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PERIARTERIAL MEMBRANES IN THE LUNG

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(Received December 1, 1953)

Literature

Around the trunk and branches of the pulmonary artery, spaces and sheaths have been found by previous authors. The most detailed review of the pertaining literature was published by *C. Cordier* and *Nguyen Huu* (1952). These authors described around both the pulmonary artery and the pulmonary vein sheaths which are in immediate connection with the external layer of the pericardium. According to Cordier and Huu, the sheaths have a threefold function, viz. a.) to protect the vessels, b.) to guarantee the movement of vessels in the sheaths (similarly to serous spaces), c.) a nutritive influence (nutrition of the vessels and protection of the vasal nerves). As a recent contribution to the problem, *F. Marchand*'s finding (1951) is mentioned who has also described sheaths around every vessel of the lung. *H. v. Hayek* (1951) writing of periarterial lymph vessels and lymph spaces, mentions that according to Aschoff, these were artefacts, and comes to the conclusion that by means of the surrounding lymph spaces, the pulsation of the pulmonary artery exerts an influence on the lymph circulation of the lung. *Hayek* describes correctly that the pulmonary veins have no sheaths and concludes from this difference that by means of their sheaths, the branches of the pulmonary artery are independent of the dilatation and contraction of the lung, while the veins are exposed to it. Most recently *A. M. Tocker* and *H. T. Langston* have stated that there are perivascular spaces in the lungs both around the arteries and the veins, even around their last ramifications. According to these authors, material injected into the perivascular space passed under the external layer of the pericardium to the opposite side, whether the injection was made around the arteries, or around the veins. Dogs were used by them as experimental animals. They make no statement as to the biological function of the spaces, but assert that these have a great practical significance.

Material and Methods

Lungs of men, dogs and cats have been examined with the vacuum method of *I. Katona*. This method is as follows. Lukewarm physiological NaCl solution was circulated through the pulmonary artery until the blood had been completely removed from the organ. Exclusively

fresh and normal lungs were used. The clean lungs were dried in the state of inspiration in a vacuum exsiccator. The exsiccated pulmonary tissue was embedded in paraffin and sections 50 to 100 microns thick were made from it. Both in human and animal lungs, I found a thin membrane of connective tissue (periarterial membrane) around both the large and small branches of the pulmonary artery. This membrane always remained in connection with the pulmonary

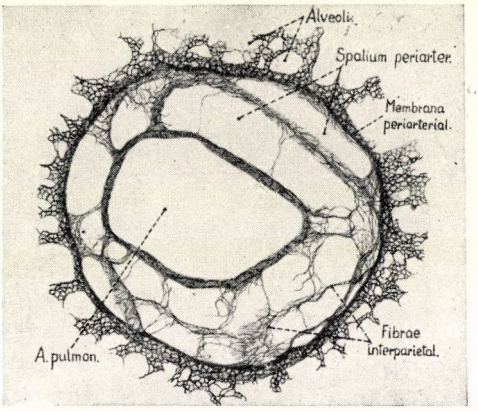

Fig. 1. Pulmonary artery and periarterial membrane of the dog. — Transverse section. Vacuum-specimen of lung, capillaries injected with India ink

tissue (with the alveoles) even in lungs dilated ad maximum. The empty pulmonary artery did not dilate parallel with the periarterial membrane and in this way an empty *periarterial space* appeared around the artery (Figure 1). In fresh, unprepared lungs, the periarterial membrane lies

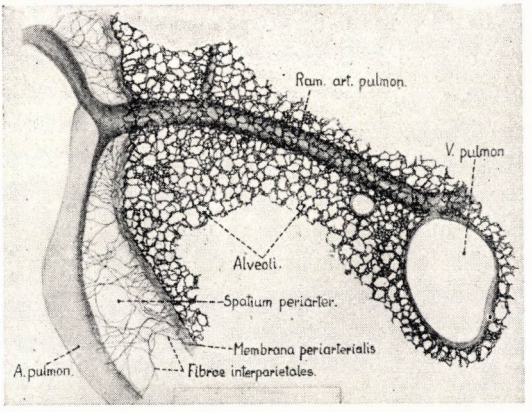

Fig. 2. Pulmonary artery and periarterial membrane of the dog. Longitudinal section. Vacuum-specimen. Lung, capillaries injected with India ink

closely on the arterial wall and resembles the adventitial layer. In fresh specimens the artery retracted in consequence of its elasticity may be pulled out of its sheath with a fine forceps while the veins cannot be pulled out in the same manner because they adhere to the pulmonary tissue. According to the experience of chest surgeons, pulmonary arteries are easier to ligate than veins ; the difference depends upon the periarterial membrane. Between the membrane and the

arterial wall, there are fine cobweblike radial collageneous fibres *(interparietal fibres)*. In slight vacuum these fibres appear in the space around the artery in an even distribution (Figure 2), while in the state of maximum inspiration part of them becomes torn and the rest matted (Figure 1). I have found no periarterial membranes and spaces to surround either large or small veins, either in men or in the animals examined (Figure 2, pulmonary vein). The lungs may be brought into a state of alternative inspiration and expiration by opening and closing the vacuum space. With carefully imitated inspiration, lukewarm milk or diluted India ink is drawn up by the pulmonary artery into the lungs. By means of suction or careful injection, a complete filling of the pulmonary capillaries may be achieved via the pulmonary artery. (Figures 1 and 2). The India ink has never entered the periarterial space.

Conclusions

a.) Periarterial membranes may be found exclusively around pulmonary arteries. b.) There are no signs of lymph vessels in the periarterial space and there is nothing to support the supposition that the space as a whole would be a lymph space. c.) The lymph vessels accompanying the venous circulation, generally follow rather the veins than the arteries. I consider the periarterial spaces as of a serous character. d.) The interparietal fibres guarantee the central position of the pulmonary artery during both inspiration and expiration. e.) The periarterial membrane always remains in connection with the pulmonary tissue, even in lungs dilated ad maximum, even if the pulmonary artery was unable to follow it. (See figures.) I see the role of the membrane chiefly in the fact that it assists the artery in dilating, in a degree which cannot as yet be expressed in percentage. f.) The position of veins is essentially different from that of the arteries. All arteries run in the substance of segments dilating with inspiration. In contrast to this, the chief veins run in the spaces among the segments. In my specimens, the periarterial membranes are dilated ad maximum, while the large veins are compressed almost flat by the dilated segments. g.) We may expect further data on the periarterial membrane and space from comparative anatomical and pathohistological examinations.

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ПЕРИАРТЕРИАЛЬНАЯ МЕМБРАНА ЛЕГКИХ

Ф. Киш

Р е з ю м е

Ствол и ветви легочной артерии окружены тонкой оболочкой (membrana periarterialis). Вокруг вен такой оболочки не имеется. Эта мембрана тесно связана с тканью легких, в то время как между мембраной и стенкой артерии находится пространство (spatium periarteriale). Мембрана связана в пространстве со стенкой артерии тонкими, микроскопическими соединительнотканевыми нитями (fibrae interparietales). Автор того мнения, что это пространство является серозным пространством, играющим по существу и по своей функции роль полости плевры (cavum pleurae). Точно так же, как с расширением грудной клетки расширяются легкие (inspiratio), так и расширение легочной ткани при вдохе, или же появляющееся одновременно с последним расширение периартериальной мембраны, сопровождается расширением легочной артерии.