Clinical and Angiographic Profile of Patients Undergoing Coronary Angiography at the Tertiary Hospital—A 19-Year Retrospective Observational Study

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Abstract

INTRODUCTION: Coronary artery disease (CAD) is one of the leading causes of death globally. Studies have shown association of CAD and its risk factors; however, data on association of these risk factors and severity of CAD as seen in angiography in our local setting are still limited.

OBJECTIVE: The aims of this study were to determine the clinical and angiographic profile of patients who underwent coronary angiography, to correlate cardiovascular risk factors to their angiographic findings, and to compare the trend of risk factors and angiography findings between decades.

METHODS: This is a retrospective observational study of patients aged 18 years or older, of either sex, who underwent coronary angiography at a tertiary hospital from 2001 to 2019. Pertinent risk factors were correlated with angiography findings to determine predictors for significant CAD.

RESULTS: The mean age of the patients was 58.6 years. There were more males (66%) than females. The risk factors for the likelihood of significant CAD are older age (4.98% more for every year increase in age), male sex (2.63 times), and diabetes mellitus (47.64%). The majority of the patients had right dominant circulation, and significant lesions were more commonly seen in the left anterior descending artery. There were statistically significant more patients with hypertension, diabetes, and obesity in the present decade compared with the past.

CONCLUSION: Increased age, male sex, and diabetes are associated with significant CAD in the local setting. Diabetes must be aggressively controlled early to prevent the development of significant CAD.

KEYWORDS: coronary artery disease, risk factors, profile, coronary angiography

INTRODUCTION

Coronary artery disease (CAD) is one of the leading causes of mortality and morbidity.[1] In the Philippines, there was increasing number of deaths due to ischemic heart disease every year from 2013 to 2017, with numbers of deaths per year of 65,378 (12.3%), 65,551 (12.2%), 68,572 (12.2%), 74,134 (12.7%), and 84,120 (14.5%), respectively. In 2017, more men (60%) than women (40%) died due to ischemic heart disease.[2]

Various studies conducted worldwide have shown the universal association of CAD and its traditional risk factors such as age, male sex, diabetes mellitus, hypertension, dyslipidemia, and smoking. However, the effects of these risk factors on the severity of CAD, as assessed by angiography in terms of number of vessels involved and extent of artery lumen occlusion, are still limited in the local setting.[1] Although some studies have shed light on the above risks, continuing studies are helpful in directing where efforts and programs must be directed to effectively prevent the development of significant CAD.

The objectives of this study were to determine the clinical and angiographic profile of patients who underwent coronary angiography, to correlate cardiovascular risk factors to their angiographic findings, and to compare the trend of risk factors and angiography findings between decades.

METHODS

This was a retrospective observational study of patients 18 years or older, of either sex, who underwent coronary angiography at a tertiary hospital from 2001 to 2019. A minimum of 493 patients were required for this study based on 28.8% prevalence of CAD among patients who underwent coronary angiography,[3] 5% level of significance, and 4% desired half-width of the confidence interval.[4]

The study commenced upon approval of the Research Ethics Committee, medical director's office, and data privacy officer. The data were retrieved from review of official coronary angiography results of patients at the cardiac catheterization and intervention unit. Forty patients per year were selected via simple random sampling to fulfill the sample size. Pertinent risk factors, including age, sex, body mass index (BMI), comorbidities, and indication for the procedure, were correlated with their coronary angiography result. Significant CAD was defined as presence of ≥50% diameter stenosis in the left main (LM) artery or other major CAD. Incomplete or irretrievable data were excluded from the study..

Statistical Analysis

Descriptive statistics was used to summarize the demographic and clinical characteristics of the patients. Frequency and proportion were used for categorical variables, median, and interquartile range for non–normally distributed continuous variables, and mean and SD were used for normally distributed continuous variables. Independent-sample *t* test, Mann-Whitney *U* test, and Fisher exact/χ^2 test were used to determine the difference of mean, rank, and frequency, respectively, between patients with significant CAD versus nonsignificant CAD, as well as past versus present decade of patients. Odds ratios and corresponding 95% confidence intervals from binary logistic regression were computed to determine predictors for significant CAD. All statistical tests were two-tailed test. Shapiro-Wilk was used to test the normality of the continuous variables. Missing values were neither replaced nor estimated. Null hypotheses were rejected at 0.05 α level of significance. STATA 13.1 was used for data analysis (StataCorp LP, College Station, Texas)..

RESULTS

Seven hundred sixty patients who underwent coronary angiography at a tertiary hospital were initially selected by random sampling. Thirty-six patients had incomplete clinical profile and were excluded from the analysis. Their ages ranged from 25 to 91 years, with a mean of 58.6 years, and the majority (66%) were male; 63% had hypertension, 29% had diabetes, and 50% were obese. Thirty-eight patients (5.3%) were post–percutaneous coronary intervention, and 16 patients (2.2%) were post–coronary artery bypass graft surgery. Patients underwent coronary angiography for different indications, with the top three being stable ischemic heart disease with symptoms (24.9%), abnormal stress test (18.4%), and segmental wall motion abnormality on two-dimensional echocardiography (15.3%), followed by acute coronary syndromes, ST-elevation myocardial infarction (STEMI) , non-STEMI, and unstable angina, in 14.1%, 11.2%, and 6.6%, respectively (Table 1).

Increasing age, male sex, and diabetes mellitus showed statistically significant association with significant CAD or having stenosis of 50% or greater in one or more coronary arteries. For every year increase in patient's age, the odds of having significant CAD also increase by 4.98%. Male patients were 2.63 times more likely to have significant CAD compared with female patients. Patients with diabetes were 47.64% more likely to have significant CAD compared with those without. On the other hand, hypertension and obesity did not show a significant statistical association.

Patients who underwent the procedure because of STEMI and non-STEMI were 15.59 and 2.98 times more likely to have significant CAD, respectively, whereas those who underwent the procedure because of abnormal stress test or segmental wall motion abnormality on echocardiography before cardiac surgery had nonsignificant CAD findings on coronary angiography.

For every millimeter increase in patient's vessel diameter, the odds of having significant CAD decrease by 19.37% in the LM coronary artery, 63.74% in the left anterior descending (LAD) artery, 41.38% in the left circumflex (LCx) artery, and 29.4% in the right circumflex artery (RCA) (Table 2).

Table 3 shows the angiographic profile of the patients. Four hundred forty-two of 724 patients (61%) had significant CAD (defined as presence of ≥50% diameter stenosis in the LM coronary artery or other major coronary arteries[5]). Most (89.6%)

Table 1. Clinical Profile of Patients

	Total (n = 724)	Significant CAD (n = 442 [61%])	Nonsignificant CAD (n = 282 [39%])	*P* Value
	Frequency (%), Mean ± SD, Median (IQR)			
Age, y	58.6 ± 12.2	61.21 ± 11.24	54.49 ± 12.46	**<0.001**
<30	10 (1.38)	1 (0.23)	9 (3.19)	**<0.001**
30–39	37 (5.11)	12 (2.71)	25 (8.87)	
40–49	117 (16.16)	55 (12.44)	62 (21.99)	
50–59	215 (29.7)	133 (30.09)	82 (29.08)	
60–69	215 (29.7)	141 (31.90)	74 (26.24)	
70–79	104 (14.36)	75 (16.97)	29 (10.28)	
≥80	26 (3.59)	25 (5.66)	1 (0.35)	
Sex				**<0.001**
Male	479 (66.16)	330 (74.66)	149 (52.84)	
Female	245 (33.84)	112 (25.34)	133 (47.16)	
Hypertension				0.568
Yes	456 (62.98)	282 (63.8)	174 (61.7)	
No	268 (37.02)	160 (36.2)	108 (38.3)	
Diabetes				**0.023**
Yes	212 (29.28)	143 (32.35)	69 (24.47)	
No	512 (70.72)	299 (67.65)	213 (75.53)	
BMI, kg/m^2	25.49 ± 4.96	25.45 ± 4.67	25.49 ± 5.39	0.998
Underweight (<18.5 kg/m^2)	33 (4.56)	16 (3.62)	17 (6.03)	0.354
Normal (18.5–22.9 kg/m^2)	185 (25.55)	109 (24.66)	76 (26.95)	
Overweight (23–24.9 kg/m^2)	145 (20.03)	93 (21.04)	52 (18.44)	
Obese (≥25 kg/m^2)	361 (49.86)	224 (50.68)	137 (48.58)	
Indication				
SIHD	180 (24.86)	106 (23.98)	74 (26.24)	0.537
Stress test	133 (18.37)	67 (15.16)	66 (23.4)	**0.006**
SWMA	111 (15.33)	55 (12.44)	56 (19.86)	**0.008**
NSTEMI	102 (14.09)	82 (18.55)	20 (7.09)	**<0.001**
STEMI	85 (11.74)	81 (18.33)	4 (1.42)	**<0.001**
UA	48 (6.63)	26 (5.88)	22 (7.8)	0.358
Abnormal nuclear imaging	39 (5.39)	18 (4.07)	21 (7.45)	0.063
Cardiac surgery	25 (3.45)	6 (1.36)	19 (6.74)	**<0.001**
Post–cardiac arrest	1 (0.14)	1 (0.23)	0	1.000

Significant p-values are in boldface.

CAD=coronary artery disease; BMI=body mass index; IQR=interquartile range; NSTEMI=non–ST-elevation myocardial infarction; SIHD=stable ischemic heart disease; STEMI=ST-elevation myocardial infarction; SWMA=segmental wall motion abnormality; UA=unstable angina.

had right dominant circulation, with average vessel size of 4.25 mm for LM coronary artery, 3.25 mm for LAD artery, 3.0 mm for LCx artery, and 3.25 mm for RCA. Patients with larger proximal vessel diameters were noted to have less odds of having significant CAD. Among patients with significant CAD, more than half of them (53.4%) had three-vessel involvement. Significant lesions were more commonly seen in the LAD artery (55.7%), followed by RCA (41.0%), LCx artery (40.9%), and LM coronary artery (10.7%).

The angiographic profile was analyzed according to its relation with age, sex, hypertension, diabetes mellitus, and BMI, as shown in Tables 4 to 8.

The mean age of the study population was 58.6 years: 57 years for male patients and 61 years for female patients. Ten patients (1.4%) who underwent coronary angiography were younger than 30 years. More patients in the group 60 years or older had significant lesions on angiography. The most common angiography result is nonobstructive CAD (37.7%) in the group younger than 60 years and three-vessel disease (40.3%) in the group older than 60 years. Left anterior descending artery and LCx artery had a statistically significant smaller diameter in older patients (aged ≥60 years) (Table 4).

Two-thirds of the patients who underwent the coronary angiography were male. Significant CAD was more common

Table 2. Risk Factors Associated With Significant CAD

Parameters	Crude OR	95% CI	*P* Value
Age	1.0498	1.04–1.06	**<0.001**
Male	2.6300	1.92–3.61	**<0.001**
Diabetes mellitus	1.4764	1.05–2.07	**0.023**
Indication			
Stress test	0.5847	0.40–0.85	**0.006**
SWMA	0.5736	0.38–0.86	**0.007**
NSTEMI	2.9839	1.78–4.99	**<0.001**
STEMI	15.594	5.64–43.1	**<0.001**
Cardiac surgery	0.1905	0.07–0.48	**<0.001**
Vessel diameter			
LM	0.8063	0.68–0.95	**0.011**
LAD	0.3626	0.28–0.46	**<0.001**
LCx	0.5862	0.47–0.73	**<0.001**
RCA	0.7060	0.58–0.85	**<0.001**

CAD=coronary artery disease; CI=confidence interval; NSTEMI=non–ST-elevation myocardial infarction; LAD=left anterior descending artery; LCx=left circumflex artery; LM=left main coronary artery; OR=odds ratio; RCA=right circumflex artery; STEMI=ST-elevation myocardial infarction; SWMA=segmental wall motion abnormality.

Table 3. Angiographic Profile of Patients

	Total (n = 724)	Significant CAD (n = 442 [61%])	Nonsignificant CAD (n = 282 [39%])	*P* Value
	Frequency (%), Mean ± SD, Median (IQR)			
Dominance				**0.020**
Right	649 (89.64)	407 (92.08)	242 (85.82)	
Left	48 (6.63)	24 (5.43)	24 (8.51)	
Codominance	27 (3.73)	11 (2.49)	16 (5.67)	
Vessel diameter				
LM	4.25 (4–5)	4 (4–5)	4.5 (4–5)	**0.009**
LAD	3.25 (2.75–3.75)	3 (2.5–3.5)	3.5 (3–4)	**<0.001**
LCx	3 (2.5–3.5)	3 (2.5–3.5)	3 (2.75–4)	**<0.001**
RCA	3.25 (2.75–4)	3 (2.5–4)	3.5 (3–4)	**0.002**
Coronary angiography result				**<0.001**
Normal coronary arteries	46 (6.35)		46 (16.31)	
Nonobstructive CAD	236 (32.6)		236 (83.69)	
One-vessel disease	116 (16.02)	116 (26.24)		
Two-vessel disease	90 (12.43)	90 (20.36)		
Three-vessel disease	236 (32.6)	236 (53.39)		
Culprit vessel (≥50% stenosis)				
LM	77 (10.72)			
LAD	403 (55.66)			
LCx	296 (40.88)			
RCA	297 (41.02)			

CAD=coronary artery disease; IQR=interquartile range; LAD=left anterior descending artery; LCx=left circumflex artery; LM=left main coronary artery; RCA=right circumflex artery.

Table 4. Angiographic Profile and Age

	≥60 y old (n = 345 [48%])	<60 y old (n = 379 [52%])	*P* Value
	Frequency (%), Median (IQR)		
Vessel diameter			
LM	4.13 (4–5)	4.5 (4–5)	0.649
LAD	3 (2.75–3.5)	3.5 (3–4)	**0.004**
LCx	3 (2.5–3.5)	3 (2.5–3.75)	**0.037**
RCA	3 (2.5–4)	3.5 (2.75–4)	0.172
Coronary angiography result			**<0.001**
Normal coronary arteries	11 (3.19)	35 (9.23)	
Nonobstructive CAD	93 (26.96)	143 (37.73)	
One-vessel disease	54 (15.65)	62 (16.36)	
Two-vessel disease	48 (13.91)	42 (11.08)	
Three-vessel disease	139 (40.29)	97 (25.59)	

CAD=coronary artery disease; IQR=interquartile range; LAD=left anterior descending artery; LCx=left circumflex artery; LM=left main coronary artery; RCA=right circumflex artery.

Table 5. Angiographic Profile and Sex

	Male (n = 479 [66%])	Female (n = 245 [34%])	*P* Value
	Frequency (%), Median (IQR)		
Vessel diameter			
LM	4.5 (4–5)	4 (3.75–5)	**0.002**
LAD	3.25 (3–4)	3 (2.75–3.5)	0.126
LCx	3 (2.5–3.5)	3 (2.5–3.5)	0.089
RCA	3.5 (2.75–4)	3 (2.5–3.75)	**0.010**
Coronary angiography result			**<0.001**
Normal coronary arteries	26 (5.43)	20 (8.16)	
Nonobstructive CAD	123 (25.68)	113 (46.12)	
One-vessel disease	81 (16.91)	35 (14.29)	
Two-vessel disease	69 (14.41)	21 (8.57)	
Three-vessel disease	180 (37.58)	56 (22.86)	

CAD=coronary artery disease; IQR=interquartile range; LAD=left anterior descending artery; LCx=left circumflex artery; LM=left main coronary artery; RCA=right circumflex artery.

in male compared with female patients (68.9% vs 45.7%), with 37.6% involving all three vessels. Among female patients, nonobstructive CAD (46.1%) is the most common finding (Table 5).

Hypertension was present in 63% of the study population, and slightly more patients in the hypertensive group had significant CAD compared with the group of patients with no hypertension (61.84% vs 59.7%), although this was not statistically significant (Table 6).

Although only 29% of the study population had diabetes mellitus, they had statistically significant more three-vessel CAD compared with those without (49.1% vs 29.1%) and statistically less normal coronary arteries on angiography (2.4% vs 8.0%). Vessel diameters were comparable among patients with diabetes and those without, with note of only LAD artery having statistically significant smaller proximal vessel diameter in patients with diabetes (Table 7).

Obesity (BMI of ≥25 kg/m^2) is seen in 50% of the study population. Their distribution is the same in those with and without significant CAD. Obese patients have bigger proximal vessel diameter in the LM coronary artery, LCx artery, and RCA (Table 8).

Table 9 shows that there were more obese patients in the groups of patients with hypertension (54.39% vs 42.16%, P = 0.006) and diabetes (57.08% vs 46.88%, P = 0.080) compared with those without these risk factors. Comparison of coronary angiogram results in relation to obesity with or without additional risk factors (hypertension and diabetes mellitus) did not show any statistical difference.

Table 6. Angiographic Profile and Hypertension

	Hypertensive (n = 456 [63%])	Nonhypertensive (n = 268 [37%])	*P* Value
	Frequency (%), Median (IQR)		
Vessel diameter			
LM	4.5 (4–5)	4 (4–5)	0.181
LAD	3 (2.75–3.75)	3.25 (3–4)	0.225
LCx	3 (2.5–3.5)	3 (2.5–3.5)	0.857
RCA	3.25 (2.75–4)	3 (2.5–4)	0.542
Coronary angiography result			0.077
Normal coronary arteries	20 (4.39)	26 (9.7)	
Nonobstructive CAD	154 (33.77)	82 (30.60)	
One-vessel disease	72 (15.79)	44 (16.42)	
Two-vessel disease	57 (12.5)	33 (12.31)	
Three-vessel disease	153 (33.55)	83 (30.97)	

CAD=coronary artery disease; IQR=interquartile range; LAD=left anterior descending artery; LCx=left circumflex artery; LM=left main coronary artery; RCA=right circumflex artery.

Table 7. Angiographic Profile and Diabetes Mellitus

	Diabetic (n = 212 [29%])	Nondiabetic (n = 512 [71%])	*P* Value
	Frequency (%), Median (IQR)		
Vessel diameter			
LM	4.25 (4–5)	4.25 (4–5)	0.559
LAD	3 (2.75–3.5)	3.25 (3–4)	**0.033**
LCx	3 (2.5–3.5)	3 (2.6–3.75)	0.056
RCA	3 (2.5–3.63)	3.25 (2.75–4)	0.061
Coronary angiography result			**0.004**
Normal coronary arteries	5 (2.36)	41 (8.01)	
Nonobstructive CAD	64 (30.19)	172 (33.59)	
One-vessel disease	29 (13.68)	87 (16.99)	
Two-vessel disease	27 (12.74)	63 (12.3)	
Three-vessel disease	87 (41.04)	149 (29.1)	

CAD=coronary artery disease; IQR=interquartile range; LAD=left anterior descending artery; LCx=left circumflex artery; LM=left main coronary artery; RCA=right circumflex artery.

Table 8. Angiographic Profile and Obesity

	Obese (n = 361 [50%])	Nonobese (n = 363 [50%])	*P* Value
	Frequency (%), Median (IQR)		
Vessel diameter			
LM	4.5 (4–5)	4 (4–5)	**0.002**
LAD	3.25 (3–4)	3 (2.75–3.75)	0.139
LCx	3 (2.5–3.75)	3 (2.5–3.5)	**0.037**
RCA	3.25 (2.75–4)	3 (2.75–3.5)	**0.042**
Coronary angiography result			0.648
Normal coronary arteries	20 (5.54)	26 (7.16)	
Nonobstructive CAD	117 (32.41)	119 (32.78)	
One-vessel disease	63 (17.45)	53 (14.6)	
Two-vessel disease	48 (13.3)	42 (11.57)	
Three-vessel disease	113 (31.3)	123 (33.88)	

CAD=coronary artery disease; IQR=interquartile range; LAD=left anterior descending artery; LCx=left circumflex artery; LM=left main coronary artery; RCA=right circumflex artery.

Table 9. Body Mass Index and Hypertension and Obesity

	Hypertensive (n = 456 [63%])	Nonhypertensive (n = 268 [37%])	*P* Value	Diabetic (n = 212 [29%])	Nondiabetic (n = 512 [71%])	*P* Value
	Frequency (%)			Frequency (%)		
Underweight (<18.5 kg/m^2)	15 (3.29)	18 (6.72)	**0.006**	7 (3.30)	26 (5.08)	0.080
Normal (18.5–22.9 kg/m^2)	109 (23.90)	76 (28.36)		45 (21.23)	140 (27.34)	
Overweight (23–24.9 kg/m^2)	84 (18.42)	61 (22.76)		39 (18.40)	106 (20.70)	
Obese (≥25 kg/m^2)	248 (54.39)	113 (42.16)		121 (57.08)	240 (46.88)	

	Obese (n = 361 [50%])	Obese and Hypertensive (n = 248 [34%])	Obese and Diabetic (n = 121 [17%])	Obese, Hypertensive, and Diabetic (n = 98 [14%])	*P* Value
	Frequency (%)				
Coronary angiography result					
Normal	20 (5.54)	11 (4.44)	4 (3.31)	1 (1.02)	0.570
Nonobstructive CAD	117 (32.41)	90 (36.29)	37 (30.58)	44 (44.9)	
One-vessel disease	63 (17.45)	43 (17.34)	21 (17.36)	17 (17.35)	
Two-vessel disease	48 (13.3)	30 (12.1)	17 (14.05)	12 (12.24)	
Three-vessel disease	113 (31.3)	74 (29.84)	42 (34.71)	24 (24.49)	

CAD=coronary artery disease.

Table 10 shows that between the two decades, there were significantly more patients with hypertension, diabetes, and obesity in the present decade (2011–2019) compared with the past decade (2001–2010). There was also noted increase in the incidence of STEMI, and more patients proceeded to percutaneous coronary intervention on the same setup in the present decade. Age, sex, presence of significant CAD, and number of vessels involved on angiography were not statistically different between the two groups.

DISCUSSION

In this study of 724 Filipino patients, the mean age was 58.6 years, with 48% being older than 60 years; 66% were male, 63% had hypertension, 29% had diabetes, and 50% were obese. Sixty-one percent had significant CAD on coronary angiography.

For every year increase in patient's age, the odds of having significant CAD also increase by 4.98%. The most common angiography result is nonobstructive CAD (37.7%) in the group younger than 60 years and three-vessel disease (40.3%) in the group 60 years or older. Elderly age is a nonmodifiable risk factor for developing a more severe form of CAD. In the study by Narayanaswamy et al,[1] the incidence of triple-vessel disease is greater in patients older than 60 years.

Male patients were 2.63 times more likely to have significant CAD compared with female patients. The mean age of patients who underwent coronary angiography was younger for males compared with females (57 vs 61 years old). In the INTERHEART study, the median age of cases with first acute myocardial infarction is approximately 9 years lower in men than in women.[6] As was seen in the study by Steyn et al,[7] men presented at a younger age than did women (53.2 vs 56.4). Male preponderance was seen probably because of the protective effects of estrogens against atherosclerosis in female patients.[8]

Hypertension was present in 63% of the study population, and slightly more patients in the hypertensive group had significant CAD compared with the group of patients with no hypertension (61.84% vs 59.7%), although this was not statistically significant. The risk of cardiovascular disease in the patient with hypertension has been shown to be greatly reduced with effective antihypertensive therapy. Randomized trials have shown that blood pressure (BP) lowering in patients with hypertension produces rapid reductions in cardiovascular risk.[9] In a meta-analysis involving 613,815 participants, metaregression analyses showed relative risk reductions proportional to the magnitude of the BP reductions achieved. Every 10-mm Hg reduction in systolic BP significantly reduced

Table 10. Profile of Patients Comparing the Past Decade With the Present Decade

	Past Decade (n = 370 [51%])	Present Decade (n = 354 [49%])	*P* Value
	Frequency (%), Mean ± SD, Median (IQR)		
Age, y	58.65 ± 12.31	58.53 ± 12.05	0.895
Sex			0.363
Male	239 (64.59)	240 (67.8)	
Female	131 (35.41)	114 (32.2)	
Hypertension			**<0.001**
Yes	161 (43.51)	295 (83.33)	
No	209 (56.49)	59 (16.67)	
Diabetes			**<0.001**
Yes	76 (20.54)	136 (38.42)	
No	294 (79.46)	218 (61.58)	
BMI, kg/m^2	24.94 ± 4.97	26.07 ± 4.90	**0.002**
Underweight (<18.5 kg/m^2)	25 (6.76)	8 (2.26)	**0.001**
Normal (18.5–22.9 kg/m^2)	106 (28.65)	79 (22.32)	
Overweight (23–24.9 kg/m^2)	75 (20.27)	70 (19.77)	
Obese (≥25 kg/m^2)	164 (44.32)	197 (55.65)	
Indication			
SIHD	106 (28.65)	74 (20.90)	**0.016**
Stress test	70 (18.92)	63 (17.8)	0.697
SWMA	41 (11.08)	70 (19.77)	**0.001**
NSTEMI	54 (14.59)	48 (13.56)	0.689
STEMI	23 (6.22)	62 (17.51)	**<0.001**
UA	33 (8.92)	15 (4.24)	**0.011**
Abnormal nuclear imaging	27 (7.3)	12 (3.39)	**0.020**
Cardiac surgery	15 (4.05)	10 (2.82)	0.365
Arrest (post–cardiac arrest)	1 (0.27)	0	0.328
Underwent PCI			**0.009**
Yes	45 (12.16)	68 (19.21)	
No	325 (87.84)	286 (80.79)	
Coronary artery disease			0.554
Significant CAD	222 (60)	220 (62.15)	
Nonsignificant CAD	148 (40)	134 (37.85)	
Coronary angiography result			0.345
Normal coronary arteries	23 (6.22)	23 (6.5)	
Nonobstructive CAD	125 (33.78)	111 (31.36)	
One-vessel disease	66 (17.84)	50 (14.12)	
Two-vessel disease	49 (13.24)	41 (11.58)	
Three-vessel disease	107 (28.92)	129 (36.44)	

BMI=body mass index; CAD=coronary artery disease; IQR=interquartile range; NSTEMI=non–ST-elevation myocardial infarction; PCI=percutaneous coronary intervention; SIHD=stable ischemic heart disease; STEMI=ST-elevation myocardial infarction; SWMA=segmental wall motion abnormality; UA=unstable angina.

the risk of major cardiovascular disease events (relative risk [RR], 0.80; 95% confidence interval [95% CI], 0.77–0.83), coronary heart disease (RR, 0.83; 95% CI, 0.78–0.88), stroke (RR, 0.73; 95% CI, 0.68–0.77), and heart failure (RR, 0.72; 95% CI, 0.67–0.78).[10] The ACCORD and SPRINT trials have also shown the efficacy of hypertension treatment for primary prevention of cardiovascular disease in patients with mean basal systolic BP of 139 mm Hg.[11] In our study, details such as duration of hypertension, average BP, and antihypertensive medications taken were not available; hence, we cannot conclude the lack of statistical significance of this risk factor.

In our study, patients with diabetes were 47.64% more likely to have significant CAD, and most (41%) had three-vessel disease.

The strong association between diabetes and CAD is due to insulin resistance, hyperinsulinemia, and glucose intolerance, which appear to promote atherosclerosis.[3] Hyperinsulinemia also causes a variety of other abnormalities, including elevated triglyceride levels, low levels of high-density lipoprotein cholesterol, enhanced secretion of very low-density lipoprotein, increased vascular resistance, and hypertension. In the study by Wu and Wang,[12] patients with diabetes had more multivessel, multilesion, extensive, and small vessel disease compared with those without. In the study by Narayanaswamy et al,[1] the incidence of three-vessel disease was also greater among patients with diabetes, and 76% to 99% occlusive lesions were more prevalent in patients with diabetes. Patients with diabetes have a high risk of developing a severe form of CAD.

Obesity is both an independent contributor to the risk for ischemic heart disease and is associated with a constellation of other risk factors, including hypertension, dyslipidemia, and abnormal glucose metabolism.[13] Obesity was seen in 50% of our study population, and although their distribution is the same in those with and without significant CAD, there were more obese patients in the groups of patients with hypertension (54.39% vs 42.16%, $P = 0.006$) and diabetes (57.08% vs 46.88%, $P = 0.080$). In the INTERHEART study, BMI was related to the risk of myocardial infarction, but this relation was weaker than that of abdominal obesity (waist-to-hip ratio).[6] The association of obesity with outcomes among patients with established stable ischemic heart disease is complex, with the most favorable outcomes consistently seen among overweight individuals or those with mild to moderate obesity, and worse outcomes among normal-weight individuals and those with extreme obesity (BMI ≥40 kg/m^2). The explanation for the "obesity paradox" by which mild to moderate obesity appears protective in observational studies has not been fully elucidated.[13]

Most (89.6%) of our patients had right dominant, followed by left dominant (6.6%) and codominant circulation (3.7%), which is not far from literature, where 85% are right dominant, 8% are left dominant, and 7% are codominant.[14] Significant lesions were more commonly seen in the LAD artery (55.7%), followed by RCA (41.0%), LCx artery (40.9%), and LM coronary artery (10.7%) in our population. In contrast, one study showed involvement of LAD artery (42.28%), followed by RCA (26.02%) and LCx artery (19.51%),[3] whereas another study also showed that among their population with single-vessel disease, LAD artery (62%) was most commonly involved, followed by RCA (32%) and LCx artery (6%).[1]

The average vessel size is 4.25 mm for the LM coronary artery, 3.25 mm for the LAD artery, 3.0 mm for the LCx artery, and 3.25 mm for the RCA in our population, in contrast to literature, where the normal calibers of the major coronary arteries are 4.5 ± 0.5 mm for the LM coronary artery, 3.7 ± 0.4 mm for the LAD artery, 3.4 ± 0.5 mm for a nondominant versus 4.2 ± 0.6 mm for a dominant LCx artery, and 3.9 ± 0.6 mm for a dominant versus 2.8 ± 0.5 mm for a nondominant RCA.[14]

The patients with larger proximal vessel diameters were noted to have less odds of having significant CAD. In the study by Zhou et al,[15] it was found that the coronary artery diameters were inversely associated with the severity of the coronary lesions, and smaller coronary artery diameter was independently associated with the prevalence of CAD. Potential mechanism underlying the association between coronary artery diameter and the severity of coronary lesions is not understood, but one study showed that coronary arterial diameters may be associated with the extent of coronary calcium levels in CAD patients.[15]

In this study, there were more patients with hypertension, diabetes, and obesity in the 2011–2019 group compared with the 2001–2010 group, and this could be due to the increasing prevalence of these modifiable risk factors through the years. Diabetes is an emerging epidemic in developing countries, with an estimated increase of more than 170% in China.[12] According to the World Health Organization, the global prevalence of diabetes among adults rose from 4.7% in 1980 to 8.5% in 2014,[16] whereas the number of adults with hypertension increased from 594 million in 1975 to 1.13 billion in 2015, with the increase seen largely in low- and middle-income countries.[17] The age-standardized prevalence of obesity and severe obesity increased significantly in the past decade (from 2007–2008 to 2015–2016) among adults,[18] and in a local study, a rise in BMI in Filipino patients was also noted, with the number of overweight subjects rising from 15.2% to 21.4% and the number of obese patients from 3.4% to 5.2% from 1992 to 2008.[19] With the increase in prevalence of CAD risk factors, it is expected that the prevalence of CAD would rise proportionately as well.[3]

CONCLUSION

In the absence of other risk factor data, the presence of increasing age, male sex, and diabetes mellitus should alert one to the presence of significant coronary artery disease. Diabetes mellitus is the only modifiable risk factor that was identified as significantly associated with severe CAD.

LIMITATIONS OF THE STUDY

No correlation was seen with hypertension and obesity in our study because important data such as duration of hypertension, intake of drugs, BP control, and lipid profile were not available for correlation, and this could have mitigating effects on these variables. Information on other risk factors such as smoking and family history was also not available and hence not included in the study. Additional information on duration of diabetes, medications taken, and glucose control was also not available, and this could have contributed to our understanding of why the other patients with diabetes did not have significant CAD.

RECOMMENDATIONS

This study echoes the adage that diabetes mellitus is a major risk factor for the development of severe CAD. Hence, more efforts must be directed at its early identification, as well as its aggressive management. With the introduction of newer drugs that have been shown to improve survival and prognosis of diabetes, as well as hypertension and dyslipidemia, catheterization intervention centers must include data of treatment and compliance to better understand the effects of these in CAD. This, together with information on cardiovascular outcomes of the patients, can add to the body of knowledge on how best to treat these patients.

For countries with scarce resources such as ours, for more preferred and ideal prospective studies, our recommendation of instituting better data collection will help improve the quality of retrospective researches in CAD.

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