

ORIGINAL PAPER

Post-cystoscopic urinary tract infection in infants: assessing risk factors and prophylactic efficacy

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ABSTRACT

Introduction: Cystoscopy is a common diagnostic and therapeutic procedure in the pediatric population. However, the incidence of post-cystoscopic urinary tract infection (pcUTI) remains largely unexamined. This study evaluates the role of urinalysis and a history of previous urinary tract infection (UTI) as potential risk factors for pcUTI. It also analyzes the efficiency of the antibiotic treatment as prophylaxis for pcUTI.

Material and methods: We conducted a retrospective analysis of the medical records of infants who underwent cystoscopic procedures at the Pediatric Surgery Department in Poznan between 2020 and 2024. The occurrence of post-cystoscopic UTI was recorded within 14 days after the procedure. Statistical analysis was performed using Statistica v.13.0.

Results: A total of 115 patients were analyzed (82% male, 18% female; median age: 5 months). A history of previous UTI was present in 29% of patients. Preprocedural urinalysis indicated signs of UTI in 21% of patients, of whom 67% received additional antibiotic treatment. Perioperative furazidone was administered to 57% of patients. Post-cystoscopic urinary tract infection occurred in 18 cases (17%). There was no statistically significant association between the occurrence of pcUTI and a positive history of UTI or urinalysis findings suggestive of UTI prior to cystoscopy, regardless of additional antibiotic treatment. Similarly, no statistically significant difference was observed between patients who received perioperative furazidone and those who received perioperative antibiotics.

Conclusions: Preoperative urinalysis is not a sufficient predictor of the post-cystoscopic UTI risk. History of previous UTI is also insufficient as a predictor of pcUTI. Neither perioperative furazidone nor antibiotic therapy appears to be effective in preventing pcUTI in infants. Further studies are necessary for standardizing the indications and methods of prophylaxis.

KEY WORDS:

cystoscopy, urinary tract infection, pediatric urology.

INTRODUCTION

Cystoscopy is one of the most important tools in the pediatric population for assessing congenital abnormalities of the lower urinary tract and for the potential treatment of posterior urethral valves (PUV), vesico-

ureteral reflux, or ureteral stent removal [1–3]. However, it carries a potential risk of post-cystoscopic urinary tract infection (pcUTI) [4, 5].

In the pediatric population, urinary tract infection (UTI), particularly pyelonephritis, may cause renal scarring which negatively impacts renal function [3, 5, 6–8].

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Although prevention of pcUTI is therefore crucial, it may result in extensive antibiotic use. However, studies on the efficacy of periprocedural antibiotic therapy used as UTI prevention in the pediatric population are lacking, especially in the youngest group, which is most susceptible to severe UTI-related complications [8, 9]. Due to a limited number of child-centered studies, pediatric urologists are forced to base their therapeutic decisions on adult-oriented research, as well as their own experience and cultural norms and practices vary widely [10]. Moreover, widespread use of antibiotic therapy leads to population-level resistance, further exacerbating the problem [11]. Therefore, it is important to identify relevant criteria to determine patients at risk of pcUTI.

This study aims to analyze the association between precystoscopic urinalysis and a history of previous UTI and the risk of pcUTI. Additionally, it seeks to evaluate the efficacy of antibiotic prophylaxis in terms of pcUTI.

MATERIAL AND METHODS

The study included patients treated at the Pediatric Surgery Department in Poznan, Poland between 2020 and 2024. The study group initially comprised 127 infants who underwent cystoscopy. The medical history of UTI and the pharmacological prophylaxis used prior to the procedure was analyzed by the researchers. Urinalysis was performed 24 hours before the planned procedure using a bag collection method. Patients with negative urinalysis were placed on UTI prophylaxis depending on the surgeons'

choice – either prophylaxis with full-dose of furazidine (7–10 mg/kg) or antibiotic prophylaxis in the form of full-dose perioperative antibiotic administration. Patients with urinalysis findings suggestive of UTI were placed on antibiotic therapy one week prior to the procedure and the cystoscopy was postponed. The urinalysis was then checked again after one week directly before the procedure. The cystoscopy was performed after one week regardless of the subsequent urinalysis results.

For the procedure, patients were positioned in the lithotomy position. The surgical field was disinfected according to the protocols of the Pediatric Surgery Department. Cystoscopy was performed either by urology specialists or residents. Follow-up for the occurrence of UTI lasted for 14 days after the cystoscopy. The perioperative intravenous hydration and length of hospitalization were analyzed. Twelve patients were excluded due to incomplete medical documentation.

The correlation between the presence of previous UTIs and the preprocedural urinalysis and the occurrence of pcUTI was studied. The urinalysis was considered positive when significant leukocyturia or positive nitrites were present. The correlation between the use of furazidine or antibiotics and the occurrence of pcUTI was also analyzed.

Descriptive statistical methods were used to present the results as frequencies (n) and percentages (%). In the statistical analysis, the χ^2 independence test was applied to assess the relationships between the studied qualitative variables. Results with a significance level of $p < 0.05$ were considered statistically significant. Statistical analysis was performed using Statistica v.13.0 (StatSoft).

TABLE 1. Demographic and clinicopathological details

Parameters	Percentage
Sex	
Male	82
Female	18
Previous UTI history	
Negative	68
Positive	29
Inconclusive	3
Urinalysis	
Positive (signs of UTI)	21
Negative (no signs of UTI)	70
Inconclusive	9
Procedures	
Diagnostic cystoscopy	37
PUV ablation	30
DJ-catheter removal	17
DJ-catheter insertion	10
STING procedure	10

DJ-catheter – double J catheter, PUV – posterior urethral valve, STING – suburethral transurethral injection, UTI – urinary tract infection

RESULTS

A total of 115 patients were included in the final analysis. The median age was 5 months, the youngest patient was 6 days old, and the oldest was 12 months. 82% of the patients were male (94 patients). Prior to cystoscopy, 37% of patients were diagnosed with vesicoureteral reflux, 26% were suspected of PUV, 12% had megaureter and 25% had hydronephrosis. 29% of patients had a positive history of at least one UTI prior to the procedure. 68% had no history of previous UTI. For the 3% the history was inconclusive. The urinalysis showed signs of UTI in 21% of the patients, but none of the patients was symptomatic. 67% of the urinalysis-positive patients received an additional antibiotic treatment a week prior to cystoscopy. The remaining eight patients (33%) were receiving antibiotic therapy prior to admission and remained on their previous treatment for a week prior to cystoscopy and during the procedure (Table 1).

57% of patients received a full dose of furazidine prior to the procedure. 46% received antibiotic prophylaxis. All patients previously treated with antibiotics were receiving antibiotic prophylaxis during cystoscopy. Twelve patients

received both a full dose of furazidine and antibiotic prophylaxis based on the individual choice of an attending physician.

Eighteen patients (15%) developed symptomatic UTI within 14 days after cystoscopy. These patients were diagnosed with primary vesicoureteral reflux (VUR) (33%), suspected PUV (33%), megaureter (22%), or hydronephrosis (11%). 38% had a positive history of UTI. Only 22% had a positive urinalysis prior to cystoscopy. 58% received furazidine prophylaxis, 38% received antibiotic prophylaxis, and one patient received both.

There was no statistically significant difference in the post-cystoscopic UTI rate between the patients with UTI-indicating urinalysis results before the cystoscopy and patients with clean urinalysis before the cystoscopy, regardless of additional antibiotic treatment implementation ($p = 0.83$). We also did not find a statistically significant difference between the positive UTI history and the occurrence of post-cystoscopic UTI ($p = 0.27$) (Figures 1, 2).

Additionally, no statistically significant difference was found between the occurrence of pcUTI and the performed procedure (diagnostic cystoscopy, STING, PUV ablation, catheter insertion, or catheter removal).

Regarding the prevention of post-cystoscopic UTI, there was no statistical difference between the group using the perioperative antibiotics compared to the group with only furazidine treatment ($p = 0.5$) (Figure 3).

DISCUSSION

Many publications assessed the occurrence rate of pcUTI in the adult population at 1.9–7.5% [12–14]. The post-cystoscopic urinary tract infection occurrence rate in our study is much higher as it reaches 15%. Unfortunately pcUTI occurrence data based on the pediatric population was not found, especially regarding infants. However, children below 2 years of age are at higher risk of UTI due to their developing immature immune systems [3]. There is also a higher prevalence of UTI in male infants and in patients with congenital abnormalities [3]. That may explain the higher incidence of pcUTI in the examined population compared to the occurrence rate in the adult population. In the Tiboni *et al.* study [15] examining outcomes of endoscopic treatment in infants and children with primary Grade 4–5 VUR, sixteen (33%) patients suffered from febrile UTI at follow-up after endoscopic treatment despite all patients were discharged on prophylaxis. However the higher rate of pcUTI in this study might be explained by the selection of patients with advanced VUR, which carries a higher risk of potential infection compared to our study. More studies regarding pcUTI in the pediatric population are necessary to determine this factor.

Considering that pcUTI may lead to serious consequences such as urosepsis, renal scarring, or even future renal failure, our study aimed to identify the associated risk factors and determine the most effective methods of pcUTI prophylaxis.

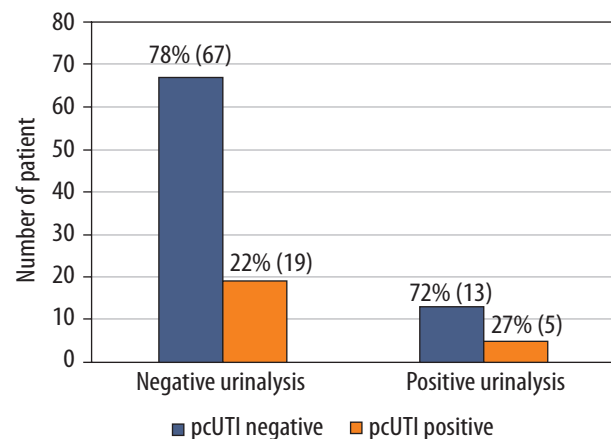


FIGURE 1. Urinalysis and post-cystoscopic urinary tract infection occurrence

pcUTI – post-cystoscopic urinary tract infection

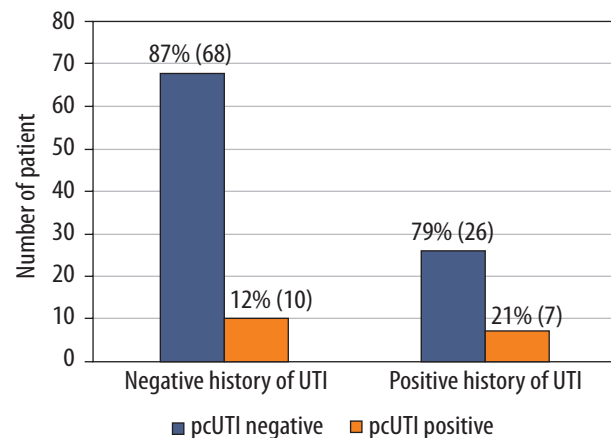


FIGURE 2. History of previous urinary tract infection and post-cystoscopic urinary tract infection occurrence

pcUTI – post-cystoscopic urinary tract infection, UTI – urinary tract infection

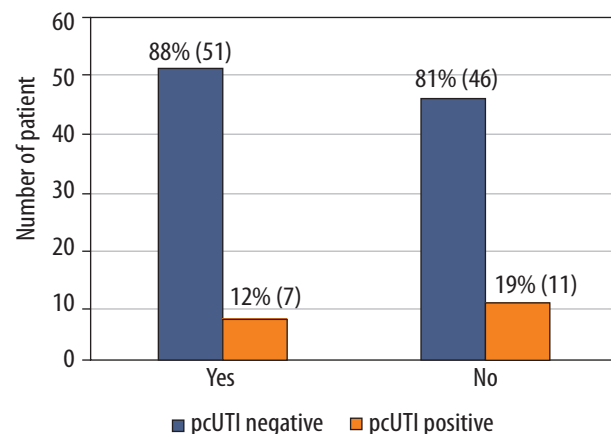


FIGURE 3. Antibiotic prophylaxis and post-cystoscopic urinary tract infection occurrence

pcUTI – post-cystoscopic urinary tract infection

URINE TESTING BEFORE CYSTOSCOPY

Multiple studies based on the adult population are opting for resignation from bacterial cultures or even urinalysis prior to cystoscopy, either due to a low prognostic value or low risk in UTI occurrence [12, 16, 17]. The study by

Chavarriaga *et al.* [18] demonstrated that the occurrence of symptomatic UTI was not correlated with urine culture. In that study, the percentage of patients with pcUTI without urine cultures and with urine cultures and later treated with antibiotics was 2.5% and 4.8% respectively, which is not a statistically significant difference. In their conclusion authors suggested that routine urine culture before outpatient cystoscopy is unnecessary, because in asymptomatic patients subsequent UTIs are rare and can be easily treated. However factors significantly associated with pcUTI included a positive pre-cystoscopy urine culture. This study included only adult patients. Similar results were achieved by Escandón-Vargas *et al.* [19], also in adults. On the other hand, Gendron *et al.* [16] presented that bacteriuria may be related to a higher pcUTI rate in the adult population. The researchers found no similarly designed studies in children. Our study did not conduct urine culture before performing cystoscopy. There was no statistically significant correlation between the positive urinalysis and pcUTI occurrence. The rate of pcUTI however was significantly higher than that presented in the adult population, which again proves a low value in comparing the results between pediatric and adult patients. It is also worth noticing that bag-collected urine in the youngest population has a significant rate of contamination with leucocytes and bacteria from external genitalia, therefore the credibility of the urinalysis might be impaired [20, 21].

HISTORY OF PREVIOUS URINARY TRACT INFECTION

History of previous UTI is proven to largely impact the risk of pcUTI in adult female patients [22]. In the study by Jackson *et al.* [22], the percentage of pcUTI was 4.8%, so it was more than 3 times lower than in our study, however the examined population comprised only adult women and is not comparable with our population. The studies on the pediatric population are lacking. However the consensus study by Esposito *et al.* [23] recommend the additional antibiotic prophylaxis to infants with a previous history of UTI. That is connected to the fact that the recurrent UTI is intertwined with urinary tract abnormalities that are a more common reason for cystoscopy in our population [24]. This is supported by the adult observations in the pcUTI rate higher for recurrent UTI and urinary tract abnormalities in the work of Cusumano *et al.* [25]. However, our study was unable to demonstrate recurrent UTI as a significant risk factor for pcUTI. We attribute this to the fact that the vast majority of our patients were infants who did not have enough time to develop UTI recurrences.

ANTIBIOTIC PROPHYLAXIS

Regarding antibiotic therapy, pediatric urology forms its recommendations on the extrapolated data from the adult population. As Snyder *et al.* [26] prove, there is no suffi-

cient report regarding different antibiotic protocols and their efficiency in children. That makes the usage of adult data necessary, but also poses a potential risk, as the pediatric population has different infection risks, and different adverse effects and has to obey certain limitations regarding antibiotic therapy based on different body weight and metabolism. It also prompts the wide difference in methods of antibiotic prophylaxis between the urologists [10].

The efficacy of antibiotic prophylaxis before cystoscopy has been extensively debated in literature on adult populations. The study by Cusumano *et al.* [25] supports the thesis that antibiotic prophylaxis does not decrease the incidence of pcUTI. The studies by García-Perdomo *et al.* [27, 28] support that viewpoint and reject the need for antibiotic prophylaxis. The review of Marino *et al.* [29] also denies the necessity of prophylactic antibiotic usage for planned cystoscopies. In the Cochrane study of 2019, antibiotics proved to be effective in preventing symptomatic UTI (the localized UTI with minor generalized symptoms) in an adult population (risk ratio = 0.49 [0.28–0.86]), but they do not have a significant influence on localized UTI or systemic UTI (sepsis or fever over 38°C with bacteriuria). The evidence level of the entire study was low [30]. The aforementioned studies seem to confirm our results, as we did not achieve statistically significant differences in pcUTI between patients with perioperative antibiotic therapy and with perioperative furazidine treatment. Unfortunately, there is not enough data regarding the pediatric population to confirm the results, therefore further investigation is necessary. In their current pediatric guidelines, the European Association of Urology also pointed out the need for standardization of perioperative antibiotic management and the need for more studies assessing the efficiency of perioperative prophylaxis [31].

Though the Cochrane study assesses the adverse effects of antibiotic therapy as not concerning, we should also take into consideration the negative influence of excessive antibiotic treatment not only on individual patients but on the entire population as well. Increasing use of antibiotics perpetuates the increasing bacterial resistance [11]. Therefore limiting antibiotic therapy to patients with actual benefits should be a focus of future research.

LIMITATIONS

The authors acknowledge that the presented study has limitations – the small group of patients prevents the large-scale extrapolation of data to the general population. Moreover, the decision to administer either furazidine or antibiotic prophylaxis was based on the individual preference of a attending physician, which introduces a possible bias, as the patients perceived as having a higher risk of UTI might have been more likely to receive antibiotic prophylaxis. Additionally, samples used for urinalysis were obtained by bag collection, which may also disrupt the results of the study. The authors also acknowledge

that, in case of patients treated prior to cystoscopy, the results of post-treatment urinalysis were affected by the antibiotic treatment, weakening the rationale for grouping and limiting the interpretability of the findings.

CONCLUSIONS

Post-cystoscopic urinary tract infection is a clinically relevant complication in infants. In this study, no significant correlations were identified between the occurrence of pcUTI and either precystoscopic urinalysis or a history of previous UTI. Antibiotic prophylaxis was also not associated with a reduced rate of pcUTI compared to furazidine prophylaxis. The findings of the study are mostly consistent with studies on adult populations, but the relevant pediatric studies are lacking. Moreover, due to its limitations, the study may not be representative of the entire pediatric population. Limited results of the study require further investigation. Further large-scale multicenter pediatric studies are necessary to establish safe and effective recommendations for further perioperative prophylaxis in pediatric urology.

DISCLOSURES

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4. Conflicts of interest: None.

REFERENCES

1. Johnson DK, Kroovand RL, Perlmutter AD. The changing role of cystoscopy in the pediatric patient. *J Urol* 1980; 123: 232-233.
2. Arena S, Russo T, Perrone P, Romeo C. Operative cystoscopy in the neonatal period. *Pediatr Med Chir* 2016; 38: pmc.2016.136.
3. Gnech, M., A. Bujons, C. Radmayr, Hoen L, Bogaert G, Burgu B, et al. Update and summary of the EAU/ESPU paediatric guidelines on urinary tract infection in children. *J Pediatr Urol* 2025; 22: 105481.
4. Gregg JR, Lai C, Dmochowski R, Talbot TR, Barocas DA. Recent antibiotic treatment increases the risk of urinary tract infection after outpatient cystoscopy. *Urol Pract* 2016; 3: 90-96.
5. Seung-Hun S, Kim K. Antibiotic prophylaxis in pediatric urology. *Indian J Urol* 2008; 24: 145.
6. Patterson LT, Strife CF. Acquired versus congenital renal scarring after childhood urinary tract infection. *J Pediatr* 2000; 136: 2-4.
7. Wennerström M, Hansson S, Jodal U, Stokland E. Primary and acquired renal scarring in boys and girls with urinary tract infection. *J Pediatr* 2000; 136: 30-34.
8. Finnell SME, Carroll AE, Downs SM. Diagnosis and management of an initial UTI in febrile infants and young children. *Pediatrics* 2011; 128: e749-e770.
9. Milas V, Pueljic S, Stimac M, Dobric H, Lukic G. Urinary tract infection (UTI) in newborns: risk factors, identification and prevention of consequences. *Coll Anthropol* 2013; 37: 871-876.
10. Kim JK, Chua ME, Ming JM, Braga LH, Smith GHH, Driver C, et al. Practice variation on use of antibiotics: an international survey among pediatric urologists. *J Pediatr Urol* 2018; 14: 520-524.
11. Kutasy B, Coyle D, Fossum M. Urinary tract infection in children: management in the era of antibiotic resistance – a pediatric urologist's view. *Eur Urol Focus* 2017; 3: 207-211.
12. Herr HW. Should antibiotics be given prior to outpatient cystoscopy? A plea to urologists to practice antibiotic stewardship. *Eur Urol* 2014; 65: 839-842.
13. Herr HW. The risk of urinary tract infection after flexible cystoscopy in patients with bladder tumor who did not receive prophylactic antibiotics. *J Urol* 2015; 193: 548-551.
14. Clark and KR, Higgs MJ. Urinary infection following out-patient flexible cystoscopy. *Br J Urol* 1990; 66: 503-505.
15. Tiboni SG, Bethell GS, Davidson JR, Farrugia MK. Factors influencing success in endoscopic treatment of grade 4–5 primary vesicoureteric reflux (VUR) in infancy and childhood. *J Pediatr Surg* 2025; 60: 162157.
16. Gendron S, Sie M, Delchet O, Merol J, Garcia A, Jebbara I, et al. Impact of untreated positive urine culture on urinary tract infections after cystoscopy. *Fr J Urol* 2025; 35: 102840.
17. Pescheloché P, Gallon J, Parier B, Bessede T, Irani J, Verrier C, et al. Faut-il contrôler la stérilité des urines avant cystoscopie en externe? *Progrès Urol* 2017; 27: 728-729.
18. Chavarriaga J, Villanueva J, Varela D, Erazo S, Usubillaga MC, Erazo JC, et al. Do we need a urine culture before cystoscopy? Time to shift away from routine testing. *Urology* 2023; 172: 13-17.
19. Escandón-Vargas K, García-Perdomo HA, Echeverría F, Osorio JD. Risk of urinary tract infection in patients with positive urine culture and antibiotic therapy undergoing cystoscopy in a third-level hospital. *Infez Med* 2015; 23: 336-342.
20. Utsch B, Klaus G. Urinalysis in children and adolescents. *Dtsch Arztebl Int* 2014; 111: 617-25; quiz 626.
21. Yamasaki Y, Uemura O, Nagai T, Yamakawa S, Hibi Y, Yamamoto M, et al. Pitfalls of diagnosing urinary tract infection in infants and young children. *Pediatr Int* 2017; 59: 786-792.
22. Jackson A, Ackerman C, Alesna N, Hicks K, Tanner JP, Chang ES, et al. A retrospective cohort study to identify the risk factors for urinary tract infection after office procedures. *Female Pelvic Med Reconstr Surg* 2022; 28: 165-172.
23. Esposito S, Rigotti E, Argentiero A, Caminiti C, Castagnola E, Lancellata L, et al. Antimicrobial prophylaxis for urologic procedures in paediatric patients: a RAND/UCLA appropriateness method consensus study in Italy. *Antibiotics (Basel)* 2022; 11: 296.
24. Dhawade P, Mulay A, Tirlapur A. POS-044 evaluation of rate and risk factors for recurrence of urinary tract infection after severe urinary tract infection needing hospitalization. *Kidney Int Rep* 2022; 7: S483.
25. Cusumano JA, Hermenau M, Gaitanis M, Travis M, LaPlante KL, Tran TY, et al. Evaluation of post-flexible cystoscopy urinary tract infection rates. *Am J Health Syst Pharmacy* 2020; 77: 1852-1858.
26. Snyder E, Mohan C, Michael J, Ross S. Inclusion of surgical antibiotic regimens in pediatric urology publications: a systematic review. *J Pediatr Urol* 202; 16: 595.e1-595.e7.
27. García-Perdomo HA, López H, Carbonell J, Castillo D, Cataño JG, Serón P. Efficacy of antibiotic prophylaxis in patients undergoing cystoscopy: a randomized clinical trial. *World J Urol* 2013; 31: 1433-1439.
28. García-Perdomo HA, Jiménez-Mejías E, López-Ramos H. Efficacy of antibiotic prophylaxis in cystoscopy to prevent urinary tract infection: a systematic review and meta-analysis. *Int Braz J Urol* 2015; 41: 412-424.
29. Marino F, Rossi F, Murri R, Sacco E. Antibiotic prophylaxis in urologic interventions: who, when, where? *Urologia* 2024; 91: 11-25.
30. Zeng S, Zhang Z, Bai Y, Sun Y, Xu C. Antimicrobial agents for preventing urinary tract infections in adults undergoing cystoscopy. *Cochrane Database Syst Rev* 2019; 2: CD012305.
31. Radmayr C, Bogaert G, Bujons A, Burgu B, Castagnetti M, Hoen LA, et al. EAU guidelines on paediatric urology. Available from: <https://d56bochlurqnx.cloudfront.net/documents/full-guideline/EAU-Guidelines-on-Paediatric-Urology-2024.pdf>.