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Original Research Article

Clinical profile of post coronary artery bypass graft patients undergoing percutaneous coronary intervention in native or graft vessels

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ABSTRACT

Background: The PCI target vessel and corresponding outcomes in prior CABG patients are poorly studied. The study aims to determine the predictors and outcomes of native coronary artery and bypass graft percutaneous coronary intervention (PCI) in patients with prior coronary artery bypass graft surgery (CABG).
Methods: The factors associated with native and bypass graft PCI were analyzed in prior CABG patients undergoing PCI between July 2011 and December 2013, at Sri Jayadeva Institute Of Cardiovascular Sciences and Research, Bengaluru. Clinical/procedural characteristics and immediate procedural outcomes were recorded and analyzed.
Results: During the study period, 76 patients underwent PCI who were before CABG patients. The PCI target was a native coronary artery in 73.6% and a bypass graft in 28.9%. The majority of patients presented more than five years after the CABG (64.4%). Post PCI angina was seen in 7(9.2%), and in 6(7.8%) patients, procedural complications seen. It was found that most PCI was done in patients who presented more than five years after CABG.
Conclusions: Most PCIs performed in prior CABG patients are done in native coronary artery lesions.

Keywords: Acute coronary syndrome, Coronary artery bypass graft, Percutaneous Coronary Intervention, ST-segment elevation myocardial infarction

INTRODUCTION

After coronary artery bypass graft surgery (CABG), bypass graft failure often develops, especially several years post-surgery.[1] Since redo CABG carries a higher risk than initial CABG, PCI is the most common revascularization procedure after CABG.[2] Although PCI in patients with prior CABG carries higher procedural risk and worse outcomes compared with PCI in patients without prior CABG, there are few reports on the specific target vessel (i.e., native coronary artery vs. bypass graft) and outcomes of PCI in such patients.[3,4] The study was done to evaluate the contemporary patterns of PCI in prior CABG patients, to identify factors associated with PCI in native coronary arteries versus bypass grafts, and to examine their in-hospital clinical outcomes.

METHODS

In Sri Jayadeva Institute Of Cardiovascular Sciences & Research, Bangalore, this study was done between July 2011 and December 2013. We analyzed the in-hospital data collected on patients with prior CABG undergoing cardiac catheterization and PCI procedures on a native vessel and bypass graft. The patient informed consent was obtained before undergoing urgent or elective PCI.

The decision to treat native vessel vs. bypass grafts, choice of stents, use of glycoprotein 2b/3a inhibitors during the procedure, use of distal protection devices were all left to the discretion of experienced operators.

Inclusion criteria

- Patients with prior CABG.
- Presenting with recurrent ischemia.
- Undergoing coronary catheterization and PCI procedures.
- Reintervention on the native vessel and bypass graft.
- On optimal medical management.

Exclusion criteria

- Patients who are candidates for re-operative CABG.
- Patients who are candidates for medical management.
- Patient who are not willing for cardiac catheterization.
- Patients who underwent re-operative CABG with concomitant cardiac procedures, such as valve replacement or repair, aortic replacement, or left ventricular aneurysmectomy.

The endpoint of the study was first coronary reintervention, i.e., PCI procedures on the native vessel and bypass graft for recurrent myocardial ischemia.

Statistical analysis

The patient's demographics, treated lesions, technical aspects of the procedure, procedure-related complications, stent characteristics, and immediate procedure outcome were recorded and retrospectively studied in patients who underwent PCI of a native coronary artery and a bypass graft. Frequencies and percentages are presented as categorical variables. By mean and standard deviation, summarized the continuous variables.

The following parameters were entered into the model: age, gender, body mass index, hospital stay, time interval from prior CABG, year of PCI, prior myocardial infarction, diabetes, glomerular filtration rate, congestive heart failure, cardiogenic shock, presentation with ST-segment elevation acute myocardial infarction, primary PCI, thrombolytic administration, presence of graft stenosis >70%, multivessel disease, prior PCI, pre and post-procedure Thrombolysis In Myocardial Infarction (TIMI) flow grade, presence of high-risk coronary lesions, extent of native coronary artery disease, previously treated lesion, lesion length, lesion type, lesion location, other lesion characteristics including presence of thrombus and calcium, percentage stenosis, type and size of stent used, use of gp IIb IIIa inhibitors, and distal protection devices. Outcomes were also recorded: Stroke, Post PCI angina, MI, VT, CHB, vascular complications, procedural complications, and hospital Death. Procedure success was defined as <50% stenosis in all lesions attempted without the occurrence of any major immediate complications such as death, Q-wave myocardial infarction, or emergency redo CABG.

RESULTS

Seventy-six patients with previous CABG underwent PCI in our study. Females accounted for 13.2% of the population. The average age was (62.1±8.12) years. The mean time interval from previous CABG to PCI was (5.8±4.2) years.

In the presenting symptoms, stable angina was predominant complaint noted in 39(51.3%) patients. Remaining patients presented with ACS. 13(17.1%) patient had unstable angina, 10(13.1%) had NSTEMI, 5(6.5%) had STEMI-AW and 9(11.8%) had STEMI-IW (Figure 1).

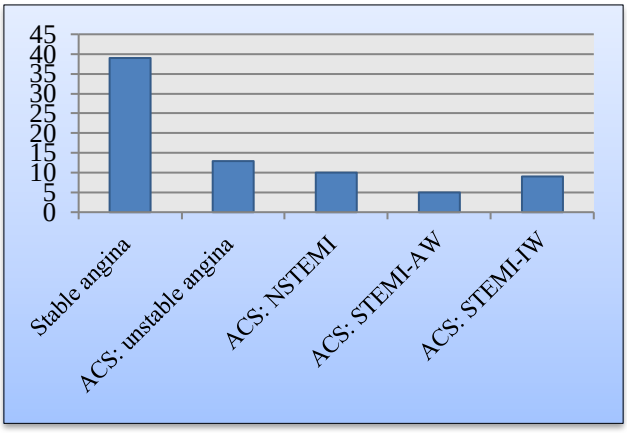

Figure 1: Presentation symptoms.

Table 1: Baseline patient characteristics (n=76).

Variable		N(%)
Demography	Age (years, mean ± SD)	62.1±8.12
	Male	66 (86.8)
Noncardiac comorbidity	Diabetes mellitus	47 (61.8)
	History of smoking	12 (15.7)
	Hypertension	48 (63)
	Dyslipidemia	26 (34)
	Peripheral vascular disease	12(15.7)
	Chronic kidney disease	1 (1.3)
	Chronic lung disease	5 (6.5)
Presentation symptoms	Stable angina	
	ACS: unstable angina	13 (17.1)
	ACS: NSTEMI	10 (13.1)
	ACS: STEMI-AW	5 (6.5)
	ACS: STEMI-IW	9 (11.8)
Years from CABG to PCI	<1y	7 (9.2)
	1-5y	18 (23.6)
	>5y	49 (64.4)

Tables 1 and 2 show the demographic and procedural characteristics of the study population. Diabetes mellitus was seen in 47(61.8%) patients, whereas hypertension in 48(63%). 12(15.7%) were present smokers. Dyslipidemia noted in 26(34%). 12(15.7%) had associated peripheral vascular disease. Only one patient had chronic kidney disease.

Table 2: Lesion and treatment characteristics.

Variable		N(%)
Target vessel	Native vessel	56(73.6)
	Graft vessel	22(28.9)
	Multivessel PCI	17(22.3)
Lesion characteristics		
Lesion location	Anastomotic site	4(5.2)
	Ostial	9(11.8)
	Proximal	39(51.3)
	Mid	30(39.4)
	Distal	17(22.3)
Lesion type	A	6(7.8)
	B	36(47.3)
	C	38(50)
	Thrombus	10(13.1)
	Calcium	7(9.2)
Treatment	Glycoprotein IIb/IIIa inhibitor	37(48.6)
	Distal protection device	2(2.6)
	Drug-eluting stents	58(76.3)
	Bare-metal stents	29(38.1)
Number of stents implanted	1	64(84.2)
	2 or more	11(14.4)
Pre-procedure TIMI flow grade	3	52(68.4)
	2	15(19.7)
	1	6(7.8)
	0	6(7.8)
Post-procedure TIMI flow grade	3	68(89.4)
	2	4(5.2)
	1	2(2.6)
	0	1(1.3)

Table 3: Immediate procedural outcomes in patients with prior CABG undergoing PCI.

Variable	N(%)
Outcomes	
Post PCI angina	7(9.2)
Stroke	1(1.3)
MI	-
VT/CHB	1(1.3)
Vascular complications	1(1.3)
Procedural complications	6(7.8)
In-hospital mortality	1(1.3)

The majority of patients presented more than five years after the CABG (64.4%). In the remaining, only 7(9.2%) patients presented within one year of CABG. Immediate procedural outcomes were analyzed and shown in Table 3. Post PCI angina was seen in 7(9.2%), and procedural complications were seen in 6(7.8%) patients. Stroke, VT, and vascular complications were seen each in 1 patient. There was one in-hospital death noted during the study.

Table 4 shows the target vessel for PCI among patients classified according to the interval from CABG. It was found that most PCI was done in patients who presented more than five years after CABG. Though native vessel PCI was high after five years of CABG, Graft vessel PCI was still higher.

Table 4: Target vessel for PCI among patients classified according to the interval from CABG.

	0–1 Yr Post CABG	1–5 Yrs Post CABG	>5 Yrs Post CABG
Native vessel PCI	5	15	34
Graft vessel PCI	2	3	15

DISCUSSION

Background

With an increasing number of patients after coronary artery bypass grafting (CABG) and with the aging of this population, there is an increasing number of patients, who are returning with the recurrence of angina pectoris (AP). According to coronary angiography, we can recommend three ways of treatment:

- Reoperation
- Percutaneous coronary intervention (PCI) and
- Conservative treatment.

Reoperation is technically more difficult (preparation of the heart structures, the risk of distal embolization, and the damage of the patent bypass, shortage of 'new' bypasses, etc.). The patients are older, have many co-morbidities (mitral insufficiency, renal insufficiency, etc.), lower ejection fraction, diffusely diseased coronary arteries, so the incidence of perioperative complications is higher (the incidence of perioperative myocardial infarction MI is 3-11%); the mortality is also higher (3-7%).

The reoperation due to ischemia in other territories than the left anterior descending artery (LAD) does not influence the patient's survival.[5] The conservative treatment is often not fully successful and does not relieve angina completely.

PCI seems to be a good alternative with a low incidence of periprocedural Q MI and mortality. In the study of Weintraub the incidence of periprocedural Q MI was in the group with PCI 1.4% (in the group with CABG 5.4%; p<0.0001), the in-hospital mortality was 1.2% (vs. 6.8% in the group with CABG; p <0.0001).[6]

The long-term patency of grafts

The long-term patency of saphenous vein grafts (SVGs) is influenced by the development of thrombosis (during the first month after the operation), fibrointimal hyperplasia (FIH) (during the first year after the operation) and atherosclerosis (after three years after the operation). It is known that after one month after the operation, approximately 10% of SVGs are occluded. After one year, it is approximately 20%, after five years 30%, and after ten years, 50% of SVGs; 50% of patent SVGs at this time have significant stenosis. The long-term patency of arterial bypasses is better. In the study of Voutilainen, 95% of mammaro coronary bypasses were patent five years after the operation. When arteria gastroepiploic was used for coronary revascularization, the 5-year patency of these bypasses was 82%.[7] The progression of atherosclerosis of native coronary arteries is accelerated after CABG; the progression is slower when the mammary artery used for revascularization. The regulation of flow by the mammary artery is a possible explanation of this fact. The progression of atherosclerosis is attenuated by aggressive hypolipidemic therapy.[8, 9]

PCI after CABG

The PCI on arterial bypasses is mostly indicated during the first year after the operation (distal anastomosis). The PCI on SVGs is indicated early after the operation (during the first year - distal anastomosis) and later (7-8 years after the operation) when atherosclerotic changes develop. In the study of Okada the procedural success was high during the intervention on SVG (90%), radial artery (88%) and native vessel (87%), but lower during the intervention on internal thoracic artery (ITA) (81%) and the lowest during the intervention on gastroepiploic artery (58%).[10] Data from this retrospective study demonstrate that: 1) in native coronary arteries, most PCIs performed in prior CABG patients; 2) after five years of CABG, most PCIs performed in prior CABG patients 3) post PCI angina was the most common immediate procedural outcome. Our study demonstrates that in prior CABG patients, in native coronary arteries, most PCIs (73.6%) are performed. Previous studies were much smaller and have shown variable results: native coronary artery PCI was performed in 56% of 142 patients reported by Varghese et al versus 44% of 95 patients reported by Chen et al.[11,12] Based on our finding that in native coronary arteries most PCIs in prior CABG patients are performed, coronary computed tomography may have significant limitations in assessing coronary anatomy and guiding angiography and revascularization decisions in these patients, who frequently have accelerated native coronary atherosclerosis and calcification. Moreover, complete native and graft angiography is important, even when the engagement of the native coronary artery and grafts is challenging in the presence of proximal complete occlusions and calcification.[13] Several single-center studies showed that prior CABG patients undergoing native coronary artery PCI have a lower procedural risk, but similar post-procedural clinical outcomes compared to patients undergoing bypass graft PCI. This suggests that, if feasible, native coronary arteries may be the preferred PCI target in prior CABG patients.[15]

In our study, the majority of the patients received drug-eluting stents, especially native vessel PCI. The data from the studies with drug-eluting stents in the treatment of native coronary artery lesions are very encouraging. However, the data from the treatment of SVG lesions with these stents are still lacking. Distal embolization is a nightmare of the interventional cardiologist. In approximately 7% of PCI on SVG, we can see a no-reflow phenomenon. Hong found in 15% of all procedures, the value of CK-MB above five times normal. This fact was associated with an increased risk of recurrent ischemia, re-PCI, and 1-year mortality. To decrease the risk of distal embolization, we can use several distal protection devices. In our study, we have used in 2.6% of patients, and all were in graft vessel PCI.[11,14]

Based on our study, post PCI angina (9.2%) was the most common immediate procedural outcome followed by procedural complications (7.8%). The in-hospital mortality was 1.3%. In the study of Weintraub, the in-hospital mortality was 1.2%.[6]

The major limitation of our observational study was that it was based on a retrospective analysis from a single-center registry data, and the case number was small. The only immediate outcome was studied, and no follow-up data were included.

CONCLUSION

PCI on venous or arterial grafts make a very dynamic part of interventional cardiology. Most PCIs performed in prior CABG patients are done in native coronary artery lesions, although SVG PCI becomes more prevalent with longer time intervals from CABG, the number of these procedures are increasing. The primary success of these procedures is high.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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