

## DIAGNOSTIC ERRORS WHEN MALE CYSTOMETRY IS PERFORMED SUPINE WITH A VOIDING AID

### Aims of study

To investigate diagnostic errors in male bladder pressure-flow studies using supine micturition through a voiding aid rather than conventional seated voiding.

### Study design, materials and methods

500ml of water was poured from a device calibrated to empty at 15 mls<sup>-1</sup> (1) into a spinning-disc flow meter ten times in three test conditions. The first condition simulated the local convention of seated male voiding by simply holding the flowmeter vertical at 44cm. The second simulated supine male voiding through a rectangular tube (0.5m x 0.06 x 0.06m) with the tube tilted at 45° at 77cm, and the third condition replaced the tube with a Cystoaid traditionally used for female cystourethrography, but shortened and with a small funnel inserted between the patient and its entrance (0.5m x 0.013m). All 30 flow curves were smoothed using a two-second moving average (2) and had peak flow rate (Q<sub>max</sub> in ml/s) and the time taken to reach this peak (TQ<sub>max</sub> in s) marked manually and documented. Q<sub>max</sub> and TQ<sub>max</sub> were compared between test conditions using Mann-Whitney U tests for non parametric unpaired groups. A non-parametric coefficient of variation (interquartile range/median) was used to quantify the variability of each parameter in each condition. The diagnostic effect of any significant changes was then considered qualitatively and quantitatively using clinical cystometrograms (CMGs) and their analysis using the Schafer nomogram (3).

### Results

Table 1 shows the group average and its 95% confidence intervals (95% CI's) for peak flow rate and the time taken to reach this peak in each experimental condition. Q<sub>max</sub> measured from the seated position was a median of 3.49 ml/s (95% CI 1.80-4.33 ml/s; U=0) faster than supine flow through the rectangular tube, and 2.31ml/s (95% CI 1.18-3.03 ml/s; U=0) faster than through the modified Cystoaid. The variability of Q<sub>max</sub> was generally small, 1.71%, 16.88% and 7.82% in the three respective conditions, but smallest in the seated condition. The flow took 33.06s (20.84-47.84s; U=0) longer to reach its peak when the rectangular tubing was employed, and 9.33s (1.12-14.34s; U=10) longer through the modified Cystoaid. The inherent variability of TQ<sub>max</sub> was large, 35.35%; 54.62%; 55.38% for the three respective conditions, but smallest in the seated simulation.

	Q <sub>max</sub> (ml/s)		TQ <sub>max</sub> (s)	
	median	95% CI's	median	95% CI's
<b>Seated</b>	15.64	15.37-15.82	7.27	5.33-10.01
<b>Rectangular Tube</b>	12.27	10.98-13.41	41.13	26.54-52.72
<b>Cystoaid</b>	13.43	12.72-14.61	18.96	9.33-20.80

The sample sizes achieved 96% power to prove the flow rate reduction by employing the rectangular tube (p<0.001) and 92% powered for the Cystoaid Q<sub>max</sub> comparison (p<0.005). For the time to reach peak flow rate, the sample sizes were 100% powered to prove the delays for each voiding aid with p<0.001.

### Interpretation of results

Gross changes to the shape of flow curves may obscure diagnostic features and artefacts usually identified during qualitative analysis. For objective analysis using the Schafer nomogram, the flow rate reductions proven here systematically resulted in bladder contractions being classed as weaker by one category if they remained uncorrected. The time delays caused indirect errors when documenting detrusor pressure at peak flow. The detrusor contraction of male subjects with obstructive benign prostatic hyperplasia typically have a sustained and flattened peak matching their characteristic flat, prolonged flow curves, and so delays of the magnitude observed here made little difference to the pressure recorded at peak flow and subsequent nomogram categorisation. However, for a mild-moderately obstructed case the attenuation caused by a voiding aid changed the obstruction category from II to I, and the long delay caused by the rectangular tube resulted in a further shift to category O (unobstructed).

### Concluding message

Mild-moderate Bladder Outlet Obstruction may be overlooked when male voiding cystometry is performed from the supine posture using voiding aids. Also, detrusor power is likely to be underestimated.