

The impact of delaying acute kidney stone surgery on outcomes

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Introduction

Kidney stone disease is very common and its incidence is increasing.¹ The main management option for kidney stones is surgery. However, with the outbreak of the coronavirus disease (COVID-19), elective surgical procedures, such as those for kidney stones, have been put on hold due to resource allocation and competing risk considerations.

The initial management of acute renal colic depends on the severity of the clinical presentation. A conservative approach is recommended in selected patients, knowing that up to 95% of ureteric stones <5 mm can pass spontaneously.² By contrast, urgent decompressive intervention is required for patients with sepsis and obstructing stones.² However, there is no clear recommendation about the optimal time to treat non-urgent obstructing stones.²

Thus, urologists must decide which cases can be safely delayed. To support such prioritization of cases, most experts recommend that non-complicated kidney stones be postponed.³ In order to support decision-making when delaying care for kidney stones and to better understand the impact of delaying kidney stone surgery, we aimed to perform a systematic review of the outcomes of early elective vs. delayed elective intervention for acute episodes of renal colic with obstructing stones.

Methods

We conducted a systematic review of the literature.

Search strategy

We searched MEDLINE and EMBASE for all articles, regardless of year of publication. The search strategy was built by an experienced librarian and designed to include subject head-

ings (MeSH/Emtree), including “kidney calculi” or “nephrolithiasis” AND “time to treatment.” Search filters for the following key phrases were added: “kidney stone,” “lithiasis,” “ureteric stone,” “time factors,” “(time OR delay) to (treatment OR intervention OR lithotripsy OR surgery).” We limited our search to human studies written in English or French.

Inclusion and exclusion criteria

Studies available as a full-text or conference proceeding were included without restrictions on modality. Studies evaluating the outcomes of early elective vs. delayed elective cases for acute episodes of renal colic with obstructing stones were eligible for inclusion. We defined elective cases as an episode of renal colic without fever, renal insufficiency, and/or unrelenting pain. Commentaries and studies focusing on asymptomatic non-obstructing stones, pediatric and pregnant populations were excluded.

Review strategy

Duplicates were removed. Titles and abstracts were reviewed by two independent investigators (AA & IS) and discrepancies were resolved by a third author (DDN). Articles retained for full-text review were also independently reviewed by three independent investigators (AA, NB & DDN). Discrepancies were resolved by consensus.

Study synthesis

Studies were qualitatively synthesized. We abstracted the following information: year of publication, study design, number and characteristics of participants (including stage of disease and method of diagnosis), inclusion and exclusion criteria, intervention, and outcome measures. Outcome measures were not determined a priori, considering the scarcity of previous literature on the topic.

Results

We retained 22 studies for full-text review selected from 675 initially identified records. Fifteen of the studies were

excluded, as they did not meet inclusion or exclusion criteria. The seven retained studies provided relevant information regarding our clinical question, however, none of them specifically evaluated the impact of delayed surgery on long-term outcomes. A broad range of study designs were left with an important heterogeneity regarding the population of interest, clinical presentation, and management. The PRISMA flow chart is presented in Fig. 1 and Table 1 shows study characteristics.

Among the selected studies, three groups assessed the outcomes associated with longer delays to surgery. They reported that important delays to definitive surgical management led to repeated emergency department (ED) visits, more medical imaging exams, re-admissions, and increased morbidity (e.g., surgical decompression, postoperative complications).^{1,4,5} Kirshenbaum et al found an increased rate of sepsis during the postoperative period in patients who underwent ureteral stent prior to surgery (0.84%) compared to those who underwent upfront ureteroscopy (URS) (0.47%) ($p<0.001$). Risk of renal insufficiency, pyelonephritis, or ureteral strictures was not associated with longer delays.⁵ Bajaj et al noted that it may be safe to delay surgery in patients with symptoms for <3 days, no history of stone disease, a low stone burden, and an absence of abdominally located stones.⁶

The effectiveness and safety of early (within 12–72 hours) extracorporeal shockwave lithotripsy (eESWL) was documented in three studies.^{7–9} The stone-free rate (SFR) was higher in the eESWL (SFR 52.8–73.2%) groups compared to the delayed ESWL (dESWL) groups (SFR 11.8–40.0%). Bucci et al reported a reduced number of additional interventions (13.9% vs. 44.1%, $p=0.039$) and duration of hospitalization (1.36 days vs. 2.21 days, $p=0.046$) in patients who under-

went eESWL as compared to dESWL.⁷ The complication rate was similar between early and delayed ESWL groups (8.3% vs. 5.9%, respectively, $p=0.691$).⁷

Discussion

As elective procedures slowly restart with the COVID-19 pandemic seemingly relenting momentarily, knowing which cases to prioritize and understanding the impact of delayed treatment becomes primordial. As such, we conducted a systematic review to examine the impact of delays on acute (but non-emergent) stone events. We found that studies on this topic are lacking — as such, current guidelines on kidney stones should primarily be guided by expert opinion.

With longer waiting lists, urologists might have to face more complicated cases.³ In a retrospective study, Gul et al demonstrated that the rate of complicated kidney stone disease increased significantly during the COVID-19 period.¹⁰ This could be explained by fear of infection leading patients to delay medical consultation, as well as non-optimal followup subsequent to discharge from the ED. Therefore, patients should have prompt access to urological care and be closely evaluated after discharge in order to identify and prevent complications. Hiller et al supported telehealth as an appropriate tool to promote patient education, patient involvement regarding treatment decisions, and to identify the need for ESWL and emergent URS.¹¹

Medical associations and research groups have tried to establish guidelines and recommendations to follow during the COVID-19 pandemic. The European Association of Urology (EAU) recommends an interventional treatment (ESWL, URS, or decompression) within <6 weeks

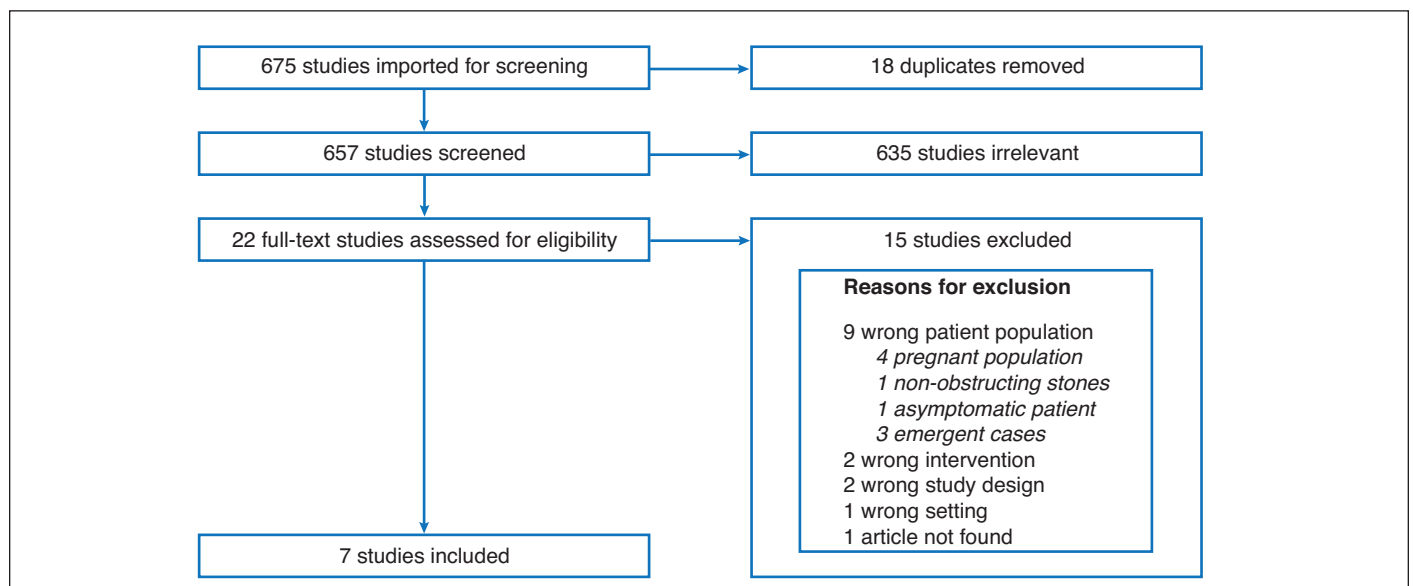


Fig. 1. PRISMA diagram.

Table 1. Study characteristics

Authors	Year	Type of study	Aims	Sample	Results	Key findings
Brubacker et al ⁴	2019	Population-based cohort study	Evaluate whether payer type or ethnicity influence time to surgery in kidney stone disease	n=15 193	Median time from diagnosis to surgery: Total: 28 days PCNL: 52 days ESWL: 29 days URS: 25 days Outcomes associated with longer delays: ≥3 ED visits ≥2 CT imaging Upper urinary tract decompression	Subgroups of patients who experience longer time to surgery are more likely to have repeated ED visits, repeated CT imaging and upper urinary tract decompression prior to definitive treatment.
Kirshenbaum et al ⁵	2019	Retrospective cohort study	Assess the socioeconomic factors influencing treatment and outcomes on patients admitted to the hospital with a primary diagnosis of urolithiasis	n=146 199	Surgical interventions: Upfront URS: 44% Stent alone: 42% ESWL: 8% PCNL: 5% Percutaneous nephrostomy: 1% Readmission rate within 30 days: Upfront URS: 5.89% Stent alone: 8.21% p<0.001 Stone procedures within 90 days: Upfront URS: 10.0% Stent alone: 49.25 % p<0.001 Postoperative sepsis: Upfront URS: 0.47% Stent alone: 0.84 % p<0.001	Patients presenting a primary diagnosis of urolithiasis who underwent ureteral stent placement are more likely to experience readmission, auxiliary stone procedures and postoperative complications.
Bajaj et al ⁶	2018	Retrospective cohort study	Identified stone-related factors predicting the need for surgical intervention in patients presenting acute ureteric colic who were not considered surgical candidates	n=527	Predictors of need for surgery: Length of symptoms >3 days Previous history of stone disease Absence of alpha-blocker therapy Stone burden Abdominal location of stone	When conservative approach was selected, patients presenting with symptoms >3 days, history of stones disease, important stone burden, and/or abdominal stone location were more likely to require surgical intervention after discharge.

CT: computed tomography; ED: emergency department; ESWL: electric shockwave lithotripsy; PCNL: percutaneous nephrolithotomy; URS: ureteroscopy.

for obstructing ureteral stones that are considered not suitable for medical expulsive therapy (MET).¹² Similarly, Socarrás et al recommend interventional treatment within 2–4 weeks for non-complicated obstructive ureteral stone >8–10mm.¹³ Socarrás et al and Carneiro et al also endorse the use of URS when a surgical procedure is indicated in order to reduce the need of additional interventions.^{13,14} This is consistent with our finding that upfront URS appeared to prevent subsequent interventions, re-admissions, and complications associated with the placement of a temporary ureteral stent.⁵ Furthermore, eESWL may be another interesting approach, as it is safe, non-invasive, and doesn't require anesthesia.

Patients who underwent ureteral stent insertion during the COVID-19 pandemic should be closely monitored while waiting for definitive surgery.^{1,4,5} Indeed, we found ureteral stents conferred a higher risk of re-admission while awaiting definitive surgery.^{1,5} These patients may experience stent-related side effects (e.g., urgency, hematuria, pain) and are at a higher risk of complications, such as ureteral stent infection and calcification, pyelonephritis, and urosepsis. In a systematic review of published recommendations during the COVID-19 pandemic, Heldwein et al reported that patients with pre-existing stents should be prioritized. With no clear consensus, the acceptable delay before stent removal was 6–12 weeks.¹⁵

Table 1 (cont'd). Study characteristics

Authors	Year	Type of study	Aims	Sample	Results	Key findings
Bucci et al ⁷	2018	Randomized clinical trial	Evaluate the efficacy of early ESWL as first-line treatment in patients with obstructive ureteral stone	n=74	<p>Hospitalization time: Early ESWL: 1.36 days Delayed ESWL: 2.21 days p=0.046</p> <p>Stone-free rate at 24 hours: Early ESWL: 52.8% Delayed ESWL: 11.8% p<0.001</p> <p>URS intervention: Early ESWL: 13.9 % Delayed ESWL: 44.1% p=0.039</p> <p>Complication rate: Early ESWL: 8.3 % Delayed ESWL: 5.9% p=0.691</p>	<p>Early ESWL and deferred ESWL are both safe procedures for first-line treatment of obstructive ureteral stones.</p> <p>Early ESWL demonstrated a higher stone-free rate and reduced the number of additional interventions and the duration of hospitalization.</p>
Smith et al ¹	2015	Retrospective study	Evaluate the readmission rate for patients with ureteral stents awaiting surgery	n=378	<p>Number of patients readmitted: n=78 (20.6%)</p> <p>Number of admissions: n=248</p> <p>Mean duration from diagnosis to first surgery: m=52.3 days</p> <p>Mean duration from diagnosis to the definitive surgery: m=63.6 days</p> <p>Number of working days lost due to readmissions: n=401 days</p>	<p>Patients with ureteral stents are at risk of complication during the waiting period until definitive surgery.</p> <p>Patients with urolithiasis often belong to the working age population (18–65 years old), which results in loss of income and significant economic impact.</p>
Panah et al ⁸	2013	Case series study	Evaluated the factors influencing the outcome of emergency ESWL (within 72 hours of presentation) in patients presenting with a first episode of ureteric colic	n=97	<p>Stones characteristics: Stone mean size: 6.73 mm Stone size range: 3–12 mm Stone density range: 286–837 HU</p> <p>Outcomes after eESWL: Stone-free rate: 73.2%</p> <p>ESWL done within 24 hours: Stone-free group: 77.5 % Non-stone-free group: 62% p=n/a</p> <p>Major complications: None</p>	<p>Emergency ESWL is a safe and effective treatment in selected patients presenting a first episode of renal colic.</p> <p>The intervention success rate was higher in patients who received ESWL within 24 hours.</p>

CT: computed tomography; ED: emergency department; ESWL: electric shockwave lithotripsy; PCNL: percutaneous nephrolithotomy; URS: ureteroscopy.

Based on our findings, we recommend that patients with non-complicated obstructive stones should be treated within six weeks to avoid repeated ED visits, more medical imaging exams, re-admissions, and increased morbidity. When early interventions (upfront URS or eESWL) are not possible, patients should be closely monitored after hospital dis-

charge. When an interventional treatment is still indicated, URS is preferred over ureteral stent drainage.

This study has limitations. First, the number of studies included was low as a result of the limited data available. Additionally, none of the studies directly evaluated the effect of delayed treatment on outcomes. Lastly, there was

Table 1 (cont'd). Study characteristics

Authors	Year	Type of study	Aims	Sample	Results	Key findings
Uguz et al ⁹	2012	Randomized clinical trial	Evaluate the efficacy and outcomes of immediate ESWL compared to delayed ESWL in management of ureteric stones	n=63	<p>Stone-free rate: Early ESWL: 53.1% Delayed ESWL: 40.0% p=0.353</p> <p>Mean time from diagnosis to stone clearance Immediate ESWL: 6.31 days Delayed ESWL: 9.82 days p=0.033</p> <p>URS intervention: Immediate ESWL: 6.2% Delayed ESWL: 19.4% p=0.472</p>	Immediate ESWL is a safe procedure and appears to shorten the time from diagnosis to stone clearance compared to delayed ESWL.

CT: computed tomography; ED: emergency department; ESWL: electric shockwave lithotripsy; PCNL: percutaneous nephrolithotomy; URS: ureteroscopy.

significant heterogeneity regarding the design, sample size, and quality of the selected studies. Many studies were limited by potential confounding factors. Despite its limitations, our review identifies the need for expert recommendations regarding kidney stones treatment delay.

Conclusions

There is a paucity of data on the impact of delayed treatment in patients with acute episodes of renal colic with obstructing stones. However, the literature review reveals that patients who experience delays to definitive surgery are more prone to have repeated ED visits, repeated imaging, and upper urinary tract decompression. We found that upfront URS and eESWL are safe procedures with clinical advantages. Data indicating long-term kidney damage in patients with delayed surgical intervention was not reported. Further studies are required to develop a safe and efficient prioritization approach to kidney stones surgery.

Competing interests: The authors do not report any competing personal or financial interests related to this work.

The paper has been peer-reviewed.

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