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COMPARISON OF AIR-CHARGED AND WATER-PERFUSED CATHETERS FOR USE IN CYSTOMETRIC ASSESSMENT

<u>Hypothesis / aims of study</u>
Urodynamics (UDS) is widely used for the diagnosis of lower urinary tract dysfunction. Water-filled catheters (WFC) are considered to be the traditional standard to measure pressures during UDS. However, nowadays other manometer-based technologies, like the air-charged catheters (ACC), are available. In order to determine if pressure readings from the ACC and WFC are equivalent, we designed an original study where, a dual lumen ACC was used to measure pressure using water and air technologies simultaneously at specific filling volumes at Valsalva manoeuvres and cough movements, and during voiding.

<u>Study design, materials and methods</u>
All protocols were approved by an ethics board committee and all subjects were consented. This was a single-center prospective study. A commercially available 7Fr T-DOC ACC dual-lumen was used to measure vesical pressure (Pves) and abdominal pressure (Pabd). Pressures were continuously recorded through the ACC sensor. The water pressures were recorded by connecting a pressure transducer to the filling lumen of T-DOC at specific filling volumes, when patients were asked to perform Valsalva manoeuvres and cough, and during voiding. This method allowed us to simultaneously assess WFC and ACC pressures. Paired-differences between systems for each event was compared using linear correlation or paired t-test and Bland-Altman plot for repeated measurements, where data is presented showing the 95% interval of confidence (IC) and mean ± standard deviation. Sample size was calculated based on a previous pilot study[1], where 19 subjects would be needed using a probability (power) 0.8. Significant difference was considered when $p<0.05$.

<u>Results</u>
25 patients were enrolled in this study, 9 men and 16 women, mean age 43.3 (21-62) years. Both systems showed a good correlation for Valsalva manoeuvres (R^2=0.985, 0.962, Pves and Pabd respectively); and cough movements (R^2=0.965, 0.963, Pves and Pabd respectively; Fig.1). Paired t-test of detrusor pressure (Pdet) showed no significant difference between the two measurements for Valsalva manoeuvres (p=0.91), at initial resting pressure (p=0.07), at 50±10ml resting pressure (p=0.10), at voiding at maximum flow (Qmax; p=0.50). Bland-Altman plots indicated that paired-differences of a given patient during Valsalva manoeuvres was of 6 cmH_2O maximum difference. However, it could reach up to 10 cmH_2O for Pabd during Valsalva manoeuvres; and up to 14 cmH_2O and 19 cmH_2O for Pabd and Pves respectively, during cough movements (Fig. 2). Other paired data also showed a large variety of differences between the two systems.

<u>Interpretation of results</u>
The linear correlation plots showed high correlations between pressures measured by ACC and WFC during Valsalva manoeuvres and cough movements. A stronger correlation was observed at Valsalva manoeuvres than that at cough movements, R^2=0.985 vs 0.965 at Pves. The cough test showed a damping response over the Pves and Pabd, especially for Pves. This finding correlates with previous bench test results from Cooper et al[2]. This shows that when performing high frequency (fast) movements the ACC would appear to be overdamped, showing a slightly delayed and diminished response in the UDS tracing when compared to the real time of the event. When the results from paired-t test were considered, no statistical significant difference was found for Valsalva manoeuvres (p=0.944, p=0.701, p=0.901 for Pves, Pabd and Pdet respectively) between the two measurements. In contrast, only Pabd showed no statistical significant difference (p=0.376) between the two measurements at cough movements. When Bland-Altman plots were analysed, a large variety of differences for any given patient was observed between the two systems. This coincides with previous studies where the readings between ACC and WFC were not directly interchangeable[3]. However, the maximum 6 cmH_2O difference at Valsalva manoeuvres for Pves seems to be more acceptable in clinical practice.

<u>Concluding message</u>
ACC and WFC may be interchangeable for some UDS parameters like Pves during Valsalva manoeuvres, but not for fast changing pressures signals like cough. This should be considered when using ACC on a patient population that requires pressure measurements identical to WFC. Further studies are needed to compare pressure measurements and diagnostics with both systems for different patient's populations.

Fig.1 - a. Correlation of Pves-ACC and Pves-WFC at Valsalva manoeuvres, b. correlation of Pabd-ACC and Pabd-WFC at Valsalva manoeuvres, c. correlation of Pves-ACC and Pves-WFC at cough movements, d. correlation of Pabd-ACC and Pabd-WFC at cough movements. Yellow line represents X=Y.

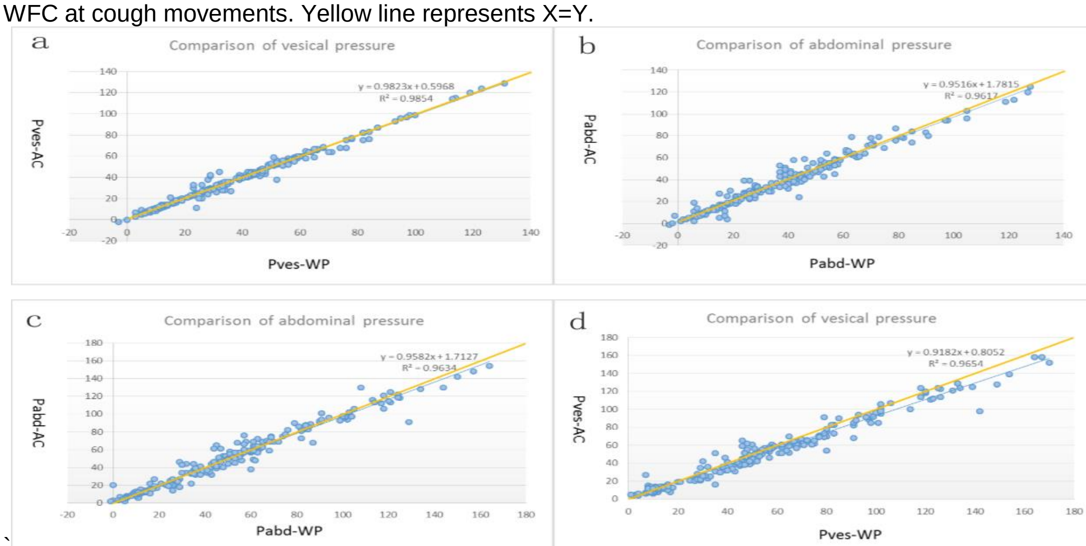
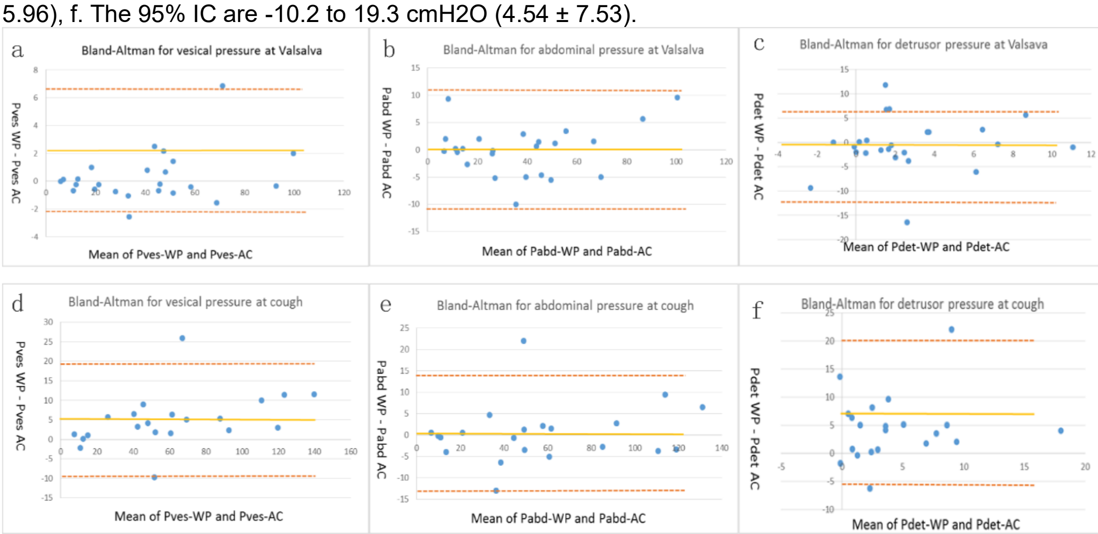


Fig.2 - Bland–Altman plots for repeated measurements per subject at Valsalva manoeuvres and cough movements. a. The 95% IC are -5.6 to 6.2 cmH2O (0.32 ± 3.02); b. The 95% IC are -10.9 to 10.9 cmH2O (0.02 ± 5.57); c. The 95% IC are -9.4 to 19.2 cmH2O (4.93 ± 7.30); d. The 95% IC are -13.2 to 14.0 cmH2O (0.41 ± 6.93), e. The 95% IC are -12.2 to 6.7 cmH2O (-0.50 ± 5.96), f. The 95% IC are -10.2 to 19.3 cmH2O (4.54 ± 7.53).



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Disclosures

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