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# Use of ureteral catheter in uterine-sparing surgery for placenta accreta

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## Abstract

**Objective:** The study aimed to investigate the effect of ureteral catheter use during surgery on the outcomes of obstetric and urinary complications in patients with placenta accreta spectrum (PAS) and placenta previa.

**Methods:** The patients who were followed up at Meram Medical Faculty Hospital of Necmettin Erbakan University between January 2016 and November 2021 and diagnosed with PAS and placenta previa were included. Patients who underwent emergency and planned surgery were grouped as those with or without an intraoperative ureteral catheter. The primary outcome was determined as the rate of urinary system damage among these groups. The number of blood transfusions, preoperative and postoperative hemoglobin values and hemoglobin changes, length of hospitalization, patients who underwent uterine-sparing surgery or hysterectomy, urinary tract injury, and wound infection were compared regarding the use of catheters.

**Results:** A total of 122 patients were included in the study. While an intraoperative ureteral catheter was placed in 56 (45.01%) patients, it was not used in 66 (54.09%) patients. Bladder injuries were determined in 31 (55.4%) patients with a catheter and 13 (19.7%) patients without a catheter, and no other urinary system injuries were found. The incidence of bladder injury was statistically significantly higher in the group with a catheter (p=0.001). The number of transfused erythrocyte suspensions, the hemoglobin change according to the preoperative hemoglobin level, and the mean duration of hospitalization in patients with a catheter were statistically significantly greater than the group without a catheter (p=0.001).

**Conclusion:** Ureteral catheterization did not reduce urinary damage in patients with PAS and placenta previa who underwent uterine-sparing surgery and hysterectomy. However, we believe that the insertion of a catheter increases the possibility of diagnosing intraoperative damage.

**Keywords:** Catheter, placenta previa, placenta accreta spectrum, maternal outcome.

## Introduction

The placenta accreta spectrum (PAS) defines placenta attachment anomalies, including placenta accreta, increta, and percreta. PAS occurs in approximately 0.4% of pregnancies.[1] It is one of the most critical causes of postpartum hemorrhage, leading to maternal mortality, and is considered a severe obstetric emergency.[2,3] The most common reason in the pathogenesis of PAS is the implantation of placental villi in this area, caused by defective decidualization due to scar at the endometrium-myometrial interface due to previous uterine surgery.[4,5] The most crucial risk factor in the development of PAS is placenta previa after cesarean section (C/S).[6] A pregnant woman with a previous diagnosis of placenta previa has a 60% risk of PAS in her next pregnancy.[7,8]

An appropriate evaluation should be made in PAS cases by interviewing the families before birth. In these cases, a multidisciplinary approach is ideal because of the risk of heavy bleeding and pelvic organ injury. The possibility of bladder invasion increases in PAS percreta cases. This situation brings the risk of urinary system injury. Prenatal ultrasonography (USG)[9] and magnetic

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resonance (MRI) should be used to evaluate bladder invasion or depth. Fistula and hematuria may be observed in case of bladder invasion.[10] Although the rate of C/S has increased in recent years, the rate of lower urinary tract injury has not changed significantly (0.3% of all C/S deliveries). Bladder injuries may occur as partial or total. Ninety-five percent of bladder injuries during C/S develop in the bladder dome and the remainder in the trigone. Bladder injuries are most commonly seen while forming the bladder flaps (43%), while 33% occur when entering the peritoneal cavity, and the remaining 24% develop during uterine incision or delivery.[11]

This study aimed to investigate the effect of ureteral catheter use during surgery on the outcomes of obstetric and urinary complications in patients with PAS and placenta previa.

## Methods

Cases diagnosed with PAS and placenta previa who were followed up at Meram Medical Faculty Hospital of Necmettin Erbakan University between January 2016 and November 2021 were included in this retrospective study. One hundred twenty-two patients with PAS and placenta previa with singleton pregnancy over 22 weeks of gestation were evaluated in the study group. PAS patients without placenta previa, fetal anomaly, and multiple pregnancies were excluded. Demographic data such as age, pregnancy, delivery, abortion, vaginal delivery, number of cesarean deliveries, week of gestation, body mass index (BMI), smoking status, diabetes mellitus, hypertension, thrombophilia, and in vitro fertilization (IVF) pregnancy status of the patients were recorded. Placenta previa was diagnosed through transvaginal USG with the closure of the internal cervical os by the lower end of the placenta.

PAS cases consisted of pregnant women whose diagnoses were determined using antenatal grayscale and colored Doppler USG with at least three of the findings such as loss of echolucent zone between uterus and placenta, thinning and interruption of the hyperechoic interface between the uterus serosa and bladder wall, or observing the bridging vessels with increased vascularity, and monitoring of lacunae with turbulent flow in the placenta, or whose diagnoses were confirmed by intraoperative findings. Surgery was planned between 34.0 and 35.6 weeks of gestation with uterus-sparing surgery method for patients diagnosed with PAS and placenta previa antenatally. In cases where the invasion was thought to be in the parametrium and bladder during the prenatal period, a catheter was inserted as long as the technical and obstetric conditions allowed. Patients who started bleeding and had preterm labor were urgently delivered in earlier weeks. The patients admitted to the study who underwent emergency and planned surgery were grouped as those with or without an intraoperative ureteral catheter. Catheters were inserted cystoscopically by urologists before the operation. The primary outcome was determined as the rate of urinary system damage among these groups. The number of blood transfusions, preoperative and postoperative hemoglobin values and hemoglobin level changes, length of hospitalization, patients who underwent uterine-sparing surgery or hysterectomy, urinary tract injury, surgery duration, and wound infection were compared according to their use of catheters.

Our clinic prefers the surgical uterus-sparing approach in PAS and placenta previa cases. After spinal anesthesia, patients were placed in the lithotomy position by the urology team, and bilateral ureteral catheters were placed under the guidance of a cystoscope, followed by a midline incision below and above the umbilicus. The uterine cavity was entered through a vertical fundus incision. The bladder flap was then dissected from the anterior surface of the uterus by LigaSure (Medtronic, Minneapolis, MN, USA), starting from the paracervical area. Until the ureteral catheter was felt in both broad ligaments, the window was opened with LigaSure, and the uterus was devascularized. For this, a clamp was placed on the cervicoisthmic region of the uterus. After the uterine segment with the placental bed was resected, placental bed sutures were placed, the uterus was closed, and the procedure was terminated. In cases with bladder invasion, the bladder was opened in a controlled manner, the placental tissue was cleaned, and the bladder was repaired after the necessary bleeding control was performed. Leakage from the bladder was checked with methylene blue. Total abdominal hysterectomy was performed in patients whose bleeding could not be controlled. Permission for this study was obtained from NEU Ethics Committee with the approval number 2022/3635(8453.R1).

### Statistics

Mean and standard deviation values were presented in the descriptive statistics of continuous variables, and frequency (n) and percentage (%) values in identifying the categorical variables. The normality assumptions of the variables were examined with skewness and kurtosis coefficients, Kolmogorov-Smirnov test, and histogram. Our data did not show a normal distribution. The Mann-Whitney U test compared the non-normally distributed continuous variables between the two groups. Chi-square and Fisher's exact tests were used for the analysis of categorical data. IBM SPSS.22 program (SPSS Inc., Armonk, NY, USA) performed all analyzes, and the $p<0.05$ value was considered the level of significance.

## Results

Sociodemographic data of 122 patients who met the study criteria are presented in **Table 1**. In the study group, 15 (12.29%) patients were reported as accreta. Others were increta in 30 (24.59%) patients and percreta in 77 (63.12%) patients. All of the cases with catheter insertion were percreta. The intraoperative ureteral catheter was placed in 56 (45.01%) patients and not in 66 (54.09%) patients. Of the patients who had a catheter, 52 (92.9%) were operated under elective conditions, and 4 (7.1%) were urgent surgeries. For the PAS group, 105 (86.06%) patients were operated on as planned and 17 (13.94%) patients under emergency conditions. The mean pregnancies of the patients were statistically significantly higher between the groups with and without catheterization (p=0.001). Considering the number of C/S cases, the mean was statistically significantly higher in the catheterized group than in the non-catheterized group (p=0.001). The mean week of gestation was statistically significantly lower in the catheterized group compared to the non-catheterized group (p=0.01).

The number of transfused erythrocyte suspensions, the hemoglobin change according to the preoperative hemoglobin level, and the mean duration of hospitalization in patients with a catheter were statistically significantly greater than the group without a catheter. The findings are summarized in **Table 2**. In placenta percreta cases, there was no statistical difference between the group with urinary catheter and the group without insertion, considering the maternal results (**Table 3**).

Bladder injuries were observed in 31 (55.4%) patients with ureteral catheters and 13 (19.7%) patients who did not have a catheter, and there were no other urinary system injuries. The incidence of bladder injury was statistically significantly higher in the group with a catheter (p=0.001). All injuries were determined intra-

**Table 1.** Sociodemographic data of patients according to catheter use in PPAS patients.

| | Catheter (-) n=66 (54.09%) mean±SD | Catheter (+) n=56 (45.01%) mean±SD | p-value |
|---|---|---|---|
| Age* | 32.22±5.74 | 33.20±4.25 | .316 |
| Gravida* | 3.45±1.41 | 4.34±1.50 | **.001** |
| Parity* | 1.80±1.23 | 2.57±1.11 | **.001** |
| Abortion* | 0.65±0.85 | 0.77±1.22 | .813 |
| Previous C/S number* | 1.65±1.14 | 2.36±1.05 | **.001** |
| Previous vaginal delivery* | 0.15±0.48 | 0.21±0.56 | .674 |
| Gestational age* | 35.00±2.73 | 33.68±2.33 | **.001** |
| BMI (kg/m²)* | 28.59±4.24 | 29.39±4.30 | .276 |
| Smoking† | 5 (7.6%) | 2 (3.6%) | .451 |
| Diabetes† | 11 (16.7%) | 7 (12.5%) | .696 |
| Hypertension† | 6 (9.1%) | 3 (5.4%) | .505 |
| Thrombophilia† | 3 (4.5%) | 6 (10.7%) | .299 |
| IVF† | 1 (1.5%) | 0 (0.0%) | 1.00 |

*Mann-Whitney U test, †Chi-square test. **BMI:** body mass index; **C/S:** cesarean section; **IVF:** in vitro fertilization; **PPAS:** placenta accreta spectrum with placenta previa.

**Table 2.** Maternal outcomes in PPAS patients according to catheter use.

| | Catheter (-) n=66 mean±SD | Catheter (+) n=56 mean±SD | p-value |
|---|---|---|---|
| Operation duration (minute)* | 109.39±52.83 | 133.04±47.05 | **.001** |
| Transfusion package unit* | 1.29±1.36 | 2.45±1.70 | **.001** |
| Preoperative hemoglobin (g/l)* | 11.83±1.14 | 11.72±0.90 | .464 |
| Postoperative hemoglobin (g/l)* | 9.37±1.32 | 8.8±0.94 | **.021** |
| Change of hemoglobin level* | 2.45±1.07 | 2.91±1.17 | **.036** |
| Length of hospital stay* | 5.36±3.83 | 8.36±3.82 | **.001** |
| Maternal mortality† | 0 | 0 | |
| Wound infection† | 4 (6.1%) | 4 (7.1%) | 1.00 |

*Mann-Whitney U test, †Chi-square test. **PPAS:** placenta accreta spectrum with placenta previa.

operatively. When we evaluated it as planned and emergency surgeries, bladder injury developed in 4 (23.5%) of 17 patients who received emergency surgery (**Fig. 1**). Two of them (50%) were in the catheterized group. Bladder injury occurred in 40 (38%) of 105 planned patients. Of these, 28 (70%) were in the catheterized group. Surgery time was significantly higher in the catheterized group (p=0.001). Other complications are summarized in **Table 4**. Uterine-sparing surgery was performed in 92.6% (n=113) of our patients in total. The hysterectomy rate was 7.4% (n=9).

## Discussion

The aim of this study was to evaluate whether the use of a ureteral catheter during uterine-sparing surgery reduces urinary system injuries in PAS patients with placenta previa or not. Our study demonstrated that preoperative ureteric catheter use in PAS patients with placenta previa did not reduce the rate of urinary damage and maternal morbidity.

PAS may cause life-threatening postpartum hemorrhages due to invasion of placental tissues. Therefore, PAS surgery should be multidisciplinary in specialized centers.[12] A large retrospective study revealed that delivery of PAS patients in tertiary centers with a multidisciplinary team approach reduced maternal morbidity.[13] Although the delivery method in placental adhesion anomalies is usually a cesarean hysterectomy, uterine-sparing surgery can also be performed in selected cases.[14] Since the placenta is not completely separated from the uterus and there is the invasion of other pelvic organs in PAS cases, catastrophic events

**Table 3.** Maternal outcomes in placenta percreta patients according to catheter use.

| | Catheter (-) n=21 mean±SD | Catheter (+) n=56 mean±SD | p-value |
|---|---|---|---|
| Operation duration (minute)* | 131.90±60.87 | 133.04±47.05 | .275 |
| Transfusion package unit* | 2.10±1.33 | 2.45±1.70 | .479 |
| Preoperative hemoglobin (g/l)* | 11.76±0.75 | 11.72±0.90 | .832 |
| Postoperative hemoglobin (g/l)* | 9.02±0.69 | 8.8±0.94 | .307 |
| Change of hemoglobin level* | 2.31±0.91 | 2.91±1.17 | .503 |
| Length of hospital stay* | 8.67±4.17 | 8.36±3.82 | .931 |
| Maternal mortality† | 0 | 0 | |
| Wound infection† | 1 (4.8%) | 4 (7.1%) | 1.00 |

*Mann-Whitney U test, †Chi-square test.

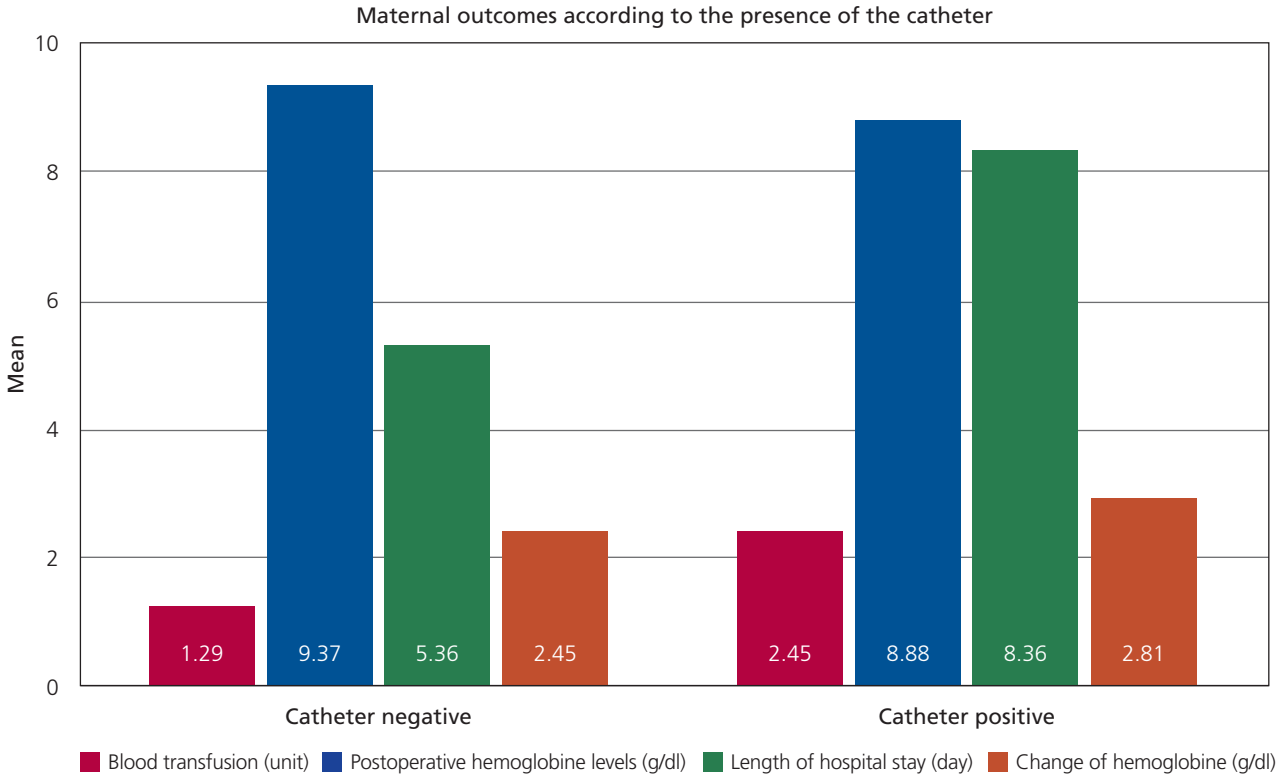


**Fig. 1.** Maternal outcomes in cases with catheter insertion.

such as massive obstetric hemorrhage, need for hysterectomy, injury to ureter, bladder, bowel or neurovascular structures, transfusion-related acute lung injury (TRALI), acute transfusion reaction, electrolyte imbalance, and renal failure may be encountered.[15] The approach of our clinic is uterus-sparing surgery. The urinary tract injury rate of 30% during C/S hysterectomy for placenta accreta is significantly higher than the rate of 4.8% during hysterectomy for gynecological diseases.[16] Possible consequences of bladder injury include prolonged operative time, urinary tract infection, prolonged indwelling catheter time, and formation of vesicouterine or vesicovaginal fistula. The most critical issue is the intraoperative recognition and treatment of bladder injury in this case.

In their retrospective study, Alanwar et al. determined the rate of urinary system damage as 21.7% during the operation in PAS patients and stated that 11.7% of this was the bladder, 4.7% was ureter, and 5.7% was ureteral injury together with bladder.[11] In another

**Table 4.** Urinary system complications.

| | Catheter (-) n=66 (54.09%) | Catheter (+) n=56 (45.01%) | p-value |
|---|---|---|---|
| Total urinary tract injury* | 13 (19.7%) | 31 (55.4%) | .001 |
| Bladder injury* | 13 (19.7%) | 31 (55.4%) | .001 |
| Ureter injury* | 0 | 0 | |
| Bladder and ureter injury* | 0 | 0 | |
| Genitourinary fistula | 0 | 0 | |

*Chi-square test.

study, urinary tract injury during C/S in pregnant women with PAS and the normal placenta was 61% and 1.5%, respectively.[17] In the study of Crocetto et al., they stated that the use of a ureteral catheter during cesarean hysterectomy in patients with placenta accreta does not reduce the rate of urinary system injury similar to our study, the risk of ureteral damage in placenta accreta patients with parametrial invasion is higher than in cases with bladder invasion, and that the use of a ureteral catheter may be beneficial in this patient group. However, it is not always necessary to use a ureteral catheter.[18] In their review, Tam Tam et al. stated that using a preoperative ureteral catheter in PAS surgery reduces the rate of urinary system injury from 18% to 6%. Although it does not eliminate the rate of urinary damage, it allows the damage to be recognized and repaired intraoperatively.[19] In our study, the urinary tract injury rate was significantly higher in the catheterized group than in the non-catheter group. The reason for this may be the use of a catheter in patients who were considered having bladder invasion by preoperative USG.

Blood transfusion is needed in 96.5% of PAS cases. At the 2012 American Congress of Obstetricians and Gynecologists, it was stated that 90% of patients with placenta accreta require transfusion of red blood cells, and 40% of the cases in this group need more than ten units of blood.[11] In our study, the reason why the change in hemoglobin level was greater in the group with the catheter, according to the total amount of blood transfused and the preoperative hemoglobin level compared to the group without the catheter, may be due to the higher level of invasion in the group with the catheter. The reason for the low rate of urinary injury in emergency cases in our study is that our hospital is experienced in such cases because it is a tertiary center that operates patients with PAS and placenta previa.

The retrospective nature of our study, the low number of patients, the low number of hysterectomies, the inability to compare with uterus-sparing surgery, and the single-center nature of our study are the limitations of our study.

## Conclusion

PAS still has significant morbidity and mortality risks. In PAS patients with placenta previa, the rate of urinary tract damage was 36% in patients who underwent uterine-sparing surgery and hysterectomy, and insertion of a catheter did not reduce urinary damage. However, we believe that it increases the possibility of diagnosing intraoperative injury in these patients.

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