

PATTERN OF THE VERTEBRAL ARTERY AND ITS ANASTOMOSES IN GERMAN SHEPHERD DOGS

İbrahim KÜRTÜL*

Nejdet DURSUN**

Sami ÖZCAN*

Geliş Tarihi : 05.07.2002

Summary: The aim of the study was to reveal the origin, branches, anastomosis, and termination of the vertebral artery of the German shepherd dog. In the study, a number of 8 German shepherd dogs regardless of sex with the age of six months to one year, provided from Gemlik Military Veterinary School and Education Center Commendership, were used as material. Colored latex was injected through either left subclavian or brachiocephalic artery. The results have showed that the vertebral artery run directly through the transversal canal, passing throughout it. It then enters the vertebral canal via the lateral vertebral foramen of the atlas, forming the basilar artery with its counterpart. The vertebral artery during its course has been shown to give branches that vascularize related anatomic structures, two of which making anastomoses with the branches of the occipital artery.

Key words: German shepherd dog, vertebral artery, basilar artery, vascularization

Alman Çoban Köpeklerinde Arteria Vertebralis'in Seyri ve Anastomozları

Özet: Bu çalışmada Alman çoban köpeklerinde a. vertebralis'in seyri sırasında vermiş olduğu dallar, yaptığı anastomozlar ve sonlaşma durumunun ortaya çıkarılması amaçlanmıştır. Çalışmada materyal olarak Gemlik Askeri Veteriner Okulu ve Eğitim Merkez Komutanlığı köpek takımından temin edilen ve yaşları 6 aylık ila 1 yıl arasında değişen erkek ve dişi karışık olmak üzere (5 erkek 3 dişi) 8 adet Alman çoban köpeği kullanıldı. Renklendirilmiş latex a. subclavia sinistra'dan veya a. brachiocephalica'dan enjekte edildi. Damarın diseksiyonda orijininin sonra direkt olarak canalis transversarius'a yöneldiği, bu kanal boyunca ilerleyip en sonunda atlas üzerinde bulunan foramen vertebrale laterale vasıtasıyla canalis vertebralis'e girerek a. basilaris'in oluşumuna katıldığı tespit edildi. Damarın bu seyir sırasında geçtiği bölgenin anatomik oluşumlarına dallar verdiği ve oksipital bölgede de a. occipitalis'in bir kolu ile de anastomozlaştığı ortaya konmuştur.

Anahtar sözcükler: Alman çoban köpeği, a. vertebralis, a. basilaris, vaskularizasyon.

INTRODUCTION

The vertebral artery (a. vertebralis) unites with its counterpart; thus, forming the basilar artery (a. basilaris) at the level of the atlas. Consequently, the basilar artery supplies the beginning of the spinal cord (medulla spinalis), pons, and medulla oblongata, later joining the circulus arteriosus cerebri. Two-third of the vascularization of the brain in the dog was shown supplied by the basilar artery^{1,2}. Histological studies have showed in human that the wall of the vertebral artery is made by a mix structure providing a specific blood passage condition³.

The left vertebral artery in domestic animals arises from the left subclavian artery (a. subclavia sinistra), the right one from the right subclavian artery (a. subclavia dextra) or the brachiocephalic trunk (truncus brachiocephalicus)⁴⁻⁶. They, in canine, always leave the right and left subclavian artery first^{5,7-9}. The vertebral artery later crosses medial surface of the first rib, passes through the transverse foramina of the first six cervical vertebrae, sending both muscular and spinal branches for the related regions, finally goes into the vertebral canal through the lateral vertebral

foramen, contributing the basilar artery^{4,10,11}.

Some of the terminal branches of the artery anastomose with the branches of the costocervical trunk^{4,8,12}. These anastomoses have been shown to be enough for the survival of the dog even if the common carotid and vertebral arteries are to be bilaterally ligated¹⁰. The vertebral artery also gives spinal branches for the spinal cord, constructing the dorsal and ventral spinal arteries during its course^{10,12,13}.

The vertebral artery at the level of the transverse foramen of the atlas sends a branch which anastomoses with the cervical ramus of the occipital artery^{3,8,10,13}, and gives an other branch which anastomoses with an other branch of the occipital artery at the level of the atlantic fossa. Continuation of each artery later passes the alar notch (incisura alaris), gets into the vertebral canal via the lateral vertebral foramen, finally each divides into cranial and caudal branches; the former making the basilar artery cranially, the latter constructing the ventral and dorsal spinal arteries^{2,10,13}.

A study done by Erden, et al.⁹ on Kangal shepherd dogs has showed the origin, course, branches,

* Department of Anatomy, Faculty of the Veterinary Medicine, Kafkas University, Kars-TURKEY

** Department of Anatomy, Faculty of the Veterinary Medicine, Ankara University, Ankara-TURKEY

anastomoses, and termination of the vertebral artery, documenting similar results with the literature.

The aim of the present study too was to reveal the origin, branches, anastomosis, and termination of the vertebral artery of the German shepherd dogs, and to determine the variation, if there is (are), among the species and to compare it (them) with the literature.

MATERIALS and METHODS

In the present study, a number of eight German shepherd dogs regardless of sex with the age of six months to one year, provided from Gemlik Military Veterinary School and Education Center Commendership, were used. Thoracic cavities (cavum pectoris) of the dogs that were gently deeply anaesthetized by xylazine-ketamine combination were opened, the hearts were cut off from the apex, and blood was emptied. The vessels were cleaned with physiologic saline through the aorta as indicated in the literature⁶. Colored latex (ZPG 582-G) was injected through the left and right subclavian arteries. The specimens were waited at room temperature in 10% formaldehyde for 2-3 days for the freezing of the latex. The course and termination of the vertebral arteries were dissected and their pictures were taken.

Nomina Anatomica Veterinaria¹⁴ was used for the anatomical nomenclature.

RESULTS

The vertebral artery (Figs. 1,2-1), the first main branch leaving the subclavian artery (Fig. 1-2), was seen arising from the subclavian artery at the level of the second rib. Approximately 0,2-0,3 cm. cranial to that was the costocervical trunk (Fig. 1-3) leaving the subclavian artery. The vertebral artery was observed passing under the costocervical trunk and advancing cranially nearly 0,2-0,3 cm later from its origin. During this course, it was observed giving a spinal branch before entering the transverse canal (Fig. 1-4). The vessel then enters into the transverse foramen of the sixth cervical vertebra (Fig. 1-5).

The vertebral artery during its course throughout the transverse canal was seen giving the dorsal (for m. scalenus, m. intertransversarius colli, m. serratus ventralis cervicis, and m. omotransversarius) and the ventral (for m. longus capitis, m. longus colli, and m. brachiocephalicus) branches for the related structures (Fig.1-6). Being called r. muscularis dorsalis et ventralis, these branches were displayed arising as a

common trunk, then, dividing into the dorsal and ventral branches which often anastomose with the branches of the costocervical trunk.

The vertebral artery was seen sending rr. spinales medially from the opposite to the muscular branches. Except the one entering into the intervertebral foramen between the second and the third cervical vertebrae, and the other getting into the cervical canal from the lateral vertebral foramen of the first cervical vertebra, the spinal branches were shown as thin ones, anastomosing each other. The spinal branch between the second and the third cervical vertebrae was observed as the thickest one joining the ventral spinal artery.

The vertebral artery, later, was shown giving a thin branch for the related muscles nearly 0,4-0,5 cm. before the transverse foramen of the second cervical vertebra (Fig. 2-1). It also was determined sending another branch at the level of the transverse foramen (before entering it). This branch was seen anastomosing with the cervical ramus of the occipital artery on the transverse process of the atlas (Fig. 2-2). The vertebral artery then was determined giving another branch which anastomoses with the descending ramus of the occipital artery after advancing approximately 0,7-1,2 cm. at the atlantic fossa. Prolongation of the vessel then was observed passing the alar notch, entering into the vertebral canal via the lateral vertebral foramen (Fig. 2-3).

Each of the vertebral artery in the vertebral canal was displayed dividing into two branches; the first one, r. cerebralis (Fig. 3-1), unites with its counterpart; thus, constructing the basilar artery (Fig. 3-2), the other, r. spinalis (Fig. 3-3), also unites with its counterpart; thus, contributing the ventral spinal artery (Fig. 3-4).

DISCUSSION

Both vertebral arteries in the dog arise from the left and right subclavian arteries, and get into the transverse canal using the transverse foramen of the sixth cervical vertebra. They, later, pass the alar notch of the atlas, and go into the vertebral canal by using the lateral vertebral foramen of the atlas, after passing throughout the transverse canal. Finally, they, in the vertebral canal, join; thus, constructing the basilar artery for the brain vascularization^{1,3,7,8,10}. The basilar artery in dogs has been shown supplying the 2/3 of the vascularization of the brain^{1,3}.

The vertebral artery during its course gives several branches which anastomose with the branches of other vessels. In the present study done on the German shepherd dogs, the pattern, branches, and anastomoses of the vertebral artery have been observed. The findings are mostly parallel to the literature. Minor variations are thought to be due to the species variations commonly seen in vascular system..

In a study performed on Kangal shepherd dogs⁴, the pattern of the vertebral artery has been observed, indicating the high resemblance of that with the literature. The results of the present study too have revealed the morphological characters of the artery, showing high resemblance with that study and the literature

The basilar artery is well known to be contributed by the right and left vertebral arteries for the brain. Supplying an organ like brain which provides very important vital functions should be via a specially protected and constructed vessel. Pattern of the vertebral artery which usually does not send main branches during its course, even though it gives small branches in each intervertebral foramina, complies with that idea. Parallel to that, histochemical studies³ have showed the vertebral artery in dogs to be made by both muscle and elastic tissues (mix condition), contributing to the fact that blood passage throughout this vessel occurs by a special passage condition.

As a result, the present study has observed the origin, pattern, branches and anastomoses of the vertebral artery in the German shepherd dogs. The results have documented that those are mostly similar to the data present. Minor variations seen are thought to be due to the species variations which are not uncommon in the vascular system.

REFERENCES

- 1 **Anderson WD, Kubicek W:** The vertebral-basilar system of dog in relation to man and other mammals. *Am J Anat.* 132(2):179-88, 1971.
- 2 **Majewska-Michalska E:** The vertebrobasilar arterial system in guinea pig as compared with dog and human. *Folia Morphol (Warsz)*, 57(2): 121-31, 1998.
- 3 **Chopard RP, Lucas G de A, Laudana A:** Microscopic anatomy of the human vertebral-basilar system. *Arq Neuropsiquiatr.* 49(4): 430-3, 1991.
- 4 **Evans HE ve Lahunta A:** Miller's Guide to the Dissection of the Dog. Fourth Edition. W. B. Saunders Company, New York, 1996.
- 5 **Getty R:** Sisson and Grosman's The Anatomy of the Domestic Animals. Fifth Edition. W. B. Saunders Company, New York, 1975.
- 6 **Miller ME:** Anatomy of the Dog. W.B. Saunders Company,

Philedalphia, London, 1964.

- 7 **Dursun N:** Veteriner Anatomi II. 4. Baskı. Medisan Yayınları, Ankara, Türkiye, 1998.
- 8 **Dursun N:** Veteriner Komparatif Anatomi (Dolaşım Sistemi). AÜ Vet Fak Yay, 377. AÜ Basımevi, Ankara, 1981.
- 9 **Erden H, Dursun N, Türkmenoğlu İ:** Köpekte boyunun arteriyel vaskularizasyonu. *Vet Bil Derg*, 13 (1): 121-126, 1997.
- 10 **Dyce KM:** Textbook of Veterinary Anatomy, W.B. Saunders Company, Philadelphia, 1987.
- 11 **Nickel R, Schummer A, Seiferle E:** The Anatomy of the Domestic Animals. Volume 3. Verlag Paul Parey, Berlin-Hamburg, 1981.
- 12 **Dursun N ve Türkmenoğlu İ:** Kangal Köpeklerinde Septum interventriculare'nin Arteriyel Vaskularizasyonu. *Vet Bil Derg*, 12(1): 141-144, 1996.
- 13 **Lahunta A and Habel RE:** Applied Veterinary Anatomy. W. B. Saunders Company, New York, 1986.
- 14 **International Committee on Veterinary Gross Anatomica Nomenclature. Nomina Anatomica- Veterinaria** Fourth Ed. Zürich and Ithaca, New York, 1994.

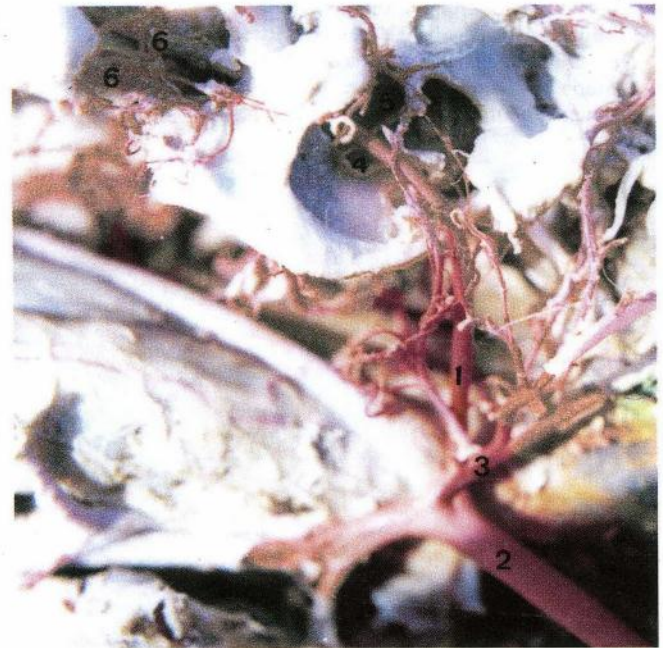


Figure 1. Exposure of the origin of the vertebral artery in German shepherd dog. 1-vertebral artery, 2-subclavian artery, 3-costocervical trunk, 4-transverse canal, 5-transverse foramen of the sixth cervical vertebra, 6-dorsal and ventral rami.

Resim 1. Alman çoban köpeğinde arteria vertabralis'in orijininin görüntüsü. 1-arteria vertabralis, 2-arteria subclavia, 3-truncus costocervicalis, 4-canalıs transversarius, 5-altıncı boyun omuruna ait foramen transversarius, 6-ramus dorsalis et ventralis.



Figure 2. Branches and anastomoses of the vertebral artery on the axis and atlas in German shepherd dog. 1-muscular ramus, 2-anastomosing branch with the cervical ramus of the occipital artery, 3-lateral vertebral foramen of the atlas.

Resim 2. Alman çoban köpeğinde arteria vertebralis'in atlas ve axis üzerindeki dalları ve ağzlaşmaları. 1-ramus muscularis, 2-arteria occipitalis'in ramus cervicalis'i ağzlaşan dal, 3-Atlas'a ait foramen vertebrale laterale.



Figure 3. Construction of the basilar and ventral spinal arteries by the spinal and cervical branches of the right and left vertebral arteries in German shepherd dog. 1-cerebral rami, 2-basilar artery, 3-spinal rami, 4-ventral spinal artery.

Resim 3. Alman çoban köpeğinde arteria vertebralis dextra et sinistra'ya ait ramus spinalis et cervicalis'in arteria basillaris ve arteria spinales ventrales'i oluşturması. 1-rami cerebrales, 2-arteria basillaris, 3-rami spinales, 4-arteria spinalis ventralis.