

Frequency of Hydroureteronephrosis in Patients With Pelvic Organ Prolapse and the Effect of Hydronephrosis on Urodynamic Parameters

Pelvik Organ Prolapsuslu Hastalarda Hidroüreteronefroz Sıklığı ve Hidronefrozun Ürodinamik Parametrelere Etkisi

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Abstract

Objective: This study aims to evaluate the frequency of hydronephrosis and the effect of hydronephrosis on urodynamic parameters in patients with advanced-stage pelvic organ prolapse (POP).

Materials and Methods: This retrospective cross-sectional study was conducted between July 2019 - February 2020 with 66 patients who were admitted to the urogynecology outpatient clinic with symptomatic advanced-stage POP. Urinary system ultrasonography and urodynamic examination were performed on all patients before the operation. The severity of prolapse in the study population was evaluated using the POP-Q system. Urinary system ultrasonography was performed by radiologists. Demographic data, POP time, and urodynamic parameters were compared in hydronephrosis and non-hydronephrosis cases.

Results: The general frequency of hydronephrosis among the patients was 19.7% (13/66 patients). It was found that the weight ($p=0.0001$) and body mass index ($p=0.004$) levels were higher in patients with hydronephrosis. There was no significant difference in the duration of POP, the presence of detrusor overactivity, and other urodynamic parameters in patients with or without hydronephrosis.

Conclusion: There was no relationship found between hydronephrosis and urodynamic parameters. In line with these data, urinary system ultrasonography is recommended for all patients with POP due to the high frequency of hydronephrosis and the consequences of hydronephrosis leading to renal failure.

Keywords: pelvic organ prolapse, hydronephrosis, urodynamics

Öz

Amaç: Bu çalışma, ileri evre pelvik organ prolapsusu (POP) olan hastalarda hidronefroz sıklığını ve hidronefrozun ürodinamik parametrelere etkisini değerlendirmeyi amaçlamaktadır.

Gereçler ve Yöntemler: Bu retrospektif kesitsel çalışma Temmuz 2019 - Şubat 2020 tarihleri arasında ürojinekoloji polikliniğine semptomatik ileri evre POP ile başvuran 66 hasta ile yapıldı. Ameliyat öncesi tüm hastalara üriner sistem ultrasonografisi ve ürodinamik muayene yapıldı. Çalışma popülasyonundaki prolapsus şiddeti POP-Q sistemi kullanılarak değerlendirildi. Üriner sistem ultrasonografisi radyologlar tarafından yapıldı. Hidronefroz ve hidronefroz olmayan olgularda demografik veriler, POP süresi ve ürodinamik parametreler karşılaştırıldı.

Bulgular: Hastalar arasında genel hidronefroz sıklığı çalışmamızda %19,7 (13/66 hasta) idi. Hidronefrozlu hastalarda kilo ($p=0,0001$) ve vücut kitle indeksi ($p=0,004$) düzeylerinin daha yüksek olduğu bulundu. Hidronefrozlu olan ve olmayan hastalarda POP süresi, detrüör aşırı aktivitesinin varlığı ve diğer ürodinamik parametrelerde anlamlı bir fark saptanmadı.

Sonuç: Hidronefroz ile ürodinamik parametreler arasında bir ilişki saptanamadı. Bu veriler doğrultusunda; hidronefroz sıklığının yüksek olması ve hidronefrozun böbrek yetmezliğine kadar giden sonuçlarının olması sebebiyle POP hastalarının tümüne üriner ultrasonografi yapılması önerilir.

Anahtar kelimeler: pelvik organ prolapsusu, hidronefroz, ürodinami

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Introduction

Pelvic organ prolapse (POP) is defined as the descent of the pelvic organs into or out of the vagina. It can be seen in about half of women giving birth. It causes urogenital symptoms and sexual dysfunction. The main reason is the loss of pelvic support [1]. In gynecology, hydronephrosis is present in many diseases, including severe genital mechanical defects, endometriosis, and postoperative iatrogenic lesions. The prevalence of hydronephrosis is shown to be significantly related to the severity of prolapse [2,3]. In this study, we aimed to investigate the frequency of pelvic hydronephrosis and the effect of hydronephrosis diagnosed by ultrasonography on urodynamic parameters in patients with symptomatic POP.

Material and Methods

After approval local ethics committee (approval number 2020/382), symptomatic female patients with stage 3-4 POP based on pelvic organ prolapse quantification (POP-Q) whose ages were ranging between 30 to 80 years and who were admitted to the urogynecology outpatient clinic in Bakirkoy Dr. Sadi Konuk Training and Research Hospital, Gynecology and Obstetrics Clinic between July 1, 2019, and February 1, 2020, were evaluated. Preoperative urinary system ultrasonography and urodynamic examination were performed for all patients. Patients with urinary obstruction secondary to abdominal or pelvic tumor, obstructive kidney stones, vesicoureteral reflux, ureteral strictures, chronic renal failure, patients with adhesions, endometriosis, previous prolapse surgery, and patients who had a hysterectomy were defined as the exclusion criterion. A total of 81 patients with stage 3 and 4 POP, who underwent corrected urodynamics and urinary ultrasonography were included in the study. Among these patients, 7 patients were excluded because of insufficient anamnesis, 5 patients due to kidney disease, and 3 patients as the preoperative urodynamic study results could not be obtained. Regardless of the stage in the urinary system ultrasonography, all patients with hydroureteronephrosis constituted the study group, and the patients without hydroureteronephrosis constituted the control group. A total of 66 patients, (13 in the study group and 53 in the control group) were included in the study.

Preoperative urodynamics report of patients in both groups was obtained from computer-based hospital records. Detailed anamnesis of these patients, including age, height, weight, body mass index (BMI), parity, and duration of POP (years) were obtained from the files of the patients.

Urinary system ultrasonography with Voluson E8 (General Electrics, USA) device was performed by a radiologist on all of the patients. Urodynamics with prolapse reduction was also performed in these patients. The urodynamic procedure was performed using a multi-channel urodynamic system under International Continence Society (ICS) standards [4]. Uroflowmetry was performed at the beginning and post-void residual (PVR) volume was measured. After bladder evacuation, catheters were placed in the rectum and bladder for filling cystometry. While the patient was in the sitting position, the bladder was filled with sterile saline at room temperature. At

the time of filling cystometry, first desire to void, strong desire to void, maximum cystometric capacity, P vesical (Pves), P detrusor (Pdet), P abdominal (Pabd), bladder compliance, detrusor overactivity (DO), valsalva leak point pressure (VLPP), and lowest detrusor pressure at which urinary leakage occurs in the absence of a detrusor contraction or an increase in abdominal pressure (detrusor leak point pressure, DLPP) values were recorded. Detrusor overactivity was considered as involuntary detrusor contraction at any pressure that could occur spontaneously or with stimulation during the filling phase in cytometry. Then, bladder emptying was evaluated by a pressure-flow study. In uroflowmetry, maximum flow rate (Qmax), time to reach maximum flow rate, voided volume, and PVR values were recorded. The Liverpool nomogram was used to evaluate uroflowmetry [5]. Study group and control group urodynamic study results (maximal flow rate, time to reach maximum flow rate, void volume, PVR, detrusor overactivity, compliance, maximal vesical pressure, maximal detrusor pressure, maximum bladder capacity, bladder volume at first desire to void, bladder volume at severe desire to void, VLPP, DLPP) were compared with age, parity, and BMI.

Statistical Analysis

In this study, which was carried out to investigate the effect of hydroureteronephrosis on urodynamic parameters in patients with POP, 30 patients were reached as a result of the pilot application designed to compare the PVR levels of the control group (no hydronephrosis) and the study group (with hydronephrosis), the potency was found to be 0.82. Based on this power of influence, a power analysis was made with GPower 3.1.9.2. As a result of the analysis, in the design of the comparison of PVR levels between the two groups, the group ratio was 0.24, 80% power, 95% confidence level, and 0.82 effect power, 52 cases for the control group and 12 cases for the study group. It was determined that a minimum of 64 cases in total should be included in the study.

Statistical analysis was performed using the SPSS 23 (statistical package for the social sciences) package program. The demographic variables of patients, the number of units (n), percentage (%), mean, and median (min-max) values were given for continuous variables. The normal distribution test of continuous variables was done with the Kolmogorov Smirnov test. Frequency and percentage values were given for categorical variables. Chi-square analysis was used for the relationships between categorical variables. Where appropriate, categorical variables were evaluated with Fisher's exact test. Independent sample t-test was used for the comparison of two groups in continuous independent variables with normal distribution, and Mann-Whitney U-test was used for two-group comparisons in variables that did not fulfill the normal distribution assumption. $P < 0.05$ value was considered significant.

Results

The data of 66 patients were evaluated. The mean age of the patients was 62.3 ± 10.53 years (32-79 years). The mean BMI of the patients was found to be 28.28 ± 3.47 . The overall incidence

of hydronephrosis among the patients was 19.7% (**Table 1**).

Detrusor overactivity was detected in 38.46% of patients with hydronephrosis and in 32.08% of patients with hydronephrosis, respectively, and there was no significant difference between the two groups ($p=0.746$) (**Table 2**).

It was determined that the patient group with hydronephrosis had higher weight ($p=0.0001$) and BMI ($p=0.004$). There was no significant difference between the two groups in terms of age, parity, and duration of POP (**Table 3**).

There was also no significant difference found between the two groups in terms of other urodynamic parameters (**Table 4**).

Discussion

The relationship between POP and hydronephrosis has been known for a long time, but the literature on the prevalence of hydronephrosis in these patients is largely variable. The reason for this variability may be related to the differences in POP stages and the duration of POP [3,6-12]. If left untreated, severe cases of POP may develop hydronephrosis or renal failure [13] and if the POP is corrected, regression of hydronephrosis may be possible [2]. The prevalence of hydronephrosis is shown to be significantly related to the severity of POP [2,14]. Based on this knowledge, we included patients with at least grade 3-4 POP to better investigate the relationship between urodynamics and hydronephrosis. Also, patients who had a previous hysterectomy, incontinence, or POP surgery were not included in the study because ureter or bladder damage could not be excluded. In previous studies, the prevalence of hydronephrosis in patients treated for POP was reported to range from 7.7% to 30.6% [3,6-12,14]. In this study, the frequency of hydronephrosis in patients with advanced stages of POP was found to be 19.7%, similar to the current international literature. No previous cross-sectional studies investigating the frequency of hydronephrosis in patients with POP have been found in our country. The high rate of hydronephrosis reported in this study indicates that renal ultrasonography should be performed before deciding on follow-up or surgical treatment in patients with POP.

POP and stress urinary incontinence coexist in up to 80 percent of women with pelvic floor dysfunction [15]. Advanced-stage POP can mask urinary incontinence by kinking the urethra. Selection of the optimal reconstructive surgical procedure and adding an anti-incontinence procedure may be challenging to surgeons as the POP repair can unmask urinary incontinence in previously continent women or even worsen the existing urinary symptoms.

There are three possible accepted strategies for potential stress urinary incontinence at the time of symptomatic treatment in women without stress urinary incontinence. One of the strategies is performing concurrent surgeries for POP and stress urinary incontinence, regardless of preoperative POP reduction and urinary stress testing. This will lead to attendant surgical risk, that is unnecessary for the patient. The other one is performing only POP surgery and making another incontinence surgery if needed related to postoperative urinary symptoms. This strategy can lead to a second anesthesiologic preparation. In our clinical practice, we choose the last strategy by performing POP reduction urodynamic testing in combination with medical

Table 1. Distribution of hydronephrosis

	n	%
None	53	80.3
Present	13	19.7
Total	66	100

Table 2. Detrusor overactivity according to the presence of hydronephrosis

Detrusor overactivity	Without hydronephrosis n:53		With hydronephrosis n:13		p
	n	%	n	%	
None	36	67.92	8	61.54	0.746
Present	17	32.08	5	38.46	

*Fisher Exact Test; $P<0.05$ was considered statistically significant

Table 3. Age, height, weight, BMI, POP duration, and parity analysis according to the presence of hydronephrosis

	Without hydronephrosis n:53	With hydronephrosis n:13	P
	Avg±SD Med. (Min.-Max.)	Avg±SD Med. (Min.-Max.)	
Age	62.04±10.44 64- (32-79)	63.38±11.27 64- (42-79)	0.710
Height	159.23±5.94 160- (150-170)	157.85±5.52 160- (150-165)	0.421
Weight	69.57±6.73 70- (55-85)	76.92±5.22 75- (70-85)	0.0001*
BMI	27.68±3.22 27.11- (20.2-37.77)	30.74±3.49 29.38- (26.34-37.77)	0.005*
Parity	3.62±2.4 3- (1-12)	3.62±3.07 3- (1-13)	0.691
POP Duration (year)	4.87±5.24 3-(1-25)	5.77±3.49 5-(1-12)	0.128

*Student t-test, Mann Whitney U test; $P<0.05$ was considered statistically significant

Table 4. Evaluation of urodynamic parameters according to the presence of hydronephrosis

	Without hydronephrosis	With hydronephrosis	P
	n:53	n:13	
Urodynamic parameters	Avg±SD Med. (Min.-Max.)	Avg±SD Med. (Min.-Max.)	
Residual amount of urine	67.23±90.33 32- (0-375)	81.92±87.25 57- (0-211)	0.548*
Bladder volume at first desire to void	142.47±99.57 125- (26-565)	125.92±48.54 128- (47-187)	0.564
Bladder volume at strong desire to void	308.79±121.24 282- (103-610)	302±113.48 270- (153-497)	0.855
Max. bladder capacity	406.53±127.65 387- (200-714)	396±90.33 419- (223-514)	0.780
Detrusor leak point pressure	35.13±27.86 30.5- (5-102)	40.17±53.51 27.5- (5-140)	0.773
Valsalva leak point pressure	68.38±52.56 61.5- (3-220)	89.83±46.08 118- (15-120)	0.184*
Maximum urine flow rate	10.17±10.58 6- (0-48)	7.38±7.92 4- (0-20)	0.396*
Voiding volume	132.47±167.66 53- (0-614)	108±144.71 28- (0-446)	0.565*
Bladder compliance	33.35±23.1 27.3- (2.8-82.1)	34.63±21.48 32.9- (0-82.8)	0.856
Time to reach max. flow rate	6.38±10.22 3- (0-56)	4.77±8.36 3- (0-31)	0.601
Pves (max. vesical pressure)	119.6±29.7 118- (48-181)	127.31±44.11 116- (60-221)	0.452
Pdet (maximal detrusor pressure)	69.62±38.97 63- (15-216)	62.08±40.28 52- (16-163)	0.536

*Mann Whitney U test-Student's t-test; P<0.05 was considered statistically significant

history for the assessment occult stress urinary incontinence in patients planning POP surgery. We add incontinence surgery if urinary incontinence is demonstrated by prolapse reduction [16].

In our study, a relationship between urodynamic results and the presence of hydronephrosis in POP patients was also investigated, and no significant difference was observed in urodynamic parameters. In other words, it is not possible to predict hydronephrosis based on urodynamic results. Therefore, renal ultrasonography should be performed to investigate the presence of hydronephrosis, even if urodynamics has been performed in patients with POP who are scheduled for follow-up or surgery.

As a result of the study, there was no significant difference between the duration of POP and the frequency of hydronephrosis. In a study conducted on 140 patients with stage 1-4 prolapse between 2009 and 2012, it was stated that the probability of hydronephrosis increased as the duration of prolapse increased [8]. The reason for this difference may be due to the high number of patients and the inclusion of all stages of POP even the asymptomatic stages in the study.

A significant difference was found between the group with and without hydronephrosis in terms of weight and associated BMI is a valuable secondary result of our study. No similar results were found in previous literature. These results can be

attributed to high abdominal pressure which can be a factor in the progression of POP. It can be postulated that high abdominal pressure due to weight may increase hydronephrosis. To understand this relationship more clearly, it should be investigated in more detail with different studies in the future.

In our study, a retrospective analysis was performed on a sample group of 66 people in a local education and training hospital. Although this may be a weakness the study has enough statistical power to press on our valuable finding “the urodynamics does not have the efficient role for the prediction of hydronephrosis in patients with POP”. Using a multi-channel urodynamic system following ICS standards is also a strength of our study. To make a more detailed evaluation of this issue, a larger patient group can be followed and examined for a longer period.

Conclusion

According to the results of our study, no correlation was found between hydronephrosis and urodynamic parameters. Weight and BMI have a significant effect on the progression of hydronephrosis. In line with these data, urinary system ultrasonography is recommended for all patients with POP due to the high frequency of hydronephrosis and the consequences of hydronephrosis leading to renal failure. There is a need for prospective studies with larger numbers of patients to obtain definitive results on this issue.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of University of Health Science, Dr. Sadi Konuk Training and Research Hospital (Approval date and number: 07/09/2020-382).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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