

# **Grossly and Microscopic study of the trachea and bronchial tree in the local sheep ( *Ovis aris*).**

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## **Abstract**

The trachea of the local sheep is a tubular structure that begins at the cricoid cartilage of the larynx and ends when it bifurcates to form the principle bronchi, composed of series of incomplete rings that were incomplete dorsally present between of them longitudinal folds.

The study include twelve specimens divided into four groups grossly, histological study, cast and radiography. The anatomical study include the mean total tracheal length from the first ring to the bifurcation about (25.9 cm) , mean number of cartilaginous rings (48.6), mean number of folds (45), measured the length of trachea from the cricoids cartilage to the trachealis bronchus which enter to the cranial lobe of lung which branches from the trachea in last third before divided into two bronchi right and left each of one enter the lung for respiration also measure diameters of each tracheal ring which deference according the position of rings, which decrease of diameters when direction caudally to the root of lung the rings have different shape in the three parts of the trachea cervical, middle and thoracic the histological study showed the trachea lining pseudo stratified ciliated columnar epithelium with goblet cells, the wall of trachea consist of mucosa, submuosa, hyaline cartilage and adventitia and have large amount of tracheal gland,the trachealis muscle composed of elastic fibers interupted with smooth fibers.

The cast of trachea showed the bronchial tree and radiography explain the trachea , bronchi and bronchioles.

**Keyword:** Grossly, microscopic, cast, Trachea, Bronchial tree, Bronchi, Histology, sheep.

## **Introduction**

The respiratory system include conducting portion, consisting of the (nasal cavity, nasopharynx, larynx, trachea, bronchi ) while the respiratory portion where gas exchange takes place consisting of respiratory bronchioles, alveolar duct and alveoli, a major function of conducting portion is to condition the air before it enters the lungs, inspired air is cleansed, moistened and warmed (1,2 and 3) The trachea is flexible organ that extend from the base of the larynx to the point at which bifurcates into the primary bronchi that enter the lung.

The trachea consist of series of arranged cartilogenous rings that were incomplete dorsally, theres differences in length of trachea between the species and in the same animal , tracheal length is about (65 cm) in ox and cow , about (25 cm) in sheep and goat, the entire trachea must be flexible to allow the movement of head , neck and larynx (4,5 and 6), the cast very useful for teaching and research they can be used to obtain anatomical models of both normal and abnormal (7).

the aim of this study is to providing anatomical and histological information and data about important part of respiratory system and the aim of the cast technique to showing the branching of the trachea.

### **Materials and Methods :**

Twelve specimens of trachea of healthy local sheep were used in this study, divided into four group, five specimens for anatomical study , five specimens for histological study one specimen used to cast and other for radiography. The anatomical measurement including the total length of trachea ( the distance between the origin of trachea to the tracheal bronchus) , number of rings and fold, length of primary bronchi and measure the transverse and vertical of outer diameters of rings by vernier .

The histological study include the histological procedure begin washing and fixed in 10% formalin , washing and dehydration by an ascending series of ethanol 70% , 80% , 90% and 100% in which two times 1-2 hr. , cleaning and embedding after that slide blocks had sectioned by rotary microtome with 5-6  $\mu$  in thickness and staining by Hairs Hematoxyline - eosin to showing the histological structure of trachea and documented by digital photography(8).

in cast technique was prepared by using normal saline for washing the specimens and then injected the cold acrylic to study the bronchial tree, prepared resin , rapid repair selfcuring powder and liquid containing methyl methacrylate, injection the specimens by using the disposable syringe 50 ml in the trachea and distributed into branches and becomes so sufficiently rigid (7) .

### **Results and Discussion:**

#### **Anatomical study:**

The results showed trachea of sheep is a firm tube like structure directed caudally from cricoids cartilage of larynx to the hillus lung where bifurcates into left and right principle bronchi ( fig. 1 ).Tracheal region divided into three areas cervical region , middle region , and thoracic region, the trachea gives off bronchus to the cranial lobe of the lung called tracheal bronchus originated from the right side only of the trachea before it`s bifurcation at the hillus of the lung, length of the tracheal bronchus about (3 cm) measured from the origin of the bronchus to the point of it`s division into two branches ( fig. 2 ), the distance between the tracheal bronchus and the bifurcation equal to (5 cm) these results agree with (9).

The anatomical measurement taken as follows:

The total length mean of trachea were (25.9 cm) measured from the cricoids cartilage to the carina, and the primary bronchi were (22 cm) the mean number of cartilagenous rings about (48.6) rings and there about (45) folds present between the rings (table 1 ) these results are similar those mentioned (10) in philippinne carabao which has (45-49) rings and disagree with (11) in giraffe which mentioned the trachea of giraffe has (87-100) ring due to the length of the neck.

These rings present mostly in cervical region which is located at the neck that means the tracheal rings of cervical region is most affected by neck movement and the flexibility is possible due to the cartilages which forms individual rings connected by fibroelastic ligament agree with that of (12 and 13 ).

The diameters of the tracheal regions ( cervical, middle, thoracic) measured by vernier are (22.31 ± 1.3 mm ) transverse , (30.7 ± 1.5 mm) vertical, (21.82 ± 1.5mm)transverse, (27.5 ± 2.6 mm) vertical, (20.7 ± 2.7 mm) transverse, (23.87 ± 1.1 mm) vertical respectively (table 2 ) there is differences in the diameters of tracheal rings according to the position, these parameters decreased gradually toward the posterior third of the trachea cross section tracheal ring noticed the free ends overlapping each other at the cranial third but they become divergent in middle third and become close to each other dorsally disagree with (14).

### **Histological study:**

The wall of the trachea consist of mucosa, submucosa, hyaline cartilage and adventitia, the trachea is lined with atypical respiratory mucosa lined by pseudo stratified ciliated columnar epithelium with goblet cells, the underlying lamina properia which contains fine connective tissue fibers, the elastic membrane divides the lamina properia from the submucosa ( fig.3).

The submucosa contain tubuloacinar seromucous tracheal glands (fig.4). The trachea is kept open by c-shaped hyaline cartilage which surrounded by the dense connective tissue perichondrium which merges with submucosa and adventitia the larger chondrocytes in lacunae that are located in the anterior of the hyaline cartilage appear bundles of smooth muscle, this muscle allows regulation of the lumen of trachea. The adventitia of fibroelastic connective tissue. These results corresponds with (15 and 16).

The trachea divides outside of the lungs and give rise to primary or extrapulmonary bronchi, on entering the lungs, the primary bronchi divide and give rise to a series of smaller or intrapulmonary bronchi.

The histology of the intrapulmonary bronchi is similar to the trachea except that in the intrapulmonary bronchi the c-shaped cartilage rings of the trachea are replaced by

cartilage plates. The intrapulmonary bronchus branches into smaller bronchi and bronchioles, the epithelial height and the cartilage around the bronchi decrease, cartilage disappears from the bronchioles when their diameters decrease to about 1mm.

The result of cast technique of bronchial tree showed the trachea give off tracheal bronchus and divided into right and left principal bronchi and each bronchus subdivided to bronchioles(fig. 5) this result disagree with ( 17 ) in dog, (fig.6) explain radiography of the lung and bronchial tree, (fig.7) cross section of lung of local sheep.

**Table ( 1): Total tracheal length with distance between the origin of the trachea to the origin tracheal bronchus , number of rings and longitudinal folds.**

| <b>Sample o.</b> | <b>Number of cartilages rings</b> | <b>Number of folds</b> | <b>Total tracheal length up to the bifurcation (cm)</b> | <b>Tracheal length up to the origin of tracheal bronchus (cm)</b> |
|------------------|-----------------------------------|------------------------|---|---|
| 1                | 47                                | 44                     | 25  | 18.25   |
| 2                | 52                                | 50                     | 26  | 19.50   |
| 3                | 48                                | 43                     | 24.25   | 18  |
| 4                | 49                                | 45                     | 26.50   | 19  |
| 5                | 47                                | 43                     | 27.75   | 18  |
| <b>Mean</b>      | 48.6                              | 45                     | 25.9  | 18.55   |

**Table ( 2): Outer diameters of rings in 3 tracheal parts of Iraqi local sheep.**

| <b>Outer rings diameters</b> | <b>Cervical part</b> | <b>Middle part</b> | <b>Thoracic part</b> |
|------------------------------|----------------------|--------------------|----------------------|
| <b>transverse diameter</b>   | 22.3 ± 1.3           | 21.82 ± 1.5        | 20.72 ± 2.7          |
| <b>Vertical diameter</b>     | 30.7 ± 1.5           | 27.51 ± 2.6        | 23.78 ± 1.1          |

**Mean ± standard error**

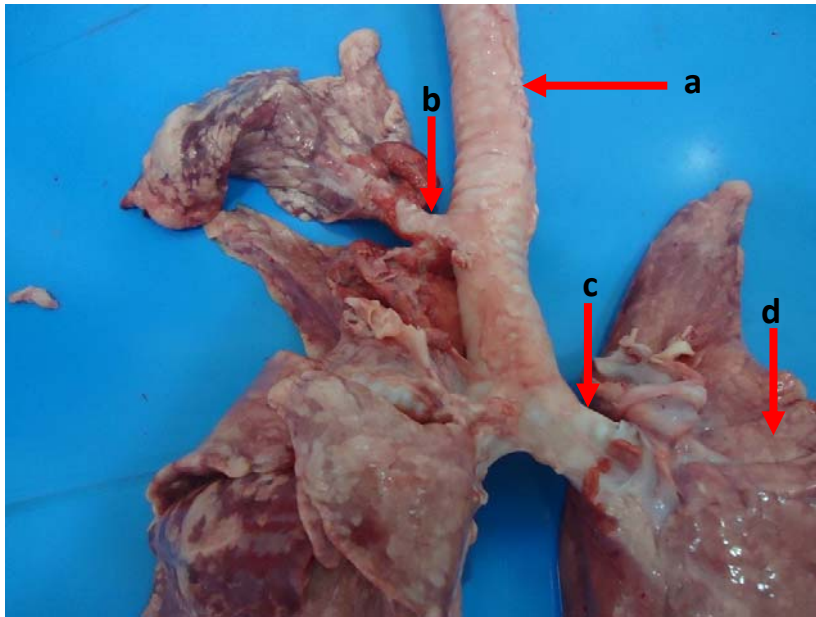


Fig (1):Show trachea (a) , tracheal bronchus (b) , left bronchus (c) , left lobe of lung (d).

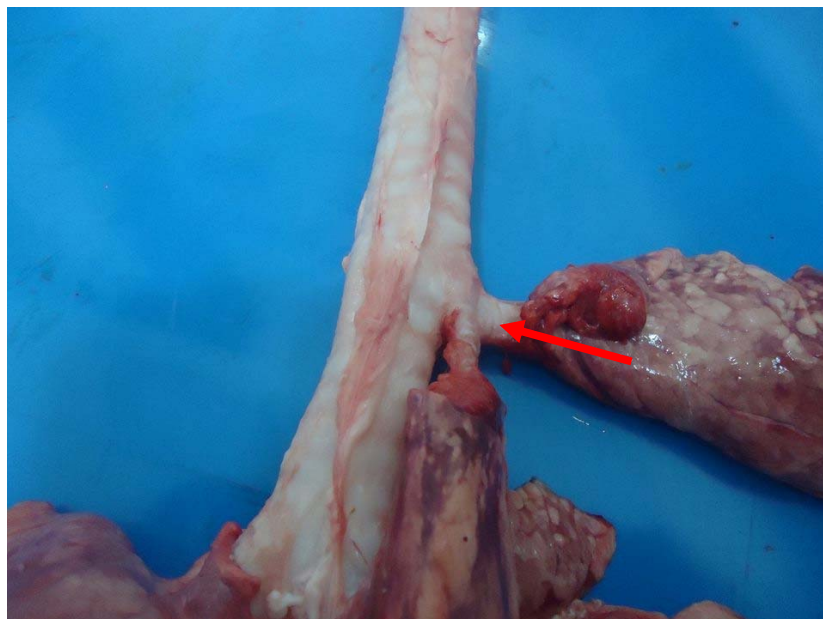


Fig. (2): show the bifurcation of tracheal bronchus into two branches and enter the cranial lobe of lung .

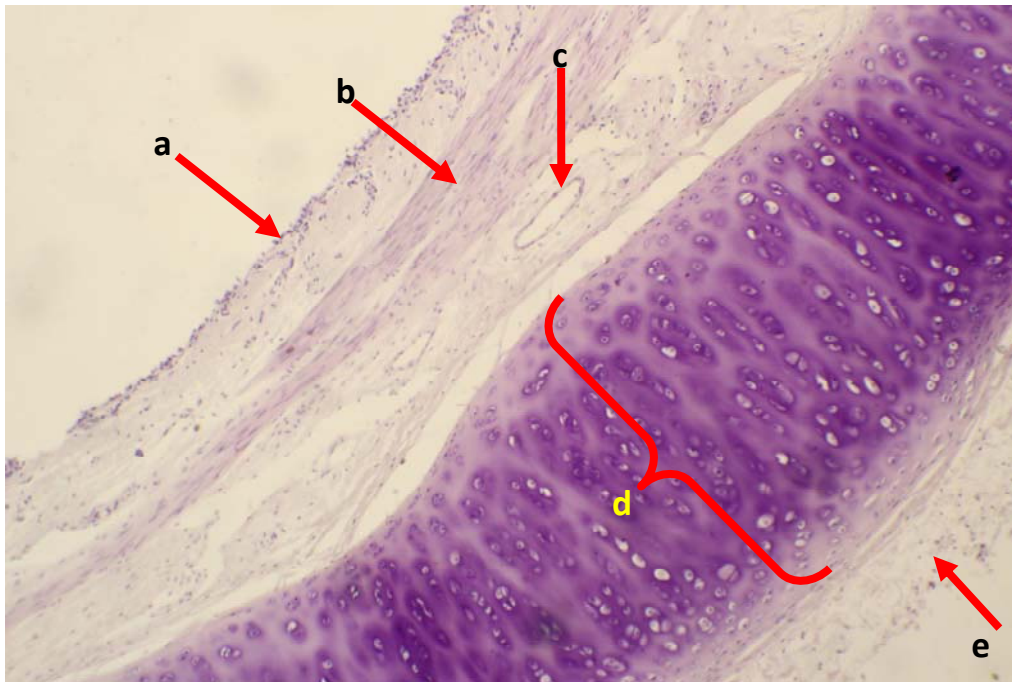


Fig. (3) : Show cross section of trachea pseudostratified ciliated columnar epithelium (a) , lamina propria (b) , blood vessels (c),perichondrium (d) ,the adventitia (e) , Haematoxylin and eosin stain 100x.

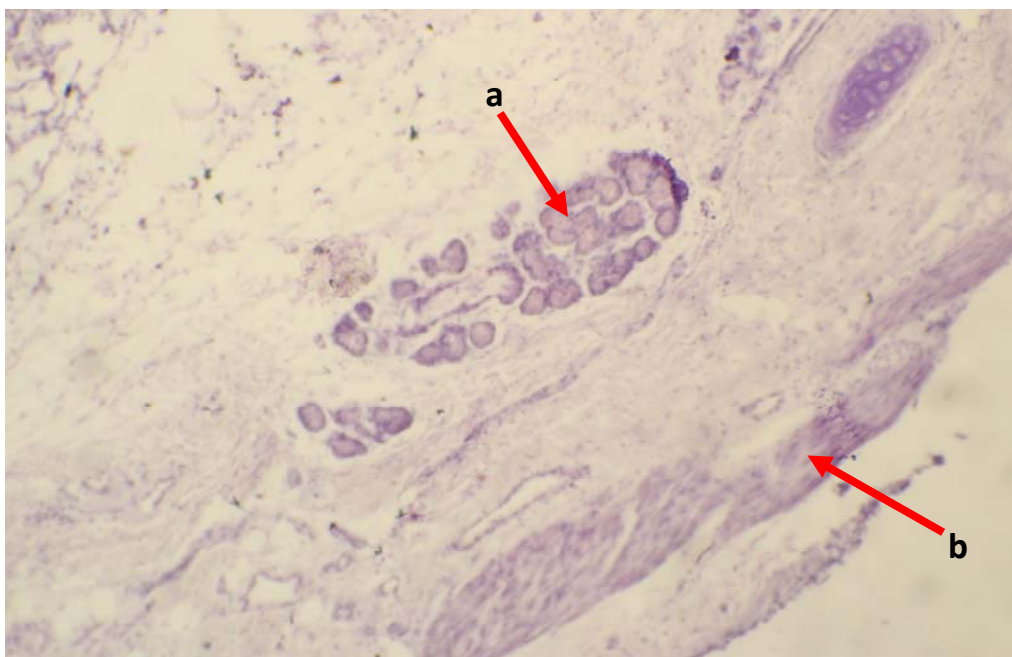


Fig (4): Show cross section of trachea, tracheal glands(a) , trachealis muscle(b) haematoxylin - eosin stain 100x.

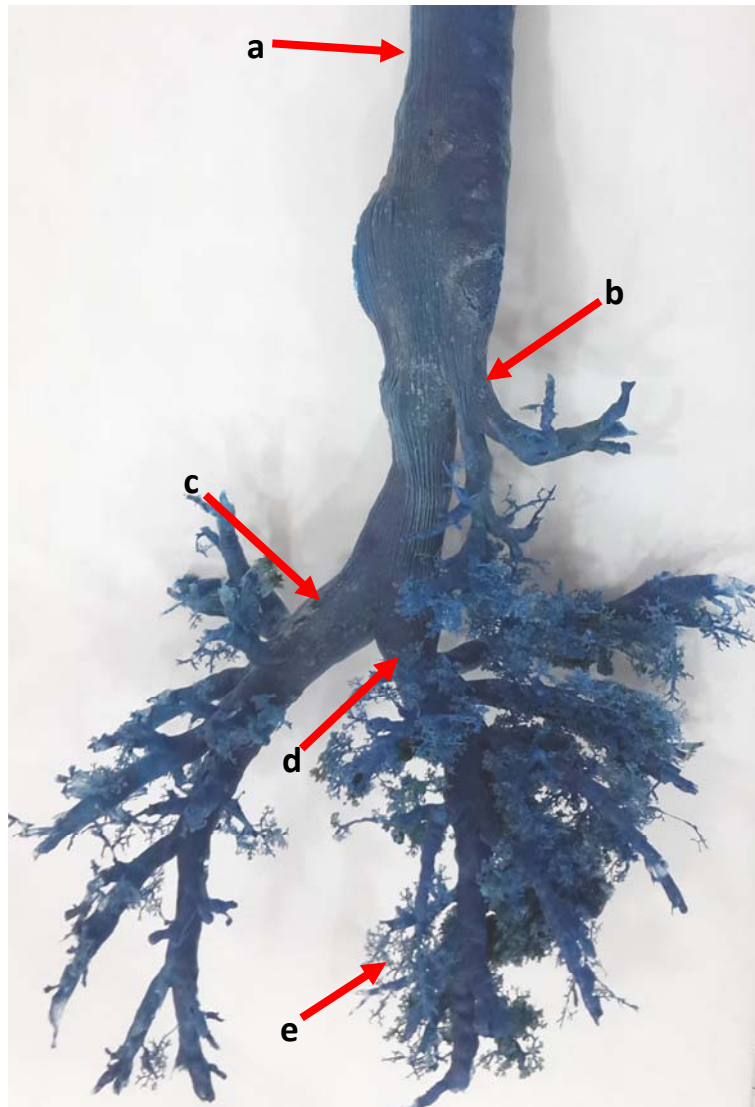


Fig (5) : Show cast bronchial tree illustrate the ramification of the bronchial, bronchiols branches and directions: trachea(a), tracheal broncus(b), left broncus(c), right broncus(d), bronchiol(e).





Fig (6): Show radiograph illustrates the lung and the bronchial tree of trachea.

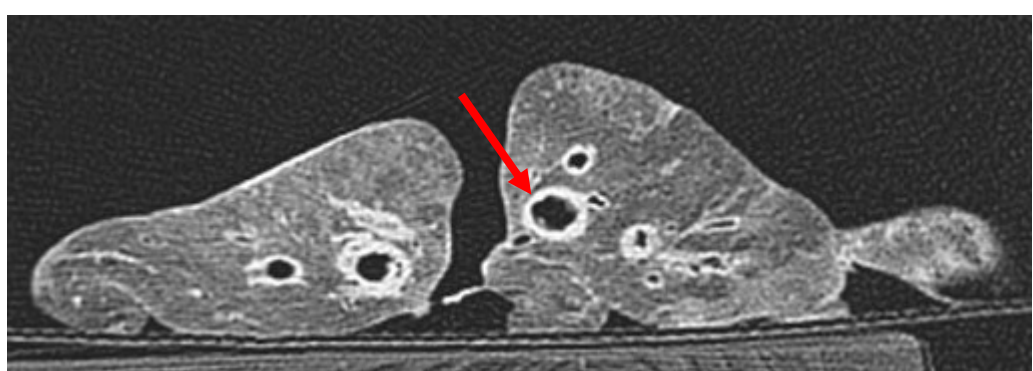


Fig (7): Show radiograph illustrate cross section of lung , bronchi ( the pointed part ).

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## دراسة عيانية ومجهريّة للرغامى والتفرعات الشجرية في الأغنام المحلية ( *Ovis aris* )

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### الخلاصة:

إن رغامى الأغنام المحلية هي تركيب أنبوبي يبدأ من الغضروف الحلقي للحنجرة وتنتهي بتفرعها إلى القصبات الرئيسية وتتكون من سلسلة من الحلقات الغضروفية غير مكتملة ظهريا تحصر بينها طيات طولية، شملت الدراسة على اثنتا عشر عينة لغرض الدراسة التشريحية والنسجية وعمل قالب الرغامى والتصوير الشعاعي.

تضمنت القياسات التشريحية حساب معدل طول الرغامى الكلي من الحلقة الأولى ولغاية التفرع إلى قصبتيين رئيسيتين فوجد انه يساوي (25.9) ، معدل عدد الحلقات ( 48.6 ) ، معدل عدد الطيات كان ( 45 )، قياس طول الرغامى من المنشأ ولغاية القصبة الرغامية التي تدخل إلى الفص الأمامي للرئة والتي تتفرع من الرغامى في الثلث الأخير قبل انقسامها إلى قصبتيين يميني ويسرى كل واحدة تدخل إلى رئة لتتهيأ أيضا تم قياس قطر حلقات الرغامى التي اختلفت أقطارها حسب موقعها حيث يقل قطر الحلقات كلما اتجهنا إلى الخلف باتجاه جذر الرئة وتمتلك الحلقات أشكالا مختلفة في الأجزاء الثلاثة من الرغامى المنطقة العنقية والوسطى والصدريّة.

أوضحت الدراسة النسجية أن الرغامى مبطنة بظهارة عمودية مطبقة كاذبة مع خلايا كأسيه وجدارها يتكون من الطبقة المخاطية وتحت المخاطية والغضروف الزجاجي والطبقة والبرانية وتم تحديد وجود غدد رغامية بشكل كبير والعضلة الرغامية تكونت من ألياف مرنة متداخلة مع ألياف ملساء وظهرت التفرعات الشجرية واضحة من خلال عمل قالب الرغامى وكذلك تم إجراء التصوير الشعاعي وظهرت فيه الرغامى والقصبتيين اليمينى و اليسرى والقصييات.