QUALITY IN SPORT
eISSN 2450-3118 · Open Access · Peer-reviewed
apcz.umk.pl/QS Nicolaus Copernicus University in Toruń

Cite as: GRABARCZYK, Mikołaj, KOZŁOWSKI, Sebastian, BŁASZCZYK, Bartosz, SZCZEPAŃSKA, Weronika, SZYCHOWSKA, Aleksandra, and SMOLIŃSKA, Ewa. Determinants of Double-J Ureteral Stent Intolerance: Patient Susceptibility, Device Design, and Symptom-Modifying Strategies. Quality in Sport. 2026;62:73094. https://doi.org/10.12775/QS.2026.62.73094

ARTICLE TIMELINE
Received: 05.06.2026. Revised: 01.07.2026. Accepted: 03.07.2026. Published: 09.07.2026.

The journal has been awarded 20 points in the parametric evaluation by the Polish Ministry of Higher Education and Science (Annex to the announcement of 05.01.2024, No. 32553). Unique Journal Identifier: 201398. Scientific disciplines assigned: Economics and finance (Field of social sciences); Management and Quality Sciences (Field of social sciences).
Punkty Ministerialne z 2019 – aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398. Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych). © The Authors 2026.

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Determinants of Double-J Ureteral Stent Intolerance: Patient Susceptibility, Device Design, and Symptom-Modifying Strategies

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Abstract

Double-J ureteral stents are widely used in contemporary urological practice to maintain urinary drainage and protect renal function in patients with obstructive, postoperative, benign, and malignant ureteral conditions. Despite their clinical utility, these devices are frequently associated with pain, lower urinary tract symptoms, sexual discomfort, reduced physical activity, impaired work performance, and deterioration of quality of life. This narrative review summarizes current evidence on determinants of Double-J stent intolerance. Available data indicate that stent-related symptoms are not determined solely by the presence of a foreign body

in the urinary tract, but rather by a multidimensional interaction between individual pain susceptibility, psychological phenotype, baseline urinary and pain symptoms, clinical context, microbiological factors, stent material, device geometry, indwelling time, and pharmacological management. Chronic pain conditions, depressive symptoms, anxiety, pain catastrophizing, central sensitization, younger age, higher body mass index, pre-existing urinary symptoms, stone burden, and bilateral disease may increase the risk of poor tolerance. Modifiable device-related factors include excessive intravesical stent length, distal coil crossing the bladder midline, incomplete distal curl, larger diameter, greater stiffness, and conventional designs with substantial bladder material. Softer and smaller-diameter stents, optimized stent positioning, complete intraureteral designs, pigtail-suture stents, and antireflux stents may reduce selected symptom domains. Pharmacological strategies, including alpha-blockers, antimuscarinics, beta-3 agonists, and pregabalin, should be tailored to the dominant symptom profile. A personalized approach integrating preoperative risk stratification, careful device selection, optimized dwell time, and targeted pharmacotherapy may improve stent tolerance and support better clinical decision-making.

Keywords: Urology, Double-J stent, Urolithiasis, Urinary tract

INTRODUCTION

Double-J (DJ) ureteral stents are among the most frequently used devices in contemporary urological practice. A DJ stent, also referred to as a double-pigtail ureteral stent, is a flexible tubular implant positioned within the ureter to maintain urinary drainage between the renal collecting system and the bladder. Its characteristic curled ends are designed to reduce migration: the proximal coil remains in the renal pelvis, whereas the distal coil is located in the urinary bladder. The principal function of a DJ stent is to preserve or restore ureteral patency, thereby preventing or relieving upper urinary tract obstruction and protecting renal function until definitive treatment or further intervention can occur [1–3]. The use of DJ stents has expanded substantially with the development of endourology, especially in the management of urolithiasis. Stents are commonly inserted after ureteroscopy or flexible ureterorenoscopy, before or after extracorporeal shock wave lithotripsy in selected cases and for acute

decompression of obstructed collecting systems. In stone disease, their role includes drainage of an obstructed kidney, prevention of transient ureteral occlusion caused by edema or residual fragments, facilitation of passive ureteral dilatation before a planned procedure, and support of urine flow after endoscopic manipulation. Emergency drainage is particularly important when obstruction is complicated by infection, sepsis, bilateral obstruction, a solitary kidney, or refractory pain [3,4]. Beyond stone disease, DJ stents are used in a broad spectrum of benign and malignant conditions. Common non-lithiasic indications include ureteral strictures, postoperative edema, ureteral injury, urinary leakage, extrinsic ureteral compression, and the need to provide a temporary scaffold after reconstructive surgery. In malignant ureteral obstruction, stenting may serve as palliative internal drainage and may reduce or postpone the need for percutaneous nephrostomy. DJ stents are also used outside routine endourology, including obstetric and gynecological contexts, such as symptomatic gestational hydronephrosis, obstructive ureteral calculi during pregnancy, ureteral protection during complex pelvic surgery, management of ureteral injury, and obstruction related to pelvic malignancy or previous radiotherapy [5–7]. Several types of ureteral stents are currently available, differing in material, design, coating, stiffness, diameter, length, drainage architecture, and intended duration of use. Conventional polymeric DJ stents remain the most widely used and are typically made of polyurethane, silicone, or other polymer blends. Polyurethane stents are easy to insert and provide adequate radial support, whereas silicone stents are generally softer and more biocompatible, features that may improve patient tolerance in selected settings. Modern silicone stents often incorporate hydrophilic coatings to reduce friction during placement. Other design modifications include variable-durometer stents, multilength stents, stents with extraction strings, antireflux designs, tandem stents, and pigtail-suture or loop-tail stents that reduce intravesical material in an attempt to decrease bladder irritation and stent-related symptoms [1,8,9]. Despite their clinical utility, DJ stents are frequently associated with poor tolerability. Stent-related symptoms may include urinary frequency, urgency, dysuria, hematuria, flank pain, suprapubic discomfort, urinary retention, sexual discomfort, reduced physical activity, impaired work performance, and diminished quality of life. Recent studies indicate that these symptoms are common and may affect the majority of patients with indwelling stents [6,9]. This review focuses on both patient-related and device-related factors influencing DJ stent tolerance, as a better understanding of these determinants may guide the development of more advanced implants and improve clinical decision-making.

Materials and Methods

This study employed a narrative literature review methodology focused on factors influencing DJ ureteral stent intolerance. The analysis was conducted on the basis of scientific publications indexed in PubMed and Google Scholar. The search strategy included the following keywords and combinations of keywords: “Double-J ureteral stent”, “DJ stent”, “ureteral stent intolerance”, “stent-related symptoms”, “ureteral stent symptoms”, “Ureteral Stent Symptom Questionnaire”, “stent pain”, “stent material”, “stent diameter”, “stent design”, “biofilm”, “bacterial colonization”, “stent dwell time”, “alpha-blockers”, “antimuscarinics”, “mirabegron”, and “pregabalin”. Publications relevant to ureteral stent tolerance and stent-related symptoms were included in the analysis, comprising original studies, prospective cohort studies, randomized controlled trials, systematic reviews, meta-analyses, and narrative reviews. Particular attention was given to studies assessing patient-related determinants of intolerance, including pain sensitivity, psychological phenotype, baseline urinary symptoms, demographic and clinical characteristics, as well as device-related determinants such as stent material, coating, diameter, length, intravesical position, distal coil configuration, and modified stent designs. The review also included studies evaluating the influence of microbiological factors, including urine culture, bacterial colonization, and biofilm formation, as well as publications concerning the impact of stent indwelling time and pharmacological strategies used to reduce stent-related symptoms. Articles not directly related to ureteral stents, studies focused exclusively on other urinary drainage devices, and publications without clinically relevant data on stent tolerance, symptoms, complications, or management were excluded. The selected publications were subjected to qualitative analysis in order to summarize current knowledge on the multifactorial nature of DJ ureteral stent intolerance. The findings were organized into patient-related, microbiological, device-related, temporal, and pharmacological factors to provide a comprehensive overview of mechanisms contributing to poor stent tolerance and potential strategies for improving patient outcomes.

2. Factors Influencing DJ Stent Intolerance

DJ ureteral stent intolerance is a multidimensional clinical problem that results from the interaction between patient susceptibility, the underlying urological condition, microbial factors, stent biomaterial, device geometry, indwelling time, and pharmacological management. Although stent-related symptoms are often attributed primarily to local mechanical irritation, contemporary data suggest that symptom severity is not determined by the stent alone. Rather,

it reflects a complex relationship between the device and individual biological, psychological, sensory, and clinical characteristics of the patient [10–12].

2.1. Pain sensitivity and psychological phenotype

The patient's pain phenotype appears to be one of the most important patient-related determinants of DJ stent intolerance. The multicenter prospective cohort from The Study to Enhance Understanding of Stent-associated Symptoms (STENTS) demonstrated substantial interindividual variability in pain and other urinary symptoms after ureteroscopy with stent placement, even among patients treated for the same general indication, namely urinary stones [10]. In that study, pain intensity increased markedly on postoperative day 1 and decreased over the following days, but pain interference remained clinically relevant despite the reduction in its intensity [10]. This observation suggests that the subjective and functional burden of a ureteral stent may persist even when acute postoperative pain begins to improve. In multivariable analysis from the STENTS cohort several characteristics related to higher pain intensity have been identified, including chronic pain conditions, prior severe pain with a ureteral stent and baseline depressive symptoms. Simultaneously older age was associated with lower pain intensity [10]. A physiological basis for this variability was supported by quantitative sensory testing. Lai et al. evaluated preoperative hypersensitivity and central sensitization in patients from the STENTS study and found that higher preoperative pain ratings to mechanical pressure in the ipsilateral flank and abdominal regions were associated with greater postoperative stent pain intensity. Greater temporal summation, used as a marker of central sensitization, was also associated with higher postoperative pain intensity, whereas female sex, chronic pain conditions, widespread pain, and depression were associated with preoperative hypersensitivity on quantitative sensory testing [11]. These data support the concept that some patients may have an amplified nociceptive response before stent insertion, making the same mechanical stimulus more painful than in less sensitized individuals. Pain catastrophizing is another relevant phenotype. In a prospective study of patients undergoing ureteroscopic laser lithotripsy with stent placement, patients with higher preoperative Pain Catastrophizing Scale (PCS) scores experienced greater postoperative pain and required more analgesics, including additional prescriptions and opioids. They also generated more unplanned health care contacts after surgery [13]. This suggests that psychological appraisal of pain may contribute not only to symptom intensity, but also to medication use and postoperative health care utilization. More recent prediction models from the STENTS study incorporated these

patient-level variables into clinically oriented risk stratification tools. Tasian et al. developed models for severe pain and urinary symptoms after ureteroscopy with stent placement and found that female sex, younger age, higher body mass index (BMI), baseline pain interference, number of chronic pain conditions, renal stone location, and history of anxiety predicted severe pain. A related model using baseline urinary symptoms instead of baseline pain interference demonstrated strong discrimination for severe postoperative urinary symptoms [12].

2.2. Clinical patient-related factors

Clinical patient-related factors include demographic variables, physique, baseline urinary symptoms, stone characteristics and the clinical context in which the stent is inserted. Compared with the pain sensitivity and psychological phenotype, these factors are more heterogeneous and less consistently reproduced, but they remain clinically useful for preoperative counseling and risk stratification. In the STENTS cohort, older age was associated with lower pain intensity after ureteroscopy with stent placement [10]. Conversely, prediction models from the same research network identified younger age as one of the variables associated with severe postoperative pain [12]. This may reflect differences in pain perception, baseline activity, occupational expectations, psychological profile, or willingness to report symptoms. However, age alone should not be considered a sufficient predictor of intolerance, because its influence likely interacts with pain phenotype and baseline functional status [12]. Harper et al. did not identify sex as a major driver of stent-associated symptoms in the original STENTS risk-factor analysis [10]. However, Tasian et al. later found that female sex contributed to prediction of severe pain in a multivariable model, and Lai et al. reported that female sex was associated with preoperative hypersensitivity on quantitative sensory testing [11,12]. Therefore, female sex may not directly cause stent intolerance, but it may identify a subgroup with greater sensory susceptibility or overlapping pain vulnerability. BMI has also been included in predictive models. In a prospective analytical study of 150 patients undergoing ureteroscopic lithotripsy with DJ stenting, BMI >25 kg/m² was significantly associated with stent-related symptoms and received the highest weight in the proposed preoperative prediction score - the Stanley Stent Symptom Status Score (S5 Score) [14]. In the STENTS prediction model, higher BMI was also among variables predicting severe pain after ureteroscopy with stent placement [12]. The mechanism is uncertain, but obesity may be associated with chronic low-grade inflammation, altered pain processing, more severe lower urinary tract symptoms, or technical differences in stent positioning and imaging assessment. Baseline symptoms are particularly relevant. History

of loin pain and hematuria were also significant preoperative factors in the S5 score, along with stone size >1 cm, and bilateral stone disease. These factors may reflect a more symptomatic stone phenotype before intervention, greater ureteral irritation, higher inflammatory burden, or more extensive endoscopic manipulation during treatment [14]. Recent STENTS data also suggest that bilateral ureteroscopy with bilateral stent placement may lead to greater increases in pain intensity, pain interference, and urinary symptoms than unilateral procedures. These findings suggest that the extent of disease and procedural burden should be considered when interpreting stent-related symptoms [15].

2.3. Urine culture, biofilm, and bacterial colonization

A positive urine culture or symptomatic urinary tract infection may cause dysuria, urgency, frequency, suprapubic pain, fever, and malaise, which overlap with stent-related symptoms. However, infection-associated morbidity is not identical to mechanical or sensory stent intolerance. Therefore, microbiological factors should be interpreted as potential symptom modifiers rather than universal direct causes of stent intolerance. The relationship between urine culture and stent colonization is imperfect. Samir et al. reported that stent and urinary cultures may show the same isolates when both are positive, but urine culture had low sensitivity for detecting stent bacterial colonization, despite high specificity [16]. This means that a positive urine culture may indicate colonization, but a negative urine culture does not reliably exclude a colonized stent [16]. Tulone et al. similarly found low concordance between urine cultures and cultures from different portions of DJ stents, suggesting that conventional urine culture may underestimate device colonization [17]. Prospective data on whether colonization worsens symptoms of DJ stent intolerance are mixed. Samir et al. concluded that bacterial colonization may contribute to stent-associated morbidity and that colonization increases with stent retention time [16]. However, Betschart et al. investigated patients with long-term DJ stenting using the Ureteral Stent Symptom Questionnaire (USSQ) and a validated method for biofilm quantification, and found that higher biofilm mass was not associated with higher USSQ total scores or subscores [18]. These apparently conflicting findings may reflect differences in patient selection, stent duration, symptomatic infection status, biofilm measurement, bacterial species, and antibiotic exposure. Biofilm may be highly relevant to infection, encrustation, and stent failure, while its independent contribution to pain and urinary symptoms is less certain. Stent colonization and biofilm may aggravate symptoms in selected patients, especially when

associated with symptomatic infection or prolonged dwell time, but current evidence does not support biofilm burden as a universal independent determinant of stent intolerance [16–18].

2.4. Stent material and coating

Stent material influences flexibility, friction, radial force, biocompatibility, encrustation tendency, and the degree of mechanical irritation exerted on the ureter and bladder. Conventional polymeric stents include polyurethane, silicone, and various blends. Polyurethane stents are commonly used because they are relatively easy to insert and provide adequate support, but they are generally stiffer than silicone. Silicone stents are softer and more flexible, which may reduce irritation of the ureteral wall and bladder trigone [8]. A systematic review by Boeykens et al. concluded that silicone DJ stents, and by extension softer stents, appear to reduce stent-related symptoms compared with nonsilicone polymers and harder stents, but the authors emphasized that no definitive conclusion could be drawn because of limited and heterogeneous evidence [8]. A more recent systematic review and meta-analysis by Putrantyo et al. supported the potential benefit of softer stent materials. In that analysis, firm ureteral stents were associated with a higher risk of infection, hematuria, and lower body pain, whereas soft stents appeared to display protective influence in this matter. Surface coatings remain conceptually attractive because in theory they may reduce friction, bacterial adherence, biofilm formation, and encrustation. Nevertheless, current evidence does not clearly demonstrate that coatings reduce patient-reported stent intolerance. Moreover, Putrantyo et al. found that antimicrobial or functional coatings, including silver nanoparticles and triclosan, did not consistently reduce infection risk in analyzed cohorts [19].

2.5. Mechanical device-related factors

Mechanical factors are among the best documented determinants of stent-related symptoms. They are also highly clinically relevant because they can often be modified at the time of stent insertion. The most consistently supported factor is the position of the distal stent end within the bladder. Correct intravesical stent position is critical, because patients whose stents cross the bladder midline experience more severe ureteral stent-related symptoms than those whose stents do not cross the midline [20]. This supports the hypothesis that excessive intravesical stent length increases irritation of the bladder trigone and contralateral bladder wall.

The same concept appears in predictive modeling. Prakash et al. found that distal end crossing the midline and incomplete distal curl were associated with stent-related symptoms in patients

undergoing ureteroscopic lithotripsy [14]. These findings indicate that mechanical optimization should include both correct length selection and confirmation of appropriate distal coil configuration. A stent that is too long may increase bladder symptoms, while poor curl formation may increase irritation or migration risk. Stent diameter is another mechanical determinant. Diatmika et al. performed a systematic review and meta-analysis comparing different ureteral stent diameters and concluded that smaller stent size may reduce stent-related symptoms without significant differences in stent migration, pain, analgesic use, or stone-free rate [21]. Ehsanullah et al. similarly found that smaller-diameter ureteric stents were associated with reduced urinary symptoms and patient-reported pain, while other USSQ domains were statistically similar between smaller and 6 Fr stents. These findings suggest that smaller stents may reduce lower urinary tract irritation, although the benefit may not extend equally to all quality-of-life domains [22]. Modified stent designs aim to reduce the intravesical burden of the device. Complete intraureteral stent placement was evaluated in a meta-analysis by Ho et al., who found that it significantly decreased stent-related urinary symptoms and pain compared with conventional stent placement [23]. Hinojosa-Gonzalez et al. later reported that complete intraureteral stents significantly decreased urinary symptoms and pain associated with conventional indwelling ureteral stents, while emphasizing the need for further trials to refine patient selection. These studies reinforce the idea that reducing or eliminating bladder coil irritation can meaningfully improve tolerance [24]. Pigtail-suture stents represent another strategy to reduce bladder material. In a prospective randomized trial, Bosio et al. reported that pigtail-suture stents significantly reduced stent-related symptoms, particularly urinary symptoms and pain, compared with conventional DJ stents after uncomplicated ureteroscopy [25]. In a subsequent prospective multicenter longitudinal trial, patients undergoing DJ substitution with a pigtail-suture stent reported a significant decrease in stent-related symptoms [26]. Although these designs are not universally applicable, they may be particularly useful in patients at high risk of bladder-dominant symptoms. Antireflux stents target a different mechanism: vesicoureteral reflux and pressure transmission during voiding. Adhoni et al. performed a meta-analysis of randomized controlled trials and found that antireflux ureteral stents reduced stent-related pain, severe stent-related pain, and flank pain during urination compared with standard stents. These findings suggest that in some patients, voiding-related flank pain may be driven less by local bladder irritation and more by reflux-mediated pressure changes [27].

2.6. Stent indwelling time

The duration of stent placement is commonly assumed to correlate directly with intolerance; however, evidence suggests that the relationship is not simply linear. Longer dwell time increases cumulative exposure to the foreign body and is associated with higher rates of bacterial colonization and encrustation [16,18]. Conversely, very early removal may be associated with increased postoperative healthcare utilization. In a multicenter study, Ghani et al. found that ureteral stent dwell time of 4 days or less after ureteroscopy was associated with a significantly higher risk of emergency department visits around the time of stent removal, particularly in non-prestented patients [28]. A systematic review and meta-analysis by Porto et al. evaluated optimal stenting duration after ureteroscopy and nephrolithotomy by comparing shorter and longer stent durations. Overall post-procedure-related events did not differ significantly between stents removed within ≤5 days and those removed after ≥6 days. However, in that analysis longer stent duration was associated with higher rates of flank pain and hematuria, whereas shorter duration was associated with higher rates of fever and dysuria. These findings highlight the difficulty of defining a single optimal dwell time for all patients [29].

2.7. Pharmacotherapy

Pharmacotherapy should be considered a symptom-modifying factor rather than a primary cause of intolerance. It can meaningfully reduce urinary symptoms, pain, and quality-of-life impairment in selected patients. The main studied drug classes include alpha-blockers, antimuscarinics, beta-3 agonists, phosphodiesterase-5 inhibitors, and neuromodulatory agents such as pregabalin [30–34]. Alpha-blockers are among the most commonly studied therapies. They may reduce ureteral smooth muscle spasm, decrease ureteral pressure, and improve voiding-related discomfort. Bayesian network meta-analysis has evaluated multiple pharmacological regimens for ureteral stent-related symptoms and supports the use of alpha-blockers and antimuscarinic agents as core therapeutic options [30]. Tamsulosin and other alpha-blockers appear to improve urinary symptoms and pain in many studies, although effects may vary by endpoint and comparator (Hinojosa-Gonzalez et al., 2023; Madarshahian et al., 2025). Their beneficial effect is thought to result primarily from relaxation of ureteral smooth muscle through blockade of α1-adrenergic receptors, leading to reduced ureteral peristaltic activity and lower intraluminal pressure. This mechanism may be particularly relevant in patients who experience flank pain during voiding, a symptom often attributed to increased

pressure transmission along the stented ureter. In addition, alpha-blockers may alleviate lower urinary tract symptoms such as urgency, frequency, and incomplete bladder emptying by reducing functional outlet resistance and improving urinary flow dynamics. Evidence from comparative studies suggests that alpha-blockers are generally more effective for pain-related and voiding-related symptoms than for storage symptoms, which are often driven by bladder irritation from the distal stent coil. Consequently, alpha-blockers are frequently used either as first-line monotherapy or in combination with antimuscarinic agents, especially in patients presenting with a mixed symptom profile that includes both flank pain and bothersome urinary symptoms [30,35]. Antimuscarinic drugs, particularly solifenacin, target bladder storage symptoms such as urgency, frequency, and suprapubic discomfort. Harahap et al. performed a systematic review and meta-analysis comparing solifenacin and tamsulosin and concluded that solifenacin was more effective than tamsulosin in reducing stent-related symptoms, while the combination of tamsulosin and solifenacin was superior to either monotherapy. These findings support the use of antimuscarinic therapy when bladder-dominant symptoms are prominent [32]. Mirabegron, a beta-3 agonist, has gained attention because stent-related storage symptoms resemble overactive bladder symptoms. Xiang et al. performed a network meta-analysis comparing mirabegron, tamsulosin, and solifenacin and found that mirabegron performed best for alleviating body pain, sexual matters, and adverse events, with relatively small differences in urinary symptoms and general health [31]. Pregabalin may be particularly relevant for patients with a pain-sensitization phenotype. Singgih et al. conducted a systematic review and meta-analysis of pregabalin, solifenacin, and combination therapy and found that solifenacin monotherapy reduced total USSQ, urinary symptoms, and sexual matters, whereas pregabalin monotherapy significantly reduced pain. Combination therapy with pregabalin and solifenacin produced additional benefits in total USSQ, urinary symptoms, pain and sexual matters [33]. Overall, pharmacotherapy should be individualized according to the dominant symptom domain. Patients with urgency and frequency may benefit most from antimuscarinic or beta-3 agonist therapy. Voiding-related flank pain or ureteral spasm are symptoms best mitigated with alpha-blockers, whereas high pain vulnerability, chronic pain conditions, or neuropathic features may require more targeted pain-modulating strategies [30–35].

CONCLUSIONS

DJ ureteral stent intolerance is a complex and multifactorial condition that cannot be attributed solely to the presence of a foreign body within the urinary tract. Current evidence indicates that

symptom severity results from the interaction between patient-specific susceptibility, baseline clinical status, microbiological factors, stent material, mechanical device characteristics, indwelling time, and pharmacological modulation. This multidimensional nature explains why patients with apparently similar indications for stenting and comparable procedural courses may experience markedly different levels of pain, urinary symptoms, functional impairment, and quality-of-life deterioration. Among patient-related determinants, pain phenotype appears to play a particularly important role. Chronic pain conditions, previous severe stent-related pain, depressive symptoms, anxiety, pain catastrophizing, central sensitization, and baseline pain interference may increase the risk of poor tolerance. Clinical factors such as younger age, higher BMI, pre-existing urinary symptoms, loin pain, hematuria, stone burden, bilateral disease, and renal stone location may further contribute to symptom severity. These findings suggest that preoperative risk stratification should not be limited to anatomical or procedural variables, but should also include assessment of pain history, psychological vulnerability, and baseline symptom burden. Device-related factors remain highly relevant because they are directly modifiable. Excessive intravesical stent length, distal coil crossing the bladder midline, incomplete distal curl, larger stent diameter, greater stiffness, and conventional designs with substantial bladder material are associated with worse tolerability. Conversely, careful stent length selection, avoidance of midline crossing, use of smaller-diameter or softer stents, and consideration of modified designs such as complete intraureteral, pigtail-suture, or antireflux stents may reduce selected symptom domains. Although biofilm formation and bacterial colonization may aggravate symptoms in some patients, especially when associated with infection or prolonged dwell time, available evidence does not support biofilm burden as a universal independent cause of stent intolerance. The optimal duration of stenting should be individualized rather than based on a universal “shorter is better” approach. Very early removal may increase post-removal pain or unplanned healthcare visits in selected patients, whereas prolonged indwelling time may increase dysuria, colonization, encrustation, and cumulative discomfort. Pharmacotherapy also has an important role in symptom control. Alpha-blockers, antimuscarinics, beta-3 agonists, phosphodiesterase-5 inhibitors, and pregabalin may improve different symptom domains, and combination therapy may be particularly useful in patients with mixed urinary and pain symptoms. Future research should focus on validated prediction models, standardized patient-reported outcomes, and the development of next-generation stents designed not only to provide effective urinary drainage, but also to minimize pain, bladder irritation, infection-related morbidity, and impairment of daily functioning. Such an approach

may reduce symptom burden, improve quality of life, decrease unplanned healthcare utilization, and support more personalized decision-making in patients requiring ureteral stenting.

Disclosure: Authors do not report any disclosures.

Supplementary Materials: Not applicable

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All authors have read and agreed with the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgements: Not applicable.

Conflicts of Interest: The authors declare no conflicts of interest.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used Chat GPT (OpenAI) to improve grammar and language corrections. After using this tool, the authors have reviewed and edited the content as needed and accept full responsibility for the substantive content of the publication.

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