MORPHOLOGICAL STUDY OF RABBIT LUNG, BRONCHIAL TREE AND PULMONARY VESSELS USING CORROSION CAST TECHNIQUE

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ABSTRACT

Background: The aim of the present work is to study the bronchial tree pattern as well as the vascular pattern of rabbit lung using corrosion cast technique. **Material and Methods:** Fifteen normal adult rabbits were used in the present study. Healthy animals of both sexes used. These animals divided into five groups with three rabbits in each group. The bronchial tree was injected with "Epoxy Resin" and pulmonary vessels were injected with "Gum- milk Latex". **Results:** The present study revealed that the trachea divides into right and left bronchi. Pattern of bronchial division in the rabbit lung followed a monopodial pattern. The right lung of rabbit consisted of four lobes; cranial lobe, middle lobe, caudal lobe and accessory lobe, while the left lung consisted of two lobes; cranial and caudal lobes. **Conclusion:** It was observed that the rabbit has four pulmonary veins, two from each lung.

Key words: corrosion casts, rabbit, pulmonary vessels, Bronchial tree.

INTRODUCTION

The lung is a soft compact and spongy mass of tissues lying in the pleural cavity within the thorax. Each lung is covered by a fold of coelomic epithelium formed of two layers, a layer which in contact with the organ (visceral pleura) and, that lines the chest wall (parietal pleura). Between these two layers of pleura there is a pleural space which is potential space containing small amount of fluid. Each lung is divided into lobes ***(Ramchandi et al., 2001).***

The right lung has four lobes, whereas, the left lung has only two lobes. The vascular system of the tracheo-bronchial tree performs a variety of functions: apart from those common to most vascular beds, such as nourishment of tissues, removal of waste materials or supply of migratory cells and mediators, it is also involved in the specific functions of the airways related to the conditioning of inspired and expired air ***(Widdicombe, 1990).***

The vascular corrosion cast is the most adequate and effective technique to examine the angioarchitecture of normal and pathological tissues. The vascular microcorossion casts precisely reflect the course and anastomoses of blood vessels and also allow observing arrangement of arterial networks and venous plexuses. Vascular corrosion casts allow observing the microangioarchitecture of capillaries that create the terminal ways of functional and nourishing blood circulation ***(Verli et al., 2007).***

A corrosion cast is a resin made cast of the lumen of the passages in real organs. Gross anatomy of the lung can be studied easily with the wet specimen or a dry plastinated lung. However, the pulmonary airway patterns cannot be studied by handling a gross lung specimen. A corrosion cast of the pulmonary airway can give complete detail of its branching patterns in various animals ***(Noor- Jahan, 1982).***

In 2014, instead of using epoxy resin, ***Sivagnanam et al.,*** have used curable silicone resin to make a cast out of calf lung. They stated that, when it is made with epoxy resin the cast is so hard, firm and brittle. Hence, authors in their study have chosen silicone resin for preparation of such casts. Resin mixture was poured through the trachea. After complete filling, the specimen was hanged in air, leaving for natural maceration to remove the biological tissue surrounding the resin cast. Five days later, the cast was left with some remnants of the tissue which had been washed out with soap water and removed by cleaning the cast. The aim of the present work is to study the bronchial tree pattern as well as the vascular pattern of rabbit lung using corrosion cast technique.

MATERIAL AND METHODS

Material

Animals:

Fifteen rabbits will constitute the principal material for the present study. Healthy animals of different age and sex would be used. These animals divided into five groups with three rabbits in each group. Each three rabbits were housed in a separate plastic cage, at room temperature. They were fed balanced diet consisted of vegetables and bread. All rabbits were kept under the same circumstances throughout the experiment.

Animals were injected in the following way:

<u>Group(1):</u> The bronchial tree was injected with "Epoxy resin".

Group(2): The pulmonary artery was injected with "Gum- milk latex".
Group(3): The pulmonary veins were injected with "Gum- milk latex".
Group(4): Pulmonary arteries and veins were injected together, in the same specimen with "Gum- milk latex".
Group(5): Pulmonary vessels were injected with "Gum- milk latex" and bronchial tree was injected with "Epoxy resin" in the same specimen.

Cast material:

1) Gum- milk latex

The fresh specimens were injected with gum-milk latex (red for the arteries, blue for the veins). Rotting ink was used as a coloring agent. Then the specimens were preserved in acidified formalin solution (20%) for three days before they were subjected to dissection.

2) **Epoxy resin**

The fresh specimens were injected with epoxy yellow for the bronchial tree. The specimens are then left at room temperature for about 2-3 days until the plastoid material is hardened. The specimens then are put in a concentrated (37-39%) hydrochloric acid solution to start the maceration process. The specimens are washed out using a slow current of tap water every day or every other day to get rid of the debris of the digested tissues. Finally, after about 1-2weeks, the lung tissue is completely digested and a complete vascular or bronchial tree cast of the organ would be obtained showing the complicated micro-architecture of the blood vessels and the bronchial tree.

Methods: According to **(*Sivagnanam et al, 2014) and (Nazih, 2008):***

Bronchial tree casts preparation:

A cast models for the bronchial tree of animals under investigation were prepared.

i. Fresh lungs were used. The bronchial system injected through the trachea with Kem-apoxy No 150 (consists of 2 solutions A and B, which were mixed by a ratio 3: 1 respectively colored yellow with Rotring ink).
ii. The injected specimens left for 2- 3 days to dry in the open air for solidification of the Kem-apoxy.
iii. The specimens were then macerated in conc. Hcl for 1-2 weeks for corrosion, and then gently washed in running tap water until become free from the macerated tissue.

Pulmonary vessels cast preparation:

i. The colored latex (red for pulmonary trunk and blue for veins) were injected under steady pressure and filled all the lung and vascular bed.
ii. The specimens were dried at room temperature by air exposure; the exposure of the specimen to air is a simple drying method and is often used.
iii. Corrosion is the dissolution of tissues surrounding the cast, and is performed by sodium hydroxide (NaOH) and potassium hydroxide (KOH) solutions at different concentration.

RESULTS

The animals were divided into five groups with three rabbits in each group and injected in the following way:

Group (1): The bronchial tree was injected with "Epoxy resin".

The trachea (fig.1, 2&٣) was made of incomplete C-shaped cartilaginous rings held together by connective tissues. The tracheal cartilages exhibited a random pattern of anastomoses between adjacent rings. The rings were oval and increased in size craniocaudally. They extended from the cricoid cartilage, through the thoracic inlet, into the thoracic cavity.

The trachea bifurcated into the right and left principal bronchi (fig.٤&3). The trachea dilated cranial to its bifurcation. The left and right principal bronchi entered the left and right lungs at their hila (fig.٤& 3). The esophagus continued on the dorsal surface of the intrathoracic trachea into the esophageal hiatus of the diaphragm.

Bronchial division pattern is dissimilar among the specimens. Human bronchial tree shows division with dichotomic pattern (each bronchus divided in two distal bronchia) while in the rabbit lung followed a monopodial pattern (fig.4) (every secondary bronchus arose from each longitudinal main bronchus).

Lungs (fig.1) of the rabbit were bright red in colour. They were relatively large, completely encircling the heart except for the position occupied by the aorta. The heart was also large, kept in a stable position by the adhering lungs (fig.1). Thus, the shape of the lungs in situ was in conformity with the shape of the thoracic cavity and the heart (fig.7). The right lung (fig.1) was made up of four lobes while, the left lung (fig.1, 2) was made up of two lobes in all animals dissected. The lobes of the right lung included: cranial lobe (fig.1), middle lobe, caudal lobe and accessory lobe. These divisions followed the sequence of the lobar bronchi. The cranial lobe (fig. 2& 3) had a convex coastal surface devoid of prominent rib impressions. The medial surface was concave with prominent right auricular impression.

The accessory lobe (fig. 1, 2& 4) was located on the midline, bounded cranially by the left ventricle, caudally by the thoracic surface of the diaphragm and laterally by the medial surfaces of the left lung and the caudal lobe of the right lung. In left lung cranial and caudal lobes (fig. 2, 3) were separated by oblique fissure, also cranial lobe divided by incomplete fissure to cranial and caudal parts (fig. 2). The right lung divided by oblique fissure to caudal and middle (fig. 3) while, the middle and cranial lobes separated by transverse fissure.

The left lung (in situ) (fig. 1, 2& 3) was cone shaped; the base was formed by a concave diaphragmatic surface which was encircled by a caudal border. Its apex was formed by the cranial end of the costal and medial surfaces. The left lung has cranial and caudal lobe. The left cranial lobe is smaller than the right due to the presence of the heart. Rabbit lung has no septa dividing lobes into lobules so pneumonia if occurs it will be generalized.

Group (2): The pulmonary artery was injected with “Gum- milk latex”.

The main pulmonary artery (fig. 6) (MPA) is intra-pericardial and courses posteriorly and superiorly from the pulmonary valve. It divides into the left pulmonary artery (LPA) (fig. 5, 6) and right pulmonary artery (RPA) (fig. 5). The RPA is longer than the LPA and crosses the mediastinum sloping slightly inferiorly to the right lung hilum. The LPA represents the continuation of the MPA.

Segmental (fig. 6) and subsegmental pulmonary arteries generally parallel to segmental and subsegmental bronchi and run alongside them. This is in contrast to the course of most pulmonary veins, which run independently of bronchi within interlobular septa. There are frequently accessory arteries from neighboring segments. Segmental and subsegmental pulmonary arteries vary considerably in the location of their origins, in whether they arise as common trunks with other arteries or as separate arteries and in their number (fig. 12).

Group (3): The pulmonary veins were injected with “Gum- milk latex”.

Veins (fig. 7) are the blood vessels that carry blood to the heart. Pulmonary veins are responsible for carrying oxygenated blood from the lungs back to the left atrium of the heart. This differentiates the pulmonary veins from other veins in the body, which are used to carry deoxygenated blood from the rest of the body back to the heart. Rabbits have four pulmonary veins in total (fig.7& 8) two from each lung. There are two right pulmonary veins, known as the right superior and right inferior veins. These veins carry blood from the right lung.

Each pulmonary vein is linked to a network of capillaries (small blood vessels) in the alveoli of each lung (fig. 5) where they are continuous with the capillary ramifications of the pulmonary artery. Alveoli are tiny air sacs within the lungs where oxygen and carbon dioxide are exchanged. These capillaries eventually join together to form a single blood vessel from each lobe of the lung.

The right lung contains four lobes, while the left lung is slightly small and contains only two lobes. Initially there are four vessels for the right lung, but the veins from the middle, caudal and a accessory lobes of the right lung tend to fuse together to form right inferior pulmonary vein while cranial lobe give right superior pulmonary vein. The left superior pulmonary vein comes out from left cranial lobe while, left inferior pulmonary vein comes out from caudal lobe (fig.7& 8). Ultimately two trunks from each lung are formed; they perforate the fibrous layer of the pericardium and open separately into the upper and back part of the left atrium.

At first pulmonary veins (fig. 5) appears posterior to terminal part trachea separated from it by pulmonary trunk and its right and left branches. At lung hilum veins appear to be posteromedial to main bronchi. Inferior pulmonary veins in both sides following main bronchi a long its course on its medial side, sending multiple vennules to all parts of caudal lobes.

The superior pulmonary veins (fig. 8) take an oblique inferomedial course whereas the inferior pulmonary veins run horizontally peripherally before taking a more vertical course. They pass through the lung hilum, anteroinferiorly to the pulmonary arteries, forming a short intrapericardial segment, to drain into the left atrium. The ostia of the inferior pulmonary veins are more posteromedial and the left pulmonary veins being more superior.

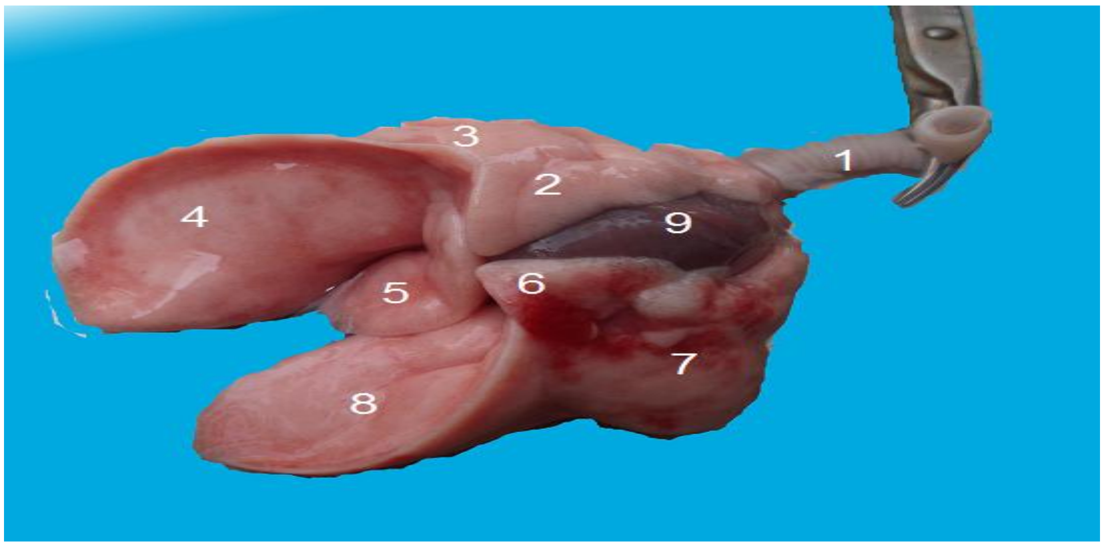
Group (4): Pulmonary arteries and pulmonary veins were injected together, in the same specimen, with "Gum- milk latex".

Two pulmonary veins emerge from each lung hilum, receiving blood from bronchial veins and draining into the left atrium. An inferior and superior vein drains each lung, so there are four veins in total. The veins are fixed to the pericardium. The pulmonary veins travel alongside the pulmonary arteries.

At the root of the right lung the right superior pulmonary vein lies in front of and a little below the pulmonary artery; the inferior is situated at the lowest part of the lung hilum. Bronchi are most posterior structures in the hilum. At the root of left lung, the left superior pulmonary vein lies in front of pulmonary artery and, the inferior pulmonary vein is the lowest structure in hilum. The left pulmonary artery is anterior and a little above the level of bronchus which is the most posterior structure in left lung hilum. The right pulmonary veins (fig.7& 9) (contains oxygenated blood) pass behind precaval veins and, right atrium. The left pulmonary veins pass in front of the descending thoracic aorta to end into left atrium.

Group (5): Pulmonary vessels were injected with "Gum- milk latex" and bronchial tree was injected with "Epoxy resin" in the same specimen.

On entering the lung (fig.١0& 1١) the major arteries and their paired airways course through the center of the lobe from the hilum to the pleural surface. The bronchovascular bundles coursing along this axial pathway are typically constrained by a common adventitial sheath. In smaller mammals (rabbit) pulmonary veins follow a course independent of the airway artery bundle.



(Fig. 1): A photograph showing topography of rabbit lung and heart.

1. The trachea, 2. Cranial lobe of the right lung, 3.Middle lobe of the right lung, 4. Caudal lobe of the right lung, 5. Accessory lobe of the right lung, 6. Cranial part of the left cranial lobe, 7. Caudal part of the left cranial lobe, 8. Caudal lobe of left lung, 9. Heart.

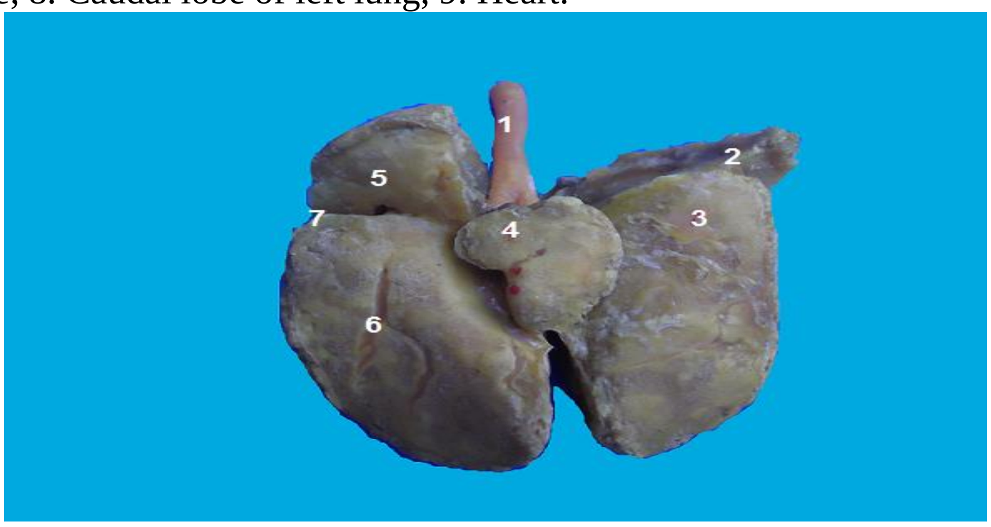


Fig. (2): A photograph showing the ventral aspect of rabbit lungs cast.

1. The trachea, 2. Cranial lobe of the left lung, 3. Caudal lobe of the left lung, 4. Accessory lobe of the right lung, 5. Cranial lobe of the right lung, 6. Caudal lobe of the right lung, 7. Oblique fissure of the left lung.

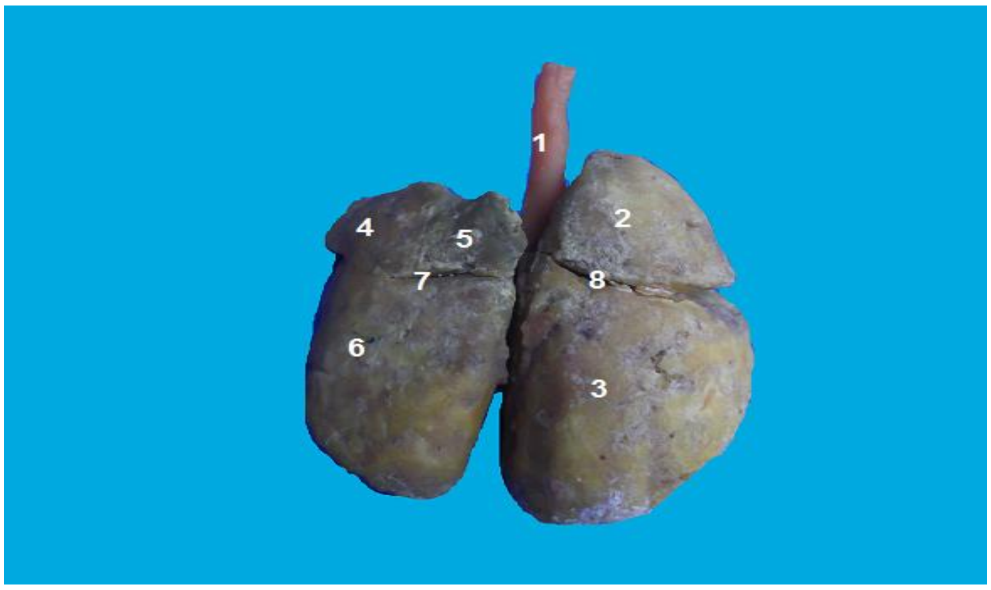


Fig. (3): A photograph showing the dorsal aspect of rabbit lungs cast.

1. The trachea, 2. Cranial lobe of the right lung, 3. Caudal lobe of the right lung, 4. Cranial part of the left cranial lobe, 5. Caudal part of the left cranial lobe, 7. Caudal lobe of left lung, 8. Oblique fissure of the left lung, 9. Oblique fissure of the right lung.

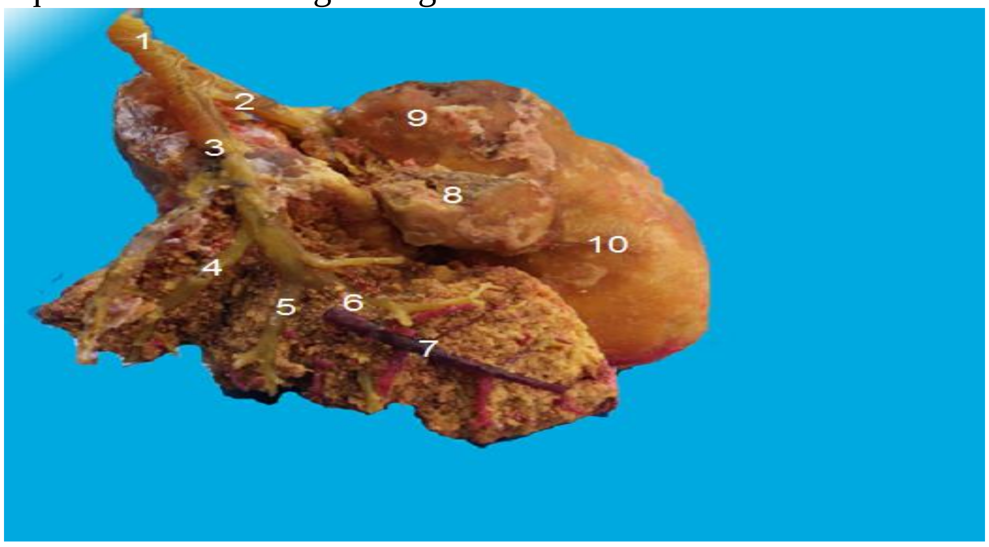


Fig. (4): A photograph showing the bronchial tree of rabbit right lung cast.

1. The trachea, 2. Left main bronchus, 3. Right main bronchus, 4. Right cranial lobar bronchus, 5. Right middle lobar bronchus, 6. Right caudal lobar bronchus, 7. Right pulmonary artery, 8. Accessory lobe of the right lung, 9. Left cranial lobe, 10. Left caudal lobe.

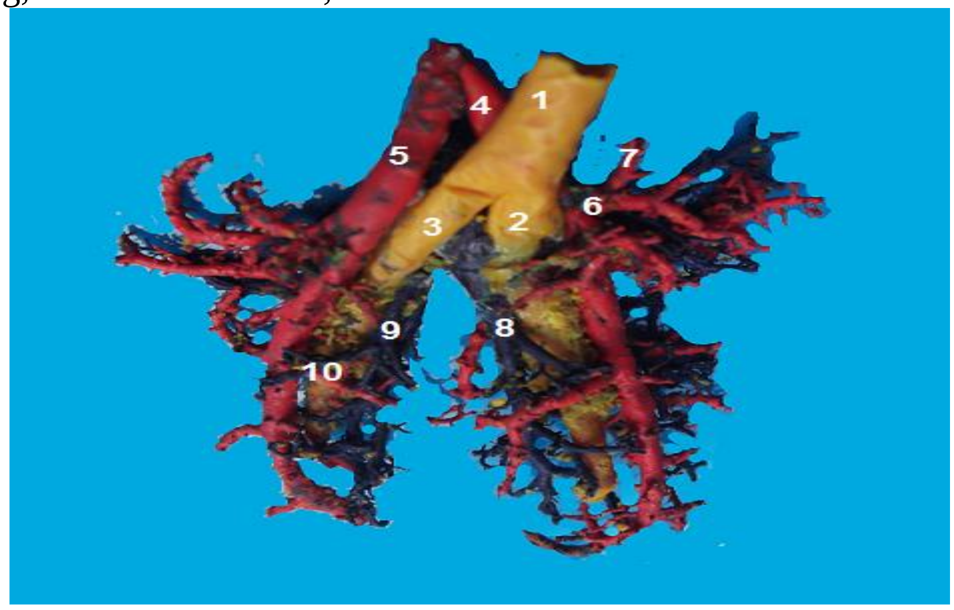


Fig. (5): A photograph showing bronchial tree and pulmonary vessels cast.

1. The trachea, 2. Right main bronchus, 3. Left main bronchus, 4. Left pulmonary artery, 5. Right pulmonary artery, 6. Right pulmonary segmental artery, 7. Right pulmonary subsegmental artery, 8. Right inferior pulmonary vein, 9. Left inferior pulmonary vein, 10. Network of capillaries.

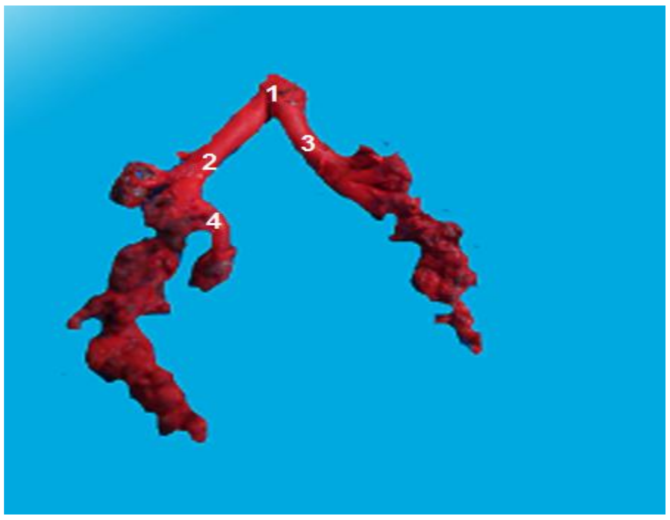


Fig. (6): A photograph showing pulmonary arteries cast.

1. Pulmonary trunk, 2. Right pulmonary artery, 3. Left pulmonary artery,4. Right pulmonary segmental artery.

Fig. (7): A photograph showing cardio-pulmonary system of rabbit at time of cast injection.

1. Right atrium, 2. Left atrium, 3. Right ventricle, 4. Right superior pulmonary vein, 5. Right inferior pulmonary vein, 6. Vein of accessory lobe, 7. Left inferior pulmonary vein, 8. Left superior pulmonary vein, 9. Cranial lobe of the right lung, 10. Middle lobe of the right lung, 11. Caudal lobe of the right lung, 12. Accessory lobe, 13. Caudal lobe of left lung, 14. Cranial lobe of left lung, 15. Right auricle, 16. Apex of the heart (dissected).

(Fig. 8): A photograph showing cast of pulmonary veins.

1. Left auricle, 2. Left atrium, 3. Left superior pulmonary vein, 4. Left inferior pulmonary vein, 5. Right inferior pulmonary vein, 6. Right superior pulmonary vein, 7. Right caudal lobe vein, 8. Right middle lobe vein.

Fig. (9): A photograph showing pulmonary vessels cast.

1. Pulmonary trunk, 2. Left atrium, 3. Left pulmonary artery, 4. Right pulmonary artery, 5. Right pulmonary segmental artery, 6. Right superior pulmonary vein, 7. Right inferior pulmonary vein, 8. Left inferior pulmonary vein, 9. Left pulmonary subsegmental artery.

Fig. (10): A photograph showing cardio-pulmonary system of rabbit at time of cast injection.

1. Trachea, 2. Right main bronchus, 3. Left main bronchus, 4.Cranial lobe of the right lung, 5.Middle lobe of the right lung, 6. Caudal lobe of the right lung, 7. Cranial part of cranial lobe of left lung, 8. Caudal part of cranial lobe of left lung, 9. Caudal lobe of left lung, 10.Left auricle, 11. Left pulmonary artery, 12. Right pulmonary artery, 13. Right inferior pulmonary vein, 14. Accessory lobe of right lung, 15. Apex of the heart (dissected), 16. Oblique fissure of the right lung, 17. Oblique fissure of the left lung, 18. Incomplete fissure of the left lung, 19. Remnant of the thymus.

Fig. (11): A photograph showing rabbit bronchial tree and pulmonary vessels cast.

1. Pulmonary trunk, 2. Right pulmonary artery, 3. Right pulmonary segmental artery, 4. Right pulmonary subsegmental artery, 5. Left pulmonary artery, 6. Trachea, 7. Left main bronchus, 8. Segmental bronchus, 9. Right main bronchus, 10. Left atrium, 11. Left superior pulmonary vein, 12.Left inferior pulmonary vein, 13. Right superior pulmonary vein, 14.Right inferior pulmonary vein, 15. Arterioveinus anastomoses.

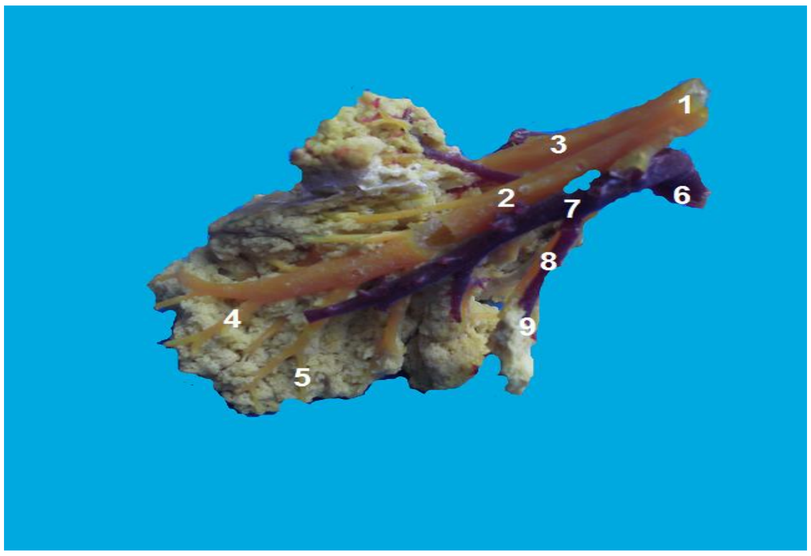


Fig. (12): A photograph showing right lateral aspect of rabbit lung and pulmonary artery casts. 1. Trachea, 2. Right main bronchus, 3. Left main bronchus, 4. Right segmental bronchus, 5. Right subsegmental bronchus, 6. Pulmonary trunk, 7. Right pulmonary artery, 8. Right pulmonary segmental artery, 9. Right pulmonary subsegmental artery.

DISCUSSION

Concerning the importance of the museums, this work was in agreement with ***Reinarz (2005)*** who mentioned that the museums were central to instruction at medical schools. The recent role played by the museum as a place for self learning attract our objectives to reconstitute the museum of the faculty of Medicine Al-Azhar University and build up many modular systems; including Respiratory, digestive, urinary, …etc. In the agreement with ***Turk (1994) and Tolba (2010),*** the old face of the museum as a place for only presenting exhibitions changed to its new face as a place for teaching; it provides multiple diversions of tools for self learning.

In the present study, one complete module was constructed to be used as a particular theme for an example of modular construction**.** Usage of corrosive cast is safe as it consider a good replacement for formalin as a preservative as there are no health hazards and solves several ethical and religious issues regarding dissection of dead bodies in some countries. These specimens can be handled with bare hands without side effects like contact dermatitis and conjunctivitis. These specimens are also odorless and easy to preserve in contrast to formalin fixed specimens. The luminal casts of gastrointestinal system and tracheobronchial system, if well prepared can be used to practice endoscopic procedures as well. The knowledge of the comparative anatomy of tracheobronchial tree is very useful as patterns that closely resemble human pattern are useful in therapeutic research. Similar to findings that observed by ***Sivagnanam et al. (2014)***

This study performed on the rabbit because it is a useful model for studying lung physiology and pathophysiology as it offers better understanding of lung structure than smaller animal models. On the other hand the rabbit is phylogenetically closer to humans than rodents. Because of the anatomical, physiological, genetic, and biochemical similarities between rabbits and humans, this species is preferentially used in pulmonary, cardiovascular, and metabolic studies, including those of airway obstructive disease, embolic stroke, arteriosclerosis, cholera, and cystic fibrosis. As a classical experimental animal model, rabbits also are used for drug screening tests, antibody production, and the production of therapeutic proteins. Similar observations were reported by ***Latahir and Yahaya (2012), Nurfatin et al. (2013)*** in rabbit.

The present work was performed for studying the bronchial tree and the vascular pattern of rabbit lung macroscopically through the usage of corrosion cast technique. This method helping in tracing the pulmonary vessels in the lung, following their courses, the manner of distribution and helping greatly in detecting the exact position of the vessels in relation to the organ. Moreover, this method display clearly the outline of the lung and hence, these casts would give of an idea about the framework of the lung and enabled us in drawing an illustration for its shape. A result which simulates the observation of ***Hal and Ghoshal (1988).***

In this study through the injection of three different coloured dyes, one for bronchial tree (yellow), one for pulmonary arteries (red) and one for pulmonary veins (blue). The most useful way for exploration of the blood and lymphatic vessels was to prepare corrosion casts. It is consider the ideal method for demonstration of bronchial tree with its different stages of branching that was never easy without a corrosion cast preparation. With the help of such casts, the caliber of the lumen of trachea, primary bronchi, secondary bronchi and tertiary bronchi are easily demonstrated to the students. The branching pattern differs in different animals which can be understood only with the help of such corrosion casts. Similar observation was reported by ***Huber and Edmund (1967), Jedrzejewski et al. (2002).*** This encouraged us to carry out an independent study on the vasculature of the rabbit lung using this technique.

The present work revealed that the trachea is a long respiratory tube extending through the neck into the thoracic cavity. It has 'c' shaped cartilaginous rings printed on surface of cast, these rings help to prevent the collapse of trachea and to keep it expanded allowing free passage of air to and from the lungs. The trachea itself is narrow relative to body size. Similar findings were observed by ***Venkatesh et al. (2013).***

The trachea branched into right and left primary bronchi, which in turn divided into secondary bronchi. The bronchi possess the similar structure as the trachea. Each principal bronchus entered the lung at its hilum. In the rabbit lung bronchial division pattern followed a monopodial pattern. Each bronchus divides into many thinner branches, called bronchioles, which divide into finer branches of fewer diameters known as respiratory bronchioles. Each respiratory bronchiole divides again into many finer branches, called alveolar ducts ***(Hiroyoshi and Yoshito, 2002***).

The right lung was made up of four lobes, while the left lung was made up of two lobes. The lobes of the right lung included: cranial lobe, medial lobe, caudal lobe and accessory lobe, while the left lung has cranial and caudal lobe. The left cranial lobe is smaller than the right due to the presence of the heart. Rabbit lung has no septa dividing lobes into lobules. This finding was in accordance with that reported by ***Nakakuki (1980)*** on the same animal and with that of ***Stan (2013)*** on rabbits and guinea Pigs.

In present study, it was found that the right caudal lobe was the larger lobe, cranioventrally to the heart extending forward to the thoracic inlet; we noticed the presence of thymus. The lungs lacks of septa, which in majority of animals split the lobes into lobules, therefore an anatomical explanation of absence of lobular pneumonia in these species is provided. A similar result was reported by ***Barone (1997)*** in guinea pig.

The present findings revealed that left lung cranial and caudal lobes were separated by oblique fissure, also cranial lobe divided by incomplete fissure to cranial and caudal parts. The right lung divided by oblique fissure to caudal and medial while, the medial and cranial lobes separated by transverse fissure while, the accessory lobe of right lung present separated in middle line ventrally between two caudal lobes and below the heart (***Rachel, 1996)***.

Pulmonary vessels:

The present study as well as, those of ***Cathy et al. (2011)*** in smaller mammals - monkey, dog, cat, rabbit, guinea pig and rat revealed that the pulmonary trunk starts from right ventricle, covers by pericardium at its beginning then divides into right and left pulmonary arteries. Each of them enters the hilum of corresponding lung. The right pulmonary artery appears longer than the left. Each pulmonary artery divides in tree manner as first generation that known as segmental arteries. Segmental arteries give second generation of intrapulmonary arteries that known as subsegmental arteries. Segmental and subsegmental pulmonary arteries generally parallel segmental and subsegmental bronchi and run alongside them. Unlike pulmonary veins they run independently of bronchi within interlobular septa.

It was observed that rabbits have four pulmonary veins in total, two coming from each lung. There are two right pulmonary veins, known as the right superior and right inferior veins. These carry oxygenated blood from the right lung. Each pulmonary vein is linked to a network of capillaries (small blood vessels) in the alveoli of each lung, where they are continuous with the capillary ramifications of the pulmonary artery. These capillaries eventually join together to form a single blood vessel from each lobe of the lung. The result obtained in this study was similar to those of ***Mary (2013)*** on pulmonary arteries, capillaries and veins in human.

The present study, as well as, those of ***Meredith and Flecknell (2006)*** in rabbit, revealed that the right lung contains four lobes, while the left lung is slightly small and contains only two lobes. Initially there are four vessels for the right lung, but the veins from the middle, caudal and a accessory lobes of the right lung tend to fuse together to form right inferior pulmonary vein while cranial lobe give right superior pulmonary vein. The left superior pulmonary vein comes out from left cranial lobe while, left inferior pulmonary vein comes out from caudal lobe. Ultimately two trunks from each lung are formed; they perforate the fibrous layer of the pericardium and open separately into the upper and back part of the left atrium.

According to the present study, the root of the right lung formed of Bronchi which are most posterior, superior pulmonary vein lies in front of and a little below the pulmonary artery and the inferior vein is the lowest structure in the hilum . In the left lung, superior pulmonary vein lies in front of pulmonary artery and, the inferior vein is the lowest. The left pulmonary artery is anterior and a little above the level of bronchus which is the most posterior structure in left lung hilum. This was the same result obtained by ***Cathy et al. (2011)*** in rabbit.

SUMMARY

This work was focused on building up respiratory system modules for domestic animal as an example for the comparative modular systems in the museum and as initial step for application of technique on human specimens. The different parts of the respiratory system (bronchial tree and pulmonary vessels) were presented by technique of corrosive cast. The vascular corrosion cast is the most adequate and effective technique to examine the angioarchitecture of normal and pathological tissues.

Corrosion casts of the airway of the lungs of mammals made with epoxy are good museum specimens and valuable teaching aid. It is very durable and appealing. Deflated lung of a rabbit is collected without damage along with trachea. Commercially available epoxy is self curing in nature. Hence epoxy is injected through trachea into the lung.

Since the consistency of epoxy is thick and cured fast, it is deposited in the trachea has to be squeezed into the bronchi and its branches by hand from the surface of the lungs. When the natural colour of the surface of the lungs changes to the colour of the epoxy it is understood that the entire airway is filled with epoxy. Then the specimen is hanged undisturbed for ٢-3 days. Acid maceration may be done to obtain the cast after 1-2 weeks and the resulting cast may well be washed in water.

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دراسة مورفولوجية للتفرعات الشعبية والاوعية الرئوية لرئة الأرنب باستخدام تقنية عمل المجسمات

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قد ركز هذا العمل على بناء وحدات الجهاز التنفسي للحيوانات المستأنسة كمثال للمقارنة بين وحدات الأجهزة في المتحف وكخطوة أولية لتطبيق التقنية على العينات البشرية.

كما عرض الأجزاء المختلفة للجهاز التنفسى (القصيبات الهوائية، والأوعية الهوائية) من خلال تقنية عمل المجسمات . وتعتبر تقنية عمل المجسمات للأوعية الدموية هى اكثر الأساليب ملائمة وفاعلية فى دراسة بنية الأوعية الدموية فى الأنسجة الطبيعية والمرضية.

وتم عمل مجسم للجهاز التنفسى للثديات من مادة الأيبوكسى وهذا يمثل اضافة عينات جيدة ومساعدات علمية قيمة للمتحف وهذه العينات دائمة وجذابة.

تم جمع القصبة الهوائية و رئة الأرنب مفرغه من الهواء مع عدم الأضرار بها ، نقوم باستخدام الأيبوكسى المتاح تجاريا وهو قابل للبلمرة ذاتيا ومن ثم يتم حقن الأيبوكسى من خلال القصبة الهوائية للرئة.

وبما ان الأيبوكسى مادة لزجة واكثر سماكة وقابل للبلمرة بسرعة فلابد من الضغط على القطبة الهوائية وفروعها باليد او من سطح الرئة. وعندما يتغير لون سطح الرئة الى لون الأيبوكسى فمن المفهوم ان جميع القصيبات الهوائية قد تشبعت بالأيبوكسى ثم تعلق العينة من يومين الى ثلاثة ايام ، ثم توضع فى حمض لأزالة بقية الأنسجة للحصول على مجسم بعد من اسبوع الى اسبوعين ويتم غسل هذا المجسم في الماء .