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Original article

Solomon-Greenwell as the most accurate nomogram for female bladder outlet obstruction

Solomon-Greenwell es el nomograma más preciso para el diagnóstico de la obstrucción de la salida de la vejiga femenina

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Abstract

Objective: Compare the different definitions for bladder outlet obstruction (BOO) in women with dysfunctional voiding (DV) and find which one is most specific and sensitive to achieve a more accurate diagnosis.

Materials and methods: a cross-sectional study of urodynamic investigation studies fr

om women diagnosed with DV in a period from 2017-2020 were classified with obstruction or not, based on 6 urodynamic definitions. The control group were women who had been categorized with obstruction in at least 3 definitions of BOO. Likelihood positive ratio, sensitivity and specificity were calculated. Statistical analysis was carried out by IBM SPSS Statistics for Windows, Version 23.0 (IBM Corp., Armonk, N.Y., USA). A p <0.5 was considered statistically significant.

Results: A total of 146 urodynamic studies were analyzed, Solomon-Greenwell nomogram has shown to be the more specific and sensitive, obtaining the highest likelihood positive ratio >100. The comparison between our the control group and every definition of BOO has shown statistically significant difference.

Conclusions: The diagnosis of BOO requires expertise and individualization, it is made through physical examination and complete urodynamic study, Solomon-Greenwell has shown to be specific and sensitive for diagnosis in the group of study.

Keywords:
Female, bladder outlet obstruction, urodynamics

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Resumen

Objetivo: Comparar las diferentes definiciones que existen para definer la obstrucción del tracto de salida en la mujer y encontrar cuál es la más específica y sensible para un major manejo de estas pacientes.

Material y métodos: Se analizaron estudios urodinámicos de mujeres con diagnóstico de disfunción del vaciamiento, fueron clasificados como obstruidas y no obstruidas de acuerdo con cada definición de obstrucción del tracto de salida, se compararon con un grupo control que consistía en estudios que resultaron obstruidos con al menos 3 definiciones diferentes. Se llevó acabo un análisis estadístico de razón de verosimilitud.

Resultados: El nomograma de Solomon-Greenwell ha resultado ser la definición más específica y sensible, obteniendo la mayor razón de verosimilitud >100

Conclusiones: El dianóstico de obstrucción del tracto de salida require un studio complete e individualizado, a través de un examen físico y de estudios urodinámicos completos.

Palabras clave: Mujer, obstrucción del tracto de salida, urodinámica

Introduction

Diagnosis of bladder outlet obstruction (BOO) in women has become a challenge in Urology. The prevalence is reported in 2-23% and it is expected to be ascending.[1] There are some nomograms accepted for men, none of these are applicable for women because the etiological factors for BOO are diverse. The voiding in females are more complex due to mobility of the bladder neck, proximal urethra and pelvic floor movements.

BOO in women is defined by the International Continence Society (ICS) as: "a reduced urine flow rate and/or presence of a raised post void residual and an increased detrusor pressure."[2] Voiding symptoms such as weak urinary stream and sense of incomplete emptying are suggestive of BOO. Complete urodynamic evaluation is needed to confirm the diagnosis.

The absence of a well identified etiology and the lack of a universal agreement in urodynamic diagnosis has resulted in many definitions for BOO exclusively in women.[3] The aim of our study is to compare different definitions for BOO in women, to find the most specific and sensitive.

Materials and methods

After institutional review board approval, clinical files from our urodynamic database from women diagnosed with DV from 2017-2020 were reviewed. Studies that didn't fulfilled the good quality data according to ICS standards were excluded.[4] The selected studies were classified as obstructed or not based on Farrar (Qmax<15 ml/s and Vol >200 ml),[5] Chassagne (Qmax ≤15 ml/s and PdetQmax >20 cmH20),[6] Lemack (Qmax <11 ml/s y PdetQmax >21 cmH20),[7] Defreitas (Qmax < 12 ml/s or PdetQmax >25 cmH20),[8] Blavais and Groutz (PdetQmax > Qmax + 7),[9] Solomon-Greenwell (PdetQmax > 2.2 Qmax + 5).[10]

As there is not a gold standard, the control group were women who had been classified as obstructed with at least 3 definitions of BOO. Likelihood positive ratio, sensitivity and specificity were calculated. Statistical analysis was carried out by IBM SPSS Statistics for Windows, Version 23.0 (IBM Corp., Armonk, N.Y., USA). A p <0.5 was considered statistically significant.

Results

We analyzed 146 cases, 79 meet the quality criteria for assessment (15 cases were excluded due to underactive bladder). Fifty cases were categorized with obstruction and 29 without.

Farrar, Chassagne and Lemack showed high specificity. In contrast, Defreitas, Blaivas and Groutz high sensitivity. Solomon-Greenwell nomogram was the most specific and sensitive, obtaining the highest likelihood positive ratio >100 (Table 1).

Table 1. Likelihood positive ratio, sensitivity and specificity for BOO definitions

BOO criteria	*LR*	*Sensitivity*	*Specificity*
Farrar	6	12%	100%
Chassagne	22	40%	100%
Lemack	8	18%	100%
Defreitas	12	100%	20%
Blaivas and Groutz	20	100%	31%
Solomon-Greenwell	103	100%	100%

Discussion

The urodynamic assessment provides critical data for management for patients with BOO. The definitions of BOO in woman use different parameters cut-offs resulting in a variety of sensitivity and sensibility. This study has shown that Solomon-Greenwell nomogram had a useful diagnostic value for BOO, providing the highest sensitivity and specificity, compared with the other definitions. Chassagne and Defreitas have qualitative criteria and no arithmetic operations, making it easier to be applied. Blaivas and Groutz proposed a visual nomogram, due to its simplicity has been the most acknowleged. Nevertheless, adequate training for the interpretation of urodynamic studies and its quality control are essential for the application of any definition.

Solomon Greenwell nomogram proved an excellent level of agreement compared with radiographic evidence against different urodynamic definitions.[11] We found similar results in our study, however, recent studies have shown that the sensitivity of the Solomon-Greenwell nomogram for detecting female BOO was not satisfactory.[12] This could be explained due to the different etiologies of the obstruction.

We acknowledge several limitations of our study, this was a retrospective study and etiologies of the obstruction were not categorized, we did not discriminate if the obstruction was for functional or anatomic causes. We didn´t used videourodynamics as gold standard. We

assumed obstruction in patients that fulfilled the criteria of at least three definitions of BOO as the control group.

The ideal operational definition should be simple to apply, based on reliable data obtained from the pressure-flow profile in order to avoid subjectivity. In case some arithmetic calculations are performed, should be as simplified. Larger studies with adequate methodological quality are required, also categorized by specific cause.

Conclusion

The diagnosis of BOO requires expertise and individualization, it is made through physical examination and complete urodynamic study, Solomon-Greenwell has shown to be specific and sensitive for diagnosis in our group of study.

CRediT Taxonomy

P. Castro: Data collection or management, data analysis, manuscript writing.
I. Noyola: Protocol/project development, manuscript writing.
E. Maldonado: Protocol/project development, manuscript writing.
J. Moreno: Protocol/project development, data collection or management, data analysis, manuscript writing/editing.

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Conflict of interest

The authors declare no conflicts of interest.

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