ABSTRACT

Urinary incontinence affects 46.5% of Mexican women and it is a fact that its prevalence increases in relation to the aging process. Adequate diagnosis cannot be made through clinical evaluation alone, except in select cases, and it generally requires several study techniques such as simple cystometry, cystoscopy, ultrasound imaging, and urodynamics. Urodynamic testing is the criterion standard for diagnosing urinary incontinence, but it is expensive and not easily accessible. There are many techniques available for the study of these patients, and it is the authors’ opinion that ultrasonography has been underused for this purpose.

Objective: To describe ultrasonographic anatomy and a validated technique for performing ultrasound imaging of the pelvic floor that has a specificity of 79.6% and a sensitivity of 92% in the diagnosis of urethral hypermobility.

Keywords: Ultrasound, urinary incontinence, diagnostic techniques, urethral hypermobility, Mexico.

RESUMEN

La incontinencia urinaria afecta a 46.5% de las mujeres en nuestro país, se sabe que su prevalencia aumenta conforme avanza la edad. La valoración clínica no es suficiente para realizar un diagnóstico adecuado a excepción de casos selectos, por lo que se requiere de varias técnicas de estudio tales como: cistometría simple, cistoscopia, ultrasonido y urodinámica. La prueba urodinámica es el estándar de oro para el diagnóstico de incontinencia urinaria; sin embargo, es caro y de acceso difícil, pensamos que el ultrasonido no se ha popularizado y es sub-utilizado para este fin, debido a las múltiples técnicas y variables descritas para su aplicación en estas pacientes.

Objetivo: Describir la anatomía ecográfica y una técnica validada para la realización del ultrasonido del suelo pélvico cuya especificidad es de 79.6% con una sensibilidad de 92% en el diagnóstico de hipermovilidad uretral.

Palabras clave: Ultrasonido, incontinencia urinaria, técnicas diagnósticas hipermovilidad uretral, México.
INTRODUCTION

Urinary incontinence affects 1 in every 5 women over the age of 50 years. The prevalence of urinary incontinence is quite variable as reported on in the international literature. Geographic region, race, and age are all factors influencing this 4-57.1% prevalence.1,2 For the Mexican woman the figure is 46.5%.3 Likewise the present authors found that the prevalence of the different types of incontinence can also vary based on similar demographic factors. However, an important meta-analysis of the different international publications concluded that stress incontinence was the most frequent, with 49%, followed by mixed incontinence, with 29%, and then urge incontinence, with 22%.4 On the other hand, as the patients became older, urge incontinence became the most frequent.

Intrinsic sphincter incontinence and urethral hypermobility are the two causes of stress urinary incontinence. The latter is the most frequent, found in 80-90% of cases,5 and it is posited that suburethral support tissues and tissues under the bladder neck provide a firm platform over which the urethra is compressed when abdominal pressure increases. When this mechanism fails, it is clinically manifested by urethral hypermobility and consequent urinary incontinence.6 Mostwin and other researchers have come to similar conclusions using other imaging studies and suggest that there is a certain degree of sphincter deficiency in all patients with urethral hypermobility.7

In regard to stress urinary incontinence identification, there is an ever-increasing supply of techniques for its study and there is no generalized and well-standardized consensus as to diagnostic parameters of the pathology. This is the case with simple cystometry. Medical history per se is not a reliable diagnostic element,8 except in distinguishing patients that should undergo more detailed study. In regard to physical examination, the usefulness of both the Crystle (Q-tip) test and the Marshall-Bonney test is debatable. Some authors even completely discourage their use in urethral hypermobility diagnosis.9

The criterion standard for stress urinary incontinence is still urodynamics. Diagnosis is made by observing the exit of urine during an increase in intra-abdominal pressure in the absence of detrusor contractions.10

Taking the above into consideration, the general inaccessibility of urodynamic units and the high cost to the patient has forced the search for new diagnostic methods within the reach of the majority of centers to continue, and in 1980 the first reports came out on pelvic floor, specifically urethrovesical, ecography.11 However, ultrasound as an element for studying female urinary incontinence problems, has not become generalized. This is probably due to the great quantity of technical variations, their complexities, and the different diagnostic criteria that abounds in the different publications. For example, exploratory echographic techniques are described for the pelvic floor and lower urinary tract using these different approaches: transabdominal, transvaginal, translabial, introital, perineal, intraurethral, and transrectal,12-25 using different transducers and even contrast medium,26 and more recently using Doppler16 and 3D26,27 sonography.

Although different limitations for this diagnostic resource are described in the literature,28,29 the present authors feel that in general, it is an excellent means of studying the incontinent patient that provides reliable and useful information. In agreement with other colleagues, they believe ultrasound imaging has replaced radiographic studies in investigating pelvic floor and lower urinary tract dysfunction30-32 because of all the advantages sonography offers. It is also beneficial in the study of bladder tumors,33 in postoperative control of patients having undergone anti-incontinence surgery,34-37 in hyperactive detrusor diagnosis,24,28 in calculating residual urinary volume,38 in the diagnosis of urethral diverticula,39 and in the study of intrinsic sphincter mechanism.40

OBJECTIVE

To describe the sonographic anatomy of the most relevant structures and the technical principals essential for the echographic study of the pelvic floor and urinary incontinence of a technique that has 79.6% specificity and 92% sensitivity for the diagnosis of urethral hypermobility.18

METHODS

GE Logiq 3 ultrasound equipment with 8 Hz vaginal transducer was employed in the study. With patient in the gynecological position, transducer was placed in the vagina and principally sagittal views of the structures to be studied were taken. Study was carried out with recommended bladder volume of 50-150 mL, calculated for ultrasound with the Haylen formula. A higher volume can reduce bladder neck descent and also be uncomfortable for the patient.

Sonographic anatomy and study technique. It is essential to find the correct ultrasound plane, which, as indicated in the majority of articles on the subject, was reached with a sagittal view over the pubis, placing the transducer exactly where the least acoustic attenuation
is produced, suggesting that it is at the cartilage joining both rami of the pubic bone. To secure this position the transducer is turned slightly sideways toward the rami of the bone structure under study, observing the large acoustic shadow. The pubic bone is the most important structure and the easiest to identify. The arcuate ligament that joins both inferior pubic rami is a reference point and remains stationary with the movement of the transducer.

The retropubic space, echographically delimited by the pubis, bladder, and urethra, is where blood vessels and collections that are generally small hematomas can be observed in patients that have recently undergone corrective surgery for urinary incontinence.

With this approach, only the pelvic portion of the urethra can be studied and a portion with very little echogenicity, due to mucosal wall coaptation, can be identified, along with the surrounding sphincter that is somewhat more echogenic. Lesions, especially diverticula, should be looked for when evaluating it, at rest.

The bladder neck can be identified at the point where the bladder and urethra are joined, and normally it should be closed.

The bladder is easily visualized, and due to its contents, displays an anechoic image and is positioned over the pelvic midline. During the study it is important to observe its wall for neoplastic lesions, stones, ureteral meatuses, or simply measure its thickness, since an increase can be associated with hyperactive detrusor (Image 1).

Echographic diagnosis of urethral hypermobility: Bladder neck descent can be clearly observed and essentially two measurements are required: the first is the distance between the urethra and bladder neck, at rest, as a reference point. This measurement should be made from the point where the urethra intersects the axis, passing through the pubic symphysis to the bladder neck, and the patient should be completely still (Image 2); then the same distance should be measured when pressure is applied while the patient performs the Valsalva maneuver (Image 3); both measurements are subtracted, one from the other, and if the difference is greater than 8 mm, then there is urethral hypermobility, determined as urethral movement of more than 8 mm. In this study case, movement was 14 mm. In a second case, shown in Image 4, the urethra moved 9 mm. Another important measurement is the distance from the pubic symphysis to the bladder neck, which some authors have stated to be greater than 23 mm in continent women.

Deficient sphincter mechanism: When studying the urethra, and especially the bladder neck, urethral mobility can be identified during very limited Valsalva maneuver or when there is none (fixation). There can also be funnelling at the bladder neck level, which has special importance if it is observed during the “at rest” state. On other occasions great urethral mobility with associated bladder neck funnelling can be observed; these sonographic data highly suggest deficient sphincter mechanism. These findings are related to low maximum urethral closure pressures in urodynamic study, albeit research is still being carried out on this. Image 5 shows a case of important urethral neck funnelling during pressure.

The patient is then asked to go into the bathroom for voluntary micturition and afterwards return and resume the gynecological position. With the transducer in the vaginal cavity, residual urine is measured (Image 6) using the Haylen formula \((5.9 \times \text{height (H)} \times \text{depth (D)} - 14.6 = \text{mL})\). It is defined as the quantity of fluid in the bladder after complete micturition.

Sonography is also useful in postoperative control because it can verify adequate position of suburethral slings through their visualization in the middle urethra, as well as corroborate their function in increasing urethral wall coaptation during the application of pressure.

## DISCUSSION

As mentioned at the beginning of this article, ultrasound imaging has not been a very popular method for studying urinary incontinence due to the fact that there have been
many articles on it with too many variables and mixed results over the past 30 years. However, the present authors believe it is a question of being consistent in the use of a technique that has been well-standardized in centers dedicated to this discipline. In their opinion the most comfortable technique for both the operator and patient is the use of the transvaginal transducer, placed in the introitus. There is little structure distortion from transvaginal transducer compression and it is also available to the majority of physicians.

With regard to postmicturition residual urine measurement, the Haylen formula is the most useful and the simplest. It was designed for transvaginal ultrasound and can reliably measure urine volumes of 2-175 mL that are enough for decisions to be made both during preoperative evaluation and during postoperative control, in addition to the ellipsoid technique or any other technique available for computerized volume measurement.

Evaluation through medical history and physical examination is not sufficient for adequate diagnosis of urinary incontinence in women. The Q-tip test is no longer recommendable given its high rate of false negatives due to the fact that the cotton swab often
does not reach the urethrovesical junction, modifying the test result. It is also a source of significant discomfort for the nurse.

Sonographic methods have surpassed radiographic methods because they are noninvasive and have none of the risks attributed to radiation.

In contrast to urodynamic evaluation, this technique enables the lesion causing the incontinence to be seen in real time. It is possible to see the posterior caudal movement of the urethrovesical junction and therefore to visualize urethral hypermobility. Limitations to carrying out this study with the abovementioned parameters are severe degrees of genital prolapse and the impossibility or refusal of the patient to assume the gynecological position.

**CONCLUSIONS**

It can be said that sonography is a reliable, useful, low-cost, easily accessible method for studying stress urinary incontinence and urethral hypermobility in particular, during both preoperative and postoperative evaluation. It has high sensitivity and specificity and it is the opinion of the present authors, along with others, that this technique has a promising future and at some point may supersede urodynamic testing.

**BIBLIOGRAPHY**