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Comparative study of pelvic floor function in continent and incontinent postmenopausal women

Estudo comparativo da função do assoalho pélvico em mulheres continentes e incontinentes na pós menopausa

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Abstract

Background: Urinary incontinence (UI) is multifactorial and attributed, in part, to weakness of the pelvic floor muscles. Despite being underestimated by many women, a functional pelvic floor assessment (FPA) may contribute to a correct diagnosis and appropriate treatment. **Objectives:** To compare the function of pelvic floor muscles in continent and incontinent postmenopausal women as a diagnostic factor in UI treatment. **Methods:** Based on the investigation of urinary symptoms, 153 women (age X=66.7±5.4) were divided into two groups (G1-incontinent and G2-continent). After analysis of the inclusion criteria, the women were submitted to FPA by means of bidigital palpation according to Contreras Ortiz (1994)* and quantification of perineal strength with a perineometer (PERINA 996-2 QUARK®). **Results:** There was prevalence of UI (54.9%) in the sample, with stress urinary incontinence (41.7%) as the most common. Regarding urinary symptoms such as diurnal (p=0.004) and nocturnal (p=0.02) voiding frequency, G1 had a significantly higher value. The FPA found similar results via palpation and the perineometer, with significant differences (p<0.001) between the two groups. We used descriptive statistics, the Student t test for independent samples, measures of prevalence and one-way ANOVA, followed by Bonferroni's post-hoc test (p≤0.05). The software Statistical Package for the Social Sciences (SPSS) version 10.0 (SPSS, Chicago, IL) was used to perform all tests. **Conclusions:** Palpation and the perineometer were efficient forms of assessing the force and pressure of the muscle contractions of this muscle group.
Article registered in the Clinical Trials.gov under the number NCT00765622.

Key words: urinary incontinence; pelvic floor; functional assessment.

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Resumo

Contextualização: A incontinência urinária (IU) é de causa multifatorial, sendo atribuída, em parte, à fraqueza da musculatura do assoalho pélvico. Apesar de ser subestimada por muitas mulheres, a avaliação funcional do assoalho pélvico (AFA) pode contribuir para um correto diagnóstico e terapêutica adequada. **Objetivos:** Comparar a função muscular do assoalho pélvico em mulheres continentes e incontinentes na pós menopausa como fator diagnóstico no tratamento da IU. **Métodos:** A partir da investigação dos sintomas urinários, 153 mulheres (idade X=66,7±5,4) foram separadas em dois grupos (G1 incontinentes e G2 assintomáticas). Após análise dos critérios de inclusão, as mulheres foram submetidas à AFA por meio da palpação bidigital (classificação de Contreras Ortis, 1994*) e à quantificação da pressão de contração perineal por meio do perineômetro (PERINA 996-2® QUARK). **Resultados:** Observou-se prevalência de IU (54,9%) na amostra estudada, sendo a incontinência urinária de esforço (IUE) (41,7%) o tipo mais presente. Em relação aos sintomas urinários, como a frequência miccional diurna (p=0,004) e noturna (p=0,02), o grupo G1 apresentou um valor significativamente mais alto. A AFA mostrou resultados similares durante a palpação e o perineômetro, com diferenças significativas (p<0,001) entre os dois grupos. Utilizou-se estatística descritiva, teste *t* de *Student* para amostras independentes, medidas de prevalência e análise de variância (one-way ANOVA), seguida do post hoc de Bonferroni (p≤0,05). O software Statistical Package for the Social Sciences (SPSS) versão 10,0 (SPSS, Chicago, IL) foi utilizado para realização de todas as análises. **Conclusões:** A palpação e o perineômetro se mostraram eficientes na avaliação da força e pressão de contração desse grupo muscular.
Artigo registrado no Clinical Trials.gov sob o número NCT00765622.

Palavras-chave: incontinência urinária; assoalho pélvico; avaliação funcional.

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Introduction

Urinary incontinence (UI) is defined as any condition resulting in the involuntary loss of urine, which constitutes a social or hygienic problem for women[1]. The etiology of UI is complex and a factor of social exclusion, interfering with the physical and mental health and the quality of life of affected individuals[2]. In Brazil, UI represents a costly public health problem. According to the symptoms displayed by patients, UI can be classified as stress urinary incontinence (SUI), urge urinary incontinence (UUI) or mixed urinary incontinence (MUI).

SUI is the most common form of UI, with a prevalence ranging from 12.6 to 48%[1], and its clinical symptoms and prognosis worsen with age[3]. In SUI, the involuntary loss of urine occurs after coughing, sneezing or physical strain[1]. Among the various risk factors[3,4] are the changes caused by pregnancy, obesity, decreased ovarian function, childbirth and aging[4-8], which are factors that confer a poor quality of response and a decrease in force production by a pelvic muscle. The levator ani muscle works as an occasional closing mechanism at times of increased intra-abdominal pressure[9], helping to maintain maximum urethral pressure greater than bladder pressure. With age, however, there is an impairment of the neuromuscular support of the pelvic floor[10] and progressive atrophy of supportive tissues, which hinders the arrangement of the levator ani muscle fibers[11].

Although many patients do not consider UI serious enough to require a clinical assessment[12], its diagnosis is very important. This relevance is justified because it allows the appropriate treatment for each case, thus reducing the risk of failures and complications[13] from surgical procedures that are not only invasive and expensive[14] but also have failure rates of up to 35% in patients with sphincter problems[10]. In contrast, physical therapy has been recommended by the International Continence Society as the best option for treatment of UI due to its low cost and risk, as well as proven efficiency[15]. Therefore, it is important to highlight the anamnesis, which has the function of identifying the urinary symptoms[16], and the physical examination, which determines the best course of action. The assessment of pelvic floor muscle strength and endurance is an integral part of the physical examination[17], given that it is not easy to contract the pelvic floor muscles. It is estimated that 30 to 50% of women are unable to contract this muscle group correctly[18,19].

Among the tests adopted to assess the pelvic floor muscles are electromyography, histomorphological analysis of muscle biopsy and clinical assessment by bidigital palpation, perineometer and vaginal cones[20]. Bidigital palpation is a simple method that does not require instrumentation and can provide quantitative data on strength and endurance during pelvic floor muscle contraction. The functional pelvic floor assessment (FPA) is graded according to the classification by Contreras Ortiz[20]. In addition to bidigital palpation, the perineometer can be a useful assessment device. It is a pneumatic resistance device designed in 1950 by gynecologist Arnold Kegel[19] and based on the same principle as the sphygmotensiometer. It consists of an inflatable vaginal probe connected to a manometer that indicates to the patient and to the therapist the pressure generated during a contraction. The purpose of the present study was to compare the pelvic floor muscle function of continent and incontinent postmenopausal women as a diagnostic factor in the treatment of UI.

Methods

A total of 153 women aged 58 to 87 years (mean=66.7±5.4) were assessed at the Urogynecologic and Obstetric Physical Therapy Clinic of the hospital of Universidade Católica de Brasília (UCB) between May 2007 and June 2008. The inclusion criteria were: postmenopausal women who agreed to take part in the study and who were self-sufficient in activities of daily living (ADLs). Women were excluded if, during the assessment, they reported urinary tract infection, chronic cough or lesions in the perineal region, cognitive impairments which could hinder the understanding of the therapist's commands and anatomical restrictions which hindered the examination by palpation and/or by perineometer.

Based on the anamnesis, which consisted of a full investigation of the bladder function and related complaints, the patients were divided into two groups (G1=incontinent women and G2=asymptomatic women). The classification of the type of UI was based on the clinical complaints during the anamnesis. All patients underwent physical therapy assessment, which was designed to assess the ability to contract the pelvic floor muscles by means of bidigital palpation and quantify the pressure generated during contraction by means of the perineometer. The analyzed variables included urinary symptoms such as diurnal and nocturnal voiding frequency, risk factors such as obesity, parity and time of menopause, the contraction pressure obtained by perineometer and the pelvic floor strength by bidigital palpation.

The assessment by means of bidigital palpation was performed with the patient lying in a modified gynecological

position (hip flexion-abduction with feet flat on the examination table). The assessor wore gloves lubricated with gel and placed the index and middle fingers in the vaginal canal. The patient was asked to contract the pelvic floor muscles and sustain the contraction as long as possible. The classification by Contreras Ortiz[20] was used to assess the muscle strength.

After bidigital palpation, the quantification of the contraction pressure was confirmed using a perineometer (PERINA 996-2®, QUARK), a myofeedback device that records the pressure of pelvic floor muscle contractions and transforms its intensity into visual signals. This device consists of a vaginal probe with a thick latex sheath held by rubber rings. The device meets all of the standard safety requirements for electrical medical devices set out by General Standard IEC 601 and Electrical Stimulator Standard IEC 601-2-10. The intracavitary probe was connected to a pressure manometer, covered with a condom smeared with gel and introduced into the vaginal canal. The valve was closed, and the probe was slowly inflated until the patient reported contact between the probe and the vaginal wall indicated by a slight distension without pain.

For the application of the device, the sensitivity control was set at maximum by turning the button to the right. The tare control was set at maximum, and the red LEDs on the display reached the top of the scale. After adjustment of the device, the patient was asked to contract the pelvic floor muscles three consecutive times and sustain the contraction as long as possible. The lights on the panel lit up according to the pressure during contraction. The intensity and the time of the perineal muscle contractions were observed, and the mean of three contractions was considered for analysis.

Considering the risk factors for UI, we assessed body mass index (BMI), parity and time of menopause. The BMI was calculated as body mass divided by height squared (kg/m^2), with values equal to or greater than 30 defined as obesity. With regard to parity, only vaginal deliveries were considered, and miscarriages and abdominal deliveries were excluded. The time of menopause was considered as the time in years between the last day of the menstrual cycle and current age.

For analysis of data normality, the Kolmogorov-Smirnov test was used. The results are presented through descriptive statistics, using the procedures of mean and standard deviation. Student's t test was performed to compare the various study variables between incontinent and continent patients. The distribution of types of incontinence among participants is shown through measures of prevalence, whereas comparisons of variables of interest between the types were conducted through one-way ANOVA, followed by Bonferroni's post-hoc test. The level of significance was set at $p<0.05$. The Statistical Package for the Social Sciences (version 10.0) software (SPSS, Chicago, IL) was used to carry out all analyses. All patients agreed to take part in the study by signing an informed consent form, and the study was approved by the Research Ethics Committee of UCB (CEP/UCB 014/2007).

Results

The patients selected for this study had a mean age of 66.71±5.4 years. When considering the clinical complaints, it was observed that 84 women (54.9%) were incontinent and 69 (45.1%) were continent, being respectively classified into two groups: G1) incontinent and G2) continent. The variables examined during the study had a normal distribution, therefore, the subsequent analyses were performed using parametric statistical tests.

When considering the characteristics of the clinical complaint of urinary loss in G1, there was a prevalence of 41.7% for SUI, 23.8% for UUI and 34.5% for MUI. Table 1 shows the comparison analysis between the types of UI in relation to risk factors, urinary symptoms and response of the pelvic floor muscles. One-way ANOVA revealed significant differences between the types of incontinence relative to age and time of menopause. The post-hoc analyses identified higher values in the UUI group. There were no significant differences for other variables.

Table 2 shows the comparison of dependent variables between the continent and incontinent women. There were no significant differences for age ($p=0.08$), BMI ($p=0.79$), time of menopause ($p=0.35$) and parity ($p=0.42$). When considering the symptoms related to bladder function, G1 had significantly higher diurnal ($p=0.004$) and nocturnal voiding frequency ($p=0.02$). Regarding the strength of the pelvic floor muscles, G2 had significantly higher values. This finding was true for the assessment by means of the perineometer ($p<0.001$) and bidigital palpation ($p<0.001$). The ability to sustain pelvic floor contraction was not significantly different between groups. Moreover, it was observed that age correlated negatively and significantly with the results from the perineometer assessment ($r=-0.16$, $p=0.04$).

Discussion

The prevalence rates of UI in women vary widely according to the methodology used in each study[2], however

Table 1. Comparative analysis between the types of UI, risk factors, urinary symptoms and response to contraction of the pelvic floor muscles.

Variables	Type of urinary incontinence			p value
	SUI	UUI	MUI	
N (%)	35 (41.7)	29 (34.5)	20 (23.8)	
Age (years)	65.97±5.69	69.66±6.26	65.85±4.74	0.02*
Time of menopause (years)	16.71±7.47	21.83±7.82	19.65±6.75	0.03*
Parity	5.63±2.44	5.59±3.59	5.35±3.39	0.95
Diurnal voiding frequency	5.20±1.98	5.48±2.28	6.00±2.56	0.44
Nocturnal voiding frequency	1.66±1.41	2.07±1.67	1.65±1.23	0.47
Perineometer (mmHg)	0.51±0.39	0.58±0.44	0.42±0.31	0.36
FPA	1.63±0.97	1.38±0.78	1.25±1.12	0.32

SUI=stress urinary incontinence; UUI=urge urinary incontinence; MUI=mixed urinary incontinence; FPA=functional pelvic floor assessment; * significant difference.

Table 2. Comparative analysis between continent and incontinent women and the variables.

Variables	G1	G2	p value
Age (years)	67.21±5.90	66.10±4.70	0.08
BMI (kg/m^2)	27.17±4.65	26.98±4.52	0.79
Time of menopause (years)	19.18±7.67	18.00±7.80	0.35
Parity	5.55±3.07	5.16±2.85	0.42
Diurnal voiding frequency	5.49±2.23*	4.57±1.63	0.004*
Nocturnal voiding frequency	1.80±1.46*	1.30±1.19	0.002*
Perineometer (mmHg)	0.51±0.39*	0.96±0.52	<0.001*
FPA	1.45±0.95*	2.38±0.96	<0.001*

BMI=body mass index; FPA=functional pelvic floor assessment; * Significant difference ($p \leq 0.05$) between groups G1 and G2.

several factors can contribute to increased prevalence. Among these factors, age is one of the most important. In this study, the mean age was 66.71±5.4 years, which can be considered an advanced age because of the natural aging of the muscle fibers with subsequent hypotrophy or replacement by adipocytes. In the pelvic floor, this process can contribute effectively to incontinence[8]. According to Lopes and Higa[21] and Higa, Lopes and Reis[2], the incidence of UI increases with age, and it is more common in females. It is thought that UI has multifactorial and complex origins and, along with age and gender, some studies have reported pregnancy and delivery[7,22-24] as risk factors for UI. However, this study found no significant differences between the groups. Other factors such as obesity and time of menopause are usually related to the onset of symptoms of urinary loss[6,7], however, in this study, there was no significant difference for obesity and time of menopause.

According to the findings of the present study, the prevalence of SUI was higher than the MUI and UUI, which corroborates the findings of Abrams et al.[1] and Guarisi et al.[25]. These studies differ in methodology, however it was possible to observe a prevalence of SUI, ranging from 12.6 to 49% of the incontinent women assessed. It was not possible to submit the patients of the present study to a urodynamic test, therefore the UI diagnosis was based on careful anamnesis, physical examination and ambulatory tests. Although the lack of diagnostic confirmation by a urodynamic test did not limit the study, it could have been elucidative in some cases, especially in the severe UI cases. Feldner et al.[16] investigated the relationship between the clinical complaint and the urodynamic findings in 114 patients with a mean age of 51 years and reported that the clinical sign of stress urinary incontinence was present in 43.8% of the patients. Furthermore, 82% of the women with clinical signs of stress had this sign related to urodynamic findings, showing a stress component in SUI. The remaining 18% had a normal test or a diagnosis other than SUI. Together, the results led the authors to conclude that the clinical history, combined with the physical examination, is important in the management of urinary incontinence, but the urodynamic test would be recommended to confirm the diagnosis. This variation observed in different populations confirms the multifactorial aspect of UI; it can also be attributed to extrinsic factors such as sustenance and nutritional, socioeconomic and even genetic status, as stated by Laycock et al.[26], because these characteristics can change the proportion of type I and II fibers and/or connective tissue fibers that are essential elements to the mechanism of sphincter closure, however this aspect needs further investigation. In Brazil, there are few studies on the prevalence of UI involving the female population in different age groups, as few women seek medical help spontaneously, making it difficult to identify the possible risk factors associated with symptoms of urinary loss.

Regarding strength and pressure of contraction, when comparing the two groups, there was an increased response in the group of continent patients, demonstrating the importance of preventive work, because the mechanisms that lead women with UI to have less pelvic floor strength are not yet fully understood. Thompson et al.[27] found similar results, showing that the women who comprised the sample had very little body awareness and poor ability to contract the pelvic floor muscles.

However, a decline in overall muscle strength in a female population aged over 60 years was also observed by Vandervoort[28] who attributed these findings in part to the loss of type II muscle fibers. These muscle fibers are extremely important in fast-twitch responses, especially under stress conditions. In SUI, there is a difficulty in maintaining the intraurethral pressure at higher levels compared to the normal pattern; when there is sudden increase in intra-abdominal pressure, urinary loss occurs. Haddad[29] suggested that the striated muscle of the pelvic floor plays a relevant role in the mechanism of continence, because it is crucial in maintaining the anatomical support and intraurethral pressure.

Based on this information, we must be careful to attribute an etiological factor of SUI only to inadequate urethral support or to the atrophy of the pelvic floor muscles, although this hypothesis is supported by Glashan and Lelis[30] and Fall[31]. However, Figueiredo et al.[4] reported that women with the same degree of perineal function may report different symptoms of UI with a subsequent impact on their daily lives. Thus, it is important to consider that, although SUI is often attributed to urethral hypermobility caused in part by pelvic floor weakness, it is suggested that multiple risk factors be considered in association with pelvic floor muscle failure.

Regarding the risk factors associated with the onset of symptoms of urinary loss, there was no direct relationship with BMI, time of menopause and parity. These findings are consistent with those found by Guarisi et al.[25], who found no significant differences in risk factors for UI relative to age, obstetric factors, BMI, menopausal status and use of hormone replacement therapy. In contrast, Casado et al.[32] considered the trauma caused by multiple vaginal deliveries, previous pelvic surgery, localized inflammatory processes, metabolic disorders and estrogen deficiency as risk factors that may predispose the patient to urinary incontinence.

There is a need for a routine approach and for early investigation of strength, pelvic floor muscle resistance, use of adjuvant compensatory methods, and risk factors. These procedures are relevant to allow an early intervention, not only to identify possible risk factors but also to act through preventive strategies aimed at improving muscular quality and condition. The present study demonstrated that screening can be conducted with less invasive methods and techniques and with less risk to the health of patients, thus contributing effectively to improve muscle quality and reduce the prevalence of symptoms of UI in elderly patients. Facing the population growth, Rosenberg and Moore[33] also expressed a growing concern in elderly care, not only with regard to the biological aspect, but also with regard to the adaptation of social and health policies related to this population. Similarly, Knorst et al.[34] point to elderly care as a major public health problem, both in developed and developing countries, because the precarious socioeconomic conditions are associated with multiple pathologies, loss of autonomy and independence, and adaptation problems of the elderly, often leading to social isolation. The diagnosis of UI must be added to this overall assessment because it is not an inevitable process of aging. It is up to health professionals to develop studies to understand the types, methods and most appropriate forms of treatment so that the elderly can have better social and personal interactions.

Conclusions

It can be concluded that palpation and the perineometer were efficient in assessing the strength and the contraction pressure of the pelvic floor muscles. Thus, the aforementioned methods are important tools in screening for UI, especially given their low cost and easy implementation.

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