Clinical Profile, Angiographic Characteristics and Treatment Recommendations in Patients with Coronary Artery Disease

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ABSTRACT

BACKGROUND: The purpose of this study was to investigate the demographic profile, risk factors, angiographic findings and treatment recommendations in patients with coronary artery disease (CAD).

METHODS: This descriptive study was carried out at the Department of Cardiology, Lady Reading Hospital Peshawar. Clinical and risk factors data was collected by clinical evaluation and reviewing hospital record. Angiographic data was collected by analyzing angiograms. Data was analyzed using Statistical Package for Social Science (SPSS) version 19.

RESULTS: A total of 1325 patients were included in the study out of which 980 (73.80%) were male. Their mean age ±SD was 53±10.8years. Thirty six (36%) patients suffered from hypertension, 17% had diabetes mellitus, 42% had dyslipidemia, 37% were smokers and 32% had history for premature coronary artery disease.
On angiographic analysis 251(18.9%) patients had single vessel disease (SVD), 344(26%) had double vessel disease (DVD), 596(45%) had triple vessel disease (TVD), 42(3.2%) had left main disease (LMD) and 92(6.9%) had normal coronary arteries. The involvement of left anterior descending (LAD), circumflex and right coronary artery (RCA) was 42%, 26% and 32% respectively. A total of 2517 lesions were identified in which mild, moderate and severe were 276(11%), 327(13%) and 1912(76%) respectively. American Heart Association (AHA) type A, B and C lesions were 931(37%), 1283(51%) and 302(12%) respectively. Mean±SD lesion length was 5.9±3.8 mm. Others characteristics of lesions included ostial stenosis in 118 (4.7%), bifurcation stenosis 528 (21%), calcification 191(7.6%) and chronic total occlusion 151 (6%). Percutaneous coronary intervention (PCI) and coronary artery bypass surgery (CABG) was advised in 874(66%) and 251(18.9%), respectively.

CONCLUSION: Conventional risk factors were highly prevalent in our patients with coronary artery disease. Double and triple vessels disease was most common in our patients and PCI was frequently used as treatment modality.

Key Words: Risk Factors; Angiographic Characteristics; Treatment Recommendations; Coronary Artery Disease

INTRODUCTION

Coronary artery disease (CAD) is leading cause of death and account for approximately 12 million deaths annually worldwide [1, 2]. In 2004, CAD resulted in 6, 95,000 hospital admissions and $31 billion hospital charges in United States [3, 4, 5]. It is also the major contributor to the burden of premature mortality and morbidity and accounted for 85 million disability adjusted (DALYs) life years in 1990 [2]. By the year 2020, coronary heart disease and stroke will hold first and fourth positions respectively, in the World Health Organization's

list of leading causes of disability [3]. In Pakistan, it is estimated that one in five middle-aged adults may have underlying CAD [6].

Extensive epidemiological research has established cigarette smoking, diabetes, hyperlipidemia, and hypertension as independent risk factors for CAD [2, 3, 7, 8]. In addition; treatment of these risk factors has been convincingly shown to reduce the risk of future cardiac events [2, 8].

Invasive coronary angiography (CA), the gold standard for the diagnosis of CAD, defines therapeutic options and determines prognosis [9]. CAD is defined as more than 50% angiographic diameter stenosis in one or more of the epicardial coronary arteries. Based on disease severity, obstructive CAD is classified as single, double-, or triple-vessel disease [9, 10]. Heterogeneity of the composition, distribution, and location of atherosclerotic plaque within the native coronary artery results in unique patterns of stenosis morphology in patients with CAD [11-13]. These patterns predict procedural outcome and complications after PCI. Criteria established by a joint American College of Cardiology/American Heart Association (ACC/AHA) task force suggested that procedure success and complication rates were related to a number of different lesion characteristics [14].

Various international studies have described the clinical profile, angiographic characteristics and treatment modalities of patients with coronary artery disease [10, 15]. However, in our set up, very few studies have addressed this subject. The aim of this paper is to define the clinical profile of patients with CAD in terms of risk factors, clinical presentation, angiographic characteristics in terms of vessel involvement, its severity and type of lesions and treatment recommendations for PCI, CABG or medical therapy.

METHODS AND MATERIALS

This descriptive study was carried out at the Department of Cardiology, Postgraduate Medical institute, Lady Reading Hospital Peshawar from January 2010 to July 2010 for a total period of 7 months. For sample size calculation, we used the study by Soleimani A et al. in which the frequency of left main stem (LMS) disease was from 3.6% to 6.4% [16]. Using World Health Organization (WHO) table for sample size calculation and the aforementioned response distribution, we estimated sample size needs to be at least 420, with alpha at 5% and confidence interval at 95%.To more precisely identify the summary statistics of the variables, we choose a larger sample of 1325 patients. Consecutive sampling technique was used for sample collection. The study was approved by the hospital ethics committee. Informed consent was obtained from every patient included in the study.

Study populations consisted of patients with CAD, age 30 years and above, both genders who were undergoing coronary angiography for diagnostic or revascularization purposes. CAD was defined as presence of stable angina, unstable angina or myocardial infarction. Patients with recent myocardial infarction (within last 10 days) were also included. The diagnostic methods for above diagnoses are given below in operational definitions. Patients with stable angina were recruited from outpatient department while those of unstable angina and myocardial infarction were recruited from both ward and outpatient department. Patients less than 30 years of age, those with a history of revascularization procedures (PCI or CABG), with renal failure or with contraindications for coronary angiography were excluded from study.

Baseline demographics, clinical and risk factors data was collected from hospital record and by interviewing patients. Only conventional risk factors including diabetes mellitus, hypertension, dyslipidemia, smoking and family history for premature CAD as defined in operational definitions were assessed in this study. The clinical presentations of patient were categorized as stable angina, unstable angina and myocardial infarction as explained above.

Elective coronary angiography was performed through standard femoral or radial artery approach. Angiographic data were collected by analyzing the angiograms by two interventional cardiologists. CAD was defined as >1 epicardial coronary segment with stenosis > 25% and was diagnosed visually and using quantitative coronary angiography (QCA) software (Toshiba's Infinix-i system). Quantitative Coronary Analysis (QCA) is a technique that provides objective and reproducible measurements of coronary artery dimensions. Patients were grouped as having single vessels disease (SVD), double vessel disease (DVD) and triple vessel disease (TVD) according to the number of vessels involvement. Patients were also grouped according to the type of artery involved. Stenosis of a vessel was categorized as mild (<50%), moderate (50-69%) and severe (>70%). Atherosclerotic lesions complexity was further categorized according to the joint

American College of Cardiology/American Heart Association (ACC/AHA) task force classification system as given in operational definitions.
Treatment recommendations were based on AHA/ACC Guideline 2011 for coronary artery revascularization [14] and also expert opinion as PCI, CABG or medical therapy. Bias in the study was controlled by following strict inclusion criteria for patient recruitment, reporting angiograms by two board certified interventional cardiologists and using same QCA software for lesions measurement.
The Statistical Package for Social Science (SPSS) version 19 was used for data analysis. Results were expressed as mean ± standard deviation for numerical variables and frequencies (percentages) for categorical variables in the forms of tables.

Operational Definitions:

Stable angina: It was diagnosed on the basis of clinical (chest pain typical or atypical) and non - invasive evaluation (1mm horizontal or down sloping ST–depression on exercise ECG or perfusion defects on technetium 99 scan).

Myocardial infarction (MI): It was diagnosed in the presence of two of the following criteria: pain suggestive of myocardial ischemia lasting for at least 30 minutes; unequivocal new electrocardiographic alterations; or increase of creatinine kinase (CK- MB isoenzyme) to more than two times the upper limit. Patients with both ST elevation (STEMI) and non-ST elevation MI (NSTEMI) were included. ST segment elevation myocardial infarction (STEMI) was diagnosed when ST elevation of ≥2 mm in ≥2 contiguous precordial leads, or 1 mm in ≥2 contiguous limb leads or when new left bundle branch block was found on the qualifying ECG.

Unstable Angina: It was diagnosed in presence of typical ischemic chest discomfort of increasing severity and ST segment depression of 1 mm on limb leads and 2mm on chest leads with negative results for troponin T or I measured with help of ROCHE diagnostic kits for troponin T or I.

Diabetes mellitus (DM): It was defined as chronic use of antihyperglycemic drugs or previously documented diagnosis from medical record or established during hospital stay by repeated fasting blood glucose estimation to be ≥126 mg/dl.

Hypertension: Defined as chronic use of antihypertensive drugs or a previously documented blood pressure ≥140/90 mmHg for non-diabetics and 130/80 for diabetics from medical record. Positive family history for CAD was defined as ischemic heart disease in the father or a brother diagnosed before age 55 years and in the mother or a sister diagnosed before age 65 years.

Smoking: Any present or previous use of cigarettes was considered smoking.

Dyslipidemia: Fasting LDL level ≥130mg/dl was considered as dyslipidemia.

Type A Lesions: It included lesions having any of the following characteristics; discrete (<10 mm), concentric, readily accessible, non angulated segment <45 degrees, smooth contour, little or no calcium, less than totally occlusive, not ostial in locations, no major side branch involvement, absence of thrombus.

Type B Lesions (moderate risk): It included lesions having any of the following characteristics; tubular (10 to 20 mm length), eccentric, moderate tortuosity of proximal segment, moderately angulated segment ≥45 degrees but <90 degrees, irregular contour, total occlusions <3 months old, ostial in location, bifurcation lesion requiring double guidewire, some thrombus present.

Type C Lesions: It included lesions having any of the following characteristics; diffuse (>2 cm length), excessive tortuosity of proximal segment, extremely angulated segments ≥90 degrees, total occlusion >3 months old, inability to protect major side branches, degenerated vein grafts with friable lesions. The terms used in the description of type of lesions are explained below.

Coronary artery territories and segments: The left main coronary artery was considered a segment and a territory of its own. Proximal segments comprised the proximal parts of the left anterior descending, the left circumflex, and the right coronary arteries. Mid segments consisted of the mid parts of the 3 main coronary arteries, and of the proximal 1 to 2 cm of major diagonal and obtuse marginal branches. Segments distal to mid segments were considered distal.

Lesion length: Lesion length was measured by

caliper as the distance from the proximal to distal shoulder of the lesion in the projection that best elongated the stenosis using quantative coronary angiography, QCA. Stenosis of 10-20 mm length were defined as tubular and those of >20mm length were defined as diffuse.

Ostial stenosis: A stenosis was classified as "ostial" when it involved the origin of the proximal left anterior descending, left circumflex, or right coronary arteries.

Stenosis angle: The vessel angle formed by a centerline through the lumen proximal to the stenosis and extending beyond it and a second centerline in the straight portion of the artery distal to stenosis was measured in a non-foreshortened view at end-diastole.

Thrombus: A thrombus was scored if an intraluminal filling defect, largely separated from the adjacent vessel wall, was clearly definable.

Tortuosity: The difficulty in accessing the stenosis to be dilated due to tortuosity proximal to its site was assessed. Stenosis distal to two bends was, in general, scored as moderately tortuous, and those distal to three or more bends were considered to be associated with excessive tortuosity.

Bifurcation stenosis: The stenosis was recorded as a bifurcation stenosis if a branch vessel of medium or large size originated within the stenosis and if the side branch was completely surrounded by significant stenotic portions of the lesion to be dilated.

Calcification: Calcification was recorded if readily apparent densities were seen within the apparent vascular wall of the artery at the site of the stenosis.

Chronic total occlusion: A total occlusion (thrombolysis in myocardial infarction [TIMI] flow grade 0), judged to be ≥3 months duration on the basis of clinical and angiographic findings, was coded as a chronic total occlusion.
Eccentric stenosis: A stenosis was classified as eccentric when its lumen was in the outer on equator diameter of the apparent normal lumen.
Irregular contour: A stenosis was classified as having irregular contour if the vascular margin was rough or had a "saw tooth" appearance.

RESULTS

Table 1: Demographics, risk factors and clinical diagnosis of patient with coronary artery disease. (Abbreviations: HTN; hypertension, DM; diabetes mellitus, CAD; coronary artery disease)

Clinical characteristics		Frequency (n=1325) (%)
Age(years)±SD (Range)		53±10.8 (30-87)
Gender	Male Female	980 (74) 345(26)
Risk factors for CAD	HTN DM Dyslipidemia Smoking Positive Fx for CAD	477(36) 225(17) 556(42) 490(37) 424(32)
Clinical presentation	Stable angina Unstable angina Myocardial infarction (recent)	993(74.9) 119(8.9) 211(15.9)

A total of 1325 patients were included in the study with 980 (73.8%) males. Mean age±SD was 53±10.8 years. Frequencies of risk factors for CAD were; hypertension 477(36%), diabetes mellitus 225(17%), dyslipidemia 556(42%), smoking 490(37%) and family history for premature CAD 424(32%). These angiograms were performed for chronic stable angina in 993(74.9%), unstable angina in 119(8.9%) and recent myocardial infarction in 211(15.9 %).

Table 2: Pattern of coronary artery disease on angiography. (Abbreviations: SVD; single vessel disease, DVD; double vessel disease, TVD; triple vessel disease)

Angiographic findings		Frequency (%)
Number of vessels diseased	SVD DVD TVD	251 (18.9) 344(26) 596(45)
Left main (LM)		42(3.2)
Left anterior descending (LAD)	Total Proximal Mid-distal	556(42) 172(13) 371(28)
Left circumflex artery (LCx)	Total Proximal Mid-distal	344(26) 145(10.9) 198(14.9)
Right coronary artery (RCA)	Total Proximal Mid-distal	424(32) 106(8) 318(24)
Normal coronary angiograms		92(6.9)

These figures are summarized in table 1.
Angiographic analysis revealed that 251(18.9%) patients had single vessel disease, 344(26%) had double vessel disease, 596(45%) had triple vessel disease, 42(3.2%) had left main disease and 92(6.9%) had normal coronary arteries. (Table 2) The involvement of left anterior descending (LAD), circumflex and right coronary artery (RCA) was 42%, 26% and 32% respectively.
A total of 2517 lesions were identified of which mild, moderate and severe were 276(11%), 327(13%) and 1912(76%) respectively (Table 3). According to the joint ACC/AHA task force classification system, type A, B and C lesions were 931(37%), 1283(51%) and 302(12%), respectively. Mean±SD lesion length was 5.9±3.8 mm. Others characteristics of lesions included ostial stenosis in 118 (4.7%), angulated stenosis ≥ 60 degree 98(3.8%), angulated stenosis ≥ 45-59 degree 453(18%), bifurcation stenosis

Table 3: Severity of stenosis and type of lesions based on American College of Cardiology/ American Heart Association (AHA/ACC) lesions classification on angiography

Angiographic findings		Frequency (%)
Total Lesions		2517
Severity of disease	Mild (<50%)	276 (11)
	Moderate (50-69%)	327(13)
	Severe >70%	1912(76)
Type of lesions	Type A lesions	931(37)
	Type B lesions	1283(51)
	Type C lesions	302(12)
Lesion characteristics	Lesion length (mm)±SD	5.9±3.8
	Ostial stenosis	118(4.7)
	Bend stenosis ≥ 60	98(3.8)
	Bend stenosis ≥ 45-59	453(18)
	Bifurcation stenosis	528(21)
	Calcification	191(7.6)
	Chronic total occlusion	151(6)
	Eccentricity	1082(43)
	Irregular contour	541(21.5)
	Thrombus	87(3.5)

528 (21%), calcification 191(7.6%), chronic total occlusion (CTO) 151 (6%), eccentricity 1082(43%), irregular contour 541(21.5%) and thrombus 87(3.5%). Percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG) were advised in 874(66%) and 251(18.9%) respectively. Medical follow up due to normal or non-significant disease and diffuse disease was advised in 172(13%) and 28(2.1%), respectively.

DISCUSSION

Developing countries have a greater share to the global burden of cardiovascular disease than developed countries. The disease is very common in westernized population affecting majority of adults over the age of 60 years. It is also rising in developing countries [7]. The mean age±SD of our study population was 53±10.8 years as compared to 52±10.8 years in a study reported by Maqbool Jafary et al. and 58±11years by Sahed et al. in Pakistan and 62±5 in COURAGE trial conducted in USA [17-19]. It also correlates with the study done by Islam AEMM et al where the mean age in male was 51±9.8 and female 47.2±9.7 [18]. Gender differences in CAD risk are also important [19]. Middle aged men have a 2-5 times higher risk than women. But risk ratio differs between populations [20]. There was a clear male preponderance (74%) in our study, which is in agreement with previous studies, suggesting that CAD is predominantly a disease of men [21, 22]. Female represented only 26.0 % of our patients. This is a much higher frequency compared with data from India (5%) [23].
Similar to the published reports from other population that smoking is one of the commonest risk factor encountered in patients with acute myocardial infarction [24-26], smoking was also the risk factor in 36% of our patient. The male preponderance and smoking being the major risk factors has been well documented in many studies in the subcontinent [27-30]. However, in contrast to this study, smoking is not a major risk factor in the COURAGE trial (29%) [19]. Diabetes mellitus, present in 16 % of our study population, is also a major risk factor for CAD and well known to have an adverse influence on the prognosis [31]. Hypertension and dyslipidemia are also major risk factors for CAD [2, 3, 7, 8]. They were reported to be 35% and 60% respectively in patients with CAD [15]. In our patients, they were 36% and 41% respectively.
In various studies the frequency of clinical

presentations in patients who undergo coronary angiography included stable angina 25.9%, unstable angina 15.2% and myocardial infarction 47.3% [15]. In our study, 73.9% of patients presented as stable angina, 8.9% as unstable angina and 12.9 as myocardial infarction. The high proportion of stable angina patients and low proportion of unstable coronary syndromes in our study can be explained due to infrequent use of primary PCI or PCI for unstable coronary syndromes due to economic and logistic reasons.

Majority of the patient suffered from double vessel disease (DVD) (25.96%) and triple vessel disease (TVD) (44.98%) in our study. Sridevis et al. (27.4%) and Akanda et al. (42.1%) have recently demonstrated that majority of patients have triple vessel disease in their studies [32, 33]. The frequency of LMS disease in our study was 3.2%. Soleimani A et al. from Iran showed that LMS disease is from 3.6% to 6.4% [16].Similar to published literature [10, 15, 34], left anterior descending (LAD) artery is most commonly affected artery followed by right coronary artery (RCA) and then circumflex. The frequency of normal coronary angiograms in our patients was 6.4% which is much lower than 25% reported by MAK Akanda et al. [15]. This difference can be explained by the fact that in our set up patients are rigorously evaluated through noninvasive tests before subjecting them to coronary angiography due to financial and logistics restraints. In our study majority of patients (76%) have severe disease (70% or more narrowing).This may be due to case selection as only frankly symptomatic and none invasively evaluated patients underwent coronary angiography. In our study majority of patients had AHA/ACC Type B lesions which is in agreement with previous studies [34]. Percutaneous coronary intervention (PCI) surpasses coronary artery bypass grafting (CABG) as the most frequent revascularization modality for obstructive CAD. Results from the Artery Revascularization Therapies (ARTS II) study indicate that drug eluting stents (DES) and CABG have comparative effectiveness in major adverse cardiac events (MACE) in patients with multivessel CAD [35, 36]. In recently reported BARI-2D trial, PCI was performed in 34% and CABG in 16% in the revascularization arm [37]. In our study majority of patients (65%) were treated with PCI while 18% underwent CABG.

CONCLUSION

Conventional risk factors are highly prevalent in our patients with CAD. Double and triple vessels disease is quite frequent in our patients and PCI is the most frequently used treatment modality for the management of these patients.

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