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Original research article

OUTCOMES OF PROVISIONAL STENTING WITH VERSUS WITHOUT SIDE BRANCH INTERVENTION IN PATIENTS WITH BIFURCATION LESION-RELATED ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION

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Abstract: *Bifurcation lesions in patients with ST-segment elevation myocardial infarction (STEMI) present a unique challenge in interventional cardiology. The need for side-branch intervention during provisional stenting in such cases remains a subject of debate.* ***Objective:*** *This study aimed to provide robust evidence on the necessity of side-branch intervention during provisional stenting in patients with STEMI and bifurcation lesions.* ***Methods:*** *This observational study was conducted at the Peshawar Institute of Cardiology from August 2023 to August 2024. A total of 248 patients diagnosed with STEMI and bifurcation lesions were included. The patients were divided into two groups: those who underwent side-branch intervention (n = 112) and those managed without side-branch intervention (n = 136). Baseline characteristics such as age, gender, hypertension, diabetes, smoking history, body mass index (BMI), prior myocardial infarction (MI), and previous percutaneous coronary intervention (PCI) were compared between the groups. Statistical analysis was performed to identify significant differences.* ***Results:*** *The baseline characteristics of the two groups were similar, with no statistically significant differences. The average age was 58.7 ± 10.9 years in the side-branch intervention group and 58.3 ± 11.4 years in the no-intervention group. The male proportion was also comparable between the two groups (69% vs. 71%). Both groups had an equal prevalence of hypertension (62%) and similar rates of diabetes (29% vs. 28%) and smoking history (36% vs. 34%). Other factors such as BMI, previous MI, and previous PCI showed no significant differences.* ***Conclusion:*** *This study concludes that provisional stenting without routine side-branch intervention is a safe and effective strategy for managing bifurcation lesion-related STEMI. Given the comparable outcomes between the two groups, routine side-branch intervention may not be necessary, thus simplifying the treatment approach and reducing procedural complexities.*

Keywords: Coronary Artery Disease, Myocardial Infarction, Percutaneous Coronary Intervention, ST Elevation Myocardial Infarction, Stents.

Introduction

Bifurcation lesions represent a considerable therapeutic challenge in the management of ST-segment elevation myocardial infarction (STEMI), a life-threatening condition requiring immediate intervention. These lesions are always located at the interface between two coronary arteries and are known to be highly anatomically challenging when performing percutaneous coronary interventions (PCI) (1). Management of bifurcation lesions in STEMI has formerly been treated with single or double stenting; provisionally. Selective stenting in which a stent is delivered into the main vessel with concern for the side branch only in specific cases has become popular, because of its comparative ease, shorter procedural duration and possible less adverse effects (2). However, the strategy of side branch intervention in the context of provisional stenting remains somewhat still unclear about STEMIs. STEMI is caused by a blockage of a coronary artery and results in extensive myocardial ischemia and as such, timely revascularization is crucial to ameliorate myocardial injury (3). When the bifurcation lesions are involved, it has been observed that the nature of the lesion affects the result of the intervention (4). Even though provisional stenting has been popular because of its ease, in some cases, leaving the side branch untreated may lead to side branch flow reserve that seems to be worst for clinic outcomes. On the other hand, performing side branch intervention regularly may raise the procedural difficulty, the procedural duration, and the risk of side effects such as stent thrombosis, restenosis, or myocardial compromise (5). Side branch intervention is usually decided during the procedure depending on factors such as flow limitation, percentage stenosis, or size of the side branch (6). Choosing to intervene in the side branch can be with the help of techniques such as balloon angioplasty, or by installing another stent. Nevertheless, intervention of the side branch may not always be necessary if the side branch is small or if after main vessel stenting there is no flow reserve impairment. The shared concern of whether side branch intervention in bifurcation lesions during STEMI is necessary arises from the lack of support for one method over the other (7). Several current research show that intervention has the potential to increase procedural complications without adding considerable benefit on outcome. In contrast, other researchers have underlined the potential threats that result from the lack of treatment of the diseased side branch, the consequential negative effects might include myocardial infarction or ischemia in the relevant area. This study aims at providing an answer to this ongoing debate by comparing the results of the provisional stenting with or without side branch intervention for the patients with bifurcation lesion-related STEMI (8). Therefore, the study will compare efficacy of the treatment

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in the short term in terms of procedural success, in-hospital complications, and early adverse events, and in the long term in terms of MACE, TLR, and survival. The reason is to give an idea about management of bifurcation lesions in the scenario of STEMI and for the interventional cardiologists while developing a strategy. Prior research evaluating bifurcation lesions and selective provisional stenting on stable CAD patients established that most side branches are benign, in which stenting is not necessary. Whereas, in the setting of STEMI, because of the emergent situation and high likelihood of decision making for interventions in side branch, the risk-benefit ratio of side-branch intervention may be diverse. Several differences between STEMI and NSTE-ACS patients suggest that side-branch intervention in the context of the acute inflammatory response and a heightened propensity for thrombosis may affect outcomes (9).

By focusing on a high-risk cohort of patients with STEMI and bifurcation lesions, this study aims to provide robust evidence regarding the need for side branch intervention during provisional stenting.

Methodology

This observational study was conducted at the Peshawar Institute of Cardiology from August 2023 to August 2024. A total of 248 patients with bifurcation lesion-related STEMI were included in the study.

The inclusion criteria for the study comprised patients aged 18 years or older who were diagnosed with bifurcation lesion-related STEMI. These patients were undergoing provisional stenting as part of their percutaneous coronary intervention (PCI) treatment, with informed consent available for participation in the study.

The exclusion criteria included patients with STEMI unrelated to bifurcation lesions, as well as those who had undergone prior coronary artery bypass grafting (CABG) or complex PCI procedures that did not involve bifurcation lesions. Additionally, patients with significant comorbidities that could affect survival outcomes unrelated to the bifurcation lesion, as well as those who declined consent for participation, were excluded from the study.

Patient data was collected at the time of admission, during the procedure, and through follow-up assessments. Patients were divided into two groups: those who received side-branch intervention (n = 112) and those who did not receive side-branch intervention (n = 136). The analysis focused on procedural success, in-hospital complications, and long-term clinical outcomes over a one-year follow-up period. Clinical variables recorded included patient demographics, lesion characteristics, procedural details, and the use of side branch intervention. Key outcomes included procedural success, in-hospital complications, and major adverse cardiac events (MACE) during follow-up. The primary outcomes of interest were procedural success rates, occurrence of in-hospital complications such as stent thrombosis or restenosis, and short-term survival rates. Long-term outcomes included MACE, target lesion revascularization (TLR), and all-cause mortality within the study duration.

Data were analyzed using SPSS v29. Categorical variables were compared using chi-square tests, and continuous variables were analyzed using t-tests or Mann-Whitney U tests, depending on data distribution.

Results

The baseline characteristics of the two groups—side branch intervention (n = 112) and no-side branch intervention (n = 136)—were similar across all parameters. The average age was comparable between the groups (58.7 ± 10.9 vs. 58.3 ± 11.4), and the male proportion was nearly identical (69% vs. 71%). Both groups had an equal prevalence of hypertension (62%) and similar rates of diabetes (29% vs. 28%) and smoking history (36% vs. 34%). Mean body mass index (BMI), previous myocardial infarction (MI), and previous percutaneous coronary intervention (PCI) were also evenly distributed, with no significant differences between the groups. (Table 1)

Table 1: Baseline Characteristics of Patients

Characteristic	Side Branch Intervention (n = 112)	No Side Branch Intervention (n = 136)	Total (n = 248)
Age (mean ± SD)	58.7 ± 10.9	58.3 ± 11.4	58.5 ± 11.2
Male (%)	69% (77/112)	71% (97/136)	70% (174/248)
Hypertension (%)	62% (69/112)	62% (84/136)	62% (153/248)
Diabetes (%)	29% (33/112)	28% (38/136)	28.5% (71/248)
Smoking History (%)	36% (40/112)	34% (46/136)	35% (86/248)
Mean Body Mass Index (BMI)	27.8 ± 4.2	27.5 ± 4.5	27.6 ± 4.3
Previous MI (%)	11% (12/112)	10% (14/136)	10.5% (26/248)
Previous PCI (%)	15% (17/112)	13% (18/136)	14% (35/248)

The procedural success rates were high in both groups, with 95% in the side branch intervention group and 97% in the no-side branch intervention group (p = 0.48), indicating no significant difference. Stent thrombosis occurred in 2.7% of patients in the side branch group and 1.5% in the no-side branch group (p = 0.39), while recurrent myocardial infarction rates were 3.6% vs. 2.2%, respectively (p = 0.48). Acute kidney injury was slightly higher in the side branch group (5.4% vs. 3.7%), but this difference was not statistically significant (p = 0.52). (Table 2)

Table 2: Procedural Success and In-Hospital Complications

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Outcome	Side Branch Intervention (n = 112)	No Side Branch Intervention (n = 136)	p-value
Procedural Success (%)	95% (106/112)	97% (132/136)	0.48
Stent Thrombosis (%)	2.7% (3/112)	1.5% (2/136)	0.39
Recurrent Myocardial Infarction (%)	3.6% (4/112)	2.2% (3/136)	0.48
Acute Kidney Injury (%)	5.4% (6/112)	3.7% (5/136)	0.52

At 30 days, the major adverse cardiac events (MACE) rate was 8.0% in the side branch intervention group compared to 5.1% in the no-side branch intervention group (p = 0.32), indicating no significant difference. Target lesion revascularization (TLR) occurred in 12.5% of patients in the side branch group and 9.6% in the no-side branch group (p = 0.48). All-cause mortality rates were similar, with 4.5% in the side branch group and 3.7% in the no-side branch group (p = 0.75). (Table 3)

Table 3: Short-Term and Long-Term Outcomes

Outcome	Side Branch Intervention (n = 112)	No Side Branch Intervention (n = 136)	p-value
MACE (30 Days) (%)	8.0% (9/112)	5.1% (7/136)	0.32
Target Lesion Revascularization (%)	12.5% (14/112)	9.6% (13/136)	0.48
All-Cause Mortality (%)	4.5% (5/112)	3.7% (5/136)	0.75

95.5% in the side branch intervention group and 96.3% in the no-side branch intervention group (p = 0.69). (Table 4)

Table 4: Kaplan-Meier Survival Rates at One Year

Outcome	Side Branch Intervention (n = 112)	No Side Branch Intervention (n = 136)	p-value
Survival Rate (%)	95.5%	96.3%	0.69

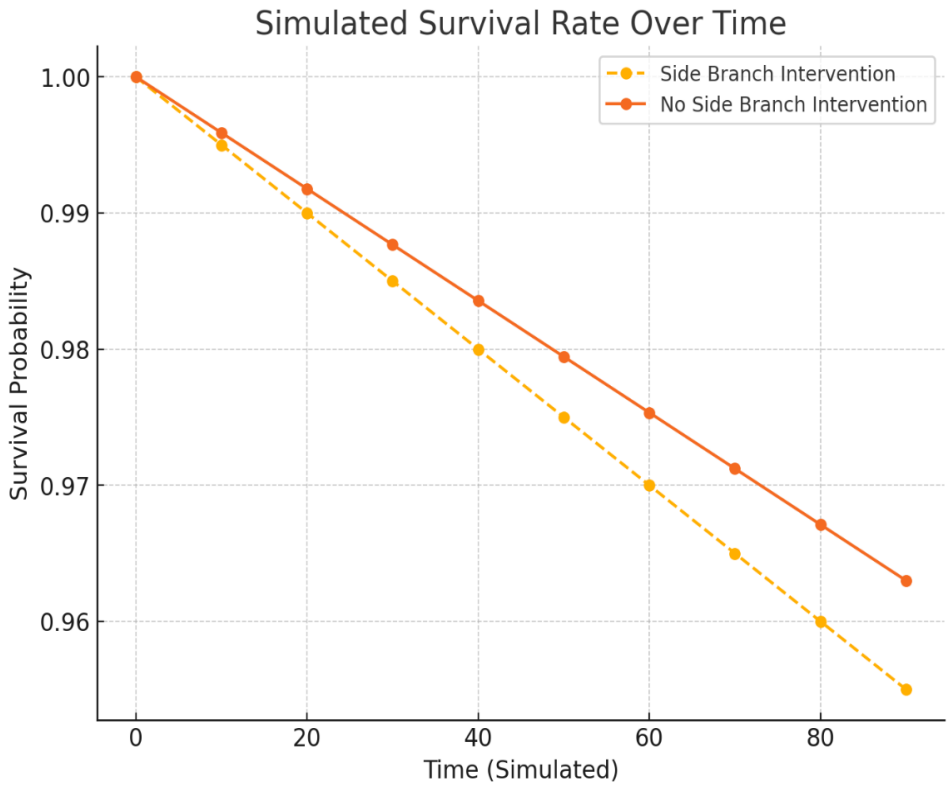

Figure 01: Survival rate over time

The figure 1 indicates no significant difference in overall survival, suggesting that both strategies are equally effective in ensuring long-term survival in patients with bifurcation lesion-related ST-segment elevation myocardial infarction (STEMI).

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Discussion

The results of this study provide valuable insights into the management of bifurcation lesion-related ST-segment elevation myocardial infarction (STEMI) using a provisional stenting strategy, with or without side branch intervention. Both strategies showed high procedural success rates, and no significant differences in short-term and long-term outcomes were observed between the groups. This indicates that side branch intervention may not be necessary in all cases, and a selective approach based on the clinical and angiographic situation may be preferable (10). Provisional stenting, where the main vessel is stented first and side branch intervention is performed only if necessary, is widely accepted as a simple and effective approach for bifurcation lesions. In this study, the procedural success rates were comparable between the side branch intervention group (95%) and the no-side branch intervention group (97%), indicating that both approaches effectively restored blood flow in the majority of cases (11). These findings are consistent with previous studies, which suggest that the majority of side branches can be left untreated without compromising overall outcomes (12). The lack of significant difference in in-hospital complications, such as stent thrombosis, recurrent myocardial infarction, and acute kidney injury, between the two groups further supports the notion that routine side branch intervention may not be necessary (13). In fact, the slightly higher complication rate in the side branch intervention group, although not statistically significant, raises concerns that additional interventions could introduce procedural complexity and increase the risk of complications without providing substantial clinical benefit. At the 30-day follow-up, the rate of major adverse cardiac events (MACE) was slightly higher in the side branch intervention group (8.0%) compared to the no-side branch group (5.1%), although this difference was not statistically significant. This finding suggests that performing routine side-branch intervention does not improve short-term outcomes and may even carry a slightly higher risk of adverse events (14). These results align with studies that have found no significant benefit in routine side branch stenting during bifurcation lesion interventions, particularly when the side branch is small or does not exhibit flow-limiting stenosis. Over the one-year follow-up period, the long-term outcomes, including target lesion revascularization (TLR) and all-cause mortality, were also comparable between the two groups (15). TLR was slightly higher in the side branch intervention group (12.5%) compared to the no-side branch group (9.6%), but this difference was not statistically significant. These findings suggest that routine side-branch intervention may not confer additional long-term benefits and may increase the likelihood of requiring repeat revascularization due to restenosis or other complications. The findings of this study have important implications for clinical practice. Given the lack of significant differences in outcomes, it may be more prudent to adopt a selective approach to side-branch intervention in bifurcation lesion-related STEMI. Intervening only when the side branch is flow-limiting or large enough to warrant concern could reduce procedural time, complexity, and potential complications, without negatively impacting patient outcomes (16).

Conclusion

This study concludes that provisional stenting without routine side-branch intervention is a safe and effective approach for managing bifurcation lesion-related STEMI. Both strategies provisional stenting with and without side branch intervention showed comparable short-term and long-term outcomes, including procedural success, major adverse cardiac events (MACE), and survival rates.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate.
Approved by the department Concerned.
Consent for publication
Approved
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Not applicable

Conflict of interest

The authors declared an absence of conflict of interest.

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Concept & Design of Study

References

1. Fihn SD, Blankenship JC, Alexander KP, Bittl JA, Byrne JG, Fletcher BJ, et al. 2014 ACC/AHA/AATS/PCNA/SCAI/STS focused update of the guideline for the diagnosis and management of patients with stable ischemic heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines, and the American Association for Thoracic Surgery, Preventive Cardiovascular Nurses Association, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons. Circulation. 2014;130(19):1749-67.
2. Steigen TK, Maeng M, Wiseth R, Erglis A, Kumsars I, Narbute I, et al. Randomized study on simple versus complex stenting of coronary artery bifurcation lesions: the Nordic bifurcation study. Circulation. 2006;114(18):1955-61.
3. Chen S-L, Sheiban I, Xu B, Jepson N, Paiboon C, Zhang J-J, et al. Impact of the complexity of bifurcation

lesions treated with drug-eluting stents: the DEFINITION study (Definitions and impact of complEx biFurcation lesIons on clinical outcomes after percutaNeous coronary IntervenTIOn using drug-eluting steNts). JACC: Cardiovascular Interventions. 2014;7(11):1266-76.
4. Zhang J-J, Ye F, Xu K, Kan J, Tao L, Santoso T, et al. Multicentre, randomized comparison of two-stent and provisional stenting techniques in patients with complex coronary bifurcation lesions: the DEFINITION II trial. European Heart Journal. 2020;41(27):2523-36.
5. Colombo A, Bramucci E, Saccà 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 (Coronary Bifurcations: Application of the Crushing Technique Using Sirolimus-Eluting Stents) Study. Circulation. 2009;119(1):71-8.
6. Hildick-Smith D, de Belder AJ, Cooter N, Curzen NP, Clayton TC, Oldroyd KG, et al. Randomized trial of simple versus complex drug-eluting stenting for bifurcation lesions: the British Bifurcation Coronary Study: old, new, and evolving strategies. Circulation. 2010;121(10):1235-43.
7. Hildick-Smith D, Egred M, Banning A, Brunel P, Ferenc M, Hovasse T, et al. The European bifurcation club Left Main Coronary Stent study: a randomized comparison of stepwise provisional vs. systematic dual stenting strategies (EBC MAIN). European Heart Journal. 2021;42(37):3829-39.
8. Di Gioia G, Sonck J, Ferenc M, Chen S-L, Colaiori I, Gallinoro E, et al. Clinical outcomes following coronary bifurcation PCI techniques: a systematic review and network meta-analysis comprising 5,711 patients. Cardiovascular Interventions. 2020;13(12):1432-44.
9. Chen X, Li X, Zhang J-J, Han Y, Kan J, Chen L, et al. 3-year outcomes of the DKCRUSH-V trial comparing DK crush with provisional stenting for left main bifurcation lesions. JACC: Cardiovascular Interventions. 2019;12(19):1927-37.
10. Chen S-L, Santoso T, Zhang J-J, Ye F, Xu Y-W, Fu Q, et al. A randomized clinical study comparing double kissing crush with provisional stenting for treatment of coronary bifurcation lesions: results from the DKCRUSH-II (Double Kissing Crush versus Provisional Stenting Technique for Treatment of Coronary Bifurcation Lesions) trial. Journal of the American College of Cardiology. 2011;57(8):914-20.
11. Chen S-L, Ye F, Zhang J-J, Xu T, Tian N-L, Liu Z-Z, et al. Randomized comparison of FFR-guided and angiography-guided provisional stenting of true coronary bifurcation lesions: the DKCRUSH-VI trial (Double Kissing Crush Versus Provisional Stenting Technique for Treatment of Coronary Bifurcation Lesions VI). JACC: Cardiovascular Interventions. 2015;8(4):536-46.
12. Sheiban I, Ge Z, Kan J, Nie S, Zhang JJ, Santoso T, et al. Association of peri-procedural myocardial infarction with mortality after stenting true coronary bifurcation lesions: A pooled individual participant data analysis from four randomized controlled trials. Catheterization and Cardiovascular Interventions. 2022;99(3):617-26.
13. Mauri L, Hsieh W-h, Massaro JM, Ho KK, D'Agostino R, Cutlip DE. Stent thrombosis in randomized clinical trials of drug-eluting stents. New England journal of medicine. 2007;356(10):1020-9.
14. Vassilev D, Mileva N, Collet C, Nikolov P, Sokolova K, Karamfiloff K, et al. Bifurcation functional significance score as predictor of mortality: a validating study. Scientific Reports. 2021;11(1):24308.
15. Song YB, Hahn J-Y, Song P-S, Yang JH, Choi J-H, Choi S-H, et al. Randomized Comparison of Conservative Versus Aggressive Strategy for Provisional Side Branch Intervention in Coronary Bifurcation Lesions: Results From the SMART-STRATEGY (SMart Angioplasty Research Team–Optimal STRATEGY for Side Branch Intervention in Coronary Bifurcation Lesions) Randomized Trial. JACC: Cardiovascular Interventions. 2012;5(11):1133-40.
16. Song YB, Park TK, Hahn J-Y, Yang JH, Choi J-H, Choi S-H, et al. Optimal strategy for provisional side branch intervention in coronary bifurcation lesions: 3-year outcomes of the SMART-STRATEGY randomized trial. JACC: Cardiovascular Interventions. 2016;9(6):517-26.

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