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**Title:** COMPARISON OF BLADDER PRESSURE, URETHRAL PRESSURE AND CUFF PRESSURE DURING INTERRUPTION OF FLOW BY INFLATION OF A PENILE CUFF

### Aims of study

Lower urinary tract symptoms (LUTS) affect one in three of all men in later life. The measurement of bladder pressure is helpful in confirming the diagnosis of bladder outflow obstruction, and some authorities believe that an invasive pressure/flow study (PFS) should always be performed before surgical intervention to alleviate outflow obstruction. However, the time, discomfort, morbidity and expense associated with the PFS mean that in practice, many patients undergo surgery on the basis of symptoms alone.

In previous years, data have been presented from a proposed non-invasive test to measure bladder pressure [1, 2]. In the reported test, the bladder pressure was measured by inflating a penile cuff to the point at which flow stops, exactly as for non-invasive blood pressure measurement. It is hoped that the new test will yield some of the important information provided by the PFS while minimising the risks to the patient and the resources required in the clinic. The aim of the current study was to assess an underlying assumption of this approach: that the urethral lumen from bladder to penis remains open for the duration of the test.

### Methods

Eleven patients referred for PFS gave informed consent to participate in the study. An experienced urology nurse (WR) introduced a custom-made triple lumen 9F catheter (MediPlus, UK) with the usual two ports in the bladder for filling and pressure measurement, plus an infused port for urethral pressure measurement. The urethral port was positioned 15 cm proximal to the external meatus, and was therefore sited between the bladder neck and a paediatric blood pressure cuff fitted around the penis. Each patient was studied with a Hewlett Packard cuff (size 3 or 4) and a Critikon cuff (red or blue), with cuff size chosen according to penis size and the order allocated at random.

The bladder was filled. With voiding underway, the cuff was inflated in steps of 10 cm H<sub>2</sub>O every 0.75 seconds until flow stopped or a limit of 200 cm H<sub>2</sub>O was reached. The cuff was deflated and, if flow resumed, the cycle was repeated. The patient was refilled, and the entire experiment was repeated for a second void using the second cuff. For each test, we made continuous recordings of intra-vesical pressure ( $P_{ves}$ ), cuff pressure ( $P_{cuff}$ ) and urethral pressure ( $P_{ure}$ ).

### Results

We recorded 64 inflation cycles in total. Following 22 there was no flow recovery, indicating that voiding had ended, and these cycles were not analysed. A further 7 cycles had technical problems with the recording.

In total, 35 cycles were analysed. 30 cycles were consistent with our hypothesis that the urethral lumen stays open during the test:  $P_{ure}$  increased with  $P_{cuff}$  as the cuff was inflated; when  $P_{ure}$  reached  $P_{ves}$ , flow ceased. For these 30 cycles, *figure 1* shows the relation of both  $P_{cuff}$  and  $P_{ure}$  with  $P_{ves}$  at the moment when flow ceased.

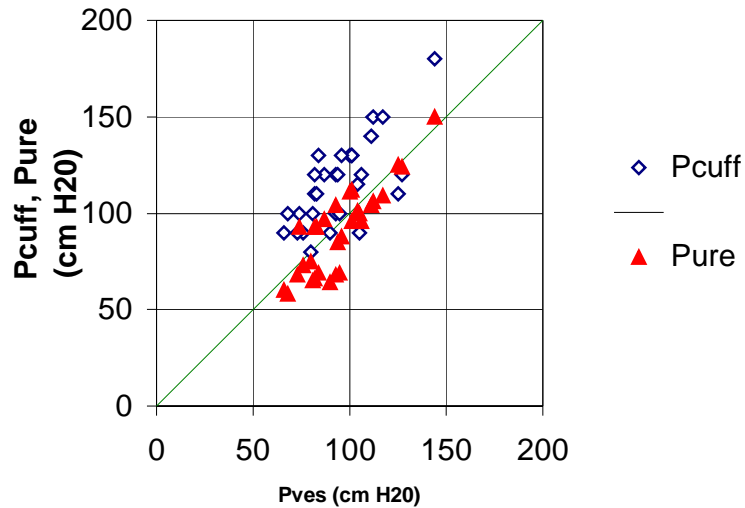


Figure 1 – The relation of  $P_{cuff}$  and  $P_{ure}$  with  $P_{ves}$  at the moment flow stopped. The line of identity is given.

For the remaining 5 cycles,  $P_{ure}$  showed erratic behaviour at interruption and could not be measured accurately. Nevertheless, the value of  $P_{cuff}$  minus  $P_{ves}$  at the moment of interruption was comparable between the two groups, which were both comparable with earlier published data [2]. The table summarises the data at the moment when flow stopped.

	Mean	SD
$P_{ves} - P_{ure}$ (n=30 good recordings)	+4.3 H <sub>2</sub> O	11.6 H <sub>2</sub> O
$P_{cuff} - P_{ves}$ (n=30 good recordings)	+20.5 H <sub>2</sub> O †	16.0 H <sub>2</sub> O
$P_{cuff} - P_{ves}$ (n=5 poor recordings)	+19.0 H <sub>2</sub> O †	24.0 H <sub>2</sub> O

†Including a systematic difference of approximately 15 cm H<sub>2</sub>O due to the height difference between bladder and cuff.

### Conclusions

There is a close relationship between intra-vesical and intra-urethral pressure. This is consistent with the hypothesis that the urethral lumen remains open for the duration of the test, a conclusion borne out by the close relationship between  $P_{cuff}$  and  $P_{ves}$  reported in this study and in earlier work.

### References

- 1 A new method for non-invasive measurement of voiding pressure? Assessment of penile cuff occlusion. *Neurourol Urodyn* 1999; 18: 256-7.
- 2 A new method for non-invasive assessment of bladder pressure during voiding compared with simultaneous invasive urodynamics. *Neurourol Urodyn* 1999; 18: 253-4.

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