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Urology

MANAGEMENT OF URINARY STONES DURING PREGNANCY: A SINGLE CENTER EXPERIENCE.

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ABSTRACT **Background:** Urolithiasis in pregnancy, while relatively rare, is a leading non-obstetric cause of hospital admission and can lead to significant maternal discomfort and complications. Physiologic changes in pregnancy promote stone formation (e.g. urinary stasis, hypercalciuria), and calcium phosphate stones are disproportionately common. Ultrasound is the first-line diagnostic modality, and conservative management (hydration, safe analgesics) often suffices. Ureteroscopy (URS), ureteral stenting, and percutaneous nephrostomy (PCN) are reserved for persistent obstruction, infection, or large stones. In this study, we present our 6-year experience managing 200 pregnant patients with urinary stones. **Methods:** We conducted a retrospective review of all pregnant women diagnosed with urinary calculi at HMC Alkhor, Qatar, from 2017 through 2022. Data collected included patient demographics, gestational age, symptoms, laboratory findings, stone characteristics (location and size on ultrasound), and management strategy (conservative vs. intervention). Outcomes and complications were recorded. Continuous variables are reported as mean ± SD, and categorical variables as counts and percentages. **Results:** The cohort (N=200) had mean age 27.8±5.6 years (range 20–43) and presented at a mean gestational age of 20.3±9.2 weeks (range 6–38). Table 1 summarizes patient demographics. Trimester at presentation was first (20%), second (50%), and third (30%). Flank pain was the predominant symptom (80%), with dysuria in the remainder. Stones were right sided in 55%, left in 40%, and bilateral in 5%. Laboratory findings included fever in 20% and pyelonephritis in 15%; 25% had a prior stone history, and 40% had urinary pyuria. Mean stone size was 5.1±4.8 mm (range 0.6–20.9). Stone location was varied (renal pelvis 35%, proximal ureter 15%, distal ureter 25%, other intrarenal sites). Conservative medical management (hydration, analgesics, antiemetics, and antibiotics if indicated) was successful in the majority of cases. Overall, 165 patients (82.5%) were managed non-surgically. Of the remaining 35 patients (17.5%) requiring intervention, 10 (5.0%) underwent ureteroscopy with laser lithotripsy, 22 (11.0%) received ureteral stent placement, and 3 (1.5%) underwent temporary PCN for drainage. No cases were treated with shock-wave lithotripsy. All interventions were uneventful, and no major maternal or fetal complications were observed. **Conclusions:** In this large single-center series, most pregnant patients with urinary stones were managed successfully with conservative therapy. Surgical interventions (URS, stenting, PCN) were reserved for those with infection, obstructive symptoms, or failed conservative therapy. Our outcomes were consistent with reported literature, and no adverse perinatal effects attributable to stone management were seen. These findings support a multidisciplinary, stepwise approach to urolithiasis in pregnancy, prioritizing maternal-fetal safety.

KEYWORDS : Pregnancy; Urolithiasis, DJ-stenting; Ureterorenoscopy Percutaneous nephrostomy PCN,; kidney stones

INTRODUCTION.

Symptomatic nephrolithiasis affects roughly 10% of the general population and, although less common in pregnancy, remains one of the most frequent non-obstetric causes of hospital admission during gestation. The estimated incidence is on the order of 0.1–0.5% of pregnancies (approximately 1–5 per 1000). [1] Hormonal and anatomic changes during pregnancy increase lithogenic risk: progesterone-induced smooth muscle relaxation and mechanical

compression of the ureters produce urinary stasis, while increased glomerular filtration and intestinal absorption of calcium/vitamin D raise serum calcium and urinary excretion. These and other alterations (e.g. higher oxalate and uric acid excretion) predispose to stone formation. Notably, calcium phosphate stones predominate in pregnant patients (up to 75% of cases) as opposed to calcium oxalate in non-pregnant individuals. [5,10,11] Diagnostic evaluation is constrained by fetal safety. Ultrasound (US) is the recommended first-line imaging modality. When US findings are equivocal, MRI without gadolinium is a safe adjunct. Low-dose CT is avoided except in life-threatening situations. [20] Conservative (medical) management is preferred for symptomatic stones: intravenous fluids, pain control with acetaminophen (opioids if necessary), antiemetics, and antibiotics for infection. Under such therapy, 50–80% of stones will pass spontaneously. If conservative measures fail or complications arise (intractable pain, infection, obstruction threatening renal function), interventional therapy is indicated. Guidelines from urologic societies recommend initial observation with escalation to intervention as needed. [13,14,15] Ureteroscopy (URS) with laser lithotripsy has emerged as a safe and effective definitive therapy during pregnancy, typically performed by experienced endourologists in the second trimester. [2,3] Ureteral stent placement or PCN provides temporary drainage in cases of sepsis or intolerable symptoms, though these may require periodic exchanges due to rapid encrustation in pregnancy. [21,22] Shock-wave lithotripsy and percutaneous nephrolithotomy are contraindicated due to fetal risk and technical limitations. Despite extensive guidelines and case series, data on urolithiasis management in pregnancy remain relatively sparse, especially in Middle Eastern populations. We therefore performed a retrospective review of all pregnant patients with urinary stones treated at Hamad Medical Corporation – Alkhor (Qatar) from 2017 through 2022. Aim of the study was to evaluate urinary stones and its management in pregnant women at HMC Alkhor Hospital Qatar.

MATERIALS AND METHODS.

We retrospectively reviewed medical records of all pregnant women diagnosed with urinary tract stones at Hamad Medical Corporation (HMC) Alkhor between January 2017 and December 2022. Diagnosis was based on clinical presentation (flank pain, dysuria, hematuria, etc.) in conjunction with imaging, typically renal/ bladder ultrasonography. Inclusion criteria were confirmed pregnancy and imaging evidence of a renal or ureteral calculus. Exclusion criteria included non-pregnant patients or those with alternative causes of flank pain. The study protocol was approved by the institutional review board, and patient consent was waived due to the retrospective chart-review design. Data collected included patient age, gravidity, gestational age at presentation (weeks), presenting symptoms, comorbidities, vital signs, and laboratory results (serum creatinine, urine analysis, urine culture). Stone parameters recorded were laterality, anatomic location (renal pelvis, calyx, ureter segment) and maximal diameter (mm) as measured on ultrasound. Treatments administered were noted: conservative therapy (hydration, analgesics, antiemetics, antibiotics), ureteral stenting, ureteroscopy (URS) with laser lithotripsy, and percutaneous nephrostomy (PCN) drainage. Because shock-wave lithotripsy and percutaneous nephrolithotomy are not performed in pregnancy, they were not used. Outcomes assessed included stone passage (clinically or via follow-up imaging), relief of symptoms, and any maternal or fetal complications attributable to the stone or its treatment. We also recorded any post-intervention adverse events (e.g. infection, preterm labor). Statistical analysis was descriptive. Continuous variables are presented as mean ± standard deviation (SD) or median with interquartile range (IQR) as appropriate. Categorical data are given as counts and percentages.

RESULTS.

Patient Demographics and Clinical Presentation Two hundred pregnant patients with urinary stones were included. The mean patient age was 27.8±5.6 years (range 20–43). The mean gestational age at presentation was 20.3±9.2 weeks (range 6–38). Serum creatinine was normal on average (mean 0.7±0.2 mg/dL). These demographics are summarized in Table 1. Most patients presented in mid-pregnancy: 40 (20%) were in the first trimester, 100 (50%) in the second trimester, and 60 (30%) in the third trimester. This distribution is similar to other series that report 2nd–3rd trimester predominance. The most common symptom was flank or back pain (160 patients, 80%). The remainder (40 patients, 20%) reported dysuria or irritative voiding symptoms as their primary complaint. Notably, none of the patients presented with vaginal bleeding or other obstetric pain. On physical exam, 20% (40) had documented fever (≥38.0°C). Laboratory tests showed microscopic pyuria in 40% and microscopic hematuria in the majority of cases (approximately 93% based on urinalysis). Positive urine cultures (bacteriuria) were found in 20% (40 patients), half of whom had concurrent fever. Table 2 details the presenting symptoms and stone laterality. About 55% of stones were on the right side, 40% on the left, and 5% were bilateral.

Stone Characteristics.

All stones were diagnosed by ultrasound. The average maximal stone diameter was 5.1±4.8 mm (range 0.6– 20.9 mm). Table 1 shows these values. Regarding location (Table 3), 70 stones (35%) were in the renal pelvis, with additional intrarenal positions (upper calyx 7.5%, mid calyx 5%, lower calyx 5%, staghorn 1%). 33 stones (16.5%) were in the proximal ureter, 10 (5%) in the mid-ureter, and 50 (25%) in the distal ureter near the bladder. Thus, roughly half of stones were intrarenal (kidney) and half were ureteral.

All patients initially received conservative management unless there was an absolute indication for immediate intervention (e.g. uncontrolled sepsis or intractable pain). Conservative therapy consisted of intravenous fluids, analgesia (acetaminophen ± opioids), antiemetics, and antibiotics if urinary infection was suspected. This approach was successful in 165 patients (82.5%), who experienced pain relief and/or confirmed stone passage on subsequent outpatient follow-up or spontaneous disappearance of hydronephrosis on imaging. Thirty-five patients (17.5%) required procedural intervention after failure of conservative measures or development of complications. Of these, 10 patients (5.0% of total) underwent ureteroscopy (URS) under appropriate anesthesia, with holmium laser lithotripsy of the stone. All URS procedures were performed by experienced endourologists without fluoroscopy (ultrasound guidance when needed) and were completed with DJ stent placement or ureteral catheter at the operator's discretion. In 22 patients (11.0% overall), an indwelling ureteral (Double-J) stent was placed without immediate stone removal; this was done either for urgent decompression (e.g. severe pyelonephritis or high-grade obstruction) or when URS was deferred. Three patients (1.5%) underwent percutaneous nephrostomy (PCN) placement, typically for emphatic drainage in septic patients or those with large obstructing stones who could not be managed ureteroscopy. No patients received shock-wave lithotripsy or percutaneous nephrolithotomy, per standard practice in pregnancy. Table 4 summarizes the treatment modalities. All interventions were technically successful. Postprocedural ultrasound or postpartum imaging confirmed either complete clearance or clinically insignificant residual fragments in all cases. No patient required repeat surgery during pregnancy. Minor complications were infrequent: transient fever occurred in a few patients after procedures and was managed with brief antibiotics. There were no cases of urosepsis, ureteral injury, or anesthesia-related maternal complications. Importantly, no adverse fetal outcomes (miscarriage, preterm labor requiring intervention, or congenital anomalies) were attributed to stone disease or its management.

DISCUSSION.

This study reports the largest Middle Eastern series to date on urinary stone management in pregnancy. We found that most pregnant patients with nephrolithiasis can be managed conservatively, with intervention reserved for those who fail medical therapy or present with infection or severe obstruction. [5,6] Our findings are in line with published literature: for example, a multicenter analysis reported that 64–84% of pregnant patients pass stones with hydration and analgesics. In our cohort, 82.5% were successfully treated without surgery, comparable to the upper range of these series. Patient demographics were similar to other reports. The mean age in our cohort was 27.8 years, mirroring a median age of 28 reported by Malkhasyan et al. [3,4]. Most patients were in the second trimester at presentation (50% here versus ~58% in published series), likely reflecting the timing of maximal ureteral dilation and physiological volume expansion. Flank pain was the overwhelmingly predominant symptom (80%), consistent with other series (e.g. 64% in the Malkhasyan study). Dysuria and irritative symptoms were less common. Urinary findings of pyuria and hematuria were frequent, as expected with stone passage; in fact, microscopic hematuria was detected in over 90% of patients, a high rate similar to prior reports. Notably, 20% of our patients had positive urine cultures, and 15% had documented pyelonephritis. This underscores the well-known association between stones and urinary tract infection in pregnancy. Indeed, the Razzaghi study noted that

nephrolithiasis can lead to urinary stasis and infection, which in turn have been linked to obstetric complications such as preterm delivery and abortion. [2]. We observed only two cases of pyelonephritis severe enough to require nephrostomy, and in our series, this did not translate into adverse perinatal outcomes.

Stone size in our patients averaged ~5 mm, smaller than many published series that focus on stones requiring intervention (for instance, the URS cohort of Razzaghi had mean 7.8 mm stones). Our stone distribution was broad, with about half in the renal collecting system and half in the ureter. This is somewhat different from some studies; for example, Razzaghi exclusively ureteral series had predominantly distal ureteral stones. [2]. The high proportion of renal stones in our cohort likely reflects case selection – many were diagnosed on routine US and managed expectantly rather than referred for URS. The management approaches and outcomes in our study reinforce current recommendations. [6-10] Conservative medical management remains first-line, yielding high stone passage rates and low complication rates. Our intervention rate (17.5%) is on the low side compared to some series that include tertiary centers, possibly because we had a robust conservative protocol. When surgery was needed, we performed URS safely. In 10 patients, ureteroscopy with laser lithotripsy was done without intraoperative fluoroscopy, analogous to modern series. There were no intraoperative complications, and postoperative morbidity was minimal. In published URS series, stone-free rates (SFR) around 85%–90% are reported with low complication rates. In our cases, all URS-treated patients achieved stone clearance. All ureteral access procedures were performed by endourologists experienced with this modality, which likely contributed to safety; Juliebø-Jones et al. emphasized that URS in pregnancy is best done in expert centers. [7,14,15] Ureteral stenting and PCN were used judiciously in our cohort. Stents were placed in 11% of all patients (often those with infection or as an adjunct to URS). [12,14-19] This is lower than some reports, but again our strategy was to avoid stenting unless clearly indicated. When used, stents relieved obstruction promptly; no patient suffered encrustation-related sequelae during the relatively short indwell times (stents were typically exchanged postpartum). Our three PCN cases were appropriately lifesaving (for pyonephrosis). No patient required both stent and PCN. These outcomes affirm that with multidisciplinary care (obstetricians and anesthesiologists involved), even interventions beyond conservative measures can be carried out safely. Importantly, we noted no maternal or fetal adverse events attributable to the stone management strategy. There were no maternal deaths or lasting morbidity, and all patients delivered healthy infants at term or near-term. This is consistent with larger series: for example, Rosenberg et al. found that while pregnant stone formers had higher rates of hypertensive disorders and gestational diabetes, their infants' birth weights and Apgar scores were not adversely affected. [5,6] Similarly, in our cohort we observed no statistical increase in preterm delivery or cesarean rate due to stones or ureteroscopy.

Limitations:

This study's retrospective design imposes inherent limitations. We relied on medical records, and some data (e.g. stone composition, long-term maternal urinary stone recurrence) were not uniformly available. There was no control group of non-pregnant stone patients. Our center's practice patterns (e.g. preference for early conservative management) may differ from other hospitals, which may limit generalizability. Also, as a single-center series, we cannot capture patients managed elsewhere. Finally, we lacked formal patient-reported outcome measures or cost-analysis. Nevertheless, the large sample size and comprehensive data over six years strengthen the findings.

CONCLUSIONS.

In this single-center experience of 200 pregnant women with urinary calculi, conservative medical management was effective in the vast majority of cases. Only a minority (17.5%) required urologic intervention, and interventions (URS, stent, PCN) were performed without significant maternal or fetal complications. Our results support current guidelines: initial observation and symptomatic treatment should be attempted, with imaging and referral for endourologic treatment if symptoms persist. Multidisciplinary care with obstetrics and anesthesia colleagues is critical to safely manage these patients. Future prospective studies or registries could further refine management protocols, but our findings add to the evidence that urolithiasis in pregnancy can be managed effectively with modern techniques and good outcomes for mother and child.

Declaration.

Financing. The study was not sponsored.
Conflict of interest. The authors declare no conflicts of interest.
Ethical approval. The study was approved by the MRC.

Authors Contribution:

All authors contribute equally to study design development, data analysis, drafting the manuscript. study concept, scientific editing, literature review, data acquisition and data analysis.

Table 1: Patient demographics

Parameters	Range	Mean±SD
Age (years)	20-43	27.8 ± 5.6
Gestational age (weeks)	6.0-38.0	20.3 ± 9.2
Serum Creatinine (mg/dL)	0.4-1.7	0.7 ± 0.2
Stone Size (mm)	0.6-20.9	5.1 ± 4.8

TABLE 2: Clinical and laboratory findings of patients

		n	%
Trimester	I	40	20%
	II	100	50%
	III	60	30%
Symptoms	Flank pain	160	80%
	Dysuria	40	20%
Stone side	Right	110	55%
	Left	80	40%
	Bilateral	10	05%
Fever	Yes	40	20%
	No	160	80%
Pyelonephritis	Yes	30	15%
	No	170	85%
History of urolithiasis	Yes	50	25%
	No	150	75%
Microscopic pyuria	Yes	80	40%
	No	120	60%
Microscopic hematuria	Yes	50	92.5%
	No	150	7.5%
Positive urine culture	Yes	40	20%
	No	160	80%

TABLE 3: Distribution of locations of stones in the urinary system

Stone location	n	%
Renal pelvis	70	35%
Upper pole	15	7.5%
Middle pole	10	5%
Lower pole	10	5%
Staghorn	02	2.5%
Proximal ureter	33	15%
Mid ureter	10	5%
Distal ureter	50	25%

TABLE 4: Distribution of the treatment methods applied to the patients

Treatment	n	%
Medical therapy	165	82.5%
Ureteroscopy	10	5%
Double-J stent insertion	22	11%
Percutaneous nephrostomy	03	1.5%

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