

Evaluation of urodynamics parameters in different age and incontinence group of women

Farklı yaş ve inkontinans gruplarındaki kadınlarda ürodinamik parametrelerin değerlendirilmesi

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Abstract

Aim: Overactive bladder syndrome (OAB) is known to have a negative impact on quality of life, and cause discomfort daily. Population-based studies on females report a prevalence of OAB which varies between 9.7% and 35.7%, with a substantial rise with increasing age. The primary aim of this analysis was to assess whether age was associated with differences in urodynamic testing parameters, using age as a continuous variable, and comparing women within wider age groups to understand physiologic variation.

Methods: In this retrospective cohort study, we evaluated the patients who were admitted to the Department of Gynecology and Obstetrics Department of Istanbul Education and Research Hospital between January 2017 and January 2020 with lower urinary tract symptoms (LUTS).

Results: We found that age, first sensation and first desire to void were strongly correlated ($P=0.007$, $P=0.003$ respectively), but a strong desire to void and maximum cystometric capacity were not ($P=0.09$, $P=0.11$ respectively). There was a weak negative correlation between detrusor pressure (P_{det}) and age ($p=0.08$). Histogram analysis of bladder compliance among stress, urge, mix incontinence and normal patients revealed that maximum compliance occurred in women of reproductive age.

Conclusion: Aging is associated with decreased self-control, thus, increased prevalence of LUTS symptoms among older women might be more accurately considered as the loss of an adaptive threshold to urinary control rather than age-associated decline in urinary functions.

Keywords: Age, Stress incontinence, Urge incontinence, Urodynamic test

Öz

Amaç: Aşırı aktif mesane sendromunun (OAB) yaşam kalitesi, normal günlük yaşam fonksiyonlarında rahatsızlık verdiği bilinmektedir. Kadınlar üzerinde yapılan nüfusa dayalı çalışmalar, artan yaşla birlikte %9,7 ve %35,7 arasında değişerek artan OAB prevalansı olduğunu bildirmektedir. Bu çalışmamızın ilk amacı, yaşın sürekli bir değişken olarak ürodinamik parametrelerde kullanılması veya ürodinami sonuçlarıyla ilişkisini değerlendirmek ve daha geniş yaş aralığındaki kadınların sonuçlarını karşılaştırarak fizyolojik değişiklikleri anlamaya çalışmaktır.

Yöntemler: Bu retrospektif kohort çalışmamızda, Ocak 2017 - Ocak 2020 tarihleri arasında İstanbul Eğitim ve Araştırma Hastanesi Kadın Hastalıkları ve Doğum Anabilim Dalı'na alt üriner sistem semptomları (AÜSS) ile başvuran hastaları değerlendirdik.

Bulgular: Özellikle ilk idrar duyma hissi ve işeme için ilk arzu ve yaş arasında çok güçlü negatif korelasyon saptadık (sırasıyla $P=0,007$, $P=0,03$). Ancak işeme için güçlü istek ve maksimum sistometrik kapasite ile yaş arasında ilişki bulamadık (sırasıyla $P=0,09$, $P=0,11$). Detrüsör basıncının (P_{det}) yaşla zayıf negatif korelasyonunu bulduk ($P=0,08$). Stres, urge, mix inkontinansı ve normal hastalarda mesane kompliansının histogram analizinde, üreme çağındaki kadınlarda maksimum komplians saptadık.

Sonuç: Menopozun inkontinans prevalansında bağımsız bir faktör olduğuna dair kanıtlar eksiktir ve gelecekte daha geniş yaş grubu kadınlarla araştırmalara ihtiyaç duyulmaktadır. Çalışmamız, büyük, heterojen ikincil bakım popülasyonunda ürodinami parametrelerini inceleyen az sayıdaki çalışmadan biridir. Yaşlanma, öz kontrolün azalmasıyla ilişkilidir, bu nedenle yaşlılarda artan AÜSS semptomları, üriner fonksiyonlarda yaşlı ilişkili düşüşten ziyade üriner kontrolde eşik kaybı olarak düşünülebilir.

Anahtar kelimeler: Yaş, Stres inkontinans, Urge inkontinans, Ürodinamik test

Introduction

Overactive bladder syndrome (OAB) is known to have a negative impact on quality of life, and causes discomfort daily [1–3]. Population-based studies on females report a prevalence of OAB that varies between 9.7% and 35.7%, with a substantial rise in prevalence with increasing age [4,5]. Previous studies have shown that aging induces detrusor underactivity, which is characterized by decreased bladder contraction and increased post-void residual urine (PVR) [6]. Clinical experience and the literature suggest that females may have an increase in urgency incontinence, voiding dysfunction and a decrease in bladder capacity, detrusor contractility, and urethral sphincter function with increasing age [7-9]. However, the results of these studies were based on questionnaire analyses. There have been many studies examining urodynamic changes among women at differing ages. These have, however, involved relatively small numbers of patients with no LUTS.

The difference between maximum urethral pressure (MUP) and bladder pressure (BP) is defined as closure pressure (CP). When CP is positive, the individual is continent; when it is negative or zero, it indicates incontinence.

The prevalence of aging-related diseases has been increasing, due to declining birth rate and mortality, and increasing life expectancy [10]. Urodynamically proven detrusor overactivity (DO) becomes much more common in old age, making it challenging to distinguish purely age-related changes in the bladder, from those due to DO.

Knowing age-associated changes in urodynamic parameters among females is insufficient. Thus, we analyzed age-associated changes in urodynamic parameters among women, especially in patients aged within a wide range, as studies have commonly involved the geriatric population.

The aim of this secondary analysis was to assess whether age is associated with differences in urodynamic variables of voiding, using age as a continuous variable, and comparing women with a wide age range for understanding physiologic variation.

Materials and methods

In this retrospective cohort study, we evaluated patients who were admitted to the Gynecology and Obstetrics Department of Istanbul Education and Research Hospital between January 2017 and January 2020 with lower urinary tract symptoms (LUTS). Various age groups of female patients (11-77 years old) diagnosed with stress, urge, mix incontinence and normal cystometric results who were referred to our Urodynamics Clinic were included in the study. Those with a history of SUI surgery within the past 6 months, current pregnancy, active infection demonstrated by catheterized urine dipstick analysis, a known active lesion or present injury to the perineum or urethra, or a known urethral obstruction were excluded.

Urodynamic study (UDS) was performed preoperatively by a single expert in an exclusive urodynamics room. UDS consisted of uroflowmetry followed by filling and voiding cystometry and was conducted interactively with the patient. Non-instrumented uroflowmetry was conducted when the

patients felt a normal desire to void and catheterized postvoid residual urine volume (PVR) was measured. Filling and voiding cystometry were conducted with the patient in sitting position. A 6-Fr triple-lumen transurethral catheter was inserted into the urethra and connected to the pressure transducer. Prior to bladder filling, signal quality check was performed. We checked that resting values for abdominal, intravesical, and detrusor pressures were in a typical range. Cough was used to ensure that the abdominal and intravesical pressure signals responded equally. Then, the bladder was filled at a rate of 50 mL/min. The artifacts occurring during the study were immediately corrected. All measured and derived signals were displayed according to ICS standards with abdominal pressure, vesical pressure, detrusor pressure, and flow [11]. Filling volume, electromyography, and voided volume were displayed in additional curves. UDS findings and the interpretation of the results were documented immediately after the study was finished. In the uroflowmetry, maximal flow rate (Qmax), time to Qmax, voided volume, PVR, and filling cystometry data including first, strong desire to void and Valsalva leak point pressure (VLPP) were measured. Also, Qmax and detrusor pressure at Qmax (Pdet@Qmax) of voiding cystometry data were analyzed.

Statistical analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences 15.0 software for Windows (SPSS, Chicago, IL, USA). Distributions of UDS parameters are described using the mean and standard deviation (SD) as well as the median and inter-quartile range (IQR 1/4 the difference between the 75th and 25th percentiles) to account for the skewness of some of the distributions. We provided histograms of the frequency distributions of the urodynamic data to graphically demonstrate any skewness. Statistical comparison of medians is performed using the Wilcoxon Signed Rank test at a 0.05 significance level.

Results

Out of 120 LUTS patients, 23 had stress, 57 had urge, 10 had mix-type incontinence and 30 had normal UDS findings.

We found that age, first sensation and first desire to void were strongly correlated ($P=0.007$, $P=0.003$ respectively), but a strong desire to void and maximum cystometric capacity were not ($P=0.09$, $P=0.11$ respectively). We found a weak negative correlation between P_{det} and age ($P=0.08$). Urodynamic data of the patients are shown in table 1.

Table 1: Urodynamic data of patients

	Patients (n=120)	SD
Mean age (years)	45.2	12.7
P _{det} max (cm H2O)	33.7	32.6
P _{det} open (cm H2O)	27	27
Bladder compliance (ml/cm H2O)	48.4	71.2
Detrusor compliance (ml/cm H2O)	35.4	35.4
First sensation (ml)	109.4	77.03
First desire to void (ml)	193.6	102.9
Strong desire to void(ml)	306.2	137.2
Maximum cystometric capacity (ml)	436.1	163.3

SD: standard deviation, P_{det} max: Maximum detrusor pressure, P_{det} open: opening detrusor pressure, P_{det} Qmax: detrusor pressure at maximum flow, P_{det} max: maximum detrusor pressure during voiding

Discussion

Sensory function has been shown to decline with age, leading to a higher volume at first desire to void in older women with LUTS undergoing cystometry [12]. Consistent with our

results, a study showed that menopausal female patients taking hormone replacement therapy maintained sensory function, implying that alterations in sensory function may be a primarily age-related phenomenon. We found a strong negative correlation between age and first sensation.

Wyndaele et.al. [13] studied bladder sensation in 50 normal volunteers and their sensation values, which were slightly higher than our results. As shown in Table 1, our values were 109.4, 193.6, 306.2 and 436.1 for first sensation, first desire to void, strong desire to void and maximum cystometric capacity, respectively. However, their study group was not homogeneous, both males and females were included.

Very few studies regarding age-associated changes in urodynamic parameters have been performed in a large group of females. In a recent study, the effect of aging on urodynamic parameters has been assessed among women with stress urinary incontinence (SUI) with a mean age of 57 years [14]. They found that Qmax, voided volume and Pdet@Qmax decreased and PVR and desire to void increased significantly with age after 60 years [10]. We also found a weak negative correlation between P_{det} and age. The difference between the two studies showed that as our study had more young population, P_{det} value did not progressively decrease with age, but other hormonal or physiologic factors played a role.

Another large study in postmenopausal females reported decreased urethral sphincter function and detrusor overactivity, as expected [15]. In that, study women older than 75 years of age showed deterioration in bladder function with a high incidence of detrusor hyperactivity with or without impaired contractility, whereas urethral function changed progressively. Interestingly, a progressive decrease of MUCP even in continent middle aged women occurred with aging, whereas PVR increased. Perucchini et al. [16] reported that this decrease could be the reflection of the association of age with a loss of striated muscle in the female urethra.

Another study in two large cohorts of women with stress urinary incontinence prior to surgery with the mean age of 50 years showed that the bladder contractility index was inversely related to age, decreasing a mean of 7.68 (1.96) cm-H₂O for each 10-year age increase and no difference in PVR. Those above 65 years of age also had lower VLPP than the younger cohort, which was explained with decreased outlet resistance, which would then potentially result in lower measured voiding pressure [17].

A study presented by Basu et al. [18] used multivariate analysis to investigate the data among different age groups (22-90 years). The outcomes of the analysis showed a significant effect on voiding volume but not on any other variables studied. According to their data, age was not related to flow rate percentile, maximum flow rate, or Pdet@Qmax. The study concluded that the main driver behind alterations in voiding is the diagnosis of DO, and not age. Their findings were not consistent with previous studies, which reported that bladder capacity improved with age [19]. We showed that detrusor compliance does not decrease in a linear fashion, rather, it increases from adolescence until the reproductive age and decreases throughout advanced age. Pareto analysis, performed in the P_{det}

urge incontinence and/or hypocompliance detrusor group, revealed similar findings with less linear increment (Figure 1, 2).

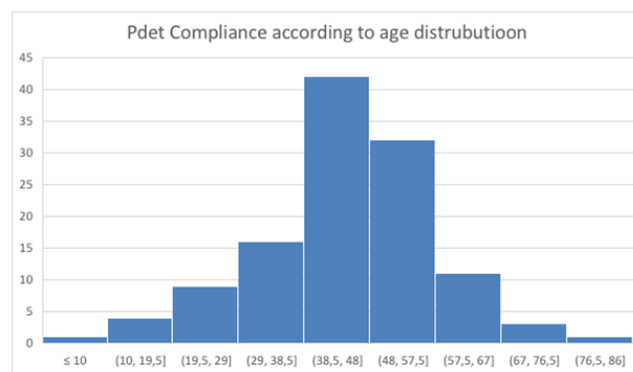


Figure 1: P_{det} compliance according to age in all groups of women. Maximum compliance occurs in women of reproductive age (patients with stress, urge, mix incontinence and normal urodynamic findings)

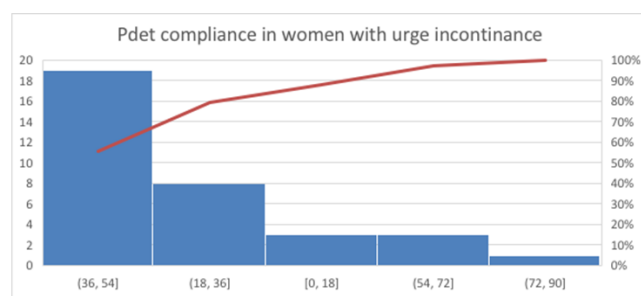


Figure 2: P_{det} compliance according to age in urge incontinence and hypocompliant bladder patients. Maximum compliance occurs in women of reproductive age, without a linear steady variance

An animal study showed that aging induces dysfunction in coordination between the urinary bladder and urethra. Thus, urethral dysfunction due to increasing age may lead to inefficient voiding with increased postvoid residual urine volume, which is often observed in the elderly population [20]. The cause of urethral dysfunction is hypothesized as decreased synthesis of NO, a molecule that relaxes urethral smooth muscle [21], and increased synthesis of the endogenous inhibitor of NO-synthase, with age [22]. Another recent animal study showed that the consistency of layer thickness and nuclear density of the bladder wall structure in mice is preserved following maturation, but this may differ in humans [10]. A correlation between urethral pressure and estrogen levels during the menstrual cycle is expected. Rud [23] showed that the decrease in urethral pressure with increasing age was continuous in a wide age group of women with no correlation with estrogen levels, however, an increase from infancy to adolescence was demonstrated. Our data lacks MUCP values, but we hypothesized that the MUCP curve in Rud's study correlates with our P_{det} curve.

Limitations

This study may include more patients with normal urodynamic findings, but their LUTS symptoms are much less than those of the incontinence population.

Evidence that menopause is an independent factor in the prevalence of incontinence remains lacking [24] and further investigation with a wide age range of women are needed for future research.

Conclusion

Our study is the one of the few studies to examine voiding parameters in a large, heterogenous, secondary care population. Further evaluation of large collections of urodynamic data could lead to the development of specific reference values

for use by urodynamics specialists. Aging is associated with a decrease in self-control, thus the increased prevalence of LUTS symptoms in the aged population might be more accurately considered as the loss of an adaptive threshold to urinary control rather than age-associated decline in urinary functions.

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