W20: ICS Institute of Male LUTS and LUTD: Non-invasive Evaluation of Bladder Outlet Obstruction

Workshop Chair: Carlos D'Ancona, Brazil

Time	Topic	Speakers
5	Welcome and introduction	Carlos D'Ancona
15	What are the limitations of uroflowmetry?	Andrew Gammie
15	The significance of the Bladder Wall Thickness	Matthias Oelke
15	The relevance of the Intravesical Prostatic Protrusion	Gommert van Koeveringe
15	Why perform the Non-Invasive Urodynamics?	Carlos D'Ancona
15	Discussion	Carlos D'Ancona Andrew Gammie Matthias Oelke Gommert van Koeveringe
10	Questions	All

Aims of Workshop

Longevity is increasing, and in male patients the complaints of lower urinary tract symptoms (LUTS) increases. Evaluation of LUTS should be quick, easy, cheap, not too bothersome, and minimally invasive. Urodynamics is invasive, time-consuming, and expensive. A number of resources in the diagnostic armamentarium could increase the opportunity for selecting less invasive tests such as: detrusor wall thickness, intravesical prostatic protrusion, uroflowmetry, minimal invasive urodynamics. The objectives of this workshop are to discuss the advantages and efficacy of these methods in comparison to urodynamics in order to provides alternatives that might better suit the needs of patients.

Learning Objectives

Evaluate the value of intravesical prostatic protrusion in diagnosis of BOO.

Target Audience

Urology, Urogynaecology and Female & Functional Urology

Advanced/Basic

Intermediate

Suggested Learning before Workshop Attendance

D'Ancona CA, Bassani JW, Querne FA, Carvalho J, Oliveira RR, Netto NR Jr. New method for minimally invasive urodynamic assessment in men with lower urinary tract symptoms.
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M. Oelke, K. Höfner, B. Wiese, V. Grünewald, U. JonasIncrease in detrusor wall thickness indicates bladder outlet obstruction (BOO) in men.
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D. AganovicThe role of uroflowmetry in diagnosis of infravesical obstruction in the patients with benign prostatic enlargement Med Arh, 58 (1 Suppl 2) (2004), pp. 109-111

Minimal Invasive Urodynamics

Carlos D'Ancona - Professor and Chairman Division of Urology, School of Medical Science, University of Campinas, Brazil

Urodynamic evaluation is considered the reference standard to diagnose bladder outlet obstruction. However, the procedure is invasive, expensive, and time-consuming. In order to obtain a less invasive way, alternative methods have been developed over the years, but with limited success. We present a new device, urethral connector, developed by the Biomedical Engineering Center and Division of Urology of UNICAMP, which offers reliable results, in an easy, reproducible and minimally invasive way.

It is a hollow polypropylene cylinder, which allows the flow of urine through its interior. The patient is instructed to insert the connector into the navicular fossa, before starting voiding, and when urinating, he is asked to occlude the exit of the device with his index finger. By briefly interrupting the urine flow, it is possible to measure intravesical pressure and flow. In the minimally invasive evaluation, the isovolumetric pressure is recorded where the flow is zero (Figure 1). In conventional urodynamics, isotonic pressure is measured where it flows (Figure 2). The nomograms used in conventional urodynamics do not apply to minimally invasive. A study was carried out comparing the two methods and through mathematical methods it was possible to describe a formula to classify the results of the minimally invasive.

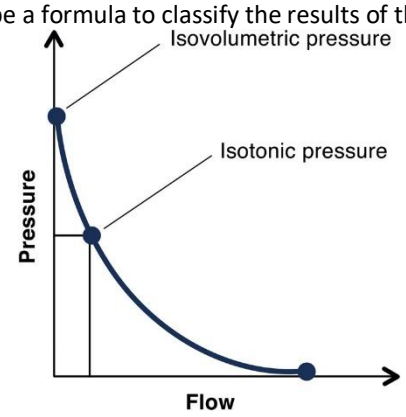

Figure 1 – Isometric and isotonic pressure are indirectly related to the condition of muscle fibers (detrusor). The isometric contraction of the detrusor, that is contraction without length modification or without shortening of the detrusor (no flow). Isotonic contraction is developing force with length modification and therefore, shortening the muscle fibers. In this case, the isotonic pressure is referring to the fact that it is being developed in the voiding phase.

The urethral device proved to be simple and easy to use. The minimally invasive method was able to detect most patients with bladder outlet obstruction; thus, the conventional urodynamic assessment could be avoided. We consider this method to have a place as a first-line noninvasive examination. Makes it possible to evaluate the result of pharmacological treatment, surgical results or even monitoring of bladder function over time.

The Limitations of Uroflowmetry
Andrew Gammie

Uroflowmetry – the measurement of urine flow rate over time – has always been popular due to its low cost, simplicity, speed and lack of invasive measurement. For this reason, there have been many attempts to gain greater diagnostic power from the test, particularly to differentiate bladder outlet obstruction (BOO) from detrusor underactivity (DU) in the male patient. Since the measurement only looks at the rate of flow and not the causes of flow, any further information will be gained by association rather than direct identification of cause. The relationship between volume and maximum flow rate can be used to identify dysfunction, by considering the amount of deviation from normal values on the Liverpool (or other) nomogram [1]. The likelihood of BOO is known in symptomatic males [2], but this figure is not diagnostic, and patients may well prefer invasive testing to the percentage uncertainty given them.

Uroflowmetry alone, as currently used, thus can be used as a guide to patient counselling, an indicator of change over time and also of dysfunction. In order to improve diagnostic certainty, the following are among those current in the literature:

- Flow Index (FI) [3]
- Flow resistive forces index (QRF) [4]
- ΔQ [5]
- D index [6]
- Flow curve shape [7]

Also, 'Flows+', i.e. uroflowmetry combined with another measurement, has been investigated for a number of variables, including prostate volume, bladder wall thickness, symptoms including straining to void, and improving data by enabling multiple voids in the home environment.

It is noteworthy that none of these extra methods are yet in common use, for some through lack of data and for others through methodological questions that remain unanswered.

We must therefore continue to squeeze flows for all of the diagnostic improvements that may be available, while urging caution that the limitations of uroflowmetry mean diagnosis and therefore surgery should still not be attempted on the basis of flows alone.

References

1. Liverpool nomogram
2. Abrams (?) % of males with BOO <10 ml/s
3. Flow Index (FI)
4. Flow resistive forces index (QRF)
5. ΔQ
6. D index
7. Flow curve shape
8. Flows+

The significance of the Bladder Wall Thickness

Matthias Oelke, Department of Urology, St.Antonius Hospital, Gronau. Germany

Benign prostatic obstruction (BPO), bladder neck sclerosis, urethral valves or urethral strictures can cause mechanical bladder outlet obstruction (BOO). In experimental animals, bladder weight increases after partial ligation of the urethra due to an increase in detrusor wall thickness. Bladder weight increases three to five fold in rats and five to six fold in rabbits within 2

weeks after partial ligation of the urethra (initial stage). Afterwards, bladder mass as well as detrusor pressure remain almost constant, and the bladder is able to empty completely or at least up to 80% of volume as compared to untreated animals (compensated stage). After a variable amount of time (2 weeks to 6 months in rabbits), bladder weight increases additionally, bladder emptying becomes incomplete and detrusor contractility decreases (decompensated stage). Because of the clear onset of BOO, strict differentiation between the initial, compensated and decompensated stages are only possible in experimental animals. In contrast, BPO and BOO develop slowly in men. Despite this difference, morphological and functional changes of the detrusor are similar in men with BOO. Microscopic investigations of detrusor specimens in men and animals with urodynamically proven BOO showed hypertrophy of smooth muscle cells and increased intercellular deposition of collagen and elastic fibers. The more severe the level of decompensation, the greater the increase of bladder mass. With decompensation of the detrusor, bladder compliance decreases progressively.

Kojima et al. were the first authors to use ultrasound devices to calculate bladder weight as an indicator of BOO. The bladder weight estimated by ultrasound was up to fourfold higher in males with BOO than in males without BOO. Since bladder weight is a constant factor in each man at the time of the investigation, evaluating ultrasound estimated bladder weight works independently from filling volume. Others authors demonstrated a significant enhancement of the thickness of the bladder wall with increasing BOO in patients with BPO. With a static filling volume of 150 ml in every patient, a bladder wall thickness of 5 mm or more identified 87.5% of the obstructed and a bladder wall thickness of less than 5 mm identified 63.3% of the non-obstructed males. However, it remains unknown at what filling volume bladder wall thickness should be measured. Furthermore, all current studies used bladder wall thickness instead of detrusor wall thickness. Since the detrusor is the only part of the bladder that shows adaptive enlargement due to BOO, detrusor wall thickness is more adequate to investigate.

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Prostate protrusion into the bladder

Prof. Dr. Gommert A. van Koeveringe

The amount of intravesical prostatic protrusion (IPP) has been shown to be indicative of the amount of infravesical obstruction. To determine the amount of protrusion, either trans abdominal ultrasound TAUS or transrectal ultrasound TRUS can be used of which the former obviously is less invasive. (1)

In several studies on a relatively large total group of patients a comparable or better diagnostic accuracy has been shown compared to uroflowmetry alone. Median sensitivity was 67,8% and median specificity was 74,8%. PPV was 73,8% and NPV was 69,3%. In different studies threshold values were different however most of them used 10 mm protrusion as a cutoff value. (2,3,4)

Some studies have combined this test with other less invasive tests such as ultrasound video urodynamics which increased the accuracy of the test considerably. (5)

Especially the minimally invasive nature of this test and the ease to combine it with flowmetry and post void residual and even bladder-wall-thickness measurement as it uses the same equipment increases the expectations of this test. Moreover, the combination with other tests is under researched until now.

The technique can, compared to some of the other techniques, be learned easily and no specific sophisticated expensive equipment is necessary.

Most of the studies on this technique were comparing the technique to invasive urodynamics, the gold standard to diagnose obstruction. The latter test has limitations too especially in its translation to the effect after treatment. Therefore, a study that relates the parameters found using this technique with therapy effect may give interesting alternative data.

In the workshop, the proof provided by the literature on IPP will be discussed in combination with new views that sheds light on the possible future additional value of this test.

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