Review Article

Time-sensitive elements in elective treatment of urinary lithiasis: a narrative review

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Background and Objective: Managing surgical queues for urinary lithiasis is a persistent challenge in healthcare systems. Despite substantial research in this area, clear criteria for prioritizing patients and determining those who can safely wait longer without complications remain elusive. This review aims to develop a rational framework for optimizing surgical queue management in urinary stone treatment by analyzing primary literature.

Methods: We conducted a review of relevant guidelines, held departmental discussions to identify additional factors, and performed an extensive PubMed search using key terms related to queue management and expectant care in lithiasis.

Key Contents and Findings: Significant factors identified include stone volume and location, presence of hydronephrosis, patient frailty and comorbidities, recurrent urinary infections, nephrostomy or double-J stent, urinary diversion, high occupational risk, limited healthcare access, and refractory pain impacting quality of life. A detailed analysis of these factors is presented in the article.

Conclusions: Effective management of surgical waitlists for urinary lithiasis requires a comprehensive assessment of factors such as stone characteristics, hydronephrosis, patient frailty, comorbidities, infections, drainage devices, accessibility, and quality of life, as prioritization based solely on waiting time is insufficient and potentially harmful.

Keywords: Kidney stones; percutaneous nephrolithotomy (PCNL); healthcare management; resource allocation; waiting list

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Introduction

Urinary stones are a common condition managed routinely by urologists (1), with treatment options including extracorporeal shockwave lithotripsy (ESWL), flexible ureteroscopy (FURS), and percutaneous nephrolithotomy (PCNL) (2). However, long surgical waiting lists often arise due to epidemiological or economic challenges, particularly in developing countries, where healthcare systems face chronic strain even without global crises (3-5). The coronavirus disease 2019 (COVID-19) pandemic highlighted the vulnerability of even advanced healthcare systems to unforeseen disruptions (6-8). This underscores

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the need to identify patients at higher risk of complications and prioritize them during elective management of urinary lithiasis.

Elective interventions for kidney stones aim to prevent renal colic, urinary obstruction, and infection (2). Yet, precise criteria to predict which stones will lead to complications or define safe surgical waiting periods remain unclear (9). Factors such as accelerated stone growth or patient frailty further complicate prioritization (10,11). Despite these challenges, the literature offers insights to guide decision-making. This narrative review aims to provide some guiding concepts for decision-making during the management of a surgical queue for kidney stones. We present this article in accordance with the Narrative Review reporting checklist (available at https://tau.amegroups.com/article/view/10.21037/tau-24-596/rc).

Methods

Initially, we conducted a review of the European and American guidelines on the management of urinary lithiasis, aiming to define which influencing factors in managing a surgical queue for urinary lithiasis have already been established. Subsequently, we held a departmental meeting where we discussed the main challenges that we face daily in managing our surgical queue for urinary lithiasis and any factors not covered in the guidelines. We then performed an extensive literature review on PubMed on the discussed topics, as well as factors related to the natural history of expectant management in lithiasis, as this could help in understanding the actual impacts of prolonged waiting times in the surgical queue. The keywords used in the search were: "Kidney Stones", "Urinary Lithiasis", "Percutaneous Nephrolithotripsy", "Percutaneous Nephrolithotomy", "PCNL", "Hydronephrosis", "Recurrent Urinary Infection", "Nephrostomy", "Double J", "Urinary Diversion", "Opioid Abuse". Our search was limited to articles available in English and Portuguese. From our search, we selected the articles with the most relevant information, which are summarized in the topics ahead (*Table 1*).

Volume and disposition of stones

Context

Although no specific studies have been found on which size or disposition of stones should be prioritized in a surgical queue, there is relevant evidence regarding the expectant management of stones that provides useful insights. A retrospective analysis of 300 patients undergoing conservative treatment for asymptomatic stones, with an average follow-up of 3.7 years, demonstrated that stone size correlates with failure in expectant management. In this cohort, 100% of patients with stones larger than 15 mm required active treatment during the study period. Although the sample size was not sufficiently large to achieve statistical significance, this analysis suggested that stones located in the pelvis were the most unfavorable for conservative management (12).

Additionally, a multicenter randomized study involving 73 patients, followed for an average of 4.2 years, found that the prophylactic removal of all stones larger than 6 mm reduced the incidence of clinically significant stone-related events from 63% to 16% (hazard ratio, 0.18; 95% confidence interval, 0.07 to 0.44) and extended the time to clinical recurrence by 75% (1,631.6±72.8 *vs.* 934.2±121.8 days) (13). These findings indicate that patients with multiple lithiasis are at an increased risk of future complications, even when asymptomatic.

Furthermore, a case series of 177 patients followed for an average of 43 months showed that asymptomatic stones progressed to clinically relevant events in up to 45.1% of cases, with stones larger than 5 mm being the most likely to exhibit adverse outcomes [odds ratio (OR): 2.94; P=0.01]. The same study also revealed that stones located in the middle or upper calyces, and multiple stones, were associated with a higher probability of symptomatic events or the need for intervention. Conversely, isolated stones in the lower calyx had a lower chance of progression (OR: 2.05; P=0.05 and OR: 2.29; P=0.03, respectively) (14).

In studies evaluating the progression of asymptomatic urolithiasis, the growth dynamics of calculi tend to be heterogeneous, with some stones exhibiting slow growth while others progress more rapidly (9,15,16). This variability is a critical factor to consider when managing patients who may experience prolonged waiting periods for surgical intervention.

Practical application

Based on this evidence, it can be inferred that patients with large or multiple stones located in the middle or upper calyces are at a higher risk of experiencing adverse events during prolonged waiting periods in a surgical queue. Stones in a pelvic position are likely to be among the most

Table 1 Search strategy summary

Items	Specification
Date of search	October 2023 to July 2024
Database searched	PubMed
Search terms used	Kidney Stones, Urinary Lithiasis, Percutaneous Nephrolithotripsy, Percutaneous Nephrolithotomy, PCNL, Hydronephrosis, Recurrent Urinary Infection, Nephrostomy, Double J, Urinary Diversion, Opioid Abuse
Timeframe	1989–2023
Inclusion criteria	Full text/Portuguese or English text
Selection process	The selection of the articles was carried out by the first three authors and subsequently reviewed by the last two authors

critical, while single stones in the lower calyx present a lower risk. Patients expected to face extended delays before surgery should undergo periodic re-evaluation with imaging studies to assess stone growth. Stones demonstrating significant growth should be closely monitored, and those with increases exceeding 5 mm should be prioritized for treatment (2).

Hydronephrosis

Context

Obstructive hydronephrosis is a concerning sign, as these patients are at an increased risk of permanent renal function loss (17). In cases of urinary lithiasis with acute hydronephrosis, tubular damage can begin within minutes of acute ureteral obstruction. However, the consensus in the literature is that clinically significant and irreversible damage to the renal parenchyma generally begins around 6 weeks of obstruction (18,19). It is important to note that this 6-week timeframe is imprecise and controversial, as various factors, such as systemic arterial hypertension, diabetes mellitus, smoking, and advanced age, can influence and accelerate the loss of renal function (17).

A retrospective analysis of 27 patients with asymptomatic incidental hydronephrosis secondary to ureteral stones showed that these patients often present with already reduced renal function, and even after stone removal, renal function did not show significant improvement, as assessed by dimercaptosuccinic acid (DMSA) scintigraphy (20). This finding underscores the permanent impact of untreated hydronephrosis on renal function. Key ultrasonographic markers of hydronephrosis severity include renal parenchymal thinning and loss of corticomedullary differentiation, both of which are advanced indicators of renal atrophy secondary to obstruction (17). In cases where the renal unit's viability is already in question; further investigation can be complemented with static DMSA scintigraphy. Typically, kidneys with less than 10% relative function are considered to have a poor prognosis for recovery (21). However, this assessment is controversial, as performing DMSA scintigraphy in the presence of obstruction may underestimate the relative function of the obstructed renal unit (22). Some authors advocate that this examination should be performed post-decompression, contrary to current practices in many centers. It is also crucial to note that the simple decompression of a non-functioning kidney may be sufficient to alleviate pain and infectious symptoms, making nephrectomy an excessive and often unnecessary treatment in many cases (23).

Significant preoperative hydronephrosis is also associated with an increased risk of postoperative ureteral stricture. A retrospective analysis of 447 patients followed for 36 months after FURS found that those with moderate to severe preoperative hydronephrosis had a higher incidence of postoperative strictures compared to those with mild preoperative hydronephrosis (24). This suggests that stone impaction is an independent risk factor for ureteral stenosis, justifying the prioritization of patients with this condition.

It is important to emphasize that patients with hydronephrosis and signs suggestive of infection, acute renal insufficiency, or pain that is difficult to manage in an outpatient setting should ideally be removed from the elective context and decompressed emergently (2). In a Swedish cohort of 282 cases of urinary sepsis, the primary factor associated with 30-day mortality was the presence of obstructive uropathy, with the time from diagnosis to urinary tract decompression being a crucial prognostic determinant (25).

Practical application

In most cases, calculous obstruction can be managed expectantly for up to 6 weeks. However, patients with risk factors for chronic kidney disease—such as those with hypertension, diabetes, or advanced age—should be prioritized, as this period may be too long for them. Patients showing signs of chronic renal injury at the time of diagnosis of obstructive pathology also warrant prioritization but should be informed that they may not fully recover their prior renal function even with appropriate treatment. Additionally, patients with significant hydronephrosis should be prioritized due to their increased risk of developing ureteral stenosis.

Fragility and comorbidities

Context

The careful assessment of frail patients, such as the elderly, directly impacts their surgical outcomes. Patients over 65 years old represent approximately 15% of the population with urinary stones, a high incidence partly attributed to the presence of comorbidities such as obesity, hypertension, diabetes mellitus, and cardiovascular disease (26). Due to the scarcity of robust data, urology society protocols, such as those of the European Association of Urology, do not include specific treatment algorithms for the elderly (26). However, given the global aging population, discussions on surgical interventions in this demographic are necessary, along with a structured analysis of the need to prioritize them.

A retrospective study by Eredics *et al.* (2023) in Austria evaluated about 300 patients over 80 years old with kidney stones and multiple comorbidities, who underwent either active stone treatment (65%) or palliative measures such as double J stenting or nephrostomy (35%) (27). The study demonstrated that patients undergoing PCNL or ESWL had longer survival compared to those receiving only palliative treatments (27). Generally, patients with adequate performance status to tolerate surgical stress benefit from intervention for urinary lithiasis, even at an advanced age, showing no significant differences compared to younger patients (28-35). An exception to this is extremely elderly patients, those over 90 years old, where some evidence suggests that the risks of intervention may outweigh the benefits (26,27).

It is also worth noting that elderly patients tend to present clinical signs of stone complications later, often only after a significant increase in creatinine levels and inflammatory markers (36,37). This delayed presentation, combined with their inherently greater frailty and lower metabolic reserves, justifies prioritizing this group over younger patients, as they are at risk of rapid clinical deterioration in case of stone-related complications. The Charlson Comorbidity Index (CCI) is a useful tool for evaluating frail patients. In a multicenter analysis of 1,406 patients, those with a CCI score of two or more had significantly more severe complications than those with a lower score (38). Similar findings were reported by Resorlu *et al.* (2012), who also suggested that patients with a high comorbidity index might be better suited for expectant management due to the high risks associated with surgical intervention (39).

Another important consideration in the treatment of frail patients is that endoluminal treatments appear to result in fewer systemic complications compared to percutaneous treatments, albeit with a slightly higher rate of residual stones and additional interventions required (40).

Practical application

Elderly and frail patients have a lower tolerance for complications, making their prioritization critical. Ideally, these patients should be closely monitored while awaiting intervention. The CCI is a valuable tool for risk stratification; patients with a high CCI score or those over 90 years old should have their surgical indications evaluated carefully, as the risks of intervention may outweigh the potential benefits in these populations.

Recurrent urinary infection

Context

Infectious complications are a frequent and potentially serious issue in the management of urinary lithiasis. Urinary sepsis accounts for 20% to 30% of all sepsis cases, with urinary tract obstructions caused by stones being the primary cause (41). Patients who do not undergo timely decompression in cases of urinary sepsis due to stones have twice the likelihood of a fatal outcome compared to those who are promptly treated (19.2% *vs.* 8.82%, P<0.001) (42). Ideally, patients with obstructive lithiasis and signs of acute urinary infection should undergo emergency decompression, with definitive stone management performed only after the resolution of the infectious condition (2).

Although Struvite stones have traditionally been associated with infectious conditions, recent evidence has expanded this understanding, showing that even calcium oxalate stones can have a close relationship with the urinary bacterial microbiota. Urinary stones can result from bacterial metabolism and serve as a nidus for biofilm formation (43). This finding reinforces the concept that patients with recurrent infections, even in the absence of obstruction, may experience significant clinical improvement following the complete removal of all stone material.

Post-surgical infections are another critical concern in the management of lithiasis. Approximately 37% of patients undergoing PCNL develop postoperative infections, with up to 7.6% progressing to sepsis (44). Key risk factors for postoperative infection in PCNL include female sex, positive preoperative urinary culture, positive renal pelvis urine culture, positive renal stone culture, leukocyturia, infectious stones, leukocytosis, a high neutrophil-to-lymphocyte ratio, previous urinary stent placement, multiple intraoperative punctures, prolonged surgical duration, and residual stones postoperatively (45). Notably, even patients with sterile preoperative urinary cultures can experience significant infectious complications (46). Thus, optimized preoperative preparation is crucial; while it may not guarantee the absence of postoperative infections, it can significantly reduce their incidence.

Practical application

Patients with infectious conditions related to urinary lithiasis are at higher risk for septic complications and stone progression. Preparing these patients adequately for safe surgery is complex, and excessive delays can compromise treatment outcomes. Prioritizing these patients can dramatically improve outcomes and reduce healthcare costs.

Nephrostomy

Context

Nephrostomy is an external drainage procedure commonly used in emergencies to decompress the renal pelvis when other definitive treatments are not technically feasible, particularly in cases of infected hydronephrosis. It is also frequently employed postoperatively in PCNL to facilitate healing of the urinary tract, prevent severe urinary fistulas, and aid in controlling bleeding. In addition, a nephrostomy may be left in place at the end of surgery to facilitate a second-stage surgical revision, providing a mature access for subsequent procedures (2).

While nephrostomy is relatively safe, it is not without risks and complications, some of which are correlated with the duration of its use. Key complications associated with prolonged nephrostomy placement include displacement, migration, bleeding, encrustation, infection, local discomfort, and even depressive and anxious conditions (47-49). Care should be taken with pregnant patients, who experience a higher rate of complications; for these patients, it is recommended that nephrostomy tubes be exchanged at shorter intervals, approximately every 3 weeks (50).

Practical application

Patients with nephrostomy tubes are at increased risk of mechanical and infectious complications, as well as significant impairments in quality of life. Their surgical scheduling should be prioritized to minimize the duration of nephrostomy use. Ideally, surgery should be performed before the need for device replacement to reduce unnecessary procedures and avoid emotional distress for the patient.

Double J catheter

Context

The double J catheter is an internal drainage device frequently used for the acute decompression of calculous disease. Its primary purposes are for the staged treatment of infected hydronephrosis, to prevent bacteremia caused by endoscopic manipulation of stones, and to induce passive dilation of the ureter, allowing for safer endoscopic treatment in narrower ureters (51,52). Unfortunately, there are common complications associated with both its insertion and prolonged presence.

Being made of inert material, the double J catheter can act as a nidus for bacterial colonization, increasing the risk of urinary infections (53,54). Prolonged contact between the catheter and urinary electrolytes, especially when compounded by bacterial metabolism, promotes encrustation, a potentially severe and complex condition (55,56). Encrustation can lead to significant morbidity and may necessitate multiple interventions for its management, including cases that result in the loss of the renal unit (55). One of the main factors associated with encrustation and infection of ureteral stents is the duration of catheter

placement (57,58). The recommended duration for leaving a catheter in place varies by manufacturer, generally ranging from 3 to 12 months. Specific patient populations, such as those with urinary diversions, chronic infections, pregnancy, or metabolic dysfunctions that predispose to lithiasis, are at increased risk for complications (59).

Another notable issue related to urinary stents is the discomfort experienced by patients. Individuals with a double J stent often report symptoms like dysuria, polyuria, hematuria, lower back pain, and even incontinence. Although alpha-blockers and anticholinergics can help manage these symptoms, they tend to provide only minimal relief. The inappropriate use of analgesics in this population is not uncommon (60).

Practical application

Patients with a double J stent should be prioritized for follow-up and ideally monitored closely by the healthcare system. These patients are at a significantly increased risk of severe complications if not addressed promptly, in addition to experiencing considerable deterioration in quality of life. Special attention should be given to more vulnerable groups, especially pregnant women. Traumatic experiences involving double J stents and "forgotten catheters" have been the subject of numerous lawsuits and can pose major challenges for the healthcare team.

Urinary diversions

Context

Patients with intestinal urinary diversions have a high incidence of urinary stones, with approximately 15.3% expected to develop them over time (61). The majority of these cases, around 77%, are attributed to infectious stones (62). This high incidence may be secondary to the biological environment of the intestinal tract, which is conducive to maintaining a persistent bacterial flora, as well as urinary stasis within the reservoirs and the presence of residual foreign bodies from surgery, such as surgical staples (63-65). Other significant factors that may promote stone formation in these patients include metabolic alterations. Several mechanisms have been described in the literature, varying according to the intestinal segment used. The most frequent metabolic changes observed are disturbances in acid-base balance, hypocitraturia, and hypercalciuria (66-68).

Surgical treatment for patients with urinary diversions is highly complex and is associated with a high rate of surgical complications, affecting approximately 30% of patients (69,70).

Practical application

Patients with urinary diversions are at increased risk for stone progression. Given the inherent complexity of the surgical procedures involved, prioritization of these patients is essential, as stone progression will undoubtedly increase both the difficulty of treatment and the risk of complications.

Occupational risk and difficulty accessing the health system

Context

Certain professionals may face significant risks or cause considerable harm if they experience a renal colic episode at an inappropriate time. This includes individuals such as pilots, divers, sailors, or military personnel. Unfortunately, no relevant studies clearly demonstrate the impact of such situations, although their significance is widely acknowledged (2). Similarly, some patients live in regions with limited access to healthcare services, and if they suffer a calculous complication at an inopportune moment, the consequences can be severe, given that transport to a tertiary care center may be slow and complicated. It is common sense that these patients should receive early treatment, as they face a poor prognosis in the event of unexpected complications.

Practical application

Prioritizing patients with high occupational risk or those residing in areas with difficult access is not yet clearly supported by robust data, but it is a clinical principle acknowledged in various guidelines (2,71).

Pain and quality of life

Context

In managing a complex waiting list for urinary lithiasis treatment, it is common to encounter patients experiencing significant intermittent pain due to calculous obstruction, yet who do not meet the clear criteria for urgent surgical intervention. Some patients may even refuse bridging

Table 2 Summary of findings

Category	Key findings	Practical application
Volume and disposition of stones	Large or multiple stones in the pelvis or upper/middle calyces pose higher risks. Lower calyx stones carry lower risks	Prioritize large or multiple stones in critical locations. Monitor growth with periodic imaging
Hydronephrosis	Hydronephrosis raises risks of renal damage and ureteral strictures, worsened by chronic conditions	Patients with CKD risk factors or significant hydronephrosis require prioritization. Emergencies need immediate decompression
Frailty and comorbidities	Elderly and frail patients benefit from interventions if well-managed. Over 90 years, risks may outweigh benefits	Monitor frail/elderly patients closely. Use tools like CCI for risk assessment
Recurrent urinary infection	Recurrent infections elevate risks for sepsis and complications. Timely treatment improves outcomes	Timely intervention for recurrent infections prevents complications and reduces costs
Nephrostomy	Extended nephrostomy use increases infection, encrustation, and distress risks. Prioritization minimizes harm	Prioritize surgery before nephrostomy replacement to reduce risks and distress
Double J catheter	Prolonged double J stent use causes encrustation, infection, and discomfort. Vulnerable groups need priority care	Timely stent removal prevents complications, especially for vulnerable groups
Urinary diversions	Urinary diversions raise stone risks and complicate surgeries. Early treatment prevents complications	Prioritize urinary diversion patients early to reduce surgical risks and complications
Occupational risks and access	High-risk occupations and limited healthcare access heighten complication risks, needing prioritization	High-risk occupations and limited access require early prioritization to prevent severe complications
Pain and quality of life	Severe pain from stones harms quality of life and increases medication misuse. Prioritization is critical	Prioritize severe pain cases to mitigate emotional and physical harm

CKD, chronic kidney disease; CCI, Charlson Comorbidity Index.

treatments, such as ureteral stents, opting instead to use analgesics more frequently until their scheduled surgery. Unfortunately, such situations can severely impact the quality of life and contribute to the misuse of analgesics and opioids (72).

Practical application

Patients with refractory painful conditions that are difficult to manage on an outpatient basis should be closely monitored by the healthcare system and, if possible, prioritized to avoid negative outcomes related to emotional distress, occupational impairment, analgesic intoxication, and even opioid addiction.

Strengths and limitations

In this narrative review of the literature, we aim to practically address the main factors that can negatively impact a prolonged waiting list for surgical treatment of kidney stones. Despite the various topics studied, this subject is complex, and undoubtedly, more variables will emerge over time. Another important issue is how to quantify the relevance of these factors and use them objectively to assess the risk for each patient, thereby reducing complications related to treatment delays while waiting for surgery. This remains an area that requires further study and holds significant importance for settings that need to manage long surgical queues (*Table 2*).

Conclusions

Managing a surgical waitlist for urinary lithiasis is a complex task, and a simple organization based solely on waiting time is both ineffective and potentially dangerous. An effective approach requires a comprehensive assessment of critical factors, including stone volume and location, the presence of hydronephrosis, patient frailty and comorbidities, recurrent urinary infections, the use of nephrostomies or double-J stents, urinary diversions, occupational risks, healthcare accessibility, symptom severity, and the overall impact on quality of life.

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Footnote

Reporting Checklist: The authors have completed the Narrative Review reporting checklist. Available at https://tau.amegroups.com/article/view/10.21037/tau-24-596/rc

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