

## METHODS

### PERFUSION OF THE HUMORALLY ISOLATED LIVER

N. P. Plakhotin

UDC 615.38.033.36

The liver was isolated from the general circulation by means of two anastomoses, leaving its nervous connections intact. The first anastomosis was formed with a glass three-way tube, the long branch of which was introduced into the inferior vena cava toward the heart. The inferior vena cava was ligated proximally and distally to the liver. All blood from the lower part of the body returned to the heart via this anastomosis. The second anastomosis was formed between the portal vein and inferior vena cava by means of a rubber tube connected to the second branch of the three-way tube and to a cannula introduced into the portal vein, and blood from the viscera was returned to the heart through it. The liver was perfused via the portal vein.

Isolation of the liver by several methods has been described in the literature [1-3], but all the methods have disadvantages.

The method of perfusing the humorally isolated liver to be described below is based on that proposed by Merkulova [2], which takes advantage of the special arrangement of the blood vessels in this organ, for in animals there is no anatomically independent hepatic vein, and each individual lobule of the liver has its own vein, which runs through the tissues of the lobule and then empties quite independently into the inferior vena cava near the diaphragm. The inferior vena cava is intimately connected anatomically with the liver tissue. Fluid used to perfuse the liver thus cannot be collected by inserting a cannula into a vein draining the organ.

In Merkulova's method a long glass tube is introduced into the inferior vena cava and the vein is ligated proximally and distally to the liver. All the blood from the lower half of the body thus passes through the artificial anastomosis and is returned to the heart. To prevent stasis of blood in the viscera, an anastomosis is formed between the portal vein and the external jugular vein.

To form the first anastomosis the writer replaced the glass tube by a special glass three-way tube, the long branch of which was introduced into the inferior vena cava toward the heart, and the inferior vena cava was ligated proximally and distally to the liver. The second anastomosis between the portal vein and inferior vena cava was formed by means of the same three-way tube.

Blood thus reached the heart along the vena cava not only from the lower half of the body, but also from the internal organs. In this way excessive cooling of the blood as it passed through the anastomoses was prevented.

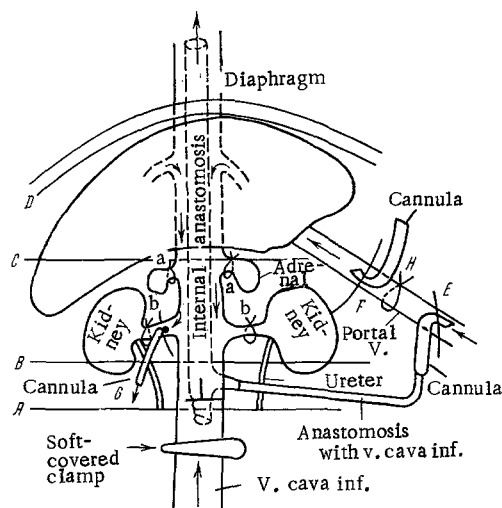


Fig. 1. Scheme of perfusion of the liver.  
Explanation in text.

Laboratory of Bioelectronics and Laboratory of General Physiology, Institute of Physiology, Academy of Sciences of the Kazakh SSR, Alma-Ata. (Presented by Academician V. V. Parin.) Translated from *Byulleten' Éksperimental'noi Biologii i Meditsiny*, Vol. 71, No. 1, pp. 94-95, January, 1971. Original article submitted April 29, 1970.

©1970 Consultants Bureau, a division of Plenum Publishing Corporation, 227 West 17th Street, New York, N. Y. 10011. All rights reserved. This article cannot be reproduced for any purpose whatsoever without permission of the publisher. A copy of this article is available from the publisher for \$15.00.

After laparotomy, both hepatic arteries and veins, both suprarenal veins, the right vein to the uterus or testes (the left usually drains into the left renal vein), and the vein from the abdominal wall were dissected. The inferior vena cava was mobilized distally to the kidneys for a distance of 3-4 cm, and two long, thick ligatures A and B (Fig. 1) were placed under it. A ligature C was passed under the inferior vena cava between the liver and adrenals, and a ligature D between the liver and diaphragm. A small vein running from the diaphragm and draining into the inferior vena cava was ligated near the diaphragm. A soft-covered clamp was applied to the inferior vena cava below the ligature A and the ligature C was tied tightly. A T-shaped incision was made in the inferior vena cava between the kidneys and the soft-covered clamp. The glass three-way tube was introduced into the vein to form the artificial anastomosis.

Before the three-way tube was inserted it was filled with warm Ringer's solution and a clamp was applied to the rubber tube fixed on one of its branches. When the long branch of the three-way tube being introduced into the inferior vena cava reached the region of ligature C, this ligature was relaxed a little. As soon as the three-way tube was fully inserted into the vena cava the ligatures A and B were tied. After inspection to make sure that no air bubbles were present, the soft clamp was removed, after which all blood from the lower part of the body returned to the heart via the anastomosis. This operation must be carried out rapidly. The portal vein was then mobilized and the ligatures E and H passed under it. Ligature H was tied, and ligature E was used to anchor the cannula in the vessel. A rubber tube fixed on one end of the three-way tube was connected to the cannula inserted into the portal vein. The clamp was then taken off the rubber tube joining the three-way tube to the portal vein. All blood from the portal vein then returned to the heart via the first anastomosis. In this way blood not only from the lower part of the body, but also from the viscera, was returned to the heart through the first anastomosis.

The liver was perfused via the portal vein, and the hepatic artery was ligated. This artery is surrounded by a dense plexus of nerves, and special care must therefore be exercised during its dissection. A shoe-shaped cannula was inserted into the portal vein and anchored with the ligature F. Aerated, warm Ringer's solution was passed through the cannula. The liver was perfused under a pressure of 20-25 cm water, close to the normal pressure in the portal vein.

The perfusion fluid was drained off via one of the renal veins. The ligature D was tied tightly, thereby preventing the perfusion fluid from entering the general circulation. The perfusion fluid draining away through the mouths of the individual hepatic veins was directed in the only way still left open: between the inner wall of the inferior vena cava and the outer wall of the three-way tube forming the anastomosis into one of the renal veins containing a cannula.

#### LITERATURE CITED

1. P. P. Astanin, Yu. L. Krivskii, and V. M. Rubel', *Arkh. Biol. Nauk*, 28, No. 1, 3 (1928).
2. O. S. Merkulova, *Izvest. Akad. Nauk SSSR, Seriya Biol.*, No. 4, 483 (1948).
3. Yu. A. Petrovskii and Ya. B. Maksimovich, *Byull. Éksperim. Biol. i Med.*, 37, No. 4, 11 (1954).