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ARTERIAL SUPPLY OF ATRIOVENTRICULAR NODE AND BUNDLE IN RELATION TO DEGREE OF STENOSIS OF CORONARY ARTERY AMONG POPULATION OF KINGDOM OF SAUDI ARABIA (CORONARY ANGIOGRAPHY STUDY)

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ABSTRACT

This study aimed to determine the dominant coronary artery as well as evaluating the arterial supply of atrio-ventricular node and bundle in relation to degree of stenosis of coronary artery among Saudi population by using the Coronary Angiography. This was a retrospective type of study carried out on patients reporting to King Fahad Cardiac Center in Riyadh from January 2016 to November 2016. The study conduct in (260 patients of both genders over 15 years records were collected as sample) whose coronary artery angiography their findings showed pathology in coronary arteries. The finding showed that among males and females Saudis' patients the majority were RCA dominant (59.23%), they also showed that both RCA and LAD had equal viability to stenosis. No correlation was found between the sex and the site of

stenosis. The findings also have shown that there is weak correlation between the DCA and the degree of reduction in the RCA (0.192) as well as LAD (0.294) stenosis.

Keywords: Dominant coronary artery, Coronary Angiography, Stenosis

INTRODUCTION

Coronary artery disease is narrowing or occlusion of the lumen of one or more of the coronary arteries, usually due to atherosclerosis; this leads to myocardial ischemia; which can cause angina pectoris and myocardial infarction. Atherosclerosis is one of the most causes of morbidity and mortality worldwide especially in the developing countries.

Good understanding of normal coronary arteries anatomy gives a good base into understanding the pathophysiology, thereby better management of coronary arteries disease.

The heart is supplied by two main arteries; right and left coronary arteries. The left coronary artery (LCA) is further subdivides into anterior descending artery (LAD) and circumflex artery (LCx). The LAD also known as anterior interventricular artery supplies the anterior and left side of the heart. The circumflex artery supplies the left and posterior side of the heart. The right coronary artery (RCA) subdivides into posterior descending artery (PDA) also known as posterior interventricular artery and acute marginal arteries. The RCA supplies right atrium, right ventricle, sinoatrial (SA) node, atrioventricular (AV) node and portion of the left ventricle [(1)].

The term (dominance) in relation to coronary arteries describes when either the RCA or LCx gives off the posterior descending and the posterolateral branches. The left dominance (LD) with a prevalence of about 7% to 8% of population, and is often described as variant of normal anatomy. Population with left dominance have non-dominant right coronary artery which supplies only the right ventricle and the atria, while the entire left ventricle is supplied by the left coronary artery[(2)].

The right coronary artery is dominant in about 85% of population and non-dominant in 15% of population. 50% of the non-dominant right coronary artery cases have the posterior descending (LAD) and the posterolateral branches arisen from left circumflex artery (LCx), in this case left dominance, and in the other 50% the PDA and LCx are branches of the Right coronary artery, in this case co-dominant circulation[(1)].

As mentioned before the pattern of dominant vessel is variable and this has a

clinical significance. Good knowledge of the coronary arteries variation and pathology is critical in interpretation of the cardiac diseases findings, determining and planning the proper treatment[3].Knowledge of the exact coronary arteries anomalous; their aortic origin is also essential for the exact surgical procedures[4].

Nerantzis et al. mentioned that in less than 10% of the cases, the right coronary artery provides blood supply not only to the right ventricle, but also to about half of the left ventricle as well by extending branches[5].

Nerantzis and koutsaftis reported acase where the right and left coronary arteries arose by a common trunk from the left aortic sinus, then took a course to the left heart via the ventricular septum [6]. Topaz et al. reported the occurrence of the posterior descending (posterior interventricular) artery in relation to right coronary artery [7].

The sinoatrial nodal artery arises from the right coronary artery in about 60% of cases and supplies the sinoatrial node. In about 40% of cases, it is either arises from the left coronary artery or one of its branches [8].The site of origin is not related to which coronary artery is dominant. On the contrary the atrioventricular branch that supplies the atrioventricular node is dependent in determining the dominant coronary artery.

The sinoatrial nodal (SAN) artery, is an artery of the heart which responsible for supplies of sinoatrial node which is in charge of initiating each heartbeat, it's classified as one of the most important branches [9].

In about 60% of people the (SAN) arises from the right coronary artery and in the remaining 40% of cases it arises from the left circumflex coronary artery[10].

The blood supply of the atrioventricular node is by right coronary artery in 80% of cases, in 10% of cases it supplied by left coronary artery in the remaining 10% cases the atrioventricular node supplied by both artery. The atrioventricular bundle or bundle of His the blood supply is taken place by the right coronary artery in 10% of cases, in about 73% of people it arises from left coronary artery, the remaining 17% it arose from the right and left coronary arteries together. Most of the blood supply of right bundle (the moderator band) by interventricular septal branches from the left coronary artery [11].

Many attempts have been made to create a grading analysis system with more complicated and 'granular' lesion [12, 13, 14, 15]. There wasn't any improvement since early severity categorization of Oberman *et al* (1972) [16]. The most common severity grading analysis used is:

- Less than 50% diameter reduction. Based upon severity alone, the lesions are stable and very unlikely to have clinical significance, there is no proven value.
- Between 50% and 70% diameter reduction. In this range, the lesions are of borderline hemodynamic and clinical significance. It is very important prior to intervention to specify for lesions in this range, this would benefit from confirmation of hemodynamic significance by non-invasive assessment techniques [16,17].
- Over 70% but less 100%. Almost all lesions are hemo dynamically significant in this range. No established benefit to make a more precise reduction grade within this range. Some studies have used a 90-99% range with no clear clinical usefulness. Gould stated that there is hyperemic response in 65-85% diameter reduction; this refers to by Gensini as "the resistance elbow". In this range, the angiography lacks enough discriminating power. Lesions over than 85% might demonstrate reduced flow at rest [16].
- 100%. For complete occlusion vessels is associated with multiple clinical and therapeutic reasons [16].

MATERIALS AND METHODS

This was a retrospective study depend on archival data carried out on 266 Patients (199 males and 61 females), all patients of both gender over 15 years of age who presented to the King Fahad Cardiac Center in Riyadh for different indications were included by Appropriate sampling technique. The research contain an excluded criteria represented in Patients with congenital heart diseases.

Regarding the patient's angiograph was performed under local anesthesia with small-diameter catheters introduced through a transarterial sheath. The outer diameter of the catheter is specified using French units, where one French unit (F) = 0.33 mm. normally, 4- or 5-F catheters are used for diagnostic purposes.

We formed a specific data collecting cheat, data collected by a check list from patient's records which included age, gender, coronary artery stenosis, and site of stenosis and the dominance of the heart. The data were analyzed by using SPSS (statistical packages for social science) version (22.0) and the (P value < 0.05) was considered as statistically significance. The ethical issues were approved from ethical committee of Prince Sattam Bin Abdulaziz University.

RESULTS

The study was conducted on 260 patients who had come to the cardiology

department. The findings showed that 154 (59.23%) of the patients were right dominant coronary artery 118 (45.38%) male and 36 (13.85%) female, 71 (27.31%) left dominant coronary artery 51 (19.62%) males and 20 (%) females and 35 (13.64%) co-dominant 30 (11.54%) males and 5 (1.92%) females.

Table 1: shows the dominant coronary artery stenosis among Saudi's population

Gender of the Patient	Dominant Coronary Artery			
	Right Coronary Artery	Left Coronary Artery	Co-dominant Artery	Total
Male	118	51	30	199
Female	36	20	5	61
Total	154	71	35	260

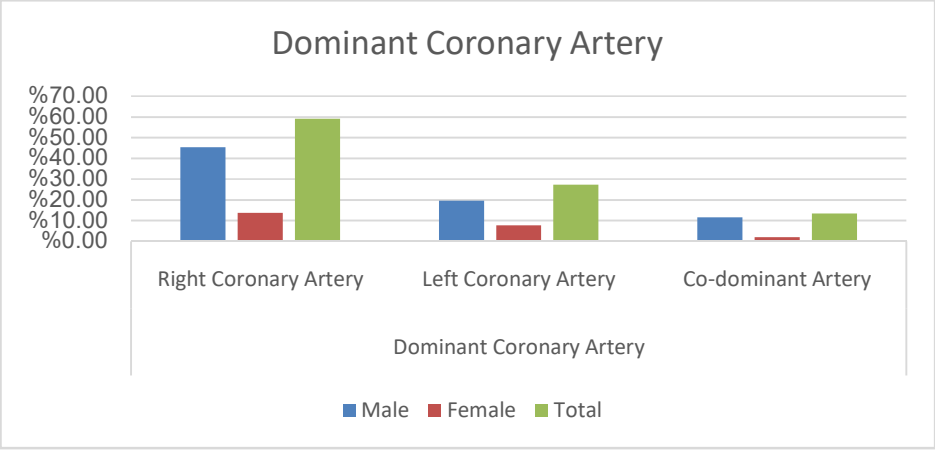

Fig 1: Clustered bar shows the dominancy of the coronary arteries among the patients

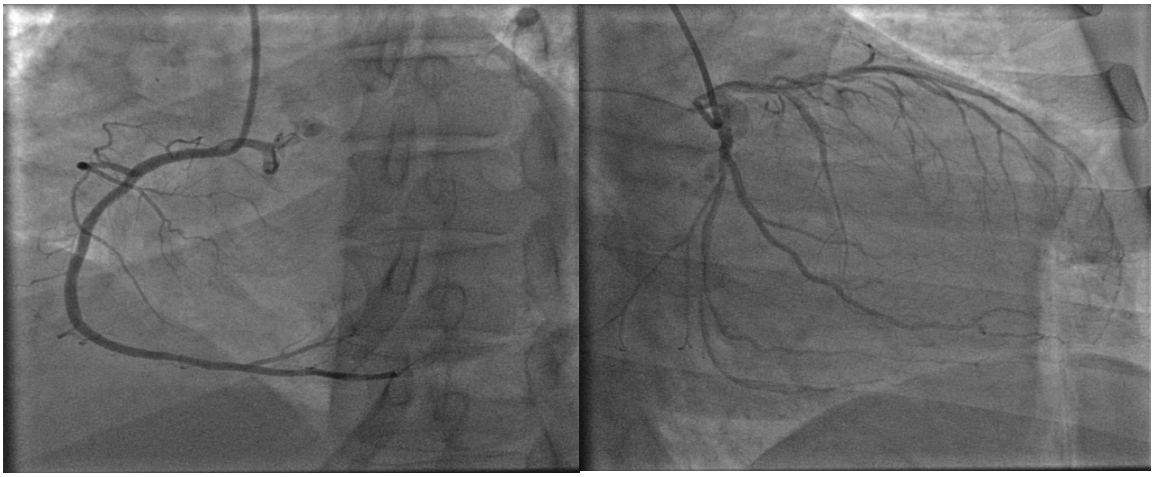

Fig 2: Shows the RCA and LCA angiography in Right-Dominant coronary artery

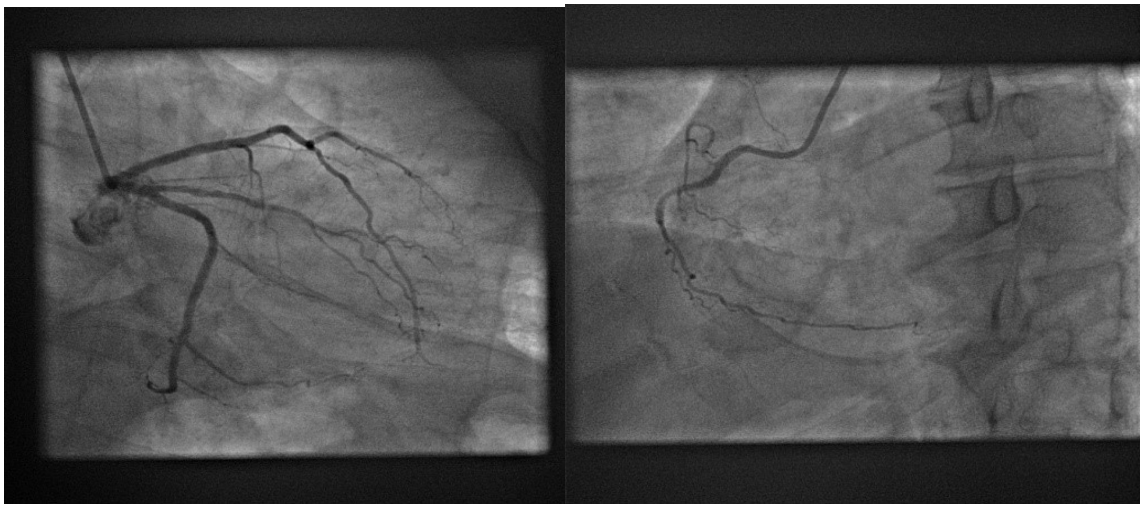

Fig 3: shows the RCA and LCA angiography in Left-Dominant coronary artery

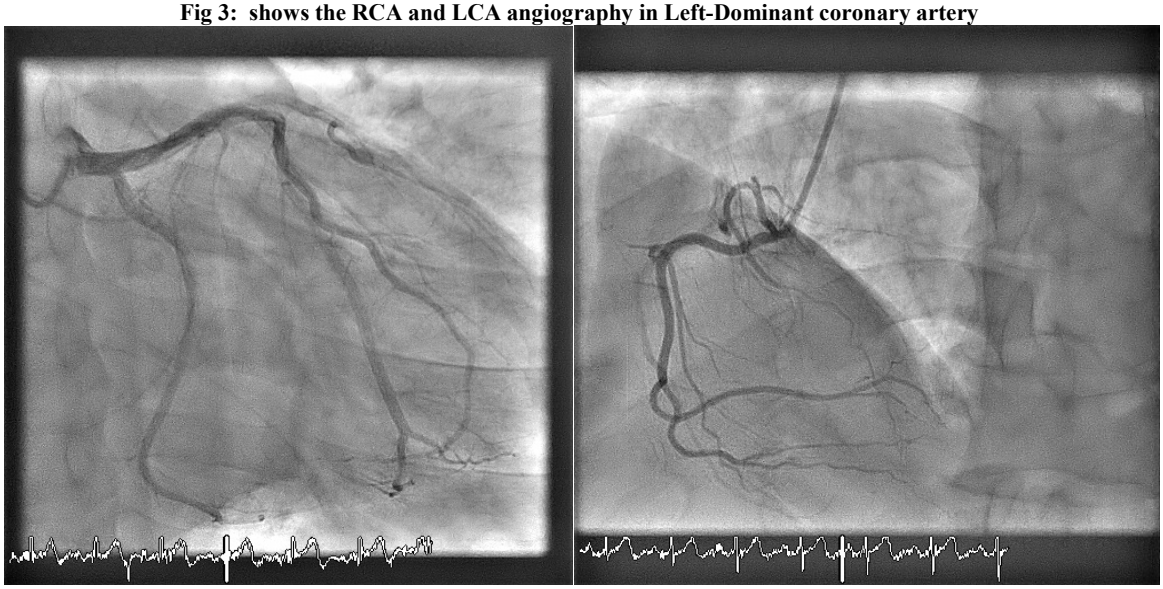

Fig 4: shows the RCA and LCA angiography in Co-Dominant coronary artery

For the site of stenosis the findings showed that 40 (15.4 %) of the patients were normal, 56 (21.54 %) were right dominant stenosis 15% male and 6.54 % females. Left anterior descending artery stenosis were in about 20 (19.24 %) about 38 (14.62 %) males and 4.62 (4.62 %) Females. And in both arteries showed degree of stenosis in 114 (43.85 %) around (33.85 %) males and 12 (10 %) female, 71 (%) left dominant coronary artery 51 (%) males and 20 (7.69%) females (Table 2).

Table 2: shows the site of coronary arteries stenosis among Saudi's males and females

Gender of the Patient	Site Of Stenosis				
	Normal	Right Coronary Artery	Left Anterior Descending Artery "LAD"	Both arteries	Total
Male	34	39	38	88	199
Female	6	17	12	26	61
Total	40	56	50	114	260

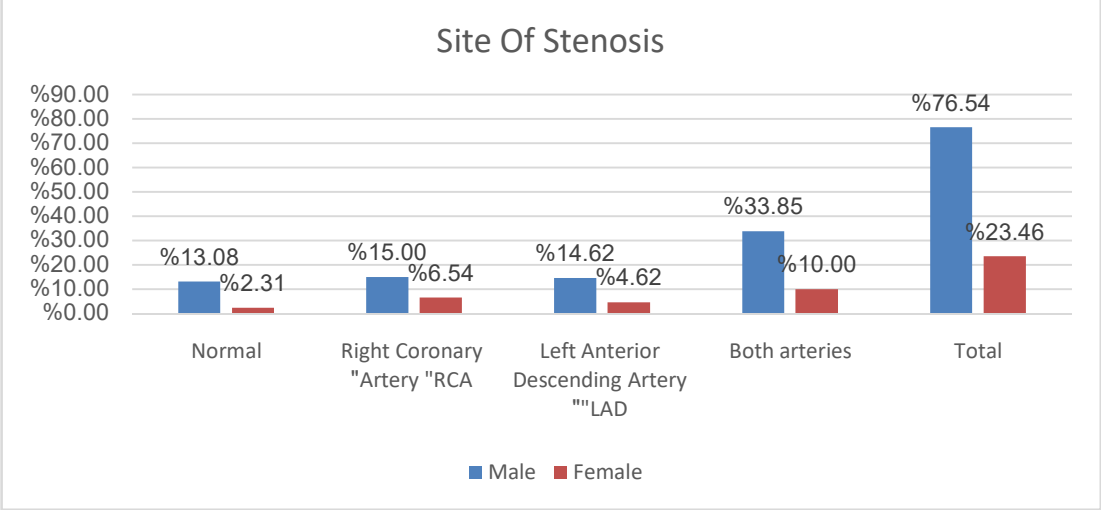

Fig 5: Clustered bar shows the site of coronary arteries stenosis among male and female patients

The data also was tested for the degree of stenosis and distributed according to new grading analysis techniques. It showed according to the recent grading analysis that 34.62 % of the patient had no RCA stenosis and 36.92 had normal LAD, there were about 23.85 % RCA and 20.38 % LAD with diameter reduction less than 50%. Between 50% and 70% diameter reduction the data showed than about 50 (19.23%) had RCA stenosis and 38 (14.42%) in LAD. Also around 50 (19.32 %) were with more than 70% but less than 100% diameter reduction, 50 (19.23 %) were in RCA and 63 (24.23%) in LAD and there were complete occlusion in 8 (3.08 %) of the RCA and 10 (3.85%) of the LAD (Figure 5).

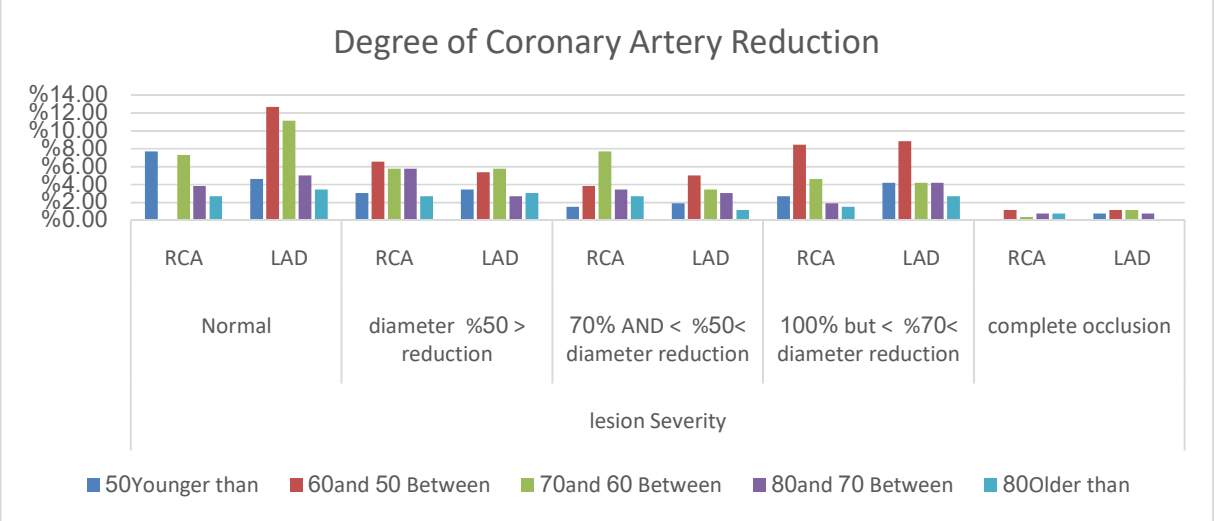

Fig 6: shows the lesion severity according to the most common coronary arteries grading analysis

The finding also showed there is a correlation when comparing the dominant coronary artery to the degree of reduction in the RCA as well as LAD stenosis. This correlation was tested with Cramer's V test for association and the finding showed that there is weak correlation between the dominant coronary artery and the degree of reduction (Tables 3-8, Figures 6-7).

Table 3: shows the degree of RCA stenosis in relation to dominant coronary artery in RCA stenosis

Lesion Severity LAD	Dominant Coronary Artery			Total
	Rt Coronary Artery	Lt Coronary Artery	Co-dominant Artery	
Normal	17 (14.2%)	24 (35.3%)	9 (28.1%)	50 (22.7%)
< 50% diameter reduction	39 (32.5%)	17 (25.0%)	6 (18.8%)	62 (28.2%)
>50% AND < 70% diameter reduction	30 (25.0%)	11 (16.2%)	9 (28.1%)	50 (22.7%)
>70% but < 100% diameter reduction	30 (25.0%)	12 (17.6%)	8 (25.0%)	50 (22.7%)
complete occlusion	4 (3.3%)	4 (5.9%)	0 (0.0%)	8 (3.6%)
Total	120 (100.0%)	68 (100.0%)	32 (100.0%)	220 (100.0%)

Table 4: shows the correlation between DCA and the degree of reduction in RCA stenosis

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.275[a]	8	.039
N of Valid Cases			

a. 3 cells (20.0%) have expected count less than 5. The minimum expected count is 1.16.

Table 5: shows the strength of association between DCA and the degree of reduction in RCA stenosis

		Value	Approx. Sig.
Nominal by Nominal	Cramer's V	.192	.039
N of Valid Cases			

Table 6: Degree of LAD stenosis in relation to dominant coronary artery in LAD stenosis

Lesion Severity LAD	Dominant Coronary Artery			Total
	Rt Coronary Artery	Lt Coronary Artery	Co-dominant Artery	
Normal	47 (39.2%)	6 (8.8%)	3 (9.4%)	56 (25.5%)
< 50% diameter reduction	30 (25.0%)	18 (26.5%)	5 (15.6%)	53 (24.1%)
>50% AND < 70% diameter reduction	15 (12.5%)	16 (23.5%)	7 (21.9%)	38 (17.3%)
>70% but < 100% diameter reduction	22 (18.3%)	24 (35.3%)	17 (53.1%)	63 (28.6%)
complete occlusion	6 (5.0%)	4 (5.9%)	0 (0.0%)	10 (4.5%)
Total	120 (100.0%)	68 (100.0%)	32 (100.0%)	220 (100.0%)

Table 7: shows the correlation between DCA and the degree of reduction in LAD stenosis

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	38.151[a]	8	.000
N of Valid Cases	220		

a. 2 cells (13.3%) have expected count less than 5. The minimum expected count is 1.45.

Table 8: shows the strength of association between DCA and the degree of reduction in LAD stenosis

		Value	Approx. Sig.
Nominal by Nominal	Cramer's V	.294	.000
N of Valid Cases		220	

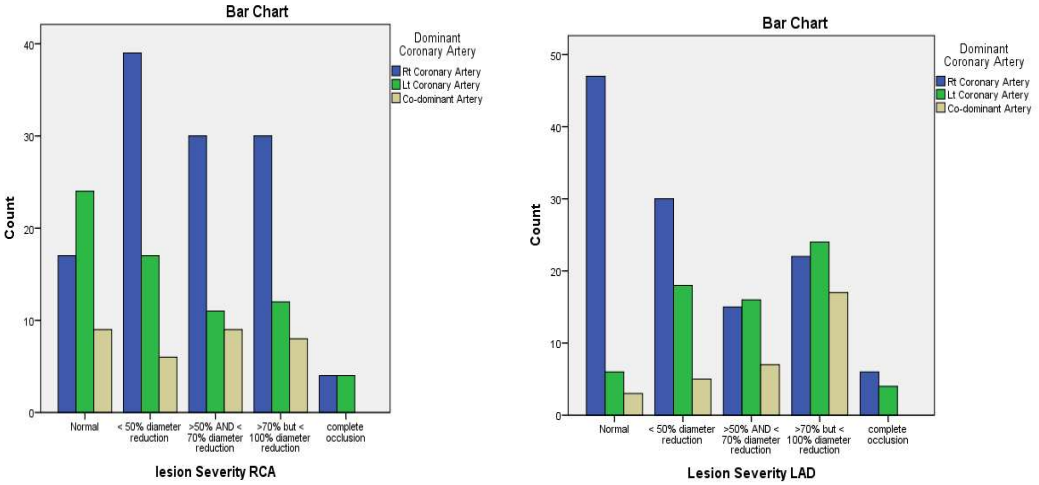

Fig 7: Clustered bar shows the lesion severity of coronary arteries stenosis in the RCA and LAD among male and female patient

DISCUSSION

Our findings showed that among males and females Saudis' patients the majority were RCA dominant (59.23%), they also showed that both RCA and LAD had equal viability to stenosis. No correlation were found between the sex and the site of stenosis. According to the grading analysis the majority of the patients is unlikely to have hemodynamic and clinical significance based upon the severity alone (<50%). The findings also have shown considerable number of patients with high degree of severity >70%, this has been labeled as a threshold for clinical significance [(16)]. Most of those patients had stenosis in both RCA and LAD. There is need to compare the statistics with the other clinical findings [(18, 19, 20)]. No significant correlation was found between the site and degree of stenosis among the patients. But the findings have shown that there is a correlation between the DCA and the degree of reduction in the RCA as well as LAD stenosis, and the correlation was weak when tested with Cramer's V test for association in RCA stenosis (0.192) and LAD stenosis (0.294).

Recommendations

We recommend that future studies must investigated diameter of coronary artery using the different radiological techniques such as 64 slice MSCT scan for determine the waney or tapering of the vessel from the origination site to the termination of the arteries and also to determine the dominance artery in relation to deferent types of ethnic group inside and outside the Kingdom of Saudi Arabia to get define conclusion.

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