

# Morphometric And Anatomical Study Of Coronary Arteries In Different Ages In Kirkuk Governorate

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## Abstract

**Background:** The ascending aorta gives rise to the two main coronary arteries including the right coronary artery (RCA) and left coronary artery (LCA). The right coronary artery emerges from the right anterior aortic sinus, while the left coronary artery emerges from the left posterior aortic sinus.

**Aim of the study:** The current study aims to describe the normal anatomical coronary artery length, origin, external diameter, and distribution.

**Material and methods:** Twenty hearts of twenty normal Iraqi adults, with age ranged from 40- 70 years were taken from the forensic medicine department of Kirkuk Teaching Hospital in the Azadi region during the period from September 2021 to June 2022. The study specimens were grouped according to the cadaver age and were inspected grossly for the course of each coronary artery, anatomical position, width, and length. **Results:** The mean length and diameter of RCA  $124.3 \pm 35.3$  mm and  $3.4 \pm 0.7$  mm respectively. The mean length and diameter of branches of RCA was for right marginal artery (RMA)  $42.4 \pm 11.6$  mm,  $1.6 \pm 0.3$  mm, for sino atrial nodal artery (SANA)  $15.3 \pm 6.7$  mm,  $1.2 \pm 0.3$  mm, for posterior interventricular artery (PIVA)  $54.5 \pm 10.1$  mm,  $1.9 \pm 0.4$  mm and for conus artery  $16.2 \pm 8.2$  mm,  $0.9 \pm 0.2$  mm respectively. The mean length and diameter of LCA  $11.2 \pm 3.5$  mm and  $4.2 \pm 2.0$  mm respectively. The mean length and diameter of branches of LCA was for anterior interventricular artery (AIVA)  $85.4 \pm 17.8$  mm,  $3.1 \pm 0.2$  mm, for left circumflex artery (LCX)  $45.1 \pm 17.9$  mm,  $2.7 \pm 0.6$  mm, for left marginal artery (LMA)  $40.3 \pm 16.4$  mm,  $1.5 \pm 0.3$  mm and for left diagonal artery (LDA)  $26.6 \pm 12.4$  mm,  $1.9 \pm 0.4$  mm respectively

**Keywords:** Morphometric; anatomical; coronary arteries.

## Introduction

The term "Coronary" is derived from the Latin word "Corona" which means crown. The right coronary artery (RCA) and left coronary artery (LCA) are the first branches of the aorta. They arise from the corresponding aortic sinuses of the ascending aorta just above to the aortic semilunar valve. Then pass around reverse sides of the pulmonary artery<sup>(1)</sup>.

The heart is supplied by two CAs, left and right, and their branches, which are located between epicardium and myocardium. The

RCA and the LCA arise from the aortic sinus of valsalva at the root of the aorta and encircle the base of ventricles like a crown<sup>(2)</sup>.

The LCA lies between the pulmonary trunk and the left atrial auricle, emerging into the AV groove, in which it turns left. Reaching the AV groove, the LCA usually divides into two main branches<sup>(3)</sup>. So RCA descends in the right AV groove and at the inferior border of the heart. It continuous posteriorly along the AV groove anastomose with LCR in posterior interventricular groove<sup>(4)</sup>.

The RCA originates above the right aortic sinus above the aortic valve. It passes through the right coronary sulcus (right AV groove), towards the crux of the heart. It gives off many branches, including the conus artery, SANA, the right marginal artery (RMA) and PIVA<sup>(5)</sup>.

The LCA originates from the left sinus of Valsalva in the aortic root. The LCA is a short trunk that bifurcates in 47%, trifurcates in 40%, and quadrifurcates in 11% of specimens<sup>(6)</sup>.

### Materials and Methods: -

Twenty normal hearts of adult cadavers, with age ranging from (50–70) years were taken from forensic medicine departments of Kirkuk governorate during the period extended from September 2021 to June 2022.

An informed permission was obtained from the police station to perform this study.

The causes of death for each cadaver were either bullet injuries, brain stroke, car accidents, sudden death, or others. Heart diseases were excluded from this study.

The Medical Ethics Committee of Tikrit University College of Medicine had approved this study with the code number

(IQ.TUCOM.REC.3/7/296). Ethical agreement statements were acquired from all individuals' families in this study, according to the World Medical Association Declaration of Helsinki, revised in 2000, Edinburgh. The collection of data was kept confidential and not be divulged except for the purpose of the study.

## Results

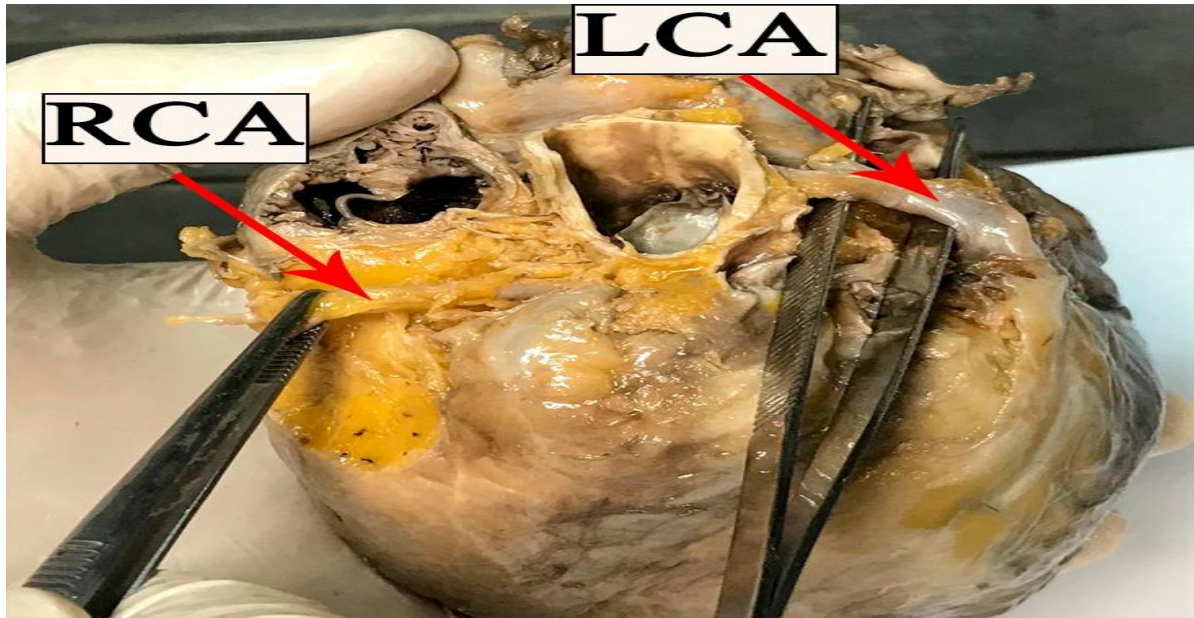
### Anatomical Description:-

#### Morphometric and origin of the RCA:

It originates from ostium of the right aortic sinus of ascending aorta immediately above the aortic valve. It passes through the right coronary sulcus (right AV groove), towards the crux of the heart. The RCA supplies to the RV, the RA, and the SA node and AV nodes. It gives off the following branches, including the PIVA, RMA, SANA and the conus artery. The length of the RCA was measured from the origin to the endpoint the RCA into the coronary sulcus. The mean length and external diameter of the RCA are  $124.3 \pm 35.3$  mm and  $3.4 \pm 0.7$  mm respectively (Table -1 and Figure 1,2).

**Table (1): The RCA and its branches.**

Name of Artery	RCA	Conus Artery	SANA	RMA	PIVA
Origin	Right Aortic Sinus	RCA	RCA, LCX	RCA	RCA, LCA or both
External Diameter	$3.4 \pm 0.7$ mm	$0.9 \pm 0.2$ mm	$1.2 \pm 0.3$ mm	$1.6 \pm 0.3$ mm	$1.9 \pm 0.4$ mm
Length	$124.3 \pm 35.3$ mm	$16.2 \pm 8.2$ mm	$15.3 \pm 6.7$ mm	$42.4 \pm 11.6$ mm	$54.5 \pm 10.1$ mm



**Fig. (1): Shows the origin of RCA and LCA from ascending aorta.**



**Fig. (2): The diameter of the RCA near its origin from the ascending aorta.**

**Morphometric and origin of left coronary artery:**

It originates from the left posterior aortic sinus and it runs towards left, under the left auricle. After a short course, it usually divides about 1 cm into the AIVA and LCX. The mean length and external diameter of the LCA was found to be  $11.2 \pm 3.5$  mm and  $4.2 \pm 2.0$  mm respectively (Table- 2 and Figure 3).

**Table (2): The LCA and branches.**

Name of Artery	LCA	AIVA	LCX	LMA	LDA
Origin	Left Aortic Sinus	LCA	LCA	AIVA	AVIA

<b>External Diameter</b>	<b>4.2 ± 2.0mm</b>	<b>3.1 ± 0.2mm</b>	<b>2.7 ± 0.6mm</b>	<b>1.5 ± 0.3mm</b>	<b>1.9 ± 0.4mm</b>
<b>Length</b>	<b>11.2 ± 3.5mm</b>	<b>85.4 ± 17.8mm</b>	<b>45.1 ± 17.9mm</b>	<b>40.3 ± 16.4mm</b>	<b>26.6 ± 2.4mm</b>



**Fig. (4): Shows the diameter of LCA arise from left aortic valve.**

## Discussion

### Morphometric of coronary arteries:

In present study the length of RCA, SANA, RMA and PIVA was  $124.4 \pm 35.3$  mm,  $15.3 \pm 6.7$  mm,  $42.4 \pm 11.6$  mm and  $54.4 \pm 10.1$  mm respectively. These findings agreed with Hoang Nguyen Vu et al., who recorded in the study hearts, the RCA originated from the right aortic sinus and the RCA had a mean length was  $122.5$  mm  $\pm$   $17.8$  mm. The length of the SANA, RMA and PIVA was  $16.5 \pm 3.4$ ,  $45.6 \pm 5.4$  and  $52.6 \pm 4.2$  respectively<sup>(7)</sup>.

Another result about the length of the RCA was disagreed with that of the pervious study<sup>(8)</sup> who mentioned the length of the RCA  $180 \pm 23.5$  mm.

In current study the length of LCA, AIVA and LCX was  $11.2 \pm 3.5$  mm,  $85.4 \pm 17.5$  mm and  $45.1 \pm 17.9$  mm respectively. These results agreed with study by Kumar A et al., who mentioned the mean length of LCA was  $10.2 \pm 3.5$ mm. The mean length of AIVA was  $83.4 \pm 17.8$ mm, whereas the mean length of LCX was  $44.6 \pm 17.9$ mm<sup>(9)</sup>.

In present study results about length of the LCA was disagreed with that of the Roy S et al.,

who reported the length of the LCA  $6.3 \pm 2.1$ , may be due to variation in genetic factors<sup>(10)</sup>.

### External diameter of coronary arteries:

Knowledge of size of CA has a great importance while doing percutaneous coronary interventional procedures like angioplasty and CA bypass surgery. The present study found that the of the external diameter of LCA was  $4.2 \pm 0.6$  mm and RCA was  $3.8 \pm 0.6$  mm.

The maximum and minimum diameters of the RCA were found to be 8.74 mm and 3.32 mm, respectively. These data are reasonable when compared to the results of studies done in other geographic and ethnic groups like Bhimalli et al., 2011<sup>(11)</sup>; Priyandharshini et al.,<sup>(12)</sup>.

The present study disagreed with following findings that reported by Zhou FF et al.,<sup>(13)</sup> who recorded the external diameter of RCA was  $2.8 \pm 0.2$  mm.

Regarding to the mean diameter of LCA, the findings were reported by Dattatray D et al., was  $4.64 \pm 1.02$ mm<sup>(14)</sup>. Fazliogullari Z et al., noted that the average diameter of LCA was  $4.4 \pm 1.7$  mm<sup>(15)</sup>.

The current results about the external diameter of LCA was disagreed with Reig J et al., who reported the diameter of the LCA is  $5.34 \pm$

1.01<sup>(16)</sup>, that may reflect several environmental factors.

### Conclusions:

- The present study revealed that the external diameter and length of the RCA and its branches include; RMA, SANA, PIVA and conus arteries.
- The present study showed that the external diameter and length of the LCA and its branches include; AIVA, LCA, LMA and diagonal arteries.

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