Urodynamic evaluation of stress urinary incontinence severity: a comparative study for detecting intrinsic external urethral sphincter deficiency


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KEYWORDS
Stress urinary incontinence; Urodynamics; Mexico.

Abstract
Aims: To determine the sensitivity and specificity of the abdominal leak point pressure (ALPP) in order to comparatively evaluate the presence of intrinsic sphincter deficiency (ISD) with maximum urethral closure pressure (MUCP) and establish the corresponding clinical and urodynamic correlation.

Results: Thirty-four patients with stress urinary incontinence (SUI) were evaluated. Seventeen of those patients (50%) were urodynamically diagnosed with ISD through ALPP and 9 of them had severe SUI. Only 2 patients were diagnosed with ISD through MUCP; one of them had severe SUI and the other presented with moderate SUI. Eighteen patients were clinically classified with severe SUI, 17 of whom had moderate to severe ISD diagnosed through ALPP (94%).

Conclusions: Urodynamic evaluation of SUI made it possible to clearly establish the pathophysiology of concomitant lower urinary tract dysfunction and to objectify the presence of SUI through ALPP in at least 85% of the cases. ALPP had a much higher sensitivity and specificity for diagnosing ISD than MUCP.
Evaluación de la severidad de la incontinencia urinaria de esfuerzo con estudios urodinámicos: un estudio comparativo para detectar deficiencia intrínseca del esfínter uretral externo

Resumen
Objetivo: Determinar la sensibilidad y especificidad del punto de presión de fuga abdominal (ALPP), para evaluar la presencia de deficiencia intrínseca del esfínter (DIE) comparativamente con la presión máxima de cierre uretral (MUCP, por sus siglas en inglés), estableciendo la correlación clínico-urodinámica correspondiente.

Resultados: Fueron evaluadas 34 pacientes con incontinencia urinaria de esfuerzo (IUE); 17 pacientes (50%) fueron diagnosticadas urodinámicamente con DIE por punto de ALPP; 9 tuvieron IUE severa mientras que sólo 2 (5.8%) lo fueron por MUCP, de las cuales una tuvo IUE severa y otra, IUE moderada. Dieciocho pacientes fueron catalogadas clínicamente como IUE severa, de las cuales 17 tuvieron DIE por ALPP entre severa y moderada (94%).

Conclusiones: La evaluación urodinámica de la IUE permite establecer de manera clara la fisiopatología de una disfunción del tracto urinario inferior concomitante, con la posibilidad de objetivar la presencia de DIE con el ALPP en al menos 85% de los casos, con una sensibilidad y especificidad para diagnosticar DIE muy superior a la MUCP.

Introduction
Stress urinary incontinence (SUI) noticeably alters the quality of life of the women that present with it. Meta-analyses reveal a prevalence of 30% in women between the ages of 30-60 years. 1

As a symptom, SUI is defined as the involuntary escape of urine during physical effort, such as coughing, sneezing, abrupt movements, and laughing. 2 It becomes a sign when we objectively demonstrate its presence through physical examination, whether by having the patient cough or with Valsalva maneuvers. 3

It is a urodynamic condition when the involuntary escape of urine is shown by an increase in abdominal pressure due to coughing or the Valsalva maneuver, in the absence of detrusor muscle contraction during filling cystometry. 4

Urge urinary incontinence is the involuntary escape of urine accompanied by or immediately before the urge to urinate. The presence of involuntary or uninhibited detrusor contractions is objectified in the filling cystometry. 5,6

In mixed urinary incontinence, involuntary escape of urine is present both during the increase in abdominal pressure and when there are involuntary detrusor contractions, and can be demonstrated in the same urodynamic study. 7,10

The 2007 management guideline discussion panel of the American Urological Association (AUA) proposes the following as standard evaluation: clinical history and directed physical examination objectively demonstrating the escape of urine during effort, residual volume measurement, and urine culture.

As other recommended measures, they propose characterizing the type of incontinence, defining whether it is genuine, urge, or mixed SUI, utilizing a micturition diary and quality of life questionnaires.

As additional recommendations they propose the diaper test, urodynamic studies, cystoscopy, and imaging studies.

McGuire (1993) described the test known as the abdominal leak point pressure (ALPP), which is carried out during filling cystometry at a capacity of 200 cc. The patient coughs at regular intervals and the bladder pressure at which urine escapes without detrusor contraction is registered. A pressure under 60 cm/H₂O correlates with intrinsic sphincter deficiency and a pressure above 60 signifies urethral hypermobility. 11,13

The urethral pressure profile (UPP) was popularized by Brown and Wickman in 1969. It utilizes a small catheter with lateral openings with a constant infusion at a velocity of 1-2 mL/min, and catheter traction at a velocity of 1-2 mm/sec along the entire urethra. The profile evaluates, among other parameters, the maximum urethral closure pressure (MUCP), which is the maximum difference between the urethral pressure and the bladder pressure. The normal figures are from 40 to 60 cm/H₂O. Many authors have used a figure of less than 20 cm/H₂O to define intrinsic sphincter deficiency and a figure above 20 cm/H₂O correlates with urethral hypermobility. 14

The aim of the present article was to determine the sensitivity and specificity of the ALPP for evaluating intrinsic external urethral sphincter (EUS) deficiency in SUI in women, its severity, and its comparison with the MUCP, establishing the corresponding clinical and urodynamic correlation.

Methods
A comparative, prospective, and cross-sectional study was conducted that evaluated the sensitivity and specificity of the urodynamic diagnostic tests (ALPP and MUCP), determining their positive and negative predictive values.
in order to analyze urinary incontinence severity and detect the intrinsic deficiency of the external urethral sphincter.

The study was carried out within the time frame of November 2012 and August 2013 and was conducted on female patients diagnosed with SUI that had been referred to our center for complete urodynamic study that included ALPP and MUCP. When ALPP was not easy to assess, it was determined without the transurethral catheter.

Those patients with a surgical history of SUI treatment and with neuropathy were excluded from the study. Because the patients had been referred by their attending physicians, the clinical evaluation of both incontinence severity and quality of life was carried out with the ICIQ: UI-SF questionnaire validated in the United Kingdom. According to the score, incontinence was classified as mild, moderate, or severe. The clinical and urodynamic correlation was determined by taking the ALPP values into consideration. According to established standards, when the value is above 60 cm/H$_2$O it corresponds to urethral hypermotility and when it is below that figure, it correlates with intrinsic external sphincter deficiency; for the MUCP, the values are above 20 cm/H$_2$O and below 20 cm/H$_2$O, respectively.

Results

Thirty-four women were included that had been diagnosed with SUI and referred to our center for complete urodynamic study. The age range was 37 to 80 years with a mean age of 58 years. Clinically, 23 patients (67.65%) presented with mixed urinary incontinence and 11 (32.35%) with pure SUI. Of the mixed urinary incontinence cases, 9 (39.13%) presented with uninhibited contractions (fig.1).

Of the patients with uninhibited contractions, 5 (55%) presented with urge urinary incontinence (fig. 2).

Of the 34 patients, 29 (85%) presented with positive ALPP, and it was negative in 5 patients, although without transurethral catheter (14.7%); this is regarded as type 0 occult SUI, in other words, not demonstrated urodynamically (fig.3).

Of the 34 patients, 17 presented with positive ALPP under 60 cm/H$_2$O, which was classified as intrinsic sphincter deficiency (ISD) and 12 above 60 cm/H$_2$O, which was regarded as urethral hypermotility, and 5 with negative ALPP (fig.4).

Clinically, SUI was classified as severe in 18 cases, moderate in 14, and mild in 2.

Of the 17 cases of ALPP under 60 cm/H$_2$O (ISD), 9 had severe SUI, 7 moderate, and one mild (fig.5).

Only 2 cases of the 34 were diagnosed as ISD through MUCP (5.8%) vs. 50% through ALPP (fig.6).

The sensitivity and specificity of ALPP and MUCP, as well as the respective positive and negative predictive values for each test are shown in tables 1 and 2, respectively.

Discussion

Various studies have shown that in women with pure SUI and no obstructive pathology, urodynamic studies do not provide greater additional information for making the diagnosis.

The European Guidelines (2006) recommend urodynamic studies in the following cases: 1) if hyperactive detrusor is suspected, 2) if there is a surgical history of treating stress incontinence or pelvic prolapse, and 3) if there are data suggestive of infravesical obstruction. The question has been posed whether urodynamic studies improve clinical progression or not, in cases of SUI. There is much controversy regarding this, however, there is no doubt that in complex cases and when faced with irreversible treatment, urodynamic studies are mandatory.
especially based on the fact that through them we can establish the pathophysiologic findings of the underlying alteration, allowing the adequate treatment to be chosen. \(^1\)

Another controversial point is related to the evaluation of SUI severity with urodynamic studies such as ALPP and MUCP. In this regard, the 4th Committee for Dynamic Studies (2009) recommended using these studies with caution and not as the only factor for progression and for predicting therapeutic results. Likewise, they recommended the continuation of controlled and randomized research studies in order to correctly standardize the application of these diagnostic methods.

In 1993 McGuire et al. evaluated 125 women with SUI and correlated a severe grade of incontinence with ALPP under 60 cm/H\(_2\)O in up to 81% of the cases, which was considered to be “fixed urethra” in 75% of the cases, classifying it as intrinsic deficiency of the external urethral sphincter. In our study there were 17 cases with ALPP under 60 cm/H\(_2\)O, of which only 9 (52.9%) corresponded to clinically severe SUI.

It has been reported that ALPP is negative in up to 15% of the cases, despite the fact that the patient complains of SUI; this can be related to the obstruction caused by the urethral catheter. In our study, 5 patients had negative ALPP, corresponding to pelvic prolapse in all the cases. Once the prolapse was manually reduced, the Marshall test was

**Figure 3** Five patients had negative abdominal leak point pressure despite transurethral catheter removal and all had pelvic prolapse.

**Figure 4** Five patients presented with occult urinary incontinence. Upon reducing the prolapse, the escape of urine during stress was obvious in all the patients.

**Figure 5** Of the 18 patients with clinically severe incontinence only 9 had an abdominal leak point pressure under 60 cm/H\(_2\)O.

**Figure 6** Only 2 patients had an abdominal leak point pressure under 20 cm/H\(_2\)O.
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positive, which is urodynamically classified as occult urinary incontinence.

In the majority of continent women, the length of the functional urethra is approximately 3 cm and the MUCP is 40-60 cm/H$_2$O, although normal values may vary widely.

Many authors have used the definition of a MUCP under 20 to identify ISD. Nevertheless, this definition can have the same problems as establishing ISD through ALPP. Another warning in relation to urethral profilometry is that this test does not diagnose SUI (unlike ALPP) and a continent woman may have the same MUCP as an incontinent one. 16-18

In our study, only 2 cases (clinically, one with severe and one with moderate SUI) were diagnosed as ISD through MUCP, with a sensitivity of 5.56% vs. 56.25% through ALPP, concurring with the international literature. The conclusion we found after a review of the literature was that MUCP cannot be used for evaluating SUI severity and that ALPP can be a useful tool for analyzing SUI-related urethral dysfunction, with the limitation of a current lack of technique standardization.

**Conclusions**

The urodynamic evaluation of SUI, carried out under the indications determined by the International Committee, clearly established the pathophysiology of a concomitant lower urinary tract dysfunction, as well as making it possible to objectify the presence of SUI through ALPP in at least 85%

### Table 1  Sensitivity of 56.25%, specificity of 38.46%

<table>
<thead>
<tr>
<th>ALPP sensitivity and specificity for ISD</th>
<th>95% CI</th>
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</thead>
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<tr>
<td></td>
<td>Lower limit</td>
</tr>
<tr>
<td>Disease prevalence</td>
<td>55.17%</td>
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<tr>
<td>Correctly diagnosed patients</td>
<td>48.28%</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>56.25%</td>
</tr>
<tr>
<td>Specificity</td>
<td>38.46%</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>52.94%</td>
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<tr>
<td>Negative predictive value</td>
<td>41.67%</td>
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<tr>
<td>Positive probability quotient</td>
<td>0.91</td>
</tr>
<tr>
<td>Negative probability quotient</td>
<td>1.14</td>
</tr>
</tbody>
</table>

ALPP: abdominal leak point pressure; ISD: intrinsic sphincter deficiency.

### Table 2  Sensitivity of 5.56%, specificity of 93.75%. Specificity was very high due to the sample size

<table>
<thead>
<tr>
<th>MUCP SENSITIVITY AND SPECIFICITY FOR ISD</th>
<th>95% CI</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Lower limit</td>
</tr>
<tr>
<td>Disease prevalence</td>
<td>52.94%</td>
</tr>
<tr>
<td>Correctly diagnosed patients</td>
<td>47.06%</td>
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<tr>
<td>Sensitivity</td>
<td>5.56%</td>
</tr>
<tr>
<td>Specificity</td>
<td>93.75%</td>
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<tr>
<td>Positive predictive value</td>
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<tr>
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<tr>
<td>Positive probability quotient</td>
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<tr>
<td>Negative probability quotient</td>
<td>1.01</td>
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</tbody>
</table>

MUCP: maximum urethral closure pressure; ISD: intrinsic sphincter deficiency.
of the cases, with a much higher sensitivity for diagnosing ISD than MUCP. However, neither of the 2 tests were adequate for clearly determining SUI severity and therefore should not be the only factors used for predicting surgical treatment results, as has been established by the International Consensus Committee on Invasive Urodynamic Studies. This international body also suggests that further multicenter, prospective, and randomized studies be conducted in order to establish the true value of these diagnostic tests.

Conflict of interest

The authors declare that there is no conflict of interest

Financial disclosure

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