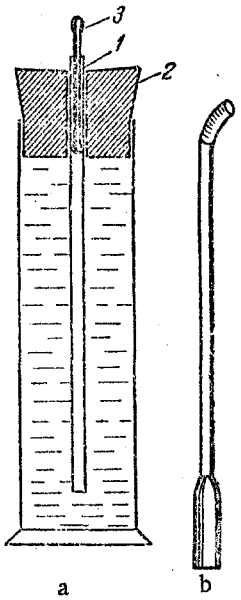
CATHETERIZATION OF THE HEART IN RABBITS AND CATS

A. G. Subbota

S. M. Kirov Order of Lenin, Military Medicine Academy, Leningrad
(Presented by Active Member AMN SSSR, V. V. Parin)
Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 51, No. 1, pp. 106-107, January, 1961
Original article submitted December 10, 1959

The catheterization of the cavities of the heart and large vessels is becoming widely employed experimentally and clinically. The methods of catheterization are being continually perfected [1-7]. Soft catheters are used which are usually introduced under the control of an x-ray apparatus. Without such a control, the heart cavity can only be gotten into with a hard catheter, but the latter has not found wide distribution due to the possibility of causing trauma to the inner walls of the heart. For rabbits and cats, the catheterization of the heart cavities has not been worked out sufficiently.



A new model of a catheter for investigating the heart.

The catheter suggested by us does not require x-ray control, does not cause trauma of the heart, and is intended for experiments on rabbits and cats. Its manufacture is based on the principle of the change of elasticity of polyvinyl chloride or polyethylene under the influence of ethyl ether. A short piece of tubing made of such a polymer, and measuring 3 mm in diameter, is immersed in a cylinder filled with ether (see figure, a). One of its ends 1 is led into a previously prepared opening in the cork 2. The opening of the tube inserted in the cork is sealed with a glass rod 3. After 24 hours, the partially-finished product is removed from the ether and left in the air. The portion of the tube which had been protected from ether vapors by the cork and the glass rod becomes soft. The remaining longer part, however, hardens or decreases its elasticity considerably after several hours following its removal from the ether.

Before leaving the tube in the air, the heart end must be bent at an angle of 10-15°. The bend makes it easier for the catheter to get into the heart. The soft end must be no longer than 1 cm, and must be cut off obliquely (see figure, b).

For rabbits, the total length of the heart catheter is 100 mm, while for cats it is 130 mm. The outside diameter of the catheter for cats is 2.8-2.9 mm.

Aside from probes with nonuniform elasticity, soft catheters can also be used, but then they must be inserted with metal mandrins. The disadvantage of the latter method is that, after the mandrin is withdrawn, it is difficult to control such a catheter without an x-ray apparatus.

Method of Insertion

The right jugular vein is exposed, and, first, a Dieffenbach clamp is applied to it (on the thoracic end), and then a ligature (on the cephalic end). The soft end of the probe is inserted into the sac formed between the clamp and the ligature through an incision widened by a hook. The clamp is then removed, and the catheter is moved forward in the direction of the heart (back from the front, from right to left).

If resistance is encountered in the course of insertion of the catheter, and if systolic pulses are felt with the hand, this is evidence of getting into one of the right cavities of the heart. By watching the recording apparatus, it can be said with certainty where the catheter is situated. If sharp fluctuations in pressure from 0 to 15 mm of a mercury column or more are seen, then the catheter is in the right ventricle of the heart. In this case, fluctuations in the blood-tinged liquid in the catheter are also clearly seen.

Barely noticeable systolic oscillations and pronounced respiratory waves are evidence that the catheter is located in the right auricle of the heart. If the catheter goes freely to the side of the abdominal cavity, this means that it is located in the posterior vena cava.

The passage from the right auricle to the right ventricle is carried out by careful turning of the catheter around its axis.

In order to decrease the inertness of the system, tubes of the shortest length and least elasticity should be selected for connecting the catheter with the recording device. Prior to the experiment, the system should be filled with liquid (2% glucose solution or physiological saline solution with heparin), while during the time of the experiment, the liquid should be introduced periodically into the heart cavity in amounts of 1-2 ml. This prevents the formation of thrombi in the catheter by blood. Such lavage is most conveniently done from a reservoir of liquid attached 0.5 m higher than the level of the animal and connected with the catheter system by a T-tube.

Some investigators use dropping methods of introducing liquid into the blood, and stop its delivery only when recording pressure. In all cases, anticoagulants must be administered to the animal in standard dosages.

The simplicity and convenience of using the catheter with nonuniform elasticity make it possible to study the hemodynamics of the greater and lesser circulatory systems simultaneously.

SUMMARY

The author describes the preparation and the technique of introduction of a polyvinyl chloride (polyethylene) catheter with nonuniform elasticity into the cavity of the right heart and inferior vena cava. The catheter is introduced without x-ray control, and does not traumatize the endocardium.

LITERATURE CITED

1. E. N. Meshalkin, The Probing and Contrast Investigation of the Heart and Principal Vessels [in Russian] (Moscow, 1954).
2. L. Brandt, J. Appl. Physiol. 13, 523 (1958).
3. A. Cournand et al., J. Clin. Invest. 24, 106 (1945).
4. L. Dexter et al., J. Clin. Invest. 26, 554 (1947).
5. M. Lategola and H. Rahn, Proc. Soc. Exper. Biol. and Med. 84, 667 (1953).
6. D. W. Richards, Jr., Am. J. Med. 3, 434 (1947).
7. R. C. Stroud, K. R. Statson, and H. Rahn, Proc. Soc. Exper. Biol. and Med. 81, 246 (1952).