HISTOLOGICAL STUDIES ON THE ORGANS OF UPPER RESPIRATORY TRACT FROM NOSTRIL TO LARYNX IN BLACK BENGAL GOAT (Capra hircus)

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Abstract: In the present study tissue samples were collected from external nares, nasal cavity, nasopharynx and larynx of six healthy adult Black Bengal goat. The samples were routinely prepared for histological observation. The external nares, and nasopharynx were lined by stratified squamous epithelium, and nasal cavity was ciliated pseudostratified columnar epithelium. Numerous hair follicles were identified at the outer border of the external nares. Nasal epithelium showed several cell types including ciliated cell, secreting cell, brush cell and basal cell. The nasal glands were serous and mucous type and solitary lymph nodes were identified in the propria. Epiglottis was made up of elastic cartilage where as others was made up of hyaline cartilage. Test buds were observed in all laryngeal cartilage except in the cricoid cartilage. The cricoid cartilage appeared in the form of continuous plate in contrast to small plates in others. No lymphonodular tissue was found at the base of epiglottis.

Key word: Respiratory tract, Black Bengal goat, Histology

INTRODUCTION

Black Bengal goat is a popular breed of goat, mainly found in the eastern region of India. This is known for its high prolificacy, good meat quality and disease resistant power. All economies of rural people are dependent on goat farming, but major losses of goat farmer are due to respiratory disease of goat. Respiratory disorders are mainly cause due to air born diseases, and pathological changes of the respiratory system. Respiratory tract is exposed to large quantities of foreign materials and inhaled with air. The large particles are usually trapped in the upper respiratory tract and only the very smallest particle inter to the lung. Respiratory tract contains lymphoid tissue in the form of nodules within the mucosa in the walls of the air ways, which is maintained the respiratory system immunity. The histological details of upper respiratory tract of some mammals, like sheep and equine, are available in literature [1-3], but information regarding goat upper respiratory tract is scanty. Therefore, in present study structure of normal upper respiratory tract, from nostril to larynx, in Black Bengal goat has been discussed here.

MATERIALS AND METHODS

The samples were collected from six (3 male and 3 female) adult Black Bengal goats. All the organs of the upper respiratory tract of goat are taken from Tangra slaughter house, Kolkata, India. The samples are harvested from External nares, Nasal cavity, Nasopharynx and Larynx. The samples were fixed in 10% neutral buffer formalin. The tissues were then routinely processed to prepare the paraffin blocks. Then sections of 5 microns thickness were cut and stained with hematoxlin and eosine [4]. For collagen, elastic and glycogen, Masson [5], Mallory [6] and McManus [7] techniques were applied [5-7]. Sections were photographed by using Leica Qwin Image
RESULTS

**Anterior nares:** The dorsal border of the anterior nares was composed of epidermis and dermis at the both sides and a bulky stroma in between. The stroma was composed of connective tissue fibers with abundant collagen fibers and elastic fibers, smooth muscle fibers, vessels and nerves. The average thickness of the epidermis was recorded as 153.13 ± 12.75µm. The epidermis was lined by keratinized stratified squamous epithelium. Numerous hair follicles were identified at the outer border of the external nares, whereas it was less towards the internal border. Abundant sweat glands and sebaceous glands were found in both the regions. A good number of clusters of mesocrine glands were found at the middle core of the external nares [Fig. 1].

**Nasal cavity:** The respiratory epithelium was lined by ciliated pseudostratified columnar epithelium and it was restricted up to the middle of nasal meatus. The ciliated pseudostratified columnar epithelium of the nasal cavity showed several cell types including ciliated cell, secreting cell, brush cell, and basal cell. The secretary cells were identified at the level of the basal lamina to the epithelial surface and the cells were PAS positive. Few round shaped goblet cells with there nuclei pushed to the base of the cell were identified within the epithelium. Some cells with elongated body and microvilli were also identified within the epithelial lining. Small polyhedral cells were found along the basal lamina and they represented as basal cells.

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The propria submucosa was made up of connective tissue fiber, which induced predominant collagen fiber and scanty elastic fiber with huge infiltration of lymphocytes and was highly vascular. The nasal glands mostly serous and mixed types. Some of the nasal conchae and nasal septum were also found within this connective tissue fiber. Few erectile tissues were also observed in this area. Aggregation of lymphocytes in the form solitary lymph node was revealed within the nasal mucosa [Fig. 2].

**Nasopharynx:** The lamina epithelialis was lined by stratified squamous epithelium. The average thickness of the epidermis was recorded as 144.88 ± 47.15 µm. Goblet cells were not detected, few areolar tissues were detected underneath in the form of cluster and separated by connective tissue septa. The nasopharyngeal tonsil was observed within the mucosa of the nasopharyngeal wall. Some large voluminous glands of round, elliptical and tubular shaped were found. Few enfolding of luminal epithelium were identified and they were lined by multilayered cells of same luminal epithelial origin.

In the submucosal layer numerous mucous and serous types of glands were identified. The glands revealed PAS positive reaction. The acini of the gland were found to be compact and strands of connective tissue fiber were present in the form of septa.

The tunica muscularis was composed of skeletal muscles. The striated muscle fiber of pharynx revealed PAS positive reaction for muscle glycogen [Fig. 3].

**Larynx:** It was composed of four cartilages namely epiglottis, thyroid, arytenoids and cricoids. Out of four cartilage arytenoids is paired and others are single. The histoarchitecture of the laryngeal cartilages was observed.

**Epiglottis:** Histological section of epiglottis revealed three distinct zones: [A] lamina epithelialis [B] lamina propria and [C] lamina submucosa. Lamina

Explanation of figures:

Fig. 1: Overview of histological appearance of anterior nares in goat; E: Epithelium; Epidermis; SG: Sebaceous gland; S: Sweat gland; C: Stratum cornium; Arrow: Hair follicle

Fig. 2: Histological appearance of nasal cavity in goat; E: Epithelium; Arrow: Ciliated cell.

Fig. 3: Histological appearance of nasopharynx in goat; E: epithelium; G: gland.

Fig. 4: Histological appearance of epiglottis in goat; E: epithelium; C: cartilage; G: gland; A: Adipose tissue.

Fig. 5: Histological appearance of thyroid cartilage in goat; C: cartilage; G: gland; E: epithelium; Arrow: test bud.

Fig. 6: Histological appearance of Arytenoid cartilage in goat; C: cartilage; G: gland; E: epithelium; T: test bud.

Fig. 7: Histological appearance of collagen fibers in cricoid cartilage in goat; Arrow: Collagen fibers.

Fig. 8: Histological appearance of PAS positive in cricoid cartilage in goat.
epithelialis was lined by stratified squamous epithelium. Few test buds were observed within the lamina epithelialis. The propria was composed of dense connective tissue fibers and serous, mucous and mixed types of gland. The connective tissue fiber of lamina propria merged with the perichondrium of the epiglottis cartilage. Within the submucosa and propria there were huge lymphatic aggregations. The elastic cartilages were distributed in form of plate like structure and they were not continuous. The cartilages were embedded at the central core of the histological section and on its either side it was surrounded by tunica submucosa. Serous and mucous glands were also visible within the cartilaginous plate. Besides these glands, adipose tissues were also visible in between cartilaginous plate. The central portion of the elastic cartilage in the transverse section revealed a conical projection and the core of the projection was distributed with huge connective tissue fiber. No lymphonodular structure was found at the base of epiglottis cartilage [Fig. 4].

**Thyroid:** Histologically it was similar with elastic cartilage with few exceptions. Test bud was occasionally found on the lamina epithelialis. Within the lamina propria small focus of lymphatic aggregation in the form of lymph nodes were seen in regular interval. In the propria branched tubulo alveolar glands were also visible. Mucous glands were predominant and showed PAS positive reaction but in some areas serous and mixed type of glands were detected. The cartilaginous plates were hyaline type and appeared in the form of small and large plates [Fig. 5].

**Arytenoid:** The histological sections of arytenoid cartilage revealed almost similar histoarchitecture like that of the thyroid cartilage. Solitary lymph nodes were found within the lamina propria. Similar PAS reaction was noticed in the mucous secreting glands [Fig. 6].

**Cricoid:** Histologically the cricoid cartilage of larynx revealed similar histoarchitecture like that of the other cartilages with few exceptions. Epithelial lining was made by pseudostratified ciliated or respiratory epithelial. The distributions of glands were infrequent as compare to other cartilages and they are mostly restricted within the propria. The cricoid cartilage was hyaline type and appeared as continuous plate like structure. Test buds were absent. Goblet cells were found within the epithelial tissue. Striated muscles were distributed in the tunica muscularis but no glands were found within this region. Tunica adventitia was made up of fibrous connective tissue [Figs.7,8].

**DISCUSSION**

The present study established that the anterior nares were lined by keratinized stratified squamous epithelium and nasal cavity was lined by ciliated pseudostratified columnar epithelium. This observation is similar to the findings of other species of goat [8].

In the internal surface of the anterior nares, the numbers of hair follicles were scanty as compare to the external surface. Allar cartilage was not found in case of goat, but in support of this result no literature is available.

The nasal cavity was lined by ciliated psudostartifid squamous epithelium. Similar observation has been recorded in other mammals [9,10]. Few round shaped goblet cells with there nuclei pushed to the base of the cell were identified within the epithelium. No mucosal gland present in the rostral portion of the nasal cavity in goat. Camel [11] and human [12] also show similar nature.

The number of goblet cells in the epithelial lining was more and lymphatic nodules were more frequent. The respiratory epithelium showed a small number of goblet cell and there were a mixture of acidic and neutral mucins inside the epithelial and glandular mucous cell in case of rat [13]. This is in agreement with our finding. Similar findings were also reported in case of one humped camel [11]. Several cell types in case of respiratory nasal mucosa were reported in other mammal [14]. The similar epithelial lining was reported in the nasopharynx of cashmere goat [8]. The presence of the goblet cells in esophageal tissue of the nasopharynx recorded in human [14], were not seen in goat.

Normally the histoarchitecture of thyroid, arytenoid, epiglottis were almost similar. Cricoid cartilage revealed few special histological characteristic; taste bud population was numerous in case of epiglottis, but least in thyroid. In case of arytenoid, the test buds were more as compare to thyroid. Similar observation was reported in ruminants in the epiglottis region [9]. In case of ruminant epiglottis consisted of many
mucous tubule, a few serous element and are occasional mucous duct [16]. This is also evident in present observation. In case of sheep laryngeal surface of the epiglottis was always provided with numerous taste buds [17]. Similar observation was also made in goat. The histological examination of lymphoid tissue of cattles clearly demonstrated the presence of isolated primary and secondary lymphoid follicles and diffuses aggregation of lymphocytes in the subepithelial lamina propria of the mucosa at the base of epiglottis [18]. Such arrangement was not found in our present study, instead of that the nodular structure revealed as a connective tissue components.

The cricoid cartilage revealed some peculiar characteristics in comparison to other three cartilages. The distributions of glands were infrequent as compare to other cartilages and they were mostly restricted within propria [10]. Taste buds were absent in the surface area, rather goblet cells were found in the epithelial tissue [9,10]. The cartilage appeared in the form of continuous plate.

CONCLUSION

The epithelium of upper respiratory tract comprised several cells types like ciliated cell, secreting cell, brush cell, and basal cell. Apart from this, serous and mucous type of glands are present. These are essential to trap foreign materials and maintaining the required humidity. The lymphoid tissue organized within the mucosa of upper respiratory tract, it indicates to contribute in respiratory system immunity making the Black Bengal goats more disease resistance.

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REFERENCES