A Self-Guiding Catheter for Cardiac and Pulmonary Arterial Catheterization and Occlusion.* (20745)

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In closed-chest dog preparations, catheterizations of the right heart and pulmonary arteries are usually accomplished with radiopaque catheters which are placed by manipulation with fluoroscopic visualization(1). The catheter described below enjoys certain advantages in that it can be placed quite rapidly without apparent trauma to the heart and vessels, it can be easily constructed and above all, it does not require a fluoroscope for placement. It is particularly suited to experimental procedures where pressure recording and blood sampling are desired. Furthermore, it may also be used to block the blood flow at some particular site.

This catheter has been used routinely in this laboratory for two years. Its success is due mainly to its large degree of flexibility whereby a small inflatable balloon located at its tip is able to guide the catheter automatically in the direction of the blood flow from the veins through the right heart and into the pulmonary artery.

Construction of Catheter. The catheter (Fig. 1) is approximately 3 feet long and consists of 2 tubes. The outer tube, through which pressures are recorded or blood samples are withdrawn, consists of polyvinyl† (O.D. 3.2 mm; I.D. 2.4mm). The other tube consists of polyethylene‡ (O.D. 1.27 mm; I.D. 0.86 mm) and is placed inside. It emerges through the wall of the larger tube at each end where it is secured by thread as indicated in the figure. This tube serves to inflate the balloon which consists of the tip of a rubber "finger-cot", likewise fastened by thread after first flame-flanging the polyethylene tip. The thread-covered areas are coated with liquid latex and are vulcanized by a 20-second exposure to the vapors of sulfur monochloride. A No. 13 gauge needle is fitted into the lumen of the larger tube and a No. 20 gauge needle serves the smaller tube for attachment to a three-way stop cock and syringe, respectively.

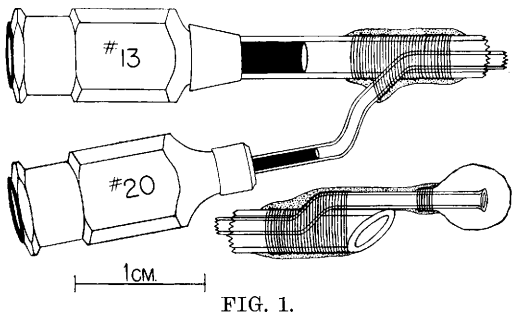

FIG. 1.
Detailed construction of a self-guiding catheter.

Placement procedure. The above catheter size serves adequately for dogs of 20 kg or more. The larger tube is filled with saline and connected to either a gravity-feed, heparinized-saline drip or a saline manometer by means of a 3-way stop cock. The smaller tube is attached to a 10 cc syringe which also contains saline. The catheter is introduced into the jugular vein with a balloon in a deflated state. The 3-way stop cock is then turned to record pressure in the manometer via the larger tube. The manometer is set to zero with reference to venous pressure in the vicinity of the heart. One cc or more of saline is then injected into the balloon. As the catheter is slowly advanced into the jugular vein, the partially inflated balloon, acting like a sail, is swept into the right heart by the blood flow. The entrance of the balloon into the right ventricle is signalled on the manometer by a rise in pressure from zero to that of mean right ventricular pressure. This is usually about 10 cm H_2O. With the balloon still inflated, further slow admittance of the catheter allows the balloon to be swept into the pul-

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† No. 12 transflex extmold plastic tubing—Irvington Varnish and Insulation Co., Irvington, N. J.

‡ Tubing PE-90-Clay-Adams Co. Inc., 141 E. 25th St., New York City.

monary arterial system. This event is signalled by a further rise in pressure to approximately double that of the mean right ventricular pressure. The balloon can now be deflated and the three-way stop cock turned from the manometer to the saline drip to prevent clotting. The entire catheterization procedure takes approximately 5 minutes. The maximum time of passage through the right heart is usually no more than a few seconds.

For acute occlusion of the pulmonary arteries or the chambers of the right heart, the balloon may be reexpanded. Right or left pulmonary artery occlusion is usually obtained with 5-7 cc of saline. If specific placement of the balloon is required, this system may be filled with a radio-opaque liquid instead of saline and placed by means of fluoroscopy.

Discussion. The success with which these catheters are placed is due mainly to their complete flexibility. In contrast to the usual stiff radio-opaque catheters, these cannot be "guided" at all and depend entirely for their directional movement on the flow of blood pushing the partially inflated balloon through the chambers of the heart—hence "self-guiding". It should therefore be emphasized that the much more flexible polyvinyl plastic is necessary and that substitution of the stiffer polyethylene plastic for the outside tube is not recommended.

If the catheter is truly self-guiding, no skill should be necessary for its placement once it has been inserted into the jugular vein. This has been repeatedly verified by asking medical students and other staff members to place this catheter into the pulmonary artery merely by watching the pressure rise in the saline manometer as they slowly advance the catheter into the jugular vein. The branching of the two main pulmonary arteries is such that this catheter will in most instances enter the left pulmonary artery.

One disadvantage of this catheter is the clots which frequently develop along the folds of the balloon. These, however, are minimal in size and number and have not interfered with the experimental procedures.

Summary. 1. A self-guiding catheter has been described for placement in the right heart or pulmonary arteries of dogs. 2. This technic does not require a fluoroscope and localization is determined from the pressure recording. 3. The same catheter has likewise been used routinely for occlusion of the left pulmonary artery.

1. Cournand, A., Riley, R. L., Breed, E. S., Baldwin, E. deF. and Richards, D. W., Jr., *J. Clin. Invest.* 1945, v24, 106.

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Influence of Colchicine on the Form of Skeletal Muscle in Tissue Culture.* (20746)

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When mature mammalian striated skeletal muscle is cultured *in vitro,* as shown by Pogogeff and Murray(1), there ensues intensive regeneration of muscle with the formation of long continuous sarcoblastic ribbons or fibers. In the rat these may reach lengths approaching 3 mm, and widths of 6 to 15 μ (Fig. 1). Their cytoplasm is highly refractile, firm, and viscous or gelated(2); they exhibit a faint positive birefringence; they often show strong contractile activity (fibrillation and pulsation) and many subsequently differentiate, developing longitudinal and cross-striations.

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