Abstract:

Background: The physics of ideal fluid flow is well characterized. However, the effect of catheter size, tubing types, injection port adjuncts, and viscosity on flow is not well described. We used a simulated environment to determine how various permutations of common elements affect fluid flow.

Study design and methods: We tested 16 peripheral and central venous catheters to assess flow through several standard infusion sets and a rapid infuser set; tested flow through standard and blood infusion sets with the addition of intravenous extension tubing, stopcocks, and a needleless connector; and compared the relative viscosity of commonly used blood products and colloids to that of normal saline.

Results: The maximal flow rate was 200 mL/min for the standard infusion set but 800 mL/min for the rapid infusion set. Choice of infusion tubing was the rate-limiting component for many larger catheters. A 14-gauge, single-lumen central venous catheter (CVC) and 18-gauge peripheral intravenous catheter (PIV) had equivalent flow rates with all infusion sets. A 16-gauge single-lumen CVC allowed a flow rate that was slower than that of a 20-gauge PIV, and faster than that of a 22-gauge PIV. The addition of adjuncts slowed flow rate. Needleless connectors had the greatest impact, reducing flow by 75% for the blood infusion set. Packed red blood cells had a viscosity 4.5 times that of normal saline and thereby reduced flow.

Conclusion: Catheter and tubing choice, adjuncts, and fluid viscosity influence flow rates. Our results will help inform adequate vascular access planning in the perioperative environment.

Reference: