Complications Associated with Stents in post-Covid-19 Lithiasis Pathology

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ABSTRACT

Introduction: Renoureteral lithiasis was one of the most common pathologies associated with SARS-CoV-2 infection during the pandemic. The aim of this study was to evaluate the complications associated with neglected stents inserted for renoureteral lithiasis during the pandemic.

Material and Methods: Between March 2022 and August 2022 we conducted a retrospective study in the Urology Department of the Emergency Clinical Hospital "Saint John" in order to evaluate the complications arising from the neglect of stents for a period of more than 3 months, inserted for renoureteral lithiasis during the Covid-19 pandemic.

Results: We included in the analysis 44 patients who were admitted with stents mounted more than 3 months ago, with an average age of 58.3 years. Of these, 32 (72.7%) have mounted double J stents, and 12 (27.3%) are percutaneous nephrostomy. Of the total number at 40 (90.9%) patients the pathology was unilateral, while 4 (9.1%) showed bilateral stents. The main complications were urinary tract infection, as follows: 26 (68.4%) patients were infected with E.Coli, 5 (13.2%) with Klebsiella, 4 (10.5%) with Proteus and 3 (7.9%) with other bacterial species. Other complications were urinary obstruction, calcification, hematuria and fragmentation of stents.

Conclusions: Forgotten the stents in position associated with renoureteral lithiasis can have important complications, urinary tract infection being the most common.

Keywords: Complications, Covid-19, Lithiasis, Urinary Tract Infection

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Introduction and objectives

Renoureteral lithiasis accounts for 1-2% of emergency room admissions [1]. The incidence of kidney stones increased significantly by 48.57% between 1990 and 2019, reaching 115.55 million new cases, highlighting a growing public health problem [2]. The costs associated with treating urinary lithiasis are substantial, with annual expenditures in the United States estimated to reach $3.79 billion by 2030 [3].

The global burden of urolithiasis is further compounded by its high recurrence rate, ranging from 40% to 60% within five to nine years, respectively. This escalating prevalence and high recurrence rate underscore the critical need for effective management strategies to mitigate its substantial economic and social impact [4,5]. Consequently, particular attention must be given to vulnerable populations such as pregnant women, where the physiological changes of gestation can exacerbate urological conditions and complicate their management [4]. This makes the judicious application of interventions like JJ stents particularly relevant, as their placement requires careful consideration of both maternal and fetal well-being. In this context, double-J stents serve as a crucial temporary measure for relieving ureteral obstruction and managing renal colic, while minimizing invasive procedures during pregnancy [6].

However, the placement of these stents is not without potential complications, including stent migration, blockage, and encrustation, which necessitate careful monitoring and timely intervention. In fact, studies have reported that urinary tract infections occur in 7,436 cases, and stent encrustation and calcification are observed in 832 cases among 50,000 procedures [7]. The risk of encrustation is particularly elevated in pregnant patients due to altered urinary composition, characterized by increased calcium and urate concentrations, necessitating more frequent stent exchanges to prevent complications [8]. The intricate balance between preventing urinary stasis and minimizing stent-related morbidity is paramount, particularly given the elevated risk of pyelonephritis and its potential obstetric complications in pregnant individuals [7]. This necessitates a comprehensive understanding of optimal JJ stent management strategies, including appropriate stent material selection, scheduled exchanges, and meticulous follow-up, to ensure both maternal comfort and fetal safety throughout gestation [8]. Moreover, the hormonal and anatomical changes inherent to pregnancy contribute to ureteral dilation and reduced peristalsis, further predisposing pregnant women to urinary tract obstruction and increasing the complexity of managing conditions like urolithiasis [9]. Therefore, the selection between a double-J stent and a percutaneous nephrostomy requires careful consideration, taking into account the stage of pregnancy, patient tolerance, and the potential for complications associated with each method [10,11].

The profound impact of the COVID-19 pandemic on healthcare systems has extended beyond acute viral infection, manifesting in various post-illness pathologies, including an emergent constellation of complications in lithiasis patients requiring stent placement. This phenomenon necessitates a comprehensive examination of the unique challenges and increased risks associated with urological stenting in individuals recovering from COVID-19, particularly given the reported rise in complicated ureteral stone presentations during the pandemic [12].

This study aimed to evaluate the complications associated with neglected stents inserted for renoureteral lithiasis during the pandemic.

Material and Methods

Between March 2022 and August 2022 we conducted a retrospective study in the Urology Department of the Emergency Clinical Hospital "Saint John" in order to evaluate the complications arising from the neglect of stents for a period of more than 3 months, inserted for renoureteral lithiasis during the Covid-19 pandemic. The inclusion criteria for this study comprised all patients who underwent ureteral stent insertion for renoureteral lithiasis during the specified period and subsequently presented with stent-related complications

attributed to prolonged indwelling times, defined as exceeding three months, within the context of the COVID-19 pandemic

Results

During the period between March 2022 and August 2022, 44 patients who were admitted with stents mounted more than three months ago, with an average age of 58.3 years was studied in the Urology Department of "Saint John" Emergency Hospital. Of these, 32 (72.7%) have mounted double J stents, and 12 (27.3%) are percutaneous nephrostomy (Figure 1). Of the total number, at 40 (90.9%) patients the pathology was unilateral, while four (9.1%) showed bilateral stents. As for the age of the participants, it varied between 20 and 89 years, with an average age of 58.3 (Table 1).

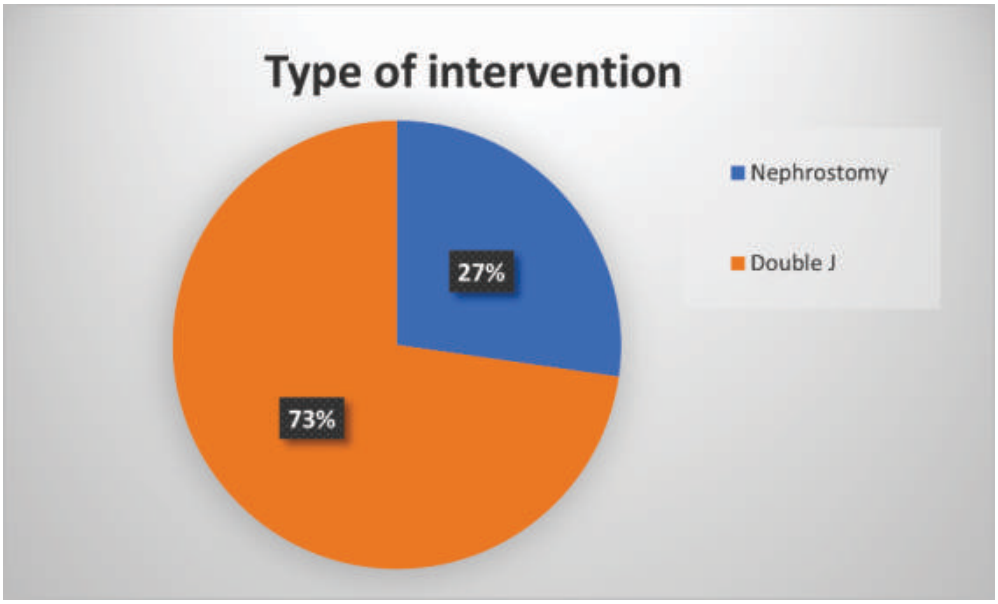


Figure 1 – Type of intervention

Table 1 – Distribution per age

	Men	Women
44 patients	18 (40.9%)	26 (59.1%)
Mean age	58.3 (20-89)	
<60 years	31 (70.5%)	
>70 years	13 (29.5%)	

The main complications were urinary tract infection, as follows: 26 (68.4%) patients were infected with E.Coli, five (13.2%) with Klebsiella, four (10.5%) with Proteus and three (7.9%) with other bacterial species (Figure 2). Other complications were urinary obstruction, calcification, hematuria and fragmentation of stents (Figure 3).

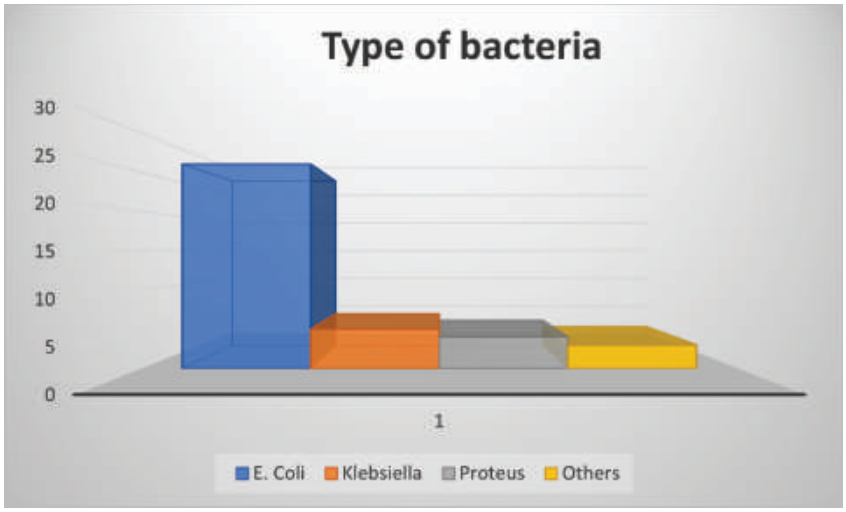


Figure 2 – Representative type of bacteria

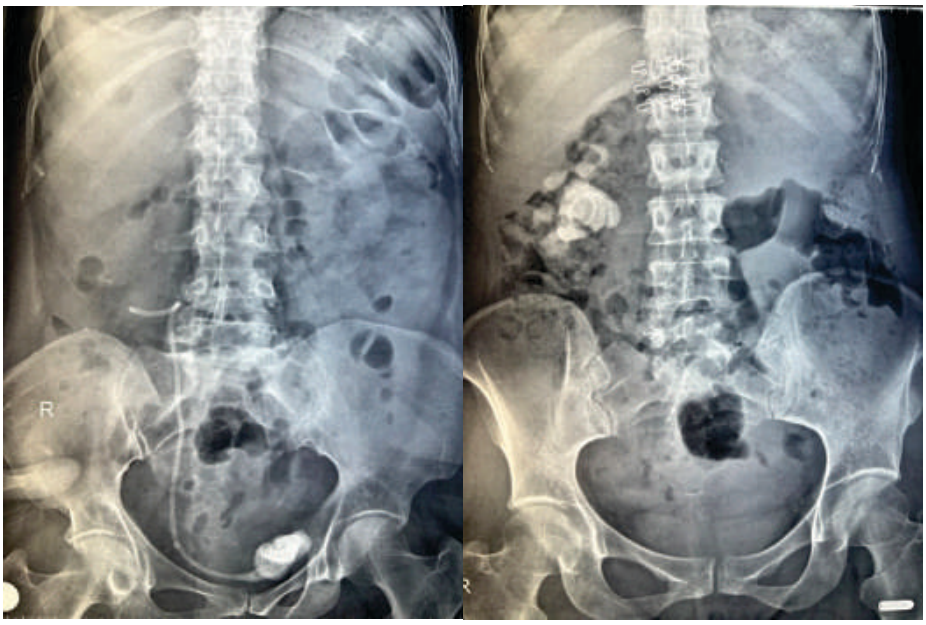


Figure 3 – KUB images of other complications

Discussions

The disruption to routine outpatient and elective procedures during lockdown periods led to delayed presentations for symptomatic kidney stones, often resulting in more severe and complicated cases requiring urgent intervention [13]. This study aims to elucidate the intricate interplay between delayed presentation, and the subsequent complications arising from ureteral stent placement in nephrolithiasis patients, a scenario exacerbated by healthcare resource reallocation and patient hesitancy to seek medical attention during the pandemic.

Indeed, studies have shown that patients undergoing emergent stent placement during the COVID-19 era were notably sicker, indicating a significant delay in seeking care for conditions unrelated to the virus [14]. This delay has directly contributed to higher rates of urinary tract infections, increased preoperative positive urinary cultures, and greater encrustation rates of ureteral stents, which collectively heighten the complexity of urolithiasis treatment [15]. Moreover, the prolonged indwelling times of stents due to disruptions in follow-up care have led to an increase in forgotten ureteral stents, with mean indwelling times observed to be as long as 33.5 months in some cohorts [16]. This extended indwelling period, coupled with potential immunomodulatory effects of COVID-19, may predispose patients to more severe stent-related adverse events, including persistent bacteriuria, biofilm formation, and increased calcification [17,18]. These factors collectively contribute to a higher incidence of complex stent-related complications, demanding more aggressive and multifaceted interventions for their resolution [18]. This increase in complicated presentations is further supported by observations of higher overall complication rates in urolithiasis patients during the pandemic [19]. The scarcity of medical personnel further exacerbated these challenges, leading to higher complication rates in patients undergoing ureterorenoscopic treatment [15]. This confluence of factors underscores the critical need to investigate the specific complications arising from stent placement in this vulnerable patient population, particularly concerning the increased propensity for encrustation and infection.

According to Spooner et al., the prevalence of E. coli infections in their cohort highlights a significant bacterial susceptibility, potentially exacerbated by the prolonged use of stents during the pandemic. This susceptibility is further compounded by the observation that delayed presentation of urolithiasis during the pandemic led to a higher proportion of patients requiring ureteral stent placement for septic or febrile stone presentation [19]. Furthermore, bacterial colonization of ureteral stents, often by Enterococcus species and Escherichia coli, is a well-established phenomenon, occurring in up to 90% of cases, and can lead to bothersome symptoms and clinical urinary tract infections in a significant proportion of patients, particularly with longer stent placement times [20]. This increased bacterial burden, in conjunction with COVID-19-induced physiological changes, may contribute to the heightened rates of severe sepsis and systemic inflammatory response syndrome observed in this patient population [21]. Indeed, studies have shown that the pandemic period was uniquely associated with a worse clinical state at presentation for patients with obstructing urinary stones complicated by infection, likely reflecting delays in seeking emergency medical services [21]. Such delays not only prolong patient suffering but also contribute to an increased need for stent replacement due to infections, with urinary tract infections being a primary cause for such interventions. Moreover, the extended waiting times during the pandemic led to higher complication rates, including recurrent urinary tract infections and stent encrustation, necessitating more complex interventions [15]. These extended complications underscore the critical need for vigilant post-stent placement monitoring and timely interventions to mitigate adverse outcomes in this vulnerable patient group, especially considering the higher rates of complicated ureteral stones observed during the pandemic [12,15].

The prevalence of gram-negative bacteria, such as E. coli, as primary colonizers of stents is consistent with prior research, but the identification of E. faecalis as a significant pathogen, particularly given

its common resistance to institutional prophylactic antibiotics, introduces a critical challenge for effective antimicrobial strategies in this context [22]. This emphasizes the importance of culture-specific antibiotic selection for managing stent-related infections, moving beyond empirical broad-spectrum treatments. The prolonged indwelling times of stents further contribute to encrustation, a serious complication often necessitating surgical removal, with rates significantly increasing after 6 to 12 weeks [23,24]. In fact, stent dwelling time has been directly correlated with bacteriuria and colonization, with the risk of sepsis increasing cumulatively from 2.2% at 30 days to 9.2% for dwelling times exceeding 90 days [25]. The interplay between prolonged stent indwelling times and the immunomodulatory effects of COVID-19 could further exacerbate the risk of ascending infections and systemic inflammatory responses, making timely stent removal or exchange crucial for preventing severe outcomes [26].

Pre-interventional urine cultures and appropriate antibiotic therapy are therefore mandatory, despite the increasing challenge of antibiotic resistance, while intrarenal urine and stone cultures are recommended to guide antibiotic adjustment in cases of postoperative infectious complications [27]. This necessity is further underscored by findings that demonstrate a higher incidence of postoperative infectious complications in patients undergoing ureteroscopy with indwelling stents, particularly those colonized by resistant organisms like E. Faecalis [22]. Multivariable analyses consistently indicate that the positivity of stent cultures is a significant predictor of such infectious complications [22]. While preoperative urine cultures are valuable, studies have indicated that stent cultures may reveal different bacterial profiles, complicating antibiotic selection and potentially leading to post-procedure sepsis [28]. This disparity suggests that relying solely on preoperative urine cultures may underestimate the true microbial burden and resistance patterns within the stent biofilm, thereby increasing the risk of ineffective empirical antimicrobial therapy [26].

The study has drawbacks, including its retrospective design, single-center perspective, and small sample size.

To accurately assess this, it is crucial to analyze specific complications within distinct subgroups and conduct prospective trials with various therapeutic approache.

Conclusions

Forgotten the stents in position associated with renoureteral lithiasis can have important complications, urinary tract infection being the most common.

Disclosure of potential conflicts of interest.
The authors do not have anything to disclose.

References:

1. Antonucci M, Recupero SM, Marzio V, De Dominicis M, Pinto F, Foschi N, Di Gianfrancesco L, Bassi P, Ragonese M. The impact of COVID-19 outbreak on urolithiasis emergency department admissions, hospitalizations and clinical management in central Italy: a multicentric analysis. Actas Urol Esp (Engl Ed). 2020 Nov;44(9):611-616. doi: 10.1016/j.acuro.2020.06.005. Epub 2020 Jul 3. PMID: 32713658; PMCID: PMC7598308.
2. Qian, X., Wan, J., Xu, J., Liu, C., Zhong, M., Zhang, J., Zhang, Y., & Wang, S. (2021). Epidemiological Trends of Urolithiasis at the Global, Regional, and National Levels: A Population-Based Study. International Journal of Clinical Practice, 2022(1), 6807203. https://doi.org/10.1155/2022/6807203
3. Li, S., Huang, X., Liu, J., Yue, S., Hou, X., Hu, L., & Wu, J. (2022). Trends in the Incidence and DALYs of Urolithiasis From 1990 to 2019: Results From the Global Burden of Disease Study 2019. Frontiers in Public Health, 10, 825541. https://doi.org/10.3389/fpubh.2022.825541
4. GBD 2021 Urolithiasis Collaborators. The global, regional, and national burden of urolithiasis in 204 countries and territories, 2000-2021: a systematic analysis for the Global Burden of Disease Study 2021. EClinicalMedicine. 2024 Nov 21;78:102924. doi: 10.1016/j.eclinm.2024.102924. PMID: 39640943; PMCID: PMC11618031.
5. Mohammadi A, Farabi H, Baghdadabad LZ, Narouie B, Reis LO, Aghamir SMK. Serum and 24-hour urinary tests cost-effectiveness in stone formers.

BMC Urol. 2023 Aug 27;23(1):141. doi: 10.1186/s12894-023-01310-w. PMID: 37635222; PMCID: PMC10464256.
6. Geavlete P, Jecu M, Geavlete B, Multescu R, Nita G, Georgescu D. Ureteroscopy--an essential modern approach in upper urinary tract diagnosis and treatment. J Med Life. 2010 Apr-Jun;3(2):193-9. PMID: 20968209; PMCID: PMC3019052.
7. Geavlete P, Georgescu D, Mulțescu R, Stanescu F, Cozma C, Geavlete B. Ureteral stent complications - experience on 50,000 procedures. J Med Life. 2021 Nov-Dec;14(6):769-775. doi: 10.25122/jml-2021-0352. PMID: 35126746; PMCID: PMC8811679.
8. Jin X, Liu B, Xiong Y, Wang Y, Tu W, Shao Y, Zhang L, Wang D. Outcomes of ureteroscopy and internal ureteral stent for pregnancy with urolithiasis: a systematic review and meta-analysis. BMC Urol. 2022 Sep 14;22(1):150. doi: 10.1186/s12894-022-01100-w. PMID: 36104697; PMCID: PMC9476568.
9. Radu, V.D.; Vasilache, I.-A.; Costache, R.-C.; Scripcariu, I.-S.; Nemescu, D.; Carauleanu, A.; Nechifor, V.; Groza, V.; Onofrei, P.; Boiculese, L.; et al. Pregnancy Outcomes in a Cohort of Patients Who Underwent Double-J Ureteric Stenting—A Single Center Experience. Medicina 2022, 58, 619. https://doi.org/10.3390/medicina58050619
10. Thakur, A.P.S., Sharma, V., Ramasamy, V. et al. Management of ureteric stone in pregnancy: a review. Afr J Urol 26, 60 (2020). https://doi.org/10.1186/s12301-020-00070-5
11. Weltings S, Schout BMA, Roshani H, Kamphuis GM, Pelger RCM. Lessons from Literature: Nephrostomy Versus Double J Ureteral Catheterization in Patients with Obstructive Urolithiasis-Which Method Is Superior? J Endourol. 2019 Oct;33(10):777-786. doi: 10.1089/end.2019.0309. Epub 2019 Aug 28. PMID: 31250680.
12. Gul M, Kaynar M, Yildiz M, Batur AF, Akand M, Kilic O, Goktas S. The Increased Risk of Complicated Ureteral Stones in the Era of COVID-19 Pandemic. J Endourol. 2020 Aug;34(8):882-886. doi: 10.1089/end.2020.0658. Epub 2020 Jul 29. PMID: 32668987.
13. Somani, B. K. (2021). After COVID-19: Planning postpandemic care of patients with kidney stones. Nature Reviews. Urology, 18(9), 511. https://doi.org/10.1038/s41585-021-00463-3
14. Edelblute BT, Khusid JA, Gallante BE, Atallah WM, Gupta M. Emergent Stenting for Obstructive Nephrolithiasis During the COVID-19 Pandemic Compared to the Prepandemic Era. Urol Pract. 2021 Mar;8(2):165-167. doi: 10.1097/UPJ.0000000000000197. Epub 2020 Sep 29. PMID: 37145611.
15. Yurdakul, O. V., Seitz, C., Veser, J., Hassler, M. R., Shariat, S. F., & Remzi, M. (2024). Impact of Personnel Scarcity on Urolithiasis Treatment: A Comparative Study of the Pre- and Post-Pandemic Eras. Research Square (Research Square). https://doi.org/10.21203/rs.3.rs-3839554/v1
16. Wang, X., Ji, Z., Yang, P., Li, J., & Tian, Y. (2024). Forgotten ureteral stents: a systematic review of literature [Review of Forgotten ureteral stents: a systematic review of literature]. BMC Urology, 24(1). BioMed Central. https://doi.org/10.1186/s12894-024-01440-9
17. Assad, A., Nguyen, D., Sadri, I., & Bhojani, N. (2021). The impact of delaying acute kidney stone surgery on outcomes. Canadian Urological Association Journal, 15(8). https://doi.org/10.5489/cuaj.6877
18. Thangavelu, M., Abdallah, M. Y., Isola, O. J., & Kotb, A. (2022). Management of encrusted ureteral stents: Two center experience [Review of Management of encrusted ureteral stents: Two center experience]. Archivio Italiano Di Urologia e Andrologia, 94(3), 305. PAGEPress (Italy). https://doi.org/10.4081/aiua.2022.3.305
19. Spooner, J., Masoumi-Ravandi, K., MacNevin, W., Ilie, G., Skinner, T., & Powers, A. L. (2024). Septic and febrile kidney stone presentations during the COVID-19 pandemic: What is the effect of reduced access to care during pandemic restrictions?
20. Kilciler, M., Erdemır, F., Bedir, S., & Demir, E. (2011). The Evaluation of Ureteral Stent Complications: Our Clinical Experience andReview of the Literature. DergiPark (Istanbul University). https://dergipark.org.tr/tr/pub/gutfd/issue/34288/378889
21. Herzberg, H., Savin, Z., Lasmanovich, R., Marom, R., Ben-David, R., Mano, R., Yossepowitch, O., & Sofer, M. (2022). Impact of COVID-19 pandemic on patients with obstructing urinary stones complicated by infection.
22. Carobbio, F., Zamboni, S., Cristinelli, L., D'Aietti, D., Lattarulo, M., Daja, J., Hauwermeiren, E.

V., Moroni, A., Antonelli, A., & Simeone, C. (2020). Role of cultural analysis in patients with indwelling ureteral stent submitted to ureteroscopy for stones. Minerva Urologica e Nefrologica, 72(6). https://doi.org/10.23736/s0393-2249.19.03549-5

23. Domingues, B., Pacheco, M., Cruz, J. E. de la, Carmagnola, I., Teixeira-Santos, R., Laurenti, M., Can, F., Bohinc, K., Moutinho, F., Silva, J. M., Aroso, I. M., Lima, E., Reis, R. L., Ciardelli, G., Cauda, V., Mergulhão, F., Soria, F., & Barros, A. A. (2021). Future Directions for Ureteral Stent Technology: From Bench to the Market. Advanced Therapeutics, 5(1). https://doi.org/10.1002/adtp.202100158

24. Sali, G., & Joshi, H. B. (2019). Ureteric stents: Overview of current clinical applications and economic implications [Review of Ureteric stents: Overview of current clinical applications and economic implications]. International Journal of Urology, 27(1), 7. Wiley. https://doi.org/10.1111/iju.14119

25. Yıldız, A. K., Bayraktar, A. B., Kaçan, T., Keseroğlu, B. B., Özgür, B. C., Doluoğlu, Ö. G., & Karakan, T. (2023). Optimal dwelling time for ureteral stents placed for passive dilation after impassable ureteroscopy. Research Square (Research Square). https://doi.org/10.21203/rs.3.rs-2448025/v1

26. Nevo, A., Mano, R., Baniel, J., & Lifshitz, D. A. (2017). Ureteric stent dwelling time: a risk factor for post- ureteroscopy sepsis.

27. Papatsoris, A., Alba, A. B., Llopis, J. A. G., Musafer, M. A., Alameedee, M., Ather, H., Caballero-Romeu, J. P., Costa-Bauzà, A., Dellis, A., Howairis, M. E., Gambaro, G., Geavlete, B., Haliński, A., Hess, B., Jaffry, S., Kok, D. J., Kouicem, H., González, L. L., Martinez, J. M. L., … Tuerk, C. (2024). Management of urinary stones: state of the art and future perspectives by experts in stone disease. Archivio Italiano Di Urologia e Andrologia, 96(2). https://doi.org/10.4081/aiua.2024.12703

28. Khusid, J. A., Hordines, J., Sadiq, A. S., Atallah, W., & Gupta, M. (2021). Prevention and Management of Infectious Complications of Retrograde Intrarenal Surgery [Review of Prevention and Management of Infectious Complications of Retrograde Intrarenal Surgery]. Frontiers in Surgery, 8. Frontiers Media. https://doi.org/10.3389/fsurg.2021.718583