

# The Impact of Age, Sex and Coronary Dominance on the Morphological Characteristics of the Left Main Coronary Artery in Jordanian Population

Impacto de la Edad, el Sexo y la Dominancia Coronaria en las Características Morfológicas de la Arteria Coronaria Izquierda en la Población Jordana

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**SUMMARY:** To examine the correlation between the anatomical variations of the left main coronary artery (LMCA) and age, sex and coronary dominance in Jordanian population. A retrospective cohort study was conducted on 212 patients (127 males and 85 females; mean age of  $56 \pm 11.1$  and ranged from 28 - 81 years) with normal coronary arteries on angiograms were enrolled in this study. Coronary angiograms were retrieved from the database archive from January to July 2021 and reviewed by two independent experienced interventional cardiologists. The length and the branching pattern of the LMCA, the termination pattern of the left anterior descending (LAD) artery and the pattern of coronary dominance were determined. The collected data were subjected to statistical analysis. The length of the LMCA was ranged from 2.8 - 22.2 mm. The ramus intermedius (RI) artery was observed in 21.7 % of cases. The LAD artery has terminated before the apex in 15.1%, at the apex in 31.1% and wrapped around the apex in 53.8 % of cases. A positive correlation was observed between the length of the LMCA and the number of its terminal branches. Also, significant differences were detected in the length of the LMCA between sexes with the tendency of having a short LMCA found in females. The pattern of coronary dominance has a low impact on the LMCA morphology where patients with right dominant (RD) pattern tended to have the longest LMCA with trifurcation pattern. However, age did not show any significant correlation. The present study revealed that the length of the LMCA is sex-specific and females are affected more by the consequences of the short LMCA than males. The data of this study could help understand the clinical problems that might be associated with some of these variants for good clinical outcomes.

**KEY WORDS:** The left main coronary artery; Left anterior descending artery; Termination pattern; Angiography.

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## INTRODUCTION

Coronary artery disease (CAD) is one of the cardiovascular diseases (CVDs) that is considered a leading cause of mortality and morbidity worldwide. According to the World Health Organization (WHO), CAD affects 110 million people and is the cause of 8.9 million deaths (15.9 % of deaths) annually. The prevalence of CAD death is predicted to reach 23.6 million people worldwide in 2030. In Jordan, CAD is the main cause of death and is responsible for 18.60% of the total deaths in 2020 (Al-Zaru *et al.*, 2020).

The left main coronary artery (LMCA) and its branches irrigate vital heart structures. Diseases affecting the LMCA remain an important risk factor for increased mortality and morbidity worldwide. Like many organs in

the body, the heart is subjected to wide anatomical variations in its coronary arteries and their main branches. Based on their anatomical features, normal coronary arteries are known as any morphological features that usually occur in the majority of the general population. Any deviations in what habitually occurred in the coronary arteries and their main branches regarding their origin, length and termination patterns are defined as anatomical variations and observed in more than 1 % of the same population. These deviations may be a boon or a bane for the patients with one. Many factors such as genetic, environment, pathological and developmental conditions can affect the morphological characteristics of the coronary arteries (Angelini *et al.*, 1999).

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The LMCA normally emerges from the ostium in the left posterior aortic sinus of Valsalva of the ascending aorta. Habitually it took a short path of 5-15 mm before it bifurcated into two branches: the anterior interventricular artery (also known as left anterior descending, LAD or anterior coronary artery of Vieussens) and the left circumflex (LCX) artery. Sometimes the main trunk may divide into more than two terminal branches, giving off one or more median (intermediate or ramus intermedius, RI) artery/ies between the LAD artery and the LCX artery forming trifurcation, quadrifurcation or pentafurcation pattern of termination (Angelini *et al.*, 1999; Vilallonga, 2003).

The number of diagnostic and therapeutic interventional procedures and cardiac surgeries has amplified as a result of increased prevalence of patients who have CAD. The familiarity of the LMCA anatomy and its anatomical variations is of great interest to many investigators since it has relevant clinical and surgical implications. The best way to avoid injury to blood vessels is to know all possible variations in their course, distribution and branches. Anatomists and cardiologists are responsible for researching, understanding and spreading the knowledge of the various anatomical variations of coronary arteries and their main branches (Kosar *et al.*, 2009)

There is scarce information about anatomical variations of the coronary arteries and their main branches among Jordanian population. The present work intends to inspect how various factors such as age, sex and the pattern of coronary dominance influence the structural characteristics of the LMCA in patients with healthy coronary arteries using conventional coronary angiography (CCA). As a result, more information about the impact of these variables on anatomical variations will enhance the knowledge of interventional cardiologists and cardiovascular surgeons, helping them understand the clinical problems that might be associated with some of these variants to perform various procedures and cardiac surgeries without catastrophic complications. Besides, aiding them in correctly interpreting the angiogram findings and improves the prognosis for good clinical outcomes.

## MATERIAL AND METHOD

A retrospective cohort study was carried out on patients who underwent CCA at the catheterization section of the Cardiology and Cardiovascular Surgery clinics at the Jordan University Hospital (JUH) from January to July 2021. Coronary angiograms were retrieved from the

database archive and reviewed by two independent experienced interventional cardiologists after the Ethics Committee and Institutional Review Board (IRB) of JUH confirmed and approved the present study (IRB approval No. 276/2021). The informed consent was not applicable due to the retrospective design of the study that was conducted in compliance with the ethical standards of the JUH Ethics Committee and conformed to the principles of the Declaration of Helsinki.

Only patients with normal coronary arteries on angiograms and above the age of 18 years were enrolled in this study. Patients with a history of congenital heart disease, obstructive coronary arteries, coronary artery bypass graft surgery (CABG), coronary interventions (such as balloon or stenting) or anomalies were excluded. Age and sex data were obtained from the hospital's medical records.

CCA was performed by trained invasive cardiologists using Seldinger's standard technique. The recommended angiographic standard views were obtained from the Philips Medical System (Model- Cardio Vascular - Allura Centron, Netherlands) and Siemens Healthcare GmbH (Model MEGALIX Cat Plus, Erlangen, Germany). The RadiAnt DICOM viewer 2021.1(64-bit), a software program, was used for coronary angiogram visualization.

The length of the LMCA was measured from its origin to the point of its division three times and the average value was recorded as the final data. According to McAlpine's (1975) criteria, the LMCA was classified as short when measuring  $\leq 5$  mm, long when its length is  $> 15$  mm and normal when its length is  $> 5$  mm and  $\leq 15$  mm. Its termination pattern was determined based on the number of branches emerging from its main trunk. The termination pattern of the LAD artery was specified depending on the endpoint of the artery relative to the apex of the heart. The pattern of coronary dominance was recognized based on which artery gives off the posterior descending artery (PDA) and/ or at least one of the posterolateral left ventricular branches (PLVs) as right dominant (RD), left-dominant (LD) and codominant (CD).

**Statistical analysis.** The obtained data were tabulated and analyzed using the Statistical Package for Social Sciences (SPSS) version 22 (SPSS Inc., Chicago, IL). Categorical variables were expressed using frequency and percentage. Numerical variables were presented using the mean  $\pm$  standard deviation. Spearman's rho and Mann-Whitney's tests were performed to test the association between the studied anatomical variations with age, sex and coronary artery dominance. The P-values less than 0.05 will be considered to have a statistically significant correlation.

## RESULTS

Two hundred and twelve patients (127 males and 85 females) with normal coronary arteries on angiograms were enrolled in this study. Their ages ranged from 28 - 81 years with a mean age of  $56 \pm 11.1$  years and were categorized into 5 age groups (less than 40 years, 40 - 49 years, 50 - 59 years, 60 - 69 years and 70 years and more). The majority of patients (59.4 %) were in their 5<sup>th</sup> and 6<sup>th</sup> decades of life.

The average length of the LMCA was  $10.2 \pm 3.9$  mm ranging from 2.8 - 22.2 mm. It was within the normal limits in 153 (72.2 %) cases, whereas short LMCA was observed in 26 (12.3 %) and long LMCA in 33 (15.6 %) cases. The most frequent pattern of the LMCA division was bifurcation which was observed in 166 (78.3%) cases while the RI artery was detected only in 46 (21.7 %) cases. Furthermore, the termination patterns of the LAD artery were before the apex in 32 (15.1 %) and at the apex in 66 (31.1 %) cases; whereas in more than half of the cases, 114 (53.8 %) the LAD artery was wrapped around the apex running in the inferior interventricular groove. Based on the definition of coronary dominance adopted in the present work, the patterns of coronary dominance were RD in 158 (74.5 %), LD in 32 (15.1 %) and CD in 22 (10.4 %) of the cases. Different angiographic images of various anatomical variations of the LMCA are shown in Figures 1, 2 and 3.

The impact of age on the LMCA was investigated using Spearman's rho correlation test. It was noticed that

age does not affect the LMCA length (short, normal or long) and its termination patterns as well as the termination patterns of the LAD artery ( $P > 0.05$ ) (Table I). Further analysis showed a significant weakly positive correlation between the length of the LMCA and its termination patterns ( $r_s = 0.317$ ,  $P\text{-value} = 0.000$ ). The length of the LMCA was longer with the increasing number of its terminal branches. The mean length of the LMCA was  $9.5 \pm 3.6$  mm (ranging from 2.8 - 18.7 mm) in the bifurcation pattern while in the trifurcation pattern was  $12.8 \pm 4.2$  mm (ranging from 4.8 - 22.2 mm).

Statistically significant differences in the length of the LMCA were detected between sexes ( $Z = -2.863$ ,  $P\text{-value} = 0.004$ ) using the Mann-Whitney test with the tendency of having a short LMCA found in females and a long LMCA in males. The mean length of the LMCA was  $9.3 \pm 3.8$  mm in females and  $10.9 \pm 3.9$  mm in males. On the other hand, no statistically significant association was noticed between the termination patterns of the LMCA and the termination patterns of the LAD artery with sex ( $P > 0.05$ ) (Table II).

Looking at the correlation between the length of the LMCA and the various patterns of coronary dominance showed a poor statistically significant correlation ( $r_s = -0.119$ ,  $P\text{-value} = 0.084$ ). The average length of the LMCA was higher in patients who had the RD ( $10.5 \pm 3.9$  mm) followed by those with the LD ( $9.6 \pm 3.7$  mm) than those with the CD ( $9.2 \pm 4.4$  mm). Also, a poor statistically

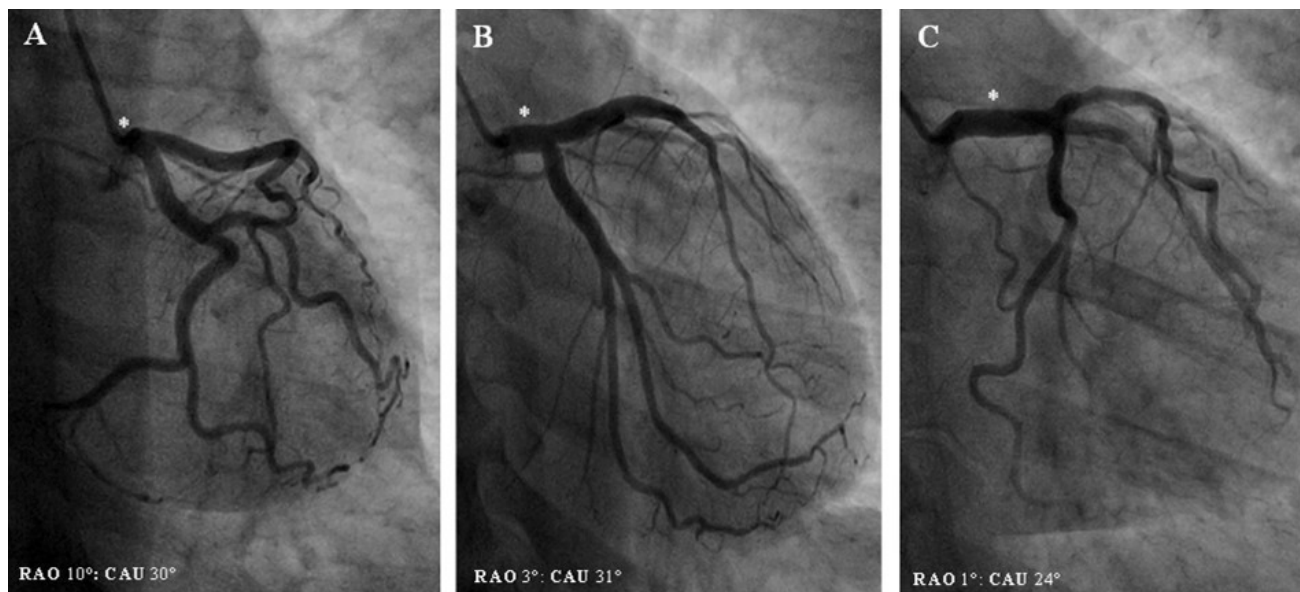


Fig. 1. Angiographic images showing the 3 different classes of the LMCA length. An asterisk (\*) indicates the LMCA: Left main coronary artery; A: Short LMCA; B: Normal LMCA; C: Long LMCA; RAO: Right anterior oblique; CAU: Caudal.

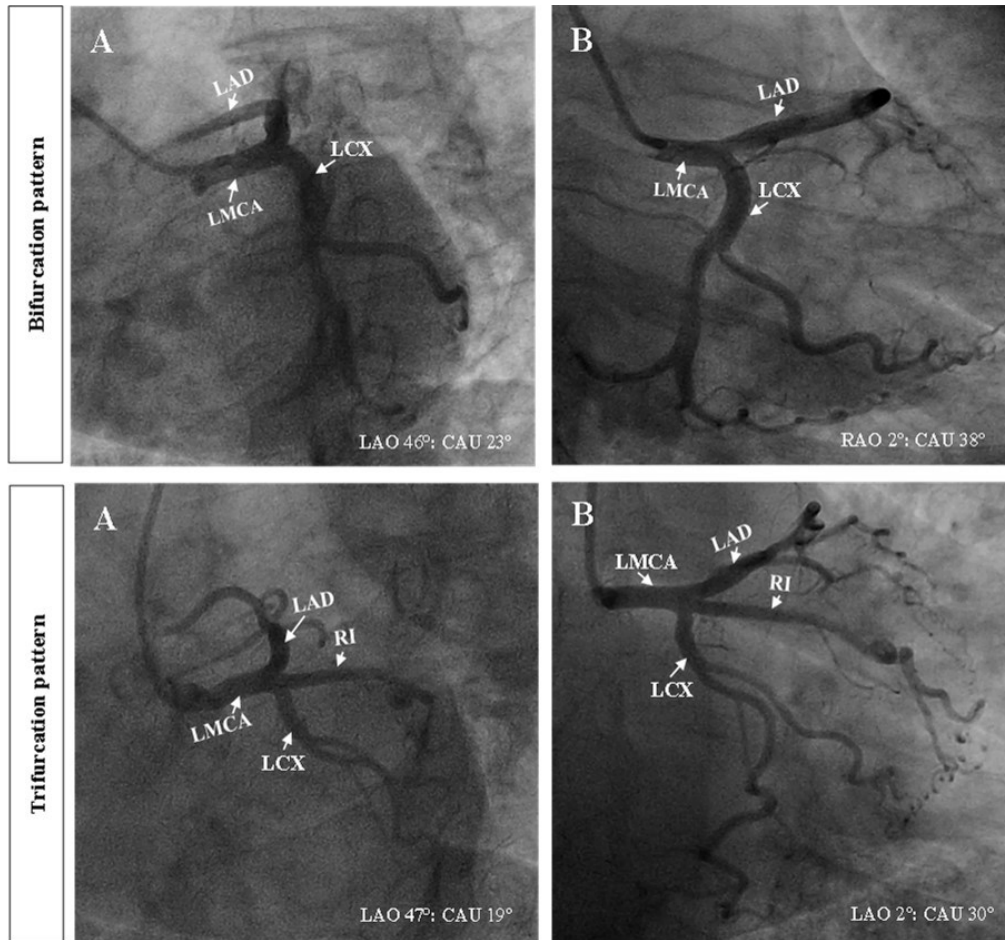


Fig. 2. Angiographic images showing the different termination patterns of the LMCA. A and B in each pattern are different angiographic views for the same patient. LMCA: Left main coronary artery; LCX: Left circumflex; LAD: Left anterior descending; RI: Ramus intermedius; LAO: Left anterior oblique; RAO: Right anterior oblique; CAU: Caudal.

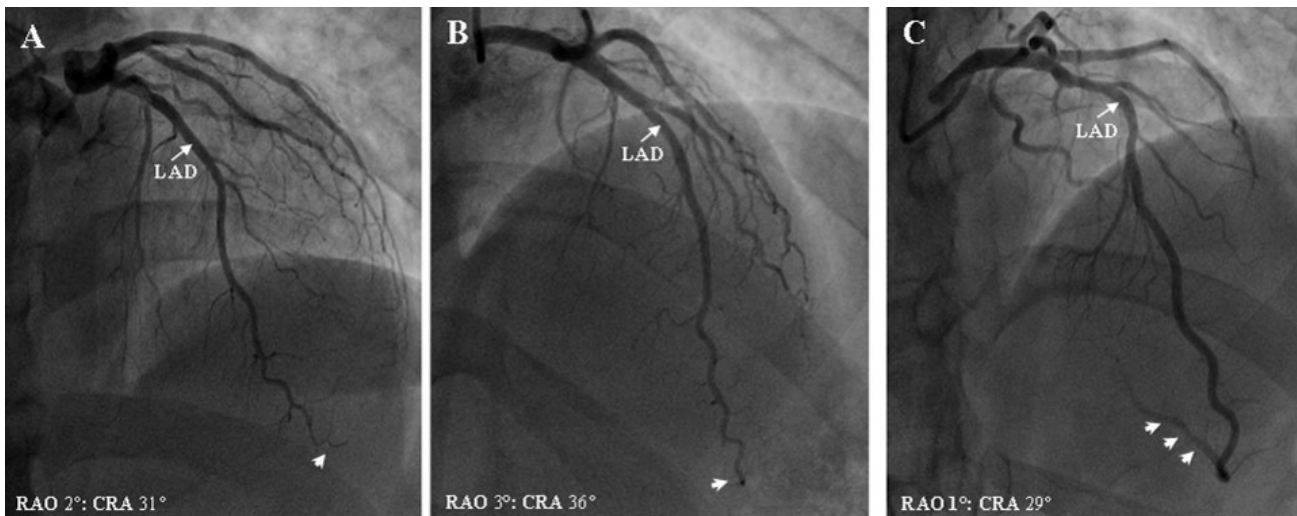


Fig. 3. Angiographic images showing the different termination patterns of the LAD artery. The Arrowhead indicates the LAD artery termination. A: Before the apex; B: At the apex; C: Wrapping around the apex; LAD: Left anterior descending; RAO: Right anterior oblique; CRA: Cranial.

significant very weak correlation was detected between the different patterns of coronary dominance and the termination patterns of the LMCA ( $r_s = -0.168$ , P-value = 0.014). The proportion of patients with the trifurcation pattern was more common in patients with the RD followed by those with the CD than those with the LD. No statistically

significant correlation was noticed between the different patterns of coronary dominance and the LAD artery termination patterns ( $r_s = -0.113$ , P-value = 0.100). Despite that, the LAD artery was shorter in RD patients and was terminated before the apex compared with those with the LD and the CD (Table III).

Table I. The impact of age on the morphological characteristics of the LMCA.

Overall (n = 212)	Age groups (years)				
	< 40 (n = 15)	40 - 49 (n = 42)	50 - 59 (n = 76)	60 - 69 (n = 50)	≥70 (n = 29)
<b>Length of LMCA</b>					
Short (n = 26)	1 (6.7 %)	2 (4.8 %)	11 (14.5 %)	10 (20.0 %)	2 (6.9 %)
Normal (n = 153)	11 (73.3 %)	34 (80.9 %)	51 (67.1 %)	33 (66.0 %)	24 (82.8 %)
Long (n = 33)	3 (20.0 %)	6 (14.3 %)	14 (18.4 %)	7 (14.0 %)	3 (10.3 %)
$r_s$ value			- 0.129		
P value			0.061 <sup>ns</sup>		
<b>Termination Patterns of LMCA</b>					
Bifurcation (n = 166)	11 (73.3 %)	33 (78.6 %)	56 (73.7 %)	44 (88 %)	22 (75.9 %)
Trifurcation (n = 46)	4 (26.7 %)	9 (21.4 %)	20 (26.3 %)	6 (12 %)	7 (24.1 %)
$r_s$ value			- 0.052		
P value			0.448 <sup>ns</sup>		
<b>Termination Patterns of LAD</b>					
Before Apex (n = 32)	2 (13.3 %)	5 (11.9 %)	14 (18.4 %)	6 (12 %)	5 (17.2 %)
At Apex (n = 66)	5 (33.3 %)	14 (33.3 %)	23 (30.3 %)	16 (32 %)	8 (27.6 %)
Wrapped around apex (n = 114)	8 (53.4 %)	23 (54.8 %)	39 (51.3 %)	28 (56 %)	16 (55.2 %)
$r_s$ value			0.003		
P value			0.960 <sup>ns</sup>		

\*Significant, <sup>ns</sup>not significant.

Table II. The impact of sex on the morphological characteristics of the LMCA.

Overall (n = 212)	Sex	
	Male (n = 127)	Female (n = 85)
<b>Length of LMCA</b>		
Short (n = 26)	10 (7.9 %)	16 (18.8 %)
Normal (n = 153)	92 (72.4 %)	61 (71.8 %)
Long (n = 33)	25 (19.7 %)	8 (9.4 %)
Z value		- 2.863
P value		0.004*
<b>Termination Patterns of LMCA</b>		
Bifurcation (n = 166)	95 (74.8 %)	71 (83.5 %)
Trifurcation (n = 46)	32 (25.2 %)	14 (16.5 %)
Z value		- 1.507
P value		0.132 <sup>ns</sup>
<b>Termination Patterns of LAD</b>		
Before Apex (n = 32)	21 (16.5 %)	11 (12.9 %)
At Apex (n = 66)	39 (30.7 %)	27 (31.8 %)
Wrapped around apex (n = 114)	67 (52.8 %)	47 (55.3 %)
Z value		- 0.523
P value		0.601 <sup>ns</sup>

\*Significant, <sup>ns</sup>not significant.

Table III. The impact of the pattern of coronary dominance on the morphological characteristics of the LMCA.

Overall (n = 212)	Coronary Dominance		
	Right dominant (n = 158)	Left dominant (n = 32)	Codominant (n = 22)
Short (n = 26)	17 (10.8 %)	3 (9.4 %)	6 (27.3 %)
Normal (n = 153)	114 (72.1 %)	27 (84.4 %)	12 (54.5 %)
Long (n = 33)	27 (17.1 %)	2 (6.2 %)	4 (18.2 %)
r <sub>s</sub> value		- 0.119	
P value		0.084 <sup>ns</sup>	
<b>Termination Patterns of LMCA</b>			
Bifurcation (n = 166)	117 (74.1 %)	30 (93.8 %)	19 (86.4 %)
Trifurcation (n = 46)	41 (25.9 %)	2 (6.2 %)	3 (13.6 %)
r <sub>s</sub> value		- 0.168	
P value		0.014 <sup>ns</sup>	
<b>Termination Patterns of LAD</b>			
Before Apex (n = 32)	27 (17.1 %)	3 (9.4 %)	2 (9.1 %)
At Apex (n = 66)	51 (32.3 %)	8 (25 %)	7 (31.8 %)
Wrapped around apex (n = 114)	80 (50.6 %)	21 (65.6 %)	13 (59.1 %)
r <sub>s</sub> value		0.113	
P value		0.100 <sup>ns</sup>	

\*Significant, <sup>ns</sup>not significant.

## DISCUSSION

Coronary arteries and their main branches display a wide variability in their morphology regarding their origin, length, course, termination patterns and the pattern of coronary dominance. Most of these variations are clinically benign without symptoms and are discovered incidentally during medical procedures. On the other hand, if these variations are not recognized on time, it may lead to misinterpretations and catastrophic complications during coronary interventional procedures and cardiac surgery (Angelini *et al.*, 1999; Kosar *et al.*, 2009).

In the Literature, numerous studies mentioned various anatomical variations of the LMCA in terms of the length, number of its terminal branches and the termination patterns of the LAD artery (Table IV). The present work retrospectively inspects these variations to assess the susceptibility of various anatomical variations to be affected by age, sex and the pattern of coronary dominance in patients with healthy coronary arteries and to assist interventional cardiologists and cardiovascular surgeons in understanding the clinical problems that might be associated with some of these variants for significant clinical outcomes.

The LMCA length impacts therapeutic options in the management of CAD. In the majority of hearts, the normal LMCA length is ranged between 5 - 15 mm long whereas the extreme values of the LMCA length are considered as variations. Short LMCA increases the technical complexity during interventional and surgical procedures. As a result, inadequate coronary perfusion for a patient who had a short LMCA during surgical operations

like aortic valve replacement causes myocardial ischemia in the territory of the non-intubated terminal branch that may lead to ventricular arrhythmias, myocardial heart attack or both. Also, short LMCA was reported as a risk factor for developing coronary atherosclerosis and the incidence of blockage in the left branch of the bundle of His. Some authors explained that the initial segments of its terminal branches were subjected to a certain degree of twisting and tangling during systole that increases the mechanical stress undergone by its walls leading to intimal changes and atherosclerotic degeneration. Consequently, the impairment of blood supply to the bundle of His led to its blockage specifically when the lesion injured the initial part of the LAD (Kronzon *et al.*, 1974; Reig & Petit, 2004; Ballesteros & Ramirez, 2008; Tomar *et al.*, 2013; Diwan *et al.*, 2017; Javed *et al.*, 2023).

In the present study, no statistically significant correlation was found between the length of the LMCA and age which was in agreement with the results of Diwan *et al.* (2017) and Javed *et al.* (2023). While significant differences in the length of the LMCA were noticed between sex; the mean length of the LMCA for females ( $9.3 \pm 3.8$  mm) and for males ( $10.9 \pm 3.9$  mm) with the tendency of having a short LMCA found in females and a long LMCA in males. These findings were contradicted by what was reported by other investigators who denied the presence of any significant correlation between the length of LMCA and sex (Abedin & Goldberg, 1978; Zeina *et al.*, 2007; Ajayi *et al.*, 2013; Tomar *et al.*, 2013; Diwan *et al.*, 2017; Javed *et al.*, 2023).

Table IV. Comparison of the results of many studies in the literature regarding the LMCA morphological characteristics.

Author	Year	No.	Metho ds	LMCA length		LMCA branches					LAD artery termination		
				Average	Range	2	3	4	5	Before apex	At apex	Wrapped around	
Abedin & Goldberg	1978	37	Angiograms	9.7 ± 4.3									
Ilia <i>et al.</i>	2001	200	Angiograms										
Reig & Petit	2004	95	Dissection	10.8 ± 5.52	2.0 - 23.0	62.0 %	38.0 %				10.5 %	22.5 %	67.0 %
Zeina <i>et al.</i>	2007	70	Angiograms	10.5 ± 4.0									
Ballesteros & Ramirez	2008	154	Dissection	6.48 ± 2.57		52.0 %	42.2 %	5.8 %			1.3 %	27.8 %	70.9 %
Christensen <i>et al.</i>	2010	105	Dual source CT	9.9 ± 4.15	2.0 - 21.0	81.0 %	19.0 %						
Erol & Seker	2012	2096	Angiograms				31.3 %						
Ajayi <i>et al.</i>	2013	151	Angiograms	10.4 ± 4.1	2.8 - 23.9	80.8 %	18.5 %	0.7 %					
Tomar <i>et al.</i>	2013	50	MDCT	7.11 ± 3.04	1.8 - 15.0	76.0 %	24.0 %						
Altin <i>et al.</i>	2015	5548	Angiograms			89.0 %	11.0 %						
Ogeng'o <i>et al.</i>	2016	208	Dissection								8.2 %	23.0 %	68.8 %
Diwan <i>et al.</i>	2017	1115	Angiograms			84.0 %	16.0 %						
Pereira da Costa Sobrinho <i>et al.</i>	2019	63	Dissection	8.53 ± 4.03	1.9 - 22.7	39.7 %	52.4 %	7.9 %					
Abeb & Seyoum	2020	30	Dissection			56.7 %	26.7 %	16.6%					
Kannabathula <i>et al.</i>	2022	100	Dissection	10.2	3.0 - 25.0	76.0 %	20.0 %	2.0 %					
Javed <i>et al.</i>	2023	1500	MDCT			71.7 %	25.1 %	2.7 %					
Present study	2025	212	Angiograms	10.2 ± 3.9	2.8 - 22.2	78.3 %	21.7 %				15.1 %	31.1 %	53.8 %

CT: Computed tomography; MDCT: Multi-detector computed tomography.

Concerning the correlation between the different patterns of coronary dominance and the length of the LMCA, a poor statistically significant but weak correlation was noticed which was in agreement with the results of several studies (Kronzon *et al.*, 1974; Reig & Petit, 2004; Tomar *et al.*, 2013; Diwan *et al.*, 2017). While, other researchers denied the presence of such a statistical correlation (Christensen *et al.*, 2010; Ajayi *et al.*, 2013; Javed *et al.*, 2023). However, the average length of the LMCA was higher in patients who had the RD followed by those with the LD than those with the CD. These results confirmed the association between the highest length of the LMCA and the RD and the shortest length of the LMCA with the CD followed by the LD as mentioned by further researchers (Kronzon *et al.*, 1974; Reig & Petit, 2004; Ajayi *et al.*, 2013; Tomar *et al.*, 2013; Kannabathula *et al.*, 2022).

Considerable variations in the termination patterns of the LMCA were reported by various authors. The presence of RI artery/ies as additional terminal branches is of clinical importance. It may cause technical difficulties during coronary catheterization and may lead to misdiagnosis or complicated therapeutic interventions. Additionally, occlusion of the RI artery in atherosclerosis may be as dangerous as that of the LAD artery or the LCX artery occlusions since when exists it supplies a significant territory of the myocardium with blood. Moreover, in the case of occlusion of the LAD artery or the LCX artery, it constitutes an important source of collateral circulation and its existence might decline the ischemic effect of obstruction of these arteries (Reig & Petit, 2004; Tomar *et al.*, 2013; Diwan *et al.*, 2017; Pereira da Costa Sobrinho *et al.*, 2019; Javed *et al.*, 2023).

In the current study, no statistically significant correlation was observed between the termination patterns of the LMCA with age or sex. This result followed what was documented by Tomar *et al.* (2013) and Abebe & Seyoum (2020) about the absence of any association between the incidence of the RI artery and sex. However,

three studies reported a high incidence of the presence of trifurcation patterns in male patients (Erol & Seker, 2012; Altin *et al.*, 2015; Diwan *et al.*, 2017). Furthermore, a significant weak positive correlation was detected between the branching pattern and the length of the LMCA clarified by the tendency of the mean length of the LMCA to be longer in the trifurcation pattern than in the bifurcation pattern. This result corroborated the findings of Javed *et al.* (2023) but it was contrary to what was reported by Ajayi *et al.* (2013) and Diwan *et al.* (2017) who denied the presence of such a correlation.

Concerning the association between the different patterns of coronary dominance and the termination patterns of the LMCA, a statistically significant but very weak correlation was detected. The proportion of the patients who had the trifurcation pattern was more common in the patients with the RD followed by those with the CD than those with the LD which was comparable with the results of Purushothama *et al.* (2014) who reported the highest prevalence for the trifurcation pattern was more frequent in the patient with RD followed by the LD and the CD. As well, the quadrifurcation pattern was only seen in the RD.

The length of the LAD artery displayed significant variations which resulted in different levels of termination. The result of this research revealed no statistically significant correlation between the termination patterns of the LAD artery and age or *sex* which was in agreement with the results of Badran *et al.* (2020). These findings contradicted what was reported by Ilia *et al.* (2001) about the tendency of females to have longer LAD arteries that wrapped around the apex more than the males. Relating to the correlation between the different patterns of coronary dominance and the termination patterns of the LAD artery, no statistically significant correlation was noticed in the present work. Despite that, the LAD artery was longer and wrapped around the apex in patients who had the LD followed by those with the CD than those with the RD. Therefore, any obstruction or stenosis of the LAD artery would have more clinical importance in patients with LD than in those with RD. These findings were comparable with what was informed by other authors about the length of the LAD artery which was longer and wrapped around the apex in patients with the LD compared with those with RD (Ilia *et al.*, 2001; Ozturk *et al.*, 2011).

## CONCLUSIONS

The present study concerned numerous anatomical variations of the LMCA regarding its length, number of its terminal branches and the patterns of the LAD artery termination. Also, different patterns of coronary dominance were determined among Jordanian population where the

obtained prevalence came in agreement with what was recorded in the literature.

This work revealed that the length of the LMCA is *sex*-specific. Thus, females are affected more by the consequences of the short LMCA in developing CAD as well as in technical procedures like cardiac revascularization and coronary angiography than males. Furthermore, the pattern of coronary dominance has low impact on the morphological characteristics of the LMCA. As well as the branching pattern of the LMCA is affected by its length.

The results of this work clarify some clinical problems that might be associated with some of these variants. Therefore, greater attention should be given to these variables on the anatomical variations during diagnostic and therapeutic interventions and surgical procedures for good clinical outcomes which are essential for correct diagnosis and prevention of potential complications during interventional and surgical procedures.

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AL-OMARI, I. L.; SHATARAT, A. T.; BANI HANI, A. M.; HADIDI, M. T. & AL-MAKHAMREH, H. K. El impacto de la edad, el sexo y la dominancia coronaria en las características morfológicas de la arteria coronaria izquierda en la población jordana. *Int. J. Morphol.*, 43(1):335-343, 2025.

**RESUMEN:** El objetivo de este estudio fue examinar la correlación entre las variaciones anatómicas de la arteria coronaria izquierda (ACI) y la edad, el sexo y la dominancia coronaria en la población jordana. Se realizó un estudio de cohorte retrospectivo en 212 pacientes (127 hombres y 85 mujeres; edad media de  $56 \pm 11,1$  y rango de 28 a 81 años) con arterias coronarias normales en las angiografías que se examinaron en este estudio. Las angiografías coronarias se recuperaron del archivo de la base de datos de enero a julio de 2021 y fueron revisadas por dos cardiólogos intervencionistas independientes con experiencia. Se determinaron la longitud y el patrón de ramificación de la ACI, el patrón de terminación de la arteria interventricular anterior (AIA) y el patrón de dominancia coronaria. Los datos recopilados se sometieron a análisis estadístico. La longitud de la ACI osciló entre 2,8 y 22,2 mm. La rama intermedia (RI) se observó en el 21,7 % de los casos. La AIA terminó antes del ápex en el 15,1 %, en el ápex en el 31,1 % y envolvió el ápex en el 53,8 % de los casos. Se observó una correlación positiva entre la longitud de la ACI y el número de sus ramas terminales. Además, se detectaron diferencias significativas en la longitud de la ACI entre ambos sexos, con una tendencia a



tener una ACI corta en las mujeres. El patrón de dominancia coronaria tiene un bajo impacto en la morfología de la ACI, donde los pacientes con patrón dominante derecho tendieron a tener la ACI más larga con patrón de trifurcación. Sin embargo, la edad no mostró ninguna correlación significativa. El presente estudio reveló que la longitud de la ACI es específica del sexo y las mujeres se ven más afectadas por las consecuencias de la ACI corta que los hombres. Los datos de este estudio podrían ayudar a comprender los problemas clínicos que podrían estar asociados con algunas de estas variantes para obtener buenos resultados clínicos.

**PALABRAS CLAVE: Arteria coronaria izquierda, Arteria interventricular anterior; Patrón de terminación, Angiografía.**

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