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Original Article

# Evaluation of the Effect of Pelvic Organ Prolapse on Renal Function: Retrospective Cohort Study

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## ABSTRACT

**Objective:** Pelvic organ prolapse (POP) is a common condition; however, it is rarely observed to affect renal functions and cause hydronephrosis. In our study, we aimed to evaluate these effects of POP.

**Methods:** In this retrospective study, patients who underwent anti-prolapse surgery due to POP were included as the case group, and those who underwent hysterectomy for non-POP indications were included as the control group between January 1 and July 1, 2024. Renal function blood parameters (urea, creatinine, blood urea nitrogen [BUN], glomerular filtration rate [GFR], and uric acid values) were compared between the control and POP groups. Preoperative urinary system ultrasonography (US) data were also analyzed.

**Results:** Patients were included in the POP group and the control group (N1=N2=187). The groups were statistically similar and homogeneous in terms of age (p=0.678) and comorbidities (p=0.872). The number of patients with values outside laboratory cut-off values was 8, 17, 51, 16, and 15 patients in the POP group for creatinine, uric acid, GFR, urea, and BUN, respectively. GFR (p<0.001), urea (p=0.005), and BUN (p=0.008) values showed statistically significant differences between the two groups. When renal function tests were analyzed according to POP grades, no significant differences were detected for any parameter between grades 2, 3, and 4. Hydronephrosis was detected in 9 patients (16.4%) in the POP group evaluated with urinary US.

**Conclusion:** We determined that lower GFR, and higher BUN and urea values were present in the prolapse group. Although it is believed that this condition may regress after POP surgery, data supporting this could not be obtained due to the retrospective nature of the study.

## INTRODUCTION

Pelvic organ prolapse (POP) is a condition that can present with vaginal bulging, urinary, defecation, and sexual problems and affects the quality of life.[1,2] Risk factors for POP include older age, higher gravidity and parity, obesity, smoking, chronic cough, and constipation.[2] The prevalence of surgery due to pelvic organ prolapse varies between 11% and 18% in the literature, and it is thought to increase further with the aging world population.[2-4] Many techniques have been described in the surgical treatment of pelvic organ prolapse, including anterior and posterior vaginal repair, sacrocolpopexy, sacrospinous fixation, uterosacral ligament suspension, and lateral suspension, which can be performed vaginally, abdominally, or laparoscopically.[2,5-7] The appropriate technique for treatment is selected individually for the patient, depending on the compartment and degree of prolapse.[2]

In current meta-analyses and studies, the prevalence of hydronephrosis (HN) and renal failure (RF) due to POP is 3.5-30.6% and 3.3%, respectively.[8,9] After surgical repair of prolapse, complete resolution or partial recovery may also ocur.[8,10] Although renal complications due to POP are rare, it may cause severe uretero-hydro-nephrosis, acute or chronic RF in patients, which may lead to dialysis and renal transplantation.[9] A positive correlation has been determined between the degree and duration of prolapse and the degree of HN and RF.[11] In this retrospective study, we aimed to evaluate POP-related renal function failure and the effect of hydronephrosis, if present.

## MATERIALS AND METHODS

This study was designed retrospectively. An evaluation was made on patients at a tertiary health center between 01/01/2024 and 01/07/2024. Patients who underwent anti-prolapse surgery with hysterectomy indication for benign reasons within a 6-month period were determined as the case group. As the control group, patients who were not diagnosed with POP and underwent hysterectomy for benign gynecological indications were randomly selected in a 1:1 ratio. The study was approved by the Institutional Scientific Research Ethical Board (No: E-2024/010.99/6/26). Since it was a retrospective study, written and verbal consent was not obtained from the patients. In addition, the study was conducted in accordance with the ethical standards outlined in the Declaration of Helsinki.

The inclusion criteria were as follows: (1) age of 40–80 years; (2) patients who underwent only hysterectomy or concurrent anti-prolapse surgery for benign indications. The exclusion criteria were: (1) patients with malignancies; (2) patients with a history of renal disease or comorbidities that may cause renal failure, including uncontrolled diabetes mellitus or hypertension, etc.; (3) patients with previous POP surgery.

Patients' ages, parity, body mass index (BMI), comorbidity data, surgical procedure information, preoperative renal function blood parameters (urea, creatinine, BUN, GFR, and uric acid values), pelvic organ prolapse quantification (POP-Q) stages, presence of urinary system ultrasonography, and HN data were collected from the hospital database system. Cut-off ranges for blood parameters are <0.95 mg/dl, 2.6-6 mg/dl, ≥90 ml/min, 17-43 mg/dl, and 6-20 mg/dl for creatinine, uric acid, GFR, urea, and BUN, respectively (cut-off values have been validated by the hospital laboratory and biochemistry experts).

The primary outcomes involved assessing the effect of pelvic organ prolapse on renal function parameters. For this purpose, renal function blood parameters were compared between control and case groups. The secondary outcomes involved assessing the percentage of hydronephrosis in the POP group.

### Statistics Analysis

Normality assumptions were assessed using the Shapiro–Wilk test and skewness/kurtosis values. Descriptive statistics included mean, standard deviation (SD), median, number, and frequency. The Chi-square test and Fisher's Exact Test were used to compare categorical variables. Normally and non-normally distributed paired groups for preoperative blood parameters were compared using paired samples t-test and ANOVA test. The data were analyzed with IBM SPSS Statistics version 22.0 (IBM Corporation, Armonk, NY, USA). All tests were two-sided, and a p-value of less than 0.05 was considered statistically significant.

## RESULTS

In the study, 374 patients were evaluated between January 1, 2024, and July 1, 2024. To compare 187 patients who underwent surgery due to pelvic organ prolapse, 187 patients were randomly selected as the control group. The groups were statistically similar and homogeneous in

**Table 1.** Group characteristics and comparison of renal function tests between pelvic organ prolapse and control groups

| | Pelvic organ prolapse group (n=187) | Control Group (n=187) | p |
|---|---|---|---|
| Age (year) | 60.19±7.11 | 58.86±6.52 | 0.678 |
| Surgery type (n,%) | | | |
| VH + McCall culdoplasty | 45 (24) | | |
| VH + Sacrospinous fixation | 23 (12.4) | | |
| VH + vaginal sacrouterine plication | 67 (35.8) | | |
| TAH + Abdominal sacrocolpopexy | 21 (11.2) | | |
| TLH + Laparoscopic sacrouterine plication | 18 (9.6) | | |
| Laparoscopic lateral suspension | 13 (7) | | |
| TAH (+/- BSO) | | 44 (23.5) | |
| TLH (+/- BSO) | | 125 (76.9) | |
| Ovarian cystectomy | | 18 (9.6) | |
| Creatinin (mg/dl) | 0.67±0.16 | 0.66±-0.24 | 0.558 |
| Uric acid (mg/dl) | 4.48±1.08 | 4.29±1.13 | 0.116 |
| GFR (ml/min) | 93±14.06 | 103.9±13.59 | <0.001 |
| Urea (mg/dl) | 32.02±9.71 | 25.98±7.93 | <0.001 |
| BUN (mg/dl) | 14.93±4.49 | 12.14±3.77 | <0.001 |
| Hb (g/dl) | 13.01±0.96 | 11.49±1.48 | <0.001 |

VH: Vaginal hysterectomy; TAH: total abdominal hysterectomy; TLH: total laparoscopic hysterectomy; BSO: bilateral salpingo-oophorectomy; GFR: Glomerular filtration rate; CK: creatinine kinase; BUN: blood urea nitrogen.

terms of age (p=0.678) and comorbidities (p=0.872).

In the control group, 123 patients (65.8%), 41 patients (21.9%), and 23 patients (12.3%) underwent surgery due to abnormal uterine bleeding, myoma uteri, and adnexal cyst, respectively. The types of surgeries performed in the two groups are given in Table 1. Preoperative renal function test values are provided in Table 1. The number of patients with values outside laboratory cut-off ranges was 8, 17, 51, 16, and 15 for creatinine, uric acid, GFR, urea, and BUN, respectively, in the POP group. GFR, urea, and BUN values showed statistically significant differences between the two groups (Table 1 and Table 2). Lower GFR and higher BUN and urea values were observed in the prolapse group. When renal function tests were analyzed according to POP grades, no significant difference was detected for any parameter between grades 2, 3, and 4 (Table 3).

The preoperative hemoglobin value in the control group was found to be 11.49±1.48, significantly lower than in the POP group.

It was determined that 1 patient (1.7%) with POP grade 2 and 54 patients (42.2%) with grades 3 and 4 had urinary system ultrasonography (US) in the retrospective screening. Hydronephrosis was detected in 9 patients (16.4%) in the POP group evaluated with urinary US. Of these patients, 6 had grade 1 HN and 3 had grade 2 HN. In the postoperative period, 2 of the 3 patients with grade 2 HN underwent control US, and it was found that the HN had decreased to grade 0.

## DISCUSSION

Pelvic organ prolapse (POP) may be associated with mi-

**Table 2.** Comparison of renal function parameters between pelvic organ prolapse and control groups according to laboratory reference values

| | Pelvic organ prolapse group (n=187) | Control Group (n=187) | p |
|---|---|---|---|
| Creatinin | | | |
| <0.95 mg/dl | 179 (95.7) | 183 (97.9) | |
| ≥0.95 mg/dl | 8 (4.3) | 4 (2.1) | 0.284 |
| Uric acid | | | |
| 2.6-6 mg/dl | 170 (90.9) | 172 (92) | |
| ≥6 mg/dl | 17 (9.1) | 15 (8) | 0.427 |
| GFR | | | |
| ≥90 ml/min | 136 (72.7) | 168 (89.8) | |
| <90 ml/min | 51 (27.3) | 19 (10.2) | <0.001 |
| Urea | | | |
| 17-43 mg/dl | 171 (91.4) | 183 (97.9) | |
| ≥43 mg/dl | 16 (8.6) | 4 (2.1) | 0.005 |
| BUN | | | |
| 6-20 mg/dl | 172 (92) | 183 (97.9) | |
| ≥20 mg/dl | 15 (8) | 4 (2.1) | 0.008 |

GFR: Glomerular filtration rate; BUN: blood urea nitrogen; Variables are reported n (percentage,%) format.

**Table 3.** Comparison of renal function parameters of patients in the pelvic organ prolapse group according to prolapse grades

| | Grade 2 POP (n=59) | Grade 3 POP (n=56) | Grade 4 POP (n=72) | p |
|---|---|---|---|---|
| Creatinin (mg/dl) | 0.66±0.15 | 0.68±0.20 | 0.67±0.13 | 0.661 |
| Uric acid (mg/dl) | 4.47±1.08 | 4.06±1.14 | 4.38±1.05 | 0.349 |
| GFR (ml/min) | 93.7±13.57 | 92.73±15.41 | 92.61±13.51 | 0.789 |
| Urea (mg/dl) | 31.71±7.37 | 31.26±13.20 | 32.86±8.14 | 0.788 |
| BUN (mg/dl) | 14.79±3.45 | 14.62±6.16 | 15.29±3.66 | 0.491 |
| Hb (g/dl) | 13.04±0.94 | 12.98±0.93 | 13.01±1.02 | 0.855 |

POP: Pelvic organ prolapse; GFR: Glomerular filtration rate; BUN: blood urea nitrogen; Hb: hemoglobin.

nor or major urological problems, including urinary tract infection, hydronephrosis (HN), and renal dysfunction.[9,12] The main reason for the pathophysiology of this condition is thought to be that the bladder or uterus pushes downward, increasing ureteral pressure, causing mucosal edema, and leading to partial/total obstruction.[9] It has been suggested that there is a relationship between hydronephrosis/renal failure and the severity and duration of prolapse.[8,11]

In this study, we determined that lower GFR and higher BUN and urea values were present in the prolapse group. However, it was found that this change in renal function parameters was not associated with the degree of prolapse, contrary to expectations. It was thought that this situation might be caused by the different cohort and the small number of patients. The hemoglobin value in the control group was found to be lower due to the fact that the indication for most surgeries was abnormal uterine bleeding. However, since the average hemoglobin value of the control group was above the anemia threshold, we think that this difference did not affect renal perfusion and can be considered negligible.

In a systematic review investigating hydronephrosis associated with POP, the prevalence of hydronephrosis was found to be between 3.5% and 30.6%, and it was stated that hydronephrosis had complete resolution in 56% to 83% of cases after surgical treatment of prolapse.[8] Additionally, current literature suggests that urinary system ultrasonography (US) should be performed routinely in severe POP cases.[11] Urinary system US was performed in 42.2% of patients with stage 3 and 4 POP, and the hydronephrosis rate was found to be 16.4%, similar to the literature. Complete recovery was detected by control US in 2 of 3 patients with grade 2 HN postoperatively. Control urinary US was not performed in patients with grade 1 HN. This retrospective study showed that the evaluation of hydronephrosis in patients with POP is lacking and awareness should be raised among clinicians on this issue.

Although HN and renal failure (RF) due to POP are rare complications, POP repair usually resolves prolapse-associated hydronephrosis and prevents serious long-term complications.[10,13] However, some studies have found that renal functions did not significantly improve (GFR value) after POP repair or were limited to partial recovery (creatinine value).[14,15] As the authors, we think that the degree and duration of prolapse may affect the return of renal functions and HN in the postoperative period. Early surgical repair of POP may preserve renal function in patients with symptomatic prolapse.

To the best of our knowledge, this study is the first to compare renal functions with a control group in the literature, but it also has some limitations. The main limitation is that, since it was a retrospective study, postoperative renal functions and hydronephrosis were not clearly evaluated. This study can be expanded prospectively with a larger patient population in future research.

## Conclusion

Renal function parameters, including GFR, urea, and BUN, are negatively affected by the presence of POP. Although it is thought that there may be improvement in HN and renal function parameters after POP surgery, data supporting this could not be obtained since it was a retrospective study. It should be kept in mind that there may be HN and RF associated with POP, and evaluation should be performed using both blood tests and renal US in the preoperative and postoperative periods.

### Ethics Committee Approval

The study was approved by the Kartal Dr. Lütfi Kırdar City Hospital Ethics Committee (Date: 26.07.2024, Decision No: E-2024/010.99/6/26).

### Informed Consent

Retrospective study.

### Peer-review

**Externally peer-reviewed.**

### Authorship Contributions

Concept: P.B.İ., M.M.K., B.C., A.İ.; Design: P.B.İ., M.M.K., B.C., A.İ.; Supervision: P.B.İ., M.M.K.; Materials: P.B.İ., M.M.K., B.C., A.İ.; Data collection &/or processing: P.B.İ., M.M.K., B.C., A.İ.; Analysis and/or interpretation: P.B.İ., M.M.K.; Literature search: P.B.İ., M.M.K., B.C., A.İ.; Writing: P.B.İ., M.M.K., B.C., A.İ.; Critical review: P.B.İ., M.M.K.

### Conflict of Interest

None declared.

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## Pelvik Organ Prolapsusunun Böbrek Fonksiyonu Üzerine Etkisinin Değerlendirilmesi; Retrospektif Kohort Çalışması

**Amaç:** Pelvik organ prolapsusu (POP) yaygın bir durumdur; ancak böbrek fonksiyonlarını etkilediği ve hidronefroza neden olduğu nadiren görülür. Çalışmamızda, POP'un bu etkilerini değerlendirmeyi amaçlıyoruz.

**Gereç ve Yöntem:** Bu retrospektif çalışmada, POP nedeniyle anti-prolapsus cerrahisi uygulanan hastalar vaka grubu olarak, POP dışı endikasyonlarla histerektomi uygulanan hastalar ise kontrol grubu olarak dahil edildi. Böbrek fonksiyonu kan parametreleri (üre, kreatinin, kan üre azotu [BUN], glomerüler filtrasyon hızı [GFR] ve ürik asit değerleri) kontrol ve POP grupları arasında karşılaştırıldı. Ameliyat öncesi üriner sistem ultrasonografisi (US) verileri de analiz edildi.

**Bulgular:** Hastalar POP grubu ve kontrol grubuna (N1=N2=187) dahil edildi. Gruplar yaş (p=0.678) ve komorbiditeler (p=0.872) açısından istatistiksel olarak benzer ve homojendi. Laboratuvar eşik değerleri dışında değerlere sahip hasta sayısı kreatinin, ürik asit, GFR, üre ve BUN için POP grubunda sırasıyla 8, 17, 51, 16 ve 15 hastaydı. İki grupta GFR (p<0.001), üre (p=0,005) ve BUN (p=0.008) değerleri arasında istatistiksel olarak anlamlı fark vardı. Böbrek fonksiyon testleri POP derecelerine göre incelendiğinde, derece 2, 3 ve 4 arasında hiçbir parametrede anlamlı fark saptanmadı. Renal US ile değerlendirilen POP grubunda 9 hastada (%16.4) hidronefroz tespit edildi.

**Sonuç:** Prolapsus grubunda daha düşük GFR, yüksek BUN ve üre değerleri olduğunu saptadık. Bu durumun POP ameliyatından sonra geri leyebileceği düşünülse de, retrospektif bir çalışma olduğu için bunu destekleyen veri elde edilemedi.

**Anahtar Sözcükler:** Böbrek yetmezliği; glomerüler filtrasyon hızı; hidronefroz; pelvik organ prolapsusu.