METHOD OF OBTAINING A SURFACTANT FROM ATELECTATIC LOBES OR SEGMENTS OF THE LUNGS*

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To obtain a surfactant from atelectatic lobes or segments of the lungs in dogs, a heart-lung preparation was isolated and the broncho-vascular bundle of the healthy lobes of the lungs was ligated. The preparation was placed in a closed vessel and during alternate compression and decompression of the air in the system, perfusion with physiological saline was carried out through the inferior vena cava, the right heart, and the pulmonary vessels. The perfusion fluid drained away through the aorta. The aortic end was then clamped, and the liquid flowing through the trachea was collected and dried. By the suggested method the surfactant can be obtained in the same preparation both from healthy and from injured lobes of the lungs by consecutive ligation of the broncho-vascular bundles.

The alveoli are lined with a thin monomolecular film containing a surfactant which plays an important role in the gas exchange, capillary permeability, and the biomechanics of the lungs [1, 8, 10, 12, 13]. A change in the activity of the surfactant has been shown [2, 5, 11] to play an important role in the pathogenesis of atelectasis, pulmonary edema, the hyaline membrane syndrome in the newborn, and various other diseases of the lungs.

Several methods of obtaining the surfactant and determining its activity have been suggested [3, 7, 9, 14]. One such method [6] is similar to that developed by the writer, but it has certain disadvantages. (It cannot give evidence of changes in surfactant activity in segmental or lobar lesions of the lungs; the extract obtained from the lungs is contaminated with blood cells.) The writer's method of obtaining the surfactant is free from these disadvantages.

Under thiopental anesthesia (which does not affect the film lining the alveoli [15]) thoracotomy was performed. Clamps were applied to the inferior vena cava and the abdominal part of the aorta close to the diaphragm; the remaining vessels were ligated and divided. The trachea was separated from the esophagus and divided at the level of the cricoid cartilage. The heart-lung preparation was carefully removed from the chest.

TABLE 1. Properties of Surfactant Obtained from Intact and Atelectatic Lobes of Dogs' Lungs

Source of surfactant	Number of investigations	Coefficient of surface tension of surfactant from lungs (in dynes/cm)
Healthy lung lobes	10	16,8±0,75
Atelectatic lung lobes	10	13,7±1,6 <0,05

To obtain the surfactant from the atelectatic lobes or segments of the lungs the broncho-vascular bundles of the healthy lobes were ligated (Fig. 1). Surfactant from the intact lobes of the lungs could be obtained by ligating the broncho-vascular bundles of the pathologically changed lobes or segments. The heart-lung preparation was then placed in a glass vessel (Fig. 2) fitted with a rubber stopper with four holes. One hole was used to connect the artificial respiration apparatus, a rubber tube was passed through the second hole to a

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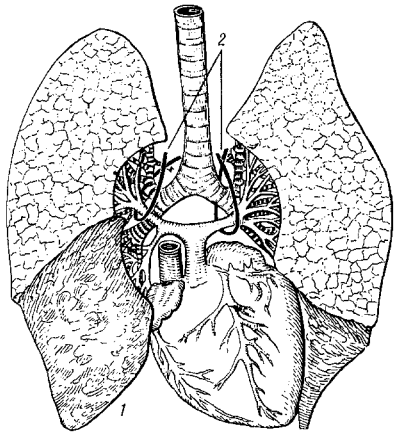

Fig. 1

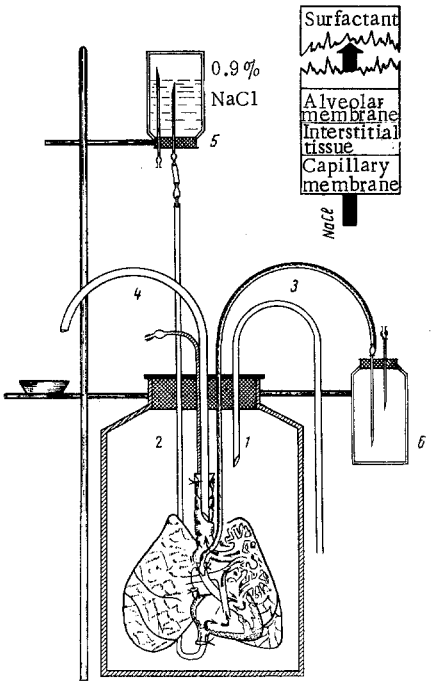

Fig. 2

Fig. 1. Obtaining the surfactant from an atelectatic lobe of the lung by ligation of the broncho-vascular bundle: 1) atelectatic lobe of the lung; 2) ligatures applied to the broncho-vascular bundles of the healthy lobes of the lungs.

Fig. 2. Scheme of apparatus for obtaining surfactant of the lungs uncontaminated with blood: 1) tube for connecting artificial respiration apparatus; 2) tube connected to inferior vena cava; 3) tube connected to aorta; 4) tracheal tube; 5) vessel with physiological saline for delivery into inferior vena cava; 6) vessels for draining perfusion fluid mixed with blood.

glass cannula in the inferior vena cava, and another tube through the third hole connected to a cannula in the aorta. The tracheal tube (preferably with an inflatable cuff) was passed through the fourth hole. The inferior vena cava was connected to one vessel containing physiological saline and the aorta to the other.

The heart-lung preparation was kept suspended in the glass vessel. Sodium chloride solution (0.9%) entered the vessel at the rate of 50-90 drops per minute depending on the size of the heart-lung preparation. The artificial respiration apparatus was connected at the same time, to produce alternate expansion and contraction of the lungs. After preliminary rinsing of the heart-lung preparation until fluid uncontaminated with blood appeared, the tube connected to the aorta was clamped. From 10 to 15 min later fluid began to flow from the tracheotomy tube and this was collected, dried to a powder, and then diluted to the required concentration.

The activity of the surfactant was determined by Rebinder's method [4] at 37°C. The results of the investigation are given in Table 1.

The suggested method can thus be used to obtain a surface-active substance from atelectatic lobes or segments of the lungs uncontaminated with blood. When this method is used it is unnecessary to set up control experiments, for the surfactant can be obtained from the healthy and atelectatic lobes of the lungs simply by ligating the broncho-vascular bundles consecutively in the same heart-lung preparation.

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