

# Variation in coronary arteries and clinical implication

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## ABSTRACT

The coronary arteries are responsible for the supply of the myocardium, supplying oxygen supply to this organ, so it is extremely important that the anatomy of these arteries be studied both from the normal point of view and in their possible variations and anomalies. In view of this situation, whatever the change, be it structural, functional or anatomical, we can think of important clinical repercussions. Anomalies, even rare, when found can promote from asymptomatic cases to mild, moderate symptoms and, the most serious: sudden death. Thus, when recognized, they can guarantee a better prognosis through appropriate and targeted treatment. That said, the present case report describes a variation of the coronary arteries in a dissected and glycerin heart of an Anatomy Laboratory. After the description, it is necessary to highlight the importance of the apparent clinical correlations, forms of prevention and even treatment that can be instituted before the individual has any associated comorbidity.

**Keywords:** Coronary; Arteries; Variations; Anomalies

## INTRODUCTION

Coronary arteries are vessels responsible for myocardial oxygen supply. The right coronary artery (RCA) originates in the right valve sinus of the aorta, goes through the coronary groove to the lower margin and passes over the diaphragmatic face. On the other hand, the left coronary artery (LCA) originates from the left valve sinus of the aorta and is responsible for irrigating the most part of the left ventricle. [1,2]

The RCA has three irrigation paths, the first extends from its origin to the right edge of the heart, the second extends from the upper edge to the posterior longitudinal groove and the third follows on the left part of the posterior interventricular groove. In other words, the irrigation areas of this coronary artery are regions adjacent to the ventricles and perforating septal interventricular branches that go to the interventricular septum, thus completing the irrigation of the organ's diaphragmatic face. [2,3].

In contrast, the LCA is divided into 2 branches, the anterior interventricular branch and the circumflex branch. The first will be responsible for irrigating adjacent regions of the ventricles and part of the interventricular septum. The second follows the coronary groove around the left margin of the heart to its posterior face, originating the left marginal branch that supplies the left ventricle. [2,3]

Considering the relevance of coronary irrigation, it is worth mentioning the occurrence, which is rare, however, due to congenital anomalies of these arteries. The incidence of these changes varies from 0.3% to 2% with the majority of patients being asymptomatic carriers. [4,6]

However, some may have clinical manifestations, such as dyspnea, acute myocardial infarction, tachycardia and arteriovenous fistulas. In these individuals, the symptoms will be associated with anomalies that lead to changes in myocardial perfusion or that

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result in a deviation of circulation, that is, an increase in irrigation of the right part of the heart. [4,5]

In the clinical field, knowledge of anomalies in a patient can be of fundamental importance in determining the individual's diagnosis and prognosis. Mainly because coronary anomalies may be accompanied by some other congenital malformation, such as abnormal position of the aortic root, double outflow of blood from the right ventricle and complete transposition of the coronary arteries. [1]

The objective of this article is to perform an anatomical description of the changes found in the coronary circulation and to relate them to the main clinical manifestations that may be involved because, in this context, it is necessary to know the existence of anatomical variations and their possible repercussions for taking therapeutic decisions, especially in cases where the patient has associated valve diseases or previous cardiac comorbidities. [6]

## **MATERIALS AND METHODS**

The research was carried out from August 2020 to October 2020. As databases used were PubMed, Scielo and Science Direct, within this research we found 20 articles dealing with the subject and these 12 were selected. The articles cover the period of publication from 1958 to 2018. In addition, all photos in this article were authorized by those responsible for the Anatomy Laboratory, which is on the premises of the Centro Universitário Barão de Mauá.

## **RESULTS**

Coronary arteries 1, 2 and 3, as shown in Figure 1, have their origin in the ascending portion of the aorta before the branching of the brachiocephalic trunk, left common carotid artery and left subclavian artery. These three arteries are then directed to irrigate the region of the interventricular septum, part of the left ventricle and right ventricle.

On the other hand, coronary artery 4, which is the anterior descending artery, has its

origin in the left valve sinus of the aorta and will irrigate the most part of the left ventricle.

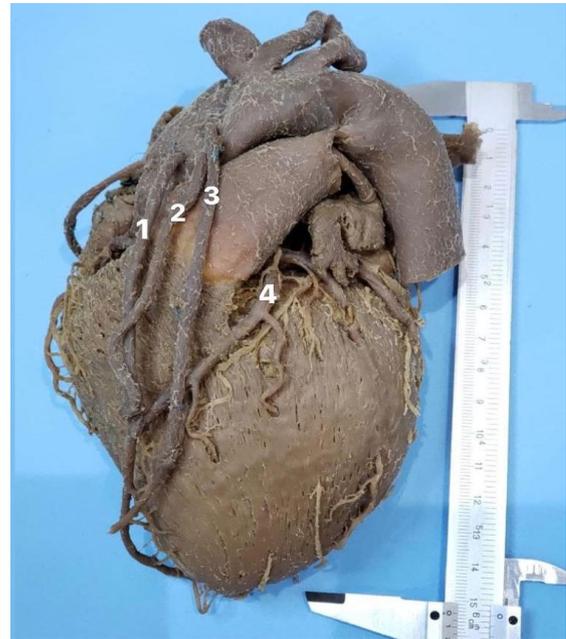


Figure 1: Anterior view of the anatomical specimen. Coronary arteries 1, 2, 3 and 4 can be seen. Authorial image.

According to figure 2A arteries 5 and 6 originate from the ascending aorta, even before the origin of arteries 1, 2 and 3. Coronaries 5 and 6 apparently form the irrigation region of the right coronary artery together. In addition, it is possible to observe that in image C, they anastomose in artery 9, and resemble the path of irrigation corresponding of the physiological right coronary artery.

Finally, in Figure 2B, which shows a posterior view of the heart, the coronary sinus, indicated as number 7, the posterior interventricular vein indicated as 8, and the anastomosis of arteries 5 and 6 in artery 9, are possible to observe.

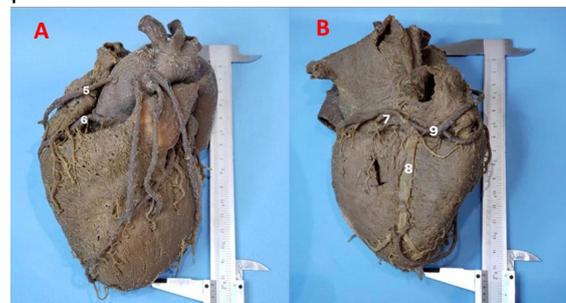


Figure 2A: Right lateral face of the anatomical specimen. Coronary arteries 5 and 6 can be seen. Authorial image.  
Figure 2B: Posterior view of the anatomical specimen shows the coronary sinus, posterior interventricular vein and coronary artery 9. Authorial image

## **DISCUSSION**

Given the case, it is known that these abnormalities have been previously described and that, in most cases, patients did not have an important clinical case, even presenting themselves as asymptomatic. [9] On the other hand, cases have been reported in which young patients and athletes, such as soccer players, who had coronary artery anomalies were more likely to suffer from arrhythmias, myocardial ischemia and sudden death during physical exercise. [10]

To explain these consequences, the studies based on the physiology of the vascular system and understood that the increase in blood flow causes an increase in demand and this, consequently, would lead to a high overload, which would require greater myocardial work. [11] Thus, when associating the practice of physical exercise, which normally leads to increased effort, with the anatomical abnormality of the coronary artery we would have an even greater burden, which could cause sudden death in the patient.

In addition, there are descriptions of an association between anatomical variation of the coronary arteries and bicuspid valve disease. Accurate knowledge of coronary anomalies could prevent risks during surgical procedures for patients with bicuspid valve disease, improving their prognosis. [7] The development of changes in the bicuspid valve may be directly related to coronary anomalies, and not least, the tricuspid valve may also be involved [8].

Although clinical suspicion is almost insufficient due to the fact that most cases are asymptomatic, investigating congenital anomalies proved to be important and necessary, as their treatment must be early and, in many cases, surgical indication is mandatory. [12]

To conclude, it is important to understand that in order to identify coronary anomalies, it is necessary for the physician to request imaging tests, because without them there is no proven clinical evidence to suspect these abnormalities. Therefore, these are discovered accidentally, as the order of these tests is not mandatory in clinical practice, as they

enter as complementary tests based on suspected diagnostics.

## **CONCLUSIONS**

By recognizing changes in the anatomy of the patient's coronary arteries, the doctor can prevent the appearance of several comorbidities through recommendations such as reducing strenuous physical effort and a balanced diet with reduced consumption of fatty foods to prevent the formation of atheromatous plaques, decreasing the probability of a possible myocardial function overload, for example. Therefore, the diagnosis of anatomical variations in coronary circulation allows prevention, or improves the treatment of several comorbidities associated with clinical cardiovascular repercussions, such as diabetes mellitus, systemic arterial hypertension, congestive heart failure, among others.

## **ACKNOWLEDGEMENTS**

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## **CONFLICTS OF INTEREST**

There are no conflicts of interest in this study.

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## RESUMO

### *Variação de artérias coronárias e implicações clínicas*

As artérias coronárias são responsáveis pelo suprimento do miocárdio, fornecendo suprimento de oxigênio a esse órgão, por isso é de extrema importância que a anatomia destas artérias seja estudada tanto do ponto de vista normal quanto em suas possíveis variações e anomalias. Diante dessa situação, seja qual for a mudança, seja ela estrutural, funcional ou anatômica, podemos pensar em repercussões clínicas importantes. As anomalias, mesmo raras, quando encontradas podem promover desde casos assintomáticos até sintomas leves, moderados e, o mais grave: a morte súbita. Assim, quando reconhecidos, podem garantir um melhor prognóstico por meio de um tratamento adequado e direcionado. Dito isso, o presente relato de caso descreve uma variação das artérias coronárias em um coração dissecado e glicerinado de um Laboratório de Anatomia. Após a descrição, é necessário

destacar a importância das correlações clínicas aparentes, formas de prevenção e até mesmo tratamento que podem ser instituídos antes que o indivíduo tenha qualquer comorbidade associada.

**Palavras-chave:** coronárias, artérias, variações, anomalias.