ORIGINAL ARTICLE

Bacterial characteristics and clinical significance of ureteral double-J stents in children

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Received 9 April 2014; accepted 14 April 2014
Available online 4 December 2014

KEYWORDS
Urinary tract infection; Ureteral stent; Children; Pyeloplasty; Megaureter

Abstract
Objective: To determine the incidence of urinary tract infection in those patients that we have used an ureteral double-J stent as internal diversion after urological procedures.
Materials and methods: We reviewed all the medical records of patients who had a ureteral double-J stent after a urological procedure from August 2007 to May 2013. We have analyzed the following data: age, gender, type of prophylaxis, incidence of urinary tract infection (UTI), days of internal diversion with double-J stent, surgical procedure, bacterial characteristics, bacterial sensibility to antibiotics and UTI treatment.
Results: We have used 73 double-J stents as ureteral internal diversion in 67 patients with a mean age of 44.73 ± 57.23. Surgical procedures were 50 laparoscopic Anderson-Hynes pyeloplasties in 49 patients, and 20 high-pressure balloon dilatation of the ureterovesical junction to treat primary obstructive megaureter in 15 patients; and 3 patients with ureterovesical obstruction after endoscopic treatment of vesicoureteral reflux. Forty three stents showed a bacterial colonization in cultures. Pseudomonas aeruginosa was present in 9 (20.9%) stents. Only in 12 stents, bacterial colonization was sensible to antibiotic prophylaxis. Stent colonization was higher in boys and younger patients. Four patients had a febrile UTI. Incidence of UTI in younger patients that underwent HBPD of UVJ is higher.
Conclusion: Bacterial colonization is frequent in double-J stents but the incidence of UTI is low. Double-J colonization is higher in younger patients. Patients that underwent HBPD have a higher risk of UTI related with ureteral double-J stent.
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PALABRAS CLAVE
Infección del tracto urinario; Catéter uretral; Niños; Pieloplastia; Megauréter

Características bacterianas y significado clínico de catéteres ureterales doble J en niños

Resumen
Objetivo: Determinar la incidencia de infección del tracto urinario en los pacientes en los que hemos utilizado un catéter uretral doble J como desvío interno después de procedimientos urológicos.

Material y métodos: Se revisaron todas las historias clínicas de los pacientes que tenían un catéter uretral doble J después de un procedimiento urológico desde agosto de 2007 hasta mayo de 2013. Hemos analizado los siguientes datos: edad, sexo, tipo de profilaxis, incidencia de la infección del tracto urinario (ITU), días de desvía interna con catéter doble J, procedimiento quirúrgico, características bacterianas, sensibilidad de las bacterias a los antibióticos y tratamiento de ITU.

Resultados: Hemos utilizado 73 catéteres doble J como desvío interno uretral en 67 pacientes con una edad media de 44,73 ± 57,23. Los procedimientos quirúrgicos fueron 50 pieloplastias laparoscópicas Anderson-Hynes en 49 pacientes y 20 dilataciones con balón de alta presión de la unión ureterovesical para tratar megauréter obstructivo primario en 15 pacientes, y 3 procedimientos con obstrucción ureterovesical después del tratamiento endoscópico del refluo vesicoureteral. Cuarenta y tres catéteres mostraron una colonización bacteriana en los cultivos. Pseudomonas aeruginosa estaba presente en 9 (20,9%) catéteres. Solo en 12 catéteres la colonización bacteriana era sensible a la profilaxis antibiótica. La colonización del catéter era mayor en los niños y los pacientes más jóvenes. Cuatro pacientes tuvieron una ITU febril. La incidencia de ITU en los pacientes más jóvenes que se sometieron a DBAP de UVU es mayor.

Conclusión: La colonización bacteriana es frecuente en los catéteres doble J, pero la incidencia de ITU es baja. La colonización doble J es mayor en los pacientes más jóvenes. Los pacientes que se sometieron a DBAP tienen un mayor riesgo de ITU relacionada con el catéter uretral doble J.

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Introduction

The double-J ureteral stent is a useful urological device enabling internal diversion after urological procedures. In pediatric urology, double-J stents are used after pyeloplasty, ureteral reimplantation and some endourological procedures such as stone treatment. Ureteral stents allow the passage of urine from the renal pelvis to the bladder and make it possible to maintain the diameter of ureteral anastomosis. More recently, double-J stents are being used in the treatment of primary obstructive megaureter as adjuvant therapy after high-pressure balloon dilation of the ureterovesical junction.

Morbidity associated with double-J stents has been reported: lower abdominal pain, dysuria, fever, hematuria, migration, fragmentation, calcification and urinary tract infection (UTI). It is well-known that any kind of catheter is an ideal surface for bacterial colonization and plays a major role in the pathogenesis of stent infection. However, there are very few reports available in pediatric urology showing the incidence of bacterial colonization and UTI associated with double-J ureteral stents.

The aim of this study was to determine the incidence of urinary tract infection in those patients where double-J ureteral stents were used for internal diversion after urological procedures.

Materials and Methods

We reviewed all medical records of those patients who had a double-J ureteral stent after a urological procedure from August 2007 to May 2013. We analyzed the following data: age, gender, surgical intervention, previous history of UTI, type of antibiotic prophylaxis, days of internal diversion, incidence of urinary tract infection, bacterial characteristics of urine and double-J stent, bacterial sensitivity and UTI treatment.

All patients were under antibiotic prophylaxis with amoxicillin during the surgical procedure and until the ureteral stent was removed. All double-J stents were placed and removed under sterile conditions. A bladder catheter was used 48 h after the primary procedure; it was not used in the case of ureteral removal.

The double-J ureteral stent was analyzed for bacterial colonization; positive cultures were defined as >105 cfu/ml of a single pathogen.

UTI was defined as fever >38.5 °C and a positive urine culture >105 cfu/ml obtained after bladder catheterization. UTI was treated with antibiotics, but in some cases the double-J stent was removed within the same time period.

Quantitative data were analyzed using Student’s t-test or the Mann–Whitney U test, and qualitative data were analyzed using the chi-square test or Fisher’s test; a p value < 0.05 was considered statistically significant.
Table 1  Characteristics of the patients.

<table>
<thead>
<tr>
<th></th>
<th>LP group (n = 49)</th>
<th>HBPD group (n = 15)</th>
<th>Others (n = 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (months)</td>
<td>58.20 ± 64.1</td>
<td>12.15 ± 7.4b</td>
<td>37.33 ± 2.3</td>
</tr>
<tr>
<td>Sex (male/female)</td>
<td>32/17</td>
<td>10/5</td>
<td>1/2</td>
</tr>
<tr>
<td>Circumcised/uncircumcised</td>
<td>7/25</td>
<td>0/10</td>
<td>0/1</td>
</tr>
<tr>
<td>Past history of UTI (yes/no)</td>
<td>1/48</td>
<td>8/7b</td>
<td>2/1b</td>
</tr>
<tr>
<td>History of VUR (no/yes)</td>
<td>0/49</td>
<td>0/15</td>
<td>3/3b</td>
</tr>
<tr>
<td>Placement of ureteral JJ (days)</td>
<td>43.4 ± 17.2</td>
<td>49.35 ± 13.5</td>
<td>51 ± 21</td>
</tr>
</tbody>
</table>

*a* Mann–Whitney U.

*b* Fisher’s test.

Results

Between August 2007 and May 2013, we used 73 double-J ureteral stents for internal ureteral diversion in 67 patients (47 boys and 24 girls) with a mean age of 44.73 ± 57.23 months. 3 surgical procedures were reported: 50 laparoscopic pyeloplasties (LP) in 49 patients (one repetition), 20 high-pressure balloon dilations (HPBD) of the ureterovesical junction (UVJ) for treating primary obstructive megaureter in 15 (one bilateral and 4 repetitions) and 3 patients with distal ureteral obstruction after endoscopic treatment of vesicoureteral reflux (VUR). Double-J ureteral catheterization was performed at the same time as the primary procedure, in laparoscopic pyeloplasty using an antegrade technique, and in the HPBD group using a retrograde technique. In patients with distal obstruction of the UVJ after endoscopic treatment of VUR, the double-J stent was used when an obstruction was diagnosed.

Only 7 patients were previously circumcised with no significant difference among groups. A history of urinary tract infection was observed in 11 patients; the HPBD group had a more significant past history of UTI rates than the pyeloplasty group. There was no history VUR in the pyeloplasty and HPBD groups.

A 4.8-Fr stent of polyether-block amide (PEBA) (Vortex-Coloplast®) was used in all patients for 45.34 ± 16.46 days, with no significant differences among groups (Table 1).

50 double-J ureteral stents were used in the LP group, 20 in the HPBD group and 3 in the case of ureteral obstruction after endoscopic correction of VUR. There were no migrations, but mild discomfort was observed in most patients (dysuria when voiding) during JJ catheterization.

Double-J stent culture was positive in 43 (58.9%). The most commonly cultured microorganism was *Pseudomonas aeruginosa* in 9 (20.9%) (Table 2). There were no significant differences neither in mean age, gender, surgical procedure, and days of catheterization nor in their previous history of circumcision, UTI or VUR (Table 3).

Four patients (5.9%) had 5 UTIs; the most commonly cultured microorganism in urine was *P. aeruginosa* in 4. All patients were treated with antibiotics for 10 days. Double-J removal was brought forward in 3 patients.

If we compare those patients who had urinary infection with those who did not have it, there were no significant differences in gender and days of catheterization, their previous history of circumcision, UTI or VUR. The only significant difference was observed in the mean age, which was lower in those patients with UTI. Despite 3 of the 4 patients with UTI had undergone HPBD of the UVJ, there were no significant differences with other procedures (Table 4).

Discussion

The use of double-J ureteral stents is common in pediatric urology, but there are few reports showing infectious complications in children.1,5 The urinary tract is the most common nosocomial infection and bacteremia secondary to urological procedures has an incidence of around 30% in adults.7,8 Bacterial colonization of double-J stents is well-known in adult urology, but its association with UTI is not clear. Catheter colonization rates of 44–68% have been reported. This high incidence led us to use antibiotic prophylaxis in these patients.

Our series showed a bacterial colonization rate of 58.9%, similar to the series of adults and children.1,5,8 Bacteriological characteristics were reported in the adult series; the most common pathogens that colonized double-J stents were: *Enterococcus, E. coli* and *Pseudomonas*.7,8 In our series, the most common pathogen was *Pseudomonas* followed by *Proteus mirabilis*. These findings are similar to other series.

Those patients with positive double-J stent cultures had a lower mean age than those with sterile cultures. The incidence of UTI was 5.4% of patients; this rate was lower in the Ben-Mier series.3 Only 12 colonized ureteral stents were sensitive to the antibiotic prophylaxis we used (amoxicillin). The most common pathogen in patients with UTI

Table 2  Cultured double-J microorganism.

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Number of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>P. aeruginosa</em></td>
<td>9</td>
<td>20.1</td>
</tr>
<tr>
<td><em>Proteus mirabilis</em></td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>5</td>
<td>11.6</td>
</tr>
<tr>
<td><em>Enterococcus</em></td>
<td>5</td>
<td>11.6</td>
</tr>
<tr>
<td><em>Klebsiella pneumoniae</em></td>
<td>4</td>
<td>9.3</td>
</tr>
<tr>
<td><em>Serratia marcescens</em></td>
<td>4</td>
<td>9.3</td>
</tr>
<tr>
<td><em>Candida albicans</em></td>
<td>2</td>
<td>4.7</td>
</tr>
<tr>
<td><em>Morganella morgani</em></td>
<td>2</td>
<td>4.7</td>
</tr>
<tr>
<td><em>Enterobacter cloacae</em></td>
<td>2</td>
<td>4.7</td>
</tr>
<tr>
<td><em>Staphylococcus simulans</em></td>
<td>1</td>
<td>2.3</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>1</td>
<td>2.3</td>
</tr>
<tr>
<td><em>Acinetobacter lwoffi</em></td>
<td>1</td>
<td>2.3</td>
</tr>
<tr>
<td><em>Alcaligenes</em> sp.</td>
<td>1</td>
<td>2.3</td>
</tr>
</tbody>
</table>
was Pseudomonas. This condition should change prophylaxis guidelines in patients with double-J ureteral catheterization.

**Conclusion**

There are few articles reporting bacterial characteristics in children with double-J stents placed after a urological procedure. Pseudomonas is the most common pathogen that colonized double-J stents and is the most commonly found microorganism in UTI. In our series, the youngest patients showed a higher rate of double-J bacterial colonization.

**Conflict of interest**

The authors declare that they have no conflict of interest.

**References**


