

## Angiographic Profile and Lesion Complexity in NSTEMI – Insights from a Comparative Analysis of Revascularization Strategies

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### ABSTRACT

**Introduction:** Non-ST-elevation myocardial infarction (NSTEMI) is a common presentation of acute coronary syndrome and is frequently associated with multivessel coronary artery disease (MVD), which increases the risk of adverse cardiovascular outcomes. **Methods & Materials:** This cohort study was conducted at the Department of Cardiology, Ibrahim Cardiac Hospital & Research Institute, over a 19-month period from December 01, 2022, to June 30, 2024. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 25.0. **Result:** The two patient groups were comparable in age, gender, and BMI, with chest pain being the predominant symptom and similar hemodynamic parameters observed ( $p > 0.05$ ). Killip Class III heart failure was significantly more frequent in the Culprit-only PCI group ( $p = 0.020$ ). Both groups showed minimal left main artery involvement, while significant LAD and LCx lesions were comparable. The Complete PCI group had a higher prevalence of RCA lesions (33% vs. 23.4%,  $p = 0.046$ ). Angiographically, three-vessel disease and thrombus burden were significantly greater in the Culprit-only PCI group (TVD: 34.3% vs. 23.5%,  $p = 0.025$ ; thrombus:  $p = 0.005$ ). **Conclusion:** In patients with NSTEMI and multivessel coronary artery disease, the choice of revascularization strategy is primarily influenced by the extent and complexity of coronary lesions rather than patient demographics. Complete PCI was more frequently undertaken in those with less severe disease and lower thrombus burden, whereas culprit-only PCI was favored for patients with more complex anatomy and higher clinical risk.

**Keywords:** Angiographic Profile, Lesion Complexity, Revascularization Strategies, NSTEMI

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### INTRODUCTION

Non-ST-elevation myocardial infarction (NSTEMI) accounts for a substantial percentage of acute coronary syndromes (ACS) and is commonly seen in conjunction with multivessel coronary artery disease (MVD). In comparison to patients with single-vessel coronary artery disease, NSTEMI patients with MVD have a propensity for recurrent ischemic events, heart failure, and late mortality<sup>[1]</sup>. NSTEMI patients have a typical underlying angiography showing diffuse atherosclerosis, complex lesions, and varying severity of coronary artery obstruction, thus making the selection of revascularization approaches more complex and challenging to manage. Lesion complexity identified on coronary angiography plays a critically important role in defining the efficacy of percutaneous coronary interventions (PCI). In order to predict the complexity of coronary anatomy, the SYNTAX score and its variants have been developed, incorporating the complexity of the lesion in terms of location, morphology, bifurcation,

calcification, and chronic total occlusion<sup>[2]</sup>. Higher SYNTAX scores have been consistently found to be predictive of adverse cardiac events and outcomes after PCI in patients with ACS, thereby underlining the importance of comprehensive assessment on coronary angiograms for risk stratification in these patients<sup>[3]</sup>. A therapeutic dilemma is posed for patients with NSTEMI and MVD regarding the extent of revascularization as a therapeutic approach for these patients. Culprit vessel-only revascularization has classically been preferred for these patients due to a larger contrast volume requirement and a longer procedural time and a possible risk of complications with more extensive invasive approaches. However, this may be a contributing cause for future events and ischemia as a result of incompletely revascularized lesions in these patients with NSTEMI and MVD<sup>[4,5]</sup>. On the other hand, the focus on complete revascularization, or the treatment of all significant coronary lesions, has gained more attention as a potentially more favorable approach. Although there is good randomized data in

the STEMI population to support the success of complete revascularization, the evidence in the NSTEMI population remains relatively scarce<sup>[6]</sup>. However, several studies in the NSTEMI group have found lower event rates for all-cause mortality, myocardial infarction, and repeat revascularization with the complete revascularization group as compared to the culprit PCI group<sup>[7]</sup>. The complexity of the lesions affects the ease and potential benefit of full revascularization. Angiographic complexity, like long lesions, bifurcation lesions, severe calcifications, and chronic occlusions, makes procedures challenging and possibly increases procedural risk, especially among patients with a high Syntax score<sup>[8]</sup>. Residual Syntax score, which is an index of the lesion complexity left after PCI, has been recognized as an independent predictor of outcomes, and this underlines the importance not only of MVD, but also the level of complexity, in determining prognosis<sup>[9]</sup>. This study aimed to compare the angiographic profile and lesion complexity of NSTEMI patients

undergoing complete versus culprit-only PCI.

**METHODS & MATERIALS**

The cohort study, was carried out in the Department of Cardiology, Ibrahim Cardiac Hospital & Research Institute, for a period of 19 months starting from 01 December 2022 to 30th June 2024. A total of 354 consecutive patients admitted with their initial episode of Non-STEMI and confirmed to have multivessel disease through angiography were selected through informed consent and ethical clearance obtained from the Ethical Review Committee of the Institute. The patients were divided into two groups depending on

revascularization techniques. In Group I, 179 patients underwent complete revascularization in a single sitting through PCI, while in Group II, 175 patients with only culprit vessels underwent PCI. The inclusion criteria included patients who are above 18 years old regardless of sex with initial Non-STEMI. Patients with cardiogenic shock, myocardial infarction, previous PCI or coronary artery bypass, SYNTAX score>32, valvular heart disease, or systemic illnesses such as collagen vascular disease, amyloid, or malignancies would be excluded. The study would be conducted using a semi-structured predesigned questionnaire. The analysis would be done using the Software for

Statistical Package for the Social Sciences version 25.0. The continuous variables would be represented using the average and standard deviation, while the categorical variables would be shown using the frequency, using the Students t-test, and Chi-square test, respectively. The p-value would be set at 0.05.

**RESULTS**

The age distribution was similar in the two patient populations, with an average age of approximately 58 years (p = 0.665). Gender distribution was comparable, showing a male predominance in both groups (p = 0.991), and there were no differences in BMI data as well p = 0.451 (Table I).

**Table I**  
Comparison of demographic characteristics between the study groups.

Demographic characteristics	Group		p-value
	Complete PCI (n = 179)	Culprit Only PCI (n = 175)	
Age (years)	58.5 ± 10.4	57.9 ± 10.9	0.665 <sup>#</sup>
Sex			
Male	138(77.1)	135(77.1)	0.991*
Female	41(22.9)	40(22.9)	
BMI (kg/m <sup>2</sup> )			
Underweight (<18.5)	2 (1.1)	3 (1.7)	0.451*
Normal weight (18.5-24.9)	75 (41.9)	87 (49.7)	
Overweight (25-29.9)	77 (43.0)	63 (36.6)	
Obese (30-39.9)	25 (14.0)	22 (12.6)	

Figures in the parentheses indicate corresponding %; \*Chi-squared Test (χ<sup>2</sup>) was done to analyze the data. <sup>#</sup>Data were analyzed using an Unpaired t-Test and were presented as mean ± SD.

Chest pain was a common complaint among patients in both groups (p = 0.894). The prevalence of shortness of breath was marginally lower in the Complete PCI cohort compared to the Culprit-only PCI cohort (p = 0.091). The mean duration from

the onset of MI was 1.3 days for both groups (p = 0.555). There were no significant differences in pulse and both systolic and diastolic blood pressures among the hemodynamic variables between both groups (p = 0.099, p = 0.661, and p = 0.733,

respectively). Of note, the incidence of Killip Class III heart failure was significantly higher in the Culprit-only PCI arm compared to the Complete PCI arm p = 0.020 (Table II).

**Table II**  
Comparison of clinical characteristics between the study groups.

Clinical variables	Group		p-value
	Complete PCI (n = 179)	Culprit-only PCI (n = 175)	
<b>History &amp; presenting symptoms</b>			
Chest pain	179(100.0)	174(99.4)	0.894**
Shortness of breath	71(39.7)	85(48.6)	0.091*
Duration of NSTEMI (days)	1.3 ± 0.45	1.3 ± 0.47	0.555 <sup>#</sup>
Pulse (bpm)	79.4 ± 19.2	76.4 ± 14.5	0.099 <sup>#</sup>
Systolic (mmHg)	127.9 ± 20.8	126.9 ± 20.4	0.661 <sup>#</sup>
Diastolic (mmHg)	77.6 ± 10.3	77.3 ± 10.1	0.733 <sup>#</sup>
<b>Killip Class on admission</b>			
Class I	96(53.6)	95(54.3)	0.020*
Class II	79(44.1)	64(36.6)	
Class III	4(2.2)	16(9.1)	

Figures in the parentheses indicate corresponding %; \*Chi-squared Test (χ<sup>2</sup>) was done to analyze the data. <sup>#</sup>Data were analyzed using an Unpaired t-Test and were presented as mean ± SD.

Both cohorts showed a substantial freedom from lesions within the left main artery. About 18% of patients in the Complete PCI group and 21.7% of patients in the Culprit-only PCI group showed significant lesions

within the left anterior descending (LAD) artery (p = 0.365). More than one-quarter of patients in both cohorts showed significant lesions within the left circumflex (LCx) (p = 0.810). But the Complete PCI group showed

a significantly higher percentage of significant lesions within the right coronary artery (RCA) (33%) than those in the Culprit-only PCI group (23.4%) p = 0.046 (Table III).

**Table III**  
Comparison of lesion characteristics between the study groups.

Percentage of lesions*	Group		p-value
	Complete PCI (n = 179)	Culprit-only PCI (n = 175)	
<b>LM</b>			
Significant	0(0.0)	(0.0)	Not computable
Insignificant	179(100.0)	175(100.0)	
<b>LAD</b>			
Significant	32(17.9)	38(21.7)	0.365
Insignificant	147(82.1)	137(78.3)	
<b>LCx</b>			
Significant	47(26.3)	44(25.1)	0.810
Insignificant	132(73.7)	131(74.9)	
<b>RCA</b>			
Significant	59(33.0)	41 (23.4)	0.046
Insignificant	120(67.0)	134 (76.6)	

Figures in the parentheses indicate corresponding %; \*Chi-squared Test<sup>2</sup> was done to analyze the data.

Analysis of the angiographic information showed that there were significantly more patients with three-vessel disease (TVD)

within the Culprit-only PCI group (34.3%) compared with the Complete PCI group (23.5%) (p = 0.025). Furthermore, the

thrombus burden was also greater within the Culprit-only group p = 0.005 (Table IV).

**Table IV**  
Comparison of angiographic comments between the study groups.

Angiographic findings	Group		p-value
	Complete PCI (n = 179)	Culprit-only PCI (n = 175)	
<b>Number of vessels involved</b>			
DVD	137(76.5)	115(65.7)	0.025*
TVD	42(23.5)	60(34.3)	
Thrombus burden	56(31.3)	80(45.7)	0.005*

Figures in the parentheses indicate corresponding %; \*Chi-square Test<sup>2</sup> was done to analyze data.

## DISCUSSION

In this cohort study involving NSTEMI patients with multivessel disease who underwent either complete or culprit-only PCI, the distribution of their demographic characteristics is well balanced at baseline between the two groups. The mean age was similarly distributed in the complete PCI (58.5 ± 10.4 years) and culprit-only PCI groups (57.9 ± 10.9 years), without any statistically significant difference. There was male predominance in both groups, amounting to 77.1%, which reflects the already identifiable pattern in the epidemiological studies of coronary artery disease among South Asian populations. This has been reported by Bangalore et al., citing a mean age of approximately 60 years, with over 70% male representation among the patients undergoing multivessel PCI for NSTEMI [5]. Likewise, the ACUTY trial substudy demonstrated no significant age or sex differences between revascularization strategies in NSTEMI, supporting the demographic comparability observed in our study [10]. Body mass index categories were also evenly distributed between groups, consistent with findings from contemporary registries showing a high prevalence of overweight and obesity among ACS patients in South Asia and other regions [11]. Clinical presentation and hemodynamic parameters were largely similar between groups. Nearly all patients

presented with chest pain, and the duration of NSTEMI before intervention did not differ significantly. However, one thing that stood out was the marked difference in the Killip class at admission. Killip class III was seen to be higher in the culprit-only PCI group (9.1%) compared to the complete PCI group (2.2%), indicating instability among patients undergoing culprit-only PCI. This is consistent with what was observed by the SWEDEHEART registry study, where Killip class had been found to be higher among patients preferring aggressive strategies for NSTEMI because of the risks associated with process [12]. This was further observed by Shishehbor et al., where patients with initial signs of cardiac failure are often not subjected to complete revascularization procedures but instead undergo culprit-only PCI procedures because of risks associated with procedure [13]. Angiographic lesion patterns were different among both groups. Significant RCA lesion patterns were higher among the complete PCI group (33.0%) compared to the culprit-only group where it stood at 23.4%, involving statistical significance. No significant differences were observed for LAD or LCx involvement. Palmerini et al. reported that non-LAD lesions, particularly RCA disease, are more frequently addressed during complete revascularization strategies, as they are often technically less complex and associated with lower

procedural risk [3]. The absence of significant left main disease in both groups reflects appropriate patient selection and is consistent with guideline-directed exclusion of high SYNTAX score anatomy from PCI-based strategies [14]. Regarding overall angiographic burden, double-vessel disease was significantly more prevalent in the complete PCI group (76.5%), whereas triple-vessel disease was more common in the culprit-only PCI group (34.3%). Additionally, thrombus burden was significantly higher in the culprit-only PCI group (45.7% vs. 31.3%). These findings suggest that patients with more extensive disease and higher thrombus load were preferentially treated with culprit-only PCI. Similar trends were reported by Bailey et al., who demonstrated that NSTEMI patients with higher anatomical complexity and thrombus burden were less likely to undergo complete revascularization during index hospitalization [15]. Furthermore, Généreux et al. showed that higher residual disease burden and thrombotic complexity influenced revascularization completeness and were independently associated with adverse outcomes [16].

## LIMITATIONS

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

## CONCLUSION

In NSTEMI patients with multivessel disease, the revascularization strategy is largely determined by angiographic severity and lesion complexity rather than demographic factors. Complete PCI was more commonly performed in patients with less extensive disease and lower thrombus burden, while culprit-only PCI was preferred in those with greater anatomical complexity and clinical instability.

## RECOMMENDATION

Revascularization strategy in NSTEMI patients with multivessel disease should be individualized based on comprehensive angiographic assessment, including lesion complexity, thrombus burden, and extent of vessel involvement. Complete PCI may be considered in clinically stable patients with lower anatomical complexity, while culprit-only PCI should be reserved for those with higher lesion complexity or clinical instability.

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## CONFLICT OF INTEREST

None declared

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