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ARE FOLEY CATHETERS INTRINSICALLY OBSTRUCTIVE? SIZE MATTERS!

Hypothesis / aims of study

Incomplete bladder emptying through Foley catheters has been previously documented and the complications of an indwelling catheter are well known. We postulate that the catheter and drainage systems cause obstruction to the flow of urine. To test this hypothesis, we studied the effect of catheter size and orientation on flow at varying pressures with and without drainage tubing in vitro and compared this data to indices of bladder outlet obstruction.

Study design, materials and methods

14, 16, 18 and 20 Fr silicone/latex Foley catheters were coupled to 1.5" PVC tubing with reducer bushings and petroleum jelly for a water-tight seal. Catheter orientations utilized included vertical and horizontal positions, horizontal position with un-looped straight drainage tubing, in the vertical position with looped tubing and in the horizontal position with looped tubing. The drainage tubing was 21 7/8" long and, when looped, consisted of two complete 8" loops with draining port oriented in parallel to the catheter. The catheter/PVC coupling slips were paired to PVC tubing with heights of 10, 30, 50 and 70 cm. The PVC tubing was filled with water and the apparatus was held over a Urocap III flowmeter for 20 sec as the water level was maintained. This was repeated 5 times at each configuration from which the average and standard deviation uroflows and corresponding pressures were calculated. The pressure-flow data were superimposed onto the ICS Bladder-outlet obstruction index nomogram.

Results

For all catheter sizes the looped horizontal tubing orientation (Average flow = 2.66 mL/s) caused the greatest reduction in flow at a 61.6% flow reduction from the vertical catheter-only orientation (Average flow = 6.95 mL/s) and a 53.6% flow reduction from the vertical with looped tubing orientation (Average flow = 5.75 mL/s). The differences in flow were found to be statistically significant ($p<0.01$). Data for 14, 18, and 20 Fr catheters at their least and most obstructive orientations are demonstrated in Figure 1.

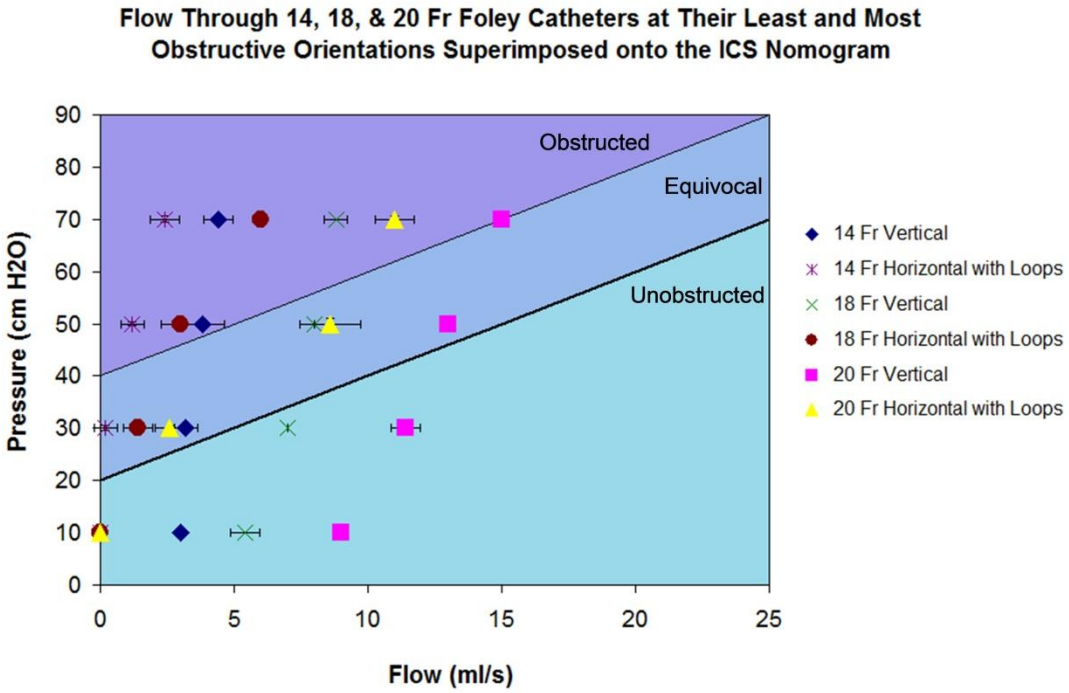

Figure 1. Pressure-flow data from 14, 18 and 20 Fr Foley catheters at their least and most obstructive orientations, vertical and horizontal with looped tubing respectively, superimposed on the ICS BOOI nomogram

Interpretion of results

Foley catheters up to 20Fr offer resistance to the flow of urine that corresponds to urethral obstruction according to the ICS nomogram. When the drainage tubing is looped, which is often the case at the bedside, resistance increases greatly. Since these experiments were performed in a completely open system, in the clinical setting, when there is a closed system and a drainage bag, it is likely that resistance will be much greater.

Concluding message

Foley catheters cause obstruction to the flow of urine. Catheter size and orientation contribute significantly to the resistance offered by the catheter. The hydrodynamic effects of the catheter itself and associated drainage tubing may contribute to catheter complications.

Disclosures

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