nary assessment of the state of the protein, nucleic acid, and carbohydrate metabolism and of the elastic membranes of the blood vessels of the liver, when a large quantity of material has to be processed in a short time.

The method is suitable for use by experimental morphologists when studying the effect of chemicals on the liver and other organs and when determining the functional state of the tissues.

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INTRAVITAL MICROSCOPY OF THE LUNG TISSUE IN SMALL LABORATORY ANIMALS

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A method of biomicroscopy of the lungs using a modified experimental lung fixing device is suggested. It enables intravital investigation of the microcirculation of the lung tissue to be carried out not only during artificial respiration, but also during spontaneous breathing of the animals.

KEY WORDS: microcirculation; lungs; lung fixing device.

A difficult stage of intravital investigation of the pulmonary microcirculation is fixation of the lung tissue. Various technical approaches to the solution of this problem are known [1, 2, 6]. However, all have certain shortcomings: considerable trauma during fixation of the lobe of the lung, the impossibility of using high magnifications during visual observation, the use of complex optical systems, etc.

The method of fixation of a superficial part of a lobe of the lung by means of a special fixing device [7] is less traumatic and enables the investigation to be undertaken under high power of the microscope. The immobility of the region under observation is achieved by the use of a negative pressure created in the tubing of the fixing device.

This particular design of the device has been suggested for large animals (dogs), so that it naturally cannot be used to study the microcirculation in small laboratory animals.

In this paper a design for a fixing device for the lobe of the lung is suggested [3] which not only allows the microcirculation to be studied in small laboratory animals (albino rats), but if necessary the animals can be switched to spontaneous breathing in the course of the observations [4].

The lung fixing device (Fig. 1) consists of the body 1, the lid 2, a glass 3, the floor of the inner chamber 4, and the tubes 5 and 6. The body contains two chambers (inner 7 and outer 8), isolated from each other by the partition 9. Holes 10 are made in the base of each chamber. The ML-2 luminescent microscope, working in reflected light [5], was used for biomicroscopy.

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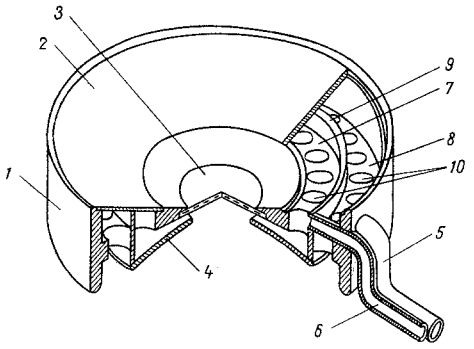

Fig. 1. Scheme of lung fixing device. Explanation in text.

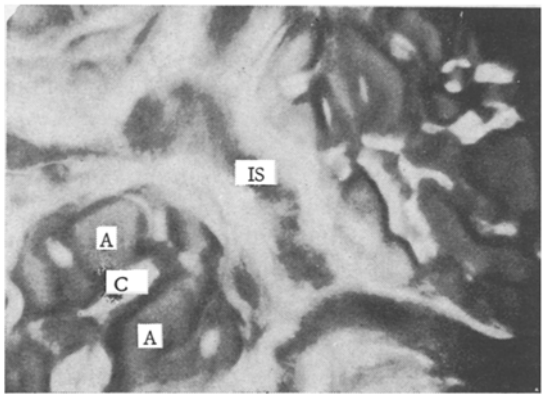

Fig. 2

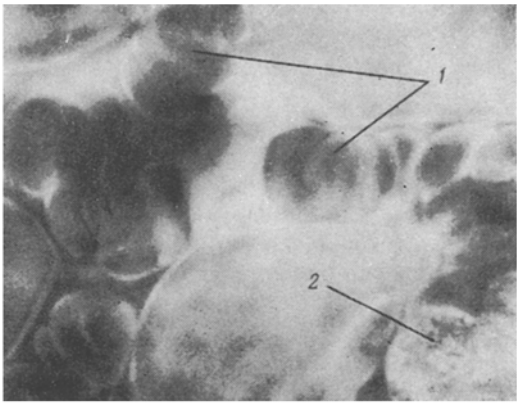

Fig. 3

Fig. 2. Fragment of microcirculation of the lung (84×). A) Alveolus; C) capillary; IS) interalveolar space.

Fig. 3. Lung capillaries of albino rat (360×): 1) erythrocytes; 2) leukocytes.

The animal, anesthetized with urethane (100 mg/100 g body weight) is fixed to a specially designed stand heated with an ultrathermostat (t=38°C). A tracheotomy tube is introduced into the exposed trachea. The 5th rib is removed together with the intercostal muscles on the right side. Immediately before resection of the rib, an artificial respiration apparatus is connected to the tracheotomy tube. The fixing device is applied to one lobe of the right lung with the lower surface of the inner chamber and the holes in the floor of the outer chamber. A negative pressure is created in the outer chamber (5-10 cm water) by connecting the tube of the chamber to a water-jet pump. The superficial region of the lung is firmly in contact with the lower surface but not in sufficiently close contact with the glass. To obtain complete fixation a negative pressure is similarly created in the inner chamber (2-3 cm water). Under these circumstances the lung tissue is slightly stretched, and this completely prevents vertical movements of this region. To prevent cardiopulmonary cycles, the lung fixing device is secured through the tube to a massive, stationary base.

To prevent the tissues from drying and to allow the animal to breathe spontaneously, a thin airtight synthetic film is glued around the circumference of the fixing device, and its free ends are glued to the edges of the operation wound. When complete airtightness is assured, a negative pressure of 2-3 mm Hg is created in the pleural cavity. The artificial respiration apparatus is disconnected after 1-2 min and the animal breathes spontaneously. To avoid atelectasis, every 5-10 min air is pumped into the lungs under a pressure of 15 cm water. At the end of 30 min after application of the fixing device, microscopic examination can be commenced. The stand with the animal is placed on the stage of the ML-2 microscope so that the lung fixing device fits into the hold of the epiobjective. Objectives and oculars of different magnifications were used for observation and photomicrography: objectives 9, 21, and 90×; oculars 4, 7, and 10× (Figs. 2 and 3).

This method can be used not only to study the microhemodynamics of the lungs, but also to investigate alveolar function in health and disease.

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A DISMOUNTABLE PLETHYSMORECEPTOR FOR DETERMINING THE VOLUME VELOCITY OF THE BLOOD FLOW IN THE LEG AND FOREARM BY THE VENOUS OCCLUSION PLETHYSMOGRAPHY METHOD

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The dismountable air plethysmoreceptor suggested by the author differs from the one-piece models in that it can be quickly and repeatedly applied to and removed from the human limb to be studied. Because of the flexibility of the inner wall of the dismountable plethysmoreceptor the blood flow can be recorded without preliminary injection of air into its inner cavity.

KEY WORDS: dismountable plethysmoreceptor; venous occlusion plethysmography.

Plethysmoreceptors used for direct volume plethysmography can be divided into the following three groups: 1) water, or hydroplethysmoreceptors, 2) water-air, and 3) air, or pneumoplethysmoreceptors [1]. The latter has become widely adopted in connection with the appearance of comparatively simple and convenient rubber plethysmographic cuffs, as suggested by Dohn [7] for the investigation of the circulation in the human limbs (in the forearm, leg, and hand).

Some workers have attempted to use ordinary cuffs for measurement of the blood pressure as pneumoplethysmoreceptors [4, 8]. However, in these cases in order to secure the cuff satisfactorily to the limb an unacceptably high positive pressure (10-50 mm Hg) had to be created in it. Even the improved flexible segmental oncometer introduced by Dohn [7] has its disadvantages, according to Skards and Vitols [2], for the cylindrical shape of the inner wall of the oncometer prevents it from fitting snugly against the limb segment to be studied, which is conventionally conical in shape. Skards and Vitols [2] have suggested a flexible segmental oncometer, in the form of a truncated cone for determining the volume blood flow in the forearm and leg by the venous occlusion plethysmography method.

Existing plethsmoreceptors, both water [5, 6] and air [3, 8], can be used to record the volume blood flow in the forearm more successfully than in the leg.

Considering the existing disadvantages of the use of all the above-mentioned plethysmoreceptors for measuring the volume velocity of the blood flow in the leg during dynamic physical exertion, the writer has attempted to develop and make dismountable plethysmoreceptors.

The suggested dismountable air plethysmoreceptor for the leg (Fig. 1) consists of a strip of viniplast 1, 40 mm wide and 2 mm thick, curved into a ring with its ends separate. Rubber edging 2, triangular in cross-section is glued to the inner edges of the body of the plethysmoreceptor, and the difference between the height of the edging on the two sides gives the inner surface of the plethysmoreceptor its conical shape. The inner

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