

Histomorphology of the Pulmonary Alveoli of Goat (*Capra hircus*)

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Abstract

Histomorphological studies were conducted on the pulmonary alveoli of ten adult healthy goats of either sex. The alveoli were roughly spherical structures which opened into the alveolar ducts and alveolar sacs or respiratory bronchioles. Alveoli were composed of two types of cells i.e. Type-I pneumocytes and Type-II pneumocytes. Former formed the main lining epithelial cells of alveoli which were squamous in type having prominent perinuclear area and centrally located nucleus, while the later were cuboidal in shape with centrally located nucleus and occasionally found among the Type-I cells in the alveolar epithelium. The average alveolar diameter was $45.28 \pm 1.81 \mu\text{m}$ and the average thickness of inter alveolar septa was $6.64 \pm 0.35 \mu\text{m}$

Key words: Histomorphology, pulmonary alveoli and goat

Introduction

Respiratory system performs vital functions in the body. Besides being responsible for conduction and exchange of gases, the respiratory organs also play important functions like phonation, olfaction, body temperature regulation, production and removal of many substances like histamine, PGE and F etc. (Banks, 1993).

The alveoli form the basic structural and functional unit for gas exchange in the lung parenchyma and as such their detailed histological knowledge is indispensable for better understanding of their physiology, biochemistry and pathology. Review of literature reveals that the studies on the histological aspects of respiratory organs of goat are very scanty, as compared to those of other domestic animals.

Keeping these facts in view, the present study was undertaken to elucidate the histological details of the pulmonary alveoli of goat.

Materials and Methods

The lungs of ten adult healthy goats of either sex collected from the local slaughter houses were utilized for the present study. These specimens were preserved in 10% buffered formalin. Small tissue pieces were collected from different representative areas of various lung lobes. The tissues were processed by routine paraffin embedding technique and were sectioned at $6 \mu\text{m}$. The paraffin sections were stained with Harris

Haematoxylin and Eosin (Culling *et.al.*, 1985), Weigert and van Gieson's stain for collagen and muscle fibres and Gomori's aldehyde fuchsin method for elastic fibres (Culling *et.al.*, 1985) and Gomori's reticulin method for reticular fibres. Micrometry was done with the help of calibrated ocular micrometer by standard methods of micrometry (Culling *et.al.*, 1985). Statistical analysis of the data obtained from the above histometrical parameters was done as per standard methods.

Results and Discussion

The alveoli form the basic structural and functional unit for gas exchange in the lung parenchyma (Cormack, 1987). In the present investigation, the alveoli were generally small, roughly spherical structures that opened into the alveolar ducts, alveolar sacs or into the respiratory bronchioles wherever present.

The alveolar ducts were found as tubular structures surrounded by alveoli and usually followed a long tortuous course and gave off several branches. The walls of the alveolar ducts consisted of open sides of alveoli and the terminations of the interalveolar septa which separated the alveoli. Collagen and elastic fibres and smooth muscle fibres were discernible in the walls of the alveolar ducts at the portions wherefrom the alveolar sacs arose from them. Smooth muscle fibres and elastic fibres were also observed on the margins at the apices between the adjacent alveoli.

After giving off several branches, the alveolar

ducts terminated into clusters of saccules termed as alveolar sacs. The common opening of the alveolar sacs formed the atrium. The alveolar sacs were completely surrounded by alveoli. Almost similar descriptions were given by Trautmann and Fiebiger (1957), Banks (1993) and Plopper and Adams (1993) in domestic animals and Bloom and Fawcett (1970), Craigmyle (1986) and Cormack (1987) in humans.

The alveolar wall was composed of a thin single layer of epithelium. A very thin layer of connective tissue composed of fine elastic, reticular and collagen fibres underlay the epithelium. The alveolar epithelium consisted of two types of cells designated as pneumocytes- i) Membranous pneumocytes (Type-I pneumocytes) and ii) granular pneumocytes (Type-II pneumocytes).

Type-I pneumocytes formed the main lining epithelium of alveoli. The shape of the cells was squamous having prominent perinuclear area and the nucleus was centrally located. These cells were stated to be mainly responsible for maintaining an interface between the air and blood to allow the gas exchange (Banks, 1993). Type-II pneumocytes were occasionally found among the Type-I cells in the alveolar epithelium of the goat under present study. They were cuboidal in shape having centrally placed nuclei. According to Banks (1993), type-II cells were secretory in nature, possessing well developed cell organelles. When the secretion is liberated onto the epithelial surface, it lowers the surface tension thereby preventing the alveoli from collapsing during expiration (Craigmyle, 1986; Plopper and Adams, 1993). Kahwa and Purton (1996) reported that the alveolar epithelium of the goat was of simple squamous type only, whereas Kahwa *et.al.*, (1997) demonstrated both type-I and type-II cells in the same species and Rybicka *et.al.*, (1974) and Iovannitti *et.al.*, (1985) identified both these cell types in cattle.

The average alveolar diameter of the right and left lungs was found to be 45.44 ± 2.39 mm and 45.12 ± 2.82 mm respectively, with an overall value of 45.28 ± 1.81 mm. 't' test showed non-significant effect of the right and left lungs on the alveolar diameter.

Free phagocytic cells known as alveolar macrophages were observed in the lumina of only a few alveoli. Their shape was roughly rounded. The presence of the alveolar macrophages was also reported by Trautmann and Fiebiger (1957), Banks (1993) and Plopper and Adams (1993) in domestic animals, Bloom and Fawcett (1970), Craigmyle (1986) and Cormack (1987) in humans, Epling (1966) in swine, Atwal and Sweeny (1971) in goat and Rybicka *et.al.*, (1974) and Iovannitti *et.al.*, (1985) in cattle. Cormack (1987) opined that these cells were loosely attached

to alveolar surface epithelium in life and were immersed in little pools of alveolar tissue fluid. The alveolar macrophages were considered to be as a part of the macrophage system distributed throughout the body, having a protective role through their defensive system (Plopper and Adams, 1993).

The common septa between the adjacent alveoli formed the interalveolar septa (Fig. 4). The septa were covered on both sides by alveolar epithelium and were internally supported by fine elastic, reticular and collagen fibres. These delicate interalveolar walls were provided with very extensive capillary network. The connective tissue fibres were continuous with the surrounding interstitial tissue. These findings generally resembled with the reports of Trautmann and Fiebiger (1957), Schummer and Nickel (1979), Banks (1993) and Plopper and Adams (1993) in domestic animals, Bloom and Fawcett (1970), Cormack (1987) in humans, Epling (1966) in pigs and Atwal and Sweeny (1971) in goats. 't' test indicated non-significant effect of right and left lungs on the interalveolar septal thickness, the values being 6.56 ± 0.54 mm (right lung) and 6.72 ± 0.48 mm (left lung) with an overall value of 6.64 ± 0.35 mm.

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