

# Coronary artery anomalies and variants among adult patients undergoing coronary angiography in Azadi heart center, Duhok/Iraq

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## Abstract

**Background:** Congenital coronary artery anomalies are rare among general population and are usually asymptomatic. And diagnosed accidentally during coronary angiography.

**Methods:** A total of 2177 patients underwent diagnostic coronary angiography at Azadi cardiac center in Duhok city/Iraq between January 2018 and January 2020 and their angiogram were searched for coronary anomaly.

**Results:** Among 2177 patients who included in this study, 26 patients (16 males and 10 females) had coronary artery anomalies. The vast majority of anomalies were in the origin and distribution of coronary arteries which was seen in 22 patients (84.6 % of anomalies), while anomalies of coronary artery termination were found in only 4 patients (15.4 %). Separated origin left anterior descending and left circumflex artery was the most common anomaly that was found in 11 patients (42.3 % of anomalies).

**Conclusion:** Congenital coronary arteries anomalies are uncommon finding in patients undergoing coronary angiography.

**Key words:** Coronary artery, Anomalies, Duhok, Iraq.

## Introduction

Coronary artery anomalies (CAAs) can be defined as a diverse collection of congenital abnormalities with a variable presentation and pathophysiology. Coronary artery anomalies can be completely asymptomatic but occasionally few symptoms are encountered. The vast majority of CAAs are benign in nature; however, they might be associated with deleterious clinical consequences such as myocardial infarction and heart failure. Such anomalies might lead to syncope and sudden death.<sup>1</sup> The evaluation of such anomalies can be evaluated by non-invasive procedures like cardiac computed tomography or cardiac magnetic resonant imaging, but for accurate evaluation coronary angiography is required.<sup>1-2</sup> Coronary artery anomalies are some of the most confusing and ignored topics in

cardiology and for the purpose of classification of coronary artery anomalies many schemes have been proposed, some were based on clinical significance or functional relevance, but the most accurate and detailed classification was based on the anatomical features and it was as follow: (1) anomalies of origination and course of coronary arteries like the separate Ostia of left anterior descending artery (LAD) and the left circumflex artery (LCX), anomalous location of coronary Ostia within the aortic root, outside the sinuses of Valsalva or at the contralateral sinus and single coronary artery. (2) anomalies of intrinsic coronary anatomy (split RCA/LAD, ostial stenosis/atresia, ectasia, hypoplasia, intramural course/bridging, absent coronary artery, ectopic origin of first septal branch, ectopic origin of PDA

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from the LAD or a septal branch); (3) anomalies of coronary termination (mainly fistulas); and (4) anomalous collateral vessels.<sup>1-2</sup> The diagnosis of such anomalies by angiography is crucial for the management of patients with ischemic heart diseases. Coronary artery anomalies of one or more coronary arteries was detected in around 1% of subjects attending angiography sessions. Occasionally, CAA is completely asymptomatic and only diagnosed in postmortem autopsy.<sup>3-7</sup> In a study conducted in Iran, CAA was found in 1.3% of the patients underwent angiography. The majority of anomalies diagnosed in Iran was anomalies of the origin of the arteries

### Materials and methods

A retrospective study that recruited all patients (a total of 2177 patients) who underwent coronary angiography between January 2018 and January 2020 at Azadi heart center / Duhok city/ Iraq. The angiograms were reviewed by two experienced interventional cardiologists looking for anomalous coronary arteries who reached a consensus before final classification of anomalies. In case of any difference of opinion, a consensus was reached after discussion. Patients with coronary anomalies associated with complex congenital heart disease were not included. Patients with separate origin of conus or right ventricular branch in the right sinus of Valsalva and patients with

and the separated Ostia of the left anterior descending artery was the most common abnormalities.<sup>8</sup> In a study conducted in Turkey recruiting 53,655 subjects, CAA was found in 1.21% of the patients. Amongst those, more than 90% of the diagnosed CAA was at the origin of the arteries. Separated origin of left anterior descending (LAD) and left circumflex (LCX) coronary artery was the most common anomaly found in Turkish study.<sup>3</sup> The prevalence of CAA has not been studied in Duhok city, Kurdistan region of Iraq. Therefore; we aimed at studying the prevalence of CAA in patients undergoing angiography in Duhok heart center.

coronary anomalies associated with complex congenital heart disease were excluded. The ethical approval of this study was obtained from the Kurdistan Higher Council of Medical Specialties. The major types of congenital anomalies and distribution of the Coronary Artery Anomalies were determined in number and percentage. In addition, the Coronary Artery variants in patients underwent coronary angiography were determined in number and percentage. The statistical calculations were performed by statistical package for social sciences version 25 (IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp).

### Results

Among 2177 patients who included in these study 26 patients (16 males and 10 females) had coronary artery anomalies which form 1.19%. Their mean age was  $57 \pm 10$  years. The vast majority of anomalies were in the origin and distribution of coronary arteries (1) and seen in 22 patients (87.9%), on the other hand anomalies of coronary artery termination were detected only in 4 patients (12.1%) of all anomalies Table (1).

**Table (1):** Major types of congenital anomalies

	No. of Patients	Anomaly Prevalence %	Angiographic Prevalence %
Anomalies of coronary origin and distribution	22	87.9	1.01
Coronary artery fistulae	4	12.1	0.18
Total coronary anomalies	26	100	1.19

Separated origin of LAD and LCX (absence of main left coronary artery) from the left coronary sinus of Valsalva was the most common anomaly Table (2) that found in 11 of patients (42.3 %), followed by anomalous origin of LCX from the right coronary sinus of Valsalva was found in 6 patients (23.1), anomalous origin of RCA

from left coronary sinus of Valsalva was seen in 3 patients (11.5%) and anomalous origin of left main coronary artery from the right coronary sinus of Valsalva or right coronary artery in 2 patients (7.7%). Other anomalies detected in this were coronary artery fistulae which seen in 4 patients (15.4% of anomalies) Table(2).

**Table (2):** Distribution of the Coronary Artery Anomalies

Types of coronary anomaly	No. of patients	Anomaly prevalence	Angiographic prevalence
Separated origin of LCx and LAD	11	42.3	0.50
LCx from RT cusp or RT coronary artery	6	23.1	0.27
RCA from LT cusp or LT coronary arteries	3	11.5	0.13
LM from RT cusp or RT coronary artery	2	7.7	0.09
LAD from RT cusp or RT coronary artery	0	0	0
Coronary fistula	4	15.4	0.18

Regarding coronary artery variants, Muscle Bridge was seen in 7 patients (0.32 %) and regarding coronary dominance in this study the right coronary artery was dominant in 2000 patients (91.86%), while left coronary artery was dominant in 117 patients (5.39%) and co-dominancy in 60 patients (2.75%) Table(3).

**Table (3):** Coronary Artery Variants

Variants	No. of patients	Angiographic Prevalence
Muscle bridge	7	0.32 %
Coronary Dominancy:		
• Right dominancy	2000	91.86%
• Left Dominancy	117	5.39%
• Co-dominant	60	2.75 %

**Discussion**

Coronary artery anomalies are very rare congenital anomalies and are mostly symptomless and usually encountered as coincidental findings during coronary angiography or at autopsy. Coronary artery anomalies are generally asymptomatic, however; some anomalies predispose to deleterious consequences such as congestive heart failure, arrhythmia,

myocardial infarction, syncope and sudden death.<sup>9-15</sup> The overall angiographic prevalence of coronary artery anomalies varies between 0.16 to 2% as reported in many countries. In this study, the prevalence of coronary artery anomalies was 1.19%, which is similar to that reported in neighborhood countries such as Iran which was 1.3%,<sup>16</sup> while in a study

conducted in turkey by Kenan E. et al the incidence was higher (3.9%).<sup>17</sup> Most patients with coronary anomalies were male (16 males versus 10 females), this may be explained by the fact that most patients who underwent coronary angiography were males (63% male versus 37% female) as they have more coronary artery disease risk and are more commonly referred for coronary angiography than females.<sup>18-19</sup> The separate Ostia of LAD and LCX (absent LMCA) were the most common anomaly and it was found in 11 patients (42.3%) with angiographic incidence of 0.5%. These results were similar to the results of studies conducted by Angelini et al (0.55%), Yamanaka et al (0.41%), Topaz et al who reported a rate of 0.4% for absent LMCA.<sup>18-21</sup> while Kenan E. et al<sup>17</sup> reported 0.7%.<sup>17, 19-21</sup> Some researchers such as Angeslini P. et al, Eid AH et al, Kimbiris DE et al, and Ogden JA et al did not regard absent LMCA as Coronary artery anomalies because the absence of LMCA is not associated with hemodynamic disturbance and it is regarded as a benign anomaly.<sup>20, 22-24</sup> Also, in angiographic views it may be sometimes difficult to differentiate absent from very short LMCA therefore they did not pay attention to these Coronary artery anomalies. But, actually it is important to diagnose this anomaly while performing coronary angiography because if it is not diagnosed, this may be interpreted as complete occlusion or congenital absence of one coronary artery which may leads to further unnecessary work up.<sup>17</sup> The second most common anomaly was the origin of LCX artery from the right coronary cusp or right coronary artery and was seen in 6 patients (23.1% of anomalies). This was much lower than the incidence found in studies conducted by Kimbris et al and Ogden et al as they found this anomaly in 57.3% and 60% of their patients, respectively. This differences can be explained by the fact that separated Ostia of LAD and LCX was not regarded as an

anomaly in these two studies.<sup>23-24</sup> The course of left circumflex coronary artery was retro aortic as reported in all other previous studies, for that it is regarded as benign anomaly. Once long non-branching proximal LMCA and a non-perfused lateral wall is noticed in angiography, such an anomaly should be suspected.<sup>10, 19, 25-26</sup> The third most common anomaly seen was the coronary artery fistula which was detected in 4 patients (15.4% of anomalies). Similar results were found by Yamanaka et al, Aydinlar et al and Yildiz et al.<sup>13, 19, 27</sup> two of these fistulae were draining into LV and other 2 into pulmonary artery. In coronary, in artery fistula the blood will divert from high to low resistance region and this may manifest clinically as ischemia or congestive heart failure symptoms.<sup>28-30</sup> Other anomalies detected were the right coronary artery arising from left coronary sinus which was found in 3 patients and left main from right coronary sinus or right coronary artery was seen in 2 patients. Regarding coronary artery variants, Muscle Bridge was found in 7 patients with angiographic incidence of 0.32% and all of them were in the mid LAD with a length ranging from 6-20mm. The incidence of myocardial bridging is considerably variable depending on tool used for diagnosis. The incidence has been reported to be 58% in case series studied by histological methods, whereas the incidence ranges from 0.5% to 4.5% in case series studied by angiography. Besides, high incidence rates reported in pathologic studies and low rates reported in angiographic studies suggest that myocardial bridging is not associated with cardiac events in most cases.<sup>31</sup> In relation to coronary artery dominance pattern, in this study we found right dominance in 2000 patients (91.86%), while left coronary artery was dominant in 117 patients (5.39%) and co-dominance in 60 patients (2.75%) which is similar to the results of many studies.<sup>32-34</sup>

## Conclusion

Congenital coronary arteries anomalies are uncommon finding in patients undergoing coronary angiography. Separate origin of LAD and LCx from the left sinus of

valsava and LCx coronary artery arising from RSV/RCA are the most frequently diagnosed anomalies in our city.

## Conflicts of interest

The author reports no conflicts of interest.

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