Assessment of infravesical Obstruction

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• Faculty Of Medicine
• Alex University
urethral stricture, stone (bladder or urethra)

*Enlarged prostate* with LUTS
difficult to diagnose \(\rightarrow\) weak Detrusor.
Irritative symptoms
• Symptoms: mainly obstructive.
• DRE is a must
• U/S Abdomen and Pelvis: bladder capacity, Prostate size, stones, PVR.
• Lab: Routine including PSA.

When to Worry??

• Irritative Symptoms
• Imaging: Ultrasound: Huge bl. capacity
• PVR: > ???
• Neurogenic suspicion!!
• Disc, D.M., Parkinson, and many others....
Pressure-Flow Study

To do or not to do.....

This Is The Question

AUA Guidelines

Clinicians may perform multi-channel filling cystometry when it is important to determine if DO or other abnormalities of bladder filling/urine storage are present in patients with LUTS, particularly when invasive, potentially morbid or irreversible treatments are considered. (Expert Opinion)
AUA Guidelines

The literature is **inconclusive** and "pure" symptomatology is rare.

EAU Guidelines

A large PVR is not a contraindication to watchful waiting (WW) or medical therapy, although a large PVR may indicate a poor response to treatment and especially to WW. In both the MTOPS and ALTESS studies, a high baseline PVR was associated with an increased risk of symptom progression.
There are no published RCTs in men with LUTS and possible BPO that compare the standard practice investigation (uroflowmetry and PVR measurement) with PFS with respect to the outcome of treatment but one such study is ongoing in the UK.

Patients with neurological disease, including those with previous radical pelvic surgery should be assessed according to the EAU Guidelines on Neuro-Urology.

Due to the invasive nature of the test, a urodynamic investigation is generally only offered if conservative treatment has failed. The Guidelines Panel attempted to identify specific indications for PFS based on age, findings from the other diagnostic tests, and previous treatments. The Panel allocated a different degree of obligation for PFS.
**Recommendations**

- PFS should be performed **only** in individual patients for specific indications prior to invasive treatment or when evaluation of the underlying pathophysiology of LUTS is warranted. 3 B

- PFS should be performed in men who have **had previous unsuccessful (invasive) treatment** for LUTS. 3 B

- When considering invasive treatment, PFS may be used for patients who **cannot void > 150 mL.** 3 C

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**Recommendations**

- When considering invasive therapy in men with bothersome, predominantly voiding LUTS, PFS may be performed in men **with a PVR > 300 mL.** 3 C

- When considering invasive treatment in men with bothersome, predominantly voiding LUTS, PFS may be performed in men **aged > 80 years.** 3 C

- When considering invasive treatment in men with bothersome, predominantly voiding LUTS, PFS should be performed in men **aged < 50 years.** 3 B
• Schafer 2001

• 30% non obstructed

### Prognostic value of P/Q

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Gotoh Lt 99</strong></td>
<td>95%</td>
<td>80%</td>
<td>52%</td>
<td>52%</td>
</tr>
<tr>
<td><strong>Favle P 98</strong></td>
<td>100%</td>
<td>53%</td>
<td>35%</td>
<td>0%</td>
</tr>
</tbody>
</table>
- Clear association between classical obst and better outcome
- Boo --> indication of surgery
- Det. contractility --> Prognostic of surgical outcome.

<table>
<thead>
<tr>
<th>Morbidity</th>
<th>Study</th>
<th>Frequency</th>
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</thead>
<tbody>
<tr>
<td>UTI</td>
<td>Porru et al.(^{106})</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>Kortmann et al.(^{108})</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>Harari et al.(^{104})</td>
<td>15%</td>
</tr>
<tr>
<td>Dysuria mild</td>
<td>Porru et al.(^{106})</td>
<td>33%</td>
</tr>
<tr>
<td>Dysuria severe</td>
<td>Porru et al.(^{106})</td>
<td>3.6%</td>
</tr>
<tr>
<td>Haematuria mild</td>
<td>Kortmann et al.(^{108})</td>
<td>17.6%</td>
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<tr>
<td>Haematuria severe</td>
<td>Kortmann et al.(^{108})</td>
<td>2%</td>
</tr>
<tr>
<td>Leukocytoria men</td>
<td>Yokoyama et al.(^{107})</td>
<td>4.6%</td>
</tr>
<tr>
<td>Leukocytoria women</td>
<td>Yokoyama et al.(^{107})</td>
<td>7.5%</td>
</tr>
<tr>
<td>Urgency</td>
<td>Kortmann et al.(^{108})</td>
<td>56%</td>
</tr>
<tr>
<td>Frequency</td>
<td>Kortmann et al.(^{108})</td>
<td>15.8%</td>
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Pressure flow studies of Micturition

1st Rehfisch 1897
Then Von Garrlet 1956
& Miller 1979
urethra (as a rigid tube)--> many resistance factors
but (urethra is a distensible tube)
(bladder is a contractile tube)
Continuous monitoring of vesical press. and flow

Interpretation of P/Q study

↓ Pdet. & Normal flow
Unobstructed

↓ Pdet. ↓ flow
Det under activity

↑ Pdet. + Normal flow
Obst. + ↑ det. activity

↑ Pdet ↓ flow
Obst.

Grey zones
Analysis of pressure flow study

One point  2 point  Curve analysis
One point analysis
Max flow & corresponding voiding press.
compressive type

* Abram Griffiths (AG number)
(BOOI)
(Pdet. at Q max -2 Q max)

unobstructed  \( \leq 20 \) cmH20
equivocal  20-40 cmH20
obst.  \( > 40 \) cmH20
Schäfer Nomogram 7 zones

Grade 0 & I .... Unobst. ....
Grade II mild obst. or equivocal
Grade III --> VII increasing degree of obst.
young non obst volunteers ....O, I

schäfer 2000
ICS P/Q nomgram

\[
\text{OCO} = \frac{\text{Pdet, Qmax}}{40 + 2 \text{ Qmax}}
\]

Miktionskennzahlen OCO & DECO
DAMPF

Pat: W. L. 67 yrs; BPH
pre 17/18 TURP 19/20 post
Grade: II/N -> O/N
Typ: compressive

Date: 6-89

Urodynamisches Labor der BWTI Aachen 1989

URETHRA: O= normal; I= mild -> VI= severe obs. DETRUSOR: Very Weak / Weak / Normal / Strong

Flow rate

Q.obs

Compressive

Constrictive

Normal

Pressure

Pmou 1

Pmou 2

Pobs
2 point method analysis
Linear PURR

↑ steep
constrictive

Horizontal
compressive
↑ flow with constant press.
Schafer 90

Choice of method

One point
for simple diagnosis

Two point
compromise in between

Curve analysis
Pathophysiology very high quality data
Conclusion

(BOO)

Upper line of ICS nomogram

--> Defacto standard

➢ Griffiths upper boundary
➢ Schafer between II, III
➢ A/G Number > 40 cmH20

Prognostic value of P/Q

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INTRODUCTION

Non Invasive urodynamic assessment of bladder outlet obstruction

INTRODUCTION

The penile cuff test (PCT)
INTRODUCTION

In an analogy with blood pressure measurements...
INTRODUCTION
Van Mastroigt condom catheter test

INTRODUCTION
Van Mastroigt test

The internal bladder pressure and the external pressure were simultaneously measured.

The agreement between the internal bladder pressure and the external pressure was better in the group of non-obstructed patients than in the group of obstructed patients.
Van Mastrigt test

In 2014 Shafik and colleagues conducted a pilot study on 20 adults

A simple multichannel pressure flow study with manual closure of the urethra during voiding

The patient was asked to void into the condom until flow stopped due to fullness of the condom

They found that the mean PIP was 70.01 +/- 44 and mean TIP was 61.65 +/- 31. No statistical difference was found between the two groups
PATIENTS AND METHODS

PATIENTS

This prospective study was conducted on 29 adult male patients

**Inclusion criteria**

- Male patient.
- Older than 50 years old.
- Complaining of lower urinary tract symptoms.
- Able to void.
- Sonographic evidence of prostatic enlargement.

**Exclusion criteria**

- Patients with neurogenic voiding dysfunction.

METHODS

Pressure flow study with stop flow (pinch) test.

- The bladder was filled with saline at rate of 30ml/minute.
- When the bladder is full the patient is asked to void.
- While the bladder pressure is leveling, manual compression of the penile urethra was done till cessation of flow occurs.
- The corresponding bladder pressure is documented as (the maximum isovolumetric pressure).
PATIENTS AND METHODS

METHODS

A novel non-invasive urodynamic test:

An air-free condom catheter is fitted on the penis and attached to the pressure transducer of the urodynamic machine.
PATIENTS AND METHODS

METHODS

Decreasing the distensibility of the external catheter

Rapping the whole condom by adhesive tape prevented over distention of the condom and limited its maximal capacity to 70 - 120 ml.
PATIENTS AND METHODS

METHODS

Fixation of the condom to the penis

The Coloplast - Latex Male External Condom Catheter is self adhesive condom, yet for extrasecurity and prevention of urine leakage specially at high pressures the condom is secured to the base of the penis with adhesive tape in a non-compressive manner to avoid occlusion of the penile urethra.

Making the condom air free

- In order to make the condom air free for proper pressure conduction a double lumen Y shaped connecter was developed.
- The single limb of the Y connector is attached to the tip of the condom catheter.
- One limb of the Y connector is attached to a water-filled tube connected to a conventional external strain gauge transducer.
- The other limb of the Y connector is attached to an infusion set with a valve a free other end.
PATIENTS AND METHODS
METHODS
Making the condom air free

The condom if filled with saline through infusion of the pressure transducer of the MMS urodynamic machine (USA).

Then and with the condom directed upward the valve of the infusion set is opened permitting air within the condom to escape.

The saline within the condom is then milked out while the condom directed upward and the valve is then closed.
PATIENTS AND METHODS

METHODS

Measuring the transmitted isovolumetric pressure

After secure fixation of the condom to the penis and making sure the condom is air-free, the patient is asked to void freely into the condom until cessation of urine flow.

Patients are encouraged not to strain. When cessation of urine flow occurs the highest corresponding pressure is determined and called ”transmitted isovolumetric pressure”.

PATIENTS AND METHODS

METHODS

Statistical analysis

The agreement between the maximum isovolumetric pressure measured via the stop flow technique and the transmitted isovolumetric pressure measured via our novel urodynamic test is done according to Bland-Altman method.

Student t test was used to test the significance of difference between the 2 tests. Statistical analysis was done using SPSS programme.
**RESULTS**

Invasively measured Isovolumetric Pressure

<table>
<thead>
<tr>
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<th>Moderately symptomatic</th>
<th>Severely symptomatic</th>
<th>P</th>
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<tbody>
<tr>
<td><strong>Mean ±SD</strong></td>
<td>103.6±30.7</td>
<td>91.8±20.8</td>
<td>110.8±34.0</td>
<td>0.191</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>40 - 185</td>
<td>70 - 130</td>
<td>40 - 185</td>
<td></td>
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RESULTS

Non Invasively Measured Isovolumetric Pressure
### RESULTS

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<tr>
<td><strong>Mean ±SD</strong></td>
<td>106.8 ± 30.7</td>
<td>96.6 ± 28.3</td>
<td>113.0 ± 31.2</td>
<td>0.988</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>65 - 200</td>
<td>65 - 150</td>
<td>75 - 200</td>
<td></td>
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</table>
RESULTS

Agreement Between Isovolumetric Pressure Measured Invasively and Non Invasively.

- Student $t$ test was used as a test of significance. The mean pressure difference between isovolumetric pressure measured invasively and non invasively was $-3.17 \pm 14.58$ cmH2O.
- The mean pressure difference was not significantly different from 0 ($P = 0.251$).
- 95% confidence interval of the difference ($-8.72 - 2.37$).
We conclude that isovolumetric bladder pressure can be measured noninvasively using a modified condom catheter test.

No significant difference was found between the invasive and non invasive measurement of isovolumetric bladder pressure in this group of obstructed male patients.

This test is simple, quick and feasible. No appreciated difficulties or morbidity was met during the test.