

A comparative study between a single dose pre-induction antibiotic versus continuous antibiotics to prevent urinary tract infection during ureteroscopy

Rasti Karim Mama^{1*}, Pishtewan Hashim Al-bazzaz² and Nihad Pauls Al-Ibraheem²

¹Departement of Urology, Rizgary Teaching Hospital, Erbil, Iraq

²Department of Urology, College of Medicine, Hawler Medical University, Erbil, Iraq

Abstract

Background and objective: This study aimed to evaluate if the addition of postoperative antibiotics reduces the incidence of symptomatic urinary tract infections following ureteroscopic stone treatment beyond the recommended preoperative dose.

Methods: This prospective comparative study was conducted between March and November 2017. A total of 80 patients with preoperative negative urine culture undergoing ureteroscopy were randomly allocated. All the patients received single dose antibiotic before the induction of anesthesia and a group of them also received postoperative antibiotics. The rate of symptomatic urinary tract infection was compared between the patients who received only preoperative antibiotics (group 1) and those who received pre- and postoperative antibiotics (group 2).

Results: Eighty patients underwent ureteroscopy for stone treatment, the time to follow up was 4±2 weeks from ureteroscopy. Eleven (13.8%) patients in total developed urinary tract infections postoperatively, including five (12.5%) from group 1 and six (15%) from group 2, P=0.74. In group 1, four patients presented with cystitis and one with sepsis; those patients with infections in group 2 presented with pyelonephritis (n=2) and cystitis (n=4). Risk factors such as preoperative stenting, nephrostomy tubes, and Foleys catheters neither differed between groups nor did they predispose patients to postoperative infections.

Conclusions: The postoperative symptomatic urinary tract infection rate in this study (13.8%) is in agreement with previous reports. This study suggests that a single preoperative dose of antibiotics is sufficient, and additional postoperative antibiotics do not decrease infection rates after ureteroscopic stone treatment.

Introduction

Ureteroscopic lithotripsy is a common urological treatment for ureteric stones. This procedure poses a risk of postoperative urinary tract infection (UTI) of up to 25% in patients without prophylactic antibiotics [1,2]. This is primarily attributed to the introduction of bacteria into the urinary tract upon insertion of surgical instruments. Any intravasation of bacteria or endotoxins into the blood stream may lead to urosepsis, a potentially lethal complication. These infections carry significant morbidity and increased healthcare expenditures [3,4].

Stone intervention should not be underestimated. All patients should be evaluated with a complete medical history, proper physical examination, and laboratory tests, including midstream urine (MSU) culture and sensitivity. A full preoperative evaluation will identify high-risk patients with the potential for infectious complications including Immunosuppression, Diabetes mellitus, female gender, anatomic anomalies, voiding dysfunction, urinary diversion, urinary tract obstruction and presence of indwelling tubes (stent, catheter, nephrostomy) [5-7].

To decrease the risk for infection following ureteroscopy, optimizing modifiable risk factors is ideal. Furthermore, antimicrobial prophylaxis is recommended by the American Urology Association (AUA) Best Practice Guidelines to decrease further the risk of postoperative infection in patients undergoing ureteroscopy. Preoperative prophylactic antibiotics play an important role in reducing postoperative infections.

AUA guidelines recommend a single dose use of antibiotic covering both positive and negative uropathogens on all patients taking ureteroscopic lithotripsy [8].

This study aimed to evaluate the effect of adding postoperative antibiotics on reducing urinary tract infections (UTIs) following ureteroscopic stone treatment beyond the recommended preoperative dose.

Material and methods

This prospective comparative study was conducted in Rizgary Teaching Hospital, Erbil, Kurdistan region-Iraq from March to November 2017. A total of 80 patients with ureteric stones and sterile urine were scheduled to receive ureteroscopic lithotripsy in. All the patients were received a single dose of i.v gentamycin (80 mg), ceftriaxone (1 g) or Ciprofloxacin (400 mg) before starting the induction of anesthesia. A group of patients received only preoperative antibiotics (group 1), while in addition, a subset of patients also received postoperative antibiotics (gentamycin, ciprofloxacin or cefixime) (group 2). The preoperative

*Correspondence to: Rasti Karim Mama, Department of urology, Rizgary Teaching Hospital, Erbil, Iraq, Tel: 009647504453406; E-mail: Rasty_Karim@yahoo.com

Key words: antibiotics, infection, prophylaxis, stones, ureteroscopy

Received: September 12, 2018; **Accepted:** September 24, 2018; **Published:** September 26, 2018

patient evaluation included a thorough history taking, physical examinations, blood chemistry tests, urine analysis and urine culture. Exclusion criteria were: age <18, preoperative positive urine cultures and abnormal renal function. All the procedures were done under general anesthesia by using semirigid ureteroscope 9.5Fr., pneumatic Lithoclast was used as intracorporeal lithotripter and Dormia basket was used for extraction of stone fragments. A DJ stent was inserted at the end of the procedure according to the surgeon's discretion.

Our primary end point was symptomatic UTI. If any symptoms of UTI developed (pain, urgency, frequency, dysuria, fever) during follow up, a urine culture was repeated.

A specially designed questionnaire was used for collecting data. The data were entered in the computer and then analyzed by the statistical package for the social sciences (version 22). The results were compared between patients with different variables, with a statistical significance level of <0.05.

The results were presented as rates, ratios, frequencies, percentages in tables and figures and analyzed using the t-test and Chi square test.

The study was approved by the scientific and the ethics committees at the Kurdistan Board for Medical Specialties.

Results

Over the period of the study, 80 patients underwent ureteroscopic lithotripsy at our institution, the median age was 41.8 (range: 23–74), and male to female ratio was 43:37. Mean BMI was comparable between the two groups; group 1 had a BMI of 25.83 (standard deviation [SD]=4.107) and group 2 had a BMI of 27.75 (SD=5.113). Both groups were similar in terms of basic demographics (Table 1).

The preoperative antibiotic selection was predominantly gentamycin in 47 (58.8%) patients followed by ciprofloxacin in 17 (21.3%) patients and ceftriaxone in 16 (20%) patients (Figure 1). Ciprofloxacin was most commonly used in 57% patients followed by gentamycin in 22.50% patients and cefixime in 20%.

Overall, eleven patients had a clinical UTI postoperatively or positive urine culture (Figure 2).

Five (12.5%) of these patients were in group 1. One of them presented with urosepsis and the other four with cystitis. The uroseptic patient was culture positive for *Klebsiella* while *E. coli* was positive in three patients and *Pseudomonas aeruginosa* in one patient with cystitis.

Six (15%) patients in group 2 clinically demonstrated signs of a UTI; two patients presented with pyelonephritis, one of them urine culture was positive for *E. coli*, the other was urine culture negative. The other four patients presented with cystitis; two of them urine culture was positive for *E. coli*, urine culture for one of the other two patients was positive for *Enterococcus* and the other one was negative culture. All were treated effectively.

Table 1. Demographic characteristics of the participants

Variable	Groups	N	Mean/N	S.D/%	P value
Age	Group 1	40	41.08	12.855	0.77
	Group 2	40	41.88	11.791	
BMI	Group 1	40	25.83	4.107	0.06
	Group 2	40	27.75	5.113	
Gender	Group 1	Male	21	52.5%	0.82
		Female	19	47.5%	
	Group 2	Male	22	55%	
		Female	18	45%	

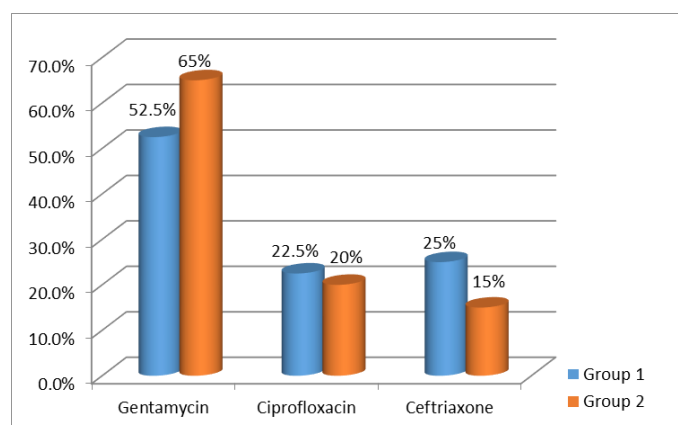


Figure 1. Preoperative antibiotic use for Group 1 and Group 2 patients

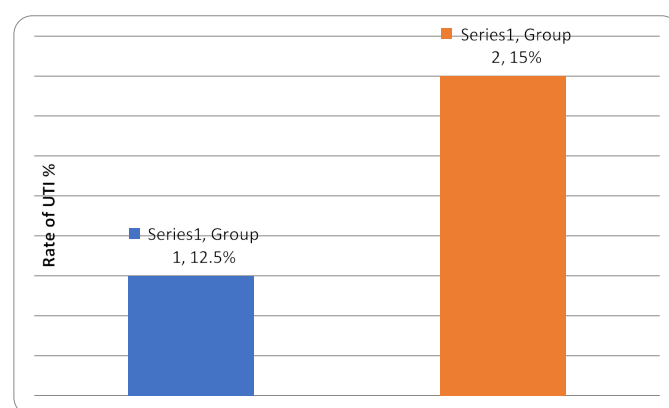


Figure 2. Post-operative UTI of both Groups (P=074)

Surgical factors and risk factors for infections were also assessed, as demonstrated in (Table 2). No associations with infection could be made here.

Discussion

Retrograde ureteroscopy as a method of treatment for ureteral calculi can lead to infectious complications. In our study 11 (13.8%) patients were treated for cystitis, pyelonephritis, or urosepsis since their ureteroscopy was performed. This compares with the historical rate of UTI after ureteroscopic management for the stone disease for the distal, middle, and upper ureter is 4%, 2%, and 4%, respectively [9–11]. Among studies with less stringent exclusion criteria or inclusion of stenting, the rate of UTI or fever is comparable at 9% to 10%, and 33%, respectively [12,13]. This elevated rate of infection may be attributable to the inclusion of patients with risk factors for postoperative infections described in Table 2.

Among preoperatively stented patients, three of twelve (25%) presented with postoperative infection. Mechanistically, this could occur as a result of a biofilm being present on the stent, as being reported to occur in up to 25% of cases depending on indwelling duration; however, positive urine cultures are only found among 10% of patients with stent colonization [14,15]. Several studies looking at the colonization of ureteral stents upon removal have shown that a significant number of stents are colonized despite the use of prophylactic antibiotics, suggesting that prophylaxis is ineffective to prevent the interaction of bacteria with the surfaces of stents [16–18]. The fact that, however, in these studies and routine practice, the presence of a bacterial biofilm

Table 2. Surgical factors and infection risk factors compared among patients receiving only preoperative antibiotics (Group 1) to those receiving Pre- and postoperative antibiotics (Group 2)

Variable	Categories	Study samples				P-value
		Group 1		Group 2		
		No.	(%)	No.	(%)	
Postoperative Foley's catheter	Yes	1	(2.5)	2	(5.0)	0.55
	No	39	(97.5)	38	(95.0)	
Pre-operative stent	Yes	8	(20.0)	4	(10.0)	0.21
	No	32	(80.0)	36	(90.0)	
Postoperative stent	Yes	32	(80.0)	34	(85.0)	0.55
	No	8	(20.0)	6	(15.0)	
Diabetes mellitus	Yes	1	(2.5)	0	(0.0)	0.31
	No	39	(97.5)	40	(100.0)	
Ureteroscopy side	Right	19	(47.5)	21	(52.5)	0.65
	Left	21	(52.5)	19	(47.5)	
Stone location	Upper ureter	8	(20.0)	12	(30.0)	0.17
	Mid ureter	4	(10.0)	8	(20.0)	
	Lower ureter	28	(70.0)	20	(50.0)	
Total		40	(100.0)	40	(100.0)	

is not generally detected until the scheduled stent removal (i.e., the majority of patients did not develop a symptomatic UTI) indicates that the presence of bacterial colonization or even a biofilm on the surface of a stent does not necessarily lead to infection, especially in patients with intact immune systems.

Overall, 66 (82.5%) patients had a postoperative stent and accounted for 8 (72.7%) of the UTIs. So the rate of UTI among postoperative stent patients was 12.1%, thus, indicated that stenting in the present study might not increase the risk of postoperative infection. All of these stents were removed with cystoscopy and antibiotics were used at the time of cystoscopies. Moltzahn et al. reported a 9.5% UTI rate following ureteroscopy with postoperative stenting and they concluded that continuous low-dose antibiotic treatment during the entire stent-indwelling time did not reduce the quantity or severity of UTIs compared with the peri-interventional antibiotic prophylaxis only [13].

The rate of infection for group 1 was 12.5%, and 15% for group 2, but the rate was not significantly different ($p=0.74$). Chew et al. reported the rate of UTI in patients with perioperative antibiotics only and patients with continuous post-operative antibiotics (4.8% and 10.2, $p=0.1457$) respectively [19]. However, it is important to recognize that failing to reach statistical significance could also be due to small sample size. We do not believe that postoperative antibiotics are associated with increased rates of infection; however, these findings are congruent with the AUA Best Practice Policy Statement, which does not support the use of postoperative antibiotics beyond 24 hours following Ureteroscopy [8,11].

The choice of antibiotic for prophylaxis should take into account the effectiveness, tolerability and the cost. The spectrum must be large enough to cover normal and pathogenic flora. In patients with prolonged hospitalization, we should be aware of the hospital flora and have in mind the risk of potential infection, the target organ and the role of local inflammation [20,21]. For the genitourinary tract, fluoroquinolones, cephalosporins and aminoglycosides have been recommended for antibiotic prophylaxis because of their prolonged half-life, a relatively broad spectrum of action, minimal side effects and low price [22]. Both fluoroquinolones and cephalosporins have proven useful in antibiotic prophylaxis [23] without apparent differences in efficacy between these two antibiotic classes [3].

Although in our hospital there is no standard policy regarding the choice of antibiotic, there are hospitals where antibiotics used for prophylaxis are changed periodically according to the local sensitivity spectrum. Moreover, it should be noted that there are compelling reasons to limit antibiotic prescription to the extent possible. Most notably, the overuse of antibiotics will promote antibiotic resistance, as increasing the exposure of bacterial species to antibiotics unnecessarily will increase their chances of developing resistance mechanisms, making it significantly more difficult to treat them with the antibiotics we currently have available. Infections with MRSA, *P. aeruginosa*, and *Stenotrophomonas* are only a few examples of difficult to treat bacterial strains. Exposing bacterial strains to antibiotics unnecessarily will only limit the number of agents we have available to treat the infection.

Conclusions

In patients undergoing ureteroscopic stone treatment who had a negative baseline urine culture, rates of postoperative UTI was not reduced by continuous postoperative antibiotic prophylaxis and a single dose intraoperative antibiotic is quite sufficient to prevent postoperative UTI. Proper effort should also be made to ensure one is familiar with local antibiograms and accordingly chooses an appropriate preoperative antibiotic. The benefits of implementing this approach across the urological community are likely to include reduced healthcare costs, fewer treatment-related adverse effects, and decreased selective pressure for resistant organisms.

Conflict of interest

The authors declare that they have no competing interests.

References

- Fourcade RO (1990) Antibiotic prophylaxis with cefotaxime in endoscopic extraction of upper urinary tract stones: a randomized study. The Cefotaxime Cooperative Group. *J Antimicrob Chemother* 26: 77–83.
- Grabe M (2004) Controversies in antibiotic prophylaxis in urology. *Int J Antimicrob Agents* 23 Suppl 1: S17–23. [[Crossref](#)]
- Geavlete P, Jecu M, Geavlete B, Multescu R, Nita G, et al. (2010) Ureteroscopy--an essential modern approach in upper urinary tract diagnosis and treatment. *J Med Life* 3: 193–199. [[Crossref](#)]
- Urban JA (2006) Cost analysis of surgical site infections. *Surg Infect (Larchmt)* 7 Suppl 1: S19–22. [[Crossref](#)]
- Gonen M, Turan H, Ozturk B, Ozkardes H (2008) Factors affecting fever following percutaneous nephrolithotomy: A prospective clinical study. *J Endourol* 22: 2135–2138.
- Sharifi Aghdas F, Akhavanizadeh H, Aryanpoor A, Inanloo H, Karbakhsh M (2006) Fever after percutaneous nephrolithotomy: Contributing factors. *Surg Infect (Larchmt)* 7: 367–371.
- Chen L, Xu QQ, Li JX, Xiong LL, Wang XF, et al. (2008) Systemic inflammatory response syndrome after percutaneous nephrolithotomy: An assessment of risk factors. *Int J Urol* 15: 1025–1028.
- Wolf JS, Bennett CJ, Dmochowski RR, Hollenbeck BK, Pearle MS, et al. (2008) Best practice policy statement on urologic surgery antimicrobial prophylaxis. *J Urol* 179: 1379–1390.
- Knopf HJ, Graff HJ, Schulze H (2003) Perioperative antibiotic prophylaxis in ureteroscopic stone removal. *Eur Urol* 44: 115–118.
- Ramaswamy K, Shah O (2012) Antibiotic prophylaxis after uncomplicated ureteroscopic stone treatment: Is there a difference? *J Endourol* 26: 122–125.
- Preminger GM, Tiselius HG, Assimos DG, Alken P, Buck AC, et al. (2007) 2007 Guideline for the management of ureteral calculi. *Eur Urol* 52: 1610–1631. [[Crossref](#)]
- Pricop C, Dorobat C, Puia D, Orsolya M (2013) Antibiotic prophylaxis in retrograde ureteroscopy: What strategy should we adopt? *Germs* 3: 115–121.

13. Moltzahn F, Haeni K, Birkhauser FD, Roth B, Thalmann GN, et al. (2013) Peri-interventional antibiotic prophylaxis only vs continuous low-dose antibiotic treatment in patients with JJ stents: A prospective randomized trial analyzing the effect on urinary tract infections and stent-related symptoms. *BJU Int* 111: 289–295.
14. Ozgur BC, Ekici M, Yuceturk CN, Bayrak O (2013) Bacterial colonization of double J stents and bacteriuria frequency. *Kaohsiung J Med Sci* 29: 658–661.
15. Cadieux PA, Chew BH, Nott L, Seney S, Elwood CN, et al. (2009) Use of triclosan-eluting ureteral stents in patients with long-term stents. *J Endourol* 23: 1187–1194. [[Crossref](#)]
16. Chew BH, Denstedt JD (2004) Technology insight: Novel ureteral stent materials and designs. *Nat Clin Pract Urol* 1: 44–48. [[Crossref](#)]
17. Rahman MA, Alam MM, Shahjamal S, Islam MR, Haque ME (2012) Predictive value of urine cultures in evaluation of bacterial colonization of ureteral stents. *Mymensingh Med J* 21: 300–305.
18. Tenke P, Köves B, Nagy K, Hultgren SJ, Mendling W, et al. (2012) Update on biofilm infections in the urinary tract. *World J Urol* 30: 51–57. [[Crossref](#)]
19. Chew BH, Flannigan R, Kurtz M, Gershman B, Arsovska O, et al. (2016) A Single Dose of Intraoperative Antibiotics Is Sufficient to Prevent Urinary Tract Infection During Ureteroscopy. *J Endourol* 30: 63–68. [[Crossref](#)]
20. Naber KG, Hofstetter AG, Bruhl P, Bichler KH, Lebert C (2001) Guidelines for the perioperative prophylaxis in urological interventions of the urinary and male genital tract. *Int J Antimicrob Agents* 17: 321–326.
21. Monga M (2013) Ureteroscopy: Indications, Instrumentation & Technique. New York: Humana Press.
22. Enzler MJ, Berbari E, Osmon DR (2011) Antimicrobial prophylaxis in adults. *Mayo Clin Proc* 86: 686–701. [[Crossref](#)]
23. Wilson W, Taubert KA, Gewitz M, Lockhart PB, Baddour LM, et al. (2008) Prevention of infective endocarditis: guidelines from the American Heart Association: a guideline from the American Heart Association Rheumatic Fever, Endocarditis and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group. *J Am Dent Assoc* 139: 3S–24S.