Research Square

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Women wait longer: gender disparities in timing of urinary decompression for obstructive uropathy due to ureteral stones

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Research Article

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Abstract

IntroductionWomen have been reported to have a higher risk of stone-related infections and urosepsis than men. However, potential gender-related differences in the management of obstructive uropathy remain unexplored. This study evaluated the impact of gender on waiting times for urinary decompression in patients presenting to the emergency department(ED) with ureteral stone obstruction.Materials and methodsWe retrospectively analyzed data from 303 consecutive patients presenting to the ED of a single referral center with obstructive uropathy due to ureteral stones who underwent urgent urinary decompression between 01/2016 and 09/2025. Demographic, clinical and laboratory data were collected. All patients underwent preoperative imaging with computed tomography(CT) scan. Three time intervals were recorded: time from symptom onset to hospital presentation(StH), from hospital presentation to CT scan(HtC) and from hospital admission to decompression(HtD). Descriptive statistics and multivariable linear regression models were applied.ResultsOf the 303 patients included, 150 were male(49.5%) and 153 female(50.5%). No significant differences were observed in median age, median CCI, stone location and hydronephrosis grade among genders. Female patients presented with significantly higher preoperative body temperature ($p<0.001$), white blood cells count($p=0.01$) and C-reactive protein(CRP) values($p<0.001$) than males.Median StH was 24(10–48) hours in females versus 14(8–48) hours in males($p<0.01$); median HtC was 13(5–21) hours versus 9(4–14) hours($p=0.01$); and median HtD was 21(10–32) hours in females compared with 14(8–27) hours in males ($p<0.001$).Sepsis occurred more frequently in females than males(29.4%vs13.3%($p<0.001$)).At multivariate analysis, female gender(β 6.0; 95%CI 0.4–12.1; $p=0.01$) and CRP(β −2.7; 95%CI −4.2 to −1.1; $p=0.01$) were independently associated with longer HtD.ConclusionFemale patients with obstructive uropathy experienced longer diagnostic and treatment delays despite presenting with a more severe inflammatory profile. These findings support the implementation of gender-sensitive triage strategies and earlier diagnostic and urological intervention in women with signs of infection.

INTRODUCTION

Obstructive uropathy due to ureteral stones is a common urological emergency that affects a substantial proportion of patients presenting to the emergency department (ED).[1–3] Prompt recognition and management are crucial, as delayed treatment may lead to rapid clinical deterioration and serious infectious complications such as sepsis, septic shock, prolonged hospitalization and mortality, as well as higher healthcare costs and resource utilization.[4–6]

Existing literature has identified several predictors of adverse outcomes in obstructive uropathy, including advanced age, comorbidities and markers of systemic inflammation.[1, 7] Notably, epidemiological studies consistently report that women experience a higher incidence of stone-related infections and urosepsis compared to men.[8, 9] In parallel, research in other acute care settings, particularly in cardiology, has demonstrated significant gender disparities in access to diagnostic evaluation and timely treatment, with women often facing longer waiting times than men.[10, 11]

However, whether similar gender-related differences exist in the management of obstructive uropathy has not been systematically investigated. To date, no study has specifically evaluated potential gender disparities in the timing of urinary decompression among patients presenting with ureteral stones and obstructive uropathy. This represents a gap in knowledge, as unrecognized delays in care may contribute to worse outcomes in a population already at increased risk of infection-related complications.[5] Clarifying the role of gender in access to urgent treatment could have important implications for clinical decision-making, risk stratification and optimization of emergency care pathways. Therefore, the aim of this study was to evaluate the presence and extent of gender-related differences in waiting times for urinary decompression in patients presenting to the ED with obstructive uropathy due to ureteral stones, and to identify factors associated with delays to intervention in this clinical setting.

MATERIALS AND METHODS

We conducted a retrospective analysis of all consecutive patients presenting to the ED of a single referral center with obstructive uropathy secondary to ureteral stones who underwent urgent urinary decompression with either ureteral stent placement or percutaneous nephrostomy tube between January 2016 and September 2025. Eligible cases were retrieved from institutional ED discharge databases and selected according to diagnoses coded with the International Classification of Diseases (ICD-9-CM).[12] In cases of multiple emergency department presentations for the same obstructive stone event, only the visit ultimately resulting in urinary decompression was used as the reference admission for timing analyses. All study variables and outcome definitions were applied retrospectively during data extraction and analysis. Upon presentation, all patients underwent a comprehensive clinical and laboratory evaluation, which included complete blood count, electrolyte panel, coagulation profile, C-reactive protein (CRP), liver enzymes, bilirubin and serum creatinine. Comorbidity burden was quantified using the Charlson Comorbidity Index (CCI).[13] All patients underwent preoperative imaging with computed tomography (CT) scan to assess anatomical features, including the degree of hydronephrosis, as well as stone characteristics such as diameter, density, location and laterality. For each patient, the following time intervals were calculated: from symptom onset – defined as the time of first symptom awareness as reported by the patient or, when unavailable, by a witness or caregiver – to hospital presentation (StH); from hospital admission to CT scan (HtC); and from admission to decompressive intervention (HtD). The choice of drainage modality, retrograde ureteral stenting or percutaneous nephrostomy, was determined on a case-by-case basis according to clinical judgment and patient characteristics. Percutaneous nephrostomy was generally selected for larger ureteral stones (> 1.5 cm), in situations where retrograde access was deemed unlikely to succeed or when anesthesia or sedation posed elevated risk. Retrograde stenting was typically preferred in patients on anticoagulation therapy or with coagulation disorders to limit hemorrhagic risk. Failure of retrograde access prompted immediate transition to percutaneous drainage within the same session. Bladder urine specimens were routinely collected for culture, while blood cultures were obtained in patients with fever (≥ 38°C) and/or chills before or after decompression. When technically feasible, urine samples from the renal pelvis were also collected.

Empiric broad-spectrum intravenous antimicrobial therapy was initiated at presentation or at the time of surgery according to clinical status. Antimicrobial regimens were subsequently refined based on microbiological findings and clinical response, with dose adjustments guided by renal function. Renal function was assessed through serum creatinine and estimated glomerular filtration rate, with measurements obtained at the time of maximum renal dysfunction, defined as the highest serum creatinine level recorded prior to decompression.

Ethical approval

Data was collected according to the principles outlined in the Declaration of Helsinki. All patients signed an informed consent agreeing to share their own anonymous information for future studies. The study was approved by the Foundation IRCCS Ca' Granda – Ospedale Maggiore Policlinico Ethical Committee (Prot. 25508).

Statistical analysis

Data distribution was tested graphically and with the Shapiro-Wilk test. Descriptive statistics of categorical variables focused on frequencies and proportions. Medians and interquartile ranges (IQR) were reported for continuously coded variables. Statistical analyses were performed in multiple steps. First, descriptive statistics were used to describe the whole cohort. Secondly, potential differences between male and female patients in clinical and laboratory parameters were tested with Mann-Whitney U test and Chi Square test, as indicated. Univariable and multivariable linear regression models were used to identify risk factors for HtD in the whole cohort.

SPSS v.28 (IBM Corp., Armonk, NY, USA) was employed to perform statistical tests. All tests were two sided, with a significance level set at 0.05.

RESULTS

Overall, 303 patients were included: 150 males (49.5%) and 153 females (50.5%).

Characteristics of the whole study cohort are depicted in Table 1.

Table 2 reports the comparison between male and female patients. No significant differences were observed in median age, which was 59 (48–69) years in males and 60 (45–77) years in females (p=0.7). Similarly, median CCI was comparable between groups, with a value of 1 (0–2) in both males and females (p=0.6). Stone location distribution (proximal, mid, distal) was also similar: 42.0%, 22.6% and 35.4% in males versus 34.6%, 22.8% and 42.6% in females (p=0.5), respectively. Likewise, no significant difference was found in the rate of grade III–IV hydronephrosis, which was present in 40.6% of males and 41.2% of females (p=0.3).

Regarding clinical and laboratory data, median maximum body temperature was significantly higher in females, reaching 38 (36.7–38.7) °C, compared with 37.0 (36–38) °C in males (p<0.001). Median WBC count was also higher in females [15.8×10³ (9.1–18.3) /mmc] than in males [11.6×10³ (8.8–14.7) /mmc] (p=0.01). Similarly, median CRP levels were significantly greater in females, at 11.2 (3.4–22.0) mg/dL, compared with 5.4 (1.2–12.1) mg/dL in males (p<0.001). No significant differences were observed in median serum creatinine, which was 1.6 (1.3–2.2) mg/dL in males and 1.4 (0.9–1.7) mg/dL in females (p=0.2). Stone characteristics were also comparable, with a median stone diameter of 6.5 (4.5–9.0) mm in males and 7.0 (5.0–9.2) mm in females (p=0.1) and a median stone density of 581 (393–906) HU versus 633 (458–976) HU, respectively (p=0.08).

Regarding management timelines, females experienced significantly longer delays. Median StH was 24 (10–48) hours in females versus 14 (8–48) hours in males (p<0.01); median HtC was 13 (5–21) hours versus 9 (4–14) hours (p=0.01); and median HtD was 21 (10–32) hours in females compared with 14 (8–27) hours in males (p<0.001).

The type of urinary drainage did not differ significantly between groups: ureteral stenting was performed in 89.4% of males and 90.8% of females, whereas nephrostomy was used in 10.6% and 9.1%, respectively (p=0.6). Finally, sepsis occurred significantly more frequently in females, with an incidence of 29.4% compared with 13.3% in males (p<0.001).

Table 3 depicts linear regression models predicting HtD. In univariate analysis, female gender was associated with HtD (β 6.1; 95% CI 0.3–11.8; p<0.01). Maximum body temperature (β −1.1; 95% CI −2.1 to −0.8; p<0.01), CRP (β −2.4; 95% CI −3.9 to −1.1; p<0.01), WBC count (β −1.3; 95% CI −2.8 to −0.7; p=0.01) and grade III–IV hydronephrosis (β −2.3; 95% CI −4.5 to −0.5; p=0.02) were associated with HtD. Age (β 0.1; p=0.2) and stone diameter (β 1.0; p=0.2) were not associated with HtD. In multivariate analysis, female gender (β 6.0; 95% CI 0.4–12.1; p=0.01) and CRP (β −2.7; 95% CI −4.2 to −1.1; p=0.01) remained independently associated with HtD. Maximum body temperature (β −1.0; p=0.1) and hydronephrosis grade (β −1.7; p=0.2) were not statistically significant.

DISCUSSION

To our knowledge, this is the first study to investigate gender-related differences in the timing of urinary decompression among patients presenting with ureteral stone obstruction and obstructive uropathy. Our results demonstrate a clinically significant and paradoxical pattern: female patients exhibited a markedly more severe inflammatory profile at admission, evidenced by significantly higher body temperature, white blood cell counts and CRP levels, yet experienced substantially longer delays to urinary decompression across all measured time intervals. These findings are particularly concerning given the well-established association between delayed decompression and adverse outcomes, including sepsis, prolonged hospitalization and mortality, and are further underscored by previous evidence reporting a 29% higher odds of death in patients with obstructive uropathy and concomitant infection who underwent delayed drainage, even after adjustment for disease severity and comorbidities.[2] In this

context, it is worth noting that women have been reported to have an increasing incidence of urolithiasis and a greater susceptibility to urinary tract infections both at baseline and following urological procedures, which may at least partly account for the more severe inflammatory presentation observed in our female cohort.[14–17]

Notably, gender-related disparities in access to healthcare have been consistently reported across different acute care settings, with women experiencing longer delays in diagnostic evaluation and therapeutic intervention compared with men.[10,11] A paradigmatic example is represented by cardiology, where women have been shown to experience a significantly longer interval between their first physician encounter indicative of coronary artery disease and their first diagnostic cardiac catheterization compared to men.[10,11] Our findings suggest that a similar pattern may exist in the urological setting, extending the evidence of gender-related disparities to the management of obstructive uropathy.

At multivariable analysis, female gender was independently associated with longer HtD, whereas higher CRP levels were associated with shorter decompression time. In our cohort, women had significantly higher body temperature, WBC count and CRP levels, yet this did not translate into faster intervention, as also reported in previous literature.[18]

These findings suggest that the observed gender disparity may not simply reflect differences in disease severity, but could represent an independent phenomenon warranting further investigation into the processes governing clinical decision-making in this setting.

Several hypotheses may explain these observations: differences in symptom reporting, different clinical presentation patterns and triage prioritization. One plausible explanation relates to the atypical or overlapping symptomatology that frequently characterizes urinary tract pathology in women. Flank pain, dysuria and lower abdominal discomfort in female patients constitute a broad differential diagnosis encompassing gynecological conditions. This diagnostic complexity may lead clinicians to initially consider alternative diagnoses, delaying the recognition of obstructive uropathy as the primary etiology and, consequently, postponing the initiation of urological workup and intervention. Differences in clinical presentation patterns between men and women have been reported in multiple diseases, with women more frequently experiencing atypical or less specific symptom manifestations, which may contribute to diagnostic and therapeutic delays.[19] Gender-related disparities in diagnostic timing may also be influenced by historically male-centric research frameworks and the underrepresentation of women in clinical studies, which may have contributed to the development of symptom recognition models largely based on male populations.[20] Moreover, cognitive heuristics in clinical practice may further play a role, as atypical or less specific symptom presentations in women may be more likely to be initially attributed to non-organic causes, including anxiety or functional disorders, potentially delaying escalation of care.[20] In addition, underestimation of pain severity and variability in triage categorization have been reported, suggesting the possible contribution of systemic and perceptual factors to gender-related differences in treatment timing.[21]

The observed prolongation of the StH interval in female patients suggests that gender-related delays begin even before hospital presentation. This may reflect a greater tolerance of pain or a tendency to attribute symptoms to more familiar and recurrent conditions, such as urinary tract infections or gynecological disorders, potentially leading women to defer seeking emergency care. These pre-hospital delays are particularly concerning given the more severe inflammatory profile observed at admission in female patients, suggesting that women may arrive at the ED at a more advanced stage of infectious complications than their male counterparts.

Beyond pre-hospital delays, the HtC interval was also significantly prolonged in women, suggesting that disparities extend into the early in-hospital diagnostic pathway. This may reflect differential prioritization during emergency triage, where composite severity scores may not fully capture gender-specific inflammatory responses, potentially leading to a lower urgency categorization in female patients. Furthermore, if the initial presentation is attributed to gynecological or other non-urological conditions, the indication for dedicated urinary tract imaging may be delayed or initially overlooked, thereby compounding downstream delays to diagnosis and, ultimately, to urinary decompression.

The second point to analyze concerns the differential impact of anatomical versus systemic inflammatory markers on decompression timing. Markers of systemic inflammation, particularly CRP, were consistently associated with shorter HtD, suggesting that biochemical evidence of infection or systemic response plays a central role in triggering rapid intervention. This likely reflects real-world clinical prioritization, where the perceived risk of sepsis drives urgency more than structural findings alone. Accordingly, anatomical severity, reflected by the degree of hydronephrosis, showed an association with HtD only in univariate analysis, indicating that radiological evidence of obstruction, when considered independently, may not be sufficient to influence timing decisions unless accompanied by systemic signs of infection. Taken together, these findings support the notion that, in acute setting, treatment is primarily guided by clinical and laboratory parameters rather than radiological findings, with systemic inflammatory burden acting as the key determinant of urgency.

Our study has several strengths. It addresses a previously unexplored aspect of emergency urological care, providing the first evidence of gender-related disparities in decompression timing in this setting. Moreover, demonstrating that this delay is independent of disease severity highlights a potentially modifiable disparity within emergency care pathways, with direct practical implications for optimizing triage processes, refining decision-making criteria and improving equity in the management of acute obstructive uropathy.

Our study is not devoid of limitations. Firstly, the retrospective design inherently introduces potential biases, including possible inaccuracies in timing of symptom onset and clinical documentation. Secondly, as a single-center study, results may not be fully generalizable to other healthcare settings with different organizational pathways or patient populations; therefore, larger studies are needed to externally validate our findings. Thirdly, although clinically relevant, some variables (e.g., symptom onset timing) rely on patient recall and may be subject to recall bias. Fourthly, in patients with multiple ED

presentations, StH was calculated using the admission that ultimately led to urinary decompression. As previous evaluations were not incorporated into this measure, the reported StH may underestimate the overall time elapsed between symptom onset and definitive treatment in patients requiring repeated ED admissions before decompression. Nevertheless, the primary focus of the study was the evaluation of in-hospital delays, which are unlikely to be substantially affected by previous healthcare encounters. Future prospective multicenter studies are needed to further elucidate the mechanisms underlying gender-related differences in treatment timing and to validate these findings across different healthcare settings.

Declarations

SHORT TITLE

Gender differences in decompression timing

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CONCLUSIONS

Female patients with obstructive uropathy experienced longer delays in diagnostic evaluation and urinary decompression compared with males, despite presenting with more pronounced inflammatory profiles. This finding suggests that treatment timing is not solely determined by objective markers of disease severity, but may also be influenced by a complex interplay of factors operating across the care pathway. These may include differences in symptom perception and reporting, variability in initial clinical assessment and triage prioritization, and broader organizational dynamics within emergency care systems. Awareness of these dynamics should prompt the adoption of gender-sensitive triage protocols and lower thresholds for urgent imaging and urological intervention in female patients presenting with fever and elevated inflammatory markers, representing an important opportunity to improve both equity of care delivery and clinical outcomes in this time-sensitive condition.

beta, p-value 95% CI beta, p-value 95% CI

Age 0.1, 0.2 − 0.1–0.3

Female gender 6.1, < 0.01 0.3–11.8 6.0; 0.01 0.4–12.1

Max body temperature − 1.1, < 0.01–2.1 - -0.8 -1.0, 0.1–2.3–1.5

C-reactive protein − 2.4, < 0.01–3.9 – -1.1 -2.7; 0.01–4.2 – -1.1

White blood cells count − 1.3; 0.01–2.8 – -0.7

Stone diameter 1.0, 0.2–0.5–1.2

Grade III-IV hydronephrosis – 2.3; 0.02–4.5 - -0.5 -1.7; 0.2–2.9–1.2

Keys: UVA = Univariate model; MVA = Multivariate model

HtD = timing from admission to surgical decompression

Author Contribution

L. M. B.: data collection; wrote the manuscript; revised the manuscriptF. P.: data collectionM. S.: revised the manuscriptG. A.: data collectionL. B.: conception and design of the study; statistical analysisE. DL.: conception and design of the study; revised the manuscript; supervised the work

Data Availability

The datasets are available from the corresponding author on reasonable request.

CONCLUSIONS

Female patients with obstructive uropathy experienced longer delays in diagnostic evaluation and urinary decompression compared with males, despite presenting with more pronounced inflammatory profiles. This finding suggests that treatment timing is not solely determined by objective markers of disease severity, but may also be influenced by a complex interplay of factors operating across the care pathway. These may include differences in symptom perception and reporting, variability in initial clinical assessment and triage prioritization, and broader organizational dynamics within emergency care systems. Awareness of these dynamics should prompt the adoption of gender-sensitive triage protocols and lower thresholds for urgent imaging and urological intervention in female patients presenting with fever and elevated inflammatory markers, representing an important opportunity to improve both equity of care delivery and clinical outcomes in this time-sensitive condition.

Tables

Tables 1-3 are available in the Supplementary Files section.

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Supplementary Files

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