Estimation of Detrusor Muscle Reserve using a novel prototype test of simulated outflow resistance in adult males

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Hypothesis/Aims of Study

• Detrusor muscle reserve that compensates for increased infravesical resistance is not well studied yet in the literature is available
• A predictive value of the Detrusor muscle reserve would be of predictive value in patients with BPH, Diabetic cystopathy, neurogenic bladder, and Botox injection

A novel prototype non-invasive urodynamic test for the estimation of DMR is tested. The test aims at the creation of a simulated controlled obstruction model to study DMR in adult males.

DMR definition: The capability of detrusor muscle to maintain flow and bladder emptying within normal range, in spite of increase in outflow resistance.

This study aims at evaluation of the feasibility and safety of the test, and identifying the cut-off value of DMR in young adult males

Materials & Methods

• Twenty adult male volunteers <40 years old were subjected to this study. Exclusion criteria were known symptomatic or radiologic infra vesical obstruction and/or Maximum flow rate < 15 ml/sec or significant post void residual.
• The subjects were asked to void through a condom catheter into a vertical graduated glass tube of variable heights placed at the level of symphysis pubis. The test aims at the estimation of change in Qmax and PVR. Subject were instructed not to strain during voiding.
• A series of glass tubes of variable heights (10, 20, 30, 40, 50 and 60 cm) with fixed internal caliber of 14 Fr. were used (figure 1). A single uroflow was measured per day to avoid bladder and patient exhaustion. Mean Qmax of each test was compared to the subject's initial mean Qmax. The tubes were disinfected after each use. PVR was measured after each test using trans abdominal ultrasound with a 3.5-MHz probe.

Results:

• Mean Qmax decreased progressively with each increase in height resistance. We noticed a severe decrease with the 10 cm height resistance tube (17.9%). Further increase in height resistance resulted in milder decrease in Qmax, ranging between 0.7% and 7.2%. At 60 cm height resistance, still 83% of volunteers had mean Qmax >15 ml/sec.
• PVR progressively increased with increase in height resistance. 76% of volunteers had PVR < 50 ml at 40 cm height resistance.
• A cut-off level of 70% of volunteers that could pass the test successfully with Qmax ≥15 ml/sec and PVR < 50 ml was designated for passing this test. PVR progressively increased with increase in resistance. 76% of volunteers had PVR < 50 ml at 40 cm height resistance. Although still 83% of volunteers had mean Qmax >15 ml/sec at 60 cm height resistance.
• A 40 cm height resistance is found to be the cut-off value for adult males < 40 years to pass this test successfully.

Conclusions:

• This novel test allowed the non-invasive estimation of the Detrusor muscle reserve in healthy young adult males. The test is cheap, simple, and feasible and with very limited technical difficulties. Avoiding straining during the test is the only limiting problem. A 40 cm height resistance is set as the cut-off level of resistance that a young healthy adult male should be tested against to estimate his DMR. This non-invasive test seems to be an ideal prototype for creation of calculated staged outflow resistance in adult males. A larger series is required to further confirm these initial results of the DMR test and confirm the designated cut-off values.