The branches of the descending palatine artery and their relation to the vomeronasal organ in Angora goats

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ABSTRACT: The aim of this study was to reveal the branches of the descending palatine artery, and its relation to the vomeronasal organ in Angora goats. For this purpose, ten heads of adult Angora goats obtained from a slaughterhouse were used. The ramifications of the latex enjected descending palatine artery and their vomeronasal organ-related findings were revealed by fine dissection and transverse sections. Arterial blood reached the caudally vomeronasal organ primarily via the sphenopalatine artery, and also cranially via a fine branch of the major palatine artery by crossing the palatine fissure. The average diameters of both the descending palatine artery and its branches were thicker on the left side than on the right, and its ramifications were not variable in this species.

Keywords: vomeronasal organ; descending palatine artery; anatomy; Angora goat

The vomeronasal organ (VNO) is a tube-like structure located at the base of the nasal cavity (Brennan, 2001). It consists of bilateral vomeronasal duct and vomeronasal cartilage on the floor of the nasal cavity, separated by the nasal septum (Besoluk et al., 2001). VNO is a sensory organ involved in reproduction by detecting pheromones. In the reptiles, however, it also mediates the trailing of prey and food detection (Halpern, 1987). It is not the sole organ used to detect pheromones, e.g. in pigs it is the olfactory organ that detects androstenone (Dorries et al., 1995). In herbivorous mammals, it probably serves as an accessory olfactory organ (Ghoshal, 1975).

In previous studies, some researchers have studied the arterial supply to the nasal cavity in different species regardless of that of VNO (Dawes and Prichard, 1953; Nawar et al., 1975; Khamas and Ghoshal 1982; Grevers and Heinzmann, 1989), despite the fact that this organ forms part of the nasal cavity. They reported that the blood supply to the nasal cavity was mainly derived from the sphenopalatine and external ethmoidal arteries, and lesser contributions are also made by the major palatine artery.

While examining the arteries of the nasal cavity in the cat, dog and sheep, Salazar et al. (1991, 1997, 1998) also took into consideration the supply to VNO. In the literature, very little was found on the arterial supply of the nasal cavity in goats (Dawes and Prichard, 1953; Schnorr and Henger, 1967), and these studies described rather superficially the descending palatine artery and was not involved in the arterial supply to VNO as well. However, previous studies on morphological structure of VNO are of particular interest because it plays a key role in behaviour particularly, reproductive/sexual behaviour (Wysocki, 1979). Stimuli of VNO are apparently cleared by relaxation and dilation of its arterial (Wysocki and Meredith, 1987). It has been suggested that the blood supply to VNO plays an important role in its function (Bertmar, 1981).

We have carried out this study with the aim of describing the branches of the descending palatine artery and their relation to VNO.

MATERIAL AND METHODS

Ten heads of adult Angora goats, 5 males and 5 females, a native breed in Turkey, obtained from the slaughterhouse in the Konya province, were utilised in this study. Immediately after slaughtering, the

heads were transferred to the anatomy laboratory of the Veterinary Faculty of Selcuk University. In 8 heads, the vessels were rinsed with 0.9% physiologic saline through the common carotid arteries. Then, Red (Setacolor™, cardinal red, num. 24, PEBEO, Cedex, France) – coloured latex (Rubber latex™, MERCAN, Istanbul, Turkey) were injected into the common carotid arteries of eight heads. Two days later, they were fixed with 10% formalin. Finally, the branches of the descending palatine artery and its location in relation to VNO were revealed by fine dissection. The diameters of vessels were measured by Mitutoyo® Digimatric Callipers. VNO of the remaining two heads of both sexes were removed from the longitudinal ridge of mucosa in the ventral portion of the nasal septum for the transverse sections of VNO about at 1 cm intervals, and were examined using a stereomicroscope (Nikon SMZ-2T, Nikon Corp., Tokyo, Japan). The observations were recorded and photographed.

RESULTS

The descending palatine artery (Figures 1 and 2/3) is one of the terminal branches of the maxillary artery. Its average diameter on the left and right is 2.5 mm and 2.3 mm, respectively. The descending palatine artery runs rostroventrally, and in the fossa pterygopalatina, divided into the sphenopalatine, the major and the minor palatine arteries.

The sphenopalatine artery (Figures 1 and 2/4) was the thickest branch of the descending palatine artery, and on average was 2.4 mm in diameter on the left and 2.2 mm on the right. It was responsible for most of the blood supply to the inside of the nasal cavity, passing through the sphenopalatine foramen and giving rise within the nasal cavity to several branches, each of which furnished different areas of the nasal mucosa. Dorsally, it gave off several branches for the middle nasal concha, and following a short rostral course it branched out the frontal and maxillary sinuses, as well as the dorsal and lateral walls of the nasal cavity in the area of the middle nasal concha.

Finally, the sphenopalatine artery gave off the lateral, caudal and septal nasal arteries. The lateral nasal artery (Figure 1/9) mainly vascularized the dorsal nasal concha, as well as the lateral wall of the nasal cavity covering it. The caudal nasal artery (Figure 1/8) continued rostrodorsally, giving off several branches to supply the middle nasal concha. The septal nasal artery (Figure 1/7), which is the continuation of the sphenopalatine artery, extended rostroventrally towards the area of the ventral nasal concha. One of the last branches of the

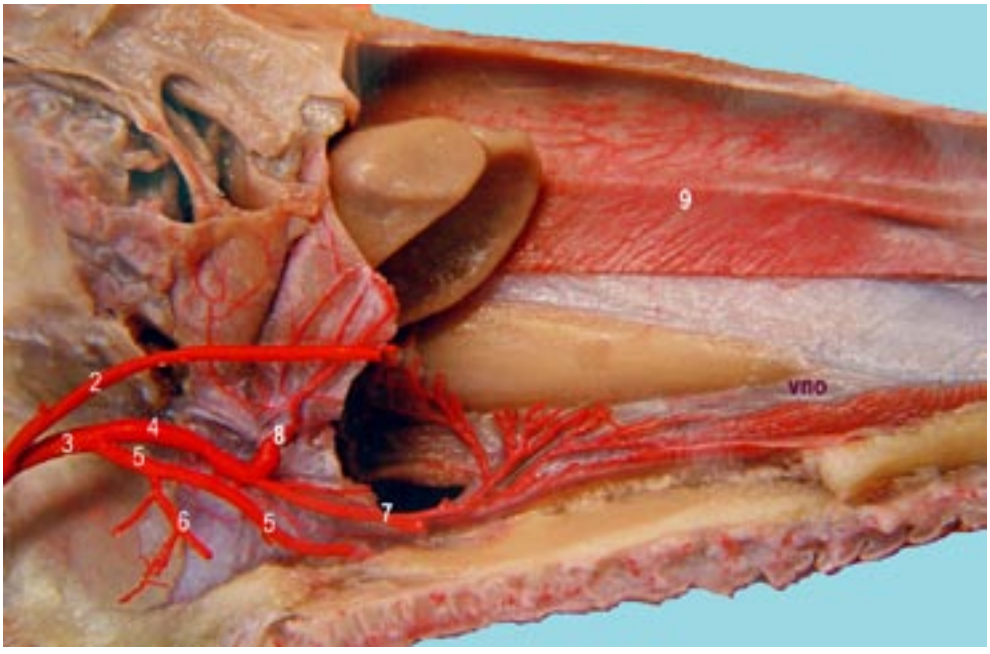

Figure 1. Descending palatine artery and its branches in Angora goat; right lateral view, deep dissection

1 – maxillary artery, 2 – infraorbital artery, 3 – descending palatine artery, 4 – sphenopalatine artery, 5 – major palatine artery, 6 – minor palatine artery, 7 – septal nasal artery, 8 – caudal nasal artery, 9 – branches of the lateral nasal artery

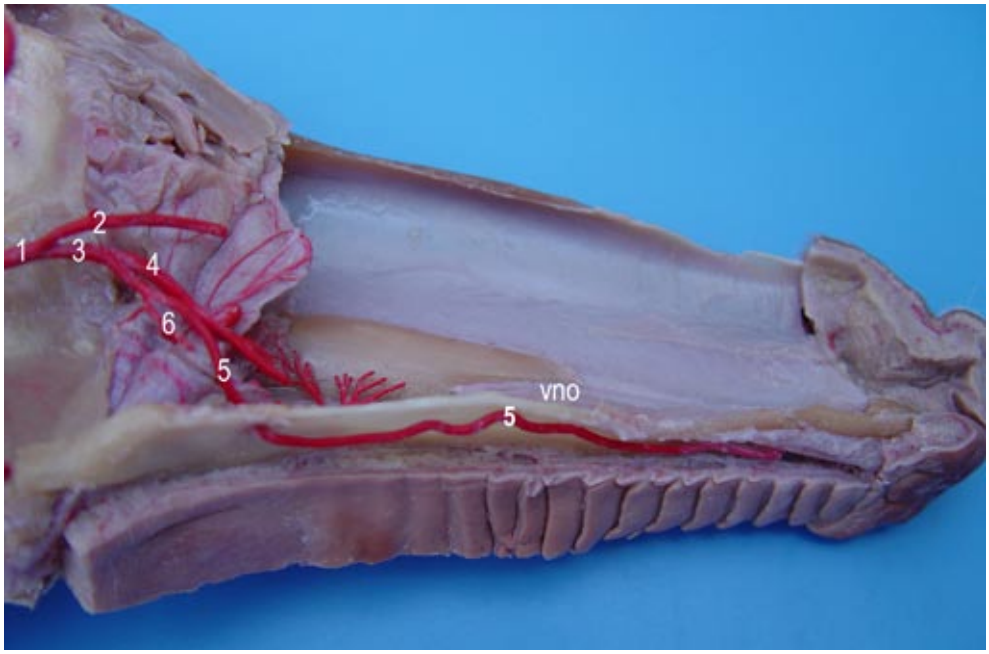

Figure 2. Descending palatine artery and its branches in Angora goat; right latero-ventral view, deep dissection

1 – maxillary artery, 2 – infraorbital artery, 3 – descending palatine artery, 4 – sphenopalatine artery, 5 – major palatine artery, 6 – minor palatine artery, 7 – septal nasal artery, 8 – caudal nasal artery, 9 – branches of the lateral nasal artery, vno – vomeronasal organ

septal nasal artery ran along the floor of the nasal cavity, and then crossed from lateral to medial, and thus reaching caudal to VNO.

The minor palatine artery (Figures 1 and 2/6), the thinnest branch of the descending palatine artery, was on average 0.8 mm in diameter on the left and 0.6 mm on the right. It coursed laterally to the pterygoid process to supply the soft palate, and has no contact with VNO.

The major palatine artery (Figures 1 and 2/5), the longest branch of the descending palatine artery, was on average 1.5 mm in diamater on the left, and 1.4 mm on the right. It entered the palatine canal through the major palatine foramen, and then extended rostrally in the sulcus palatinus between the hard palate and the palatine process of the maxilla. In its course it gave off branches to the hard palate and also furnished the rostral area of VNO via the palatine fissure.

DISCUSSION

In the present study, we have found that the branching of the descending palatine artery and its relation to VNO in Angora goat was similar to those of the sheep, which is consistent with the findings of Salazar et al. (1998). Although Schaller (1992) reported that the minor palatine artery may be absent in ruminants, we found that in the Angora goats dissected for the present study, it was present.

As stated by Ghoshal (1975), it originated from the major palatine artery. Although Lung and Wang (1987) showed that the nasal mucosa of dogs was supplied by sphenopalatine and major palatine arteries, our study revealed that the later furnished only the mucosa on the rostral portion of the nasal cavity. Doving and Trotier (1998) and Berg (1995) recorded the sphenopalatine artery to be the major vessel responsible for the supplying of VNO, without mentioning the septal artery which, in this study, was shown how to run the organ mentioned. Although Nickel et al. (1981) recorded that the major palatine artery anastomosed with the ramifications of the sphenopalatine artery at the base of the rostral portion of the ventral nasal meatus, no finding of this kind was seen in Angora goats. Ghoshal (1975) stressed, in ruminants, the major palatine artery to be continuation of the descending palatine artery, but the vessel of similar quality was the sphenopalatine artery in Angora goats.

In all transverse sections we observed that the arterioles were mostly accumulated on the lateral wall of VNO (Figure 3/A), therefore we have also

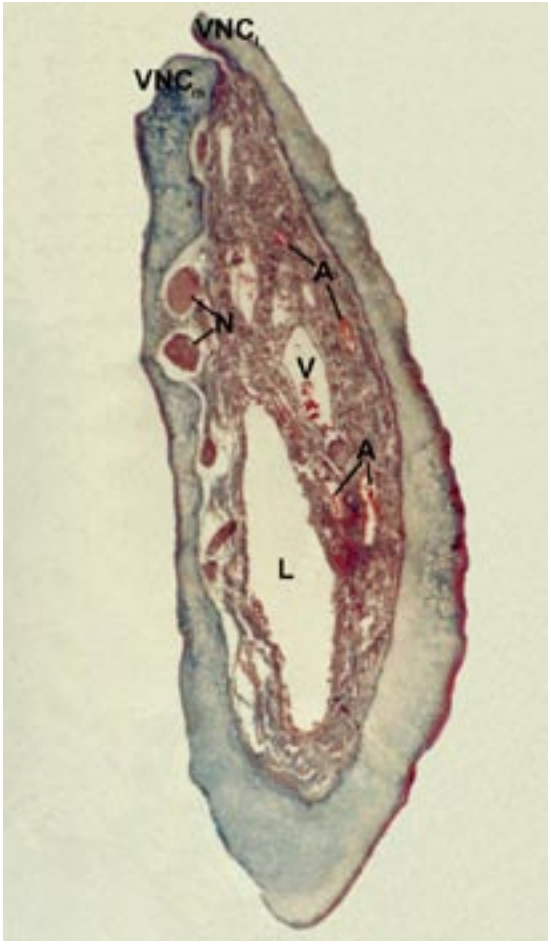

Figure 3. Transverse section of right vomeronasal organ in Angora goat; caudal view, 30×

A – arterioles, L – lumen of vomeronasal duct, N – nerve fiber, V – venule, VNC_m – medial part of vomeronasal cartilage, VNC_l – lateral part of vomeronasal cartilage

suggested that when arterial vessels constrict they may create a lower pressure in VNO, drawing stimulus-charged mucus and/or air into the lumen as reported by Wysocki and Meredith (1987), and also assumed that its vascular system is in some respects similar to that of erectile tissue of penis.

We concluded that the average diameters of both the descending palatine artery and its branches were thicker on the left side than on the right, and its ramifications were not variable in our specimens.

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