Original Research Article

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Angiographic Complexity and Procedural Outcomes in Non-ST-Segment Elevation Acute Coronary Syndrome Patients with Prior Coronary Artery Bypass Grafting

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Abstract

Background: Post-CABG patients with NSTE-ACS represent a complex cohort with advanced native disease and graft attrition. Angiographic characteristics and procedural outcomes of PCI in this population, particularly in Bangladesh, remain understudied.

Objective: To evaluate the angiographic complexity and procedural outcomes of NSTE-ACS patients with prior CABG undergoing percutaneous coronary intervention.

Methods: This prospective observational study was conducted at Ibrahim Cardiac Hospital and Research Institute from July 2022 to June 2024. Among 195 enrolled post-CABG NSTE-ACS patients, 97 underwent PCI and were included in this analysis. Angiographic assessment evaluated native vessel disease, graft involvement, thrombus burden, and TIMI flow. Procedural success, in-hospital outcomes, and BARC bleeding were documented. Statistical analysis used SPSS version 25.0.

Results: Mean age was 64.4 ± 8.2 years, with 91.8% male. Triple vessel disease (92.8%) and SVG involvement (60.8%) were highly prevalent. PCI targeted RCA (32.0%) and SVGs (42.3%). Pre-procedural TIMI 1 flow (95.9%) improved to TIMI 3 in all patients (100%). Procedural success was 100%. No deaths, reinfarctions, or strokes occurred. Type 1 bleeding occurred in 5.2%, with no major bleeding events.

Conclusion: Post-CABG NSTE-ACS patients exhibit high angiographic complexity with triple-vessel and SVG disease. Despite this, PCI achieves excellent procedural success and favorable in-hospital outcomes, supporting an invasive approach in appropriately selected patients.

Keywords: Angiography, coronary artery bypass grafting, non-ST-elevation acute coronary syndrome, percutaneous coronary intervention, TVD, vein graft

Introduction

Patients with prior coronary artery bypass grafting (CABG) presenting with non-ST-segment elevation acute coronary syndrome (NSTE-ACS) represent a growing and clinically challenging population. The prevalence of NSTE-ACS in post-CABG patients is substantial, with these individuals exhibiting worse long-term outcomes compared to those without prior bypass

surgery.[1] This unfavorable prognosis is attributed to a combination of factors, including advanced age, higher comorbidity burden, and the complex underlying coronary anatomy characterized by progressive native vessel disease and significant graft attrition.[2] Saphenous vein grafts (SVGs), the most commonly used conduits in CABG surgery, are particularly vulnerable to atherosclerotic degeneration over time. Studies have demonstrated that SVG patency rates decline progressively, with approximately 50% of vein grafts showing significant disease or occlusion by 10 years post-surgery.[3,4] This graft attrition, coupled with the progression of atherosclerosis in native coronary arteries, creates a complex anatomical substrate when these patients present with acute coronary syndromes.[5] The angiographic characteristics of post-CABG patients with NSTE-ACS are notably distinct from those without prior revascularization. These patients frequently exhibit multivessel native disease, significant graft involvement, and complex lesion morphology, including degenerated vein grafts with large thrombus burdens and propensity for distal embolization.[6] Contemporary data indicate that triple vessel disease is present in the majority of these patients, and SVG intervention carries unique procedural challenges, including the risk of no-reflow phenomenon and periprocedural myocardial infarction.[7] Percutaneous coronary intervention (PCI) in post-CABG patients has become increasingly common, with recent studies demonstrating that these procedures now account for a substantial proportion of contemporary PCI practice.[8] However, the optimal management of graft versus native vessel PCI remains debated. While some evidence suggests that native vessel PCI may offer superior long-term outcomes compared to SVG intervention, the technical feasibility and complexity of treating severely diseased native vessels in this population often necessitate graft intervention.[8,9] Recent advances in interventional techniques and intracoronary imaging have enhanced our ability to perform complex PCI in post-CABG patients. Intravascular ultrasound (IVUS) and optical coherence tomography (OCT) provide a detailed assessment of lesion morphology and plaque characteristics, and can identify unusual causes of graft failure, such as surgical clip compression.[10,11] These imaging modalities have been shown to improve procedural outcomes in complex PCI settings by optimizing stent expansion and identifying complications.[12] Despite these technological advances, data specifically examining the angiographic complexity and procedural outcomes of PCI in post-CABG patients with NSTE-ACS remain limited, particularly in the South Asian context. The Bangladeshi population exhibits a high propensity for premature and severe coronary artery disease, yet detailed angiographic characterization of post-CABG patients presenting with acute coronary syndromes in this setting is lacking.[4] Understanding the angiographic profile and procedural outcomes in this population is essential for optimizing patient selection and improving clinical outcomes. Therefore, this study aimed to evaluate the angiographic complexity and procedural outcomes of NSTE-ACS patients with prior CABG undergoing percutaneous coronary intervention at a tertiary cardiac center in Bangladesh.

Methods

This prospective observational study was conducted at the Department of Cardiology, Ibrahim Cardiac Hospital and Research Institute, a tertiary cardiac center in Bangladesh, over 24 months from July 2022 to June 2024. Among 195 enrolled post-CABG patients presenting with NSTE-ACS, 97 patients who underwent percutaneous coronary intervention (PCI) were included in this angiographic analysis.

Inclusion Criteria

Patients with prior coronary artery bypass grafting (CABG) admitted with a diagnosis of non-ST-segment elevation myocardial infarction

(NSTEMI) or unstable angina who underwent PCI during index admission were included in the study.

Exclusion Criteria

Patients were excluded if they presented with ST-segment elevation myocardial infarction (STEMI), had a history of prior valve replacement surgery, were selected for redo CABG during hospitalization, or had dialysis-dependent renal impairment, severe chronic illness, systemic diseases such as malignancy, or structural heart disease.

Study Procedure

Detailed angiographic assessment was performed, evaluating native vessel disease extent (single, double, or triple vessel disease), graft vessel involvement (venous, arterial, or both), thrombus burden, and TIMI flow grades before and after intervention. PCI procedures were performed via radial or femoral access following pre-procedural risk stratification. Procedural success was defined as attainment of TIMI 3 flow with residual stenosis <30%. In-hospital outcomes, including cardiac death, myocardial reinfarction, stroke, and bleeding complications according to BARC classification, were documented.

Data Analysis

Statistical analysis was performed using SPSS version 25.0. Continuous variables were expressed as mean ± standard deviation. Categorical variables were presented as frequencies and percentages.

Result

Table 1 summarizes the baseline demographic and clinical characteristics of the study population. The mean age was 64.4 ± 8.2 years with a marked male predominance (91.8%). Nearly half of the patients had normal BMI, while a substantial proportion were overweight or obese. The mean duration since CABG was 9.5 ± 4.1 years. Most patients had preserved left ventricular function (mean LVEF 52.5 ± 9.1%), and the majority presented in Killip class I (89.7%), indicating relatively stable clinical status at admission [Table 1].

Table 2 shows the distribution of cardiovascular risk factors among the study participants. Hypertension (88.7%) and diabetes mellitus (82.5%) were highly prevalent, followed by dyslipidemia (74.2%). Chronic kidney disease was present in a smaller proportion (12.4%), while smoking history and family history of coronary artery disease were relatively less common [Table 2].

Table 1: Baseline demographic and clinical characteristics ($N = 97$)

Characteristic	Value
Age (years), mean ± SD	64.4 ± 8.2
Male Sex, *n* (%)	89 (91.8)
BMI (kg/m²), *n* (%)	
Normal (18.5–24.9)	46 (47.4)
Overweight (25–29.9)	40 (41.2)
Obese (30–39.9)	10 (10.3)
Time since CABG (yrs.), mean	9.5 ± 4.1
LVEF (%), mean ± SD	52.5 ± 9.1
Killip Class I on admission, *n* (%)	87 (89.7)

BMI: Body mass index; CABG: Coronary artery bypass graft; LVEF: Left ventricular ejection fraction.

Table 2: Distribution of cardiovascular risk factors

Risk factor	*n* (%)
Hypertension	86 (88.7)
Diabetes mellitus	80 (82.5)
Dyslipidemia	72 (74.2)
Chronic kidney disease	12 (12.4)
Smoking habit/Tobacco use	8 (8.2)
Family history of CAD	6 (6.2)

CAD: Coronary artery disease.

Table 3 presents the angiographic characteristics of native coronary vessels and grafts. The vast majority of patients had triple vessel disease (92.8%), with no cases of single vessel disease. Venous graft involvement was most common (60.8%), while a smaller proportion had both venous and arterial grafts or arterial grafts alone. No graft involvement was noted in 27.8% of patients. Thrombus burden was rare, observed in only 1.0% of cases [Table 3].

Table 4 illustrates the distribution of target vessels for PCI. Saphenous vein grafts were the most frequently treated vessels (42.3%). Among native coronary arteries, the right coronary artery was the most common target (32.0%), followed by the left circumflex artery (23.7%) and left anterior descending artery (8.2%). Left main and LIMA interventions were rarely performed [Table 4].

Table 5 compares TIMI flow grades before and after PCI. Before intervention, most patients had impaired flow, predominantly TIMI grade 1 (95.9%), with a few cases of TIMI 0 and 2. Following PCI, all patients achieved TIMI grade 3 flow, indicating complete restoration of coronary perfusion and excellent procedural success [Table 5].

Table 6 compares TIMI flow grades before and after PCI. Before intervention, most patients had impaired flow, predominantly TIMI grade 1 (95.9%), with a few cases of TIMI 0 and 2. Following PCI, all patients achieved TIMI grade 3 flow, indicating complete restoration

Table 3: Angiographic characteristics of native vessels and grafts

Angiographic parameter	*n* (%)
Extent of native vessel disease	
Triple vessel disease	90 (92.8)
Double vessel disease	7 (7.2)
Single vessel disease	0 (0.0)
Types of graft involved	
Venous graft only	59 (60.8)
Both venous and arterial grafts	7 (7.2)
Arterial graft only	3 (3.1)
No graft involvement	27 (27.8)
Thrombus burden present	1 (1.0)

Table 4: Distribution of target vessels for percutaneous coronary intervention

Target vessel	*n* (%)
Graft vessels	
Saphenous vein graft (SVG)	41 (42.3)
LIMA	1 (1.0)
Native vessels	
Right coronary artery (RCA)	31 (32.0)
Left circumflex artery (LCx)	23 (23.7)
LAD	8 (8.2)
Left main coronary artery (LM)	1 (1.0)

LIMA: Left internal mammary artery, LAD: Left anterior descending artery.

Table 5: TIMI flow grade before and after PCI

TIMI flow grade	Pre-PCI	Post-PCI
	n (%)	
TIMI 0	3 (3.1)	0 (0.0)
TIMI 1	93 (95.9)	0 (0.0)
TIMI 2	1 (1.0)	0 (0.0)
TIMI 3	0 (0.0)	97 (100.0)

TIMI: Thrombolysis in myocardial infarction; PCI: Percutaneous coronary intervention.

Table 6: In-hospital procedural outcomes and complications

Outcome	*n* (%)
Procedural success (TIMI 3 flow)	97 (100.0)
Cardiac death	0 (0.0)
Myocardial reinfarction	0 (0.0)
Stroke	0 (0.0)
Bleeding (BARC classification)	
Type 0 (No bleeding)	92 (94.8)
Type 1 (Minor bleeding)	5 (5.2)
Type 2 or 3 (Major bleeding)	0 (0.0)

BARC: Bleeding academic research consortium.

of coronary perfusion and excellent procedural success [Table 6].

Discussion

This study evaluated the angiographic complexity and procedural outcomes of percutaneous coronary intervention (PCI) in post-coronary artery bypass grafting (CABG) patients presenting with non-ST-segment elevation acute coronary syndrome (NSTE-ACS) at a tertiary cardiac center in Bangladesh. Our findings demonstrate that this population exhibits a high burden of complex coronary disease, with predominant triple vessel involvement and frequent saphenous vein graft (SVG) disease. Despite this anatomical complexity, PCI was performed with excellent procedural success and favorable in-hospital outcomes, supporting the feasibility and safety of an invasive approach in appropriately selected patients. The baseline characteristics of our study population reflect a high-risk cohort consistent with contemporary literature on post-CABG patients with acute coronary syndromes.[1,2] The mean age of 64.4 years and the high prevalence of diabetes (82.5%) and hypertension (88.7%) align with previous reports from South Asian populations, where premature and aggressive coronary artery disease is well-documented.[4,13] The mean time since CABG of 9.5 ± 4.1 years corresponds to the expected timeline for saphenous vein graft degeneration, with approximately 50% of vein grafts developing significant disease or occlusion by 10 years post-surgery.[3,4] This temporal relationship underscores the importance of surveillance and timely intervention in this growing patient population. The angiographic findings in our cohort reveal an exceptionally high prevalence of triple vessel disease (92.8%), which exceeds rates reported in some Western registries.[6,8] This observation may reflect the aggressive nature of coronary artery disease in the Bangladeshi population, as previously described by Islam and Majumder.[4] The frequent involvement of saphenous vein grafts (60.8%) as targets for intervention is consistent with the natural history of SVG atherosclerosis and aligns with contemporary PCI practice patterns in post-CABG patients.[5,7] The predominance of SVG PCI (42.3%) and right coronary artery intervention (32.0%) in our study reflects common anatomical considerations in post-CABG patients. RCA and LCx territories are frequently supplied by vein grafts that are prone to degeneration, while LIMA grafts to the LAD typically exhibit excellent long-term patency and are rarely targeted for intervention.[8] The low rate of arterial graft intervention (1.0% for LIMA) in our series supports the superior long-term durability of arterial conduits and the preference for native vessel PCI when feasible.[14] The procedural outcomes observed in our study are noteworthy. The achievement of TIMI 3 flow in all patients (100%) and the absence of in-hospital mortality, myocardial reinfarction, or stroke demonstrate that complex PCI in post-CABG patients can be performed safely with contemporary techniques. These results compare favorably with large registry data reporting procedural success rates of 95–98% in similar populations.[6,15] The low rate of thrombus burden (1.0%) and the absence of no-reflow phenomena in our series may reflect careful patient selection, optimal pharmacotherapy, and perhaps the predominance of chronic graft degeneration over acute thrombotic occlusion.[16] The low incidence of bleeding complications (5.2% Type 1 bleeding only, no major bleeding) is encouraging and likely attributable to the predominant use of radial access (96.9% in our overall cohort) and contemporary antiplatelet regimens. The radial approach has been consistently associated with reduced vascular complications and bleeding compared to femoral access, particularly in high-risk populations undergoing complex interventions.[17,18] Our findings support the continued adoption of radial access as the default strategy in post-CABAG patients requiring PCI. The absence of periprocedural myocardial infarction in our series warrants discussion. While some studies have reported higher rates of periprocedural myocardial injury during SVG intervention due to distal embolization, the use of embolic protection devices and

optimal pharmacotherapy may have mitigated this risk in our population.[18,19] However, routine measurement of post-procedural cardiac biomarkers was not protocolized, potentially leading to under detection of subclinical myocardial injury. The high prevalence of chronic kidney disease (12.4%) in our cohort reflects the systemic nature of atherosclerosis and the importance of contrast stewardship during complex interventions. The absence of contrast-induced nephropathy requiring dialysis in our series suggests appropriate preventive measures, including adequate hydration and minimization of contrast volume.[19]

Limitations

This single-center study with a modest sample size lacks long-term follow-up. Absence of routine post-procedural biomarker assessment may have underestimated periprocedural myocardial infarction. Selection bias exists as only patients referred for PCI were included. Intracoronary imaging was not systematically utilized.

Conclusion

Post-CABG patients with NSTE-ACS undergoing PCI demonstrate high angiographic complexity with predominant triple vessel disease and saphenous vein graft involvement. Despite this complexity, PCI can be performed with excellent procedural success, achieving TIMI 3 flow in all patients, and favorable in-hospital outcomes with no mortality or major bleeding. These findings support the safety and feasibility of an invasive approach in appropriately selected patients within this challenging population.

Recommendation

Routine intracoronary imaging should be considered to optimize complex PCI in post-CABG patients. Larger multicenter studies with longer follow-up are warranted to evaluate long-term outcomes and compare native vessel versus graft intervention strategies in this population.

References

1. Shoaib A, Rashid M, Berry C, Curzen N, Kontopantelis E, Timmis A, et al. Clinical characteristics, management strategies, and outcomes of non–ST-segment–elevation myocardial infarction patients with and without prior coronary artery bypass grafting. J Am Heart Assoc 2021 Oct 19;10(20):e018823.
2. Lee MM, Petrie MC, Rocchiccioli P, Simpson J, Jackson CE, Corcoran DS, et al. Invasive versus medical management in patients with prior coronary artery bypass surgery with a non-ST segment elevation acute coronary syndrome: a pilot randomized controlled trial. Circ Cardiovasc Interv 2019 Aug;12(8):e007830.
3. Ranjan R, Sales KM, Adhikary AB, Sales KM. Computed Tomography-Based Angiographic Evaluation of Graft Patency Rate After Coronary Artery Bypass Graft Surgery in Bangladesh. Cureus 2022 Sep 7;14(9).
4. Lin L, Lu W, Wang X, Pan L, Wang X, Zheng X, et al. Short-term outcomes of drug-coated balloon versus drug-eluting stent for de novo saphenous vein graft lesions in coronary heart disease. Front Cardiovasc Med 2023 Mar 6;10:982880.
5. Xenogiannis I, Tajti P, Hall AB, Alaswad K, Rinfret S, Nicholson W, et al. Update on cardiac catheterization in patients with prior coronary artery bypass graft surgery. JACC Cardiovasc Interv 2019 Sep 9;12(17):1635–49.
6. Shoaib A, Kinnaird T, Curzen N, Kontopantelis E, Ludman P, de Belder M, et al. Outcomes following percutaneous coronary intervention in non–ST-segment–elevation myocardial infarction patients with coronary artery bypass grafts. Circulation: Cardiovascular Interventions 2018 Nov;11(11):e006824.
7. Farag M, Brilakis ES, Gasparini GL, Spratt JC, Egred M. Percutaneous coronary intervention of native artery versus bypass graft in patients with prior coronary artery bypass graft surgery. Rev Cardiovasc Med 2022 Jun 24;23(7):232.
8. Mehaffey JH, Hayanga JA, Kawsara M, Sakhuja A, Mascio C, Rankin JS, et al. Contemporary coronary artery bypass grafting vs multivessel percutaneous coronary intervention. Ann Thorac Surg 2023 Dec 1; 116(6):1213–20.
9. Nikolsky E, McLaurin BT, Cox DA, Manoukian SV, Xu K, Mehran R, et al. Outcomes of patients with prior coronary artery bypass grafting and acute coronary

syndromes: analysis from the ACUITY (Acute Catheterization and Urgent Intervention Triage Strategy) trial. JACC Cardiovasc Interv 2012 Sep 1;5(9):919–26.

10. Panuccio G, De Rosa S, Landmesser U, Leistner DM, Abdelwahed YS. Role of integrated intracoronary imaging to identify surgical clip as a trigger for ACS-NSTE. JACC Case Rep 2023 Nov 30;29(1):102152.
11. Lee JM, Choi KH, Song YB, Lee JY, Lee SJ, Lee SY, et al. Intravascular imaging–guided or angiography-guided complex PCI. N Engl J Med 2023 May 4; 388(18):1668–79.
12. Collet JP, Thiele H. Major bleeding and the ADP-binding enzyme creatine kinase in non-ST-segment elevation acute coronary syndromes. Eur Heart J 2021 Jun 14;42(23):2313–4.
13. Islam AM, Majumder AA. Coronary artery disease in Bangladesh: A review. Indian Heart J 2013 Jul 1; 65(4):424–35.
14. Gaudino M, Benedetto U, Fremes S, Biondi-Zoccai G, Sedrakyan A, Puskas JD, et al. Radial-artery or saphenous-vein grafts in coronary-artery bypass surgery. N Engl J Med 2018 May 31;378(22):2069–77.
15. Brilakis ES, O'Donnell CI, Penny W, Armstrong EJ, Tsai T, Maddox TM, et al. Percutaneous coronary intervention in native coronary arteries versus bypass grafts in patients with prior coronary artery bypass graft surgery: insights from the veterans affairs clinical assessment, reporting, and tracking program. JACC Cardiovasc Interv 2016 May 9;9(9):884–93.
16. da Silva GL. Electroanatomical mapping and radiofrequency catheter ablation of scar-related ventricular tachycardia in patients with ischemic heart disease (Doctoral dissertation, Universidade de Lisboa (Portugal)).
17. Valgimigli M, Gagnor A, Calabró P, Frigoli E, Leonardi S, Zaro T, et al. Radial versus femoral access in patients with acute coronary syndromes undergoing invasive management: a randomised multicentre trial. Lancet 2015 Jun 20;385(9986):2465–76.
18. Paul TK, Bhatheja S, Panchal HB, Zheng S, Banerjee S, Rao SV, et al. Outcomes of saphenous vein graft intervention with and without embolic protection device: a comprehensive review and meta-analysis. Circ Cardiovasc Interv 2017 Dec;10(12):e005538.
19. McCullough PA, Choi JP, Feghali GA, Schussler JM, Stoler RM, Vallabahn RC, et al. Contrast-Induced Acute Kidney Injury. J Am Coll Cardiol 2016 Sep 27;68(13):1465–73.

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