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## دراسات تشريحية طبوغرافية على الأوردة الرئوية

في الحمار

فؤاد عثمان، صابر أبوزيد

جمعت عينات هذه الدراسة من حيوانات مختلفه الأعمار ومن كلا الجنسين.  
أستخدمت طرق مختلفه لتوضيح المنبع والمسار والعلاقة الطبوغرافية للأوردة الرئوية  
المختلفة.

أوضحت الدراسة أن تجويف الأذين الأيسر للقلب يحتوى على ثلاثة جيوب  
تستقبل الأوردة الرئوية.

الجيب الأمامي الأيسر يستقبل الوريد الخاص بالفص الأمامي الأيسر للرئة ، أما  
الجيب الأمامي الأيمن فيستقبل أوردة الفص الأمامي الأيمن والجزء البطني الأول من  
الفص الخلفي الأيمن على حين أن الجيب الخلفي فيستقبل أوردة بقية اجزاء الفص  
الخلفي الأيمن والفص المساعد للرئة اليمنى والفص الخلفي الأيسر.

أوضحت الدراسة أيضا أن الأوردة الرئوية وروافدها تحذو حذو التفرع القصبي  
في جميع الفصوص الرئوية فيما عدا الفص الخلفي الأيمن والأيسر حيث أن روافد  
الأوردة في هذه الفصوص تسير بين القصيبات المناظرة.

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Fac. of Vet. Med., Cairo University,  
Head of Dept. Prof. Dr. M.S.M. Moustafa.

**TOPOGRAPHICAL ANATOMICAL STUDIES ON THE PULMONARY VEINS  
OF THE DONKEY (*Equus Asinus*)  
(With 3 Figures)**

By  
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(Received at 30/3/1986)

**SUMMARY**

The work was carried out on 20 lungs collected from donkeys of different age and of both sexes. The study revealed that the cavity of the left atrium of the heart possesses three sinuses. They are arranged according to their topographic position into, left cranial, right cranial and caudal. Each sinus receives the veins of one or more pulmonary lobe. The left cranial sinus receives the blood from the left cranial lobe, while the right cranial sinus from the right cranial lobe and the first ventral segment of the right caudal lobe. The caudal sinus receives blood coming from the remaining part of the right caudal lobe, the accessory lobe and the left caudal lobe. The study provided also that the lobar and segmental branches as well as their further ramifications course along the corresponding bronchi in all pulmonary lobes except the right and left caudal lobes, where the segmental branches run intersegmentally.

**INTRODUCTION**

The clinical importance of the pulmonary veins initiated large number of authors to study their origin and topographical relations within the lung of domestic animals (BACKMAN, 1937; ELLENBERGER and BAUM, 1943; GUZSAL, 1955 and WILKENS and MÜNSTER, 1976). Moreover, specific studies on the different species of animals have been carried out as BARONE (1953) and EHRSAM (1957) in horse; FELDER (1962) and OSMAN & MÜNSTER (1980) in dog; SCHORONO (1955) in cattle; ADRIAN (1964) in cat; FATH ELBAB (1970) and OSMAN (1974) in camel; SWIELIM (1981) in goat and HAGRAS (1982) in buffalo.

The present study aims to give some lights on the origin, course and topographic relations of the pulmonary veins of donkey.

**MATERIAL and METHODS**

A total of 20 lungs from donkeys of different ages and of both sexes were studied. The lungs were obtained connected with the hearts to study the origin of pulmonary veins and to facilitate the process of injection. The pulmonary vessels were injected in ten specimens with coloured latex, while the bronchial tree was injected with gelatine. The specimens were dissected after fixation in 10% formalin for two days. In another five specimens, the pulmonary veins were injected with latex and provided for dissection. In the remaining specimens, the veins were injected with Micropaque solution and subjected for radiography. The terminology used in this work is that adopted by the Nomina Anatomica Veterinaria (1975).

## RESULTS

In the cavity of the left atrium, three sinuses have been recognized, the right cranial, left cranial and caudal. They are situated ventral and somewhat caudal to the bifurcation of the pulmonary trunk. Each sinus receives the veins of one or more pulmonary lobes. The lobar and segmental veins are valveless.

### I- Sinus cranialis dexter (Figs. 2/3 , 3/2) :-

The right cranial sinus drains the right cranial lobe and the first ventral segment of the right caudal lobe.

#### 1. Vena pulmonalis lobi cranialis dextri (Fig. 1/1) :

It passes on the ventral side of the corresponding lobar bronchus for about 1 cm where it gives off the Ramus segmentalis caudalis and continues cranially as the Ramus segmentalis cranialis lobi cranialis dextri.

##### 1.1. Ramus segmentalis cranialis (Fig. 1/2) :

In regard with size and direction, it can be considered as the direct cranial continuation of the lobar vein. It slants on the ventral aspect of the corresponding artery and bronchus in a cranial direction to the most cranial part of the segment. Along its course it detaches 2-3 relatively large branches to the different divisions of the segment.

##### 1.2. Ramus segmentalis caudalis (Fig. 1/3) :

It curves caudo-dorsally, crossing the lateral aspect of Bronchus principalis dexter to appear caudal to the corresponding bronchus and its subsequent divisions.

#### 2. Ramus segmentalis ventralis I lobi caudalis dextri (Fig. 1/4) :

It arises from the right cranial sinus, somewhat caudal to the preceding vein and in front of the Arteria lobi accessorii. About 1 cm from its origin, it gives off an intersegmental branch which extends between the cranial and caudal lobes (Fig. 1/5). This branch takes part in draining the caudal segment of the right cranial lobe and the first ventral segment of the right caudal lobe. The parent trunk then follows the corresponding bronchus for about 2-3 cm where it divides similarly to the bronchus, into cranial and caudal branches. The cranial smaller vessel slants on the medial aspect of the corresponding bronchus and its subsequent divisions. The caudal vessel accompanies the corresponding bronchus, and drains only the cranial portion of this segment. The caudal portion of the segment is drained by the second ventral segmental branch of the right caudal lobar vein.

### II. Sinus caudalis (Figs. 2/4 , 3/3) :-

The caudal sinus, the largest of the three sinuses of the left atrium, drains blood from the major part of the right caudal lobe, accessory lobe and left caudal lobe.

#### 1. Vena pulmonalis lobi caudalis dextri (Fig. 1/6) :

It extends in a caudal direction along the medial aspect of the corresponding lobar bronchus. Along its course, it gives off 3-5 small dorsal segmental branches (Fig. 1/7) and 2-3 larger ventral segmental branches (Fig. 1/4). Each of the dorsal group extends in a caudo-dorsal direction, intersegmentally between two adjacent segments. The ventral segmental branches cross the ventral aspect of the lobar bronchus to maintain an intersegmental position. In this way, each segmental branch, either dorsal or ventral segmental branch, takes part in draining two adjacent segments.

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**2. Vena pulmonalis lobi accessorii (Fig. 1/8) :**

It arises from the medial aspect of the vena pulmonalis lobi caudalis dextri just in front of the corresponding bronchus. It divides into a lateral and medial segmental branches which accompany the corresponding segmental bronchi. In two specimens, the two segmental veins arise separately from the caudal sinus in between the right and left caudal lobar veins.

**3. Vena pulmonalis lobi caudalis sinistri (Fig. 1/9) :**

It leaves the caudal sinus, running on the ventro-medial aspect of Bronchus principalis sinister for about 3 cm, where it gives off the vein of the first ventral segment of the left caudal lobe. It continues caudally on the same aspect of the bronchus lobaris caudalis sinister to the terminal part of the caudal lobe. Along its course, it detaches 3-5 dorsal (Fig. 1/11) and 2-3 ventral (Fig. 1/10) segmental tributaries, that ramify in a similar way like those of the right caudal lobe. In two specimens, the first ventral tributary arose directly from the caudal sinus, somewhat lateral to the origin of vena pulmonalis lobi caudalis sinistri. In another specimen, it arose together with the second ventral segmental tributary of the caudal lobe.

**III. Sinus cranialis sinister (Figs. 2/5 , 3/5) :-**

It is the smallest of the three sinuses, draining blood from the left cranial lobe.

The vena pulmonalis lobi cranialis sinistri (Fig. 1/12) leaves the left cranial sinus, crossing the ventral aspect of the left pulmonary artery to gain the caudo-lateral aspect of the left cranial lobar bronchus, where it divides into cranial and caudal segmental branches. The former can be considered as the direct cranial continuation of the parent vessel. It follows the lateral aspect of the corresponding segmental bronchus, giving off 3-5 smaller branches to the corresponding part of the lobe. The caudal segmental branch extends in a caudo-lateral direction in the interlobar septum between the cranial and caudal lobes. It drains the blood from the caudal segment of the cranial lobe and assists in draining the first ventral segment of the caudal lobe.

**DISCUSSION**

Location of pulmonary veins in the most ventral part of pulmonary hilus, is a matter of agreement of large number of authors, BARONE (1953) and GUZSAL (1955) in horse, WILKENS and MÜNSTER (1976) in domestic animals, OSMAN (1974) in camel, OSMAN and MÜNSTER (1980) in dog, SWIELIM (1981) in goat and HAGRAS (1982) in buffalo.

Regarding the number of sinuses of the left atrium in the donkey, the present work revealed the presence of three sinuses, arranged according to their topographic position into left cranial, right cranial and caudal. Similar number of sinuses was observed by GUZSAL (1955) in domestic animals, OSMAN (1974) in camel, SWIELIM (1981) in goat and HAGRAS (1982) in buffalo. However, the first two authors named the sinuses as left, right and caudal. On the other hand, ELLENBERGER and BAUM (1943) and BARONE (1953) in horse noted only two sinuses, a large left sinus and a smaller right one.

The absence of valves in the lobar veins is agreed by all authors. Furthermore, the present work shows that the segmental veins are also valveless. With regard to the number of the lobar veins there is great variability in different animals, they are 7 as demonstrated in the present work and by SWIELIM (1981) in goat, but 6 in dog (OSMAN and MÜNSTER, 1980) and 11-13 in horse (BARONE, 1953). In this connection, BACKMAN (1937) reported that the main pulmonary veins of domestic animals are four in number in the right lung and two in the left one.

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Concerning the pattern of branching of the pulmonary veins in donkey, the lobar and segmental branches course along the accompanied bronchi in all pulmonary lobes except the right and left caudal lobes, where the segmental branches run intersegmentally. Consequently, the broncho-pulmonary segments of all lobes in the donkey are of broncho-vascular type except those of the caudal one, they are of broncho-arterial type. A result which is in agreement with that of FELDER (1962) in dog, OSMAN and MÜNSTER (1980) in dog and ADRIAN (1964) in cat. However, BARONE (1953) and EHRSAM (1957) in horse asserted that the branches of pulmonary veins pass intersegmentally. On the contrary, SWIELIM (1981) in goat stated that the segmental branches course along the corresponding bronchi. Whereas SCHORONO (1955) in cattle, FATEH-ELBAB (1970) and OSMAN (1974) in camel agreed that the tributaries which drain the broncho-pulmonary segments attained intersegmental position, while the radicles of pulmonary veins within the segments were irregularly distributed.

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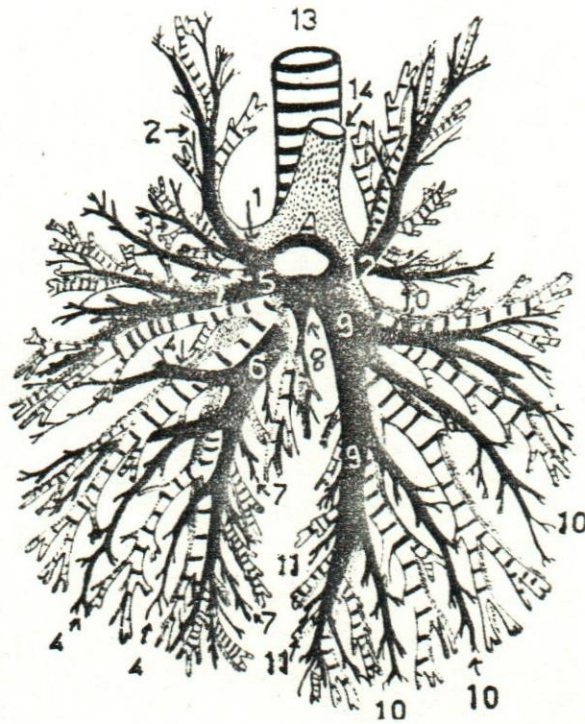


Fig. (1):

Distribution of pulmonary vessels of donkey, ventral view, schematic.

- 1- Vena pulmonalis lobi cranialis dextri, 2- Ramus segmentalis cranialis of (1),
- 3- Ramus segmentalis caudalis of (1), 4- Rami segmentalis ventrales lobi caudalis dextri,
- 5- Ramus intersegmentalis of (4), 6- Vena pulmonalis lobi caudalis dextri,
- 7- Rami segmentales dorsales of (6), 8- Vena pulmonalis lobi accessorii, 9- Vena pulmonalis lobi caudalis sinistri,
- 10- Rami segmentales ventrales of (9), 11- Rami segmentales dorsales of (9), 12- Vena pulmonalis lobi cranialis sinistri, 13- Trachea,
- 14- Pulmonary trunk.





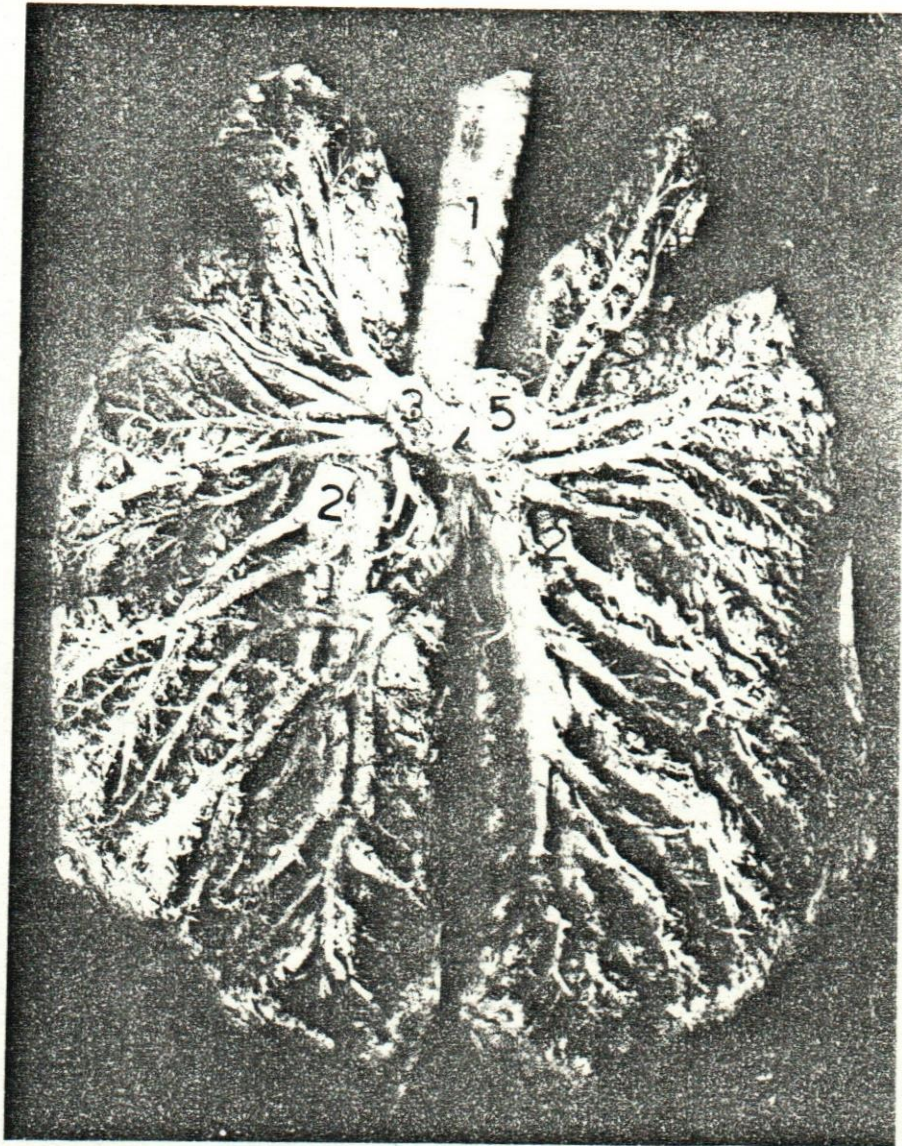
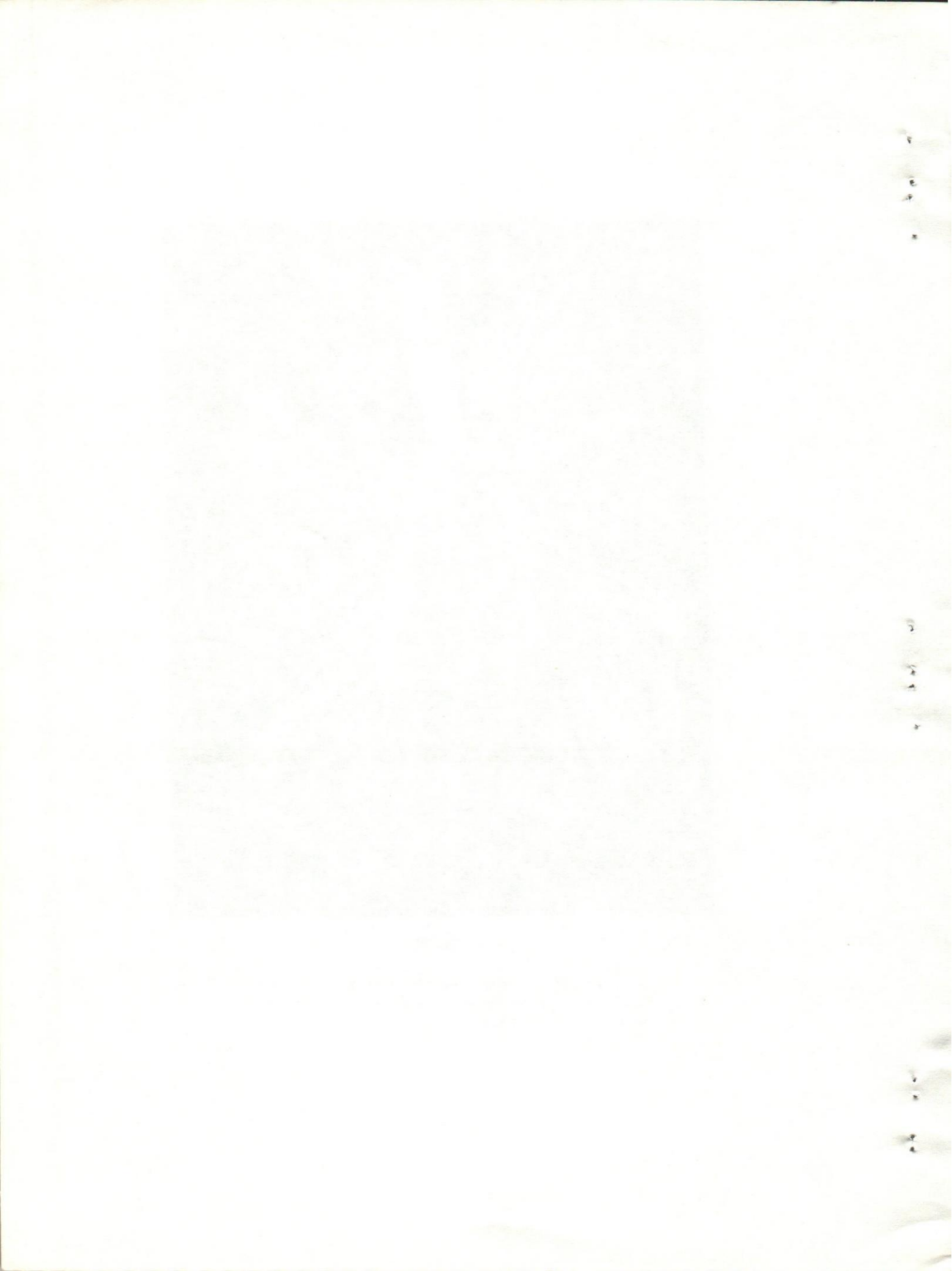
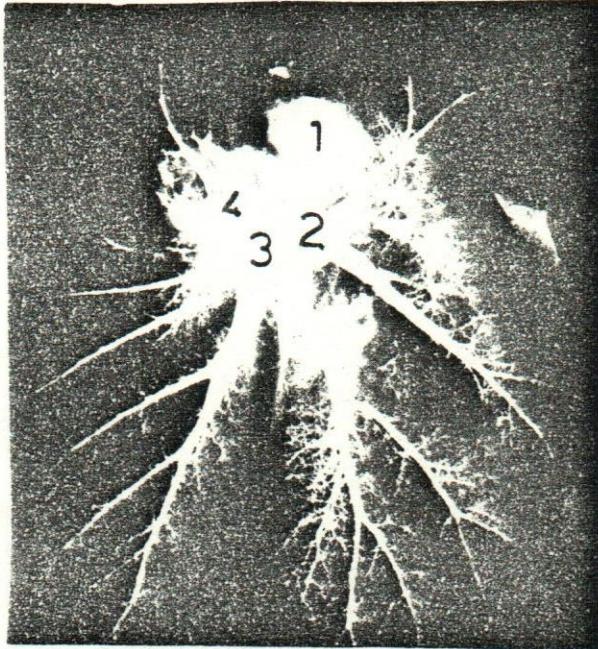


Fig. (2):

Pulmonary vessels of the donkey, injected with latex, ventral view, Photo.

1- Trachea, 2- Caudal lobar arteries, 3- Right cranial sinus,  
4- Caudal sinus, 5- Left cranial sinus.





**Fig. (3):**

Angiograph for the pulmonary veins of donkey, dorsoventral view.  
1- Auricula atri, 2- Sinus cranialis dexter, 3- Sinus caudalis,  
4- Sinus cranialis sinister.

