

Manometric scale of pelvic floor muscles strength in prostatectomized men

Escala manométrica da força muscular do assoalho pélvico em homens prostatectomizados

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Abstract

Introduction: An assessment of muscle contraction is necessary to optimize therapeutic targets and control the evolution of stress urinary incontinence rehabilitation. Digital palpation in conjunction with perineometer are reliable for scientific requirements. However, the absence of reference values in manometer affects reading the assessment results. **Objective:** To develop a classification scale for manometry of pelvic floor muscle (PFM) strength in prostatectomized men. **Methods:** A cross-sectional study was conducted at the Department of Physiotherapy at Hospital dos Servidores (Rio de Janeiro, Brazil). We evaluated a total of 100 patients, aged 51 to 78 years, who undergone radical retropubic prostatectomy. An expert performed the test using a perineometer. PFM strength data were collected and classified according to results. An evaluated scale was developed. **Results:** The Normal distribution of the PFM strength was estimated by use of Kolmogorov-Smirnov test (KS d = 0.13; p = 0.10). Removal of nine outliers. The measurement of PFM strength of 91 participants was 56,4 ± 33 cmH_2O. From these results, the manometric scale of the PFM strength was developed: excellent (above 123 cmH_2O), very good (from 90 to 122 cmH_2O), good (from 57 to 89 cmH_2O), regular (from 24 to 56 cmH_2O), and insufficient (below 23 cmH_2O). **Conclusion:** The method developed has advantages: to eliminate predictor error, and to bridge the gaps among categories where PFM strength is not divided into grade levels.

Keywords: Manometry. Men's health. Muscle strength. Pelvic floor. Prostatectomy.

Resumo

Introdução: *Avaliações da contração muscular tornam-se necessárias para otimizar alvos terapêuticos e controlar a evolução da reabilitação da perda urinária por esforço. A palpação digital, em conjunto com o perineômetro, é confiável para requisitos científicos. No entanto, a ausência de valores de referência no manômetro afeta a leitura dos resultados da avaliação.* ***Objetivo:*** *Desenvolver uma escala de classificação para manometria da força muscular do assoalho pélvico (FMAP) em homens prostatectomizados.* ***Métodos:*** *Realizou-se um estudo transversal no Departamento de Fisioterapia do Hospital dos Servidores (Rio de Janeiro, Brasil). Foram avaliados um total de 100 pacientes, com idade entre 51 e 78 anos, submetidos à prostatectomia radical retropúbica. Um especialista realizou o teste usando um perineômetro. Os dados de FMAP foram coletados e classificados de acordo com os resultados. Uma escala avaliada foi desenvolvida.* ***Resultados:*** *Distribuição normal (KS d = 0,13; p = 0,10). Remoção de nove* outliers*. A medida da FMAP de 91 participantes foi de 56,4 ± 33 cmH_2O. A partir desses resultados, desenvolveu-se a escala manométrica da FMAP, sendo: excelente (acima de 123 cmH_2O), muito boa (de 90 a 122 cmH_2O), boa (de 57 a 89 cmH_2O), regular (de 24 a 56 cmH_2O) e insuficiente (abaixo de 23 cmH_2O).* ***Conclusão:*** *O método desenvolvido tem vantagens: eliminar o erro do preditor e preencher as lacunas entre as categorias em que a força muscular do assoalho pélvico não é dividida em níveis de graduação.*

Palavras-chave: *Manometria. Saúde masculina. Força muscular. Assoalho pélvico. Prostatectomia.*

Introduction

The Global Cancer Observatory (Globocan) estimates prostate cancer was the second most frequent malignant tumor in men worldwide. In 2020, Globocan estimates 1,400,000 new cases of cancer, approach 14.1% of the total cancer value.[1] In Brazil, it occupies the first position regarding incidence of cancer in men. Triennial 2023 to 2025 an estimated 72,000 (10.2%) of new cases.[2]

Stress urinary incontinence (SUI) is an adverse side effect of radical prostatectomy. This effect is a result of intraoperative damage to bladder neck closure and urinary sphincter.[3,4] Continence is preserved by the external sphincter. Weakness of this muscle causes urine leakage. Pelvic floor muscle (PFM) contraction strengthens the perineum, reduces urine loss and develops protective reflex mechanism during effort such as cough.[5,6]

An assessment of muscle strength reveals a muscle contraction. This is an important component of the physical exam, which optimizes therapeutic targets and controls the evolution of the rehabilitation program.[7] The two methods most routinely used by physiotherapists to assess muscle properties are digital palpation, which is subjective, and the perineometer, developed for objective evaluation and quantification of pelvic floor muscle (PFM) contraction.[8] Both are strongly reliable for scientific requirements and clinical implementation for both genders (ICC < 0.93).[9,10]

Although being a reliable method, the absence of reference values in manometry affects reading the assessment results. To simplify the interpretation of professionals during clinical practice, Angelo et al.[11] developed a classification scale for manometry in women according to modified Oxford scale. Nevertheless, there is not yet a classification scale for prostatectomized. Therefore, the aim of this study was to develop a classification scale for manometer in prostatectomized, in agreement with the modified Oxford scale.

Methods

A cross-sectional study was developed in the Department of Physiotherapy at Hospital Federal dos Servidores do Estado (HFSE), Rio de Janeiro, Brazil, between October 2017 and February 2019. The assessment was done by a physiotherapist specialized who underwent two months of evaluation standardization.

The sample was on account of non-probability sampling process. This study used a convenience sample of 100 consecutive patients aged between 51 and 78 years, who undergone radical retropubic prostatectomy surgery. They were referred to the outpatient physiotherapy service by HFSE's urologists. The patients had SUI due to sphincter weakness. Inclusion criteria were: patients with low or intermediate risk prostate cancer, surgical operation 1 month up to 6 months, use of two to five disposable incontinence pads daily. Exclusion criteria were: patients with urinary symptoms such as obstructive uropathy or urinary tract infection, those who underwent transurethral resection of the prostate or previous radiotherapy post- surgical.

All participants were informed about the study and signed a statement of free and informed consent. The presented study was approved by the Ethics Committees of the State University of Rio de Janeiro (UERJ) and the HFSE (protocol no. 49971115,5, 0000.5259).

Measurement of pelvic floor muscle strength

A Peritron perineometer (PFX 9300®, Cardio-Design Pty, Ltd, Baulkham Hills, Australia, 2153), was used to measure PFM strength. The typical error of the measurement was 3.1 cmH_2O (4%) and ICC of 0.99 (95% CI = 0.98 to 0.99). The familiarization was done two or four days before the real muscle strength test. They were instructed to perform three contractions.

During the examination, the patient was standing in lateral knee-chest position on an exam table. He was asked to take off his pants and underwear. Then, the professional inserted a rectal probe into the anus and placed his other hand on the side of the abdomen to control abdominal pressure during pelvic floor contraction. Peritron measures anal force pressure through a conical sensor enclosed with a medical silicone rubber sheet. The sensor was connected to a portable microprocessor with a latex tube, allowing evaluation of force pressure in centimeters of water, therefore evaluating indirect force of this muscular structure. The occlusive pressure readings from a manometer are a representative compute of strength.[1]

Peritron was reseated to zero before each measurement. The sensor was not inflated. In agreement with the manufacturer, inflation is an optional resource that can reduce the sensitivity of the sensor's response. Patients were instructed to undertaken three maximum muscle contractions with an interval of 30 seconds.[12] Co-contraction of gluteal and hip adductor muscle was discouraged, as well as Valsalva maneuver. Just cranial inside contractions were valued.[13,14] The maximum value of the three contractions was documented.

Manometric scale of pelvic floor muscle strength

A manometric scale of PFM strength was developed using the mean (x) and standard deviation of the strength of the PFM assessed by a perineometer in men, as indicates in Table 1. The manometric scale was based on the central limit theorem in which about 70% of the results will become between the mean ± 1 standard deviation, about 95% of results will become between the mean ± 2 standard deviations, when the distribution of results is normal.

Table 1 - Development of manometric scale of pelvic floor muscles strength

Classification	Pelvic floor muscles strength (cmH_2O)
Excellent	Above x to + 2 standard deviation (SD)
Very good	From x + 1 SD to x + 2 SD
Good	From x to x + 1 SD
Regular	From - 1 SD to x
Insufficient	Below x to - 1 SD

Data analysis

Values were expressed as mean ± standard deviation. Two standard deviations above or below the mean were considered outliers and were excluded. Data normality was assessed with Kolmogorov-Smirnov (KS) test for development of manometric scale. Those analyses were performed using STATISTICA 7.0 Copyright, Stat Soft, Inc. 1984- 2004 package.

Results

A total of nine outliers were excluded. The measurement of PFM strength of 91 subjects was 56.4 ± 33 cmH_2O. The normal distribution of the PFM strength was estimated by the use of the KS test ($d = 0.13$; $p = 0.10$; Figure 1). According to those results, in view of the method described in Table 1, the manometry scale of the PFM strength was developed in Table 2.

Table 2 - Manometric scale of pelvic floor muscle strength

Classification	Pelvic floor muscles strength (cmH_2O)
Excellent	Above 123
Very good	From 90 to 122
Good	From 57 to 89
Regular	From 24 to 56
Insufficient	Below 23

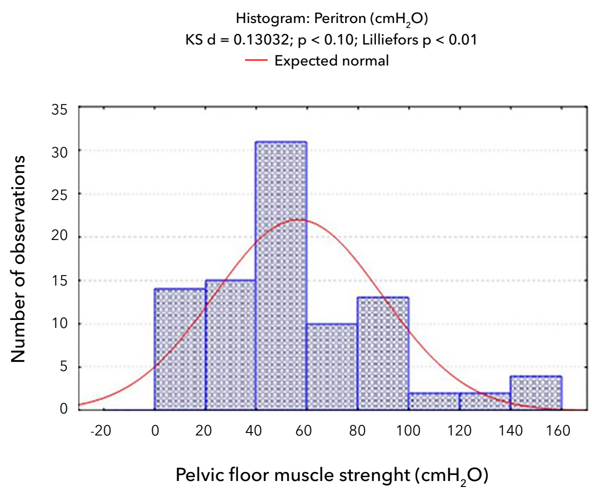

Figure 1 - Normal distribution of pelvic floor muscles strength (n = 91).

Discussion

PFM training is done to reduce SUI. Its teaching is drawn on a reliable and valid assessment of PFM strength.[15] The force of PFM can be measured by different methods: clinical observation, vaginal or rectal palpation, ultrasound, magnetic resonance imaging (MRI), electromyography (EMG), manometry and dynamometer. All of them have their place in clinical evaluation, each with its own qualities and limitations. Ultrasound and MRI are technologies not economically available to the majority of physical therapists. Surface EMG must be used with attention due to higher risk of crosstalk in other muscles. Palpation is the technique widely used by physical therapists to evaluate a correct PFM contraction, but it is questioned for being subjective and establishing qualitatively whether there is a muscle contraction.

Perineometer and digital palpation are the most frequently used methods to measure PFM strength in clinical practice. Although subjective, digital examination is a helpful examination tool used by therapists. However, it is insufficient for valid research.[16] A perineometer measurement assesses contraction and force of PFM, nevertheless there is no validated scale to classify contraction of PFM such as the modified Oxford scale.[11] Integrating both methods result in an exposure of values in series. This development could aid and clarify clinical practices. There is a correlation between the two techniques. The use of either it is often better, but it is not yet possible to rate muscle strength quantification measured with perineometer in prostatectomized men.[17] Our scale takes on different characteristics of participants in comparison with the scale developed by Angelo et al.[11] In their study, participants were women aged between 18 and 80 years, who had not given birth or underwent vaginal surgery within the last six months.[11] In our study, participants were men aged between 51 and 78 years who underwent radical retropubic prostatectomy surgery following urinary incontinence. Moreover, the development of the two scales was different. Angelo et al.[11] drew it on simple regression, while in this study the development was built on the central limit theorem.

Considering the simple linear method with low variance of prediction variable Oxford scale of 1 to 5 points may have contributed to the higher standard error of estimate (not reported in Angelo et al.[11]). Moreover, some intervals among categories are missing due to unidentified PFM strength. A solution reported by Angelo et al.[11] to fractionate each interval in half, allocating the upper half to the high category and the bottom half to the lowest category. Although rational and intelligent, this measure was unscientific. According to the central limit theorem tested, 68% of results held within ± 2.0 standard deviation average. The data followed a normal distribution.

Conclusion

The scale developed in this study to measure the strength of PFM of men with SUI as a side effect of prostate cancer surgery has two advantages: to eliminate predictor error, and to bridge the gaps among categories where pelvic floor muscle strength is not divided into grade levels.

Authors' contributions

PZ was responsible for data acquisition, and EBS, for the analysis and interpretation of data. APDF wrote and edited the manuscript, while EBS critically reviewed the article. All authors approved the final version.

References

1. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2018;68(6):394-424. DOI

2. Instituto Nacional de Câncer José Alencar Gomes da Silva. Estimativa 2023: incidência de câncer no Brasil. Rio de Janeiro: INCA; 2022. Available from: http://controlecancer.bvs.br/

3. Migliari R, Pistolesi D, Buffardi A, Muto G. Continence physiology and male stress incontinence pathophysiology. In: Del Popolo G, Pistolesi D, Li Marzi V (eds). Male stress urinary incontinence, urodynamics, neurology and pelvic floor dysfunctions. Cham, Switzerland: Springer; 2015. p. 17-34. DOI

4. Kelly HA, Dumm WM. Urinary incontinence in women, without manifest injury to the bladder. 1914. Int Urogynecol J Pelvic Floor Dysfunct. 1998;9(3):158-64. DOI

5. Siegel AL. Pelvic floor muscle training in males: practical applications. Urology. 2014;84(1):1-7. DOI

6. Biroli A. Post-prostatectomy Incontinence and rehabilitation: timing, methods, and results. In: Del Popolo G, Pistolesi D, Li Marzi V (eds). Male stress urinary incontinence, urodynamics, neurology and pelvic floor dysfunctions. Cham, Switzerland: Springer; 2015. p. 107-15. DOI

7. Rahmani N, Mohseni-Bandpei MA. Application of perineometer in the assessment of pelvic floor muscle strength and endurance: a reliability study. J Bodyw Mov Ther. 2011;15(2):209-14. DOI

8. Hundley AF, Wu JM, Visco AG. A comparison of perineometer to brink score for assessment of pelvic floor muscle strength. Am J Obstet Gynecol. 2005;192(5):1583-91. DOI

9. Kottner J, Audigé L, Brorson S, Donner A, Gajewski BJ, Hróbjartsson A, et al. Guidelines for Reporting Reliability and Agreement Studies (GRRAS) were proposed. J Clin Epidemiol. 2011;64(1):96-106. DOI

10. Zaidan P, Pereira FD, Silva EB. Strength of pelvic floor in men: reliability intra examiners. Fisioter Mov. 2018;31:e003110. DOI

11. Angelo PH, Varella LRD, Oliveira MCE, Matias MGL, Azevedo MAR, Almeida LM, et al. A manometry classification to assess pelvic floor muscle function in women. PLoS One. 2017; 12(10):e0187045. DOI

12. Barbosa PB, Franco MM, Souza FO, Antônio FI, Montezuma T, Ferreira CHJ. Comparison between measurements obtained with three different perineometers. Clinics. 2009;64(6): 527-33. DOI

13. Messelink B, Benson T, Berghmans B, Bø K, Corcos J, Fowler C, et al. Standardization of terminology of pelvic floor muscle function and dysfunction: report from the pelvic floor clinical assessment group of the International Continence Society. Neurourol Urodyn. 2005;24(4):374-80. DOI

14. Frawley HC, Galea MP, Phillips BA, Sherburn M, Bø K. Reliability of pelvic floor muscle strength assessment using different test positions and tools. Neurourol Urodyn. 2006; 25(3):236-42. DOI

15. Bø K, Kvarstein B, Hagen RR, Larsen S. Pelvic floor muscle exercise for the treatment of female stress urinary incontinence: II. Validity of vaginal pressure measurements of pelvic floor muscle strength and the necessity of supplementary methods for control of correct contraction. Neurourol Urodyn. 1990;9(5): 479-87. DOI

16. Bø K, Finckenhagen HB. Vaginal palpation of pelvic floor muscle strength: inter-test reproducibility and comparison between palpation and vaginal squeeze pressure. Acta Obstet Gynecol Scand. 2001;80(10):883-7. DOI

17. Chevalier F, Fernandez-Lao C, Cuesta-Vargas AI. Normal reference values of strength in pelvic floor muscle of women: a descriptive and inferential study. BMC Womens Health. 2014;14:143. DOI