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DUPLICATION OF THE LEFT ANTERIOR DESCENDING ARTERY: ANATOMICAL FINDINGS FROM CADAVERIC DISSECTION

DUPLICAÇÃO DA ARTÉRIA DESCENDENTE ANTERIOR ESQUERDA: ACHADOS ANATÔMICOS DA DISSECÇÃO CADAVÉRICA

DUPLICACIÓN DE LA ARTERIA DESCENDENTE ANTERIOR IZQUIERDA: HALLAZGOS ANATÓMICOS DE LA DISECCIÓN CADÁVRICA

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Natasha Thais Dahrouge Alecrim[1], Daniel Magalhães dos Santos[2], Fábio Moniz de Rezende[3]

ABSTRACT

The anterior interventricular branch (AIB) is a branch of the left coronary artery that runs obliquely toward the apex of the heart in the anterior interventricular groove. Of all the coronary arteries, the AIB has the most constant course. Duplicated anterior interventricular branch (AIB) is a rare congenital condition characterized by the presence of two distinct segments of this blood vessel in the anterior interventricular groove: one short and one long. Recognizing and reporting duplication of the left anterior descending coronary artery is helpful for optimal management of coronary patients with this condition. Duplicate Atrial fibrillation is more prevalent in women, and studies have also linked this variation to the presence of myocardial bridging and left coronary dominance.

Keywords: Left Coronary Artery. Duplicated Anterior Interventricular Branch. Anatomy.

RESUMO

O ramo interventricular anterior (RAI) é um ramo da artéria coronária esquerda que corre obliquamente em direção ao ápice do coração no sulco interventricular anterior. De todas as artérias coronárias, o RAI tem o trajeto mais constante. O ramo interventricular anterior (RAI) duplicado é uma condição congênita rara, caracterizada pela presença de dois segmentos distintos desse vaso sanguíneo no sulco interventricular anterior: um curto e um longo. Reconhecer e relatar a duplicação da artéria coronária descendente anterior esquerda é útil para o manejo ideal de pacientes coronarianos com essa condição. A fibrilação atrial duplicada é mais prevalente em mulheres, e estudos também relacionaram essa variação à presença de ponte miocárdica e dominância coronária esquerda.

Palavras-chave: Artéria Coronária Esquerda. Ramo Interventricular Anterior Duplicado. Anatomia.

RESUMEN

La rama interventricular anterior (AIB) es una rama de la arteria coronaria izquierda que discurre oblicuamente hacia el vértice del corazón en el surco interventricular anterior. De

[1] Undergraduate in Medicine. Faculdade Santa Teresa.
[2] Undergraduate in Medicine. Faculdade Santa Teresa.
[3] Doctor. Universidade do Estado do Rio de Janeiro (UERJ).

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todas las arterias coronarias, la AIB tiene el curso más constante. La rama interventricular anterior duplicada (AIB) es una afección congénita poco frecuente que se caracteriza por la presencia de dos segmentos distintos de este vaso sanguíneo en el surco interventricular anterior: uno corto y otro largo. Reconocer y reportar la duplicación de la arteria coronaria descendente anterior izquierda es útil para el manejo óptimo de los pacientes coronarios con esta afección. La fibrilación auricular duplicada es más frecuente en mujeres, y los estudios también han vinculado esta variación con la presencia de puentes miocárdicos y la dominancia coronaria izquierda.

Palabras clave: Arteria Coronaria Izquierda. Rama Interventricular Anterior Duplicada. Anatomía.

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1 INTRODUCTION

Coronary artery anomalies represent a group of congenital conditions characterized by the abnormal origin, course, or termination of one of the three main coronary arteries. Although most of these anomalies are asymptomatic and are discovered incidentally during cardiac imaging (GENTILE, 2021), they can occasionally manifest through chest pain, electrocardiogram changes, or potentially fatal complications, such as acute myocardial infarction or sudden cardiac death (MARON, 2007) .

In standard anatomy, the anterior interventricular branch (AIB) arises from the left coronary artery, running through the anterior interventricular sulcus toward the cardiac apex, and branching into diagonal and septal branches (NAMBOODIRI et al., 2008). The duplicated AIB variation is characterized by the presence of two distinct segments of the anterior interventricular branch, with a short one terminating in the proximal portion of the anterior interventricular sulcus and a long one (running proximally outside this portion), terminating in the distal portion. Although four subtypes of this variation were initially described based on morphological characteristics, two additional subtypes were subsequently reported as case studies (MARONEY, 2012).

The anatomical variation of the duplicated anterior interventricular branch is a rare congenital condition, characterized by the presence of two distinct segments of this blood vessel in the anterior interventricular sulcus (AIS) of the heart (AGARWAL et al., 2008).

The first study to classify double anterior interventricular branch anomalies based on coronary catheter angiography was conducted in 1983 by Spindola-Franco et al., establishing an initial classification system. However, subsequent reports described RIA variants that did not fit this classification (MANCHANDA et al., 2003). Most recent publications on this variation are based on case reports, and there are few comprehensive series using coronary CT angiography (YOSHIKAI, 2004).

Coronary CT angiography is currently widely used, and recognizing double RIA variations using this method requires familiarity. Understanding double RIA anomalies is crucial for coronary artery bypass grafting and surgery, and is essential for the appropriate management of patients with coronary artery disease (MARONEY, 2012) . Our objective was to report a case of duplication of the anterior interventricular branch of the LCA.

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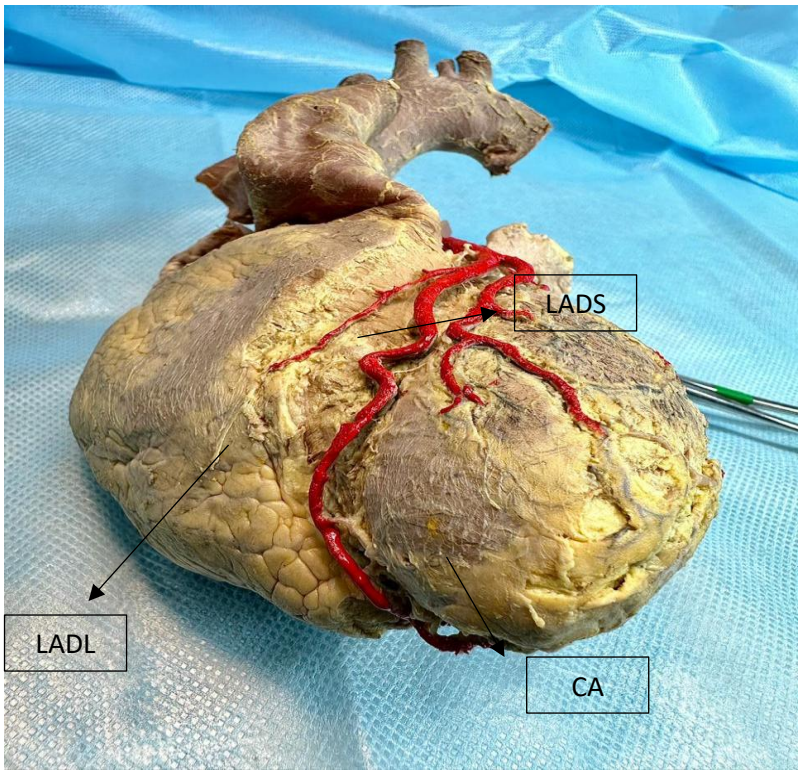
2 CASE REPORT

During a routine coronary vessel dissection, an anatomical variation of the duplicated anterior interventricular branch was observed. This anatomical variation was found in a 45-year-old male heart, 10% formalin-embedded, belonging to the collection of the human anatomy laboratory at the State University of Amazonas.A thorough exposure of the coronary vessels was performed by the technical team of the anatomy laboratory to expose the origin and course of the left coronary artery (Figure 1). The presence of the circumflex branch and the anterior interventricular branch originating from the left coronary artery was verified. However, duplication of the anterior interventricular branch, long RIA (145 mm) and short RIA (65 mm) were detected.

Figure 1

Left Coronary Artery and its branches



Legend: LADL- long anterior descending coronary, LADS-short anterior descending coronary, CA-cardiac apex.

3 DISCUSSION

The anterior interventricular branch is one of the arterial branches that originates from the left coronary artery (LCA), which in turn arises from the left aortic sinus of the ascending aorta (PIMENTA, et al., 2024). Normally, the anterior interventricular branch follows the

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course between the pulmonary trunk and the left atrium, descending obliquely toward the cardiac apex. Along its course, the RIA frequently supplies diagonal branches to the anterior free wall of the left ventricle and septal branches to the anterior interventricular septum (GAEMPERLI, 2023) .

Duplication of the anterior interventricular branch is a rare anatomical variant characterized by two coronary branches known as the "short RIA" and the "long RIA," which run through or approach the anterior interventricular sulcus (SAJJ et al., 2000) . In our study, we detected duplication of the anterior interventricular branch, and this variation is classified as type I (MORENO-MARTÍNEZ et al., 2012). We found that the short RIA had a path of 65 mm, while the long RIA ran through the anterior interventricular sulcus for 145 mm, reaching the cardiac apex. Recognition of anatomical variations of the duplicated anterior interventricular branch is of paramount importance for coronary surgeries and interventional procedures (KOŞAR, 2009).

Anatomical variants related to the origin, course, and distribution of the coronary arteries are considered uncommon, with an incidence ranging from 0.13% to 1.38% (SAJJA, 2000). These variations may be correlated with congenital malformations, such as complete transposition of the great arteries and tetralogy of Fallot (TUNCER, 2006). In a comprehensive analysis of 70,850 coronary angiography procedures in adults, conducted by Tuncer et al. (2006), 171 cases of coronary anomalies were identified, representing an incidence of 0.017% of the duplicated anterior interventricular branch. Although considered relatively rare, the duplicated anterior interventricular branch was described and classified by Spindola-Franco et al. (1983) in an uncommon pattern, present in approximately 1% of cases, emphasizing the importance of the surgical implications associated with its accurate diagnosis.

Diagonal and septal branching patterns in cases of duplicated LAD generally follow certain specificities, although variations can occur. Prior awareness of the presence of a duplicated LAD is crucial before any surgical intervention to avoid complications arising from incorrect or deficient myocardial revascularization.

Imaging tests such as coronary CT angiography, with their ability to comprehensively visualize coronary anomalies in three dimensions, enable more accurate diagnosis and promote appropriate treatment planning. In Angelini's study (2007), the author proposed an association between double RIA and other coronary artery characteristics, particularly left dominance (9.68%) and myocardial bridging (12.10%). Furthermore, a statistically significant

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disparity between the sexes was observed in the occurrence of duplicated anterior interventricular branch (AIVB), with it being more prevalent in women (56/124, 45.16%) than in men (68/124, 54.84%).

The existence of a duplicated interventricular branch has considerable anatomical and clinical significance, and accurate identification of its short and long segments is crucial for adequate planning of surgical grafts or during percutaneous revascularization procedures.

4 CONCLUSION

Routine dissections can provide solid knowledge about variants of the coronary circulation. Sometimes, large numbers of these variations are detected incidentally during routine angiograms for chest pain due to the involvement of other coronary arteries. Fortunately, most duplicated RIAs follow a benign course. Recognition and reporting of anterior interventricular branch duplication is helpful for optimal management of coronary patients with this condition.

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