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EVALUATION OF THE NON-INVASIVE ESTIMATION OF BLADDER PRESSURE USING A PENILE CUFF. AN ALTERNATIVE TO PRESSURE-FLOW STUDIES IN MEN?

Aims of Study

Both urine flow studies and pressure-flow studies (PFS) improve selection for, and outcome from TURP, in men with lower urinary tract symptoms (LUTS). Pressure/flow studies are currently recognised as the gold standard for the diagnosis of bladder outlet obstruction in men with lower urinary tract symptoms (LUTS). These do, however, come with a number of disadvantages; they are time consuming, invasive and expensive, and carry with them some morbidity for the patient.

A non-invasive technique to measure bladder pressure is being developed using a penile cuff inflated during the voiding cycle (1). We are currently undertaking a study to validate the method and to assess its role as a partial replacement for "invasive" pressure-flow studies, and to determine whether subsets of patients may be identified who are clearly obstructed or definitely not obstructed.

Methods

Male patients with LUTS were recruited from outpatients referred to our department. Each patient attended our flow clinic, performing 3 consecutive urinary flow rates. At a separate visit the patients underwent a cuff test in the absence of a urethral catheter, followed by catheterisation and conventional invasive PFS. A second cuff test was then performed with synchronous invasive pressure/flow measurement.

For the cuff test a specially designed penile cuff (Mediplus, UK), similar to a neonatal blood pressure cuff, was placed around the penis. Once voiding commenced the cuff was automatically inflated until flow was interrupted or a cuff pressure of 200cmH2O was reached. The cuff then deflates allowing voiding to continue. This cycle was repeated until the end of voiding, allowing several cycles per void (2).

Conventional PFS were performed using a 6fr double lumen, fluid filled, catheter (Mediplus, UK) connected to external pressure transducers zeroed at the level of the symphysis pubis. Men were classified according to the ICS nomogram as obstructed, equivocal and unobstructed (3).

Isovolumetric bladder pressure, the bladder pressure generated at interruption of flow, ($p_{ves,isv}$) and cuff pressure at interruption of flow ($p_{cuff,int}$) were compared. For each patient, the highest $p_{cuff,\ int}$ was plotted against the highest free flow rate Q_{max}.

Results

Data on the first 104(mean age 66years, range 42-86) of 120 patients who have been investigated with a simultaneous cuff test and invasive pressure/flow study yielded 173 separate inflation cycles suitable for analysis (Figure 1). The measured $p_{cuff,\ int}$ (range 40-190cmH2O, mean 110cm H2O) is on average 3cmH_2O ± 24cmH_2O (SD) greater than $p_{ves,\ isv}$, with a correlation coefficient of 0.78. The test is simple and straightforward to perform and produced analysable data in 83% (86/104) of patients.

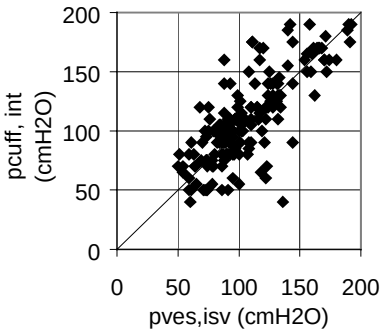
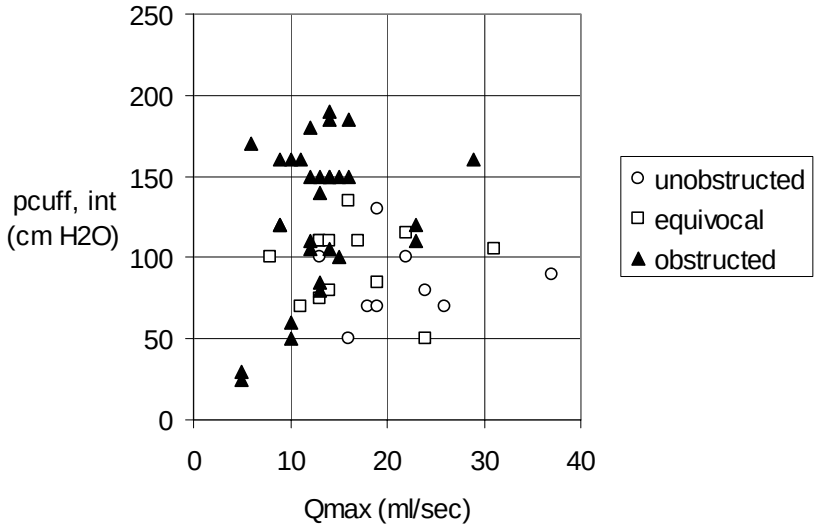


Figure 1. Isovolumetric bladder pressure vs. cuff pressure at interruption of flow.

Of the 104 patients who underwent invasive pressure flow studies, free flow data was available on 81 (7 had flow studies performed elsewhere and results were not available, 16 are awaiting flow studies). Of these 81 all underwent a free cuff test without a urethral catheter. 10 were unable to void due to inadequate bladder filling or voiding inhibition, 19 did not provide interpretable data and 52 provided a measurable $p_{cuff,\ int}$. Of these 52, 9 were classified as unobstructed, 13 as equivocal and 30 as obstructed according to their conventional pressure flow data. Highest $p_{cuff,\ int}$ was graphically compared to highest Q_{max} obtained from free flow rate examination (Figure 2).

Figure 2. Highest free $p_{cuff,int}$ vs. highest free Q_{max} according to ICS obstruction grade.



Conclusions

Previous experimental work has shown that there is good transmission of cuff pressure to the penile urethra(4) and that the urethra between bladder and cuff remains open during the test(5). Our results confirm that this technique does enable an estimation of isovolumetric bladder pressure and therefore gives information relating to bladder contractility. The overestimation seen is less than that seen in previously published data (1; 2).

From the graph of $p_{cuff,int}$ vs. Q_{max} (Figure 2) it may be seen that all those patients lying to the upper left, with high $p_{cuff,\ int}$/low Q_{max} are obstructed. Similarly there is a group to the lower right, none of whom are obstructed. In this way it may be possible to classify a proportion of patients into “definitely obstructed” and “definitely unobstructed/equivocal” using a combination of $p_{cuff,\ int}$ and free flow rate.

It seems likely that this technique could replace pressure-flow studies in two subsets of patients: those with low free flow rates and high non-invasively measured bladder pressure, and those with high flow and low non-invasively bladder pressure.

References

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