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Histological study of lower part of respiratory system (lung) in local Muscovy Duck (*Cairina moschata*)

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Abstract
The study aimed to investigations of the, histological structure, in the lung of local Iraqi Muscovy ducks. Five adult Muscovy ducks were used in this study, regardless of their sex. After dissection, the lungs were removed and rinsed with tap water to remove any impurities. Samples measuring 1 cm^3 were taken from the lung lobes and the sample was fixed by using (10% formalin), for 48 hours. Following complete fixation, the (routine histological techniques) were applied for microscopic examination. The results showed that the bronchioles were lined by pseudo stratified columnar ciliated epithelium, supported by hyaline cartilage and connective tissue, with a prominent thick layer of smooth muscle fibers. Each terminal bronchiole branched into two or three respiratory bronchioles, which were lined by simple ciliated cuboidal cells along with some non-ciliated cells. The wall of the (respiratory bronchioles) were ramifies inside the alveolar sacs and the alveolar ducts, where the epithelium transitioned to simple squamous epithelium.

Keywords: Muscovy duck, lung, histology, respiratory system, bronchioles

Introduction
The avian lungs bulk is formed of the Para bronchi, which constitute the centers of pulmonery lobules, and separated between them by the inter-Para bronchial septa. These Para bronchi branch was from, the secondary bronchi, and anastomose with that each other [1-3]. In contrast, the lungs of the ostrich lack inter-Para bronchial septa [4]. The avian Para bronchial wall is composed of three, layers arranged from the internal to the external that lining with the cuboidalepithelium, or with the squamous epithelium, without secretory present units, thin layer of (loose, connective) tissue, and the muscular layer, was containing the bundles of (smooth muscle) cells. Notably, absent of the cartilage present [5-7]. In birds such as the turkey chicken, quail, and duck (Coturnix-coturnix), at inner wall, of each (Para bronchus) is perforated by numerous of openings. The each opening leads to the cavity that called atrium (air vesicle), that was covered by epithelium ranging from (squamous) to (cuboidal), continuously with the epithelium of (air capillary). The atria consist the two type of the epithelial cells, (granular, squamous) cells. These atria was separated by (inter-atrial septa) composed of (loose connective) tissue. Additionally, the bundles was spiral that composed of (smooth muscle fibers) surround the openings of arterial [8-10].

Materials and methods
Five local Iraqi Muscovy ducks were used in this study. All birds were brought to the Laboratory of Anatomy and Histology, where they were housed in separate cages with free access to water and food. Following this, the lungs were dissected out and washed. Small pieces from each specimen were immediately fixed by using (10% formalin) for 24-48 hours. The routine (histological technique) was processing then performed, and sections were stained using (H&E) stain to demonstrate the histological features. Observations were made using a light microscope (Olympus model) [11].

Result
Microscopic examination of the tissue lung in the (Iraqi local Muscovy duck) revealed, the secondary bronchi are covered by ciliated pseudo stratified columnar epithelium, with present of mucous glands in large number that varying in its sizes (Fig. 1). Lymphoid tissue appeared beneath to the lining epithelium, forming (one, two) ridges resembling structure. The properia and the submucosa was occupied by the (dense irregular) connective tissue. A thin layer of smooth muscle bundles encircled the entire secondary bronchus, and no

cartilage was observed (Fig. 2). Several openings along the walls of the secondary bronchi led to the Para bronchi, which form the lung lobules. These openings connected to multiple atria that led into dilated ducts called infundibula (Fig. 3). Each lobule was separated by inter-Para bronchial connective tissue (Fig. 3). The walls of the Para bronchi and all associated passages, that covered with (simple) squamous epithelium. The tunica submucosa and the lamina properia was composed of connective tissue (loose connective), that surrounded by bundles of smooth muscle fibers. The air capillaries epithelium and the endothelial cell of the blood capillaries that separated by the basement membrane, forming the gas - blood barrier (Fig. 4).

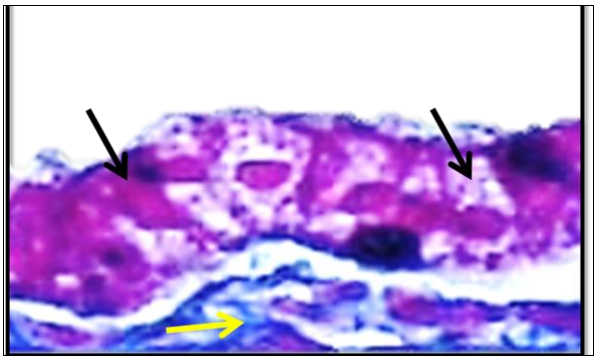

Fig 1: Histological section of local Iraqi Muscovy Duck bronchus show: pseudo stratified epithelium (black arrow), muscularis mucosa (yellow arrow), hyaline cartilage (H). H&E stain. 40X.

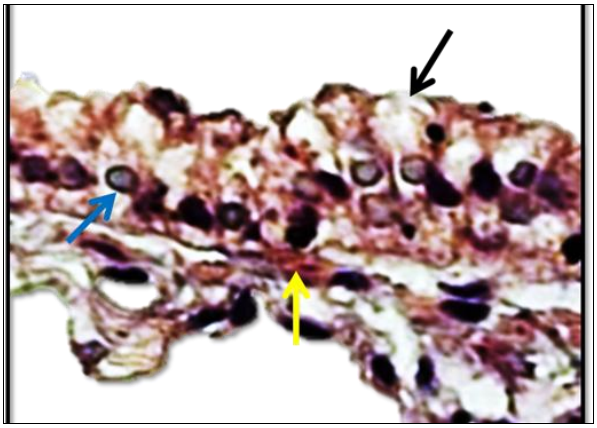

Fig 2: Histological section of local Iraqi Muscovy Duck primary bronchus show: simple columnar epithelium (black arrow), nucleus (blue arrow), muscularis mucosa (yellow arrow). H&E stain. 40X.

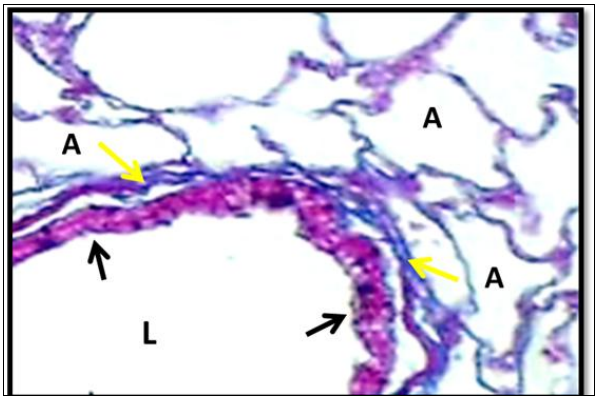

Fig 3: Histological section of local Iraqi Muscovy Duck secondary bronchiole show: simple columnar epithelium (black arrow), smooth muscle fibers (yellow arrow), lumen (L), alveoli (A). H&E stain. 40X.

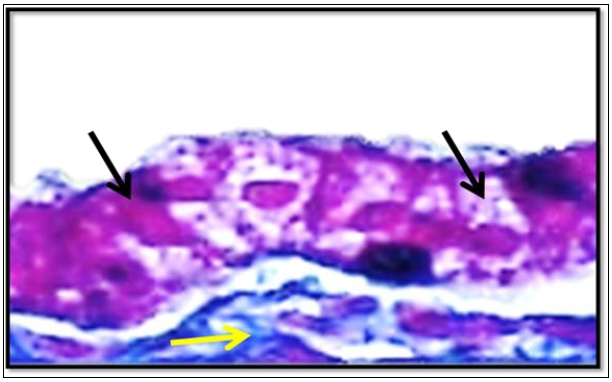

Fig 4: Histological section of local Iraqi Muscovy Duck tertiary bronchiole show: simple cuboidal epithelium (black arrows), smooth muscle fibers (yellow arrows). H&E stain. 40X.

Discussion

Microscopic examination of the turkey lungs revealed, the bronchi secondary, are overed by, pseudostratified, columnar or cuboidal, epithelium ciliated. This findings are consistent with those reported in avian species such as chicken and turkey [12]. Numerous mucous glands of varying sizes occupied the epithelial majority thickness, that only goblet cells was present. This contrasts with some reports that describe the epithelium as containing mucous glands rather than mucous cells in these birds. The lamina properia and the tunica submucosa consisted of connective tissue dense irregular, and a thin layer of smooth muscle bundles transverse in its directions, encircled the inter the bronchi secondary. this observations confirm previous findings in chickens and turkeys [12, 16]. Additionally, lymphoid tissue appeared beneath the epithelium as one to two ridges resembling mounds, which agrees with earlier studies in chickens, turkeys, rock doves, and ringed turtle doves [13, 14]. However, the findings of was not similar to finding of [17], that reported that the lymphoid nodules was oval in shape and located beneath the layer of lining epithelial, at the junction of the bronchi (primary and secondary) in chickens. This oval nodules, along with aggregations of lymphocyte, serve as mechanism of the against bacterial for the respiratory system and microbial invasions. Enlargement of these nodules is associated with high in thickness of the tunica submucosal [18]. fundamental structural of lung are the Para bronchi, that opened into the atria and lead to the infundibula, and subsequently for numerous capillaries. this finding was consistent to findings reported in other avian species [5, 19]. The lining or covering epithelial of the Para bronchi was squamous epithelium simple that supported by presents of layer of connective tissue (loose connective tissue) with smooth muscle bundles, thick layers. The air capillaries and atria and infundibula share a epithelial lining, with smooth bundles of muscle present only at the atrial openings. These findings are fully confirmed by studies in other bird species [20].

Conclusion

The histological analysis of the local Muscovy ducks' lung revealed respiratory structures characterized by well-developed respiratory structures that are typical of avian species. The bronchioles were lined with pseudostratified ciliated columnar epithelium with underlying cartilage and smooth muscle fibers to maintain structural strength and regulate air passage. The transition to simple squamous epithelium in the alveolar areas indicates specialization for

efficient gas exchange. These findings provide contributions toward understanding the normal histological architecture of the Muscovy duck lung, and provide a valuable reference for anatomical and pathological studies in the future.

Conflict of Interest

Authors declare, there is no conflict of interest

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