Original Article

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Study of Clinico-angiographic profile, Risk Factors and procedural outcomes in patients undergoing Coronary Angioplasty in Dhulikhel Hospital

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Abstract

Background and aim: Coronary Angioplasty is the preferred method of revascularization in Acute ST Elevation Myocardial Infarction (STEMI) and selected cases of Non- ST Elevation Myocardial Infarction (NSTEMI) and chronic coronary syndrome (CCS). This study was aimed to evaluate clinical and angiographic profile and procedural outcomes in patients undergoing percutaneous coronary intervention (PCI) at Dhulikhel Hospital, Nepal.

Methods: This is a retrospective, observational, single center study conducted at Dhulikhel Hospital, Kathmandu University Hospital, Kavre, Nepal. All patients who underwent PCI for Acute Coronary Syndrome (ACS) and CCS in our hospital between April 1st, 2022 to March 31st, 2024, were included in the study. Data including clinical and angiographic profile, procedure and periprocedural complications, and in-hospital outcomes of these patients were analyzed.

Results: A total of 189 patients (mean age 62.39 ±11.05 years) with 57.15% males and 42.85% females were included in the study. Hypertension and smoking were the most common risk factors, present in 79.36% and 76.19% patients respectively. Diabetes mellitus and dyslipidemia were observed in 47.62% and 35.45% patients respectively. STEMI ACS was the most common mode of presentation in 51.85% followed by NSTEMI in 32.80% and stable angina in 15.34%. Single Vessel Disease (SVD) was most common angiographic pattern, observed in 50.79% of patients, followed by Double Vessel Disease (DVD) in 63 patients (33.33%), and Triple Vessel Disease (TVD) in 30 patients (15.87%). Left anterior descending artery (LAD) was the most frequently involved vessel (63.49%). Elective PCI was performed in 53.96% and Primary PCI was done in 46.04 % patients. Radial route was used in the majority (90.47%) cases. Drug eluting stents were deployed in all the cases. Periprocedural complications occurred in 22.75%. There were 3 deaths, all after Primary PCI accounting for in-hospital mortality rates of 1.58%.

Conclusion: This study provides an overview of the salient features of Coronary Artery Diseases and the characteristics of PCIs performed with their outcomes in a semi-urban tertiary care center of Nepal. This study shows that PCI done in resource-limited settings like Nepal is also safe, effective and has low in hospital mortality and complications, which is comparable to High-income countries.

Keywords: Coronary Angiographies, Coronary artery diseases, Percutaneous coronary interventions

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Introduction

Cardiovascular diseases (CVDs) are the leading cause of death and a major public health concern worldwide. It is estimated that about 19.8 million people died from cardiovascular diseases (CVDs) in 2022, representing approximately 32% of all global deaths[1]. Of these deaths, 85% are due to heart attack and stroke[1]. The burden of cardiovascular disease has been rising globally and is particularly affecting low- and middle-income countries. Approximately 80% of the world's deaths from CVDs occur in low- and middle-income countries[2]. In Nepal, CVDs contributed to 26.9% of total deaths in 2017[3]. The higher burden of CVD could be related to increased life expectancy and higher prevalence of risk factors such as smoking, diabetes, dyslipidemia, hypertension, physical inactivity, and obesity[4,5].

CVDs comprise a group of disorders of the heart and blood vessels, including Coronary Artery Disease(CAD)[6]. CAD may present as chronic coronary syndrome (CCS) or acute coronary syndrome (ACS). Among the ACS, the short-term mortality rate is higher in ST Elevation Myocardial Infarction (STEMI) and lower long-term mortality[7]. With the increasing prevalence of CAD, the treatment of coronary heart disease has also witnessed some revolutionary changes in the last couple of decades, particularly in Percutaneous Coronary Intervention (PCI) and Stenting techniques. With the development of Drug Eluting Stent (DES) and advancements in PCI techniques, clinical outcomes have improved significantly with reduced complications and better long-term results[8].

Percutaneous coronary intervention in patients with ST-segment elevation myocardial infarction (STEMI) and selected cases of non-ST-segment elevation myocardial infarction (NSTEMI) and Stable Angina (SA) has become the standard method of revascularization with some challenges and limitations. It is effective in relieving symptoms and improving survival in certain subsets of CAD patients[9,10].

Despite this increasing trend of CAD, there are limited data regarding risk factors, angiographic profiles, and clinical outcomes in patients undergoing PCI in Nepal. This is a study to explore the clinical profiles of patients with CAD undergoing percutaneous coronary revascularization in terms of risk factors, clinical presentation, and angiographic characteristics, and to analyze periprocedural outcomes at the tertiary care center of Nepal.

Materials and Methods

Study Design

This was a retrospective cross-sectional study conducted in the department of cardiology at Dhulikhel Hospital, Kathmandu University Hospital, after getting an ethical approval from the Institutional Review Committee- Kathmandu University School of Medical Sciences (KUSMS, IRC) with an approval number of 190/24.

Inclusion and Exclusion Criteria

This study included all patients who underwent percutaneous coronary intervention at the cardiac Cath lab of Dhulikhel Hospital. Patients with missing or incomplete data were excluded.

Sample Size and Sampling

A total of 189 patients with Acute Coronary Syndrome who underwent PCI from April 1st, 2022, to March 31st, 2024, were included. Total Population Sampling was done.

Coronary artery disease was diagnosed on the basis of clinical history, 12-lead ECG findings, biochemical markers like Troponin I and/or non-invasive tests like treadmill test and 2D echocardiography. Standard hospital protocol for the procedure was followed for the PCI. After the procedure, the patient was transferred to CCU and managed. Complications were assessed till hospital stay, including mortality. Medical records were reviewed, which included medical history, physical examination, age, gender, CAD risk factor profile, smoking history, lipid profile, fasting blood sugar, HbA1C levels, ECG, echocardiography, and coronary angiography.

Risk factors were defined as follows:

1. Smoking: Current smokers were defined as persons who smoked > 100 cigarettes during their lifetime and were smoking every day or some days at the time of interview[11].

2. Diabetes Mellitus was diagnosed based on fasting plasma glucose of ≥126 mg/dl or Hemoglobin A1C ≥ 6.5% or 2-h PG ≥200 mg/dl during OGTT or in an individual with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥200 mg/dl or patient on anti-diabetic medications[12].

3. Hypertension: High blood pressure (BP), or hypertension, is defined by two levels by the 2017 American College of Cardiology/American Heart Association (ACC/AHA) guidelines; (1) elevated BP, with a systolic pressure (SBP) between 120 and 129 mm Hg and diastolic pressure (DBP) less than 80 mm Hg, and (2) stage 1 hypertension, with an SBP of 130 to 139 mm Hg or a DBP of 80 to 89 mm Hg.[13]

4. Dyslipidemia: Dyslipidemia was defined as total cholesterol >240 mg/dl, or LDL cholesterol >130 mg/dl, or triglycerides >150 mg/dl, or HDL cholesterol <50 mg/dl for females and < 40mg/dl for males, or any combination of these criteria, or a patient taking lipid-lowering drugs.[14]

The angiographic characteristics, including site, severity, type, and extent of lesions, and number of vessels involved, were assessed. Stenosis in a vessel other than the left main coronary artery (LMCA) was categorized as mild (<50% diameter stenosis), moderate (50–69% diameter stenosis), and severe (>70% diameter stenosis)[15]. LMCA lesions were classified as non-significant (<50% diameter stenosis) or significant (>50% diameter stenosis)[15]. CAD was categorized as single vessel disease (SVD), double vessel disease (DVD), or triple vessel disease (TVD) according to the number of major branches with significant involvement[15].

Procedural details, including vascular access route, site, and number of lesions intervened upon, size and number of stents used, and the periprocedural pharmacotherapy were recorded. Angiographic success was defined as successful stent placement with a residual stenosis <50%[16]. Procedural success was defined as angiographic success along with the absence of major in-hospital complications (including death, myocardial infarction, or the need for coronary bypass surgery)[16]. Procedural success rates and in-hospital outcomes, with complications, were also assessed.

Statistical Analysis

Data was collected in Microsoft Excel 2016, and statistical analysis was performed by SPSS software package (version 20.0, SPSS Inc., Chicago, Illinois, USA). All continuous variables were expressed as mean ± standard deviation (SD), and categorical variables were

reported as frequency and percentages. For univariate analysis of categorical variables, the Chi-square test or Fisher's exact test, whichever is appropriate, was employed. Continuous variables were analyzed with the help of the Student's t-test. A p-value <0.05 was considered statistically significant.

Result

Over the period of two year, a total of 189 patients who fulfilled the eligibility criteria were included in the study. The mean age of the study population was 62.39 ±11.05 years. Among them, 108 (57.15%) were males and 81 (42.85%) were females. The demographic and clinical profile of the study groups is described in Table 1.

Table 1: Demographic and Clinical Profile of the Study Population.

Variables	Subgroup	Males (n=108)	Females (n=81)	Total (n=189)	P- value
Age	<45	7 (6.48%)	0 (0%)	7 (3.70%)	0.094
	45-60	48 (44.44%)	33 (40.74%)	81 (42.85%)	
	61-75	39 (36.11%)	34 (41.97%)	73 (38.62%)	
	>75	14 (12.96%)	14 (17.28%)	28 (14.81%)	
Smoking	Yes	89 (82.40%)	55(67.90%)	144(76.19%)	0.025
	No	19(17.59%)	26(32.09%)	45(23.80%)	
Hypertension	Yes	77(71.29%)	73(90.12%)	150(79.36%)	0.002
	No	31(28.70%)	8(9.18%)	39(20.64%)	
Diabetes	Yes	44(40.74%)	46(56.79%)	90(47.61%)	0.039
	No	64(59.26%)	35(43.20%)	99(52.38%)	
Dyslipidemia	Yes	38(35.18%)	29(35.80%)	68(35.98%)	>0.99
	No	70(64.81%)	52(64.19%)	122(64.02%)	
Clinical Presentation	AWMI	37(34.25%)	18(22.22%)	55(29.10%)	0.020
	IWMI	29(26.85%)	14(17.28%)	43(22.75%)	
	NSTEMI	23(21.29%)	39(48.15%)	62(32.80%)	
	CSA	19(17.59%)	10(12.35%)	29(15.34%)	

Note: AWMI: Anterior Wall Myocardial Infarction, IWMI: Inferior wall Myocardial Infarction, NSTEMI: Non ST-Elevation Myocardial Infarction, CSA: Chronic Stable Angina

Risk factors of CAD

Hypertension and Smoking were the most common risk factors present in 150(79.36%) and 144 (76.2%) patients, respectively. Diabetes mellitus and Dyslipidemias were observed in 90 (47.7%) and 67 (35.4%) patients, respectively. Smoking (82.4% in males vs 67.9% in females, $p < 0.025$) and Dyslipidemia (35.2% in males vs 35.8% in females, $p>0.99$) are more frequently present in males; while, Hypertension (71.29% in males vs 90.12% in females, $p=0.002$) and Diabetes (40.7% in males vs 56.8% in females, $p=0.039$) was common in females.

Indications of PCI

STEMI ACS was the most common mode of presentation, found in 51.85% followed by NSTEMI ACS 32.80% and stable angina 15.34%. Anterior wall STEMI (34.3%) was the commonest mode of presentation in males, whereas NSTEMI (48.2%) was more common in females. Stable angina (17.6 %) was more prevalent in males as well.

Angiographic profiles

Amongst the patients who had undergone angioplasty, Single Vessel Disease (SVD) was the most common angiographic pattern,

observed in 96 patients (50.79%), followed by Double Vessel Disease (DVD) in 63 patients (33.33%), and Triple Vessel Disease (TVD) in 30 patients (15.87%).

The most common vessel involved was LAD, seen in 63.49% patients, followed by RCA in 53.96% and LCX in 44.44%. LMCA disease was seen in 6 patients (3.17%), all of whom had multi-vessel CAD.

Table 2: Angiographic profiles of patients

Vessel involved	SVD (N=96)	DVD (N=63)	TVD (N=30)	Total (N=189)
LAD	38	57	26	120 (63.49)
LCX	13	41	30	84 (44.44)
RCA	44	28	30	102 (53.96)

Note: SVD, Single Vessel Disease; DVD, Double Vessel Disease; TVD, Triple Vessel Disease; LM, Left Main Coronary Artery; LAD, Left Anterior Descending Artery; LCX, Left Circumflex Artery; RCA, Right Coronary Artery

Management

The right radial route was the preferred route for the procedure. 171 (90.47%) patients had undergone angioplasty via radial route, and only 18 (9.5%) patients underwent through the femoral route. Primary angioplasty was performed in 87 patients. Among them, 45 procedures were performed for Anterior wall MI, 41 procedures for inferior wall MI, and a single procedure was performed for NSTEMI. A total of 217 stents were deployed. All stents were DES, and in 8(4.23%) patients, plain old balloon angioplasty (POBA) without stenting was done because of difficulty in delivering stents and distally located lesions with a small reference diameter (<2.25mm).

Table 3: PCI to the vessel involved

	LAD	LCx	RCA	LM	Total
Elective	61	36	34	0	131
Primary	39	13	41	1	94
Total					

Table 4: PCI performed for CAD

	Ant wall	Inf wall MI	Stable angina	NSTEMI	Total
Elective	10	2	29	61	102
primary	45	41	0	1	87
Total	55	43	29	62	189

The antiplatelet regimen used was a combination of aspirin and ticagrelor in 88% patients and aspirin and clopidogrel combination in 12%. All patients received a high dose of statins before and after the procedure. Glycoprotein IIb/IIIa inhibitors were used in 24% of patients, mostly used as a bolus for slow flow/no flow and those with high thrombus burden.

Outcomes

Procedure-related complications were present in 43(22.75%) patients. The most common being arrhythmias (6.9%), which include VT and various types of blocks. Vascular complications in 3.2%, heart failure in 3.2%, periprocedural MI in 1.6%, CIN in 2.6%, slow flow / no reflow in 1.6%, major side branch occlusion, and Acute stent thrombosis in 1.1%. Procedure-related mortality was 1.6% and occurred exclusively in STEMI patients. Among the 3 patients who died, 2 died of cardiogenic shock, and 1 had no reflow phenomenon that was refractory to drugs.

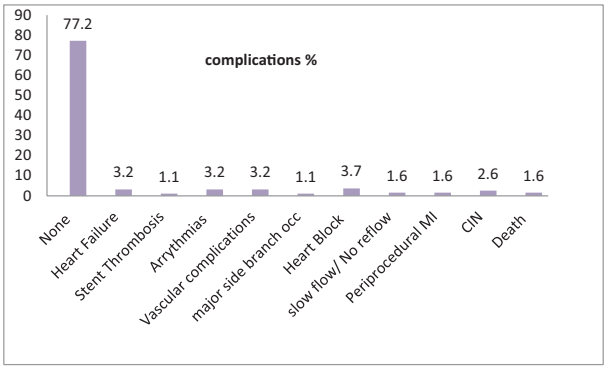

Figure1: *Procedural complication rate*

Discussion

In this study, we evaluated the angiographic profile and clinical outcomes of patients undergoing PCI at our institute. In our study, the mean age of patients was 62.39 ±11.05 years, which is consistent with a study conducted in India by Isezuo and Subban et. al., (62.2 ± 11.2 years) but was higher than the Palestinian populations (59.59±11.56 years)[17,18]. Gender distributions of this study show male predominance with a total of 108 (57.14%). This can be due to differences in risk factors like smoking, hypertension, and dyslipidemia between males and females.

Diabetes mellitus, smoking, hypertension, and dyslipidemia are established risk factors for coronary artery disease[19]. In our study, hypertension was the most common risk factor, which was present in 79.36% of total patients, followed by smoking, 76.19%. Diabetes (48.2% in males vs 51.8% in females, p=0.03) was common in females. A study conducted by Bhatta et. al., in India, reported similar findings[20]. Another study conducted by Jayachandra et. al., in India also showed that hypertension and smoking were the commonest risk factors for CAD. This was similar to our study.[21]

In our study, the majority of the patients presented with STEMI (51.7%), followed by NSTEMI (32.8%) and stable angina (15.5%). In our study, the frequency of STEMI was higher in males, whereas a higher number of females presented with NSTEMI. A study conducted by Das MK et. al., and another study conducted by Kuehnemund L et. al., showed that both STEMI and NSTEMI were more frequently present in males, which was in contrast to our findings.[22,23] The majority of the procedures (54%) were done on an elective basis. The most common artery involved in our study was left anterior descending (LAD) 63.49%, followed by Right Coronary Artery (RCA) 53.96% and Left Circumflex Artery (LCX) 44.44% which aligns with a study by Reddy KK et. al., which shows that LAD was the most commonly involved vessel (80.5%) followed by RCA in 51.9% patients[24].

In our study, 90.47% of patients underwent angioplasty via the radial route and only 9.5% patients underwent angioplasty via the femoral route. Radial access reduces the bleeding complications as well as mortality compared to femoral access[25]. Overall, the procedural success rate was 95.7% at our institute, which is similar to studies done in India[26]. These findings and successes suggest that PCI is very successful even in low-resource settings like Nepal. Periprocedural and post-PCI related complications were present in 22.75% of the patients undergoing PCI, which is similar to a study conducted by Ferreira RM et. al., which showed a complication rate of 22.3%.[27] Arrhythmias (6.9%) were the most common complications in our study and were managed accordingly. In our study, procedure-related mortality was 1.58% and occurred exclusively in acute STEMI patients. This seems to be greater than the reported in-hospital death rate of 0.8% that has been found in a study conducted by Vu H TT et. al., in Vietnam[28]. Also, the ACC NCDR CathPCI registry showed a mortality rate of 2.8% overall in-hospital or 30-day mortality[29]. Another study done in Pakistan by Shah KU et. al., showed 2.8% in hospital death rate, which is a bit higher than our study[30]. These differences may be due to the small sample size of our study population. All patients who died were presented as acute STEMI and had undergone Primary PCI. The average length of hospital stay for patients who underwent PPCI was 5 days, and patients were discharged after 24 hours in case of elective PCI.

Study limitations

There are several limitations to this study. First, this is a single-center study and has a small sample size, which limits its generalizability. Second, the retrospective nature of the study may pose the risk of missing data, but we did meticulous data collection and entry to minimize this issue. Lastly, our study didn't follow up the patients after discharge from the hospital, so the final outcome couldn't be assessed. Hence, further short-term and long-term follow-up data needs to be collected in this patient cohort to provide further insight into their clinical outcomes.

Conclusion

PCI is feasible and safe with acceptable complication and mortality rates at Dhulikhel Hospital, Nepal, which is comparable to regional and international centers. These findings provide important baseline data and highlight the need for multicenter prospective studies in Nepal

Conflict of interest:

None

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