

Comparative Histology and Histochemical Study of the Primary Bronchi between Both Male Mynah (*Acridotheres tristis*) and Starling (*Sturnus vulgaris*) birds

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Abstract

The current investigation comprised eight adult male specimens of both mynah (*Acridotheres tristis*) and starling (*Sturnus vulgaris*) obtained from the markets in Al-Basrah city and the Al-Warka district. The specimens were divided into two groups: four specimens for histology study and four specimens for histochemical study. Dissected the birds to get the right and left bronchi as well as the left and right lungs for histological and histochemical analysis. The bronchi have a fundamental structure consisting of cartilage in a C shape, which is connected by delicate membranes. The bronchi were examined histologically, revealing the presence of ciliated respiratory epithelium and pseudo-stratified columnar epithelium lining its interior. Histochemical examinations demonstrated a high reaction to alcian blue, resulting in the production of a blue color. Furthermore, these samples had a favorable response to the PAS stain, which can be attributed to the existence of mucopolysaccharides and carbohydrates in the cartilage.

Keywords: Primary bronchi, mynah, starling, Histology

I. Introduction

The respiratory system of birds is made up of two basic parts: nonvascularized ventilatory air sacs and the stiff gas-exchanging bronchial lungs, which facilitate the union of blood and air (1). The respiratory system is essential for speech, smell, and thermoregulation. (2) The nontidal respiratory system of birds. The trachea in birds splits into the left and right extrapulmonary primary bronchi (EPPB) at the syrinx. Both enter the target lungs as intrapulmonary primary bronchus (IPPB) through the hilus at the septal surface. (3,4,5)

There are longitudinal folds on the inner surface of the central bronchial epithelium in bird species such as the Rock, Turkey, and Chicken doves. A type of tissue known as pseudostratified columnar ciliated epithelium covers the folds. Goblet cells, either alone or in clusters, are present in this tissue. Furthermore, the tissue contains tiny mucous glands that are not able to pierce the lamina propria, the layer beneath the surface.

The extrapulmonary principal bronchi of the chicken and turkey contain C-shaped arrangements of hyaline cartilage. On the other hand, hyaline cartilaginous plaques in the intrapulmonary primary bronchi grow less frequently and are replaced by thick collagenous tissue as they approach the distal end. Reticular and elastic fibers are seen in considerable numbers in the lamina propria of the primary bronchus. The central bronchus is made up of smooth muscle bundles that are orientated circularly and lie beneath the lamina propria (6). The interstitial connective tissue in the surrounding area melds with the tunica adventitia.

The mucous membranes of Aseel and Vanaraja are curled and around their significant bronchi. While some of these folds are noticeably broad and fashioned like pyramids, most of these folds are thin and shorter in height. Goblet cells are found in the pseudostratified columnar ciliated epithelium, a type of epithelial tissue that lines the folds. There was noticeable vascularity in the lamina propria. This material is made up of many loose connective tissue cell types, including mast cells, plasma cells, and fibroblasts.



Comparing the subepithelial lamina propria to the deepest section, the former is denser. Hyaline cartilaginous plates can be seen beneath the lamina propria. Seven is the number.

II. Materials and methods

This study utilized a sample of eight male mynah and starling birds in a healthy a mature state. Four mynahs and four starlings were collected during winter, specifically from October to December. The birds were sourced from Al-Basrah city and the Al-Warka area markets. The weight of mynah varied between 82 and 143 grams, whereas the weight of the starling ranged from 75 to 100 grams. Inhalation anesthesia was administered using chloroform. Subsequently, a longitudinal dissection was performed within the thoracic cavity, followed by the extraction of the primary bronchi organ. The specimens were subsequently preserved in a 10% formalin solution. The dehydration method involved the utilization of various concentrations of alcohol (ethanol) (70%, 80%, 90%, and 100%), followed by the subsequent cleaning procedure employing xylene. The samples were immersed in paraffin wax, and slices with a thickness of 5-6 were prepared using a microtome. These sections were stained using the standard Hematoxylin and eosin stains and other specific stains, such as Alcian blue stain, to provide additional histological visual information. (8)

III. Results and discussion

The present study demonstrated that the primary bronchi of mynah and starling are histologically comprised of distinct layers, including mucosa, submucosa, cartilage, and adventitia. Furthermore, it was observed that a pseudostratified columnar ciliated epithelium lined the walls of the primary bronchi in male mynah and starling. (Fig.34,35) this result agrees with (2,9,10).

The goblet cell is well in the epithelium of primary bronchi in mynah birds. (Fig 34,36). This was confirmed with (11,12).And few in starling epithelium of bronchi. (Fig.35,37). The results were not communicating with (5,13,14).

The lamina propria is composed of loose connective tissue with elastic fiber. The submucosa consisted of loose connective tissue and blood vessels. The last contained perichondrium of the hyaline bronchial cartilage, the ends connected by connective tissue. (Fig 34,35). The exterior perichondrium was enveloped by adventitial connective tissue. These results agree with (15,16).

Starling and mynah bird's extrapulmonary main bronchi are made up of incomplete irregularly shaped hyaline cartilages as plate interrupted with the presence of ossified tissue and bone cells. (Fig38,29). Agree with these results (5,13,15,17,18,19,20)

The histochemical results of the cartilage of both mynah and starling birds demonstrated an excellent response to alcian blue. Fig (40,41,42,43,44,45) also showed a positive reaction to PAS stain due to the presence of mucopolysaccharides and carbohydrates in cartilage. (Fig.46,47)

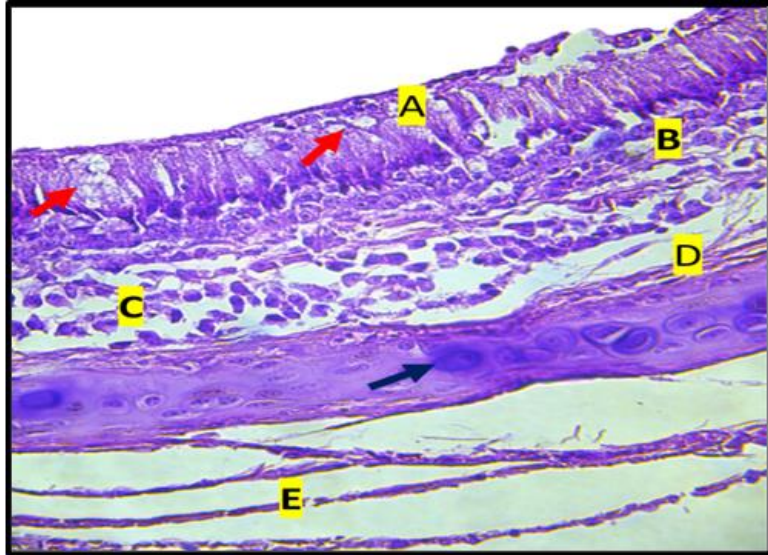
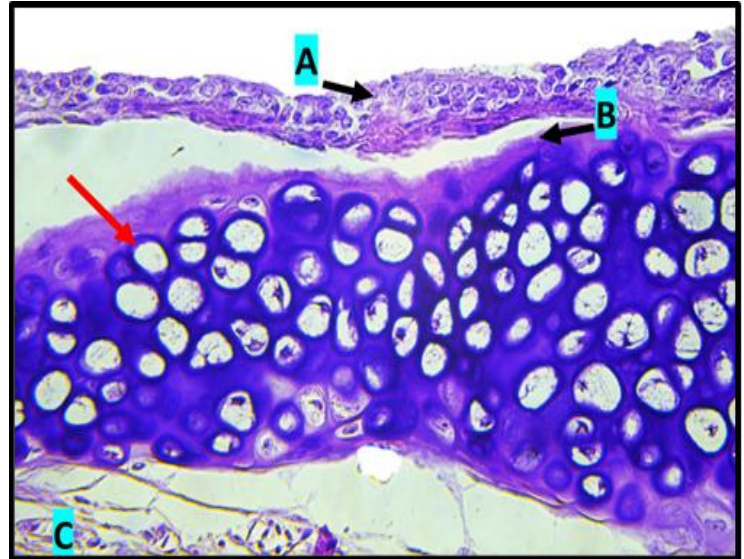
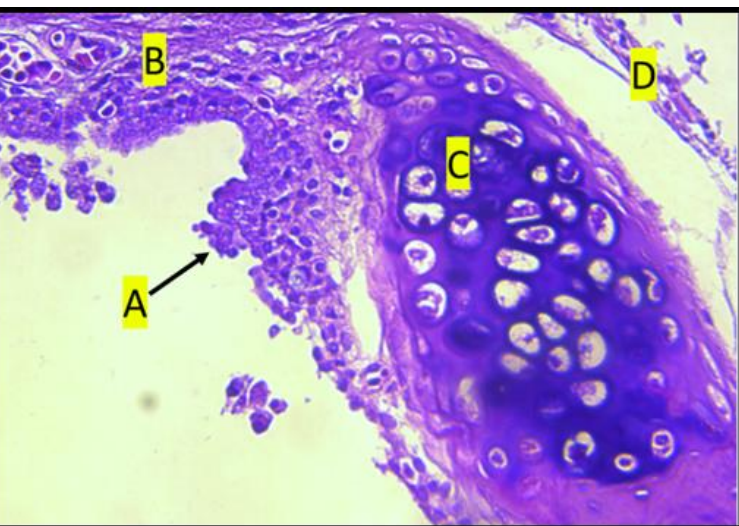


Figure (1): cross section of the primary bronchi in mynah show the :A. pseudostratified ciliated columnar Epithelial, goblet cell (red arrow) B. lamina propria, C. sub mucosa , hyalin cartilage (black arrow) , D. perichondrium , E. adventitia (H&E 40X)



Figure(2): cross section of the primary bronchi in starling show the: A.pseudostratified ciliated columnar Epithelial, Lacuna and Chondrocytes (red arrow) , B. perichondrium , C. adventitia (H&E 40X)



Figure(3): cross section of the primary bronchi in mynah show the : A. pseudostratified ciliated columnar Epithelial, B. inter connection tissue, C. Chondrocytes in. Lacuna , D. adventitia (H&E 20X)



Figure (4): cross section of the primary bronchi in starling show the: A. pseudostratified ciliated columnar Epithelial, B. lamina propria, C. Chondrocytes in. Lacuna (H&E 20X)

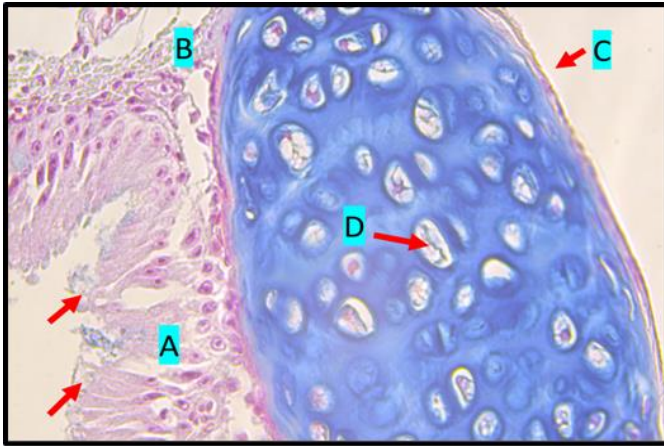
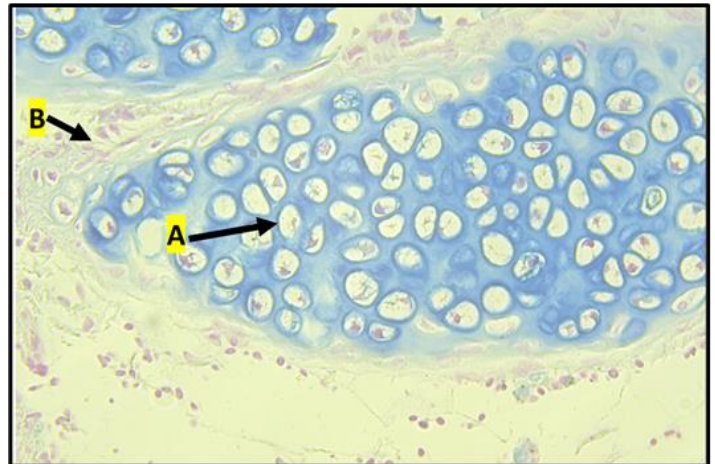
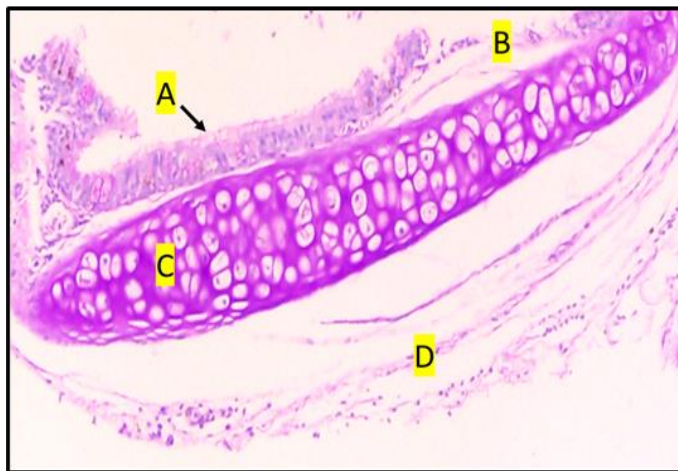


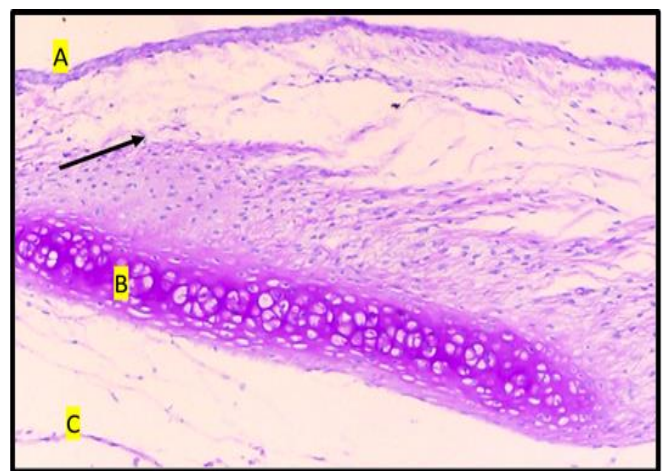
Figure (9): cross section of the primary bronchi in mynah show the : A. pseudostratified columnar ciliated epithelium, cilia (red arrow), B. lamina propria , C. Perichondrium , D. chondrocytes in lacunae. (Alcian blue 40X).



Figure(10): cross section of primary bronchi in starling show the : A. chondrocytes in lacunae , B. bronchial cartilage are attached by connective tissue band. (Alcian blue 40X)



Figure(46): cross section of the primary bronchi in mynah show the :A. pseudostratified columnar ciliated epithelium with goblet cell , B. lamina propria , C. hyaline cartilage positive to PAS stain ,D. adventitia (PAS stain 10X)



Figure(47): cross section of the primary bronchi in starling show the : A. pseudostratified columnar ciliated epithelium lamina propria , losse connective tissue (black arrow), B. hyaline cartilage , C. adventitia positive to PAS stain (PAS stain 10X)



Figure(5): cross section of primary bronchi in mynah show the: A. ossified cartilage, B. bronchial cartilage are attached by connective tissue bands. (H&E 10X)

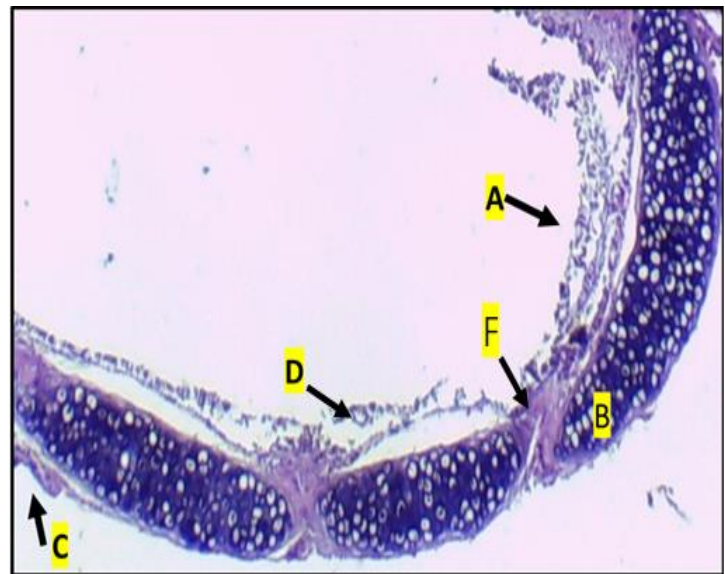


Figure (6): cross section of the primary bronchi in starling show the :A.Pseudostratified columnar epithelium ,B. hyaline cartilage, C. Perichondrium ,D. cartilage ,F. connective tissue. (H&E 10X)

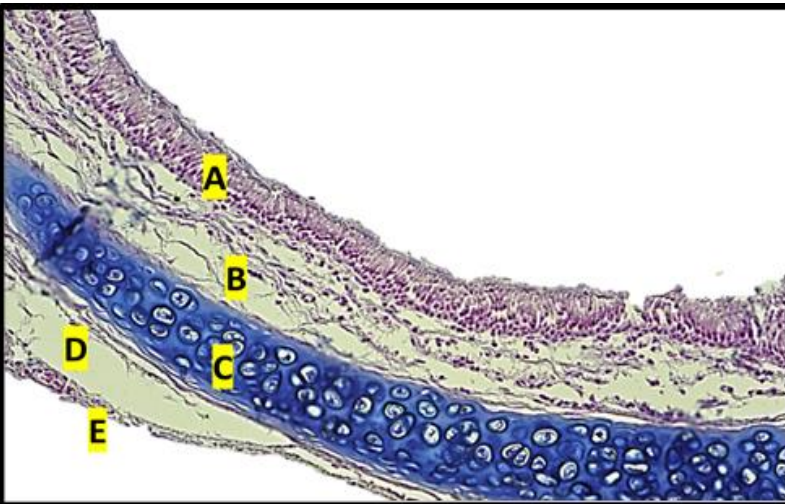


Figure (7): cross section of primary bronchi in mynah birds show the: A. pseudostratified columnar ciliated epithelium, B. lamina propria, C. hyaline cartilage,D. perichondrium, E. adventitia (Alcian blue 20X)

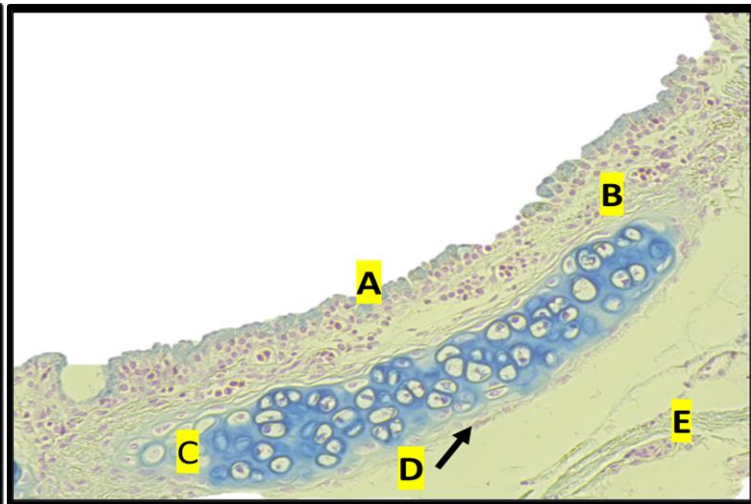


Figure (8): cross section of primary bronchi in starling birds show the: A. pseudostratified columnar epithelium, B. lamina propria, C. hyaline cartilage,D. perichondrium, E. adventitia (Alcian blue 20X)

IV. Reference

- 1-**Rastogi, S. C. (2007)**: Respiration. In: Essential of Animal Physiology. New Age Inter. Ltd. pp: 263-285.
- 2-**Pesek, L. (2000)**. The Avian Respiratory System. Winged Wisdom Pet Bird Magazine, 1: 1-3.
- 3-**Bacha, W.J., and Bacha, L.M. (2000)**: Color Atlas of Veterinary Histology 2nd (ed.) Lippincott Williams & Wilkins. PP: 175-190
- 4-**Reese, S., Dalamani, G., and Kaspers, B. (2006)**: The avian lung associated immune system: A Review. Vet. Res. 37: 311-324
- 5-**Onuk, B.; Haziroglu R.M.; Kabak, M. (2009)**: Gross anatomy of the respiratory system in goose (*Anser anser domesticus*): Bronchi and sacci pneumatici. Ankara Univ. Vet. Fak Derg. 56: 165-170
- 6-**KIRBAŞ, G., & TAKCI, İ. (2018)**. Anatomy of Respiratory System in Poultry. Mehmet Akif Ersoy Üniversitesi Veteriner Fakültesi Dergisi, 3(2), 141-147 <https://doi.org/10.24880/maeuvsfd.433946>
- 7-**Dewangan .B.K. (2011)**. Comparative Cross, Histomorphological and Histochemical Studies on Lungs of Assel and Vanaraja Breeds of 122 Poultry. Master. Thesis Indira Gandhi Krishi Vishwavidyalaya, Raipur. India.
- 8- **Bancroft JD, Stevens A (2012)**. Theory and practice of histological techniques. 7th edition. Churchill Livingstone. Pp 127-129
- 9-**Frandsen, R.D., Wilke, W.L., Fails, A.D. (2009)**: Poultry respiratory system. In: Anatomy and Physiology of farm Animals 7th (Ed): Wiley-Black Well. PP. 471-474
- 10-**Schachner, E.R., Lyson, T.R., and Dodson, P. (2009)**: Evolution of the respiratory system in nonavian theropods: Evidence from rib and vertebral morphology. Ana. Rec. 292:1501–1513
- 11- **Deshmukh, S. K., Gupta, S. K., Karmore, S. K., Barhaiya, R. K., Yadav, S. K., & Tomar, S. S. (2017)**. Histological studies on lungs of local Indian pigeon
- 12- **Firdous, D., Maya, S., Choudhury, A. R., Rafiq, A., John, M. A., & Quadir, A. (2018)**. Histochemistry of the respiratory system in Kuttanad ducks (*Anas platyrhynchos domesticus*). *Acta Scientific Agriculture*, 2, 54-55.
- 13- **Maina, J.N., and Africa M. (2000)**: Inspiratory aerodynamic valving in the avian lung: Functional morphology of the extrapulmonary primary bronchus. J. Exp. Biol. 203: 2865- 2876
- 14- **Samuelson, D. A. (2007)**. Avian respiratory system. Text book of Veterinary Histology. Saunders Elsevier, 246-248.
- 15- **Al-Umeri, S. K. W.; Al-Mamoori, N. A. M. and Al-Bishtue, A. A. H. (2013)**. Grossly and Microscopic Study of the Primary Bronchi and Lungs of Wood Pigeon (*Columba palumbus*). Kufa Vet. Med. Sci., 4 (2): 72-79
- 16- **Eurell and Froppier (2005)**: Text book of Veterinary Histology 6th Edition: Lippincott Williams & Wilkins



- 17- **Aspinall, V., and O'Reilly, M. (2005):** Bird respiratory system. In: Introduction to Veterinary Anatomy and Physiology. Butter Worth-Heine Mann. PP. 164-168.
- 18- **AL-Mahmodi, A.M. (2012):** Macroscopic and Morphometric Studies of the Extrapulmonary Primary Bronchi and Lungs of the indigenous adult Male Pigeon (*Columba domestica*) Kufa Journal For Veterinary Medical Sciences Vol. (3) No. (1).
- 19- **Jaifar, S.K (2017).** Anatomical and Histological Study of Respiratory System White Eared Bulbul. Master. Thesis. University of Basrah, Iraq
- 20- **Gazi.H.A (2017).** Histomorphological and Immunohistochemical Study on Some Respiratory Organs in adult Males European starling (*Sturnus Vulgaris*). Thesis of master, University of Basrah, Iraq

