RIGID sharp-pointed needle-catheter* (Fig. 1 top), which becomes pliable and blunt when its inner shaft is removed (Fig. 1 bottom), has been used for angiography since September, 1965, first in a series of six dog angiograms, then percutaneously in 70 patients, without significant morbidity or mortality in either group.

The instrument is made of Dacron overwoven and secured on a hollow 1 cm metal tip. The proximal half of the tip is a shank buried in the distal catheter lumen. The distal half of the tip starts with an outside diameter equal to that of the catheter, then tapers to a non-sharp end (Fig. 2) and has an additional side vent.

One metal cannula fits the catheter lumen in apposition to the embedded shank of the metal tip, thus preventing catheter migration. A second metal cannula fits the lumen of the first and traverses the tip with a sharp puncturing point. The two cannulae are welded as a unit to a Luer-Lok fitting for a metal hub in the proximal catheter end, thus securing the puncturing point (Figs. 1 and 2).

Sizes are 5 ½ and 6 French, 24 cm long for the carotid arteries, and 7 ½ and 8 French, 47 cm long for the femorals. Each is calibrated in centimeters from its tip to an enlarged 7 cm reinforced section next to the hub. This section acts as a safety factor in two ways: 1) it cannot migrate further into the artery, and 2) the effective strength of the catheter wall is least at the beginning of the calibrated area where a nylon reinforcement ends and where the diminishing pressure gradient with power injections causes the greatest relative stress. Any inadvertent blowout would occur here, a point always outside the subject's body. The nickel-silver tip in the distal catheter end is fastened by over-weaving and gluing onto the lands and into the grooves machined into

Fig. 1. Needle-catheter assembled (top) and disassembled (bottom).
Needle-Catheter Angiography

**Fig. 2.** Diagram of needle-catheter.

**Fig. 3.** Two-vessel angiogram produced by injecting right carotid with 25 cc of contrast medium at 879 psi.

**Fig. 4.** Three-vessel angiogram produced by injecting right carotid with 45 cc of contrast medium at 879 psi.