Olgu Sunumu / Case Report
Aegean J Med Sci 2023;2:56 -59

Ascending Aortic Aneurysm Surgery with Bovine Aortic Arch

Sığır aortik arkı ile çıkan aort anevrizma cerrahisi

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ÖZET

Aortik ark anatomisinde en sık görülen anatomi ve bu nedenle normal değerlendirme sol ana karotis arterin izole olarak arkus aortadan ayrıldığı formdur. Sol ana karotid arterin brakiosefalik arterden veya brakiosefalik arter ile ortak bir kökten çıktığı aortik ark varyantı 'sığır aortik arkı' olarak adlandırılır. Günlük pratikte aortik ark varyantlarının farkındalığı girişimsel klinisyenler için son derece önemlidir. Makalemizde kliniğimizde uygulanan farklı anevrizma ameliyatları ile bu varyantın literatür taraması ve cerrahi öneminin vurgulanması amaçlanmıştır.

Anahtar Kelimeler: sığır aortik arkı, aortik ark anomalileri, çıkan aort anevrizması

ABSTRACT

The most common presentation in aortic arch anatomy and therefore normal evaluation is the form in which the left common carotid artery is isolated from the arcus aorta. A variant of the aortic arch, where the left common carotid artery arises from the brachiocephalic artery or from a common root with the brachiocephalic artery, is called the bovine aortic arch. Awareness of aortic arch variants in daily practice is very important for interventional clinicians. In our article, it is aimed to emphasize the literature review and surgical importance of this variant by means of different aneurysm operations performed in our clinic.

Keywords: bovine aortic arch, aortic arch anomalies, ascending aortic aneurysm

INTRODUCTION

A variant of the aortic arch in which the left common carotid artery arises from the brachiocephalic artery or from a common root with the brachiocephalic artery is called bovine aortic arch (BAA). Terminology is controversial in the literature because bovine arch can be essentially misleading. We think that the origin of this term stems from the similarity of the radiological appearance to bovine horns, during radiological imaging [1]. Awareness of aortic arch variants is especially important for cardiovascular surgeons. We present three different surgeries for aortic valve pathologies and an ascending aortic aneurysm with a bovine arch anomaly.

CASES

Case 1

A 60-year-old male patient was hospitalized with shortness of breath and fatigue. Transthoracic echocardiography revealed EF 55%, ascending aortic diameter 42mm, aortic valve area 0.98cm2, aortic valve structure tricuspid, 2nd degree aortic valve insufficiency, and aortic valve gradient (max/average) 80/47 mmHg. Thorax Computed Tomography Angiography (CTA) demonstrated that BAA which was intraoperatively observed (Figure-1A and 1B). By performing antegrade selective cerebral perfusion (ASCP; outflow decreased to approximately 8-10 ml / kg / min) was provided bilateral perfusion cerebral blood flow via the right brachial artery through the right carotid artery and the left carotid artery.

The patient underwent a Bentall procedure and hemi-arcus replacement with the open distal anastomosis technique (ASCP time: 17 minutes). Due to advanced age of patient, serious aortic valve disease and 45 mm aortic diameter from CT images such as post-stenotic dilatation accepted as an indication for ascending aortic replacement. (ASCP time: 17 minutes).

Case 2

A 70-year-old male patient was admitted for palpitation. Transthoracic echocardiography revealed EF 50%, an

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Received/Geliş Tarihi: 19.04.2023 || **Accepted/Kabul Tarihi:** 08.06.2023

ascending aortic diameter 68mm, an aortic root (sinus of valsalva level) 56mm, presence of annuloaortic ectasia with aortic valve structure tricuspid and 2-3 insufficiency. Thorax CTA demonstrated that BAA which was seen following brachial artery cannulation, sternotomy, and uni-caval cannulation, respectively (Figure-2A and 2B). Open distal anastomosis technique was applied with ASCP and Tirone-David valve-sparing aortic root replacement (modified Yacoub) and hemi-arcus replacement were applied to the patient (ASCP time: 16 minutes).

Figure-1A and 1B. *(A) 3D CT angiography view of the case, (B) intraoperative bovine arch view of the case (TB: Truncus Brachiocephalicus, LCCA: Left Common Carotid Artery, LSA: Left Subclavian Artery)*

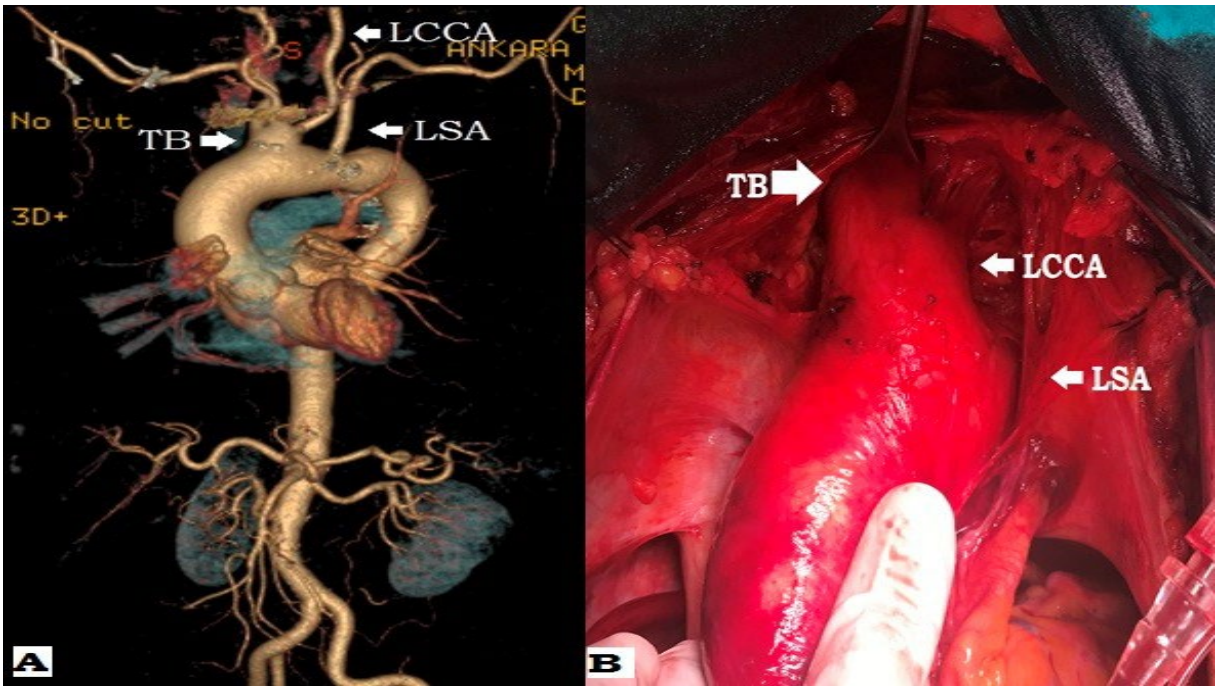
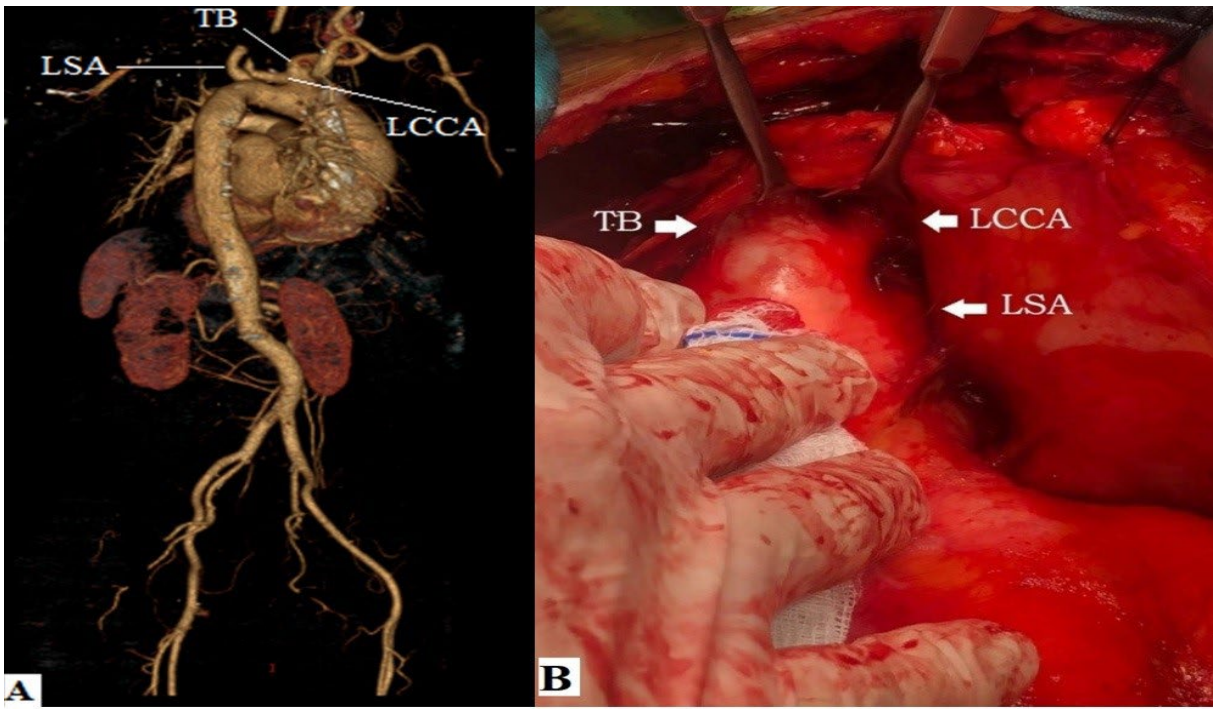


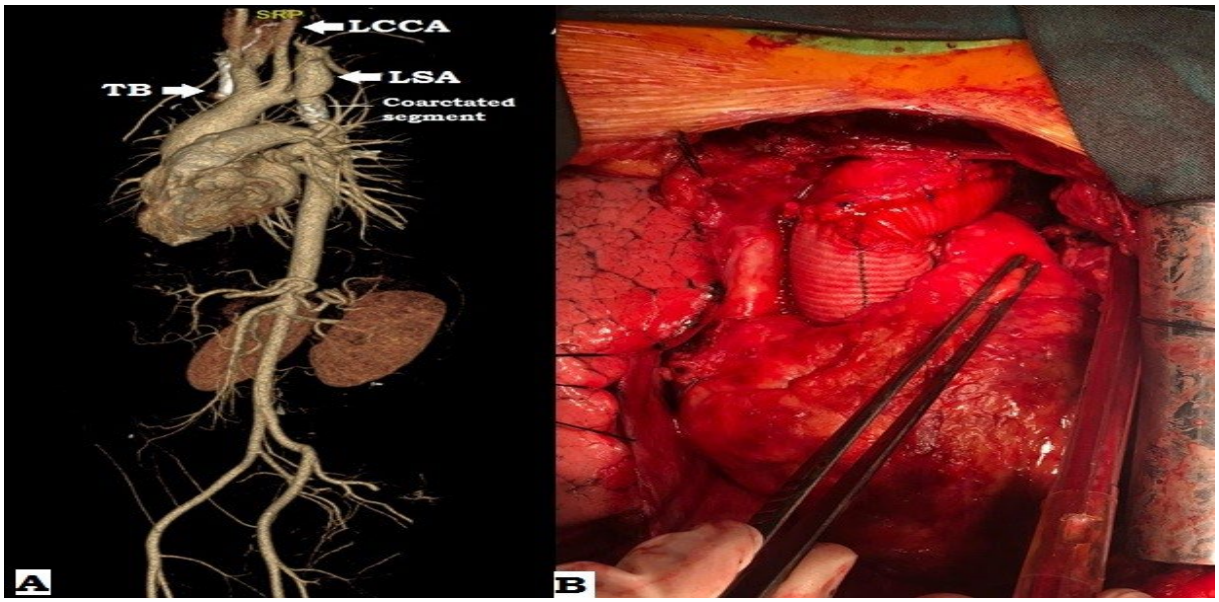
Figure 2: (A) *3D CT angiography view of the case (posterior), (B) intraoperative bovine arch view of the case (Truncus Brachiocephalicus, LCCA: Left Common Carotid Artery, LSA: Left Subclavian Artery)*



Case-3

A 32-year-old male patient presented arterial pressure irregularities. At the age of 7, he was operated for VSD and aortic coarctation. Transthoracic echocardiography showed an EF of 60%, a gradient of 60mmHg in the graft over the descending aorta, a turbulent flow in the descending aorta and prestenotic dilatation, bicuspid aortic valve with minimal valve regurgitation, and a diameter of 42mm in the ascending aorta with a patch in the perimembranous region. In Thorax CTA; it was observed that the ascending aorta was 44.3 mm in diameter, the coarcted segment by graft with a diameter of 16 mm in the aortic arch just distal to the left subclavian artery exit, prestenotic dilatation in the left subclavian artery before the coarcted segment and BAA (Figure-3A). Aortic dilatation and diameter was in accordance with our intraoperative observation and clearly presented a need for ascending aortic replacement. Furthermore, a scheduled aortic replacement as a third operation in the future would definitely be with high mortality risk for the patient, when aortic replacement have not been completed during our session. Femoral cannulation preparation was made due to urgency with innominate artery and unicaval cannulation. Supracoronary graft interposition was applied to the ascending aorta (Figure-3B). Then, the descending aorta and existing aortic graft were reached with ASCP. A partial incision was made and reconstruction was performed with a patch. (ASCP duration: 41 minutes).

Figure 3. *(A) 3D CT angiography view of the case, (B) intraoperative view of the case at the end of the operation (TB: Truncus Brachiocephalicus, LCCA: Left Common Carotid Artery, LSA: Left Subclavian Artery)*



DISCUSSION

The typical branching pattern of the left-sided aortic arch consists of the brachiocephalic trunk, isolated ascending left common carotid artery, and left subclavian artery. In a recent meta-analysis study reporting prevalence data on variants, the normal branching pattern was reported to be 80.9% and the BAA pattern to be 13.6%[2]. The incidence of BAA varies between 8% and 40.5% [3]. We think that the consistent rates stated in the normal arc prevalence cannot be found in the BAA, due to the terminological difference and the lack of current basic guidelines on classification. The 1964 Stewart classification is traditionally used for congenital aortic arch anomalies. However, this classification should be updated for newly discovered arch abnormalities thanks to technological advances in diagnostic imaging methods [4].

Cerebral protection in conventional arcus aortic operations is provided by three basic methods of deep hypothermic circulatory arrest, antegrade and retrograde cerebral perfusion. In special cases, carotid artery cannulation is a fast, safe and effective method to provide cerebral protection, but the disadvantage of this method is that it provides unilateral perfusion in the carotid arteries. BAA anatomy makes it possible to create a safe and wider field

by facilitating the methods of obtaining cerebral perfusion, which allows bilateral carotid perfusion, and completely freeing the surgical field. Since it provides a relatively larger diameter compared to the isolated carotid artery, it provides ease of cannulation and greater blood flow.

In recent years, some aortic arch anomalies have been associated with thoracic aortic disease at a higher rate compared to the general population. In one study, the incidence of BAA in patients with thoracic aortic aneurysm was 20.7%, while this frequency was 6.7% in the group without thoracic aortic aneurysm [5]. It has also been suggested that the coexistence of other cardiac abnormalities such as bicuspid aortic valve is more common in patients with aortic arch anomalies. Yousef et al. [3] reported in his study that the anomalies with the highest association with thoracic aortic aneurysms were, respectively, aberrant left subclavian artery combined with right-sided arch (33%), bovine arch (13%), and aberrant right subclavian artery anomaly (8.2%). In the same study, age, male gender, hypertension, aortic valve disease and arch anomalies were determined as independent risk factors for thoracic aortic aneurysm.

Consistent with this view and the general literature, we found similar risk factors and trends in our own cases with BAA anomaly.

CONCLUSION

Consequently, the incidence of BAA is still unknown. It is not clear whether there is a coincidental relationship between this arch anomaly and patients with bicuspid aortic valve and ascending aortic aneurysm. While most variants do not pose a life threat, we recommend imaging to include the entire aorta, especially preopratively, in terms of aortic arch anomalies and accompanying conditions. Awareness of this variant when antegrade cerebral perfusion is required during operations is extremely important because of the surgical advantages and disadvantages it provides.

Acknowledgments

The authors would like to thank the patient and her family for allowing the use and publishing of her medical records in this case report.

Etik; Bu yazıda sunulan olgu için sunulan bilgilerin akademik amaçlı kullanımı hakkında detaylı bilgileri de içeren imzalı "Bilgilendirilmiş onam formu" alınmıştır.

Ethics; For the case presented in this article, a signed "informed consent form" was obtained, which includes detailed information about the use of the information presented for academic purposes.

Yazar katkı durumu; Araştırmanın konsepti ve tasarımı: Sungur EC, Verilerin elde edilmesi: Benli ED, Verilerin analizi ve yorumlanması: Özbek HM, Literatür taraması ve makalenin yazımı: Sungur EC, Talay S, Entelektüel içerik için makalenin eleştirel revizyonu: Sarıtaş A

Author contribution status; Conception and design of the research: Sungur EC, Acquisition of data: Benli ED, Analysis and interpretation of the data: Ozbek HM, Literature Review and Writing of the manuscript: Sungur EC, Talay S, Critical revision of the manuscript for intellectual content: Sarıtas A

.Yazarlar arasında çıkar çatışması yoktur.

The author declares no conflict of interest.

Finansal Destek: yoktur / Funding : none

doi: https://doi.org/10.33713/egetbd.

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