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The association of coronary artery disease with age, gender and affected coronary segments

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Abstract

The study aims to determine the age-gender distribution of individuals with and without coronary artery disease (CAD) and to analyze the percentage size of CAD detected in different coronary artery segments by gender, including the right coronary artery (RCA), left main coronary artery (LMCA), circumflex artery (Cx), and left anterior descending artery (LAD). The research was conducted in Batman Training and Research Hospital's digital subtraction angiography (DSA) unit using angiography data obtained between April 2019 and July 2020. Coronary arteries were divided into proximal, middle, and distal segments, and the stenosis size was measured as a percentage for each segment. Among patients with CAD, in the gender distribution, males showed a significantly higher prevalence than females at a rate of 85.62% ($p<0.05$). The group with the highest incidence of disease lesions in the age-related distribution was 51-60, accounting for 32.45% of cases. The most common parts of the narrowing in the distribution according to the coronary artery parts were LAD-middle (64.36%) and RCA-proximal (49.47%). Additionally, in the distribution of the lesioned coronary arteries detected in each heart, the involvement of Cx, LAD, and RCA collectively was the most frequent form of lesioned coronary artery distribution ($p<0.05$). Our study presents detailed data revealing the localization, occlusion size, age, and gender distribution of coronary artery disease, a condition associated with high mortality risk and is therefore of paramount importance. We believe that the presented data are particularly significant in the fields of anatomy, epidemiology, and cardiology.

Keywords: Coronary artery disease, atherosclerosis, coronary segments, gender differences, angiography

Introduction

Coronary artery disease (CAD) is one of the most important health problems in the world, the incidence of which is increasing day by day with the prolongation of life expectancy. According to the World Health Organization, among non-communicable diseases, the diseases that cause the most deaths in the world are ischemic heart disease (death rate: 16%), stroke (death rate: 11%) and chronic obstructive pulmonary disease (death rate: 6%) [1-4].

The main cause of ischemic heart disease, which causes the most deaths, is occlusion in the right and left coronary arteries. This congestion is defined as CAD. Generally, the right side of the heart is supplied by the right coronary artery (RCA), and the left side of the heart is supplied by the left coronary artery (LCA). The left coronary artery consists of a main trunk called the left main coronary artery (LMCA) and two main branches arising from this trunk. These two main branches; called the left anterior descending artery (LAD) and circumflex artery (Cx) [5-8].

The main cause of CAD is atherosclerosis. Factors such as smoking, hypertension, diabetes, chronic infections, and hypercholesterolemia may lead to the development of atherosclerosis. Due to the developing atherosclerosis, plaques form on the intima layer of the coronary arteries and this begins to narrow the lumen of the vessel. This narrowing causes the deterioration of healthy blood flow. Due to advanced plaque development, myocardium may be deprived of oxygen. This can cause sudden death [9-11].

The most used method for locating CAD lesions is digital

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subtraction angiography (DSA). This method improves vascular visibility for diagnostic and treatment decisions [12,13].

The goal of this study is to investigate CAD in terms of lesion site and percentage dimensions using DSA data and to reveal age-sex related distributions.

Material and Methods

This research was approved via the Scientific Research Ethics Committee (Decision No: 257/Date: 15.12.2020) and was made in accordance with the Helsinki Declaration.

This study is a retrospective study. In our study, patients who underwent DSA between April 2019 and July 2020 in the Angiography unit of Batman Training and Research Hospital were examined. Coronary angiography was performed with the DSA (Siemens, artis Zee floor, The Nederland 2011) device as follows; left heart catheterization, right and left coronary angiography were performed selectively with the judkins technique. Contrast agent (350 mg/ml, lohexol opaxol) was used for the procedure. At each position, 6-8 ml of opaque material was manually injected into the coronary arteries.

Those who have undergone bypass surgery and serious coronary artery variation (such as absent left main stem, seperate ostium of conus branch, anomalous location of coronary ostium, single coronary artery, hypoplasia of coronary artery, atresia of coronary artery, actasia of coronary arteries, myocardial bridging) patients were excluded from the study. A total of 240 cases were included in the study. The age limit of the included patients was 28-89, mean age was 58.65±12.40 (mean age for women 58.07±13.10, mean age for men 59.03±11.97)

In the context of patients with CAD, the LMCA was evaluated as a whole. On the other hand, RCA, Cx and LAD were evaluated both as a whole and divided into three parts (proximal-middle-distal) and their parts were evaluated separately. Since these three coronary vessels were considered together; for each patient, the mean of the numerical values detected in the proximal-middle-distal parts of each vessel was calculated. When analyzed by sections, calculations were made separately for the proximal-middle-distal parts of all three vessels in each patient. The boundaries of the separated parts were drawn as follows; proximal RCA (between RCA ostium and sinoatrial nodal artery), middle RCA (between sinoatrial nodal artery ostium and acute margin branch ostium), distal RCA (between acute margin branch ostium and RCA bifurcation point), proximal LAD [from LAD ostium centre to first diagonal branch (D1) ostium level], middle LAD [from D1 ostium level to second diagonal branch (D2) ostium level], distal LAD [from D2 ostium level to beyond], proximal Cx [from the centre of Cx ostium to ostium level of the first obtuse marginal branch (OM1)], middle Cx [from ostium level of OM1 to ostium level of second obtuse marginal branch (OM2)], distal Cx [from the OM2 ostium level to beyond] (Figures 1-3). The percent expression of the lumen narrowing detected in each artery and its parts was calculated by digitally measuring three times and averaging (Figure 4).

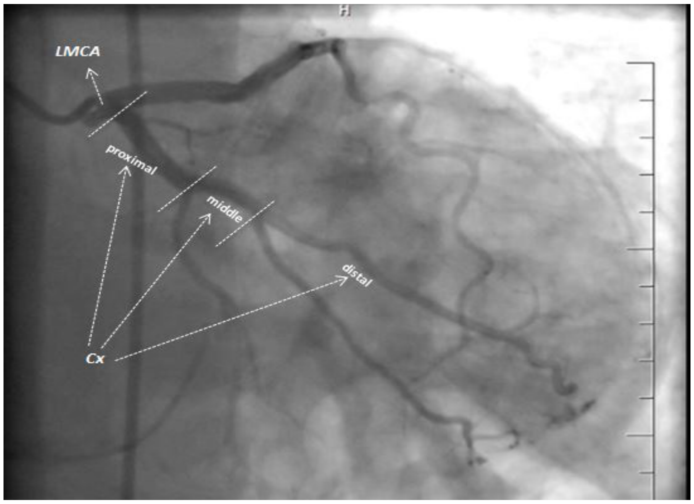

Figure 1. LMCA and proximal-middle-distal parts of the Cx; proximal-Cx [between the centre of the Cx ostium and the level of the OM1 ostium centre], middle-Cx [between the OM1 ostium level and the OM2 ostium level], distal-Cx (OM2 ostium level and beyond] (LMCA: Left main coronary artery, Cx: circumflex artery, OM1: first obtuse marginal branch, OM2: second obtuse marginal branch)

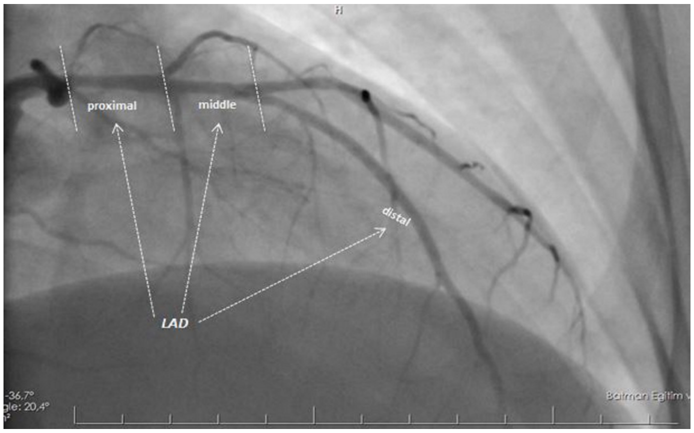

Figure 2. The proximal-middle-distal parts of the LAD; proximal-LAD [between the centre of the LAD ostium and the level of the D1 ostium centre], middle-LAD [between the D1 ostium level and the D2 ostium level], distal-LAD [the D2 ostium level and beyond] (LAD: left anterior descending artery, D1: first diagonal branch, D2: second diagonal branch)

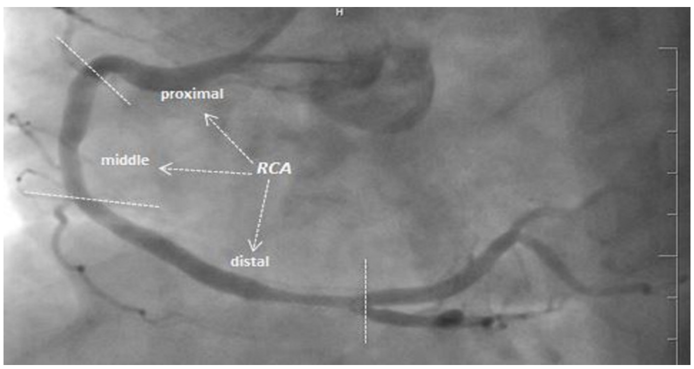

Figure 3. The proximal-middle-distal parts of the RCA; Proximal-RCA (between RCA ostium and sinoatrial nodal artery), Middle-RCA (between sinoatrial nodal artery ostium and acute margin branch ostium), Distal-RCA (between acute margin branch ostium and RCA bifurcation point) (RCA: right coronary artery)

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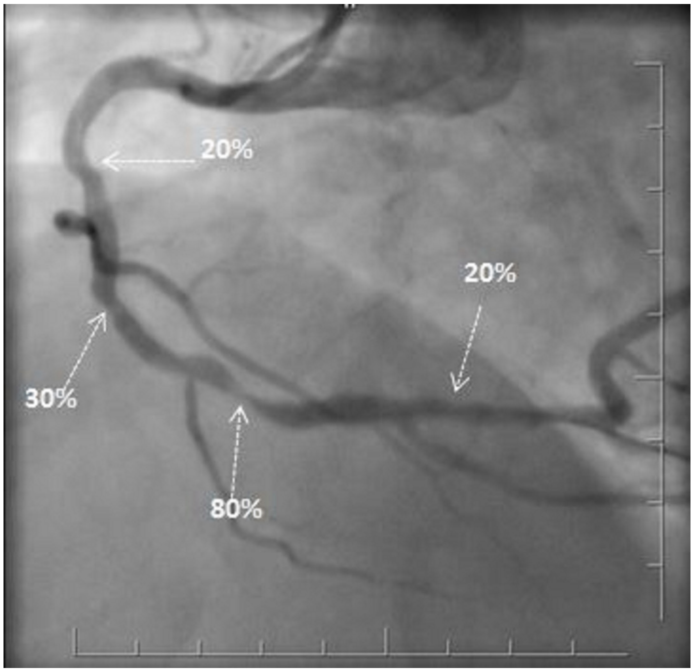

Figure 4. Measurement of coronary artery stenosis

Statistical analyses

Using the SPSS-21 program, statistical analysis of the data was carried out. The Independent Samples t-test and the Chi-Square test were used to compare the genders, with significance levels set at $p<0.05$. Results exceeding this limit were not considered statistically significant. The mean and standard deviation of the data, as well as percentages, were summarized.

Results

In Table 1, when 240 cases were distributed by gender in our study; of 94 female cases; CAD was not detected in 32.98% (31 cases) and CAD was detected in 67.02% (63 cases). In 146 male cases; while 14.38% (21 cases) did not have CAD, 85.62% (125 cases) had CAD. In this comparison between the genders, a statistically significant difference was found ($p<0.05$, $p=0.001$). We calculated a value of $p<0.05$ ($p = 0.012$) in the evaluation by combining all 240 cases according to their ages in the age-based analysis. While 72 of these cases were in the 51-60 age group, 76.39% of them were male cases and 23.61% were female cases. However, when cases with and without CAD were analyzed separately according to age groups, no significant difference was found between genders ($p>0.05$).

Table 1. Distribution of patients with and without CAD by age-groups and gender

Patients with and without CAD	Female	Male	Total	χ2 test	P value
Without CAD	31	21	52 (21.67%)		
With CAD	63	125	188 (78.33%)	11.650	0.001*
Total	94 (39.17%)	146 (60.83%)	240 (100%)		
Distribution of all patients (with and without CAD) by age-groups (n: 240)					
Age-groups	**Female**	**Male**	**Total**	**χ2 test**	**P value**
28-30 age	0	2	2 (0.83%)		
31-40 age	11	9	20 (8.33%)		
41-50 age	21	20	41 (17.08%)		
51-60 age	17	55	72 (30%)	12.802**	0.012*
61-70 age	26	28	54 (22.50%)		
71-80 age	17	26	43 (17.92%)		
81-90 age	2	6	8 (3.33%)		
Total	94 (36%)	146 (64%)	240 (100%)		
Distribution of patients without CAD by age-groups (n: 52)					
Age-groups	**Female**	**Male**	**Total**	**χ2 test**	**P value**
28-30 age	0	0	0		
31-40 age	11	6	17 (32.69%)		
41-50 age	8	5	13 (25.00%)		
51-60 age	3	8	11 (21.15%)	0.438**	0.803
61-70 age	5	2	7 (13.46%)		
71-80 age	4	0	4 (7.70%)		
81-90 age	0	0	0		
Total	31 (59.62%)	21 (40.38%)	52 (100%)		
Distribution of patients with CAD by age-groups (n: 188)					
Age-groups	**Female**	**Male**	**Total**	**χ2 test**	**P value**
28-30 age	0	2	2 (1.06%)		
31-40 age	0	3	3 (1.60%)		
41-50 age	13	15	28 (14.89%)		
51-60 age	14	47	61 (32.45%)	6.251**	0.100
61-70 age	21	26	47 (25.00%)		
71-80 age	13	26	39 (20.74%)		
81-90 age	2	6	8 (4.26%)		
Total	63 (33.51%)	125 (66.49%)	188 (100.00%)		

*p<0.05, ** chi-square test (χ2) test; groups with less than 5 patients were added to the groups closest to them. CAD: coronary artery disease

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In Table 2, the percentage values of coronary artery disease detected in the whole LMCA and in the proximal-middle-distal parts of the RCA, Cx and LAD separately were shown. These values were distributed and analyzed by gender. According to these analyzes; A total of 41 (21.8%) patients in the RCA-distal fragment had CAD size 40.76±13.82% for women and 68.18±30.41% for men, which was statistically significant ($p<0.05$, p=0.004).

In Table 3, coronary arteries with CAD were grouped separately for each patient and coronary arteries with concomitant narrowing were shown as percentages. Non-CADs were also considered as a separate group. In this distribution, it was seen that men had a higher rate overall (Figure 5.). Analyzes made according to this grouping showed that there was a significant difference between the genders ($p<0.05$, p=0.001). 'Notably, blockage of the Cx, LAD, and RCA was seen in 65 cases (27.08%), whereas just LAD occlusion was found in 21 individuals (8.75%).

Table 2. Percentage expression and gender distribution of lumen stenosis detected in LMCA and LAD-Cx-RCA proximal-middle-distal parts (n:188)

Lumen stenosis	Sex	N	Total (n/%)	Mean.±SD (%)	Overall mean.±SD(%)	t test	p value
LMCA	Female	4	10 (5.32%)	45.00±17.32	41.±13.70	0.734	0.484
	Male	6		38.33±11.69			
Cx-proximal	Female	17	57 (30.32%)	57.05±28.01	53.91±26.64	0.578	0.566
	Male	40		52.57±26.29			
Cx-middle	Female	21	56 (29.79%)	59.14±32.90	61.48±30.91	-0.435	0.665
	Male	35		62.88±30.05			
Cx-distal	Female	9	41 (21.81%)	61.11±23.68	61.87±29.75	-0.086	0.932
	Male	32		62.09±31.58			
LAD-proximal	Female	22	76 (40.43%)	58.95±30.41	58.51±28.92	0.084	0.933
	Male	54		58.33±28.59			
LAD-middle	Female	36	121 (64.36%)	61.61±26.59	61.31±27.43	0.077	0.939
	Male	85		61.18±27.93			
LAD-distal	Female	10	43 (22.87%)	54.00±23.66	51.74±24.85	0.324	0.747
	Male	33		51.06±25.51			
RCA-proximal	Female	29	93 (49.47%)	61.17±30.64	57.01±29.71	0.908	0.366
	Male	64		55.12±29.33			
RCA-middle	Female	28	71 (37.77%)	58.50±25.80	59.36±27.02	-0.216	0.829
	Male	43		59.93±28.07			
RCA-distal	Female	13	41 (21.81%)	40.76±13.82	59.48±29.13	-3.088	**0.004***
	Male	28		68.18±30.41			

*p<0.05, LMCA: left main coronary truncus, Cx: circumflex artery, LAD: left anterior descending artery, RCA: right coronary artery

Table 3. Distribution of CAD and non-CADs coronary arteries according to gender (n: 240)

CAD and Non-CADs coronary arteries	Sex		Total	χ2 test	p value
	Female	Male			
Non-CADs	31	21	52 (21.67%	21.184**	**0.001***
With CAD (blockage segments)					
Cx+LAD+RCA	21	44	65 (27.08%)		
LAD+RCA	11	24	35 (14.58%)		
Cx+LAD	3	25	28 (11.67%)		
LAD	11	10	21 (8.75%)		
Cx+RCA	8	9	17 (7.08%)		
RCA	5	3	8 (3.33%)		
LMCA+Cx+LAD+RCA	4	2	6 (2.50%)		
LMCA+Cx+RCA	0	2	2 (0.83%)		
LMCA+Cx+LAD	0	1	1 (0.42%)		
LMCA+LAD+RCA	0	1	1 (0.42%)		
Cx	0	4	4 (1.67%)		
Total	94 (39.17%)	146 (60.83%)	240 (100%)		

*p<0.05, +'s indicate co-involvement. **chi-square test (χ2) test; groups with less than 5 patients were added to the groups closest to them. CAD: coronary artery disease, LMCA: left main coronary truncus, Cx: circumflex artery, LAD: left anterior descending artery, RCA: right coronary artery

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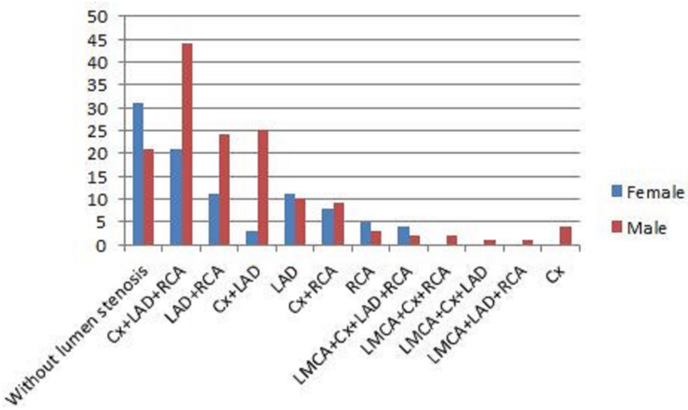

Figure 5. Distribution of CAD (+'s indicate that congestion was detected simultaneously in the specified segments) and Non-CADs (without lumen stenosis) coronary arteries according to gender

Discussion

According to the data of the Turkish Ministry of Health, coronary artery disease, the prevalence of which is increasing in our country, is an important health problem that may cause unexpected deaths. Again, according to data estimates, it is said that deaths due to cardiovascular diseases will exceed 22 million by 2030 and will constitute 45.1% of all deaths by 2035 [14-15].

According to the results and analyzes determined between men and women in our study, it can be clearly said that men are a more risky group. Males accounted for 188 (78.33%) of all cases. In the age-related distributions, it was observed that coronary artery lumen narrowing was more common in the 51-60 age group (72 patients; 30%). In this group, the majority is again men (55 patients; 76.39%) (Table 1.). This result may be related to the high rate of smoking in men, lack of physical activity and body mass index.

When we evaluate the coronary arteries and their proximal-middle-distal parts separately in terms of CAD; the highest rate of obstruction was as follows; LAD-middle 121 (64.4%), RCA-proximal 93 (49.5%), LAD-proximal 76 (40.4%) cases. It is clear that CAD is most common in the LAD among the coronary arteries, and this number is higher in men (Table 2). Mizgala et al., in their coronary autopsy study, they defined left main coronary artery narrowing as more than 50% in 17 autopsies and stated that 13 of this group were male [16]. As a result of their study, they emphasized that male shrinkage rates were higher in general. These results are in agreement with our study.

In our literature review, the studies with CAD generally focus on the relationships between CAH and risk factors (such as age, nutrition, physical activity, hypertension, diabetes, tobacco use, alcohol use, salt use) [17-21]. In these studies, we did not find the lesion area, the lesion percentage, and the results of these results compared between genders. Our own study, in which these comparisons were made, differs from other studies in this respect.

Limitations of the study; being a retrospective study, it only covers the Batman region.

Conclusion

In our study, we tried to explain in detail the age-gender distributions of coronary artery disease detected in percentage. We think that the data we presented will be useful in anatomy, epidemiology and cardiology sciences. At the same time, in the light of these data, we recommend that more public health studies should be conducted, especially in the male population. Again, we believe that our study will provide support for future research on this subject.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
This study was approved by the Scientific Research Ethics Committee of Batman Training and Research Hospital (Decision Date/No: 15.12.2020/257).

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