

## BOVINE AORTIC ARCH: CASE REPORT

### ARCO AÓRTICO BOVINO: RELATO DE CASO

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#### ABSTRACT

The bovine aortic arch is the most common variant in aortic arch anatomy. Recent imaging studies indicate that this variant is present in 10–20% of the population, although cadaveric studies have reported a prevalence ranging from 11% to 27%. Our study aimed to report a case of bovine arch in a plastinated heart. During a routine dissection of the cardiac base vessels, an anatomical variation of the aortic arch, the bovine arch, was observed. In our study, the bovine arch originated from the left lateral aspect of the brachiocephalic trunk, marking the first time this aortic arch pattern was observed in our anatomical collection. Therefore, a deeper understanding and continuous monitoring of these anomalies not only increase the knowledge of healthcare professionals but are also crucial to avoid misdiagnosis and inappropriate treatment choices.

**Keywords:** Bovine Arch. Aortic Arch. Variation. Cadaver.

#### RESUMO

O arco aórtico bovino é a variante mais comum na anatomia do arco aórtico. Estudos recentes de imagem indicam que essa variante está presente em 10–20% da população, embora estudos em cadáveres tenham relatado uma prevalência variando de 11% a 27%. Nosso estudo teve como objetivo relatar um caso de arco bovino em um coração plastinado. Durante uma dissecação de rotina dos vasos da base cardíaca, uma variação anatômica do arco aórtico, o arco bovino, foi observada. Em nosso estudo, o arco bovino originou-se do aspecto lateral esquerdo do tronco braquiocéfálico, marcando a primeira vez que esse padrão de arco aórtico foi observado em nossa coleção anatômica. Portanto, uma compreensão mais profunda e o monitoramento contínuo dessas anomalias não apenas aumentam o conhecimento dos profissionais de saúde, mas também são cruciais para evitar diagnósticos equivocados e escolhas de tratamento inadequadas.

**Palavras-chave:** Arco Bovino. Arco Aórtico. Variação. Cadáver.

#### RESUMEN

El arco aórtico bovino es la variante más común en la anatomía del arco aórtico. Estudios de imagen recientes indican que esta variante está presente en el 10-20% de la población, aunque estudios cadavéricos han reportado una prevalencia que oscila entre el 11% y el

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27%. Nuestro estudio tuvo como objetivo informar un caso de arco bovino en un corazón plastinado. Durante una disección rutinaria de los vasos de la base cardíaca, se observó una variación anatómica del arco aórtico, el arco bovino. En nuestro estudio, el arco bovino se originó en el aspecto lateral izquierdo del tronco braquiocefálico, lo que marca la primera vez que se observó este patrón de arco aórtico en nuestra colección anatómica. Por lo tanto, una comprensión más profunda y el monitoreo continuo de estas anomalías no solo aumentan el conocimiento de los profesionales de la salud, sino que también son cruciales para evitar diagnósticos erróneos y opciones de tratamiento inapropiadas.

**Palabras clave:** Arco Bovino. Arco Aórtico. Variación. Cadáver.

## 1 INTRODUCTION

Variants and anomalies of the aortic arch are relatively common. The normal aortic arch is left-sided and has three main branches: the brachiocephalic trunk, the left common carotid artery, and the left subclavian artery (MYLONAS et al., 2018). Among the various variants, the most frequent is the brachiocephalic trunk, which is the common origin of the brachiocephalic and left common carotid arteries, followed by the direct origin of the left vertebral artery from the aorta (JAKANANI et al., 2010). Common anomalies of the aortic arch also include aberrant right subclavian artery, right arch, and double aortic arch (CELIKAY et al., 2009).

Aortic arch (AA) anomalies can cause symptoms of tracheal and/or esophageal compression, with or without vascular ring formation. In other cases, these AA variants often remain asymptomatic and are often identified incidentally on imaging studies. However, recent studies have observed an association between the presence of AA variants and the risk of aortic dissection and aneurysm (MYLONAS, et al., 2018).

Bovine aortic arch (BA) is the most common variant in aortic arch anatomy. Recent imaging studies indicate that this variant is present in 10–20% of the population, although cadaveric studies have reported a prevalence ranging from 11% to 27%. The term "bovine aortic arch" refers to the shared origin of the left common carotid artery and brachiocephalic trunk (JAKANANI et al., 2010).

The aortic arch and its branches develop through a complex process during the first 3–4 weeks of fetal life (PIMENTA, 2024). Congenital anatomical variations of the aortic arch are usually discovered incidentally on radiological examinations. The so-called bovine arch, despite its misnomer, which does not reflect the branching pattern found in cattle (a single common brachiocephalic trunk that gives rise to all vessels of the head and upper limbs), is the most common variation of the aortic arch, with a prevalence ranging from 1% to 21% (EBNER et al., 2013).

In earlier studies, these patterns were considered physiological abnormalities of minor clinical impact; however, with the advancement of surgical and endovascular interventions in the aortic arch, the presence of these variants can pose significant challenges for the surgeon and even influence the outcome of the procedure. Furthermore, recent studies have identified an association between the presence of BA and aortic dilation, and others have suggested a higher prevalence of BA among patients with aortic dissection compared to healthy individuals, although this has not been confirmed by all

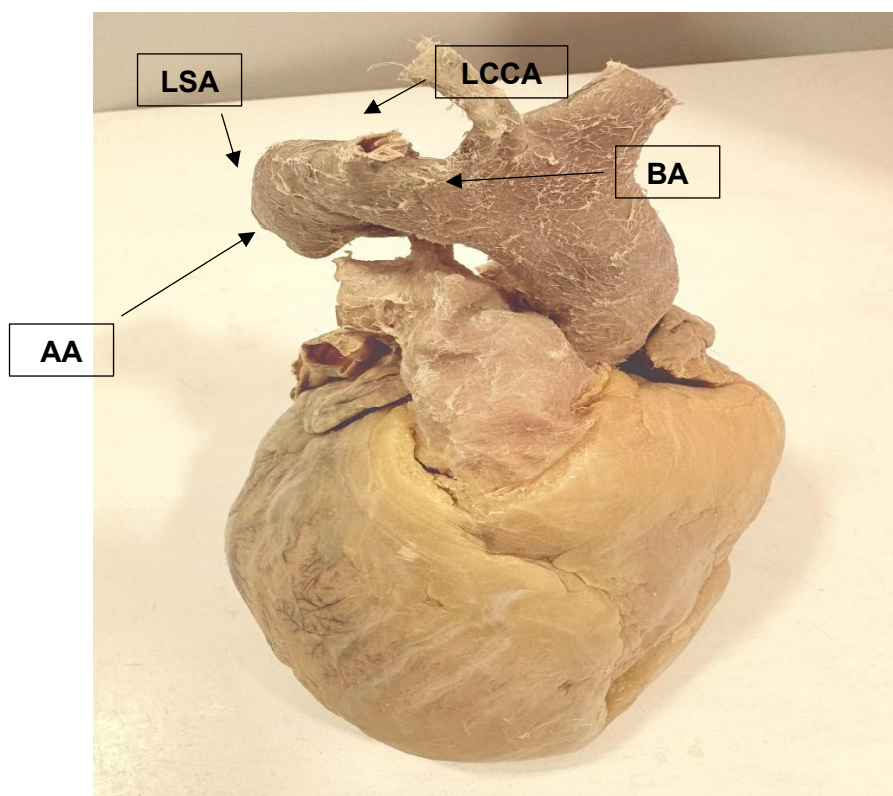
studies (RIZZO et al, 2014). Our study aimed to report a case of bovine arch in a plastinated heart.

## 2 CASE REPORT

During a routine dissection of the heart base vessels, an anatomical variation of the aortic arch was observed. This anatomical variation was found in a formalin-embedded heart that was later plastinated and belonged to the collection of the human anatomy laboratory of the State University of Amazonas. It was observed that the left common carotid artery was emitted by the brachiocephalic trunk (Figure 1). The diameter of the vessels originating from the aortic arch was also analyzed using a digital caliper (Mtx ): AA - 21.52 mm; LCCA - 8.48 mm; LSA - 10.70 mm; BA - 16.80 mm.

**Figure 1**

Posterior view of the aortic arch



BA-Bovine arch; LCCA-Left common carotid artery; LSA- Left subclavian artery; AA- Aortic arch.

## 3 DISCUSSION

In the classic anatomical configuration, the aortic arch is left-sided and has three main branches: the brachiocephalic trunk, the left common carotid artery, and the left subclavian

artery ( RESENDE et al., 2023) . In approximately 49.7% to 94.3% of the population, the aortic arch presents this standard configuration ( NELSON et al., 2001) . The prevalence of the bovine arch (BA), according to radiological or cadaveric studies, ranges from 1.0% to 41% ( NAYAK et al., 2006) . Older cadaveric studies reported a high prevalence of the bovine arch (11-27%), especially among African-American populations ( NATSIS et al., 2009) . In our study, we verified a variation of the aortic arch where the left common carotid artery originated from the left lateral aspect of the brachiocephalic trunk, conventionally called the bovine arch.

The formation of the definitive aortic arch and its branches occurs in the first weeks of fetal life, initially presenting a common arterial trunk, the truncus arteriosus, which emerges from the primitive heart and divides into six paired arches ( MYLONAS et al., 2018) . These arteries sequentially merge on both sides of the pharynx, forming

bilateral dorsal aortas. During the third week, these dorsal aortas unite to form a single descending aorta at the level of the fourth thoracic vertebra ( ÇETIN et al., 2009). The first, second, and fifth arches regress. The third arch forms the carotid arteries. The fourth arch on the right gives rise to the brachiocephalic trunk and the right subclavian artery, while the arch on the left forms the left subclavian artery and the aortic arch, which later joins the descending aorta ( ÇETIN et al., 2009).

To date, several studies have investigated the association between bovine arch (BA) variations and aortic pathologies, suggesting that the presence of this variation may be considered a new anatomical risk factor or biomarker for aortic diseases ( HORNICK et al., 2012). Dumfarth et al. (2015) demonstrated a higher prevalence of BA in patients with aortic diseases compared with a healthy control group. Furthermore, elevated aortic growth rates were reported in patients with BA compared with those without the variation.

Wanamaker et al. (2013) published a study on aortic arch anomalies in patients with thoracic aortic dissection, showing a higher prevalence (43.2%) of these anomalies in patients with thoracic aortic dissections compared to controls.

A recent study demonstrated that the AB variant presents hemodynamic flow patterns typically associated with endothelial lesions and vascular stiffness, and histological confirmation of this observation is of great interest (SHALHUB et al., 2017). Furthermore, it has been suggested that primary intimal rupture in aortic dissection is attributed to hemodynamic and structural changes resulting from aortic wall deformation ( SHALHUB et al., 2017) . These factors include wall thickness, strain-strain relationship, impact of

surrounding tissue, homogeneous material properties, blood pressure, pulse wave reflections from arterial branches, pulsatile heart motion, residual stress, and degree of aortic wall fixation (CHENG et al., 2013).

#### 4 CONCLUSION

This study reported the presence of anatomical variation in the aortic arch of the bovine arch type in a plastinated heart, a finding that is often asymptomatic and sometimes observed during diagnostic procedures. Therefore, a deeper understanding and anatomical descriptions of these anomalies not only increase the knowledge of healthcare professionals but are also crucial to avoid misdiagnosis and inappropriate treatment choices.

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