World Journal of Cardiovascular Diseases, 2024, 14, 268-281
https://www.scirp.org/journal/wjcd
ISSN Online: 2164-5337
ISSN Print: 2164-5329

Coronary Artery Patterns in Diabetic Patients Undergoing Diagnostic Coronary Angiography-Data from a Major Cardiac Center in Yemen

Mohammed M. Al-Kebsi[1*], Yehia Al-Ezzy[1], Amatasamad Al-Tanobi[2], Ayman A. Mohammed[2*]

[1]Department of Cardiology, Faculty of Medicine and Health Sciences, Sana'a University, Sana'a, Yemen
[2]Cardiac Center, Al-Thawra Modern General Hospital, Sana'a, Yemen
Email: *kibsi@hotmail.com, *aymansaif190@gmail.com

How to cite this paper: Al-Kebsi, M.M., Al-Ezzy, Y., Al-Tanobi, A. and Mohammed, A.A. (2024) Coronary Artery Patterns in Diabetic Patients Undergoing Diagnostic Coronary Angiography-Data from a Major Cardiac Center in Yemen. *World Journal of Cardiovascular Diseases*, **14**, 268-281.
https://doi.org/10.4236/wjcd.2024.144021

Received: March 5, 2024
Accepted: April 22, 2024
Published: April 25, 2024

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Abstract

Background: Diabetes mellitus (DM) is independently associated with an increased risk of cardiovascular mortality and morbidity, including coronary artery disease (CAD). CAD is a shared burden disease and the leading cause of death in developed and developing countries. We aimed to assess the angiographic patterns of coronary arteries in patients with DM in a developing country (Yemen) as the first study. **Methods:** This study is a cross-sectional, prospective, observational study that includes a total of 250 patients who were admitted for elective diagnostic coronary angiography. **Results:** 96 (38.4%) patients were diabetics; 68% were male; mean age was 57 ± 11 years. The incidence of three-vessel disease was 31.2% of patients. Considering the severity of lumen occlusion, (11.2%) of patients had non-significant lesions, (37.6%) of patients had significant lesions, and (32%) had total occlusive lesions. Lesions were of LAD in 76%, RCA in 60%, and LCX in 52% of the population. Among diabetics, two and 3-vessel diseases (33.3% vs. 20.8% & 50% vs. 19.5%, P = 0.001), left main lesion (10.4% vs. 2.6%, P = 0.012), significant stenosis (41.7% vs. 35.1%, P = 0.032), total occlusion of coronary arteries (43.8% vs. 19.5%, P = 0.032) and type C lesion (66.7% vs. 35.1%, P = 0.010) were more frequent than non-DM patients. **Conclusion:** The burden of significant and severe coronary lesions is more common among DM, which may be the major cause of morbidity and mortality of DM in developing countries.

Keywords

Diabetes Mellitus, Coronary Artery Diseases, Coronary Angiography

1. Introduction

Coronary artery disease (CAD) accounts for the most significant proportion of cardiovascular diseases (CVD) and is the single largest cause of death in developed countries [1] [2]. Furthermore, CAD is one of the leading causes of disease burden in developing countries. And three-fourth of global deaths due to CAD occurred in low and middle-income countries [1] [3]. Diabetes mellitus (DM) is associated with an increased risk of cardiovascular death and a higher incidence of cardiovascular diseases, including CAD [4] [5] [6]. Even modest elevations in blood glucose (impaired glucose tolerance), without a diagnosis of diabetes, have been linked to increased risk for the development of CAD independent of other recognized risk factors [7] [8]. The reported prevalence of CAD in diabetic patients ranges from 9.5% to 55%, and DM is associated with a two-fold increased risk of developing cardiovascular complications [9] [10]. The risk of cardiovascular events is two to three times higher in people with type 2 DM [4] [7]. Moreover, DM in developing counties may not be well controlled.

To date, no information is available on the different aspects of ischemic heart disease in diabetic patients in Yemen. In the present study, we identify risk factors, mode of presentation, treatment, and angiographic (CAG) profile of CAD in diabetic ischemic heart disease patients.

2. Methods

2.1. Study Population

This is a prospective cross-sectional descriptive study that included a total of 250 patients admitted to the cardiac center of Al-Thawra Modern General Hospital, a major referral center for cardiovascular diseases and surgeries in Yemen, referred for diagnostic CAG from different cities and other hospitals between January 2022 and June 2022 with stable angina or post-myocardial infarction. Demographic data, clinical findings, and details of electrocardiographic and echocardiographic findings were recorded on case report forms filled out by the cardiologist. All patients were admitted to the ward as a one-day admission and discharged 6 hours after the procedure. Written informed consent was obtained from all patients and approved by the Ethical Committee of Al-Thawra Hospital. This study has been carried out according to the ethical guidelines outlined in the WMA's Declaration of Helsinki.

DM was defined as a fasting plasma glucose value ≥ 7.0 mmol/l (126 mg/dl), HbA1c ≥ 6.5%, or on regular antidiabetic treatment [11]. Stable angina was defined as typical chest pain due to transient myocardial ischemia, which usually occurs with physical activity or emotional stress and is relieved by rest or sublingual nitro-glycerine [12]. Unstable angina (UA) was defined as myocardial ischemia at rest or on minimal exertion without acute cardiomyocyte injury/necrosis [13].

2.2. Coronary Angiography (CAG)

According to the standard approach, CAG was performed through the femoral and occasionally through the radial artery. Two specialist intervention cardiologists performed the report of CAG and variability determined by third opinion. Coronary lesions were considered a significant lesion when the lesion presented with stenosis of ≥50% of the left main coronary artery or stenosis of ≥70% of the diameter of a major epicardial or branch vessel. A non-significant CAD was defined as <50% stenosis of the diameter of the left main coronary artery or 50% - 70% stenosis of the diameter of a major epicardial or branch vessel. Total occlusion is defined as the abrupt termination of the epicardial vessel during coronary angiography. Lesions with <50% stenosis were considered as normal coronary arteries [14] [15].

The extent of the disease was usually defined as a single-vessel disease, two-vessel disease, and three-vessel disease of the left main coronary artery and major coronary artery branches, left anterior descending (LAD), left circumflex (LCX), and right coronary (RCA). The morphology and extensions of coronary lesions were classified into three types: A, B, and C [15] [16] [17].

Type A lesion was identified as discrete, less than (<10 mm) concentric, readily accessible, non-angulated segment (less than <45 degree), smooth contour, little or no calcification, no major side branch involvement, and absence of thrombus.

Type B was identified as tubular (10 to 20 mm in length), eccentric, moderate tortuosity of the proximal segment, moderately angulated segment (>45 degrees <90 degrees), irregular contour, moderate to heavy calcification, total occlusion < 3 months old, ostial location or bifurcation lesion requiring double guidewire, and some thrombus present.

Type C was identified as diffuse (>2 cm in length), excessive tortuosity of the proximal segment, extremely angulated segment (≥90 degrees), total occlusion > 3 months old, inability to protect major side branches, and degenerated vein grafts with friable lesions.

2.3. Statistical

Statistical analyses were performed using commercially available SPSS. Data are presented as mean ± standard deviation when numerical and compared by T-test and the Mann-Whitney U test according to normality distribution. Categorical variables are presented as numbers (%) and were compared using the Chi-square test. $P < 0.05$ was considered significant.

3. Result

3.1. Baseline Data

96 (38.4%) patients were diabetics, 68% were male, mean age was 57 ± 11 years. The incidence of three-vessel disease was 31.2% of patients. Considering the severity of lumen occlusion, (11.2%) of patients had non-significant lesions, (37.6%) of patients had significant lesions, and (32%) had total occlusive lesions. Lesions were of LAD in 76%, RCA in 60%, and LCX in 52% of the population. The sub-

jects were classified into two categories according to the diagnosis of DM the baseline data was presented accordingly (**Table 1**).

The diabetic patients were older (60.1 ± 9.3 years vs. 55.1 ± 11.6 years; P = 0.009) than non-diabetics. The frequency of patients with left ventricular systolic ejection fraction (EF%) < 50% (28, 39.5% vs. 26, 16.9%; P = 0.015), stable angina (58.3% vs. 36.4%; P = 0.016) were higher in patients with DM than non-DM. Moreover, the diabetic patients were with less ECG changes (37.5% vs. 79.2%; P = 0.041) and less STEMI (20.8% vs. 42.9%; P = 0.012) than non-DM patients (**Figure 1**).

3.2. Coronary Angiography Findings

Severity of CAD lesions in diabetic & non-diabetic patients

The prevalence of atherosclerosis of coronary arteries was significantly higher among diabetic than non-diabetic patients (91.7% vs. 74.0%; P = 0.015). Diabetic patients were more likely to have lesions in the LAD (91.7% vs. 66.2%; P = 0.001), RCA (75.0% vs. 50.6%; P = 0.007), and LCX (54.2% vs. 35.1%; P = 0.036) arteries than the non-diabetic patients. Two and three-vessel disease was more common in diabetics (33.3% vs. 20.8% & 50% vs. 19.5%, P = 0.001) than non-diabetic patients (**Figure 2**). When coronary lesions were classified according to ACC/AHA classification of coronary lesions; type B (68.8% vs. 37.7%; P = 0.010) & C (72.9% vs. 39%; P = 0.010) lesions were more prevalent among the diabetic patients. Moreover, Diabetic patients showed more significant stenosis

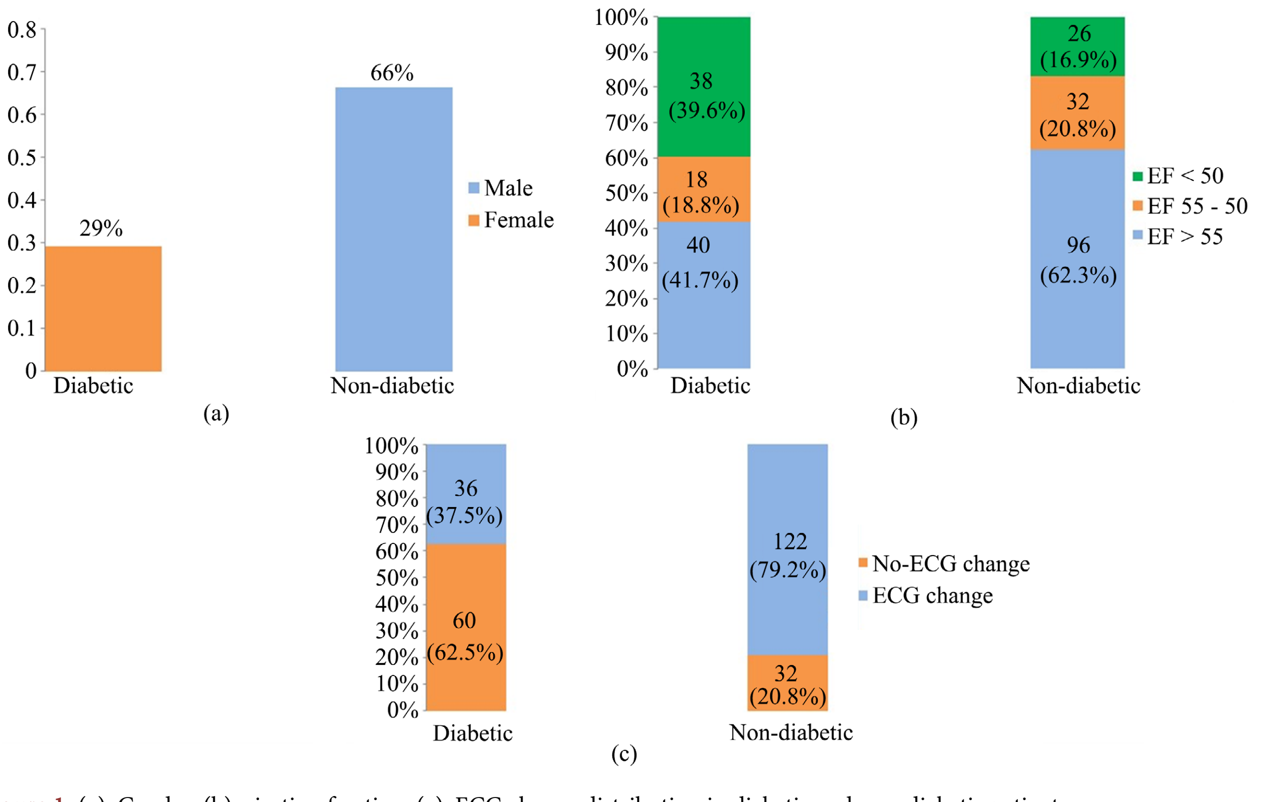

Figure 1. (a): Gender, (b): ejection fraction; (c): ECG change distribution in diabetic and non-diabetic patients.

Table 1. Baseline characteristics of diabetic and non-diabetic patients.

Variables	DM (n: 96)	Non-DM (n: 156)	P-value
Clinical data			
Age (years)	60.1 (±9.3)	55.1 (±11.6)	0.009
Male, n (%)	68 (70.8)	102 (66.2)	0.592
Smoking, n (%)	24 (25)	64 (41.6)	0.059
Hypertension, n (%)	42 (43.8)	52 (33.8)	0.262
Hyperlipidemia, n (%)	22 (22.9)	36 (23.4)	0.953
Stable angina, n (%)	56 (58.3)	56 (36.4)	0.016
Unstable angina, n (%)	16 (16.7)	16 (10.4)	0.307
STEMI, n (%)	20 (20.8)	66 (42.9)	0.012
NSTEMI, n (%)	4 (4.2)	16 (10.4)	0.364
Left ventricular systolic EF %			
EF > 55	40 (41.7)	96 (62.3)	0.015
EF 55 - 50	18 (18.8)	32 (20.8)	
EF < 50	38 (39.6)	26 (16.9)	
ECG change, n (%)	36 (37.5)	122 (79.2)	0.041
Site of lesions and characters			
LM lesion, n (%)	10 (10.4)	4 (2.6)	0.012
LAD lesion, n (%)	88 (91.7)	102 (66.2)	0.001
LCX lesion, n (%)	52 (54.2)	54 (35.1)	0.036
RCA lesion, n (%)	72 (75.0)	78 (50.6)	0.007
RCA dominant, n (%)	80 (83.3)	104 (67.5)	0.075
LCX dominant, n (%)	12 (12.5)	24 (15.6)	
Codominant, n (%)	4 (4.2)	26 (16.9)	
Ectasia, n (%)	10 (10.4)	6 (3.9)	0.283
Tortuosity, n (%)	10 (10.4)	16 (10.4)	1.000
Atherosclerotic coronary arteries n (%)	88 (91.7)	114 (74.0)	0.015
Normal, n (%)	8 (8.3)	48 (31.2)	0.001
Single vessel, n (%)	8 (8.3)	44 (28.6)	
Two-vessels, n (%)	32 (33.3)	32 (20.8)	
Three-vessels, n (%)	48 (50)	30 (19.5)	
Type A, n (%)	17 (17.7)	75 (48.7)	0.010
Type B, n (%)	66 (68.8)	58 (37.7)	
Type C, n (%)	70 (72.9)	60 (39)	
Non-significant, n (%)	3 (3.1)	25 (16.2)	0.032
Significant, n (%)	43 (44.8)	51 (33.1)	
Total occlusion, n (%)	42 (43.8)	30 (19.5)	

Variable presented as mean (±SD) and number (%); DM: diabetes mellitus; STEMI: ST Elevation myocardial infarction; NSTEMI: non-ST Elevation myocardial infarction; EF: ejection fraction; LM: left main; LAD: left anterior descending; LCX: left circumflex; RCA: right coronary artery.

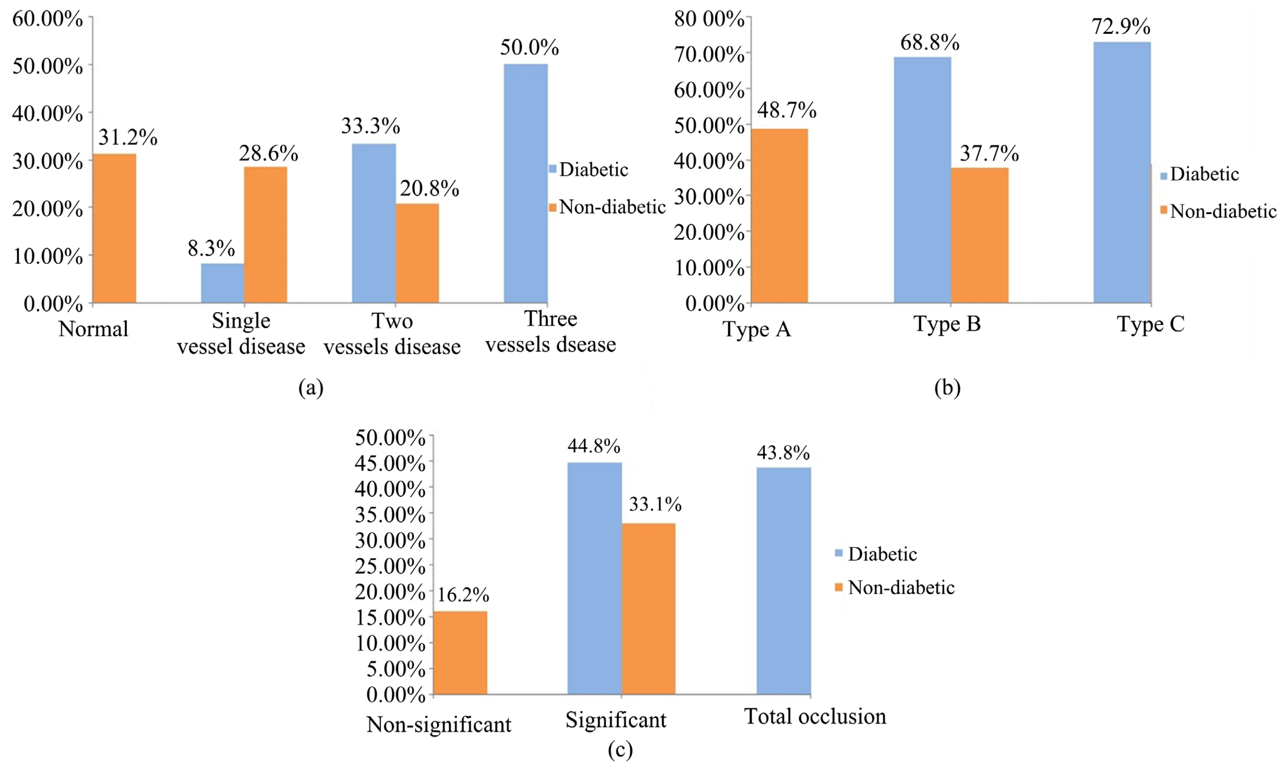

Figure 2. (a): Number of coronary vessels affected; (b): Type of coronary artery lesions; (c): Severity of coronary artery lesions in diabetic and non-diabetic patients.

(44.8% vs. 33.1%; P = 0.032), and total occlusion in diabetics (43.8% vs. 19.5%; P = 0.032) than non-diabetics. The characteristics of CAD lesions in diabetic & non-diabetic patients are shown in Table 2.

Left main artery (LM)

Significant and non-significant stenosis was reported in the LM of diabetic and non-diabetic patients. In the diabetic patients, significant stenosis was observed in the ostial, mid-LM & type B (2.1% for each), and non-significant stenosis was in the distal LM & type A (2.1%). On the other hand, significant stenosis in the non-diabetic patients was in the mid-LM & type C (1.3%), while non-significant stenosis was observed in the proximal LM type B (3.9%).

Left anterior descending artery (LAD)

In diabetic patients, significant stenosis was the primary lesion reported in LAD, followed by total occlusion and non-significant stenosis. Significant stenosis (type B & C) was most common in the proximal LAD (25% for each), then in mid-LAD (6.3% for each), and was less in osteal LAD type C (4.2%). Moreover, significant stenosis type A lesion was less frequent mostly in proximal, mid & distal LAD (2.1%). Total occlusion was more frequent in the proximal LAD (10.4%) than in the ostial and mid LAD (6.3% for each). However, the non-significant stenosis was in 4.2% of proximal LAD type B and mid-LAD type A. Non-significant lesion was 2.1% in ostial LAD type B, proximal LAD type A, mid and distal LAD type B.

Table 2. Baseline characteristics of diabetic and non-diabetic patients.

Coronary artery	Diabetic patients (96)				Non-diabetic patients (154)			
	NSL	*SL*	*TO*	*Normal*	*NSL*	*SL*	*TO*	*Normal*
Left main (LM)								
Ostial LM type A	0	0	0	96 (100)	0	0	0	154 (100)
Ostial LM type B	0	2 (2.1)	0	94 (97.9)	0	0	0	154 (100)
Ostial LM type C	0	0	0	96 (100)	0	0	0	154 (100)
Proximal LM type A	0	0	0	96 (100)	0	0	0	154 (100)
Proximal LM type B	0	0	0	96 (100)	6 (3.9)	0	0	148 (96.1)
Proximal LM type C	0	0	0	96 (100)	0	0	0	154 (100)
Mid LM type A	0	0	0	96 (100)	0	0	0	154 (100)
Mid LM type B	0	2 (2.1)	0	94 (97.9)	0	0	0	154 (100)
Mid LM type C	0	0	0	96 (100)	0	2 (1.3)	0	152 (98.7)
Distal LM type A	2 (2.1)	0	0	94 (97.9)	0	0	0	154 (100)
Distal LM type B	0	0	0	96 (100)	0	0	0	154 (100)
Distal LM type C	0	0	0	96 (100)	0	0	0	154 (100)
Left anterior descending artery (LAD)								
Ostial LAD type A	0	0	0	96 (100)	0	0	0	154 (100)
Ostial LAD type B	2 (2.1)	0	0	94 (97.9)	2 (1.3)	0	0	152 (98.7)
Ostial LAD type C	0	4 (4.2)	6 (6.3)	86 (89.6)	0	12 (7.8)	2 (1.3)	140 (90.9)
Proximal LAD type A	2 (2.1)	2 (2.1)	0	92 (95.8)	16 (10.4)	6 (3.9)	0	132 (85.7)
Proximal LAD type B	4 (4.2)	24 (25)	0	68 (70.8)	4 (2.6)	16 (10.4)	0	134 (87.0)
Proximal LAD type C	0	24 (25)	10 (10.4)	62 (64.6)	0	18 (11.7)	10 (6.5)	126 (81.1)
Mid LAD type A	4 (4.2)	2 (2.1)	0	90 (93.8)	4 (2.6)	0	0	150 (97.4)
Mid LAD type B	2 (2.1)	6 (6.3)	0	88 (91.7)	2 (1.3)	16 (10.4)	0	136 (88.3)
Mid LAD type C	0	6 (6.3)	6 (6.3)	84 (87.5)	4 (2.6)	4 (2.6)	4 (2.6)	142 (92.2)
Distal LAD type A	0	2 (2.1)	0	94 (97.9)	0	2 (1.3)	0	152 (98.7)
Distal LAD type B	2 (2.1)	0	0	94 (97.9)	0	2 (1.3)	0	152 (98.7)
Distal LAD type C	0	2 (2.1)	0	94 (97.9)	0	2 (1.3)	0	152 (98.7)
Left circumflex artery								
Ostial LCX type A	2 (2.1)	0	0	94 (97.9)	0	0	0	154 (100)
Ostial LCX type B	2 (2.1)	0	0	94 (97.9)	0	0	0	154 (100)
Ostial LCX type C	0	10 (10.4)	0	86 (89.6)	0	4 (2.6)	0	150 (97.4)
Proximal LCX type A	4 (4.2)	2 (2.1)	0	90 (93.8)	4 (2.6)	8 (5.2)	0	142 (92.2)
Proximal LCX type B	2 (2.1)	6 (6.3)	2 (2.1)	86 (89.6)	4 (2.6)	6 (3.9)	2 (1.3)	142 (92.2)
Proximal LCX type C	0	8 (8.3)	4 (4.2)	84 (87.5)	0	2 (1.3)	6 (3.9)	146 (94.8)

Continued

Mid LCX type A	2 (2.1)	0	0	94 (97.9)	2 (1.3)	0	0	152 (98.7)
Mid LCX type B	0	4 (4.2)	0	92 (95.8)	0	4 (2.6)	0	150 (97.4)
Mid LCX type C	0	6 (6.3)	0	90 (93.8)	2 (1.3)	4 (2.6)	0	148 (96.1)
Distal LCX type A	4 (4.2)	0	0	92 (95.8)	6 (3.9)	0	0	148 (96.1)
Distal LCX type B	2 (2.1)	0	0	94 (97.9)	0	2 (1.3)	0	152 (98.7)
Distal LCX type C	0	0	2 (2.1)	94 (97.9)	0	2 (1.3)	0	152 (98.7)
Right coronary artery (RCA)								
Ostial RCA type A	0	0	0	96 (100)	0	0	0	154 (100)
Ostial RCA type B	0	0	0	96 (100)	0	2 (1.3)	0	152 (98.7)
Ostial RCA type C	0	2 (2.1)	2 (2.1)	92 (95.8)	0	0	0	154 (100)
Proximal RCA type A	12 (12.5)	4 (4.2)	0	80 (83.3)	8 (5.2)	2 (1.3)	0	144 (93.5)
Proximal RCA type B	2 (2.1)	12 (12.5)	0	82 (85.4)	6 (3.9)	10 (6.5)	0	138 (89.6)
Proximal RCA type C	0	8 (8.3)	4 (4.2)	84 (87.5)	0	4 (2.6)	10 (6.5)	140 (90.9)
Mid RCA type A	6 (6.3)	2 (2.1)	0	88 (91.7)	12 (7.8)	0	0	142 (92.2)
Mid RCA type B	0	8 (8.3)	2 (2.1)	86 (89.6)	2 (1.3)	6 (3.9)	0	146 (94.8)
Mid RCA type C	0	4 (4.2)	6 (6.3)	86 (89.6)	0	4 (2.6)	6 (3.9)	144 (93.5)
Distal RCA type A	0	0	0	96 (100)	4 (2.6)	0	0	150 (97.4)
Distal RCA type B	0	0	0	96 (100)	2 (1.3)	0	0	152 (98.7)
Distal RCA type C	0	6 (6.3)	6 (6.3)	84 (87.5)	0	2 (1.3)	0	152 (98.7)

Data presented as number and percent NSL: non-significant lesion; SL: significant lesion; TO: total occlusion.

In the non-diabetic patients, significant stenosis was also the primary CAD lesion reported in the following segments of the LAD artery: proximal LAD type C (11.7%), proximal & mid LAD type B (10.4% for each), ostial LAD type C (7.8%), proximal LAD type A (3.9%), mid LAD type C (2.6%) and distal LAD type A, B & C (1.3% for each). Total occlusion (type C) was mainly in proximal LAD (6.5%), then in the mid-LAD (2.6%) and ostial LAD (1.3%). However, non-significant stenosis was mainly in the proximal LAD type A (10.4%), then in the proximal LAD type B, mid LAD type A & C (2.6% for each) and ostial & mid LAD type B (1.3% for each).

Left circumflex artery (LCX)

In diabetic patients, significant stenosis was the primary lesion in the LCX, followed by non-significant stenosis, then total occlusion. However, in the non-diabetic patients, significant stenosis was the main lesion in the LCX, followed by non-significant stenosis and total occlusion. In the diabetic patients, significant stenosis was ostial-type C (10.4%), proximal type C (8.3%), proximal type B & mid-LCX type C (6.3%), then mid-LCX type B (4.2%) and proximal type A (2.1%). On the other hand, in the non-diabetic patients, significant stenosis was proximal type A & B (5.2% & 3.9%) then 2.6% was ostial type C and mid-LCX type B & type C. less common was in 1.3% of proximal type C and distal type B & type C. Non-significant stenosis among the diabetic patients was reported in 4.2% of the proximal and distal type A and 2.1% of the ostium type A & B, proximal type B, mid-LCX type A and distal type B. However, among the non-diabetic patients, non-significant stenosis was reported in 3.9% of the distal type A, 2.6% of the proximal type A & B, and 1.3% of the mid-LCX type A & C. Total occlusion was observed in 4.2% of the proximal type C and 2.1% of the proximal type B and distal type C of the diabetic patients. In contrast, in the non-diabetic patients it was observed in the proximal type C & B (3.9% & 1.3% respectively).

Right coronary artery (RCA)

Significant stenosis was the main lesion of RCA in diabetic patients, followed by non-significant stenosis and total occlusion. In contrast, non-significant stenosis was the main lesion in the non-diabetic patients, followed by significant stenosis and total occlusions. Significant stenosis was in the diabetic patients as follows: proximal RCA type B (12.5%), proximal RCA type C & mid-RCA type B (8.3%), distal RCA type C (6.3%), proximal RCA type A & mid-RCA type C (4.2%) and ostial RCA type C & mid-RCA type A (2.1%). However, in the non-diabetic patients, the affected branches by significant stenosis were as follows: proximal RCA type B (6.5%), mid-RCA type B (3.9%), proximal & mid-RCA type C (2.6%). Then ostial RCA type B, proximal RCA type A and distal RCA type C (1.3% for each). In diabetic patients, non-significant stenosis was noticed in 12.5% of the proximal RCA type A, 6.3% of the mid-RCA type A, and 2.1% of the proximal RCA type B. In non-diabetic patients, non-significant stenosis was noticed in 7.8% of the mid-RCA type A, 5.2% of the proximal RCA type A, 3.9% of the proximal RCA type B, 2.6% of the distal RCA type A, and 1.3% of the mid & distal RCA type B. Total occlusion in diabetic patients was in the mid and distal RCA type C (6.3%), proximal RCA type C (4.2%), and ostial RCA type C and mid-RCA type B (2.1%). On the other hand, total occlusion in non-diabetic patients was in the proximal RCA type C (6.5%) and mid-RCA type C (3.9%).

4. Discussion

Atherosclerosis showed significant incidence, accounting for 91.7% of the diabetic patients' group in our study, and this is a significant result. This related finding between diabetes and CAD is in keeping with previous findings, in which insulin resistance, hyperglycemia, and glucose intolerance promote atherosclerosis [18] [19].

About 80% of all deaths among diabetic patients occur due to atherosclerosis, compared with only 30% among non-diabetic individuals, and more than 75% of hospitalizations for diabetic complications are a consequence of atherosclerosis [20].

Impaired LV systolic function in the form of EF (<50%) was more observed among diabetic compared to non-diabetic patients in our study. Consistent with our data, Sousa *et al.* [21], Ammann *et al.* [22], and Graham *et al.* [23], found in their studies that the prevalence of low ejection fraction (<50%) was more observed in diabetic than non-diabetic patients.

In our study, the most common vessel involved was LAD in diabetic and non-diabetic groups, followed by RCA and LCX. Similar to our findings, previous studies showed that among the vessels involved, LAD was the most common artery involved in diabetic patients, followed by RCA & LCX [24] [25] [26]. However, Marghany *et al.* [27] showed that the most prevalent affected vessel in diabetic patients was RCA, which differed from our findings and what was observed in most previous studies.

Regarding the prevalence of LM lesions in our study, LM coronary lesions were observed to be more prevalent among diabetics compared to non-diabetics. Similar to our study, Sharma *et al.* reported a similar prevalence of LM coronary lesions (11%) in diabetic patients [28]. Moreover, consistent with our findings, Srinidhi *et al.* [24] and Iqbal *et al.* [26] showed that the prevalence of LM coronary lesions was more frequent among diabetic than non-diabetic patients (7.5% vs. 1%) and (16% vs. 12%), respectively. In contrast to our findings, Moosavi *et al.* showed no significant difference in the prevalence of LM coronary affection between diabetic and non-diabetic patients. This difference between Moosavi *et al.* study and our study findings can be explained by the smaller sample size of their study, which was 100 patients [29].

Indeed, Graham *et al.* [23] also showed no significant difference in the prevalence of LM coronary lesions in diabetic and non-diabetic patients (10.7% vs. 9.5%). This difference with our study can be explained by the larger sample size of these studies, which was 3485 diabetic patients and 13,916 non-diabetic patients in Graham's study compared to 250 patients in our study.

Regarding the extent of coronary lesions in diabetic patients in our study, the prevalence of single vessel disease was less frequent among diabetic than non-diabetic patients. However, two-vessel and three-vessel diseases were more prevalent among diabetics than non-diabetics. These findings were similar to those observed in Hasabi *et al.* [25] and Bharath *et al.* [30] studies, which showed that single-vessel disease was more prevalent in non-diabetic patients and two and three-vessel disease were more prevalent among diabetic patients compared to the other patients' group. Also, Sharma *et al.* showed that three-vessel disease was the most prevalent lesion in diabetic patients [31]. Multiple other studies also agreed with our findings, which showed that three-vessel disease was more common in diabetic patients than non-diabetics [22] [29] [32] [33] [34].

Unlike our findings, Sousa *et al.* [21] showed no significant differences in the prevalence of single and two-vessel disease between diabetic and non-diabetic patients. However, there was an agreement between our study and Sousa *et al.* in the prevalence of three-vessel disease, which was observed to be more in diabetic than non-diabetic patients. Moreover, the prevalence of two-vessel disease was more observed in non-diabetic compared to diabetic patients, but the prevalence of three-vessel disease was higher among diabetic than non-diabetic patients in Graham *et al.* [23] compared to our study. Mohammed *et al.* [35] study reported a significantly higher prevalence of three-vessel disease (49.7% vs. 9.2%) and two-vessel disease (23.2% vs. 14.3%) among diabetic patients compared to non-diabetic patients, and the three-vessel disease was observed to be the most prevalent lesion in diabetic patients. In comparison in Mohammed *et al.* study, single vessel disease was more prevalent among non-diabetic patients than diabetic patients (23.5% vs. 14.2%).

The prevalence of normal angiography among non-diabetic patients was significantly higher than that observed in diabetic patients in our study. This result was similar to previous studies [21] [22] [24]. However, in contrast to our findings, some studies showed no significant differences in the prevalence of normal coronary angiography in diabetic and non-diabetic patients [30].

Regarding the severity of coronary artery lesions in diabetic patients in our study, non-significant stenosis was more prevalent among non-diabetics than diabetic patients. However, significant stenosis and total occlusion were more prevalent among diabetic than non-diabetic patients. Similar to our findings were observed in several studies [21] [24].

Regarding the type of coronary artery lesions, our study showed that type A coronary lesions were more prevalent among non-diabetic compared to diabetic patients. In contrast, type B and C were more prevalent among diabetic than non-diabetic patients. Similar to our findings have been shown in previous studies [21] [27] [35] [36].

Despite this is the first study came out from our developing country and similar result to other studies but still has some limitations. Our study was performed over 6 months which can be considered a relatively short time with small study population. Relatively low level of education of some patients led to inadequate gathering of optimal information and proper history. In addition to the lack of modern methods such as intravascular ultrasonography (IVUS) that is not readily available as well as the new and updated analysis programs in the angiography machines which make the visual assessment of stenosis the most used technique, which may affect the efficiency of determining the degree and severity of coronary stenosis.

5. Conclusion

Diabetic patients showed common two and three-vessels coronary diseases, significant and total occlusion with more left main coronary lesion. DM was an important risk factor with the maximum effect on coronary lesion compared to other risk factors.

Conflicts of Interest

All authors have no disclosures to report or conflict of interest.

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