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

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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 Foley 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...
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 intracorporial 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 ceftriaxone 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 pyelonephritis 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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Groups</th>
<th>N</th>
<th>Mean/N</th>
<th>S.D/%</th>
<th>P value</th>
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<tbody>
<tr>
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<td>Group 1</td>
<td>40</td>
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<tr>
<td></td>
<td>Group 2</td>
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<td>41.88</td>
<td>11.791</td>
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<td>BMI</td>
<td>Group 1</td>
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<td>25.83</td>
<td>4.107</td>
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</tr>
<tr>
<td></td>
<td>Group 2</td>
<td>40</td>
<td>27.75</td>
<td>5.113</td>
<td></td>
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<tr>
<td>Gender</td>
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</tr>
<tr>
<td></td>
<td>Male</td>
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</tr>
<tr>
<td></td>
<td>Female</td>
<td>18</td>
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</table>

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...
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

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