Research Article

International Journal of Cardiology and Cardiovascular Disorder

Clinical and Angiographic Pattern of Coronary Artery Disease in a Urban Sri Lankan Population

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Submitted : 8 May 2024 ; Published : 3 June 2024

Citation: Rahuman, M.B.F. et al. (2024). Clinical and Angiographic Pattern of Coronary Artery Disease in a Urban Sri Lankan Population. I J cardio & card diso; 5(2):1-8.

Abstract

Clinical and Angiographic Pattern of Coronary Artery Disease In A Urban Sri Lankan Population.

Introduction: *Coronary artery disease (CAD) is a leading cause of mortality worldwide.*

Objectives: *This study was conducted to describe the clinical and angiographic pattern of CAD in a urban Sri Lankan population.*

Methods: *We studied consecutive patients of all ages who underwent coronary angiogram done by a single operator in a leading private hospital, Colombo. This study was a retrospective descriptive study conducted among the total number of 352 patients who underwent angiogram from May 2013 to December 2016.*

Results: *The population with CAD is predominantly male and old (≥41 years). Non-Acute Coronary Syndrome (ACS) is the most common clinical presentation. Triple Vessel Disease (TVD) is most prevalent 136 (38.6%) with the multiplicity of synergistic risk factors. In Single Vessel Disease (SVD), the distribution of disease in LAD, RCA and LCX are 44%, 15% and 8% respectively. Higher rate of ectasia is found in RCA. Diabetes Mellitus (DM) is present in 49% of our patients, which is the second common risk factor next to dyslipidemia (DL) 55% and is significantly associated with TVD.*

Conclusion: *ST-Elevation Myocardial Infarction (STEMI) is the commonest ACS type in the study group. TVD is more common in old age group whereas SVD is the common pattern in younger population. LAD is the predominantly and severely affected artery among both ACS and non – ACS groups. DL is the commonest risk factor. DM is commonly associated with TVD, which is related to multiple risk factors.*

Keywords: Coronary Artery Disease, Coronary Angiogram, Acute Coronary Syndrome, Sri Lanka.

Introduction

At present, Cardiovascular diseases (CVD), including myocardial infarction (MI) and heart failure remain the leading cause of mortality in developed countries (Gersh et al., 2010) while 85% of all CVD deaths are due to heart attack and stroke globally. (World Health Organization (WHO), 2011). The incidence of cardiovascular disease has been increasing in some low-income and middle-income countries with >75 % of the global burden estimated to occur in these countries (WHO). (WHO, 2011; Yusuf et al., 2014). Therefore, there is an increasing concern in low and middle-income countries (LMICs) like Sri Lanka (Jayawardena et al., 2017), particularly of ischemic heart disease.

The proportion of CVD is likely to increase more in the Asian-Pacific region; thus, half of the world's cardiovascular burden is predicted to occur in this area. Although the data for coronary artery disease are few in Sri Lanka, the incidence of coronary artery disease has doubled over the past two decades. According to the Annual Health Statistics 2007, incidence of CAD ranged from 645.5 to 1364.5 cases per 100,000. It was the leading cause of hospital deaths in the country during the last 10 years accounting for nearly 10% of all hospital deaths. (Jayawardena et al., 2017).

With the development of social and economic changes of people's lifestyle, cardiovascular disease has become one of the major diseases that threaten human health in today's society. Since advent of Framingham's study, scholars conducted a series of studies, which were concentrated on the traditional risk factors for coronary heart disease such as hypertension, diabetes, dyslipidemia and CKD. (O'Donnell & Elosua, 2008). Risk factors such as diabetes, hypertension, smoking and obesity are becoming increasingly more prevalent among our study population. (Wickramatilake et al., 2015; Katulanda et al., 2010).

Among the patients, the most common presenting complaint is chest pain suggestive of coronary artery disease (CAD) which is a problem frequently encountered by primary care physicians and cardiologists. (Arnett et al., 2019). With the standard electrocardiograms, exercise ECG testing and following up with cardiac imaging techniques like CT coronary angiogram (CTA), provide valuable diagnostic and prognostic information. Studies also suggest that with the early detection and prompt treatment with the best available strategies, the outcome of younger patients with ST elevation myocardial infarction (STEMI) is comparably better than older patients. (Scholz et al., 2018).

Although coronary artery disease is usually manifest clinically in middle and older age groups, its presentation in less than 40 years of age is particularly disturbing as repercussions on the entire family structure ensue. Before the advent of coronary angiography the presence of myocardial infarction was generally accepted as a manifestation of severe diffuse coronary artery disease. Now with coronary angiography severity and extent of coronary artery disease can be defined. The Framingham heart study (O'Donnell & Elosua, 2008) played a vital role in defining the contribution of risk factor to coronary artery disease occurrence in general population. The purpose of this study is to describe the risk factor profile, angiographic characteristics and clinical pattern of coronary artery disease in Sri Lankan population.

Methods

We studied consecutive patients of all ages who underwent coronary angiogram carried out by a single operator in the heart center of a leading private Hospital, Colombo, Sri Lanka, from May 2013 to December 2016. This hospital is a multi-specialty tertiary care private hospital (The Lanka Hospitals Corporation PLC. (2022), and patients come from all over the country and even from neighboring countries such as Maldives and Seychelles (Lanka Hospitals sets pace to new era in medical care with luxurious world-class wing, 2021). Although this was a multi operator dependent center, this study was a retrospective descriptive study conducted among the total number of 352 patients whom underwent angiogram over this period by a single operator. Details of clinical features, risk factors (which were already known), pre-angiographic investigation findings such as exercise ECG, 2D Echocardiogram and the angiographic findings were extracted from the previous clinical records and angiographic reports. Both in-ward patients and out-patients were included in the study. Patients with a past history of ischemic heart disease, individuals with new onset symptoms (ischemic-type chest pain, shortness of breath) and ones awaiting cardiac assessment prior to surgery were included. Those patients who had valvular heart disease, congenital heart disease, hypertrophic cardiomyopathy and coronary artery anomalies were excluded. Coronary angiography and intervention were done using equipped with state-of-the-art technology and facilities at the private hospital Heart Centre – which is equipped with the features of an advanced catheterization laboratory or Cath-lab, with diagnostic imaging equipment, two cardiac theatres, a modern 5-bed coronary care unit. (The Lanka Hospitals Corporation PLC, 2016). Percutaneous techniques were performed from both femoral and radial approach using standard catheter techniques. It requires selective cannulation of the ostium of right and left coronary artery. Each coronary artery was selectively viewed in at- least two projections. All the reports, imaging materials and documents were analyzed by a consultant cardiologist.

Quantitative coronary arterial stenosis grading was done as recommended by the Society of Cardiovascular Computed Tomography. (Arbab-Zadeh & Hoe, 2011). Accordingly, normal lumen was described as absence of plaque or no luminal stenosis while minimal, mild, moderate, severe were classified as plaque with <25%,25-49%,50-69% and 70-99% stenosis respectively. Total occlusion was considered as 100%. (Kolossváry et al., 2017). Based on disease severity, obstructive coronary artery disease was classified as single-, double-, or triple vessel disease. We also determined the anatomic distribution and extent of ectasia and diffuse coronary artery disease. An ectatic segment was defined as one with a luminal diameter at least 50% greater than that of the adjacent segment (Ahmad & Mungee, 2022). Coronary artery ectasia is a dilation of the coronary artery lumen. The term "ectasia" refers to diffuse dilation of a coronary artery, while focal coronary dilation is called a "coronary aneurysm" (Ahmad & Mungee, 2022). Diffuse coronary artery atherosclerosis was defined as 'consecutive or longitudinal' and 'complete or partial' obstruction in coronary vessels (Kirali & Özen, 2015). Minor disease (occlusion) was considered as 1-24 % occlusion according to the qualitative or semi quantitative stenosis grading system (Arbab-Zadeh & Hoe, 2011). More than 50% of stenosis was classified as significant occlusion.

Descriptive statistic included the mean values ± standard deviation for continuous variables with normal distribution in case of essential aberrations of data distribution. Categorical variables were expressed as a number and percentage. All the variables from the reports and imaging materials were entered in the licensed copies of the Statistical Package of Social Science (SPSS) version 25.

Results

The total number of patients included in the study was 352. The base line clinical variables of the patients were summarized in Table-1. Mean age of patients was 57.11± 8.92. The mean age for male was 56.47±9.37 and female was 58.34±7.883.

Regarding the total occlusion, the commonly affected vessel is RCA (18.8%) while the least affected vessel is LMCA (0.3%). However, severe stenosis is noted with the highest prevalence of LAD artery which is about 40.9% and least is LMCA of (5.4%). When mild stenosis is considered, the most prevalent vessel is LMCA (4.3%) followed by RCA, LCX and LAD respectively (Table – 2).

DEMOGRAPHIC & CLINICAL DATA			
PARAMETER		Patients	%
Age group	≤40	15	4.3
	41-50	69	19.6
	51-60	135	38.4
	61-70	110	31.3
	>70	23	6.4
Sex	Male	231	65.6
	Female	121	34.4
Type of ischemia	Non ACS	212	60.2
	ACS	140	39.8
Risk factors	HTN	105	29.8
	DM	149	42.3
	DL	195	55.4
	CKD	2	0.6
Exercise ECG results	Positive	139	39.5
	Not Done	201	57.1
	Inconclusive	12	3.4
Ejection fraction	>55	226	64.2
	<54	126	35.8
RWMA	Yes	50	14.2
	No	302	85.8

Table 1: Demographic and clinical data

Disease	CORONARY VESSELS							
	LMCA	%	LAD	%	LCX	%	RCA	%
Normal	272	77.3	41	11.6	90	25.6	106	30.1
Mild Stenosis	15	4.3	3	9	4	1.1	7	2.0
Moderate Stenosis	13	3.7	17	4.8	17	4.8	14	4.0
Severe Stenosis	19	5.4	144	40.9	97	27.6	69	19.6
Total Occlusion	1	.3	41	11.6	26	7.4	66	18.8
Minor Disease	31	8.8	55	15.6	63	17.9	41	11.6
Ectatic	1	.3	8	2.2	8	2.2	16	14.5
Diffuse	0	.0	44	12.4	49	13.9	37	10.5

Table 2: Distribution of disease in individual coronary arteries

In clinical presentation of our population most common presentation is non-ACS followed by STEMI, NSTEMI and UA respectively (Figure – 1-a). Among the patients with an abnormal coronary angiogram in our study population, TVD is most prevalent 136 (38.6%) with the multiplicity of synergetic risk factors whereas DVD is 64 (18.2%). SVD is present in 67 (19%) among the total population with most common involvement of LAD (44%) followed by RCA (15%) and LCX (8%) (Figure – 1-b and 1-c).

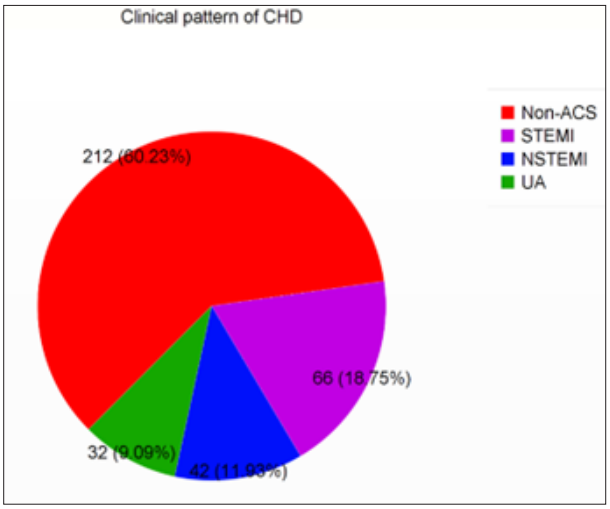

Figure 1a: Clinical pattern of CHD

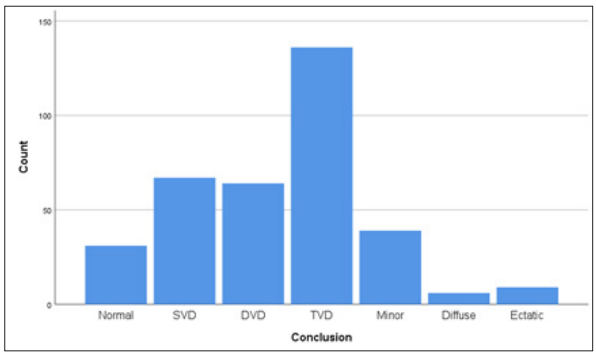

Figure 1b: Angiographic pattern of CHD

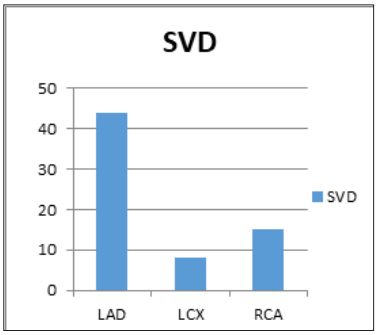

Figure 1c: SVD distribution

Out of all patients having disease coronary arteries, most common age group and gender are ≥41 years old and males respectively. Young patient population (≤40 years) with CAD is lower in our study population (4.3%) which is comparatively similar to most of the other studies (Rubin, & Borden, 2012). SVD is identified in 63 (94%) of CAD patients above 41 years of age. Among the ≥41 years population, the most prevalent age group with the CAD is 51-60 years and CHD incidence among men is 2-fold greater than in women (Table-1). Non-ACS is the most prevalent disease according to the clinical pattern of CAD among the young male population. Risk factors of diabetes mellitus, hypertension and dyslipidemia are most prevalent in non-ACS group and multi vessel disease (MVD) type of CHD.

Discussion

In our study population, out of total 352, patients of age ≤40 years were 15 (4.3%) and ≥41 years were 337 (95.7%). There were 65.6% male patients and 34.4% females. The prevalence of hypertension, diabetes mellitus, dyslipidemia and CKD, were 29.8%, 42.3%, 55.4% and 0.6% respectively (Table – 1). Coronary artery disease often strike at the peak of working age groups. Acute coronary syndrome and stable angina (non-ACS) are the clinical presentations of CAD (Fuster et al., 1992). In observed distribution of ACS (39.8%) types in our study group: the most common type was STEMI (18.8%), followed by NSTEMI (11.9%) and least commonly UA (9.1%) (Figure – 1-a). Among the patients with an abnormal coronary angiogram in our study population, TVD was most prevalent 136 (38.6%) with the multiplicity of synergetic risk factors whereas DVD was 64 (18.2%) (Figure – 1-b). SVD was present in 67 (19%) among the total population with the lesion most commonly located in the LAD, which is also consistent with most previously published studies (Ahsan et al., 2023). (Figure – 1-c). The most common site for lesion in LAD is up to mid segment.

Majority of coronary artery diseases are occurring due to atherosclerosis. The process of atherosclerosis may vary between patients. Young patient population (<41 years) with CAD is significantly lower in our study (4.3%) which is comparatively similar to most of the other studies (Rubin & Borden, 2012). There were young patients with significant coronary obstructions show less extensive disease than patients of old age group in this study which is comparable to other studies proving that atherosclerosis is a gradual and progressive disease (Faisal et al., 2022). Our study has shown that the young (≤40 years) patients had more angiographically normal coronary arteries as compared to old (≥41 years) patients (Table-3). In contrast to our study, various observations of predominantly SVD in young adults compared to more common MVD in older populations were described in other studies conducted in Europe, United States and also Asia (Swain, & Routray, 2018).

Angiographic pattern	Age Group		Sex		Risk Factors			
	≤40 (%)	>41 (%)	Male (%)	Female (%)	HTN (%)	DM (%)	DL (%)	CKD (%)
SVD	4 (6)	63 (94)	52 (77.6)	15 (22.4)	17 (25.4)	25 (37.3)	38 (56.7)	0 (0)
MVD	2 (1)	199(99)	144 (72)	56 (28)	64 (32)	98 (49)	110 (55)	0 (0)
Total	6	262	196	71	81	123	148	0

Table 3: Demographic and clinical data among SVD Vs MVD

In our study, stenotic SVD has been distributed among LAD, LCX and RCA as 44%, 8%, and 15%. Whereas Deora et al, (2016) observed stenosis as 55.3%, 11.8% and 19% in respective vessels. In angiographic characteristics it was noted that 31 (8.8%) had normal coronary arteries in that study. We observed that, SVD, DVD and TVD in 9.7%, 9.9%, and 17.6% of cases in ACS group. In contrast, they observed SVD, DVD, and TVD in 56.6%, 10.8%, and 3.6% of cases in STEMI group and 30.6%, 15.3%, 10.5% of cases in NSTEMI/UA group (Deora et al., 2016). According to the non – ACS category, TVD (76) was the most prevalent while ectatic (5) CAD was the least common. Among the ACS group, SVD was the most common distribution of CAD in STEMI whereas TVD was the most prevalent in NSTEMI and UA. Considering normal and minor vessel diseases, non – ACS group shows higher prevalence in comparison with ACS. However, our study has figured out only few number of patients (6) with diffuse CAD which was described only in the non – ACS category.

In our study, ectatic vessel disease found in non – ACS (5) and STEMI (ACS) (4) patients in similar frequency. Considering the distribution of ectatic coronary arteries, our results among the Sri Lankan population has shown a higher rate of ectasia in the RCA (4.5%) while other studies have also shown a higher rate in the RCA (Ahmad & Mungee, 2022). However the occurrence of ectasia in the LAD and LCX artery have shared the same percentage of 2.2. The prevalence of diffuse coronary artery disease in our country is similar to that of the other part of the world (Rizvi et al., 2017).

The Framingham heart study has clearly demonstrated the multifactorial nature of coronary artery disease (O'Donnell & Elosua, 2008). Major risk factors contribute significantly to our patient population of established coronary artery disease as well. The prevalence of dyslipidemia in our Sri Lankan study population with coronary artery disease has been estimated at about more than a half (55.4%) which correlates with the studies conducted by most authors in the other part of the world (40-50%) (Abdelaziz & Fawzy, 2014; Parvin et al., 2014). Diabetes has become a worldwide pandemic, with two thirds of the global diabetic population living in the developing countries. Sri Lankan studies show a definite upward trend in the prevalence of diabetes mellitus (Katulanda et al., 2006). Of note, diabetes mellitus is present in 49% (P= .359) of our patients which is the second common risk factor next to dyslipidemia 110 (55%) (P= .735) and is mostly associated with MVD. In the Copenhagen City heart Study, the relative risk of incident myocardial infarction was 2 to 3 fold increased in diabetics compared to nondiabetics, independent of the presence of other known cardiovascular risk factors (such as hypertension) (Schnohr et al., 2006).

Our study describes that dyslipidemia is the commonest (136) risk factor among both the ACS and non – ACS population while CKD was the least. However, diabetes mellitus was the most prevalence risk factor in the STEMI group than the dyslipidemia which was the second common. Dyslipidemia was 3 fold increased in STEMI compared to UA in relation to ACS group while diabetes mellitus shown 3 fold increase in STEMI than UA(Table – 5). Preventive efforts should target each major risk factor. The commitment should be now is to reduce adverse outcome by favorably modifying risk factor. However, a similar proportion (6.3%) was noted by Schoenenberger et al. (2009). A considerable difference ratio (P=.108) in the MVD between male and female was noted as 3:2 (Table -3).

The current study has several limitations. A larger population may have stronger statistical power. Finally, the patients were recruited exclusively from a single center with single operator experience in the western province of Sri Lanka. Therefore, a study with a multi centers and multi operator observations should be undertaken to verify our findings.

Clinical pattern of CAD	Angiographic distribution of CAD							
	Normal	SVD	DVD	TVD	Minor	Diffuse	Ectatic	Total
UA	1	4	3	22	2	0	0	32
NSTEMI	1	7	10	23	1	0	0	42
STEMI	0	23	22	17	0	0	4	66
Non – ACS	29	33	29	74	36	6	5	212
Total	31	67	64	136	39	6	9	352

Table 4: Clinical Vs angiographic distribution of CAD

		Risk factors			
		Hypertension	Diabetes mellitus	Dyslipidemia	CKD
Clinical pattern of CAD	UA	8 (7.62%)	10 (6.71%)	14 (7.18%)	0
	NSTEMI	14 (13.34%)	13 (8.72%)	16 (8.21%)	0
	STEMI	12 (11.43%)	34 (22.89%)	29 (14.87%)	1 (0.5%)
	Non - ACS	71 (67.61%)	92 (61.68%)	136 (69.74%)	1 (0.5%)
Angiographic pattern of CAD	Normal	8 (7.62%)	7 (4.69%)	19 (9.74%)	0
	SVD	17 (16.19%)	25 (16.78%)	38 (19.49%)	1 (50%)
	DVD	16 (15.24%)	28 (18.79%)	36 (18.46%)	0
	TVD	47 (44.76%)	69 (46.31%)	73 (37.44%)	0
	Minor	13 (12.39%)	14 (10.08%)	19 (9.74%)	1 (50%)
	Diffuse	2 (1.9%)	3 (2.01%)	4 (2.05%)	0
	Ectatic	2 (1.9%)	3 (1.34%)	6 (3.08%)	0

Table 5: Risk factor correlation with clinical pattern of CAD and angiographic pattern of CAD

Conclusion

The population with coronary artery disease (CAD) is predominantly male and >40 years of age. Non-ACS is the most common clinical presentation in both the young (≤40 years) and older (>40 years) population. In ACS category, STEMI is the commonest in both the age groups.

Angiographic studies has shown that TVD is more common in old age group whereas SVD is the common pattern in younger population. Young population with CAD, has less extensive disease with a high incidence of angiographically normal vessels and severe stenosis in the LAD artery is common finding among both non-ACS and ACS patients whereas the least common vessel was LMCA in both age groups. Total occlusion is common among non-ACS group and the most commonly affected artery is RCA while the least common is LMCA. However, majority of the diffuse vessel diseases are present among the older population with the clinical presentation of non-ACS. Our results in a Sri Lankan population has shown a higher rate of ectasia in the RCA and higher rate of diffuse disease in LAD and LCX.

Dyslipidemia is the commonest risk factor found in both the young and old population with the clinical features of non-acute coronary syndromes. Diabetes mellitus also has shown the increased trend among both the age group. Among the acute coronary syndrome patients, STEMI patients were noted with high prevalence of diabetes mellitus. As most of the patients of CAD have multiplicity of risk factors and the prevalence of coronary artery disease is on rise with the limited medical facilities in Sri Lanka (Katulanda et al., 2010), risk factor identification and control is most essential in the primary and secondary prevention.

Abbreviations

ACS : Acute Coronary Syndrome,
CAD : Coronary Artery Disease,
CHD : Coronary Heart Disease,
CKD : Chronic Kidney Disease,
CT : Computed Tomography,
CTA : Computed Tomographic Angiogram,
CVD : Cardiovascular Disease,
DL : Dyslipidemia,
DM : Diabetes Mellitus,
DVD : Double Vessel Disease,
ECG : Electrocardiogram,
HTN : Hypertension,
LAD : Left Anterior Descending (artery),
LCX : Left circumflex (artery),
LMCA : Left Main Coronary Artery,
LMIC : Low and middle-income countries,
MI : Myocardial Infarction,
MVD : Multi Vessel Disease,
Non-ACS : Non Acute Coronary Syndrome,
NSTEMI : Non-ST Elevation Myocardial Infarction,
RCA : Right Coronary Artery,
RWMA : Regional Wall Motion Abnormality,
STEMI : ST Elevation Myocardial Infarction,
SVD : Single Vessel Disease,
TVD :Triple Vessel Disease,
UA : Unstable Angina,
WHO :World Health Organization.

Acknowledgements

We acknowledge the team members of the heart center in the private hospital, Colombo, Sri Lanka where the study was conducted.

Ethical Consideration

Permission was obtained from the relevant hospital authority to collect the information. Ethical clearance was granted by the ethical clearance committee, Ethical clearance was granted by the ethical clearance committee from the relevant institute in Colombo, Sri Lanka, to collect data. As this study was an observational audit and did not collect patient identification information or patients' sensitive/confidential data hence consent was not sorted.

Conflicts of Interests

There is no conflict of interest.

Sources of Funding

None Declared.

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