Original Article

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Modes of Presentation and Patterns of Coronary Artery Disease in Patients Undergoing Percutaneous Intervention at Birat Medical College Teaching Hospital

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Abstract

Background and Aims: Percutaneous coronary interventions have been provided in various hospitals of Nepal for more than two decades. Hence, we aimed to study the percutaneous coronary intervention revascularization status in patients with coronary artery disease at a tertiary center of eastern Nepal.

Methods: A cross sectional study was conducted at Birat Medical College Teaching Hospital from 1st Aug to 30th Feb 2023. Ninety seven coronary artery disease patients (Unstable angina, Non ST elevated Myocardial Infarction ST elevated Myocardial Infarction and Stable Angina) requiring percutaneous coronary interventions were enrolled. Patient socio-demography and findings of percutaneous coronary intervention were recorded, entered in Microsoft Excel and analyzed by SPSS 23.

Results: Majority 30(31.3%) had unstable angina. Left main coronary artery was normal in all patients. Severe stenosis was found in 58(59.7%) of left anterior descending artery, 32(32.9%) of right coronary artery and 29(29.8%) of left circumflex artery. Total occlusion was found in 10(10.3%) of left anterior descending artery, 8(8.2%) of right coronary artery and 6(6.2%) of left circumflex artery. Majority 68(70.1%) of patients had elective percutaneous coronary intervention.

Conclusion: The most common mode of presentation of coronary artery disease was unstable angina and majority have severe stenosis. The preferred intervention was elective percutaneous coronary intervention.

Keywords: Coronary artery disease, Non ST elevated Myocardial Infarction, Percutaneous coronary intervention, Stable angina, Unstable angina

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Introduction

Coronary artery disease (CAD) clinically evident as stable angina, acute coronary syndrome (ACS) or ischemic cardiomyopathy is the leading cause for morbidity and mortality worldwide.[1] According to world health organization (WHO) 2020 report, mortality due to coronary artery disease in Nepal is estimated to account up to 12.26% of total deaths.[2]

Percutaneous coronary interventions (PCIs) are minimally invasive coronary revascularization procedures that are aimed at reopening obstructed coronary arteries to improve myocardial perfusion.[3,4] PCI was first performed in 1977.[5] It has now been established as the most effective and most common form of coronary revascularization therapy worldwide.[6] PCI is achieved by different methods, the most common being stenting (80%) or by balloon angioplasty.+ PCI has significantly reduced morbidity, mortality, reinfarction and stroke rates. The increased safety and increased procedural success rates has led to decreased need of emergency and elective coronary artery bypass graft surgery.[8-11] Nepal started interventional cardiology services from a private hospital in 2002 and government hospital in 2003 at Kathmandu.[12]

Hence, we aimed to study the percutaneous coronary intervention revascularization status in patients with coronary artery disease at Birat Medical College Teaching Hospital.

Methods

An observational cross sectional study was carried out at Birat Medical College Teaching Hospital from 1 August 2022 to 30 February 2023. Sample size was calculated by using formula; n= 4 pq/l^2, where n=minimum required sample size, 4 is value of Z^2 at 95% confidence interval (CI), p=prevalence of 70% of elective PCI13 and l=margin of error (10%) and non-response rate 15%. The maximum final sample size taken was 97. The consecutive

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sampling technique was used to enroll the estimated samples during the study period. Patients with the diagnosis of nstuable angina, Non ST elevated Myocardial Infarction (NSTEMI), ST elevated Myocardial Infarction (STEMI) and chronic stable angina requiring percutaneous coronary interventions with balloon angioplasty and stents were included in the study. Patients who underwent optimal medical therapy only (OMT) after coronary angiography, who had presence of other cardiac diseases like complete heart block, heart failure, rheumatic heart disease and who did not provide consent for the study were excluded from the study.

A specifically designed proforma was used to collect relevant information from the participants. In the first part, information on patient age, sex, diagnosis and associated comorbidities like hypertension, diabetes, chronic kidney disease, hypothyroidism, presence of signs/symptoms, tests performed and diagnosis were obtained.

Then in the second part, findings of the coronary angiography were recorded. The findings of coronary angiography were graded according to Coronary Artery Disease Reporting and Data System (CAD-RADS).[14] CAD-RADS correlate with the degree of stenosis measured by invasive coronary angiography(ICA) with high diagnostic accuracy.[15,16] The grading of CAD-RADS are: CAD-RADS 0(0%)-absence of CAD, CAD-RADS 1(1-24%)-minimal non obstructive CAD, CAD-RADS 2 (25-49%)-mild non obstructive CAD, CAD-RADS 3(50–69%)-moderate stenosis, CAD-RADS 4 A(70–99%) or 2-vessels ≥ 70% stenosis, and CAD-RADS 4 B left main ≥50% or 3-vessel obstructive (≥70%) disease-Severe stenosis, CAD-RADS 5(100%)-total occlusion in one or all 3 coronary arteries and CAD-RADS N (non-diagnostic study-obstructive CAD cannot be excluded.[14] Grading of stenosis of each coronary artery was done as per the classification system suggested by the Society of Cardiovascular Computed Tomography. 0%- no visible stenosis/no occlusion, 1-24%-minimal stenosis, 25–49%-mild stenosis, 50–69%-moderate stenosis,70–99%-severe stenosis and 100%-occluded.[17] Stenosis present in any of the proximal, mid, distal or in total lumen of the left anterior descending coronary artery(LAD) was defined as LAD stenosis. Stenosis present in any of the proximal, mid, distal or in total lumen of the right coronary artery(RCA) was defined as RCA stenosis. Stenosis present in any of the proximal, mid, distal or in total lumen of the left circumflex coronary artery(LCx) was defined as LCx stenosis. Patients graded on category 4a/4b and 5 of CAD-RADS were performed percutaneous coronary intervention.

Elective PCI was defined as scheduled PCI with Drug Eluting Stent (DES) of the occluded artery after prior intervention with thrombolytic therapy and stabilizing the comorbid conditions of patients. Primary PCI was defined as an emergent intervention with Drug Eluting Stent (DES) of the infarct artery upon presence of signs and symptoms at the earliest possible upon arrival to hospital (<12 hours).[18] Staged PCI was defined as planned intervention at a later date separate after the first catheterization or the performance of an initial PCI.[19] Elective plain old balloon angioplasty (POBA) was defined as using a balloon to stretch open a narrowed or blocked artery.[3] Patients were considered to have NSTEMI if they had acute chest discomfort with no persistent ST-segment elevation and elevated cardiac biomarkers. STEMI was considered as the presence of chest discomfort at rest with persistent ST-segment elevation and elevated cardiac biomarkers. Unstable angina was considered as new onset exertional angina or previously stable exertional angina that now occurs with less physical exertion or at rest. With unstable angina, cardiac enzymes remain normal or are only very minimally elevated.[20] Stable angina was defined as typical exertional chest pain that was relieved by rest or nitrates. According to Canadian Cardiovascular Society Classification, Chronic stable angina II was defined with moderate exertion, Class lll- angina with mild exertion.[21]

Collected data was entered in Microsoft Excel 16 and transferred to a statistical package for social science (SPSS version 2023). Frequency, mean and standard deviation was calculated to describe the data.

Results

Table 1: Baseline characteristics of patients (n=97)

Age in years	n(%)
31-40	5(5.2)
41-50	16(16.5)
51-60	34(35.1)
61-70	28(28.8)
71-80	12(12.4)
81-90	2(2.1)
Mean± S.D. 59.26±11.47	
Sex	
Male	74(76.3)
Female	23(23.7)
Ethnicity	
Madhesi	46(46.4)
Janajati	17(17.5)
Brahmin/Chhetri	13(13.4)
Muslim	12(12.4)
Dalit	6(6.2)
Comorbidities	
Hypertension	95(97.9)
Diabetes Mellitus	29(29.9)
Chronic Kidney Disease	1(1.03)
Hypothyroidism	1(1.03)

The maximum number of patients were in the age group 51-60 years 34(35.1%) and the least were in the age group 81-90 years 2(2.1%). Majority were male 73(76.3%) and madhesi by ethnicity 45(46.4%). Ninety six (97.9%) patients had a history of hypertension and 29 patients had a history of diabetes (Table1).

Table 2: Grading of severity of occlusion according to SCCT guidelines in Coronary Arteries (n=97)

Coronary Arteries	No visible occlusion/ Normal n(%)	Minimal Stenosis n(%)	Mild Stenosis n(%)	Moderate Stenosis n(%)	Severe Stenosis n(%)	Total occlusion n(%)
Left main coronary artery (LMCA)	97(100)	0	0	0	0	0
Left anterior descending artery	6(6.2)	0	18 *(18.7)	5(5.2)	58+ (59.7)	10 (10.3)
Left Circumflex artery	38(39.2)	0	21(21.6)	3(3.1)	29(29.8)	6(6.2)
Right Coronary artery	32(32.9)	2(2.1)	22(22.6)	1(1.03)	32(32.9)	8(8.2)

** includes 2 in stent restenosis+ 1 In stent restenosis*

Left main coronary artery (LMCA) had no visible occlusion in all patients. Fifty-eight (59.7%), 32(32.9%) 29(29.8% respectively) patients had severe stenosis in LAD, RCA and LCx. Complete total occlusion was present in 10(10.3%), 8(8.2%) and 6(6.2%) patients respectively in LAD, RCA and LCx. In the left anterior descending artery, 2 patients had mild in-stent restenosis and 1 patient had severe in-stent stenosis (Table 2).

Table 3: Coronary Artery Disease Reporting and Data System Grading and intervention of patients++ (n=97)

CAD-RADS	Procedure				
Grading	Elective PCI# **	Staged PCI	Primary PCI/ emergency PCI#	Elective Plain Old Balloon Angioplasty (POBA)	Total
4a(Severe stenosis)	39 (40.2)	0	14 (14.4)	1(1.03)	54 (55.6)
4b(Severe Stenosis)	13 (13.4)	1 (1.03)	7 (7.2)	0	21 (21.6)
5 (complete total occlusion)	16 (16.5)	1 (1.03)	5 (5.2)	0	22 (22.6)
Total	68 (70.1)	2 (2.06)	26 (26.8)	1 (1.03)	97 (100)

++All patients were prescribed Dual antiplatelet therapy(DAPT) after the procedure.
#Drug eluting stent (DES) of varying size was used.
***Multivessel PCI was performed in 13 patients.(elective PCI)*

Out of 54(55.2%) patients graded in CAD-RADS 4a Category, 39(40.2%) were performed elective PCI and 14(14.4%) were performed primary /emergency PCI. Among 21(21.9%) patients graded in CAD-RADS 4b, 13 had elective PCI and 7 had primary/ emergency PCI. Among 22(22.6%) patients with CAD-RADS 5, 16 had elective PCI and 5 had primary/emergency PCI. Two patients had staged PCI and 1 patien t(CAD-RADS 4a) had undergone elective plain old Balloon angioplasty(POBA). Multivessel PCI was performed in 13 patients (Table 3).

Table 4: Percutaneous coronary intervention in coronary artery diseases (n=97)

Disease	Elective PCI*	Primary PCI*/ emergency PCI	Elective POBA	Staged PCI	Total
Chronic stable angina II+	25(25.7)	0	1(1.03)	1(1.03)	27(28.1)
Chronic Stable angina III+	4(4.1)	0	0	0	4(4.1)
Unstable angina	20(20.7)	10(10.3)	0	0	30(30.9)
STEMI	11(11.3)	14(14.4)	0	1(1.03)	26(26.8)
NSTEMI	8(8.2)	2(2.1)	0	0	10(10.3)
Total	68(70.1)	26(26.8)	1(1.03)	2(2.1)	97(100)

** Drug eluting stent(DES) of varying size was used., + Canadian classification[21]*

The majority 30(31.3%) of patients had unstable angina followed by chronic stable angina II 27(28.1%) and ST elevated Myocardial Infarction STEMI 26(27.1%). Elective PCI 68 (70.1%) was performed in the majority of patients. Primary PCI was performed in 14(14.4%) with STEMI. One patient with chronic stable angina II had elective POBA. Staged PCI was performed in one STEMI and one chronic stable angina II patients Table 4.

Table 5: Route accessed for Percutaneous Coronary Intervention Procedure(n=97)

Route	n(%)
Right radial route	93(95.8)
Right femoral route	4(4.2)

The majority 92(95.2%) of patients were accessed through the right trans radial route for the procedure (Table 5).

Discussion

In this study, elective PCI was performed in most patients 68(70.1%) to revascularize the culprit artery. Elective plain old balloon angioplasty was performed in one patient with chronic stable angina II and two patients had staged PCI. Drug eluting stents were deployed as an intervention in elective PCI and primary PCI. All patients were prescribed DAPT after the procedure. Multivessel PCI was performed in 13 out of 97 patients. The procedural success rate was 100% achieved with no major complication and no mortality in our study. In our study, the majority of patients were in the age group 51-60 years 34(35.1%) with mean age of 59.26±11.47. Five patients were in the age 31-40 years. Among 97 patients with coronary artery disease, the majority (74 patients) were male patients. Our

finding is almost similar to the other studies in Nepal.[12,22-24] This is an acceptable finding that the risk of having coronary artery disease is high among middle age groups and male population. The prevalence of hypertension (95 out of 97 (97.9%) and diabetes 29(29.9%) in CADs patients is higher in our study compared to other studies (35%, 28.2%)[22],(51%, 30%)[23] and (52.5%, 18.5%).[24] Hypertension and Diabetes are the known risk factors for coronary artery disease. The increased prevalence in our setting shows the disease burden in eastern Nepal. This also suggests us to focus on implementing interventional programmes to reduce risk factors for CADs. We assessed the degree of luminal stenosis in coronary arteries by SCCT guidelines after coronary angiography procedure.[14] The left main coronary artery (LMCA) was normal with no visible occlusion in all patients. Our finding in LMCA is better compared to the findings from other studies of Nepal where left main coronary artery involvement was seen.[22,25] Though LMCA stenosis is relatively infrequent, multiple studies state LMCA stenosis as an independent factor to increase morbidity and mortality rates among patients with coronary artery diseases.[26-,28] We operationalised the occlusion based on the grading system irrespective of the part involved in each artery. The LAD was the main culprit artery having severe stenosis 58(59.7%), complete total occlusion 10(10.3%) and moderate stenosis 5(5.2%). Two participants had mild in-stent and 1 patient had severe in-stent stenosis in LAD. This was followed by the right coronary artery where 32(33.3%) patients had severe stenosis and 8 (8.3%) had complete total occlusion in our study. In contrast to our study, Koirala P et al and Adhikari CM et al reported RCA was the culprit vessel followed by LAD 92 (43.6%) in patients with STEMI.[22,23] The blood supply by each coronary artery is compromised with increased degree of stenosis across the coronary artery lumen. CAD-RADS grading system was employed according to the degree of stenosis in each coronary artery and number of vessels involved.[14] The patients were categorized in CAD-RADS 4a, 4b and 5. Fifty three patients were categorized in CAD-RADS 4a (severe stenosis with one or two vessels involved). Twenty-one patients with triple vessels involved of ≥70-99% were in CAD-RADS 4b in this study. Twenty two patients had 100% occlusion in any of the coronary arteries (LAD,LCX,RCA) and were categorized in CAD-RADs 5 in our study. Multiple studies from Nepal mentioned double vessels disease, triple vessels disease based on degree of stenosis.[23,24,29] We performed elective PCI in the majority of patients categorized in CAD-RADS 4a, 4b or 5 and primary PCI was performed mainly in patients categorized in CAD-RADs 4a. Contrast to our study, the majority (87% and 70%) had Primary PCI in a study by Manoj Shrestha and Koirala P et al respectively.[13,22] The difference might be due to the differences in disease pattern of patients and timely presence of patients to hospital after onset of symptoms. The other reasons for favoring elective PCI over primary PCI in our setting are related to favoring the patient's convenience, delayed referral of patients from noncardiac centers, stabilizing underlying diseases and blood markers for the intervention. Unstable angina was present in the majority of the patients 30(30.9%). Twenty six patients (26.8%) had STEMI and 10(9.4%) patients had NSTEMI in our study. 14.4% patients with STEMI were managed by primary PCI in our study. Primary PCI is the gold standard for the treatment of STEMI.30 Ten patients with unstable angina and 2 with NSTEMI patients were also managed by emergency PCI in our study due to increased risk from unstable hemodynamic and refractory angina. Several meta-analysis and randomized control trials demonstrated that immediate and early(<24 hours) PCI helps in reducing the risk of composite ischemic outcomes, especially in high risk patients even with acute coronary syndrome without STEMI.[9,31-33] European Society of Cardiology (ESC) guidelines 2020) recommend an immediate and early routine PCI in very high-risk and high-risk NSTEMI patients.[34] One patient with STEMI had staged PCI in the right coronary artery. The reason is that the same patient had primary PCI performed earlier in LAD and LCx. All patients undergoing elective PCI and primary PCI were deployed DES in our study. DES is being frequently used in several other studies from Nepal.[12,22,25] Drug eluting stents reduces the chance of renarrowing, or restenosis, of the blood vessel and has a better outcome. Route for PCI was accessed through the right radial in most of the patients in our study. Radial Arterial access is associated with fewer access site complications and early discharge.[3] Similar findings with a rising trend from other studies in Nepal is seen.[12,22] The aim of all PCI procedures is to dilate a stenosed coronary artery, or open an occluded one and implant a stent to improve myocardial perfusion and alleviate symptoms which was achieved in our study. The limitation of our study is that we did not do a follow up to inspect the long-term outcome.

Conclusions

The most common mode of presentation was unstable angina and majority had severe stenosis. Drug-eluting stents were deployed in both elective and primary PCI.

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Conflict of Interest: None

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