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Case Report

Origin of the Left Common Carotid Artery from the Brachiocephalic Artery Trunk

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Abstract

The origin of the left common carotid artery from the brachiocephalic arterial trunk is a rare anatomical malformation. We report the case of a 54-year-old man with aortic stenosis on a bicuspid aortic valve with dilatation of the ascending aorta, discovered during a chest scan performed for a pulmonary tumor, which turned out to be negative. Our message is therefore the importance of knowing this type of anatomical variation because its discovery conditions our attitude to adopt in the conduct of a surgical procedure.

Keywords: Left common carotid artery; Brachiocephalic artery trunk; Aneurysm; Anatomy

Introduction

The term “bovine aortic arch” in humans [1,2] widely used in the medical literature is one that refers to an anatomical configuration that by name would probably resemble the branching pattern of the aortic arch found in the ruminant family (bovines, buffles). Indeed, this name is a misnomer as it does not really reflect the branching pattern of the arch found in cattle (a single common brachiocephalic trunk that gives rise to all vessels of the head and upper limbs) [3]. In older studies, the different variants of the bovine arch were considered as physiological anomalies and had less clinical impact. Nowadays, with the evolution of surgical and endovascular interventions in the aortic arch, the presence of these variants could pose significant challenges to the surgeon or even influence the outcome [4,5]. Furthermore, several studies have recently found an association between the presence of a bovine arch and aortic dilatation [6-8]. In this article, we describe the specific anatomical aspect of a case of human aortic arch branching associated with aortic dilatation discovered in a patient operated on in the department. Our message is therefore the importance of knowing this type of anatomical variation because its discovery conditions our attitude to adopt in the conduct of a surgical procedure.

Material and Methods

We report the case of a 54-year-old patient, who was referred to the department for aortic stenosis on a bicuspid aortic valve with dilatation of the ascending aorta, discovered during a chest thoracic scan performed for a pulmonary tumor, which turned out to be negative.

Results

We found in this patient that the brachiocephalic arterial trunk gives rise to the left common carotid artery about 0.5 cm from the aortic arch. Therefore, only two large arterial branches arise directly from the aortic arch. It should be noted that this anomaly in the origin of the left common carotid artery was clearly visible on the thoracic scan Figures 1&2.

Figure 1: Scan of the aortic arch.

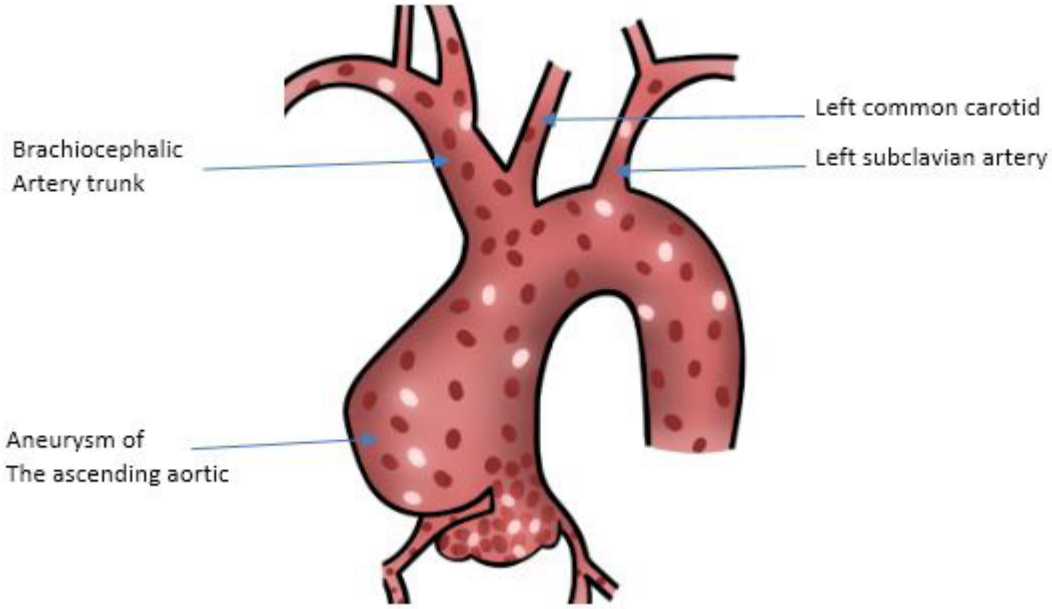

Figure 2. Diagram of the aortic arch showing the anomaly

Our attitude in this patient was therefore to perform a Bentall procedure associated with a prosthetic replacement of the aortic arch ith a separate reimplantation of the brachiocephalic artery trunk and the left primary carotid artery.

Commentary

The aortic arch and its branches develop in a complex process during the first 3-4 weeks of fetal life. In the classical anatomical configuration, the aortic arch is on the left side and has three main branches: the brachiocephalic artery trunk, the left common carotid artery and the subclavian artery. In approximately 49.7-94.3% of the population, the aortic arch has a standard anatomical configuration. [9,10]. Congenital anatomical variations of the aortic arch are usually incidental radiological findings. Older cadaveric studies have reported a high prevalence of bovine arches, particularly in African-American populations [10-12]. More recent studies have reported a prevalence of bovine arches of 8.0 to 31.1 [13-17]. In the present study, the left common carotid artery arises from the

brachiocephalic arterial trunk at a distance of 0.5 cm, so there are two large arterial branches that arise directly from the aortic arch. This variant occurs more frequently in African individuals (10%) than in European individuals (5%), with an overall rate of 9% in the general population [18,19]. Our patient also has an associated ascending aortic dilatation. There was no evidence of bicuspidity. Several authors have studied the association between the presence of a bovine arch and aortic pathologies. The presence of this birth defect can therefore be considered as a new anatomical risk factor or biomarker for aortic disease [8,20]. Some authors have demonstrated a higher prevalence of bovine arch in patients with aortic disease than in a healthy control group [21]. In a recent study, the bovine arch variant demonstrated haemodynamic flow patterns generally associated with endothelial injury and vascular stiffness [22]. Histological confirmation of this observation would be of great interest. Furthermore, several studies have shown that the primary intimal tear in aortic disease is attributed to haemodynamic and structural alterations resulting from aortic wall deformation. These factors include wall thickness, strain-stress relationship, impact of the tissue surrounding the artery, arterial pressure, pulsatile motion of the heart, residual stress and the degree of aortic wall fixation [23, 24].

Conclusion

The anomaly of birth of the left common carotid artery from the brachiocephalic arterial trunk, also known as the "bovine arch", is an anatomical variant that is always associated with dilatation of the aorta. The discovery of this anomaly conditions our attitude to adopt in the conduct of the surgical procedure.

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Misbaou BARRY, MD, PhD: supervision, revision, writing ; Mesut GUN, Eng: supervision, revision & editing, visualisation; Yuthiline HUN-CHABRY, MD : revision ; Majid HARMOUCHE, MD, PhD : revision ; Gilles TOUATI, MD, PhD : revision ; Thierry CAUS, MD, PhD : ideation, revision.

Availability of data and materials: The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

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