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Research Article

Morphological investigation of arcus aortae and branches in badger (*Meles meles*)

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ABSTRACT

The branches originating from the arcus aortae formed by the aortae after exiting the heart differs between animals. In this study, it was aimed to examine the morphology of the arcus aortae in the badger (*Meles meles*). Two adult badgers, which died as a result of a traffic accident at different times and were brought to the anatomy laboratory. Thorax was dissected and the heart and aortae were exposed. It was observed the heart was located between 3rd-7th costae and was connected to the diaphragma with the ligamentum sternophericardiacum. It was determined that truncus brachiocephalicus and arteria subclavia sinistra was originated from the arcus aortae at the level of 4th costae. It was determined that the first branch of truncus brachiocephalicus was arteria carotis communis sinistra and then divided into arteria subclavia dextra and arteria carotis communis dextra, respectively. It was seen that arteria vertebralis, truncus costocervicalis, arteria cervicalis superficialis and arteria thoracica interna originated from arteria subclavia sinistra. Branches of arteria subclavia dextra were found to be similar to arteria subclavia sinistra. It was determined that the branches originating from the arcus aortae were similar to those in cats and dogs. It is thought that this study will contribute to the anatomical knowledge of the endangered badger, which is under protection.

INTRODUCTION

Badger (*Meles meles*) belongs to the Mustelidae subfamily and order Carnivora (Demirsoy, 2003). The badger is widespread in the world, and spreads coast to 2000 m, from Trakya to Eastern Anatolia in Turkey (Ozen and Ulucay, 2010). The badger is hunted for its valuable skin and some of its by-products (Sapundzhiev et al., 2019). In Turkey, the badger population is endangered and therefore it has been taken under protection (Pamukoglu ve Demir, 2001).

There are various studies about the badger's biology, ecology and habitat (Ozen and Ulucay, 2010; Pamukoglu and Demir, 2001; Roper, 2009; Pamukoglu and Tuncer, 2014) as well as several studies on its anatomy. Anatomic studies were on badger gastrointestinal anatomy (Stark et al., 1987), pancreatic morphology (Ozdemir, 2005), skeleton macro-anatomy (Atalar and Cakır, 2004; Spataru, 2016), ear ossicles morphology and morphometry (Martonos et al., 2022), tongue morphology (Haligur et al., 2022). In the literature research, no study has been found about the aortae, which is the beginning of the circulatory system.

The curvature of the aortae after leaving the left ventricle of the heart is called arcus aortae. (Getty, 1975; Dursun, 2006). The head, neck, forelimbs, some organs in the thoracic cavity, and the anterior part of the chest are supplied by two large vessels, the arteria subclavia and arteria carotis communis, which originate from the arcus aortae. (Evans et al., 1993). In Equidea and ruminantia these two arteries stems from the truncus brachiocephalicus which originates from the arcus aortae. In carnivores and sus, the arteria subclavia sinistra originates directly from the arcus aortae, not from the truncus brachiocephalicus (Chiasson and Booth, 1982; Dyce et al., 2002).

In this study, it was aimed to morphologically examine the arcus aortae and the branches originated from the arcus aortae in the badger.

MATERIALS and METHODS

In this study, two adult female (9.21-11.72 kg) badgers (*Meles meles*), which died in a traffic accident at different times around the Ceyhan district of Adana province were used. They were brought to the Ceyhan Veterinary Faculty Anatomy Department and stored in deep freezer until study. Thoracic cavity of the badger was opened with the classical dissection method, and the tissues around the heart and aortae were removed with the same method. Tissues were fixed in 10% formaldehyde solution. The dissected materials were photographed with a digital camera. Nomina Anatomica Veterinaria (2017) was used as a reference in anatomical terminology.

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RESULTS

In this study it was determined that the heart of badger lies in a rather oblique manner in the thoracic cavity, at the mediastinum, and between the level of the third to the level of seventh costae.

It was observed that the arcus aortae (Ar) started after the aortae ascendens at the level of the fourth to the level of fifth spatium intercostale and continued up to the level of the sixth vertebrae thoracalis (Figure 1). The arcus aortae showed a craniodorsal curvatura. It was seen that in both of the badgers, firstly the truncus brachiocephalicus (Tr) (Figure 2) and then the arteria subclavia sinistra (Ss) (Figure 2) originated from the arcus aortae at the level of fourth costae. It was indicated that arteria carotis communis sinistra (Cs) (Figure 2), arteria carotis communis dextra (Cd), and arteria subclavia dextra (Sd) (Figure 2) originated from the truncus brachiocephalicus (Tr), respectively at the level of the first to the level of second costae near the apertura thoracis cranialis. The formation of truncus bicaroticus could not detected in the both of the badgers.

It was determined that firstly the arteria vertebralis (Av) originate from arteria subclavia sinistra (Ss) at the medial level of first costae, and then trunchus costocervicalis (Tc) originate at the level of the apertura thoracis cranialis (Figure 2). In addition, it was observed that arteria cervicalis superficialis and arteria thoracica interna originated from arteria subclavia sinistra after the origin of the truncus costacervicalis. Branches of arteria subclavia dextra were found to be similar to arteria subclavia sinistra.

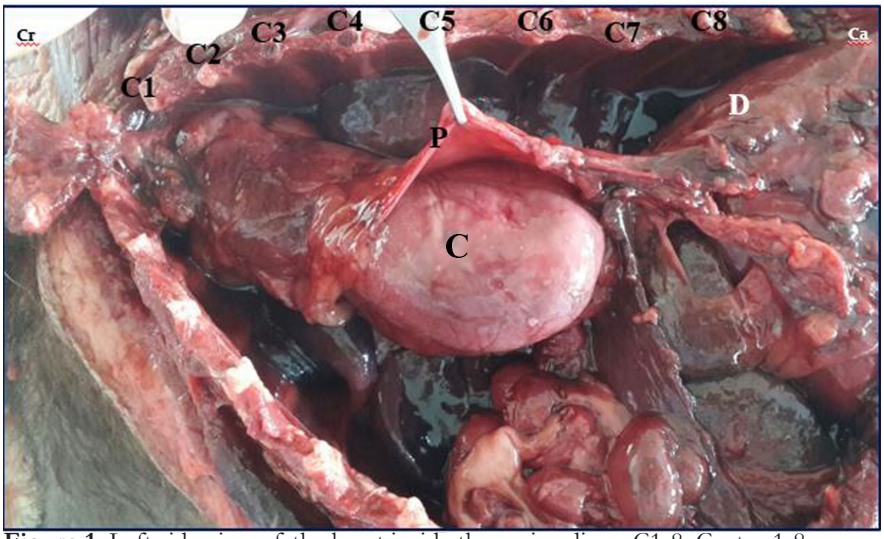

Figure 1. Left side view of the heart inside the pericardium. C1-8: Costae 1-8, Ca: Caudal, Cr: Cranial, D: Diapragma, C: Cor, P: Pericardium

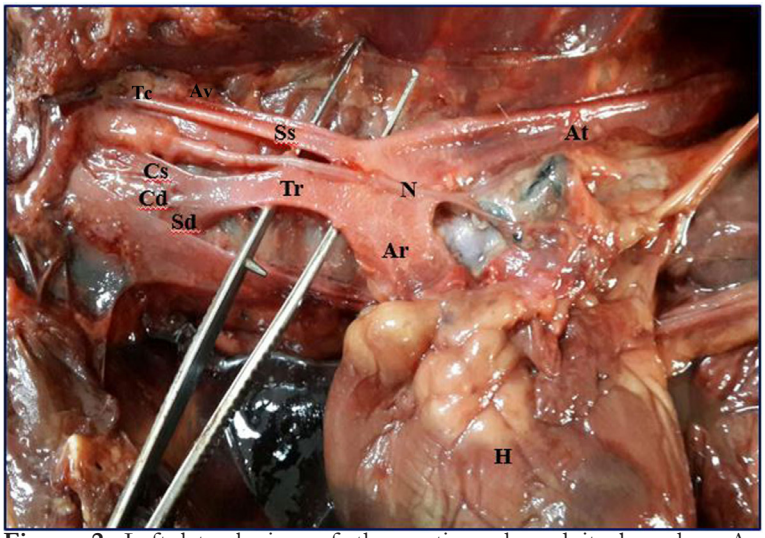

Figure 2. Left lateral view of the aortic arch and its branches. Ar: Arcus aortae, At: Aortae thoracica, Cd: Arteria carotis communis dextra, Cs: Arteria carotis communis sinistra, H: Cor, N: Nervus vagus Sd: Arteria subclavia dextra, Ss: Arteria subclavia sinistra, Tr: Truncus brachiocephalicus, Tc: Trunchus costocervicalis, Av: arteria vertebralis

DISCUSSION

The heart is located on the left midline in the mediastinum, and lies between the level of third to the level of fifth costae in the ruminant and sus, the level of third to level of sixth costae in the equide and level of third to the level of seventh costae in cats and dogs (Dursun, 2006; Chiasson and Booth, 1982). 2013). The location of the badger heart is similar to the cat and dog findings in the literature (Getty, 1975; Dyce et al., 2002).

It has been reported that the arcus aortae begins at the level of the second spatium intercostale in the rabbit (Ekim and Dursun, 2011). In the current study, it was determined that the arcus aortae in the badger started at the level of the fourth to the level of fifth spatium intercostale. In addition, it was observed that the arcus aortae in the badger continued up to the level of the sixth vertebrae thoracalis, as in the rabbit (Ekim and Dursun, 2011).

It has been indicated that truncus brachiocephalicus originates from arcus aortae as a single branch in equidea (Getty, 1975; Dyce et al., 2002; Budras et al., 2009) and ruminantia (Getty, 1975; Dursun, 2006; Dyce et al., 2002). But in cats, dogs (Getty, 1975; Dursun, 2006; Chiasson and Booth; 1982; Dyce et al., 2002) and squirrels (Sadeghinezhad et al., 2015), first the truncus brachiocephalicus and then the arteria subclavia sinistra are originated from the arcus aortae. It was reported that the truncus brachiocephalicus and arteria subclavia sinistra were originated from the arcus aortae at the level of the second costae in chinchilla (Ozdemir et al., 2008), at the level of the fifth spatium intercostale in fox (Karakulum and Ozcan, 2013). In addition to these two main arteria, arteria anonyma was also originated from arcus aortae in rat (Teke, 2000). It was reported that in spiny mice (Oto et al., 2010) and porcupines (Atalar, 2011), truncus brachiocephalicus, arteria carotis communis sinistra and arteria subclavia sinistra originate from arcus aortae, whereas in rabbit (McLaughlin and Chiasson, 1979) the arteria anonymus and arteria subclavia sinistra originate from the arcus aortae. In a study conducted in rabbits, it was reported that while the truncus brachiocephalicus firstly originated from the arcus aortae in 9 animals, arteria carotis communis sinistra, arteria carotis dextra and arteria subclavia sinistra were originated from arcus aortae respectively in one animal. In this study, similar findings were obtained in cats, dogs (Getty, 1975; Dursun, 2006; Chiasson and Booth, 1982; Dyce et al., 2002), chinchillas (Özdemir et al., 2008) and squirrels (Sadeghinezhad et al., 2015), but not in rats (Teke, 2000) and rabbits (Ekim and Dursun, 2011; McLaughlin and Chiasson, 1979).

It has been reported that arteria carotis communis sinistra, arteria carotis communis dextra, and arteria subclavia dextra originate from the truncus brachiacephalicus respectively in cats and dogs (Getty, 1975; Dursun, 2006; Chiasson and Booth, 1982; Dyce et al., 2002). As stated in rabbits (Ekim and Dursun, 2011), truncus bicaroticus structure was not found in this study. It has been reported that the sus has truncus bicaroticus and the arteria subclavia dextra immediately originates from the arcus aortae (Getty, 1975). In this study, it was observed that the truncus brachiocephalicus was in the form of a single root and arteria carotis communis sinistra, arteria carotis communis dextra and arteria subclavia dextra was originated from this root.

CONCLUSION

In present study, the morphological structure of the arcus aortae and its branches of badger (*Meles meles*) was revealed. It was determined that the branches originating from the arcus aortae were similar to in cats and dogs. The study was carried out on two animals in order not to reduce badger's population in the wild life. It is thought that this study will contribute to the anatomical knowledge of the endangered badger, which is under protection.

DECLARATIONS

Ethics Approval

This study was carried out of with the permission of the Ministry of Forestry and Water Affairs Nature Conservation and National Parks General Directorate. (numbered 38002405-445.05-177733) and the approval of Çukurova University Animal Experiments Local Ethics Committee numbered 2017/6-6.

Conflict of Interest

The authors declare that there have no conflict of interests.

Consent for Publication

Not applicable.

Author contribution

Idea, concept and design: AH, SÖ

Data collection and analysis: AH, SÖ

Drafting of the manuscript: AH

Critical review: SÖ

Data Availability

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

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