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Calibrated-Leak Balloon: Accurate Placement of the Leak

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The calibrated-leak balloon catheter, used for the selective catheterization of intracranial arteries, originally incorporated a silicone microballoon at its tip [1]. Latex balloons have now proven superior in elasticity and tensile strength when compared with balloons made of silicone [2]. Consequently, most workers construct the calibrated-leak balloon catheter by gluing a leaking latex microballoon to the end of a flexible 2.5 French catheter. However, the formation of a leak at the apex of the balloon enabling fluid to leak directly forward and not obliquely can be technically difficult. Moreover, the size of the leak is a critical factor in determining the speed of balloon deflation. A fast-deflating balloon is advantageous for the rapid delivery of isobutyl 2-cyanoacrylate and subsequent prompt catheter removal during embolization procedures. We devised a method of producing a calibrated leak that is consistent in size and position.

Materials and Methods

Four materials are necessary: (1) standard hemostatic valve 23240, Advanced Cardiovascular Systems, Mountain View, CA; (2) 23 gauge Luer stub adapter 7565, Clay Adams, Parsippany, NJ; (3) 4-0 surgical stainless steel wires B&S 32 and B&S 34, DS-32 and DS-34, Ethicon Inc., Somerville, NJ; and (4) plastic stopcock POWS-FLL-MLL, Cook Inc., Bloomington, IN.

The hemostatic valve, stub adapter, and stopcock are assembled as shown in figure 1. A 0.008-inch (0.2 mm) diameter strand of 4-0 B&S 32 steel wire is cut to a length of 15 cm and advanced through the assembly until its end is just proximal to the tip of the stub adapter. The 0 ring in the proximal end of the hemostatic valve is tightened around the wire to make a watertight seal. Water is introduced through the side arm of the hemostatic valve to fill the system and the stopcock is closed.

Latex microballoons are, at present, only available from France, so we prefer the convenience of manufacturing our own [3]. Using water as a lubricant, the sleeve of a microballoon is advanced over the barrel of the stub adapter until the tip of the adapter protrudes through the balloon neck. The balloon is inflated to a diameter of 5 mm while holding the balloon sleeve on the adapter barrel. The stopcock is closed and the steel wire is advanced into the balloon until the wire tip indents and thus identifies the true apex of the balloon (fig. 2A). The balloon is deflated and the wire is further

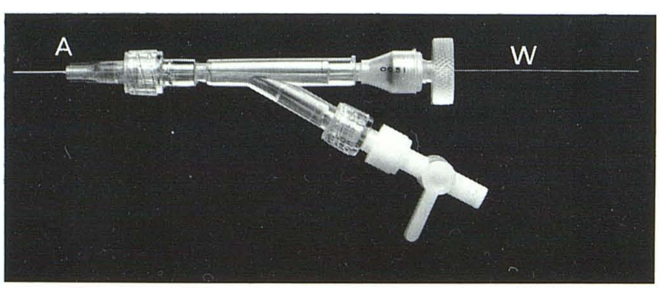

Fig. 1.—Assembly for producing calibrated leak. A = stub adapter; W = 4-0 steel wire.

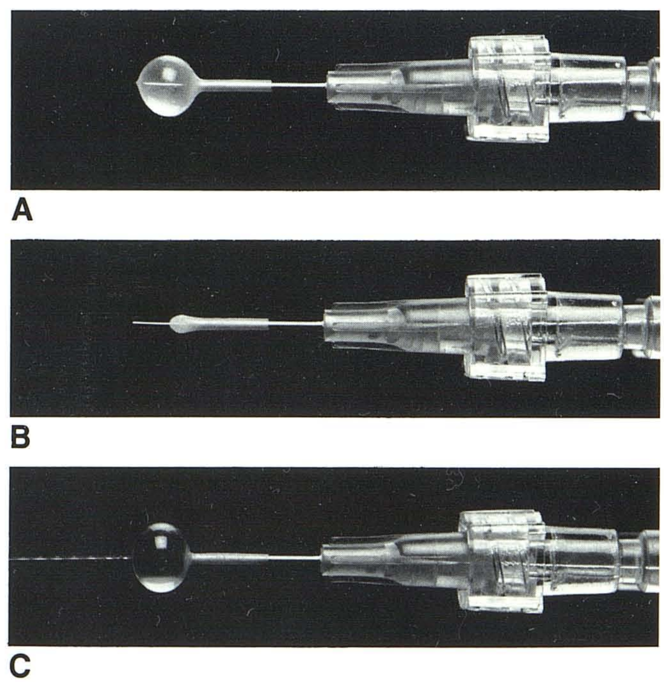

Fig. 2.—**A**, Microballoon inflated to diameter of 5 mm with wire indenting its apex. **B**, After deflating microballoon wire is advanced to pierce apex of balloon. **C**, Testing of calibrated leak and speed of balloon deflation.

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advanced to pierce the balloon (fig. 2B). The tip of the wire is retracted into the barrel of the stub adapter and the balloon inflated with an injection of water from the sidearm of the hemostatic valve. This maneuver permits confirmation of the apical site of the leak as well as the speed of balloon deflation (fig. 2C).

We have found that using 4-0 B&S 32 wire to make the leak results in a fast-deflating balloon if the balloon has a wall thickness of about 0.3 mm. A slower balloon deflation rate is achieved by piercing the balloon with a thinner 0.0063-inch (0.16 mm) diameter 4-0 B&S 34 wire.

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