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ULTRASOUND IS A GOOD, QUICK, OUTPATIENT, NON-INVASIVE ALTERNATIVE TO PRESSURE FLOW STUDIES FOR THE DIAGNOSIS OF BLADDER OUTLET OBSTRUCTION - A PROSPECTIVE STUDY AND DEVELOPMENT OF A CLINICAL SCORE

Hypothesis / aims of study
Urodynamics is currently considered the gold standard for the diagnosis of bladder outlet obstruction (BOO). However it is an invasive test that takes a long time, expensive and not without side effects. Several intents of developing a non-invasive alternative were made: measuring the thickness of the detrusor, the middle lobe intravesical protrusion and noninvasive measurement of intravesical pressure or penile cuff pressure sensor condoms. However, there is no standardization of the methodology and the sensitivity and specificity of each of the tests taken separately is low.
Our objective was to determine if all possible measurements performed during a simple outpatient abdominal ultrasound - prostate volume (PV), middle lobe protrusion (MLP) and bladder wall thickness (BWT) can be used together to diagnose BOO, with higher sensitivity and specificity than any of them alone. For that purpose we aimed to develop a clinical score incorporating these measurements.

Study design, materials and methods
Prospective study in consecutive patients, all male patients referred to the Urological diagnostic unit for a Pressure-Flow study between June and December 2012. Denial of the patient to participate in the study was considered an exclusion criterion. Demographic data and PSA values were collected.
In each patient a standard urodynamics was performed. At the end of the second voiding 200ml of saline were injected into the patient's bladder, or until the patient had desire to void. A transabdominal bladder ultrasound was performed, measuring BWT, MLP and PV.
The association between the Abrams-Griffith number (AG) and BWT, MLP and PV was estimated by linear regression using a stepwise sequential inclusion (FSTEP) and logistic regression. Regression coefficients were calculated for each variable with the Wald test.

Results
A total of 104 patients were included. Mean age - 63 years (37 - 75). Mean prostate volume - 42cm3 (21 - 78). Obstructed patients (AG>40) - 48. Mean bladder wall thickness - 5mm (1 - 12). Mean size of prostatic middle lobe - 12mm (1 - 34). Mean PSA - 2.2ng/ml (0.7 - 11.4).
In the multivariate analysis the bladder wall thickness (R^2 =0.978), the middle lobe protrusion (R^2 =0.901) and the whole prostatic volume (R^2 =0.842) were associated with bladder outlet obstruction expressed by the AG. No other variable was associated with BOO.
A clinical score was computed from the regression coefficients of each variable:

- Bladder wall thickness (0-1mm - 0points, 2-3mm - 3 points, 3-4mm - 4points, >4mm - 5 points).
- Middle lobe protrusion (0-5mm - 0 points, 5-10mm - 1 point, 10-15mm - 2points, 15-20mm - 3points, >20mm - 4 points).
- Whole prostatic volume (<35cm3 - 0 points, >35cm3 - 2 points)

Interpretation of score results:

- > 5 points – obstruction;
- < 3 points - not obstructed;.
- 3-5 points - grey zone corresponding to the 20-40 interval of the AG number.

The clinical score had a sensitivity of 82% and specificity of 83%.

Interpretation of results
The joint measurement of the bladder wall thickness, the middle lobe protrusion and prostatic volume permits the non-invasive evaluation of BOO with high sensitivity and specificity.

Concluding message
Ultrasound can be used as a good, quick, outpatient, non-invasive alternative to pressure flow studies for the diagnosis of BOO.

Disclosures
Funding: N/A **Clinical Trial:** No **Subjects:** HUMAN **Ethics Committee:** Local Institutional Review Board **Helsinki:** Yes **Informed Consent:** Yes