Surgical interventions for symptomatic urinary stones during pregnancy

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To the Editor: Symptomatic urinary stone events have been reported to impact between 1/200 and 1/2000 pregnancies worldwide. Conservative treatment is the first line of treatment for uncomplicated cases.¹ About one-third of cases ultimately require active management such as ureteral stent insertion (USI), nephrostomy, and definitive stone treatment.²³

Here we describe the experience in China employing surgical interventions for symptomatic urinary stones during pregnancy. Thirty-five records of pregnant women with symptomatic urinary calculi who failed initial conservative measures and underwent active treatment in our hospital between April 2017 and May 2019 were retrospectively reviewed (Supplementary Table 1, http://links.lww.com/CM9/A671 and Supplementary Figure 1, http://links.lww.com/CM9/A670).

Temporary drainage was the preferred initial approach in the case of infection, intractable symptoms, bilateral obstruction, solitary kidney, transplanted kidney, obstetric complications (premature onset of labor or pre-eclampsia) in the first trimester or late third trimester.²³ USI and nephrostomy procedures were performed under local anesthesia. Oblique spinal or oblique spinal lithotomy positions were adopted under spinal or epidural anesthesia for definitive treatment. All patients underwent follow-up ultrasound 1 month post-surgery. In this study, patients were initially treated as follows: USI in 24 cases, nephrostomy in 15 cases, and percutaneous nephrostomy in three cases, and definitive calculus surgery in eight cases (Supplementary Figure 1, http://links.lww.com/CM9/A670).

Statistical analyses were performed using SPSS software, version 20.0 (IBM; Armonk, NY, USA). Statistical significance was set at \( P < 0.05 \). Baseline variables were described using median and range or percentages, as appropriate. Mann-Whitney \( U \) tests were used to evaluate the difference between quantitative measurements. Chi-square test was used for categorical data.

Ureteral stents were successfully placed in 22 of 24 (92%) women, with two failed procedures. Routine stent replacement was performed in seven cases with stents retained until postpartum stone removal, while the other 15 cases were converted to definitive surgery because patients could not tolerate or did not wish to undergo routine ureteral stent replacement (Supplementary Figure 1, http://links.lww.com/CM9/A670). The two failed stent procedures occurred because of impacted ureteral stones and were thus converted to mini-percutaneous nephrolithotomy (mini-PCNL) procedures.

Percutaneous nephrostomy (PCN) was successfully performed in three women in their third trimester under local anesthesia.

Eight women requested direct stone removal. Mini-PCNL was planned for the three other cases, but in one case after visual needle puncture, intrarenal stones were clearly visualized, which led to a successful minimally invasive PCNL (microperc).

Definitive stone surgeries were performed in 25 women, including 17 cases that followed USI and eight cases of direct stone management (Table 1 and Supplementary Figure 1, http://links.lww.com/CM9/A670). There was no significant difference in the distribution of stones by side or location between flexible ureteroscopic lithotripsy (FURSL) and mini-PCNL cases (\( P = 1.000 \) or \( P = 1.000 \)). While stone load, hospital stay, and hemoglobin decrease (FURSL) and mini-PCNL cases (\( P = 1.000 \) or \( P = 1.000 \)). While stone load, hospital stay, and hemoglobin decrease in the mini-PCNL group were significantly higher than in the FURSL group, the duration of surgery was significantly shorter in the mini-PCNL group (\( P < 0.05 \) [Table 1]. There was no significant difference in stone-free rate (SFR)
at 1 month following FURSL compared to mini-PCNL ($P = 1.000$) [Table 1]. We analyze stone composition for 17 available cases: three calcium oxalate monohydrate, 10 hydroxyapatite, two mixed calcium oxalate monohydrate/dihydrate, and two calcium oxalate monohydrate/hydroxyapatite.

There was no significant difference in complication rate between FURSL and mini-PCNL cases ($P = 1.000$) [Table 1]. In all cases, the pain was successfully managed conservatively and the fever resolved after 48 to 72 hours of antibiotic treatment. All pregnancies were carried to full term and all babies born were healthy.

Active intervention was preferred for patients who failed conservative treatment for stone events. Definitive treatment was applied for patients who failed temporary drainage, or were unwilling to accept or unable to tolerate temporary drainage tube placement.$^{[1, 5]}$

Because definitive surgery is associated with anesthesia, longer operative time, and possible surgical complications, stone surgery is often postponed to the postpartum period. However, definitive stone treatment for urolithiasis during pregnancy is on the rise. Shortening the course of disease reduces costs and avoids the need for postpartum procedures, thus allowing parents to focus on their newborn.$^{[1, 3]}$ For those who do not prefer or cannot tolerate temporary drainage and request surgery, definitive stone management can improve quality of life and reduce surgical costs. Ureteroscopy is now widely recognized as a treatment measure for ureteral stones in pregnancy as recommended by the Chinese Urological Association (CUA),$^{[1]}$ European Association of Urology (EAU),$^{[4]}$ and American Urological Association (AUA).$^{[3]}$ As such, we respected patients’ wishes and performed ureteroscopy directly in five cases. To avoid teratogenic effects, reduce possible general anesthesia risk, and shorten operative duration, regional anesthesia was adopted. SFR was 7/8 in month after ureteroscopy, which was consistent with previous reports of 87.5% to 91%.$^{[1, 2]}$ All nine of our FURSL procedures were successful, which is consistent with the success rate of 100% reported by Georgescu et al.$^{[2]}$

In the past, PCNL was contraindicated for pregnant women because of concerns for radiation exposure, anesthesia risk, invasiveness, and the need for the prone position.$^{[4]}$ With the use of ultrasound guidance and advances in anesthesia, successful PCNL has been reported in each trimester. We employed a small-caliber PCNL, rather than standard PCNL to reduce the risk of surgical complications. In our study, SFR following mini-PCNL was 3/6. To date, microperc has the smallest tract size and minimal invasiveness. To the best of our knowledge, there are few previous reports of using microperc or guidelines for PCNL in the pregnancy population. For example, EUA states that PCNL is contraindicated during pregnancy.$^{[4]}$ CUA suggests PCNL should be cautiously performed in selected cases.$^{[1]}$ While AUA gives no advice.$^{[3]}$ Based on CUA guidelines and our experience, three cases in our cohort were carefully evaluated before undergoing PCNL. Thus, PCNL should be restricted to selected patients and centers with sufficient experience and equipment as well as perinatal support.

In conclusion, conservative therapy remains the first-line treatment option for pregnant women with symptomatic urinary stones. However, active management can be performed for women who fail conservative measures so as to shorten the treatment process and improve quality of life during pregnancy. Additional high-quality and multicenter studies are needed to confirm our results.

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**Table 1: Perioperative, post-operative results of pregnant women with symptomatic urinary calculi undergoing definitive stone surgeries.**

| Variables | URSL (n = 8) | FURSL (n = 9) | Mini-PCNL (n = 6) | Microperc (n = 2) |
|-----------|-------------|-------------|-----------------|-----------------|
| Age (years), median (range) | 30 (26–39) | 29 (23–35) | 28 (24–34) | 33 (28–37) |
| Gestation (weeks), median (range) | 18 (11–29) | 21 (12–27) | 20 (19–24) | 20 (15–25) |
| Side (n) | | | | |
| Left | 2 | 4 | 2 | 1 |
| Right | 6 | 5 | 4 | 1 |
| Stone location (n) | | | | |
| Kidney | - | - | 2 | 2 |
| Kidney+upper ureter | - | 2 | 3 | - |
| Upper ureter | 1 | 5 | 1 | - |
| Mid-ureter | 2 | 2 | - | - |
| Low ureter | 5 | - | - | - |
| Calculus size (mm), median (range) | 10.0 (6.0–11.0) | 11.0 (8.0–14.0) | 17.5 (12.0–20.0)$^*$ | 15.5 (15.0–16.0) |
| Operative time (min), median (range) | 50 (35–60) | 55 (50–65) | 42.5 (35–50)$^*$ | 55 (50–60) |
| Hospitalization (days), median (range) | 3.0 (3.0–5.0) | 3.0 (3.0–5.0) | 5.0 (5.0–6.0)$^*$ | 4.5 (4.0–5.0) |
| Hemoglobin decrease (g/L), median (range) | 3.6 (2.6–4.6) | 3.8 (3.2–4.9) | 6.7 (5.6–8.1)$^*$ | 6.6 (5.6–7.5) |
| SFR (n/N), post-operative 1 month | 7/8 | 8/9 | 5/6 | 2/2 |

$^*$P <0.05, FURSL compared with mini-PCNL. -: Not applicable.
Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due effort has been made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

None.

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