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Research Article

Histomorphology and histochemical study of the swell body of the nasal cavity in the local Iraqi goat, *Caprus hircu*

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Abstract: The nasal cavity is divided into many nasal passages by the nasal septum and nasal turbinates. These structures are lined by the heavy vascular mucosal membrane, which establishes many important functions such as filtering, humidification, and warming of the inspired air. The present study was conducted to investigate the characteristic features of the nasal swell body morphologically, histologically and radiologically of adult healthy goats. Fifteen goats' heads were collected from adult healthy goats from slaughterhouses immediately after slaughter. For histology, the prepared section are stained by Hematoxylin and eosin stain and for histochemistry PAS-Alcian blue was used. Based on the gross anatomical and X-Ray examination, the nasal swell body (NSB) was fusiform-shaped, projected bilaterally from the nasal septum. It was extended in parallel with the ventral concha between the dorsal and ventral concha, and the width of body was 32.4mm. The height was 45.6mm and the length was 3.25cm. The NSB was 2.2cm of the nasal floor. The NSB was consisted of the nasal septum hyaline cartilage covered from lateral sides with connective tissue rich with blood vessels and glands. The lining epithelium was of pseudostratified columnar type (respiratory) with Alcian Blue positives goblet cells.

Keywords: Anatomy, Nasal swell body, Nasal cavity, Goat.

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Introduction

The nasal cavity is the anterior part of the upper respiratory tract. The nasal common chamber is divided into two nasal passages by the cartilaginous plate of the nasal septum. Each nasal passage of the main chamber is boarded by a lateral wall, and divided into many meatuses by nasal turbinates. The nasal turbinates are bony structures projections lined by the heavy vascular mucosal membrane. Nasal turbinates are designed to increase the inner surface area of the nose, which establish many important functions such as filtering, humidification, and warming of the inspired air (Keck et al. 2000; Harkema et al. 2006; Chamanza et al. 2016; Issakhov et al. 2021). The nasal turbines, together act as valves that slow up and control the inspired airflow, proven in many animals (Craven et al. 2007; Sahin-Yilmaz and Naclerio, 2011; Chamanza et al., 2016; Xiao et al. 2021).

The nasal swell body (NSB) which is first noticed by Kolliker and Kohlraush in human nasal cavities was neglected in the past as part of the nasal cavity. The nasal septal swell body (NSB) is regarded as a part of the nasal cavity. It is a mutamayiz anatomical structure positioned in the nasal septum, close to the anterior part of the ethmoid nasal turbinate and the superior part of the inferior turbinate (Yu et al. 2018; Gelera et al. 2020) regulating various physiological functions (Cole 2003). However, others have regarded the nasal swelling body as a part of the medially bound internal nasal valve (Costa et al. 2010; Jeg et al. 2017).

The nasal septal swell body has been described in the literature in various terms. These terminologies include nasal septal turbinate (Sisman et al. 2014; Moss et al. 2019), septal swell body (Gelera et al. 2017), nasal septal body (Hizli et al. 2020), septal body (Amsyar et al. 2017), nasal swell body (NSB) (Wotman & Kacker 2015) septal erectile body (Cole 2003), and septal cavernous body (Ng et al. 1999). The nasal swell body inflammation or diseases causes nasal obstruction (Kim et al. 2016; Gelera et al. 2017). In the literature, there is a shortage of studies, concerned with the anatomical and surgical approach of the nasal swell body (Sapci et al. 2007; Neskey et al. 2009; Lee et al. 2009). Because no attention focused on the occurrence and the structure of NSB in domestic animals, the present study was designed to study the anatomical and histological structure of the nasal swell body in the local Iraqi goat, *Caprus hircu*.

Materials and Methods

This study was carried out at the Department of Anatomy, Baghdad Veterinary Medicine College. Fifteen adult healthy goats' heads were collected from slaughterhouses immediately after slaughter. The heads were washed from blood and dirt by running tap water and wiped dry. Then they were carried in polythene bags and kept in a cool box, and stored in a deep freezer. For morphological and X-ray investigation, the heads were transversely sectioned by manual sow into slices (2cm thickness). The sections were from the 5th to the second premolar teeth. The X-ray was performed by XP CR (kv80 and mAs15) according to Mustafa & Reshag (2019).

For histological investigation, the tissue samples of the nasal swell body were fixed immediately into neutral buffer formalin 10% for 48 hours (two changes). After fixation, 5-7 µm sections were prepared and stained with Harris hematoxylin and eosin stain. For mucopolysaccharide detection, periodic acid-Schiff reagent and Alcian blue staining were used (Banchroff et al. 2013; Al-Taey & Al-Haaik 2022).

Fig.1. Macrograph of the transverse section of goat nasal cavity shows: dorsal concha (dt), ventral concha (vt), nasal septum (ns), and Nasal swell body (arrow).

Results

The gross anatomical and X-Ray examination showed that the nasal swell body of the nasal cavity is an elongated fusiform-shaped structure projected bilaterally from the nasal septum (Fig. 1). The NSB was extended in parallel with the ventral concha. It was located between the dorsal and ventral concha, but closer to the last one with mean dimensions of 32.4mm (width), 45.6 mm (height), and 3.25cm (length), whilst the distance between the nasal floor and the NSB was 2.2cm.

As shown in the radiograph, the NSB is seen as two lateral gray projections sandwiching the nasal septal cartilage, which is noticed as bright white (Fig. 2). Histologically, the NSB consisted of the cartilaginous core represented by the septal hyaline cartilage, which was covered from the lateral sides by connective tissue and thick epithelium. The lining epithelium was of the ciliated pseudostratified columnar epithelium (respiratory epithelium) with goblet cells (Fig. 3). The lamina propria and submucosa were fused. They consisted of loose connective tissue, and the propria- sub mucosa differentiated into two regions; the one underneath the epithelium was glandular. The gland was serous

Fig.2. X-Ray of the transverse section of the goat nasal cavity shows: Dorsal concha (dt), ventral concha (vt), nasal septum (ns), and Nasal swell body (arrow).

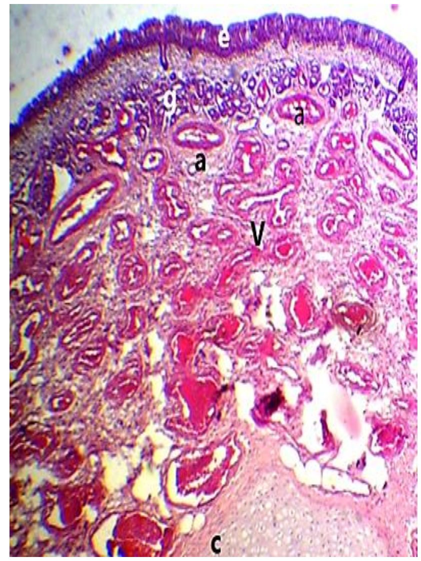

Fig.3. Micrograph of NSB histological section: Pseudostratified columnar epithelium (e), gland (g), artery (a), vein (v), and cartilage (c) (40X, H&E).

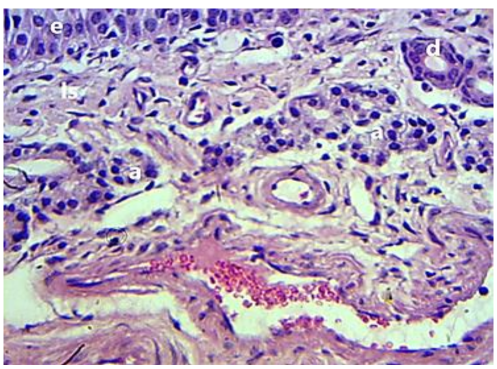

Fig.4. Micrograph of NSB histological section: Epithelium (e), gland acini (a), gland duct (d), and propria-submucosa (ls) (400X, H&E).

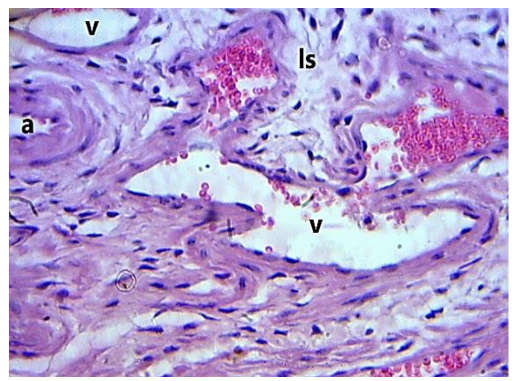

Fig.5. Micrograph of NSB histological section: Venous sinusoid (v), artery (a), and propria-submucosa (ls) (400X, H&E).

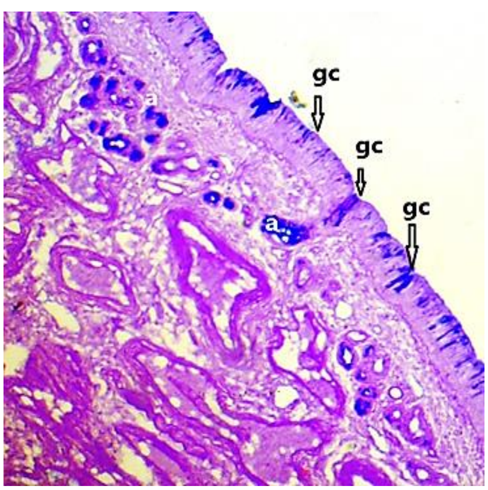

Fig.6. Micrograph of NSB histological section: Epithelium (e), goblet cell (gc), and gland acini (a) (100X, PAS-Alcian blue).

acini characterized by pyramidal secretory cells with a central spherical dark nucleus (Fig. 4). The largest part of connective tissue of propria- sub mucosa which was around the septal cartilage was highly vascular. Both muscular arteries and venous sinusoids were numerous, and the glands were absent (Fig. 5). The histochemical results showed, that both goblet cells of the lining epithelium and the gland secretion are alcian blue positive (Fig. 6).

Discussion

In the present study, the location, shape, and relation of goat NSB was proved by gross anatomical and X-Ray examination, in which the nasal swell appeared as a fusiform structure projected bilaterally from the nasal septum. It was extended in parallel with the ventral concha between the dorsal and ventral concha, and closer to the last one the width was 32.4mm, the height was 45.6mm and the length was 3.25cm. The NSB was 2.2cm up the floor of the nasal cavity.

This result was incompatible with the result of Nigro et al. (2009), Costa et al. (2010), and Meng & Zhu (2021). They reported that the NSB is part of the nasal septum and laterally extended close to the nasal turbinates. In the case of goat, the orientation and measurement were different because of the species variation. The NSB regarded accessory nasal valve (Cole 2003; Wong et al. 2020). The location of NSB plays a role with the adjacent nasal turbinates in controlling the width of air passages, which regulate the inspired air temperature, humidity and speed (Keck et al. 2000; Lindemann et al. 2002). The NSB in the radiograph appeared as two lateral gray swelling areas sandwiching the nasal septal cartilage, which was noticed as bright white. This structural feature observed in many studies (Costa et al. 2010; Gelera et al. 2017; Gelera et al. 2020).

Histologically, the NSB consisted of the cartilaginous core represented by the septal hyaline cartilage, which was covered from the lateral sides by connective tissue and thick epithelium. The lining epithelium was ciliated pseudostratified columnar (respiratory epithelium) with goblets cells. This observation was earlier recorded by many researchers in humans (Saunders et al. 1995; Elwany et al. 2009; Meng & Zhu 2021). They reported that the septal body in the nose of many studded specimens consisted of the ellipsoid structure covered by a thick, pseudostratified, ciliated epithelium with goblet cells. In our work, the thickness of the epithelium was 60μm and the thickness of the NSB was thicker than that of other regions of the nasal septum. The lamina propria and submucosa were fused, consisting of connective tissue, and the propria-submucosa differentiated into two regions. One underneath the epithelium was glandular. The gland was serous branched acini, characterized by pyramidal secretory cells with a central spherical dark nucleus.

The largest part of connective tissue of propria-submucosa which was around the septal cartilage was highly vascular. Both muscular arteries and venous sinusoids were numerous, and the glands were absent. This modified arrangement of glandulo-vascullar in the connective tissue of the NSB was described by Wexler et al. (2006), Elwany et al. (2009) and Meng & Zhu (2021) with some differences related to the percentage of glands to the percentage of the venous sinusoids. The vascular connective tissue of NSB resamples in the structure of the erectile tissue in dynamic engageable tissue, which had the ability to change the size with some physiological needs. This agrees with the findings of Ng et al. (1999) that pointed out, the distribution of the erectile tissue in the internal structure of the nasal cavity; the goblet cells and the cells of glands contain acidic mucopolysaccharides which reacted positively with alcian blue stain. The acidic nature of the cell's secretion has a great role in nasal compartment innate immunity and defense strategy against infection. These facts were discussed by Fischer & Widdicombe (2006), Jaramillo et al. (2018), Knoop & Newberry (2018), and Cortezand Schultz-Cherry (2021). They found that the acidic secretion of glands and goblet cells mucin secretion contributes to airway health, by delivering substances (APCs), and secretion to the luminal surface, which modulates immune responses and maintains the surface barrier.

Conclusions

The current study determined the morphological and histological characteristics of the goat nasal swell body and its position in the related nose structures. The close relationship of the nasal swell body to the internal nasal valve and the high occurrence of wide blood vessels and glandular connective tissue revealed its potential role in controlling the inspired airflow pattern and enabling the nose to change the humidity and temperature of the inspired air.

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