marker (HCV, HBsAg).

to identify serious valve lesions, assess LV function by EF and RWMA, and rule out alternative causes of chest pain, an echo-Doppler examination was conducted. The primary PCI procedure was completed in the allotted time. If an electrocardiogram shows ST-segment elevation myocardial infarction (STEMI), a primary percutaneous coronary intervention (PCI) should be carried out within 120 minutes of the diagnosis in a prehospital setting, or within 60 minutes if the diagnosis is made in a hospital, per the treatment guidelines of the European Society of Cardiology [7].

### **Coronary angiography**

In the radial or femoral pathways, 6- or 7-Fr diagnostic and guiding catheters were used to perform coronary intervention. All patients were given loading doses of either ticagrelor (180 mg) or clopidogrel (300–600 mg) before to or during the procedure. In accordance with worldwide guidelines, anticoagulation treatment was administered [7].

True coronary bifurcation lesion (CBL) was classified by the Medina classification (1,1,1; 1,0,1; 0,1,1) as stenosis that occurs in both the MB and the SB ostium more than 50% [8]. and may be found in the following: (1) the right coronary artery (RCA), posterior descending artery (PDA), and postero-lateral artery (PLA); (2) the left circumflex artery (LCX) and its obtuse marginal branch (OM); or (3) the left anterior descending (LAD) artery and its diagonal branch. Group I (D group) involve wiring both the MV and SB, opening the culprit main vessel if it is completely blocked, and then side branch predilatation using a non-compliant balloon 0.5 mm below the actual size of the artery to prevent its dissection. After the balloon is removed, the main vessel is stented, and the main and side branches are evaluated next. Recross the wires, kiss the side branch, and stent it if necessary if the side branch is blocked or if an ostial lesion worsens with reduced TIMI flow. In Group II (ND group), the MV and SB are wired, the primary vessel that is causing the problem is opened if completely blocked, it is stented, and the main and side branches are then assessed. Recross

the wires, kiss the side branch, and stent it if necessary if the side branch is blocked or if an ostial lesion worsens with reduced TIMI flow.

The procedures were performed by multiple operators, all of whom had at least 10 years of experience. To minimize operator-related variability, all operators followed a standardized protocol and underwent training prior to the study.

### **Statistical Analysis:**

A computer program called IBM SPSS 23.0 for Windows (SPSS Inc., Chicago, IL, USA) was used to code, enter, and analyze the gathered data. The independent t-test, Fisher's exact test (f), and the chi-squared [X<sup>2</sup>] test were employed. Effect sizes and 95% confidence intervals for the primary outcomes were used, however, for certain comparisons with small sample sizes or categorical data, effect sizes were not calculated due to limitations in interpretability. A two-tailed P-value  $\leq 0.05$  was considered to indicate statistical significance. Results with  $P > 0.05$  were regarded as not statistically significant.

### **RESULTS**

Regarding baseline data, table (1) indicates no statistically significant difference between the groups under study ( $P > 0.05$ ). Regarding target vessel and medina classification, Table (2) reveals no discernible difference between the groups under study ( $P > 0.05$ ). In terms of operating statistics, there was a statistically significant difference between the groups under investigation, with the ND group having a higher contrast volume and procedure time than the D group ( $P = 0.004$  and  $P = 0.008$ ), respectively (Table 3). There is no variation in the final TIMI flow between the groups under study ( $P > 0.05$ ), according to Table (4).

Table (5) shows that side branch dissection did not differ statistically significantly across the study groups ( $P > 0.05$ ). However, compared to 16.7% of patients in the P group, 50% of patients in the ND group needed to recross through the provisional stent to the side branch ( $P = 0.03$ ), indicating a statistically significant difference between groups. Furthermore, no

statistically significant difference was observed regarding side branch access, as assessed by balloon recrossing through the provisional stent (bailout reopening with balloon only), which was more common in the ND group (37.5%) than in the D group (12.5%) ( $P = 0.09$ ). Similarly, bailout stenting of the side branch did not statistically significantly differ between the two groups ( $P > 0.05$ ).

### Case study:

#### Case 1:

A 67-year-old hypertensive, dyslipidemic male presented with 5-hour typical chest pain radiating to the back, left arm, and jaw, associated with diaphoresis, nausea, and vomiting. ECG showed ST-segment elevation in V1–V5 and T-wave inversion in I and aVL. hs-cTn was elevated (133.06 pg). Primary PCI was performed via transfemoral access after administration of loading doses of aspirin and a P2Y12 inhibitor. Coronary angiography revealed a significant LAD bifurcation lesion involving the proximal and mid segments (Medina 1,1,1). Both LAD (main vessel) and diagonal branch (side branch) were wired, followed by predilatation of both vessels and provisional stenting of the LAD. Final angiography demonstrated a patent side branch with TIMI III flow (Figure 1).

**Table (1):** Baseline data among the studied groups

| Variables         |               | D group<br>(n=24) | ND group<br>(n=24) | P<br>Value        |
|-------------------|---------------|-------------------|--------------------|-------------------|
| Age (years)       | Mean $\pm$ SD | 52.7 $\pm$ 8.27   | 56.4 $\pm$ 9.29    | 0.15 <sup>1</sup> |
|                   | Range         | (39 – 68)         | (36 – 71)          |                   |
| Sex (n. %)        | Male          | 16 (66.7%)        | 17 (70.8%)         | 0.76 <sup>2</sup> |
|                   | Female        | 8 (33.3%)         | 7 (29.2%)          |                   |
| Diabetes mellitus |               | 12 (50%)          | 15 (62.5%)         | 0.38 <sup>1</sup> |
| Hypertension      |               | 16 (66.7%)        | 17 (70.8%)         | 0.76 <sup>1</sup> |
| Dyslipidemia      |               | 21 (87.5%)        | 19 (79.2%)         | 0.42 <sup>2</sup> |
| CKD               |               | 5 (20.8%)         | 4 (16.7%)          | 1.00 <sup>2</sup> |
| CVA               |               | 1 (4.2%)          | 1 (4.2%)           | 1.00 <sup>2</sup> |
| PAD               |               | 5 (20.8%)         | 1 (4.2%)           | 0.19 <sup>2</sup> |
| Smoking           |               | 16 (66.7%)        | 10 (41.7%)         | 0.15 <sup>1</sup> |

\*CKD=Chronic kidney disease, CVA=Cerebrovascular accidents, PAD=Peripheral artery disease

<sup>1</sup>Student T-test, <sup>2</sup>Chi-square test, Non-significant:  $P > 0.05$ , Significant:  $P \leq 0.05$ , \*The same patient may have more than one associated comorbidity

#### Case 2

A 55-year-old male patient, with a history of hypertension, diabetes mellitus, and active smoking, presented with typical chest pain of 4-hour duration radiating to the back. The pain was associated with diaphoresis and nausea and was not relieved by rest. ECG demonstrated ST-segment elevation in leads II, III, aVF, V4–V6. High-sensitivity cardiac troponin was markedly elevated (150.32 pg/ml), consistent with acute inferolateral ST-elevation myocardial infarction (STEMI). The patient underwent primary PCI via transfemoral access following administration of loading doses of aspirin and a P2Y12 inhibitor. Coronary angiography of the left system revealed a significant bifurcation lesion involving the mid left circumflex artery (LCX) and obtuse marginal (OM) branch, classified as Medina 1,1,1. Both vessels were wired, and predilatation was followed by provisional stenting of the LCX. Post-stenting, the side branch became compromised; therefore, rewiring through the stent struts with bail-out balloon dilatation was performed. Final angiography demonstrated restoration of TIMI grade 3 flow with preserved OM2 patency (Figure 2).

**Table (2):** Target vessel and medina classification among the studied groups

| Variables                          |                 | D group<br>(n=24) | ND group<br>(n=24) | P<br>Value |
|------------------------------------|-----------------|-------------------|--------------------|------------|
| Target vessel<br>(n. %)            | LAD-Diagonal    | 14 (58.3%)        | 16 (66.7%)         | 0.77       |
|                                    | LCX-OM          | 9 (37.5%)         | 8 (33.3%)          |            |
|                                    | RCA-Bifurcation | 1 (4.2%)          | 0 (0%)             |            |
| Medina<br>classification<br>(n. %) | 0-1-1           | 9 (37.5%)         | 5 (20.8%)          | 0.41       |
|                                    | 1-0-1           | 3 (12.5%)         | 6 (25%)            |            |
|                                    | 1-1-1           | 12 (50%)          | 13 (54.2%)         |            |

\*Fisher exact test, Non-significant:  $P > 0.05$ , Significant:  $P \leq 0.05$

\* LAD=left anterior descending artery, LCX=left circumflex artery, RCA=Right coronary artery

**Table (3):** Operative data among the studied groups

| Variables                          |               | D group<br>(n=24) | ND group<br>(n=24) | P<br>Value |
|------------------------------------|---------------|-------------------|--------------------|------------|
| contrast volume (cm <sup>3</sup> ) | Mean $\pm$ SD | 115.6 $\pm$ 32.4  | 155.2 $\pm$ 56.1   | 0.004      |
|                                    | Range         | (80 – 210)        | (90 – 280)         |            |
| Procedure time<br>(minutes)        | Mean $\pm$ SD | 26.3 $\pm$ 12.1   | 38 $\pm$ 16.5      | 0.008      |
|                                    | Range         | (15 – 65)         | (18 – 87)          |            |

\*Student T-test, Non-significant:  $P > 0.05$ , Significant:  $P \leq 0.05$

**Table (4):** Final TIMI flow among the studied groups

| Variables           |     | D group<br>(n=24) | ND group<br>(n=24) | P<br>Value |
|---------------------|-----|-------------------|--------------------|------------|
| TIMI in side branch | 0   | 0 (0%)            | 1 (4.2%)           | 0.72       |
|                     | I   | 0 (0%)            | 0 (0%)             |            |
|                     | II  | 1 (4.2%)          | 2 (8.3%)           |            |
|                     | III | 23 (95.8%)        | 22 (91.7%)         |            |
| TIMI in main vessel | 0   | 0 (0%)            | 0 (0%)             | 1.00       |
|                     | I   | 0 (0%)            | 0 (0%)             |            |
|                     | II  | 0 (0%)            | 0 (0%)             |            |
|                     | III | 24 (100%)         | 24 (100%)          |            |

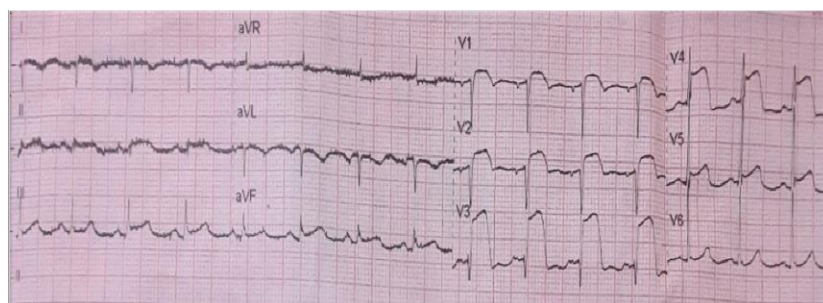
\*Student T-test, Non-significant:  $P > 0.05$ , Significant:  $P \leq 0.05$

**Table (5):** Side branch dissection, side branch compromise needed wire recrossing through provisional stent, side branch compromise needed bailout reopening by only ballon and side branch compromise needed bailout stenting among the studied groups

| Variables                                                     |     | D group<br>(n=24) | ND group<br>(n=24) | P<br>Value |
|---------------------------------------------------------------|-----|-------------------|--------------------|------------|
| Side branch dissection<br>(n. %)                              | No  | 23 (95.8%)        | 21 (87.5%)         | 0.61       |
|                                                               | Yes | 1 (4.2%)          | 3 (12.5%)          |            |
| Recrossing through provisional stent<br>to side branch (n. %) | No  | 20 (83.3%)        | 12 (50%)           | 0.03       |
|                                                               | Yes | 4 (16.7%)         | 12 (50%)           |            |
| Bailout reopening by only ballon of<br>side branch (n. %)     | No  | 21 (87.5%)        | 15 (62.5%)         | 0.09       |
|                                                               | Yes | 3 (12.5%)         | 9 (37.5%)          |            |
| Side branch compromise needed<br>bailout stenting (n. %)      | No  | 23 (95.8%)        | 21 (87.5%)         | 0.61       |
|                                                               | Yes | 1 (4.2%)          | 3 (12.5%)          |            |

\*Fisher exact test, Non-significant:  $P > 0.05$ , Significant:  $P \leq 0.05$

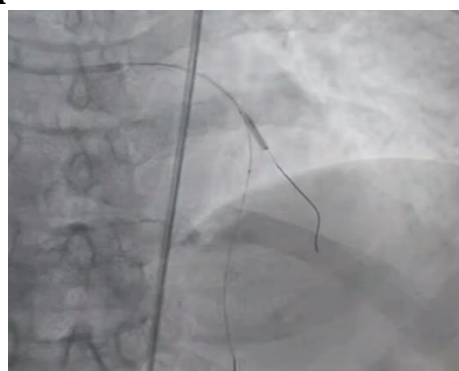




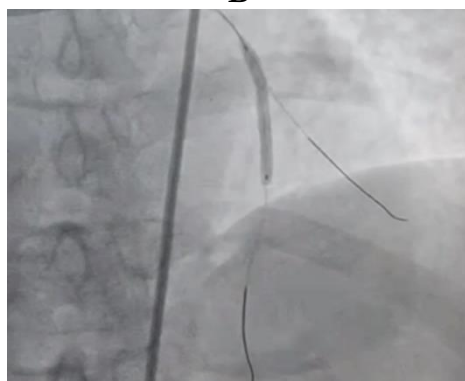
**A**



**B**



**C**



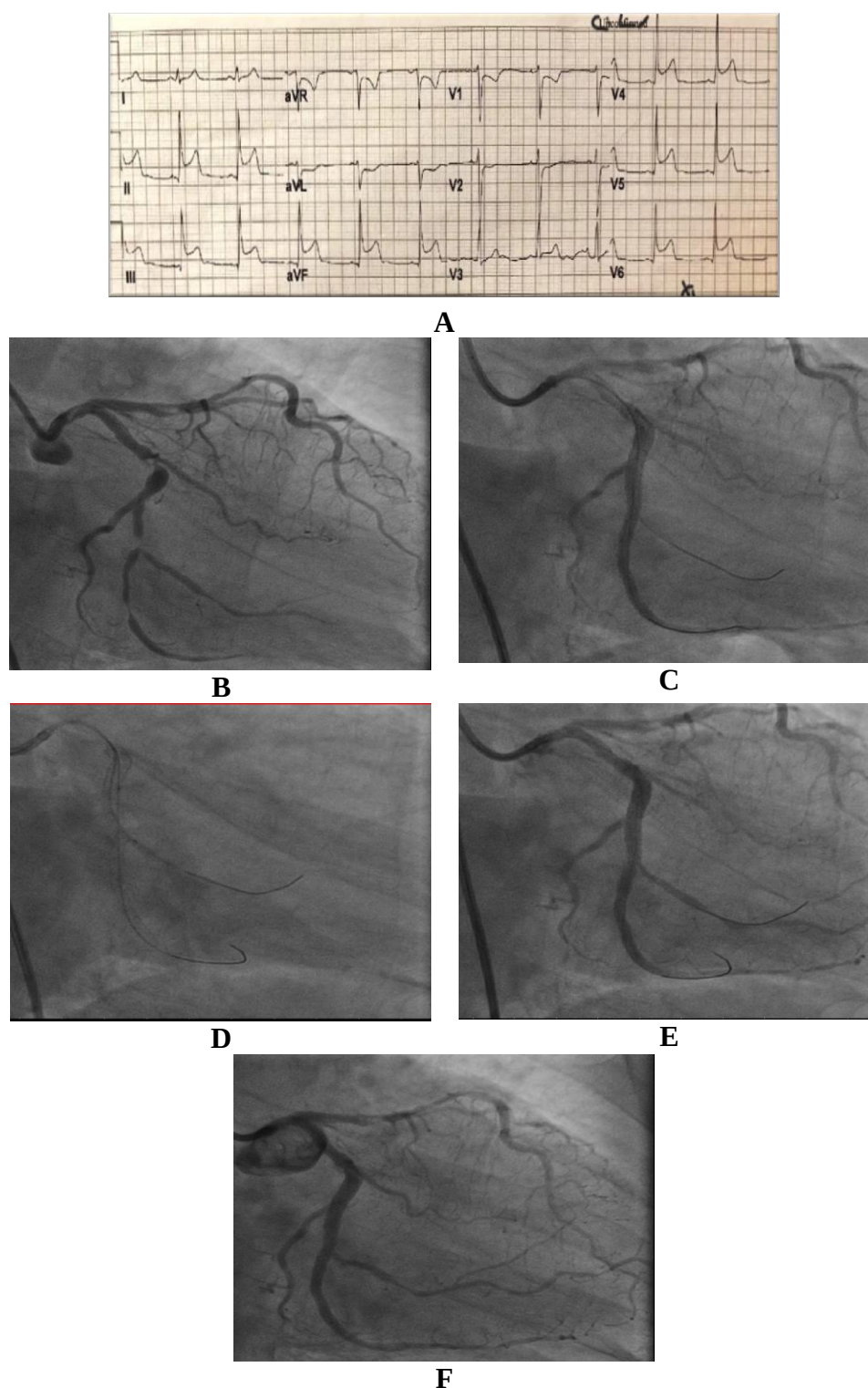
**D**



**E**

**Figure (1):** A) ECG show ST elevation V1, V2, V3, V4, V5, with T wave inversion in I, aVL. B) Coronary Angiography of the Left Coronary System Shows a Significant. C) Bifurcation Lesion In (LAD), Involving the Proximal and

Mid Segments, Classified as Medina 1,1,1. C) Wiring of LAD And D With Predilatation of Side Branch D. D) Provisional Stenting of Bifurcation Lesion. Figure (1) Final Result Patent S B.



**Figure (2):** A) ECG Show ST elevation II, III, aVF, V4, V5, V6. B) Coronary Angiography for Left System Reveals Significant Bifurcation Lesion Medina 1,1,1 Mid LCX For PCI. C) Side Branch Compromised Post Provisional Stenting of MV. D) Bail-Out Ballon Opening

of Compromised S B. E) Post Bail-Out Balloon Opening of Compromised S B. F) Final Result Maintains Side Branch (OM2) Patent.

## DISCUSSION

For percutaneous coronary intervention of bifurcation lesions, the simple approach or provisional stenting is now the suggested method. It might not be "simple," however. The SB ostium may be compromised or perhaps completely blocked following the placement of a main branch (MB) stent. It can be challenging or impossible to rewire the SB in certain circumstances [9].

This procedure is not generally acknowledged, despite the fact that SB pre-dilation may enhance the vessel's patency and Thrombolysis in Myocardial Infarction (TIMI) flow following MB stent placement. Some specialists advise against SB predilatation in order to prevent vessel dissection and the challenges associated with rewiring the vessel's real lumen, based on observational research. [6].

SB predilatation enhanced acute angiographic and procedural results for the treatment of real bifurcation lesions, but it was unable to enhance long-term clinical results. It may help patients with severe parent vascular stenosis [10]. When SB access is challenging or there is a sizable, calcified SB lesion, some experts advise using SB predilatation [11].

The purpose of this study was to evaluate the effectiveness of predilatation of the affected side branch in STEMI patients undergoing provisional main artery stenting.

48 STEMI patients undergoing primary percutaneous coronary intervention at Zagazig University Hospital's Cath. Lab unit, Cardiology Department, Faculty of Medicine, were divided into two groups for this randomized controlled clinical study: **Group I** (D group) included 24 patients who had predilatation of the diseased side branch before provisional stenting. **Group II** (ND) included 24 patients who had provisional stenting without predilatation of the diseased side branch.

### **Baseline Characteristics and Demographics:**

In our study, the demographic analysis showed that the age, sex distribution, and comorbidities of the PD and NPD groups did not differ statistically significantly, guaranteeing

sufficient baseline comparability. The mean age of patients in the PD group was  $52.7 \pm 8.27$  years compared to  $56.4 \pm 9.29$  years in the NPD group, with males predominating in both groups (66.7% vs 70.8%).

This finding goes in discordance with Gomar et al., [12] The majority of people who present with acute coronary symptoms are middle-aged males, which is in line with the demographic profile of typical STEMI populations as reported in the literature.

Also, disagreement with Dzebu et al., [13] who detailed patients with acute coronary syndrome who had percutaneous coronary intervention. Their study found that the mean age of the patients was  $61.1 \pm 10.6$  years, and 72% of them were male. This may be attributed to the predominance of risk factors such as smoking and stress, as well as hormonal protection in premenopausal females

On the other hand, Pan et al. [14] aimed to evaluate the effectiveness of side branch (SB) dilatation prior to provisional T-stent approach for lesions involving bifurcation. According to their findings, the patient groups' baseline characteristics did not differ statistically significantly from one another.

### **Cardiovascular Risk Factors**

We find in this study, the distribution of cardiovascular risk factors was comparable between groups, with dyslipidemia present in approximately 82% of patients, hypertension in about two-thirds, and diabetes mellitus in roughly half of the patients in each group.

It is anticipated that STEMI patients will have a high frequency of conventional cardiovascular risk factors and aligns with findings from major registries such as the HORIZONS-AMI trial, which demonstrated similar risk factor profiles in bifurcation versus non-bifurcation STEMI patients [15].

### **Target Vessels and Lesion Anatomy**

The distribution of target vessels was similar between groups, with LAD-diagonal bifurcations being the most common (58.3% in PD group vs 66.7% in NPD group), followed by LCX-OM bifurcations. The usual anatomical pattern of bifurcation lesions seen in clinical



practice is reflected in this distribution. The majority of patients had 1-1-1 lesions (true bifurcations with stenosis in both main vessel and side branch), which represented the most complex lesion subset requiring careful consideration of side branch management strategies. The Medina classification analysis revealed no statistically significant differences between groups.

### **Procedural Parameters**

The most striking procedural differences between groups were observed in contrast volume consumption and procedure time. The NPD group required statistically significantly higher contrast volumes ( $155.2 \pm 56.1 \text{ cm}^3$  vs  $115.6 \pm 32.4 \text{ cm}^3$ ,  $P=0.004$ ) and longer procedure times ( $38 \pm 16.5$  minutes vs  $26.3 \pm 12.1$  minutes,  $P=0.008$ ). These differences have important clinical implications, particularly in the STEMI setting where "time is muscle" and rapid reperfusion is paramount.

Preparing for the treatment of bifurcation lesions is essential because longer procedure times and more contrast use are anticipated [16]. Ten to twenty percent of STEMI patients have bifurcation lesions, which lead to longer fluoroscopy periods and more contrast use, but have acute procedural success rates comparable to those of nonbifurcation lesions [17].

Frangos et al. [18] revealed that compared to lesions without bifurcation, bifurcation lesions in STEMI are linked to statistically significantly higher contrast utilization and longer procedure durations; however, the current investigation shows that predilatation may be able to lessen these drawbacks.

Given the risk of contrast-induced nephropathy (CIN) in STEMI patients, particularly those who already have diabetes mellitus or renal impairment, the PD group's decreased contrast volume is especially statistically significant.

The shorter procedure time in the PD group likely reflects improved procedural flow and reduced complexity in managing side branch compromise. A simple method to reduce procedure time, such as the one-stent strategy with provisional approach, may be preferable in the treatment of STEMI and the current study

suggests that predilatation, rather than complicating the procedure, may actually streamline the overall approach by preventing downstream complications.

### **Angiographic Outcomes and TIMI Flow**

In the present study, both groups achieved excellent final TIMI III flow in main vessel (100% in each group) and no statistically significant difference between the studied groups (PD group =95.8%), (NPD group =91.7%) regards final TIMI III flow in side Branche, indicating high procedural success rates. This finding demonstrates that both approaches can achieve optimal angiographic outcomes in terms of final vessel patency. However, the path to achieving these results differed statistically significantly between groups, with the PD group requiring less contrast and time, suggesting a more efficient procedural approach.

Accordingly, Lee et al. [10] looked at how SB predilatation affected the short-term and long-term outcomes of using the provisional approach to repair coronary bifurcation lesions 437 individuals (40.4%) underwent SB predilatation. The angiographic success rates were found to be 69.1% vs. 52.9%,  $P<0.001$ .

According to Pan et al. [14], patients with SB predilatation following MB stent installation showed greater SB TIMI flow. Furthermore, TIMI flow  $\geq$ III did not necessitate any further treatment, and 60 patients (32%) from the SB predilatation group had SB residual stenosis by ocular inspection  $<50\%$ .

However, the goal of Peighambari et al. [19] was to evaluate how SB predilatation affected the results of real bifurcation operations. They found that after stenting the main branch, the SB predilatation's effectiveness was not linked to better SB flow or lower levels of ostial stenosis. This explained by consideration other factor like angle of bifurcation and thrombus shifting.

### **Side Branch Dissection and Bailout Interventions**

Despite a trend toward reduced dissection rates in the PD group, our study's analysis of side branch dissection revealed the groups did not

differ statistically significantly (4.2% in the PD group vs. 12.5% in the NPD group,  $P=0.19$ ). Peighambari et al. [19] demonstrated that the SB predilatation technique had no discernible impact on the procedure's result, including SB dissection following MB stenting, which is consistent with our findings.

### **Side Branch Access and Recrossing**

Our findings demonstrated a statistically significant difference in recrossing to the compromised side branch, which was required in 50% of NPD patients compared with only 16.7% of PD patients ( $P = 0.03$ ), underscoring the potential advantage of the predilatation strategy in reducing the need for additional side branch intervention.

The reduced S B recross rate in the PD group suggests that predilatation helps preserve side branch patency and reduces the need for additional interventions. Although some research has indicated that side branch predilatation may be associated with an increased risk of recurrent revascularization, the current study's acute procedural results suggest the opposite effect. The lower S B recross rate not only contributes to shorter procedure times and reduced contrast use but also simplifies the overall procedural approach and potentially reduces long-term complications associated with multiple stent techniques.

This disagrees with the Cactus trial Colombo et al., [20], where 90.8% of the patients underwent SB pre-dilatation, which has been attributed to a statistically significant rate of transition (31%), from basic provisional to comprehensive crush stenting.

This can be explained by consideration other factor like angle of bifurcation, thrombus shifting and pre-treat SB with 1:1 size NC balloon rather than 0.5:1 which lead to more chance for dissection.

No statistically significant difference was observed between the groups, as bailout reopening of the side branch with balloon only was required in 37.5% of NPD patients compared with 12.5% of PD patients ( $P = 0.09$ ).

In concordance with our study, Lee et al. [10] found no difference between the predilatation and non- predilatation groups in either eventual SB occlusion (2.7% vs. 3.9%;  $P=0.41$ ) or sudden SB occlusion (10.5% vs. 11.3%;  $P=0.76$ ).

### **Side Branch Stenting Rates**

In our study, there was no statistically significant difference in side branch stenting across the groups that were being examined ( $P>0.05$ ). According to Pan et al. [14], the rates of side branch stenting were 4% and 3%, respectively;  $P =$  not statistically significant. This was consistent with their findings. In the Nordic III study Niemelä et al., almost 60% of patients with true bifurcation lesions who were randomized to a single stent and no final kissing balloon received SB pre-dilation [21]. None of the patients in this study were given stents at the SB. In contrast, Lee et al. [10] found that the predilatation group had considerably higher rates of SB stent placement (69.1% vs. 52.9%,  $P<0.001$ ).

### **Mechanisms and Clinical Interpretation**

Several elements are probably involved in the mechanisms that underlie the benefits of side branch predilatation that have been seen in this STEMI cohort. Predilatation may lower the risk of iatrogenic side branch compromise during main artery stenting by facilitating improved wire alignment and subsequent balloon and stent delivery. Additionally, predilatation may help redistribute plaque more favorably, reducing the risk of plaque shift that commonly occurs during main vessel stent deployment.

Although it has been controversial, side branch predilatation prior to main vessel stent insertion may make provisional stenting easier. The current study's findings in the STEMI population suggest that the benefits may outweigh the theoretical risks, particularly in the acute setting where procedural efficiency and completeness of revascularization are paramount.

The improved outcomes observed with predilatation may also relate to the acute thrombotic environment in STEMI, where aggressive anticoagulation and antiplatelet

therapy create a different risk-benefit profile compared to elective procedures. In this setting, the potential for predilatation to improve flow distribution and reduce subsequent interventions may be particularly valuable. Lastly predilation of diseased SB in provisional stenting may statistically not statistically significant but numerically statistically significant.

#### **Limitations:**

Although several limitations should be noted, this study provides insightful information about the function of side branch predilatation in STEMI patients. First, the statistical power to identify slight differences may be limited by the very small sample size (24 patients per group), which also limits the ability to evaluate less common adverse events. Second, long-term clinical follow-up—which is necessary to assess the durability and clinical relevance of the reported benefits was not included in the analysis, which was limited to acute procedural outcomes.

#### **CONCLUSION**

In STEMI patients undergoing provisional stenting, predilatation of the side branch was associated with notable procedural advantages, including reduced contrast volume, shorter procedure time, lower fluoroscopy exposure, and fewer recrossing events through the provisional stent to the side branch. These findings challenge the current guideline recommendations that generally discourage routine side branch predilatation and highlight its potential value in the specific setting of STEMI with bifurcation lesions. Taken together, the results support a more individualized approach to bifurcation PCI in STEMI patients, where selective side branch predilatation may enhance procedural efficiency and potentially improve clinical outcomes. To confirm these results and evaluate clinical endpoints such target vessel revascularization, significant adverse cardiac events, and functional outcomes, future studies should incorporate larger multicenter trials with larger sample size and longer follow-up times.

#### **Conflict of Interest:**

The authors declare that they have no competing interest.

#### **Financial Disclosures:**

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

#### **Availability of the data:**

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

#### **Authors contribution:**

A. A. and T. A. were responsible for data collection and analysis and A. F. and I. G. were responsible for, writing and publication

#### **REFERENCES**

1. Bhatt DL, Lopes RD, Harrington RA. Diagnosis and treatment of acute coronary syndromes: a review. *JAMA* 2022;327(7):662–75.
2. Timmis A, Kazakiewicz D, Townsend N, Huculeci R, Aboyans V, Vardas P. Global epidemiology of acute coronary syndromes. *Nat Rev Cardiol* 2023;20(11):778–88.
3. Tan S, Ramzy J, Burgess S, Zaman S. Percutaneous coronary intervention for coronary bifurcation lesions: latest evidence. *Curr Treat Options Cardiovasc Med* 2020;22(2):6.
4. Lunardi M, Louvard Y, Lefèvre T, Stankovic G, Burzotta F, Kassab GS, Lassen JF, et al. Definitions and standardized endpoints for treatment of coronary bifurcations. *EuroIntervention* 2023;19(10): e807–31.
5. Dou K, Zhang D, Xu B, Yang Y, Yin D, Qiao S, Wu Y, et al. An angiographic tool for risk prediction of side branch occlusion in coronary bifurcation intervention: the RESOLVE score system. *JACC Cardiovasc Interv* 2015;8(1 Pt A):39–46.
6. Pan M, Lassen JF, Burzotta F, Louvard Y, Darremont O, Ferenc M, Hildick-Smith D, et al. The 17th expert consensus document of the European Bifurcation Club – techniques to preserve access to the side branch during stepwise provisional stenting. *EuroIntervention* 2023;19(1):26–36.
7. European Society of Cardiology (ESC). Clinical practice guidelines: acute coronary syndromes. Available at: <https://www.escardio.org/Guidelines/Clinical-Practice-Guidelines/Acute-Coronary-Syndromes-ACS-Guidelines>
8. Louvard Y, Medina A. Definitions and classifications of bifurcation lesions and treatment. *EuroIntervention* 2015;11(Suppl V): V23–6.

9. Kırat T. Fundamentals of percutaneous coronary bifurcation interventions. *World J Cardiol* 2022;14(3):108–38.
10. Lee SH, Song YB, Lee JM, Park TK, Yang JH, Hahn JY, Choi JH, et al. Effect of side branch predilation in coronary bifurcation stenting with the provisional approach: results from the COBIS II registry. *Circ J* 2018;82(5):1293–301.
11. Lefèvre T, Darremont O, Albiero R. Provisional side branch stenting for the treatment of bifurcation lesions. *EuroIntervention* 2010;6(Suppl J): J65–71.
12. Sanchis-Gomar F, Perez-Quilis C, Leischik R, Lucia A. Epidemiology of coronary heart disease and acute coronary syndrome. *Ann Transl Med* 2016;4(13):256.
13. Dzebu AS, Blanco SR, Medina JM. Characterisation of patients with acute coronary syndrome: a 10-year experience. *EMJ* 2023;11(1):66–74.
14. Pan M, Medina A, Romero M, Segura J, Martín P, Suárez de Lezo J Jr, Pavlovic D, et al. Assessment of side branch predilation before a provisional T-stent strategy for bifurcation lesions: a randomized trial. *Am Heart J* 2014;168(3):374–80.
15. Shah A, Feldman DN. Outcome of the HORIZONS-AMI trial: bivalirudin enhances long-term survival in patients with ST-elevation myocardial infarction undergoing angioplasty. *Vasc Health Risk Manag* 2012; 8:115–23.
16. Hildick-Smith D, Arunothayaraj S, Stankovic G, Chen SL. Percutaneous coronary intervention of bifurcation lesions. *EuroIntervention* 2022;17(18): e273–91.
17. Assal AR, Hassan MA, Mahmoud WM, El-Desouky IE, Abdin A, Abdel-Wahab M, et al. Outcomes of bifurcation versus non-bifurcation lesions in patients with ST-segment elevation myocardial infarction undergoing primary percutaneous coronary intervention. *Egypt Heart J* 2021;73(1):27.
18. Frangos C, Noble S, Piazza N, Asgar A, Fortier A, Ly QH, Bonan R. Impact of bifurcation lesions on angiographic characteristics and procedural success in primary percutaneous coronary intervention for ST-segment elevation myocardial infarction. *Arch Cardiovasc Dis* 2011;104(4):234–41.
19. Peighambari M, Sanati H, Hadjkarimi M, Zahedmehr A, Shakerian F, Firouzi A, et al. The effects of side branch predilation during provisional stenting of coronary bifurcation lesions: a double-blind randomized controlled trial. *Res Cardiovasc Med* 2016;5(2): e31378.
20. Colombo A, Bramucci E, Sacca S, Violini R, Lettieri C, Zanini R, et al. Randomized study of the crush technique versus provisional side-branch stenting in true coronary bifurcations: the CACTUS study. *Circulation* 2009;119(1):71–8.
21. Niemelä M, Kervinen K, Erglis A, Holm NR, Maeng M, Christiansen EH, et al. Randomized comparison of final kissing balloon dilatation versus no final kissing balloon dilatation in patients with coronary bifurcation lesions treated with main vessel stenting: the Nordic-Baltic Bifurcation Study III. *Circulation* 2011; 123:79–86.

## Citation

**Adel, A., Naguib, T., AL Zayat, A., Ahmed, I. Prevention of Side Branch Compromise by Partial Side Branch Predilatation in Patients Undergoing Provisional Stenting during Primary Percutaneous Coronary Intervention. *Zagazig University Medical Journal*, 2025; (5311-5322): -. doi: 10.21608/zumj.2025.418231.4135**