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Macro and microscopic findings of trachea and lungs in local indigenous guinea pigs *cavia porcellus*

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Abstract

The current study was described to determine the morphology and histological characteristics of trachea and lungs in domesticated local guinea pigs *cavia porcellus*. Adult ages was (1-2) years, weight range (1.5-2 Kg) length (20-35 cm). The study was carried out on 12 local guinea pigs; it's divided into two cages: each cage included 6 male guinea pigs for topography grossly. Either other cage had 6 animals for histological preparations. Anatomically, the trachea was a long tube of hyaline cartilage characteristic flexible structure and incomplete rings arrived by annular ligament. The location in *cavia porcellus*, it extends from 2nd cervical vertebrae to 4th thoracic vertebrae. Either lung, it consists of paired separated by mediastinum, the right lung was larger than left, that occupy much of the space in the thoracic cavity between 2nd to 13th ribs and owns pink colour which. The right lung is composed of apical lobe, middle lobe, caudal lobe and accessory lobe. While other paired is composed of apical lobe and diaphragmatic lobe only. The wall of trachea was composed from four layers recognizable by light microscopy. Tunica mucosa, Tunica submucosa, musculo cartilaginous layer, and Tunica adventitia, the epithelia is called pseudo stratified ciliated columnar cells with four major cells, columnar cells, basal cells, goblet cells and Intermediate cells. The lamina propria considered composed from loose connective tissues which containing abundant of elastic fibres, with collagen fibres, diffuse lymphocytes, and blood vessels. The bronchial wall was composed of four tunics: firstly is called tunica mucosa, submucosa, muscular cartilaginous, and adventitia. The bronchial mucosa is lined by pseudostratified ciliated columnar epithelium with few goblet cells. Lamina propria is composed of elastic fibre and smooth muscle which forms a complete ring and there is no adventitia. Absence of respiratory bronchioles, the terminal bronchioles open directly into several alveolar ductules.

Keywords: Morphology, histology, *cavia porcellus*, trachea. Lungs

1. Introduction

Generally, the respiratory system in mammalian included two portions, upper part is called conducting and lower part is respiratory. It's provides a passageway and helps next air from external environment to warming, moistening and cleaning it [1]. The respiratory tract anatomy varies depending on species [2]. The trachea is a cartilaginous structure made of hyaline cartilage, attached by a fibro-muscular membrane. It is composed from many of hyaline cartilages (C-shaped) in different animals species, these cartilages have free ends on the dorsal side. Muscles of the tracheal closed each of the cartilage [3]. The bronchial tree consists of intrapulmonary bronchi, bronchioles, and terminal and respiratory bronchioles. Furthermore, Alveolar ducts and air sacs [4]. The main action of the lung is the separate diffusion of O₂ and removal of the CO₂ and respiratory gaseous exchange [5]. It's aimed to investigate the morphology and histology characteristics of the trachea and lungs of guinea pigs

2. Materials and Methods

We brought 12 guinea pigs from Gizzel market in Baghdad & kept inside animal house range of age (1-2 years) weight range (1.5-2 Kg) length (20-35) cm before starting to dissect them for the purpose of studying histology & morphology of trachea and lungs, the weights of animals were approximately the same, we use a surgical set, formalin 37%, blades, normal saline 0.9% w/v, containers, blades, blue paper, cylinder tube. We diluted the formalin to 10% so the tissue doesn't damage. Starting to dissect the bird by killing the animal through sloughing it gently and we placed animal on his back, pull the legs to the side and the back.

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Cut the skin between the legs and abdomen on each side, Hold the legs from near the hip and then lift it to the top so inseparable, raise the skin over the thigh and chest. Complete raise the skin from the director and even oral cavity, Cut the abdomen gently of end of the sternum, in order to gain access to internal organs (trachea and lungs), cut the ribs on the right side and the left until it reaches the shoulder, Raise the chest at this stage, lift the trachea and lungs carefully, and then put each of trachea in containers that contain diluted formalin 10%, then send the samples to get dissected histologically in the histology lab. Stains have been used on samples is Hematoxyllin and Eosin stain. [6].

3. Results and Discussion

The trachea is a flexible cartilagino–membranous non-collapsible long tube (Fig. 3). It was composed of a series of incomplete cartilaginous rings of C-shaped (Fig. 4). This is different with birds the tracheal rings are completely [7].

Our study included male guinea pig and showed elastic hollow cylindrical tube made up of a many of hyaline cartilage rings which the annular ligament as seen in (Fig. 1). The tracheal ring appears oval-shaped in cross-section. This result differs from that in dogs which is elliptical in shape and as horseshoe in humans [8]. Also it differs from that of angora goat by [9].

The tracheal muscle attached to the ring edges from their external surfaces. The tracheal muscle located between the end of the tracheal ring were meeting them and that of in cat by [10]. The trachea extended caudally from the larynx at the level of second cervical vertebrae when the thyroid gland related to it is ventral surface of the first three rings (fig.1 and 2), similar findings in dogs by [11] and in ruminants by [12] and branches into the two primary bronchi. The lungs are pair of pink and spongy organs surrounding the heart, and its shape is identical to the thoracic cavity shape, as in domestic animals [13]. Covered by pulmonary (visceral) pleura. The lungs were asymmetrical in dimensions; the right lung is larger than the left lung, have the same lobe divisions: cranial, middle and caudal accessory lobes (Fig. 1 and 2) as found in goat by [9]. Each lung possesses of cranial apex which resembles the apical lobe and caudal base. The apex of the left lung is small and pointed while the apex of right lung is large bland rounded, this result agrees with the result of the [14]. In dogs and differs in cats which had pointed apex in right lung. In rabbits, the thorax is small in contrast with the large abdomen. In guinea pigs, the lungs have deep incisures. Guinea pigs respiration is made due to the anatomical properties of thoracic cavity and its components with diaphragm acting as the main respiratory muscle. Where the left lung was consist of left apical lobe which consists of (parts of caudal and cranial), and the caudal lobe [15], that disagrees with [16, 17, 18]. In a hamster which possesses only one lobe.

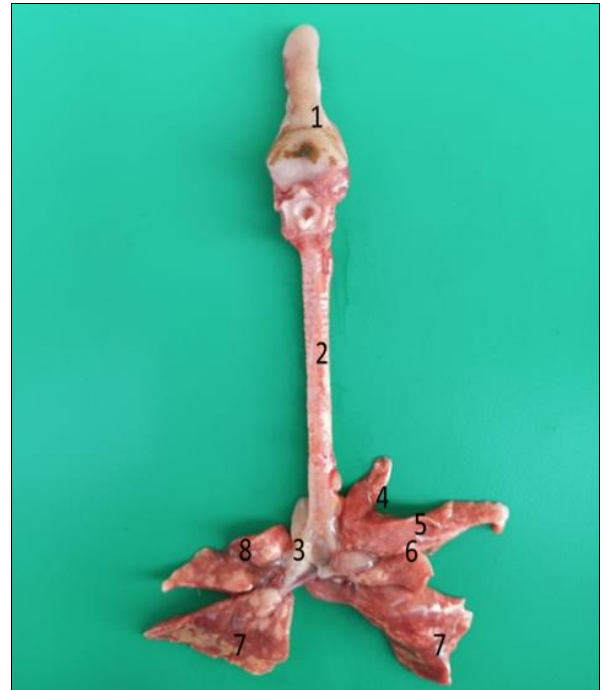


Fig 1: Topographic and the gross anatomy of dorsal view of trachea and lungs in male guinea pigs. 1-tongue 2-trachea 3-left primary bronchi 4-cranial lobe of apical lobe 5-caudal lobe of apical lobe 6-middle lobe 7-diaphragmatic lobe 8- apical lobe



Fig 2: Topographic and the gross anatomy of ventral view of trachea and lungs in male guinea pigs. Trachea (T). Thoracic region, right primary bronchi (black arrow) Left primary bronchi, cranial lobe (1), apical lobe of right lung (2, 3), middle lobe (4), diaphragmatic lobe (5, 6).



Fig 3: Topographic and the gross anatomy of dorsal view trachea and lungs in male guinea pigs. Showed trachea and lobulations of right and left lungs

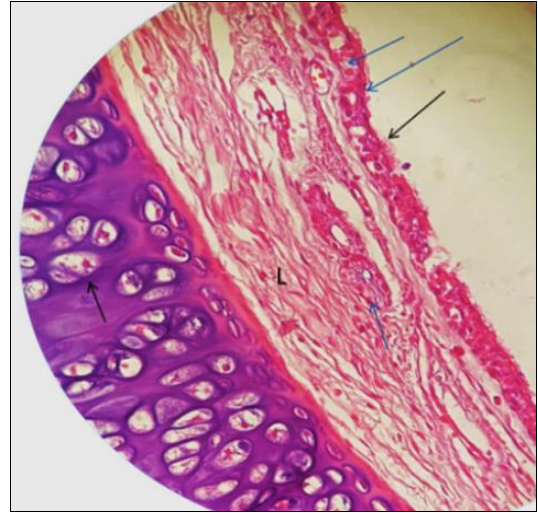


Fig 6: Histological section of trachea ring in guinea pigs Shows: Cilia (black arrow), goblet cells (blue arrow), pseudostratified columnar ciliated epithelia (black arrow), lamina proper (L), mucous cells (blue arrow), chondrocytes (black arrow) H α E stain(X 400)



Fig 4: Histological section of trachea ring in guinea pigs Shows: lumen of trachea, tracheal muscles (green arrow), tunica muscularis (blue arrow), epithelia (black arrow), Hyaline cartilage (C), H α E stain (X 100).

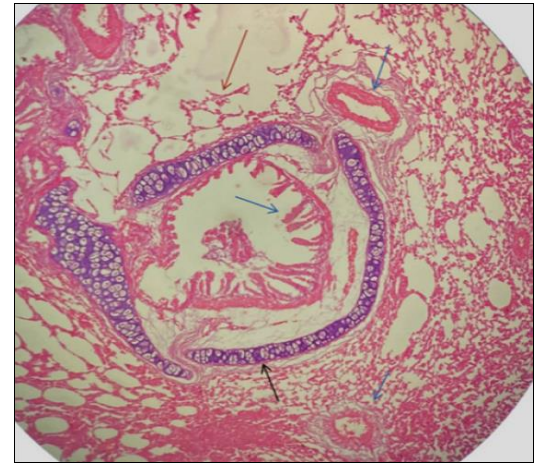


Fig 7: Histological section of secondary bronchi in guinea pigs shows: tunica mucosa (blue arrow), Smooth muscle (m), alveoli, blood vessels (blue arrow), Hyaline cartilage (black arrow), H α E stain (X 100)

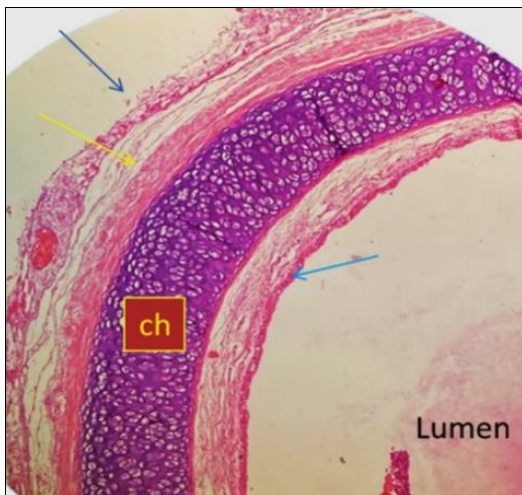


Fig 5: Histological section of trachea ring in guinea pigs Shows: lumen of trachea, tracheal muscles (green arrow), tunica muscularis (blue arrow), epithelia (black arrow), Hyaline cartilage (C), H α E stain (X 100).

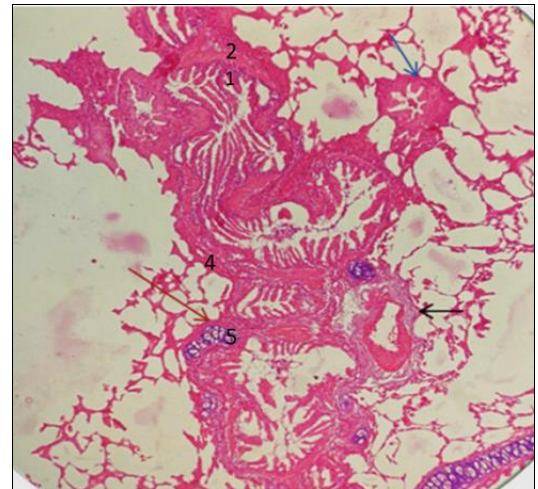


Fig 8: Histological section of tertiary bronchi in male guinea pigs shows: 1-Low simple columnar epithelium.2-Smoothmuscle 3-Tunica submucosa 4-Tunica adventitia 5-Small irregular hyaline cartilage. H α E. (X100)

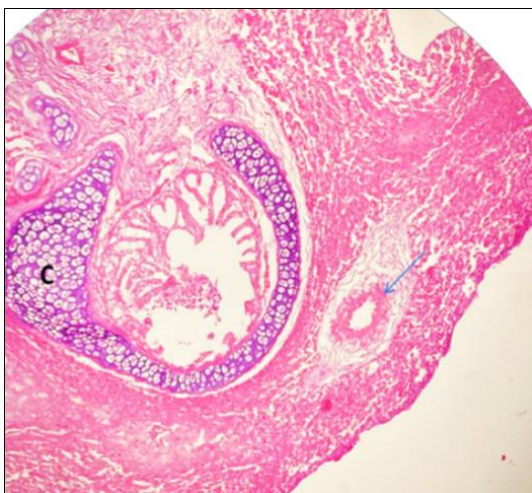


Fig 9: Histological section of large secondary bronchi and tertiary bronchi in male guinea pigs shows: simple columnar epithelium, Smooth muscle, Tunica submucosa 4-Tunica adventitia, hyaline cartilage (c). H & E. (X100)

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