**Endourology 2024 Summer Student Project Summary**

# Optimal stenting duration following ureteroscopy: systematic review and meta-analysis

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## INTRODUCTION

Ureteroscopy, a procedure that was first described in the scientific literature in the early 20th century by Dr. Hugh Hampton Young, an American urologist, is a widely practiced medical technique that plays a pivotal role in the management of various urological conditions, including urolithiasis and ureteral strictures1. A critical component of this procedure involves the placement of a ureteral stent to facilitate postoperative drainage and mitigate potential complications2. However, the optimal duration for which these stents should remain in place is still a topic of significant clinical interest and debate.

Current clinical practices and guidelines, as outlined by the American Urological Association (AUA) and the European Association of Urology (EAU), offer some recommendations regarding the duration of stent placement following ureteroscopy. Generally, the panel recommends three to seven days of stenting3. However, the ideal duration of stenting is unknown. Also, there is no meta-analysis directly addressing this topic. Most urologists prefer waiting for a period of one to two weeks following the ureteroscopy procedure4. Therefore, the existing literature and guidelines provide varying and sometimes conflicting suggestions, leaving urologists with a lack of consensus on the most appropriate stent duration.

Despite the guidance available, there still exists a notable gap in our understanding of the ideal stent duration following ureteroscopy. The controversy surrounding this topic is exacerbated by limited high-quality evidence5. As a result, there is significant variability in clinical practice, with urologists making stent duration decisions based on personal experience and institutional preferences rather than concrete evidence. Therefore, the potential impact of stent duration on patient outcomes, such as, quality of life, and overall procedure success, remains inadequately explored in the literature.6

Thus, the purpose of this study is to address the existing knowledge gaps and controversies by conducting a comprehensive meta-analysis of the available studies that investigate the outcomes associated with ideal stent duration and post-procedure related events following ureteroscopy. By synthesizing the existing evidence, our work aims to provide valuable insights that can inform evidence-based clinical decision-making and contribute to improved patient care in urology.

## OBJECTIVES:

This research aims to conduct a systematic literature review and associated meta-analysis to address the existing knowledge gaps and controversies of the available studies that investigate the outcomes associated with ideal stent duration and post-procedure related events following ureteroscopy.

## METHODS:

### Search strategy

This systematic review and meta-analysis were performed and reported in accordance with the Cochrane Collaboration Handbook for Systematic Review of interventions and the Preferred reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) Statement guidelines.7 We searched MEDLINE, Embase, Scopus, Cochrane, Web of Science and Google Scholar from its inception to October 2023 for trials that compared varying stenting durations in individuals who had undergone either ureteroscopy or nephrolithotomy procedures.
Our search strategy was: ("stent duration" OR "stenting duration" OR stenting OR "stent dwell time") AND (ureteroscop* OR "ureteroscopic surgery" OR nephrolithotomy OR "percutaneous nephrolithotomy*" OR PNL OR PCNL OR nephrolithiasis OR lithotripsy) AND ("unplanned visit*" OR ED OR "ED visit" OR "clinic visit" OR "emergency department visit" OR "post-procedure related events" OR PRE OR PREs).
The references from all included studies, previous systematic reviews and meta-analyses were also searched manually for any additional studies. The prospective meta-analysis protocol was registered on PROSPERO under protocol CRD42023465684.

### Eligibility criteria for study selection

We included: (1) Randomized trials (RCTs) or non-randomized cohorts (non-RCTs); (2) comparing the duration for which the double J was retained in each patient following ureteroscopy or nephrolithotomy procedures, (3) in adult patients (>=18 years old). In addition, studies were included only if they reported any of the clinical outcomes of interest.
We excluded studies with (1) pediatric patients (<18 years old); (2) anatomical abnormalities (e.g. solitary kidney, ureteral or urethral stricture); (3) patients with active urinary tract infection; (4) ureteral avulsion during the procedures; (5) or no stent placement. Additionally, in order to obtain better accuracy of the articles and relevance of the presented data, articles with any of these characteristics were excluded: (a) case report, (b) systematic review, and (c) bibliographic review.

### Endpoints

The primary endpoint was defined as the evaluation of the risk associated with the post-procedure related events (PREs) rate, that included phone calls and emergency department visits among patients with double J stents. Secondarily we analyzed the following complications: flank pain, hematuria, abdominal pain, fever, lower urinary tract symptoms (LUTS) and dysuria. To

compare the most appropriate length of time of stenting duration we divided the cohort in patients that had their stent removed with less or equal 5 days and patients with more or equal 6 days of stenting.

**Screening**

After deduplication, where we used Endnote online™ 20 (Clarivate, Philadelphia, PA), two independent researchers (BP and NH) screened the studies by title and abstract, and disagreements were solved by a third (JC). Following this process, full text screening was performed.

**Data extraction and quality assessment**

Two authors (BP and NH) independently extracted the data based on a predefined protocol and disagreements were solved by a third (JC). Risk of bias was assessed in randomized studies using version 2 of the Cochrane Risk of Bias assessment tool (RoB 2)8. Non-randomized studies were assessed with the Risk of Bias in Non-randomized Studies – of Interventions tool (ROBINS-I)9. Two independent authors completed the risk of bias assessment (BP and NH). Disagreements were resolved through a consensus after discussing reasons for discrepancy.

**Statistical analysis**

Dichotomous data are presented as odds ratio (OR) with 95% CI. Pooled estimates were calculated with the random-effects model, considering that the patients came from different populations.

Review Manager 5.4 (The Cochrane Collaboration, Denmark, Copenhagen) was used for statistical analysis.

## RESULTS:

**Study selection and characteristics**

After performing our screening, we retrieved 1854 articles. Following the deduplication and screening process, 4 articles10-13 were deemed relevant and included in our analysis (Figure 1/PRISMA flow chart). For a comprehensive overview of the patient demographics across all included studies, please refer to Table 1. Regarding the design of the included studies, 1 of them was RCT, while the remaining 3 were non-RCTs. Combining the data from these articles, we analyzed a total of 1762 patients that removed the stent in less or equal 5 days and 2231 patients whose stent was removed in more or equal 6 days. The mean age of all patients was 51.3 years old. Despite each trial opting for different composition in groups regarding the length of stenting duration, we could group all of those in <=5 and >=6 days of stent. Said that, while Paul divided patients in 3 vs 7 days, Banerjee separated in 5 vs 14 days, and Boyko and Wenzler trials opted for 3 groups, 0-3 days, 4-6 days >6 days. We should mention that for Boyko and Wenzler we excluded the intermediate group since it did not fit into any of the groups we predicted.

**Meta-analysis**

When comparing PREs rate we observed no difference between the clusters of patients regarding the stenting duration (OR 1.26; CI95 0.22, 7.25; p=0.79; I2=98%). (Figure 2)
When considering the stratified complications, we could see a higher prevalence of flank pain (OR 2.05; CI95 1.73, 2.43; p<0.001; I2=0%) (Figure 3) and hematuria (OR 1.29; CI95 1.04, 1.61; p=0.02; I2=0%) (Figure 4) in the group who underwent up to 5 days of double J, while fever (OR 0.44; CI95 0.23, 0.85; p=0.02; I2=0%) (Figure 5) and dysuria (OR 0.61; CI95 0.46, 0.80; p=0.0005; I2=0%) (Figure 7) were more frequent in the group submitted to 6 or more days of stenting. No difference was found between when assessing the rates of LUTS (OR 1.29; CI95 0.39, 4.29; p=0.67; I2=89%) (Figure 6) or abdominal pain (OR 1.30; CI95 0.85, 1.99; p=0.22; I2=33%) (Figure 8). Table 2 exhibits the frequency of each complication in both groups.

**Quality assessment**
The 3 non-RCTs were assessed by Robins-I score. One of them presented low risk11, another one moderate risk10, and the Wenzler13 cohort presented a serious risk due to missing data (Figure 9A). On the other hand, the only RCT trial12 presented an overall score of bias, provided by the Rob-2 tool, that regards some concerns, mainly because of the randomization process (Figure 9B).

## CONCLUSION:

In summary, our meta-analysis investigated the correlation between stenting duration and postoperative outcomes following ureteroscopy. While the overall PREs rate did not exhibit a statistically significant difference between the groups, our analysis revealed distinctive and significant patterns when specific symptoms were considered in relation to stent duration. Patients with prolonged stent placement displayed a higher tendency towards fever and dysuria, contrasting with those whose stents were removed early, showcasing elevated rates of flank pain and hematuria. Given the nuances uncovered in this study, it is imperative for future research endeavors to validate and build upon our findings. Larger-scale RCTs are essential to provide more definitive guidance for clinicians, aiding them in making informed decisions regarding the optimal duration of stent placement for patients undergoing ureteroscopy.

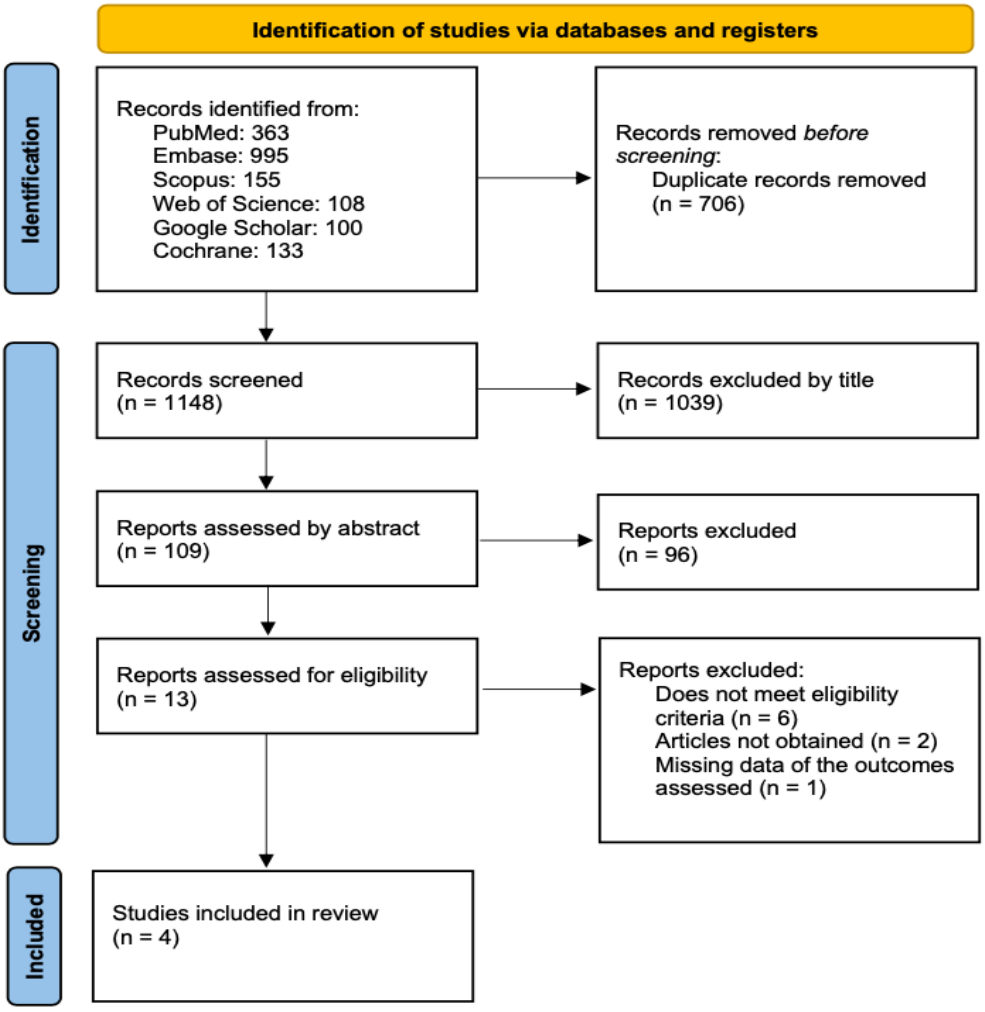
**Abbreviations**

- PREs - Post-Procedure Related Events
- OR - Odds Ratio
- CI - Confidence Interval
- MEDLINE - Medical Literature Analysis and Retrieval System Online
- RCTs - Randomized Controlled Trials
- RoB 2 - Cochrane Risk of Bias Tool Version 2
- ROBINS-I - Risk of Bias in Non-randomized Studies – of Interventions
- PRISMA - Preferred Reporting Items for Systematic Reviews and Meta-Analysis
- PNL - Percutaneous Nephrolithotomy
- PCNL - Percutaneous Nephrolithotomy
- LUTS - Lower Urinary Tract Symptoms

- $I^2$ - Heterogeneity Statistic
- AUA - American Urological Association
- EAU - European Association of Urology
- IAU - International Alliance of Urolithiasis
- UTIs - Urinary Tract Infections

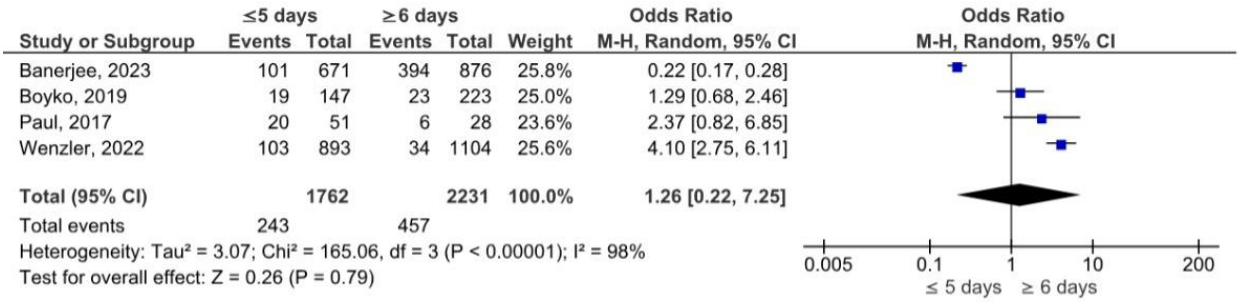
**FIGURES:**

Figure 1. PRISMA flowchart.



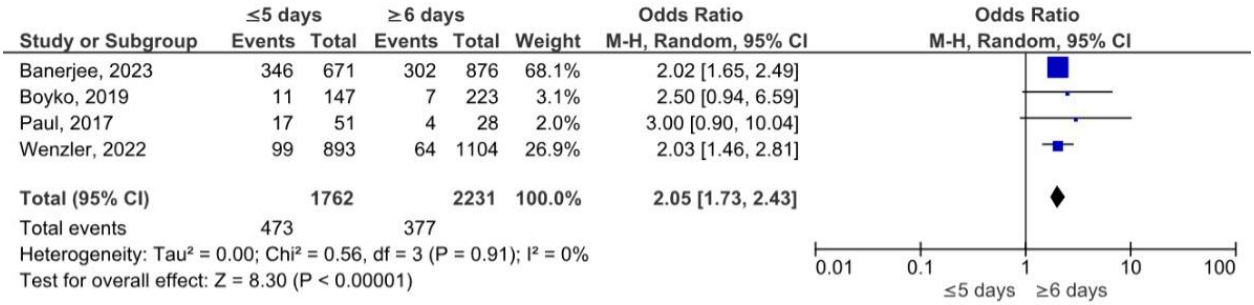

Source: Authors

Figure 2. No difference in PREs rate of ≤5 days vs ≥6 days groups of stenting duration.




Source: Authors

Figure 3. Higher incidence of flank pain in the ≤5 days of stenting duration group.




Source: Authors

Figure 4. Higher incidence of hematuria in the ≤5 days of stenting duration group.

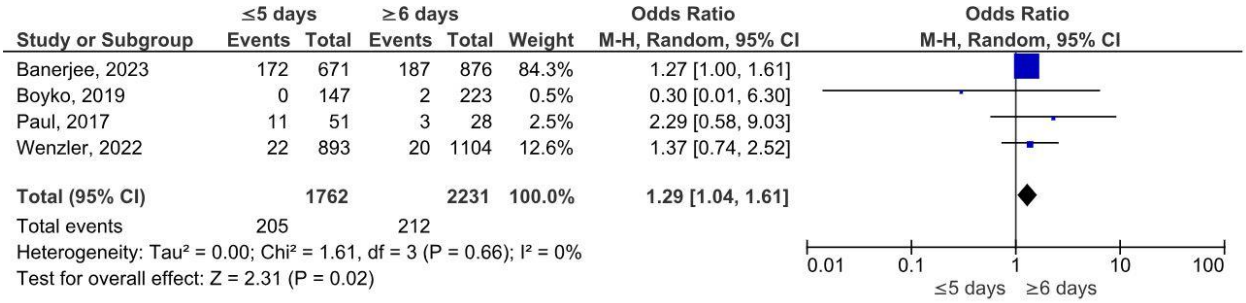



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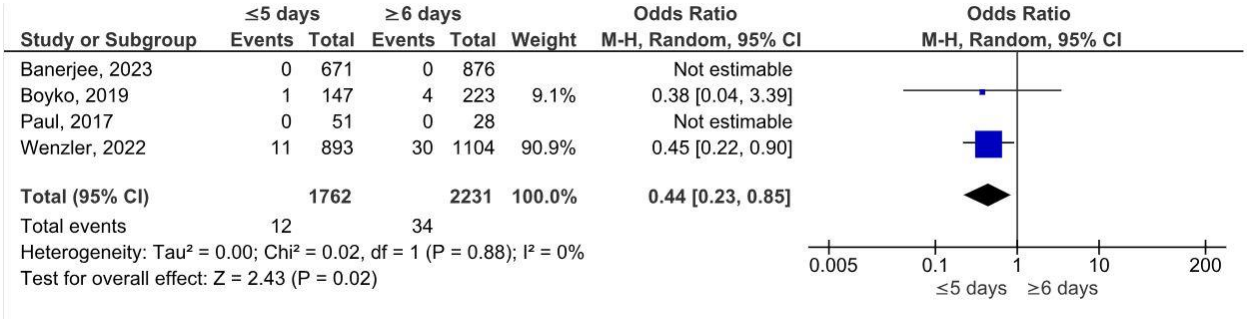
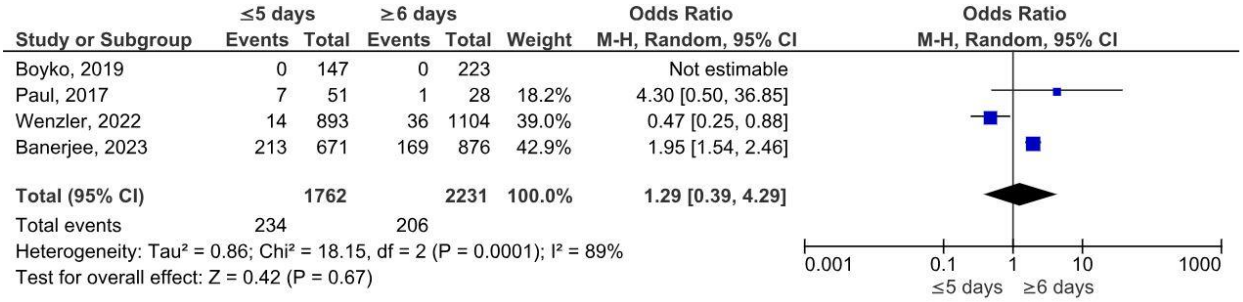
Figure 5. Higher incidence of fever in the group who underwent ≥6 days of stenting duration.




Source: Authors

Figure 6. No difference in LUTS rate between groups analyzed.




Source: Authors

Figure 7. Higher incidence of dysuria in the group who underwent ≥6 days of stenting duration.

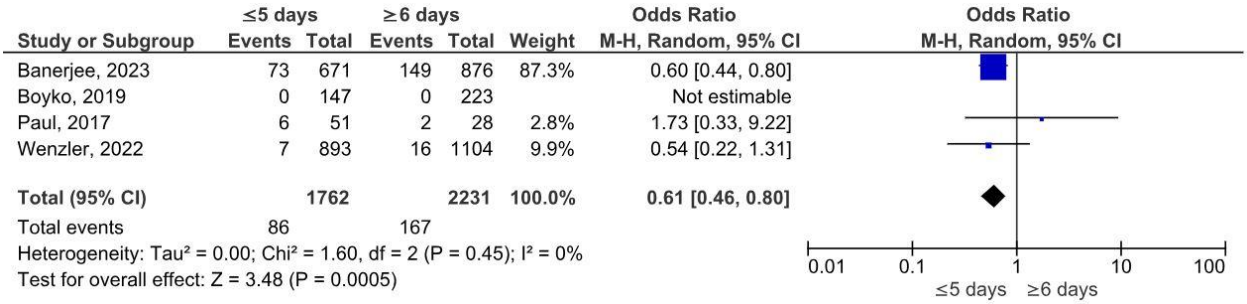



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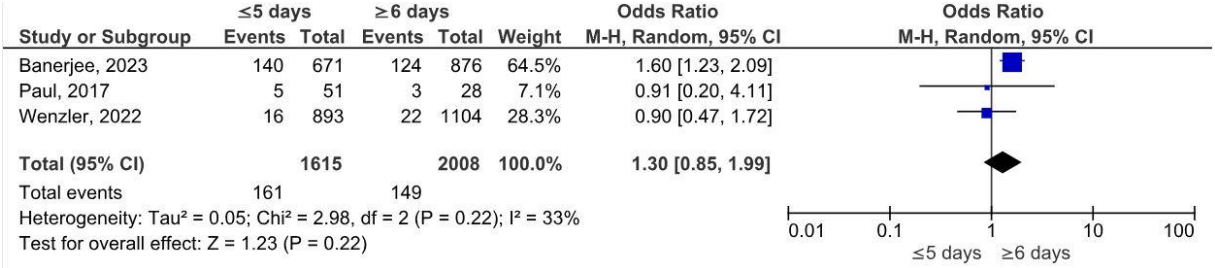
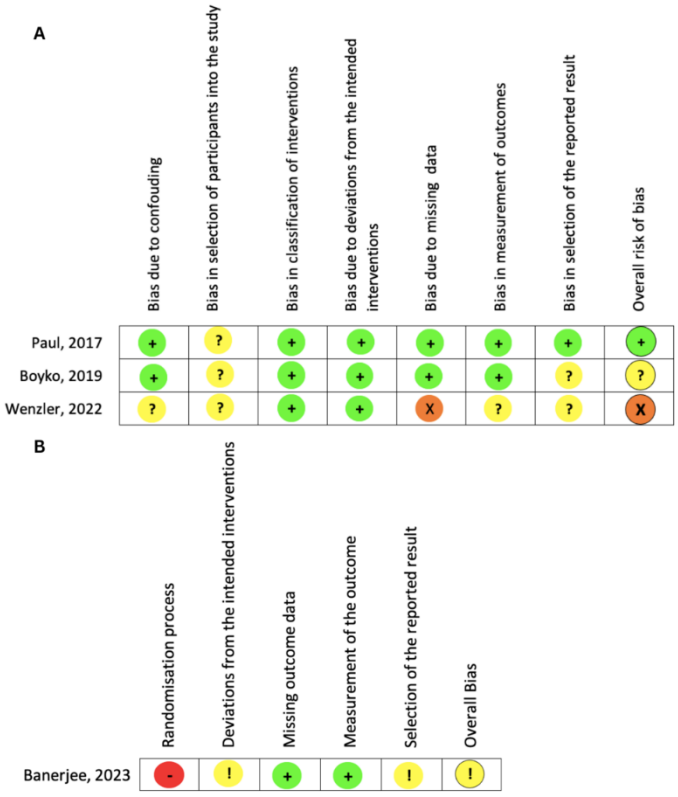
Figure 8. No difference in abdominal pain rate between groups analyzed.




Source: Authors

Figure 9. Risk of bias - 9A) Risk of bias ROBINS-I of the included non-RCT study. Legend: + – low risk bias; ? – moderate risk of bias; X – high risk of bias; 9B) Risk of bias RoB-2 tool of the included RCT studies. Legend: + – low risk bias; ! some concerns; - – high risk of bias.




Source: Authors

Table 1. Baseline characteristics and outcome data of included studies

| Study | Type of study | Language | Patients enrolled (N), ≦5/≧6 days | Mean age - years, ≦5/≧6 days | Male (%) - N, ≦5/≧6days | Mean BMI (range) - Kg/m2, ≦5/≧6 days | PREs (%) - N, ≦5/≧6 days | Presence of string (%) - N, ≦5/≧6 days | Postoperative complications (Clavien-Dindo), ≦5/≧6 days | Side of disease | Follow-up, days |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Paul, 2017** | Retrospective cohort study | English | 51/28 | 52 ± NS /52 ± NS | 18(35%)/19(68%) | NS/NS | 20 (39%)/6 (21%) | 51 (100%)/28 (100%) | 39 patients grade I (76.4%), 7 patients grade II (13.7%)/12 patients grade I (42.85%), 1 patient grade II (3.57%) | Left - 32(63%)/ 18(64%) Right - 19(37%)/10(36%) | 30 |
| **Boyko, 2019** | Retrospective cohort study | English | 147/223 | 52.09 ± NS /51.38 ± NS | 289(51.7%)/113(53.97%) | 29.3 ± NS (NS)/29.26 ± NS (NS) | 19 (32.75%)/23 (39.65%) | 130 (88.44%)/68 (30.49%) | 2 patients grade I (10.53%), 20 patients grade II (52.63%), 6 patients grade III (31.58%), 1 patient grade IV (5.26%)/ 2 patients grade I (8.70%), 17 patients grade II (73.91%), 4 patients grade III (17.39%) | NS | 30 |
| **Wenzler, 2022** | Retrospective cohort study | English | 893/1104 | 54 ± 16/56 ± 17 | NS/NS | 31.9 ± 8.2 (16.1-103.4)/30.9 ± 7.9 (13-81.1) | 103 (11.6%)/34 (3.1%) | NS/NS | 159 patients grade I (17.8%), 22 patients grade III (2.5%), 3 patients grade IV (0.3%)/160 patients grade I (14.5%), 20 patients grade III (1.8%), 7 patients grade IV (0.6%) | NS | 2 |
| **Banerjee, 2023** | Prospective randomized study | English | 671/876 | 45.08 ± NS/ 47.18 ± NS | 289(43.1%)/426(48.6%) | NS/NS | 101 (15%)/394 (44.9%) | NS/NS | NS/NS | Left - 359(53.5%)/ 463(52.9%) Right - 312(46.5%)/ 413(47.1%) | 30 |

Note: The continuous variables were represented by mean ± SD (range).

Abbreviations: BMI, body mass index; NS, non specified; SD, standard deviation; PREs, post procedure related events.

Table 2. Post operative complications.

| Study | Flank Pain (%) - N, ≦5/≧6days | Fever (%) - N, ≦5/≧6days | Hematuria (%) - N, ≦5/≧6days | LUTS (%) - N, ≦5/≧6days | Dysuria (%) - N, ≦5/≧6days | Suprapubic/Abdominal pain (%) - N, ≦5/≧6days |
|---|---|---|---|---|---|---|
| **Paul, 2017** | 17 (33.3%)/ 4 (14.3%) | NS/NS | 11 (21.6%)/ 3 (10.7%) | 7 (13.7%)/ 1 (3.5%) | 6 (11.7%)/2 (7.1%) | 5 (9.8%)/3 (10.7%) |
| **Boyko, 2019** | 11 (57.9%)/7 (30.4%) | 1 (5.2%)/4 (17.4%) | 0 (0%)/2 (8.7%) | 0 (0%)/0 (0%) | NS/NS | NS/NS |
| **Wenzler, 2022** | 99 (11.1%)/64 (5.8%) | 11 (1.2%)/30 (2.7%) | 22 (2.5%)/20 (1.8%) | 14 (1.5%)/36 (3.2%) | 7 (0.8%)/16 (1.5%) | 16 (1.8%)/22 (2%) |
| **Banerjee, 2023** | 346 (51.5%)/302 (34.5%) | NS/NS | 172 (25.7)%/187 (21.3%) | 213 (31.7%)/ 169 (19.30%) | 73 (10.9%)/ 149 (17%) | 140 (20.8)%/ 124 (14.2%) |

Note: The continuous variables were represented by mean ± SD (range).

Abbreviations: SD, standard deviation.

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