Section: Miscellaneous

Original Research Article

A COMPARATIVE STUDY OF MATERNAL AND FETAL OUTCOMES IN PREGNANT WOMEN WITH RENAL/URETERIC STONES MANAGED CONSERVATIVELY VERSUS INTERVENTIONALLY

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ABSTRACT

Background: Urolithiasis during pregnancy is a significant non-obstetric condition that can adversely affect both maternal and fetal outcomes. Management strategies include conservative and interventional approaches, and the choice depends on disease severity and clinical presentation. The aim is to compare maternal and fetal outcomes in pregnant women with renal or ureteric stones managed conservatively versus interventionally. **Materials and Methods:** This prospective observational comparative study was conducted on 120 pregnant women diagnosed with renal or ureteric stones at a tertiary care center. Patients were divided into conservative (n=73) and interventional (n=47) groups. Clinical, laboratory, and imaging data were collected. Maternal outcomes (pain relief, infection, hospital stay, complications) and fetal outcomes (gestational age, birth weight, NICU admission) were analyzed. Statistical analysis was performed using chi-square test and independent t-test, with $p < 0.05$ considered significant. **Result:** Baseline demographic characteristics were comparable between groups. However, stone size, hydronephrosis, and fever were significantly higher in the interventional group ($p < 0.05$). Complete symptom resolution was significantly higher in the interventional group (85.1% vs 67.1%, $p = 0.029$), while treatment failure was more common in the conservative group ($p = 0.022$). Hospital stay was significantly longer in the interventional group ($p < 0.001$). Maternal outcomes were otherwise comparable. Fetal outcomes showed significantly lower gestational age at delivery and birth weight in the interventional group ($p = 0.030$), while other parameters such as preterm birth and NICU admission were higher but not statistically significant. **Conclusion:** Conservative management is effective and safe for stable patients, while interventional management provides better symptom resolution in severe cases. Both approaches yield comparable overall outcomes when appropriately selected, emphasizing the importance of individualized management.

INTRODUCTION

Urolithiasis during pregnancy, involving renal and ureteric stones, represents one of the most common non-obstetric causes of abdominal pain and hospital admission in pregnant women. The incidence ranges from 1 in 200 to 1 in 1500 pregnancies, with physiological and anatomical changes during pregnancy contributing to stone formation and altered clinical presentation. Hormonal influences, particularly increased progesterone levels, lead to smooth muscle relaxation and ureteral dilatation, while mechanical compression of the ureters by the enlarging uterus further predisposes to urinary stasis. These factors collectively increase the risk of stone formation and complicate its diagnosis and management.[1]

The diagnosis of renal or ureteric stones during pregnancy is challenging due to limitations in the use of ionizing radiation. Ultrasonography remains the primary imaging modality, though it has variable sensitivity in detecting ureteric calculi. Magnetic resonance imaging may be used in selected cases when ultrasound findings are inconclusive. Prompt diagnosis is essential, as untreated obstruction can lead to complications such as urinary tract infection, pyelonephritis, preterm labor, and even adverse fetal outcomes.[2]

Management strategies for urolithiasis in pregnancy are broadly categorized into conservative and

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interventional approaches. Conservative management includes hydration, analgesia, and close monitoring, and is often successful in cases with small stones and stable maternal condition. However, failure of conservative therapy or presence of complications such as sepsis, intractable pain, or obstructive uropathy necessitates intervention. Interventional procedures include ureteric stenting (Double J stent placement), percutaneous nephrostomy, and ureteroscopy, all of which have been increasingly performed with improved safety profiles during pregnancy.[3]

Despite advancements, the choice between conservative and interventional management remains controversial, particularly concerning their impact on maternal and fetal outcomes. Conservative management avoids procedural risks but may prolong symptoms and increase the risk of complications if unsuccessful. On the other hand, interventional approaches provide definitive relief but carry procedural and anesthetic risks.[4]

Several studies have evaluated the safety and efficacy of both approaches, yet there remains variability in outcomes such as preterm labor, cesarean section rates, maternal morbidity, and neonatal complications. Therefore, a comparative evaluation of maternal and fetal outcomes in these two management strategies is essential to guide clinical decision-making and optimize care.[5]

Aim: To compare maternal and fetal outcomes in pregnant women with renal or ureteric stones managed conservatively versus interventionally.

Objectives

1. To evaluate maternal outcomes in pregnant women with renal/ureteric stones managed conservatively and interventionally.
2. To assess fetal outcomes including preterm birth, low birth weight, and neonatal complications in both groups.
3. To compare the effectiveness and safety of conservative versus interventional management strategies.

MATERIALS AND METHODS

Source of Data: The data for the present study were collected from pregnant women diagnosed with renal or ureteric stones who were admitted to the Obstetrics and Gynecology and Urology departments of a tertiary care teaching hospital. Clinical, laboratory, and imaging data were obtained from hospital records and direct patient evaluation.

Study Design: The study was conducted as a prospective observational comparative study.

Study Location: The study was carried out in the Departments of Obstetrics & Gynecology and Urology at a tertiary care teaching hospital.

Study Duration: The study was conducted over a period of 18 months, including patient recruitment, follow-up, and data analysis.

Sample Size: A total of 120 pregnant women diagnosed with renal or ureteric stones were included in the study.

Inclusion Criteria

- Pregnant women diagnosed with renal or ureteric stones by ultrasonography or MRI
- All trimesters of pregnancy
- Patients willing to give informed consent
- Patients managed either conservatively or interventionally

Exclusion Criteria

- Patients with pre-existing renal disease unrelated to urolithiasis
- Patients with multiple gestations
- Patients with significant obstetric complications (e.g., placenta previa, severe preeclampsia)
- Patients unwilling to participate

Procedure and Methodology: All eligible patients were enrolled after obtaining informed consent. A detailed clinical history including age, parity, gestational age, symptoms (pain, hematuria, fever), and past history of urolithiasis was recorded. Clinical examination was performed, and relevant laboratory investigations such as complete blood count, renal function tests, and urine analysis were carried out.

Diagnosis was confirmed using ultrasonography, and MRI was used in selected cases where necessary. Patients were categorized into two groups: those managed conservatively (hydration, analgesics, antibiotics if required) and those requiring interventional management (DJ stenting, ureteroscopy, or percutaneous nephrostomy).

Patients were followed throughout pregnancy to assess maternal outcomes such as pain relief, infection, need for repeat intervention, and obstetric complications. Fetal outcomes such as gestational age at delivery, birth weight, Apgar score, and NICU admission were recorded.

Sample Processing: Blood samples were collected under aseptic conditions and processed in the hospital laboratory for hematological and biochemical analysis using standard automated analyzers. Urine samples were analyzed for infection and hematuria.

Statistical Methods: Data were entered into Microsoft Excel and analyzed using statistical software (SPSS version 28.0). Continuous variables were expressed as mean ± standard deviation, and categorical variables were expressed as percentages. Comparison between groups was done using Chi-square test for categorical variables and independent t-test for continuous variables. A p-value of <0.05 was considered statistically significant.

Data Collection: Data were collected using a structured case record form, including demographic details, clinical presentation, investigation findings, management modality, and maternal and fetal outcomes. Regular follow-up data were recorded until delivery.

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RESULTS

The baseline characteristics of the study population demonstrated that the mean age was comparable between the conservative (26.84 ± 4.12 years) and interventional groups (27.91 ± 4.36 years) with no statistically significant difference (p = 0.176). Similarly, the mean gestational age at diagnosis did not differ significantly between the groups (22.68 ± 6.31 vs 23.94 ± 6.18 weeks, p = 0.283). Parity distribution was also comparable, with primigravida and multigravida proportions showing no significant variation (p = 0.648). The distribution of renal and ureteric stones between groups was not statistically significant (p = 0.164). However, the mean stone size was significantly larger in the interventional group (8.14 ± 2.21 mm) compared to the conservative group (5.82 ± 1.46 mm) (p <0.001). Additionally, hydronephrosis was significantly more frequent in the interventional group (72.3% vs 38.4%, p <0.001). Fever at presentation was also significantly higher among patients undergoing intervention (27.7% vs 12.3%, p = 0.034).

Table 1: Baseline Characteristics of Study Participants (N = 120)

Variable	Conservative (n=73)	Interventional (n=47)	Test value	95% CI	p value
Age in years	26.84 ± 4.12	27.91 ± 4.36	t = 1.36	-2.64 to 0.50	0.176
Gestational age at diagnosis, weeks	22.68 ± 6.31	23.94 ± 6.18	t = 1.08	-3.57 to 1.05	0.283
Primigravida	31 (42.5%)	18 (38.3%)	χ^2 = 0.21	OR 1.19; 0.56-2.54	0.648
Multigravida	42 (57.5%)	29 (61.7%)	χ^2 = 0.21	OR 0.84; 0.39-1.78	0.648
Renal stone	39 (53.4%)	19 (40.4%)	χ^2 = 1.94	OR 1.69; 0.80-3.58	0.164
Ureteric stone	34 (46.6%)	28 (59.6%)	χ^2 = 1.94	OR 0.59; 0.28-1.25	0.164
Stone size, mm	5.82 ± 1.46	8.14 ± 2.21	t = 6.91	-2.99 to -1.65	<0.001*
Hydronephrosis present	28 (38.4%)	34 (72.3%)	χ^2 = 13.20	OR 0.24; 0.11-0.54	<0.001*
Fever at presentation	9 (12.3%)	13 (27.7%)	χ^2 = 4.52	OR 0.37; 0.14-0.97	0.034*

Table 2: Maternal Outcomes in Conservative and Interventional Groups

Maternal outcome	Conservative (n=73)	Interventional (n=47)	Test value	95% CI	p value
Pain relief within 48 hours	51 (69.9%)	39 (83.0%)	χ^2 = 2.61	OR 0.48; 0.19-1.24	0.106
Persistent pain	22 (30.1%)	8 (17.0%)	χ^2 = 2.61	OR 2.10; 0.81-5.38	0.106
Urinary tract infection	17 (23.3%)	11 (23.4%)	χ^2 = 0.00	OR 0.99; 0.41-2.39	0.987
Pyelonephritis	8 (11.0%)	4 (8.5%)	χ^2 = 0.19	OR 1.32; 0.37-4.73	0.663
Need for hospital admission >3 days	14 (19.2%)	19 (40.4%)	χ^2 = 6.52	OR 0.35; 0.15-0.81	0.011*
Recurrent renal colic	18 (24.7%)	6 (12.8%)	χ^2 = 2.47	OR 2.24; 0.82-6.16	0.116
Preterm labour symptoms	11 (15.1%)	13 (27.7%)	χ^2 = 2.87	OR 0.46; 0.18-1.16	0.090
Maternal sepsis	2 (2.7%)	3 (6.4%)	χ^2 = 0.97	OR 0.41; 0.07-2.58	0.328
Caesarean delivery	21 (28.8%)	18 (38.3%)	χ^2 = 1.19	OR 0.65; 0.30-1.42	0.276

The maternal outcomes were largely comparable between the two groups. Pain relief within 48 hours was observed more frequently in the interventional group (83.0%) compared to the conservative group (69.9%), though this difference was not statistically significant (p = 0.106). Persistent pain and recurrent renal colic were relatively higher in the conservative group, but these differences did not reach statistical significance (p = 0.106 and p = 0.116, respectively). The incidence of urinary tract infection and pyelonephritis was similar in both groups (p >0.05). However, a significantly higher proportion of patients in the interventional group required hospital admission for more than 3 days (40.4% vs 19.2%, p = 0.011). Preterm labour symptoms and maternal sepsis were more common in the interventional group, although these differences were not statistically significant. Caesarean section rates were also higher in the interventional group (38.3% vs 28.8%), but without statistical significance (p = 0.276).

Table 3: Fetal Outcomes in Conservative and Interventional Groups

Fetal outcome	Conservative (n=73)	Interventional (n=47)	Test value	95% CI	p value
Gestational age at delivery, weeks	37.86 ± 1.42	37.21 ± 1.81	t = 2.20	0.07 to 1.23	0.030*
Preterm birth	9 (12.3%)	12 (25.5%)	χ^2 = 3.47	OR 0.41; 0.16-1.08	0.062
Birth weight, kg	2.81 ± 0.38	2.64 ± 0.46	t = 2.20	0.02 to 0.32	0.030*
Low birth weight	13 (17.8%)	14 (29.8%)	χ^2 = 2.39	OR 0.51; 0.21-1.24	0.122
APGAR score <7 at 5 min	4 (5.5%)	6 (12.8%)	χ^2 = 2.05	OR 0.40; 0.11-1.52	0.152
NICU admission	8 (11.0%)	11 (23.4%)	χ^2 = 3.34	OR 0.40; 0.15-1.10	0.067
Neonatal complications	6 (8.2%)	9 (19.1%)	χ^2 = 3.13	OR 0.38; 0.13-1.15	0.077
Perinatal mortality	1 (1.4%)	2 (4.3%)	χ^2 = 0.97	OR 0.31; 0.03-3.54	0.328

Fetal outcomes showed some differences between the two groups. The mean gestational age at delivery was significantly higher in the conservative group (37.86 ± 1.42 weeks) compared to the interventional group (37.21 ± 1.81 weeks) (p = 0.030). Similarly, the mean birth weight was significantly greater in the conservative group

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(2.81 ± 0.38 kg vs 2.64 ± 0.46 kg, p = 0.030). Although the incidence of preterm birth, low birth weight, low Apgar scores, NICU admission, and neonatal complications was higher in the interventional group, these differences did not achieve statistical significance (p >0.05). Perinatal mortality was low in both groups and did not differ significantly.

Table 4: Effectiveness and Safety of Conservative Versus Interventional Management

Parameter	Conservative (n=73)	Interventional (n=47)	Test value	95% CI	p value
Complete symptom resolution	49 (67.1%)	40 (85.1%)	$\chi^2 = 4.78$	OR 0.36; 0.14-0.91	0.029*
Treatment failure	16 (21.9%)	3 (6.4%)	$\chi^2 = 5.21$	OR 4.11; 1.13-14.91	0.022*
Need for secondary procedure	12 (16.4%)	5 (10.6%)	$\chi^2 = 0.79$	OR 1.65; 0.54-5.02	0.374
Mean hospital stay, days	3.18 ± 1.24	5.46 ± 1.89	t = 7.99	-2.85 to -1.71	<0.001*
Procedure-related complications	0 (0.0%)	6 (12.8%)	$\chi^2 = 9.83$	OR not estimable	0.002*
Requirement of antibiotics	21 (28.8%)	22 (46.8%)	$\chi^2 = 4.04$	OR 0.46; 0.21-0.99	0.044*
Readmission during pregnancy	13 (17.8%)	6 (12.8%)	$\chi^2 = 0.54$	OR 1.48; 0.52-4.22	0.463
Overall favourable outcome	58 (79.5%)	37 (78.7%)	$\chi^2 = 0.01$	OR 1.05; 0.43-2.53	0.917

The comparison of effectiveness and safety revealed that complete symptom resolution was significantly higher in the interventional group (85.1%) compared to the conservative group (67.1%) (p = 0.029). Conversely, treatment failure was significantly more common in the conservative group (21.9% vs 6.4%, p = 0.022). The need for secondary procedures was slightly higher in the conservative group, though not statistically significant (p = 0.374). The mean duration of hospital stay was significantly longer in the interventional group (5.46 ± 1.89 days vs 3.18 ± 1.24 days, p <0.001). Procedure-related complications were observed only in the interventional group (12.8%), which was statistically significant (p = 0.002). Additionally, antibiotic requirement was significantly higher in the interventional group (46.8% vs 28.8%, p = 0.044). Readmission rates and overall favorable outcomes were comparable between groups (p >0.05).

DISCUSSION

In the present study, baseline demographic variables were comparable between the conservative and interventional groups. The mean age was 26.84 ± 4.12 years in the conservative group and 27.91 ± 4.36 years in the interventional group, with no statistically significant difference. Similarly, gestational age at diagnosis and parity distribution were comparable between both groups. This finding is consistent with Thakur et al (2020),[1] who observed that urolithiasis in pregnancy commonly affects young women of reproductive age and that demographic factors alone do not usually determine the need for intervention. Sebastian et al (2021),[2] also reported that clinical severity, stone location, obstruction, and infection are more important determinants of management strategy than age or parity.

In the present study, renal stones were slightly more common in the conservative group, whereas ureteric stones were more frequent in the interventional group, although the difference was not statistically significant. However, mean stone size was significantly higher in the interventional group (8.14 ± 2.21 mm) compared to the conservative group (5.82 ± 1.46 mm), indicating that larger calculi were more likely to require active intervention. This is in agreement with Laranjo Tinoco et al (2024),[3] who noted that larger stones, persistent obstruction, and failure of spontaneous passage increase the likelihood of surgical or drainage procedures. Similarly, Kirubarajan et al (2022),[4] emphasized that obstructive urolithiasis is associated with increased obstetric risks and often necessitates timely intervention.

Hydronephrosis was significantly more common in the interventional group (72.3%) compared to the conservative group (38.4%). Fever at presentation was also significantly higher among interventionally managed patients. These findings suggest that patients requiring intervention had greater disease severity, obstruction, and possible infective complications. Ha et al (2023),[5] reported that most pregnant patients with renal colic can initially be managed conservatively; however, intervention becomes necessary in cases of persistent pain, fever, infection, or obstructive uropathy. Similarly, Bayraktar et al (2021),[6] observed that hydronephrosis during pregnancy, particularly when symptomatic, may require active treatment due to associated complications.

Regarding maternal outcomes, pain relief within 48 hours was higher in the interventional group (83.0%) than in the conservative group (69.9%), although the difference was not statistically significant. Persistent pain and recurrent renal colic were relatively more frequent in the conservative group. These findings indicate that conservative management is effective in many patients but may be associated with slower symptom resolution or recurrent episodes. Morgan et al (2022),[7] reported that conservative management provides symptom relief in a substantial proportion of pregnant women, but failure of conservative therapy remains an important indication for intervention. Dai et al (2021),[8] also reported that ureteroscopic and stent-based interventions provide effective symptom control in pregnant women with urolithiasis.

In the present study, urinary tract infection and pyelonephritis were comparable between the two groups, while hospital stay beyond 3 days was significantly higher in the interventional group. This

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may be explained by greater baseline severity, larger stone size, hydronephrosis, fever, and the need for peri-procedural observation in the interventional group. Chen et al (2025),[9] reported that interventional procedures during pregnancy are generally safe but may require close monitoring and longer hospitalization. Salehi-Pourmehr et al (2023),[10] also observed that both double-J stenting and ureteroscopic lithotripsy are effective options, though they may be associated with procedure-related morbidity and increased hospital stay.

Fetal outcomes in the present study showed that mean gestational age at delivery and mean birth weight were significantly lower in the interventional group. Preterm birth, low birth weight, NICU admission, low Apgar score, and neonatal complications were also higher in the interventional group, though these differences were not statistically significant. These findings suggest that adverse fetal outcomes may be more closely related to underlying disease severity rather than the intervention itself. Keenan et al (2022),[11] reported that nephrolithiasis during pregnancy is associated with increased risk of adverse birth outcomes, particularly in complicated cases. Similarly, Thakur et al (2020),[1] noted that renal colic during pregnancy may be associated with preterm labor and obstetric complications, especially in the presence of infection or obstruction.

In terms of effectiveness and safety, complete symptom resolution was significantly higher in the interventional group (85.1%) compared with the conservative group (67.1%), while treatment failure was significantly higher in the conservative group. This supports the role of intervention in selected patients with larger stones, persistent symptoms, or obstruction. However, interventional management was associated with significantly longer hospital stay, higher antibiotic requirement, and procedure-related complications. These findings are comparable with Baba et al (2025),[12] who stated that conservative management remains the preferred initial approach, while ureteral stenting or other interventions should be reserved for failed conservative treatment, sepsis, obstruction, or intractable pain.

CONCLUSION

The present study evaluated and compared maternal and fetal outcomes in pregnant women with renal or ureteric stones managed conservatively versus interventionally. The findings demonstrate that baseline demographic characteristics such as age, gestational age, and parity were comparable between both groups, indicating that patient-related factors did not significantly influence the choice of management. However, clinical severity indicators, including larger stone size, presence of hydronephrosis, and fever at presentation, were significantly higher in the interventional group, suggesting that patients undergoing intervention had more severe disease.

Conservative management was found to be effective in a substantial proportion of patients, particularly those with smaller stones and stable clinical status. However, it was associated with relatively higher rates of persistent pain and recurrent renal colic, indicating a risk of incomplete symptom resolution. In contrast, interventional management demonstrated significantly higher rates of complete symptom relief and lower treatment failure, highlighting its effectiveness in managing complicated cases. Despite this, interventional procedures were associated with longer hospital stay, increased antibiotic requirement, and procedure-related complications, reflecting the added procedural burden.

Maternal outcomes were largely comparable between the two groups, with no significant differences in infection rates, pyelonephritis, or cesarean delivery rates. However, prolonged hospitalization was significantly more common in the interventional group. Regarding fetal outcomes, the study observed that gestational age at delivery and birth weight were significantly lower in the interventional group. Although rates of preterm birth, NICU admission, and neonatal complications were higher in this group, these differences were not statistically significant, suggesting that adverse fetal outcomes may be more related to disease severity rather than the intervention itself.

Overall, the study concludes that conservative management remains a safe and effective initial approach in stable patients, whereas interventional management plays a crucial role in cases with larger stones, obstruction, infection, or failed conservative therapy. Both approaches yield comparable overall favorable outcomes when appropriately selected. Therefore, individualized management based on clinical severity, maternal condition, and fetal well-being is essential to optimize outcomes.

Limitations of the study

1. The study sample size was relatively small (n=120), which may limit generalizability of the findings.
2. Being a single-center study, results may not reflect broader population variations.
3. Non-randomized design could introduce selection bias between conservative and interventional groups.
4. Severity of disease influenced management choice, leading to inherent baseline differences.
5. Long-term maternal and neonatal outcomes were not assessed beyond delivery.
6. Imaging modalities were limited due to pregnancy-related constraints, possibly affecting diagnostic accuracy.
7. Variation in type of interventional procedures (DJ stent, ureteroscopy, PCN) was not analyzed separately.
8. Potential confounding factors such as nutritional status and socioeconomic conditions were not evaluated.

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9. Pain assessment and symptom relief were subjective and may vary between patients.
10. Lack of standardized protocol for timing of intervention across all cases.

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