Triangle of Brocq and Mouchet: anatomical study in brazilian cadavers and clinical implications

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Abstract

Introduction: The Brocq and Mouchet's arterio-venous triangle is a well know topographic region that is composed by the intersection of the great cardiac vein (GCV), the circumflex artery (CA) and the anterior interventricular artery (AIA) of the left coronary artery. These structures are located between conus arteriosus and left auricle, on the left side of anterior surface of the heart. Material and methods: Twenty three hearts were dissected and evaluated regarding to Brocq and Mouchet's arterio-venous triangle at the Department of Morphology of the Fluminense Federal University. All the specimens were dissected in male human cadavers. They were analyzed regarding to their disposition in the triangle and the relations between them. Results: The triangle was found in 20 hearts (86.9%); in the remaining 3 (11.1%) it was not formed. Regarding to the classification of the triangle, the pattern of distribution was as follows: "closed" in 5 (21.7%) hearts, "inferiorly open" in 9 (39.1%) hearts, "superiorly open" in 2 (8.7%) hearts and "completely opened" in 4 (17.4%). Conclusion: Our study may add important information to the anatomy of the heart specifically in brazilian population. These data may have relevant implications regarding to procedures in the heart.

Keywords: heart, thorax, coronary vessels, anatomy.

1 Introduction

The Brocq and Mouchet's arterio-venous triangle is a well know topographic region that is composed by the intersection of the great cardiac vein (GCV), the circumflex artery (CA) and the anterior interventricular artery (AIA), the latter two being derived from the left coronary artery. These structures are located between the conus arteriosus and left auricle, on the left side of anterior surface of the heart (MANDARIM-DE-LACERDA, 1990; BOUCHET and CUILLERET, 1980).

The main structure of the triangle is the GCV and when it leaves the interventricular groove, it curves to the left forming the base of the triangle of "Brocq and Mouchet" with the two branches of the left coronary artery, having a triple relationship with the circumflex artery. In the classical description the end part of the GCV crosses superficial to the CA at the level of the left marginal vein (the coronary sinus conduit). However, some variations have been described regarding the relations between the vessels forming the triangle, what have anatomic and surgical implications.

This vascular triangle may be classified into four types, according to disposition of the structures forming its boundaries: closed, superiorly opened, inferiorly opened and completely opened. Rarely the triangle can be absent (Figure 1) (PEJKOVICH and BOGDANOVICH, 1992; SOUSA-RODRIGUES, ALCÂNTARA, SILVA et al., 2004).

One of the clinical implications of the vessel's disposition at the triangle have been emphasized (ORTALE, GABRIEL, LOST et al., 2001; METZ, YOCK and FITZGERALD, 1997) relating to obstructive coronary artery disease. In this case, when the GCV is posteriorly located in the presence arteriosclerosis it may be compressed by the rigid arteries, what would impair the venous return to the left atrium.

Regarding to surgical procedures, the proximal segment of the left coronary artery, which is the origin of the CA and the AIA, is commonly necessary for revascularization procedures. Therefore, the study of the disposition of structures composing the triangle and its boundaries are of relevance to surgical procedures at heart.

In this study we aim to evaluate the patterns of occurrence of Brocq and Mouchet's arterio-venous triangle in human male cadavers from Brazil, helping in establishing the patterns of variations of this triangle.

2 Material and methods

Twenty three hearts were dissected and evaluated regarding to Brocq and Mouchet's arterio-venous triangle. All the specimens were dissected in male human cadavers from division of human anatomy at Department of Morphology of the Fluminense Federal University. All of them had been fixed in 10% formalin solution. The study

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was carried out according to the Helsinki's statement and was approved from our institutional review board.

We specifically evaluated GCV, CA and AIA without dissecting them from the adjacent adipose tissue to not disturb the original anatomy. They were analyzed regarding to their disposition in the triangle and the relations between them.

3 Results

The triangle was found in 20 hearts (86.9%); in the remaining 3 (11.1%) it was not formed. Regarding to the classification of the triangle, the pattern of distribution was as follows: "closed" in 5 (21.7%) hearts; "completely opened" in 4 (17.4%); "inferiorly opened" in 9 (39.1%) hearts and "superiorly opened" in 2 (8.7%) hearts.

The relation between the GCV and the both arterial branches (CA and AIA) were: no crossing any arterial branch; anteriorly crossing at least one of arterial branches; and posteriorly crossing at least one of arterial branches. There was no specimen in which the GCV crossed one arterial branch anteriorly and the other, posteriorly. The most common pattern in our study was the GCV anteriorly crossing the CA without crossing the AIA, which occurred in 6 hearts (26%).

In all the specimens where the triangle was present, the diagonal artery crossed inside it. In 14 (60.8%) cases there were also minor left ventricular branches, varying in number from 1 to 3 as follows: 8 (34.8%) hearts with one branch; 5 (27.7%) hearts with two branches; and 2 (8.7%) hearts with three branches.

4 Discussion

According to Sousa-Rodrigues' study, the triangle is present in 88% of cases, which is similar to our results and with Ortale's. Nevertheless, Pejkovich and Bogdanovich (1992) reported an occurrence of 98% at his study, an incidence slightly higher than other authors.

We subdivided the Brocq and Mouchet's triangle following the recommendations of previous studies (Figure 1) (PEJKOVICH and BOGDANOVICH, 1992; SOUSA-RODRIGUES, ALCÂNTARA, SILVA et al., 2004):

- Absence of the triangle: when the GCV is on the left of AIA, ascends to the bifurcation of CA and then turns left, where it accompanies the CA (Figure 2);
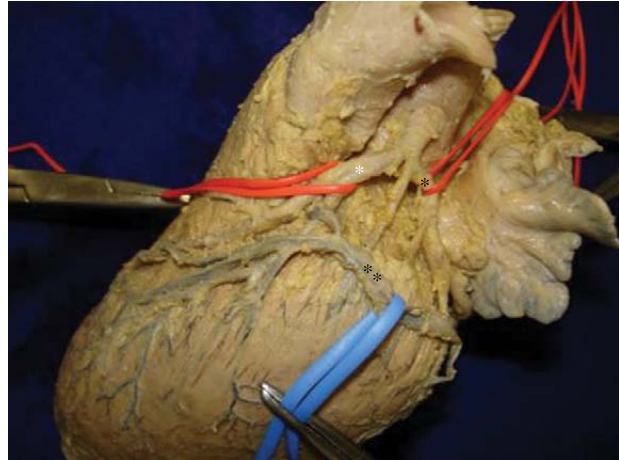- Closed: when the GCV crosses both the CA and the AIA (Figure 3);

Figure 2. Abscence of the triangle. White asterisk: anterior interventricular artery; black asterisk: circumflex branch; double black asterisk: great cardiac vein.
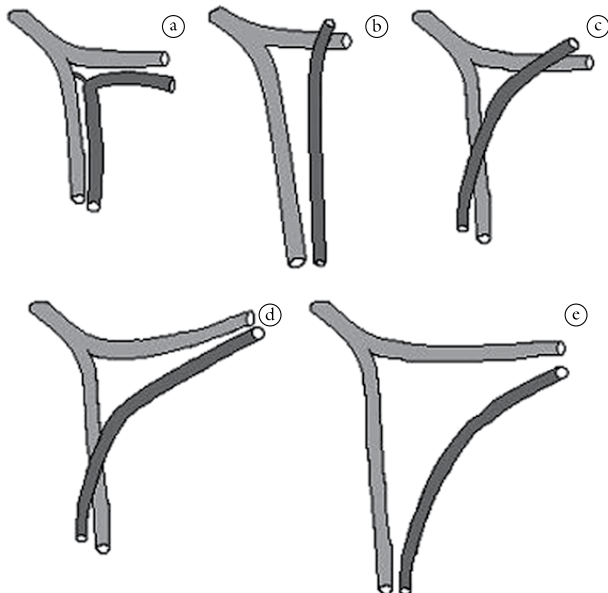

Figure 1. Schematic view of disposition of the vessels forming the trigone. a) Absence of trigone; b) inferiorly opened; c) closed; d) superiorly opened; e) completely opened (SOUSA-RODRIGUES, ALCÂNTARA, SILVA et al., 2004).
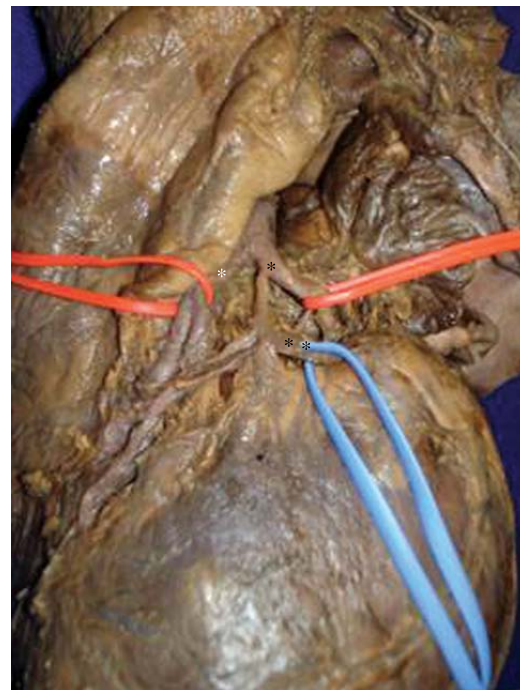

Figure 3. Closed triangle. White asterisk: anterior interventricular artery; black asterisk: circumflex branch; double black asterisk: great cardiac vein.

- Completely opened: the GCV doesn't cross any other vessel and is located inferiorly to CA in at the interventricular groove;
- Inferiorly opened: the GCV is located on the left of AIA and doesn't cross this vessel at the interventricular groove. After leaving the interventricular groove and turning left, the vein crosses the CA, passing anteriorly or posteriorly to this vessel (Figure 4); and
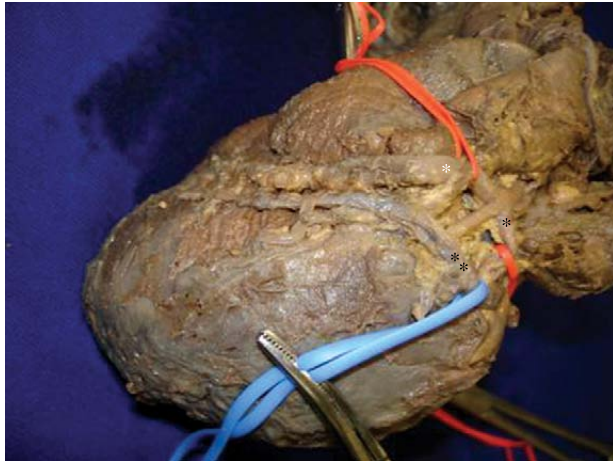
- Superiorly opened: the GCV crosses the AIA (anteriorly or posteriorly) during its course at interventricular groove, but lies inferiorly to CA without crossing this vessel.

The triangle of Brocq and Mouchet is commonly used when performing an intravascular ultrasound of coronary arteries to help in indentifying pericardium, myocardium and vessels in the neighborhood (METZ, YOCK and FITZGERALD, 1997). Variations of this triangle may have implications in detecting those structures by ultrasonography.

The relations of the GCV to CA and AIA, regarding to the "type of crossing" between vessels had been extensively studied, and the vein may cross those vessels anteriorly, posteriorly or even never cross neither (BALES, 2004).

Our results are in accordance with others with respect the distribution of the patterns of the triangle, as shown in Table 1.

This study aims to provide information regarding the anatomy of the heart in brazilian cadavers, what is the basis for surgical procedures in this organ.

Figure 4. Inferiorly opened triangle. White asterisk: anterior interventricular artery; black asterisk: circumflex branch; double black asterisk: great cardiac vein.

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Tabela 1. Comparação das freqüências dos tipos de trígono.

Classification of the triangle	Our study	Sousa-Rodrigues, Alcântara, Silva et al. (2004)	Ortale, Gabriel, Lost et al. (2001)
Closed	22%	35%	18%
Completely opened	22%	9%	15%
Inferiorly opened	44%	52%	64%
Superiorly opened	11%	4%	3%
Abscence of triangle	13%	0%	0%

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