

Title: EVALUATION OF A UNIQUE HYDRATABLE I.V. CATHETER

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Introduction: Anesthesiologists are often confronted with the problem of having to give large volumes of fluid to patients with small veins. A new IV catheter has been developed that changes its physical properties after exposure to aqueous fluid. During insertion it is the size of a 20 gauge catheter, but after hydrating, its diameter enlarges to exceed an 18 gauge. This catheter, made of a new polyurethane-based polymer from MenloCare, Palo Alto CA, was compared with four other commonly used Teflon catheters using slightly modified techniques¹.

Methods: Five catheters were studied: MenloCare 20 gauge, Critikon 18 and 20, and Deseret 18 and 20. All catheters were 1.25" in length. A test bench was constructed to precisely measure pressure and flow. The fluid path consisted of a 15 liter airtight plastic bottle filled with 0.9% saline, pressurized by compressed air. This was connected thru large bore tubing and stopcocks to spherical float, tapered glass flow meters (5 to 40 ml/min and 40 to 200 ml/min). The flow meters were connected thru a T-connector to the catheter to be tested. The other port of the T was connected to a pressure transducer to monitor pressure at the catheter hub.

Three tests were performed: 1) flow vs. time, which demonstrated the hydration changes for the Menlo catheter, 2) flow vs. pressure, which showed the importance of gauge size and driving pressure, and 3) flow after multiple kinks.

For the flow vs. time test all catheters were initially dry. Catheters were hydrated by placing them in 37° C saline. Flow was tested for 3 catheters of each type every 3-15 min. after hydration began. The Menlo catheters were fully hydrated (>2 hrs in 37° C saline) for the other tests. Flow vs. pressure was tested between 25-270 mmHg for 3 catheters of each type. The pressure at the catheter hub was adjusted to 90 mmHg before each measurement for the flow vs. time and kink tests. The kink test was done by kinking a catheter about 1 cm from the hub back on itself to an angle of 135 degrees. The catheter was then gently straightened. Flow was measured before and after 20 kinks on 7 samples of each catheter type. Data were compared using a T-test (paired samples).

Results: Before hydration, the Menlo catheter flow approximated the flow thru 20 gauge catheters. The flow increased nearly 100% over the first 60 minutes of hydration. The time for half of the maximum change was 18 minutes. Flow thru the Teflon catheters did not change with time (fig. 1). The fully-hydrated MenloCare catheters had a pressure-flow curve superior to 18 gauge catheters (fig. 2). After 20 kinks, all the Teflon catheters showed a marked reduction in flow (fig. 3). The MenloCare catheters showed no reduction in flow (fig 3).

Discussion: The new catheter material tested here changes dramatically with time. Before hydration these catheters are very stiff with a small diameter, which allows for easy insertion. With hydration, the catheter diameter expands allowing greater flow at a given pressure. The result is a catheter that can be placed in smaller veins but allows the flow of a larger catheter. An additional finding was that kinking the catheter multiple times had little effect on flow thru the Menlo catheter. This may have relevance for catheters placed in the antecubital fossa or other sites where repeated kinking may occur. Further work is needed to determine whether these factors are important in vivo.

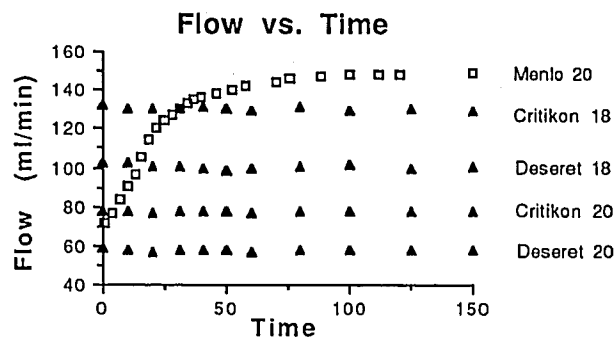


Fig. 1: Flow changed dramatically for the MenloCare catheter after exposure to saline. Teflon catheters did not change with time. Pressure was maintained at 90 mmHg proximal to the catheter. Each point represents the average of three catheters.

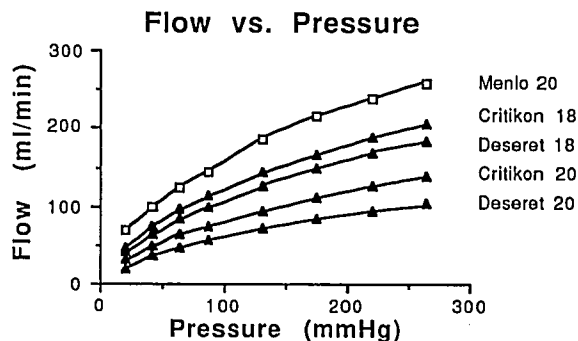


Fig. 2: Flow was higher with 18 gauge catheters compared to 20 gauge catheters. Flow was greatest with the hydrated MenloCare catheter at every pressure. Each point represents the average of three catheters.

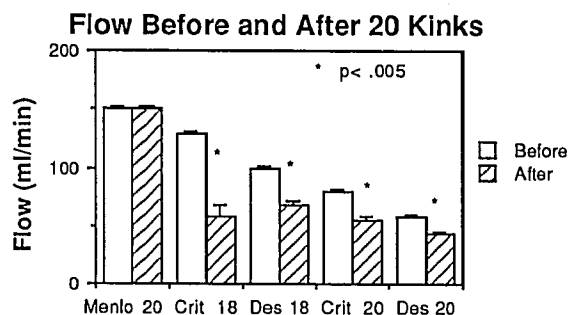


Fig. 3: Flow changed significantly after Teflon catheters were kinked 20 times (see Methods). Note that fully hydrated MenloCare catheters did not change after kinking. Bars represent mean \pm S.E. (n=7).

References:

1. Philip B, Phillip J: IEEE Trans. Biomed. Eng. 33: 529-531, 1986