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ARE THE MEASUREMENTS OF WATER-FILLED AND AIR-CHARGED CATHETERS THE SAME IN URODYNAMICS?

Hypothesis / aims of study

Water-filled catheters are the most commonly used catheters for urodynamic studies. These catheters allow the transmission of both vesical and abdominal pressures from the patient to the pressure transducers attached to an external urodynamic system. The quality of the pressures measured can be impaired by the presence of air bubbles, movement artefacts but the transducers are externally mounted which allows the position of zero to be fixed to the symphysis pubis. Air-charged catheters have been recently proposed as an ideal alternative to the water-filled catheters as they eliminate the risk of air bubble interference and movement artefact allowing a more accurate reading of the pressures. However, the reliability of air-charged catheters has only been evaluated for urethral and valsalva leak point pressure measurement with comparison to microtip transducers. The aim of our study was to evaluate the comparability of air-charged catheters with a fluid filled system simultaneously in the measurement of the vesical, detrusor and abdominal pressure during urodynamic investigations.

Study design, materials and methods

Consecutive women with lower urinary tract symptoms, referred for urodynamic investigation were prospectively studied. All women were consented for this study. A 7 Fr double lumen air-charged catheter (T-doc) and a 4.5 Fr single lumen water-filled catheter (Laborie) were inserted through the urethra to fill the bladder and to measure the vesical (Pves). A 7 Fr air-charged catheter and a 4.5 Fr single lumen water-filled catheter were inserted into the rectum to measure the abdominal pressure (Pabd). The water filled catheters were flushed with sterile water and the transducers, placed at the superior edge of the symphysis pubis, zeroed at the atmospheric pressure. The air charged catheters were zeroed prior to be charged. All four catheters were connected to a Laborie Triton urodynamic system. The subtracted detrusor pressures (pdet) were checked asking the patient to cough prior to start filling the bladder with room temperature sterile water. All the tests were performed by experienced clinicians, certified in urodynamic studies. The cystometrogram was started and the bladder filled with woman sitting only if the Pves, Pdet and Pabd measurements were recorded by the air-charged and water filled transducers within the normal ranges as described by the ICS.(1) Readings of Pves, Pdet and Pabd at the beginning and end of filling, on standing, on sitting prior to void as well as at maximum detrusor contraction recorded by both air-charged and water filled catheters were displayed on the computer screen simultaneously. The pressures recorded by both types of transducers were compared using the Bland / Altman plot and analysis of the 95% confidence interval of the mean difference against the mean pressures.

Results

Twenty women were studied. Eight women had urodynamic diagnosis of detrusor overactivity (DO), 3 patients had urodynamic stress incontinence (USI) and 5 women showed a mixed picture of DO and USI. Urodynamics did not show any abnormality in four women. Tables 1-4 show the means of the pressures measured by water-filled and air-charged catheters, the 95% CI of the mean difference and the variation of the measurements between the two pressure catheters.

end of filling	Water-filled Mean/cmH2O	Air-charged Mean/cmH2O	mean difference /cmH2O (95% CI)	**Variation % (95% CI mean difference/mean pressure)**
Pves	25.7	29.7	2.0 (-3.5-7.5)	**42%**
Pabd	10.9	26.6	6.2(2.6-9.9)	**27%**
Pdet	14.8	3.3	5.8(2.6-7.4)	**32%**

Table 1: Simultaneous pressures at the end of filling

standing	Water-filled Mean/cmH2O	Air-charged Mean/cmH2O	mean difference /cmH2O (95% CI)	**Variation % (95% CI mean difference/mean pressure)**
Pves	33.8	41.7	4.0 (-0.1-8.0)	**19%**
Pabd	28.8	38.3	4.7(0.8-8.8)	**25%**
Pdet	5.1	2.5	1.3(-4.6-2.0)	**129%**

Table 2: Simultaneous pressures on standing

sitting	Water-filled Mean/cmH2O	Air-charged Mean/cmH2O	mean difference /cmH2O (95% CI)	**Variation % (95% CI mean difference/mean pressure)**
Pves	28.3	30.7	1.2(-2.1-4.6)	**21%**
Pabd	20.6	29.0	4.2(-1.3-9.7)	**38%**
Pdet	7.7	1.8	2.9(-1.5-7.4)	**115%**

Table 3: Simultaneous pressures on sitting

max contraction	Water-filled Mean/cmH2O	Air-charged Mean/cmH2O	mean difference /cmH2O (95% CI)	**Variation % (95% CI mean difference/mean pressure)**
Pves	34.9	39.4	2.3(-2.1-6.7)	**22%**
Pabd	18.5	30.7	6.1(1.7-10.4)	**28%**
Pdet	16.4	9.7	6.1(1.7-10.4)	**53%**

Table 4: Simultaneous maximum pressures measured during involuntary detrusor contractions

Interpretation of results

Our study has shown that air-charged catheters are measuring significantly different abdominal, vesical and detrusor pressures than water-filled catheters, when used in urodynamic investigation. This finding is important as it is the first study to assess these catheters simultaneously in the same patients allowing valid reliability assessment. The significant variation of the readings produced by the two different types of catheters underlines their inability to be used interchangeably. This is important in urodynamic studies where cohorts are being assessed. Uniform types of air-charged or water-filled lines should be used when assessing groups of patients in multicentre studies. Only then will the results have intergroup validity.

Concluding message

The pressures measured using air-charged catheters are not interchangeable with fluid filled catheters. Caution should be used in comparing the urodynamic results using the two different types of catheter.

References

1. Good urodynamic practices: uroflowmetry, filling cystometry, and pressure-flow studies. Neurourol Urodyn. 2002;21(3):261-74.

Specify source of funding or grant	**None**
Is this a clinical trial?	**No**
What were the subjects in the study?	**HUMAN**
Was this study approved by an ethics committee?	**Yes**
Specify Name of Ethics Committee	**St Mary's REC**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**Yes**