Incidence of Bacteriuria in Adult Renal Stone Patients Having Ureteric Stents and Undergoing Extracorporeal Shock Wave Lithotripsy

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Abstract

Background: To evaluate the effect of Extracorporeal Shock Wave Lithotripsy (ESWL) on the incidence of bacteriuria in patients with JJ stents who had sterile urine prior to ESWL.

Aim of Study: This study aimed to evaluate the effect of ESWL on the incidence of bacteriuria in patients with JJ stents who had sterile urine prior to ESWL.

Material and Methods: The study was conducted between January and August 2015 in Aseer Central Hospital, Abha, Saudi Arabia. We prospectively recruited 126 patients who had JJ stents previously inserted for renal or ureteral stones. Elderly patients and those with chronic medical diseases and other risk factors were excluded. All the patients had negative urine culture just before ESWL. Urine cultures were done twice, immediately after ESWL and two weeks later to detect the presence of bacteriuria. Those who had one or two positive cultures for bacterial growth were labeled to be having bacteriuria after ESWL, while those with negative cultures were labeled as negative for bacteriuria.

Results: Out of 126 patients with JJ stents, 20.6% developed bacteriuria after ESWL. The incidence of bacteriuria in females was higher than males \( (p=0.002) \). Duration since JJ stent insertion \( (54.3 \pm 11.4 \text{ days}) \) and the number of JJ stents were found to be significantly associated with positive bacteriuria \( (p<0.001 \text{ for both}) \). Number and size of stones were also associated with positive bacteriuria after ESWL \( (p=0.009 \text{ and } p=0.001, \text{ respectively}) \).

Conclusions: Incidence of bacteriuria in patients with renal stones with ureteric stents undergoing ESWL was 20.6%, which was comparable to that of patients with ureteric stents who did not undergo ESWL. Therefore, antibiotic prophylaxis in patients with ureteric stents undergoing ESWL may not be necessary, except in certain cases (i.e., female gender, several stents and their prolonged duration, as well as the multiple stones and their large size).

Key Words: Extracorporeal shock wave lithotripsy – Renal stones – Stents – Bacteriuria.

Introduction

BACTERIURIA (i.e., the detection of \( 10^5 \text{ CFU per ml of urine on urine culture} \)) has been found to be sequel of Extracorporeal Shock Wave Lithotripsy ESWL. This test is done routinely for patients undergoing ESWL three days prior to procedure. Therefore, antibiotic prophylaxis for patients undergoing ESWL is practiced in many centers to prevent development of urinary tract infections and its complications. This raised the question whether ESWL increases the incidence of bacteriuria in patients who had sterile urine to begin with [1-5]. However, a recent study concluded that there is no need for prophylactic antibiotics in renal stone patients undergoing ESWL if the urine culture is sterile [6].

In patients with ureteric or renal stone who have ureteric stent, it has been reported that the incidence of bacteriuria is expected to be higher as it is considered a foreign body. In patients with indwelling ureteric stent, or JJ stent, bacterial colonization increases with the duration of stent [7]. JJ stent insertion is usually performed under complete aseptic conditions and keeping it inside the body prevents it from any external access of infection. Therefore, it has been postulated that colonization of ureteric stent usually occurs as a result of iatrogenic causes and rarely ascending infection [8,9].

Several studies have been conducted to explore the incidence of bacteriuria in patients with ureteric stents, but there is limited research on the effect of ESWL on bacteriuria in those patients who have...
renal stones and indwelling ureteric stent. Ozgur et al., [10] found the incidence of bacterial colonization was 25% in more than six weeks of stent duration and lesser incidence with lesser duration. Moreno et al., [11] reported that incidence of bacteriuria in patients without risk factors to be 5.8%. In their study, they included patients with ureteric stents and renal stone who had ESWL. No patients received antibiotics before the ESWL procedure. They concluded that the incidence of bacteriuria in patients with indwelling ureteric stent was lower than expected.

Urine culture is less sensitive in determining the real bacterial colonization of the indwelling ureteric stent compared to the results obtained from culturing of the stent itself. This could be explained by the phenomenon of biofilm formation on the surface of ureteral stent which sometimes harbors the bacteria which is undetected in urine culture [12].

The retrieval of bacteria from ureteral stent is sometimes difficult. To improve the diagnosis of ureteral stent colonization with bacteria, a new test was studied. Sonication is a method of exposure of JJ stent post-removal to low energy ultrasound to shed out the bacteria adherent to the ureteral stent. The incidence of development of bacteriuria in patients who had sterile urine before ureteric stent placement was 26% and this was much higher in those with bacteriuria before stenting (p<0.001) [13].

Honey et al., [14] clarified the argument regarding use of antibiotic prophylaxis for patients undergoing ESWL. The main differences were noticed in the guidelines of European and American associations of urology. While the European guidelines restricted the indications of antibiotics prophylaxis for patients with ureteral stents and nephrostomy tube, the American guidelines recommended the use of empirical antibiotic prophylaxis for all patients undergoing ESWL. The incidence of urinary tract infection was noticed in 0.3% of study population, while asymptomatic bacteriuria was detected in 2.8% of the patients. These results were found to be matching with European Urology Association guidelines and contradicted the American Urology Association guidelines.

Results

Table (1) shows that 126 patients were included in the study (94 patients, 74.6% were males). Age of patients ranged between 18 and 50 years (Mean ± SD: 42.0±8.8 years). The number of stones was mainly single (93.7%), with a mean size of stones of 1.7±0.7cm. Fragmented stone was present in 95.2% of cases. Most patients had one stent (95.2%), while 4.8% had two stents. Silicon stents were present in 51.6% of patients while polyurethane stents were present in 48.4% of them. The mean duration of stent use was 54.3 ± 11.4 days. Bacteriuria was positive among 26 patients (20.6%).

Table (2) shows that incidence of bacteriuria among females was significantly higher than that among males (40.6% and 13.8%, respectively, medical diseases or comorbidity (e.g., diabetes mellitus or malignancy) and other associated risk factors (e.g., elderly patients) were excluded.

All patients had negative urine culture just before ESWL. Urine cultures were done immediately after ESWL and two weeks later to detect the presence of bacteriuria. Those who had one or two positive cultures for bacterial growth were labeled to be having bacteriuria after ESWL, while those with both negative cultures were labeled as negative for bacteriuria.

Material and Methods

This study was conducted in Aseer Central Hospital in Abha, Saudi Arabia, between January and August 2015. We prospectively recruited 126 adult patients who had previously inserted JJ stent for renal or ureteral stones. Patients with chronic
Bacteriuria did not differ significantly according to patients’ age. Incidence of bacteriuria significantly increased with number and size of stones ($p=0.009$ and $p=0.001$, respectively), however, it did not differ significantly according to occurrence of stone fragmentation. Incidence of bacteriuria increased significantly according to number of stents and their duration of use ($p=0.001$ for both), but did not differ significantly according to type of stent.

Table (2): Incidence of bacteriuria according to patients’ characteristics.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Bacteriuria</th>
<th></th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative (n=100)</td>
<td>Positive (n=26)</td>
<td></td>
</tr>
<tr>
<td>Gender:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>81 (86.2%)</td>
<td>13 (13.8%)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>19 (59.4%)</td>
<td>13 (40.6%)</td>
<td>0.002</td>
</tr>
<tr>
<td>Age in years (mean ± SD)</td>
<td>41.5±8.9</td>
<td>43.8±8.8</td>
<td>0.242</td>
</tr>
<tr>
<td>No. of stones:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>97 (82.2%)</td>
<td>21 (17.8%)</td>
<td></td>
</tr>
<tr>
<td>Multiple</td>
<td>3 (37.5%)</td>
<td>5 (62.5%)</td>
<td>0.009</td>
</tr>
<tr>
<td>Size of stones in cm (mean ± SD)</td>
<td>1.6±0.6</td>
<td>2.2±0.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Fragmented stone:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>94 (78.3%)</td>
<td>26 (21.7%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>6 (100.0%)</td>
<td>0 (0.0%)</td>
<td>0.201</td>
</tr>
<tr>
<td>No. of JJ stents:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One</td>
<td>99 (82.5%)</td>
<td>21 (17.5%)</td>
<td></td>
</tr>
<tr>
<td>Two</td>
<td>1 (16.7%)</td>
<td>5 (83.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Type of stent:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polyurethane</td>
<td>45 (73.8%)</td>
<td>16 (26.2%)</td>
<td></td>
</tr>
<tr>
<td>Silicon</td>
<td>55 (84.6%)</td>
<td>10 (15.4%)</td>
<td>0.133</td>
</tr>
<tr>
<td>Duration of stent in days (mean ± SD)</td>
<td>45.4±11.4</td>
<td>53.3±7.4</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

**Discussion**

This study showed that incidence of bacteriuria in patients with renal stones and ureteric stents after ESWL was 20.6%. Significantly higher incidence rates of bacteriuria were associated with female patients, but did not differ significantly according to patients’ age.

Our finding is comparable with those of several studies, which reported incidence of bacteriuria with among patients with ureteric stents who did not undergo ESWL. Altunal et al., [15] reported that 18% of patients with ureteric stents developed urinary tract infection. Kehinde et al., [16] reported a 42% incidence of bacteriuria on the day of stent removal. Moreover, Yeniyoel et al., [9], reported that the incidence of bacteriuria in patients with JJ stents who was 18% despite most of them did not undergo ESWL. However, they found no association between patients’ gender and development of bacteriuria.

The higher incidence of bacteriuria in our female patients compared with male patients could be explained by the fact that there are some anatomical as well as hormonal factors which generally predispose females to urinary tract infection [17].

Several studies reported higher incidence of bacteriuria among in older patients [7,9]. However, in our study, older age did not show a significant association with bacteriuria, probably because our study sample included did not include patients with chronic diseases or associated comorbidity as well as the exclusion of elderly patients.

Our study revealed significantly higher incidence rates of bacteriuria were associated with number of stents and their duration of use.

These findings are in accordance with those of Ozgur et al., [10], who reported that bacteriuria was higher in patients with two stents, rather than those with single stents, which is explained by the provided bigger surface for biofilm development. Therefore, more adherent bacteria will be available for shedding in the urine followed by increase in bacteriuria.

Moreover, Altunal et al., [15] stated that the longer the duration of the stent, the higher the incidence of bacteriuria. Availability of the tube surface for bacteria for longer period can explain the mechanism of increase bacterial biofilming of tube surfaces.

Lojanapiwat [12] noted that the longer the duration of ureteral stent, the higher the incidence of bacteriuria. In stents’ durations less than a month, the rate of bacteriuria was 33%, while the highest incidence of bacterial colonization of ureteric stent reached 54% in patients with durations of stents more than 6 weeks.

Our study did not show statistically significant difference between silicone and polyurethane types of stents in the incidence of bacteriuria. Nevertheless, Farsi et al., showed that silicone was associated with less incidence of bacteriuria than polyurethane [6]. The lack of difference between both types could be attributed to the fact that the duration of the stents use in our study was quite short (with a mean duration less than two months).

Findings of the present study revealed that higher numbers and bigger sizes of stones were
significantly associated with bacteriuria following ESWL. This finding is in accordance with that of Holmgren et al., [18], who stated that usually the big stones are usually composed of magnesium, ammonium, and phosphate (MAP) which is an infected stone. Nevertheless, incidence of bacteriuria was not found to be increased in patients with successful stone fragmentation.

Moreno et al., [11] explained that, although ESWL is a non-invasive procedure, which is not supposed to cause bacteriuria in patients having sterile urine, its association with bacteriuria is supposed to be through the disintegration of stone biofilm and release of bacteria. This may explain the development of pyelonephritis after ESWL. Ureteral stents, in addition, is another source of biofilm formation and theoretically bacteria can be released as an effect of shockwave.

Lu et al., [19] noted that comparing patients undergoing ESWL with JJ stents and those without JJ stents revealed that incidence of bacteriuria in both groups was almost the same. Therefore, they stated that prophylactic antibiotics for patient with sterile urine before undergoing ESWL is not indicated.

In conclusion, this study detected that the incidence of bacteriuria following ESWL in patients with ureteric stent was 20.6%, which is comparable with those by previous studies reporting bacteriuria in patients with ureteric stent who did not undergo ESWL. Therefore, antibiotic prophylaxis in patients with ureteric stents undergoing ESWL may not be necessary, except in certain cases, (i.e., female gender, several stents and their prolonged duration, as well as the multiple stones and their large size). However, bacteriuria was not associated with stent type or stone fragmentation.

Study limitations:

The present study did not have a control group (i.e., patients with ureteric stent and renal stone not undergoing ESWL). The non-compliance of several patients regarding collecting samples two weeks after ESWL led us to exclude them and to have a limited sample size in this study.

References
البحث: تقييم تأثير تقليل الحصوات بواسطة الموجات التصاعدية خارج الجسم (ESWL) على حدوث جرثومية البول في المرضى. المستخدمي دعامات الحالب الذين كان بولهم مغص قليل.

منهجية البحث: أجريت هذه الدراسة بين يناير وأغسطس 2015. تستشفى عصير المريض، بمدينة إبها، في المملكة العربية السعودية. وقد تم إجراء 125 مريضاً من كان لديهم دعامات الحالب، وحصى بالكلك أو الحالب. وقد تم إجراء المريض للمريض السينين وذلك ببعض من أمراض مرضية منظمة وعوامل الخطورة الأخرى. وقد كانت مزاعب البول لكل المريض سلبية قبل إجراء ESWL. وقد أجريت مزاعب البول مرة أخرى لتحديد الموجات التصاعدية خارج الجسم (ESWL). وتراجعت نسبة المريض البالغين بعد إجراء ESWL في حين تم اعتبار النتيجة "سلبية" إذا لم يكن لديهم بكترياً بالبول.

النتائج: من أصل 125 مريضاً، كانت نسبة مزاعب البول إيجابية لدى 6.2% بعد إجراء ESWL. وكان معدل الإصابة في الإناث أعلى من الذكور (χ=2.99). وكانت نسبة المريض للإصابات وكذلك عددها مرتبطة بالعمر والجنسية. كما ارتبط عدد وحجم الحصوات أيضاً مع إيجابية النتائج لتمزيع البول بعد إجراء ESWL (χ=4.99 و χ=1.26 ‹6.01, على التوالي).

الإستنتاجات: إن نسبة وجود بكتريا بالبول لدى المريض الذين يعانون من حصى بالكلك مع وجود دعامات حالب بعد ESWL هي 6.2%. وهذه النسبة تقارب تلك التي يصاب بها المرضى الذين لديهم دعامات حالب مع لم يردا ESWL. لذلك، فقد لا يكون الاستعمال الوقائي للمضادات الحيوية في المرضى الذين يستخدمون دعامات الحالب قبل إجراء ESWL ضرورياً.