Taiwanese Recommendations for Antimicrobial Prophylaxis in Urological Surgery

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Objective: Surgical site infections and postoperative urinary tract infections are common causes of patient morbidity in urological surgery. Although the effectiveness of perisurgical antimicrobial prophylaxis (AMP) in reducing surgical site infections and postoperative urinary tract infections is well established, there is a wide variation in the use of AMP.

Materials and Methods: Three panels of experts of the Taiwan Urological Association were invited to review the literature and the clinical path of each hospital, and to suggest recommendations for AMP in open and laparoscopic surgeries, office procedures, and endoscopic surgery in the urological field.

Results: First-generation cephalosporins, usually not recommended in American and European guidelines, were recommended as first-line prophylactic antibiotics in Taiwan. The duration of AMP for each urological procedure was recommended and was usually limited to the period of a high risk of bacterial invasion. In patients with high-risk factors that increase the susceptibility to infection, a more-advanced agent with a longer duration is recommended. We do not discuss this agent in this article, but that does not preclude its appropriate use, depending on specific situations, including medical intolerance, agent compatibility, a history of previous infection, and community resistance patterns.

Conclusions: Controlled trials employing well-designed protocols may clarify the efficacy and safety concerning the choice of AMP for urological procedures. Practical guidelines based on clinical studies can then hopefully be updated.

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1. Introduction

Surgical site infections (SSIs) and postoperative urinary tract infections (UTIs) are common causes of patient morbidity with urological surgery. SSIs are a complication in up to 5% of clean extra-abdominal operations and up to 20% of intra-abdominal procedures.¹ SSIs almost double the costs of hospitalization, and patients with an SSI are more likely to require a prolonged stay in the hospital and suffer morbidity and mortality.²-⁵

Although the effectiveness of perisurgical antimicrobial prophylaxis (AMP) in reducing SSIs and postoperative UTIs is well established,⁶ there is a wide variation in use of periprocedural AMP, including the choice of agents, timing of administration, route of administration, and duration of prophylaxis.⁷

The use of AMP in urology has been controversial for many years, and it is still present in recent publications of European, Japanese and American guidelines.⁷-⁹ Most previous studies were poorly designed and lacked statistical
power. There were inconsistencies concerning definitions and assessment of risk factors. Several surveys among urologists have revealed wide differences in regimens and choice of antibiotics for prophylaxis.10–12

In an attempt to provide national guidance for prophylactic antibiotics in surgery and reduce medical expenditures and the emergence of resistant microorganisms in Taiwan, guidelines for AMP in surgery in Taiwan were issued by the Infectious Diseases Society of the Republic of China and Taiwan Surgical Association in 2004.13 However, there are only three guidelines for AMP in urological procedures, including transrectal prostate biopsy, transurethral prostate biopsy, and transurethral bladder tumor resection. These three published guidelines are out of date and difficult to follow. Therefore, we proposed recommendations with the support of the Taiwan Urological Association (TUA) to optimize the use of prophylactic antibiotics in urological procedures. Hopefully, this report will improve patient safety and reduce medical costs by standardizing AMP.

2. Materials and Methods

Three panels of experts of the TUA were invited to review the literature and the clinical path of each hospital. The panel of experts from northern Taiwan dedicated to the issue on AMP for endourological surgeries, the panel of experts from central Taiwan for investigative urological procedures, and the panel of experts from southern Taiwan for open urological surgeries. Furthermore, the leaders of the three panel groups presented their tentative suggestions in August 2008 at the annual meeting of the TUA. After updating the opinions from members of the TUA, the first draft of recommendations for AMP in urology was presented at the fifth biennial meeting of the Asian Association of UTIs and STDs, held in Taipei, Taiwan, in November 2008. We summarize below the consensus of the Committee of Genitourinary-infections and sexually-transmitted diseases, of the TUA in July 2009.

2.1. Characteristics of urological surgery

Several aspects of urological surgery differ from those of other surgeries. First, urine exposure in the surgical field is usually unavoidable. Intraprostatic bacteria are not easily detected, even though urine culture may show negative findings in patients with preoperative UTIs.14 Therefore, bacterial contamination is possible in surgical procedures of the prostate. An indwelling catheter is frequently used in urinary tract surgery, and the length of time a catheter is in place is longer than that with other surgeries.8 An intracorporeal stent, a type of foreign body, is sometimes used for diverse indications. Finally, high-pressure irrigation fluid is often needed to keep the visual field clear in many endourological surgeries. Because of these characteristics, the risks of SSIs or UTIs are higher in urological surgeries.

2.2. Evaluating risk factors for SSIs

Risk factors were underestimated in most clinical trials. Patients with high-risk factors have increased susceptibility of infection, and more-advanced agents with longer duration treatment are recommended.15 Risk factors can be classified into general risk factors and urological risk factors. General risk factors include an advanced age, malnutrition such as hypoalbuminemia, diabetes, smoking, obesity, remote infections such as skin and pulmonary infections, an advanced cancer stage, an immunocompromised status, and a long preoperative hospital stay. Urological risk factors include surgery involving bowel segments, a neurogenic bladder, vesicoureteral reflux, urinary obstruction, urinary stones, recurrent genitourinary infections, long-term urinary catheterization, and foreign bodies in the urinary tract such as a stent or prosthesis.7–9

2.3. Good clinical practice in surgery

Besides AMP, good clinical practice in surgery is very important in reducing perioperative infections.15 Preoperative issues include control of serum blood sugar, cessation of tobacco consumption, and washing and cleaning the body with an antiseptic agent. The preoperative hospital stay should be as short as possible, and the patient should not wear hand or arm jewelry. The hair should not be shaved preoperatively unless it interferes with the operation. If it has to be shaved, then the hair should be shaved immediately before the operation.

Intraoperative issues include good operating room ventilation; disinfection of the environment; regular microbiological sampling; and sterilization of instruments, surgical attire, and drapes. Rapid flash sterilization is not recommended. Operation room ventilation should be maintained at positive-pressure with respect to adjacent areas.

Surgical techniques play an important role in preventing SSIs. Such techniques include handling tissues gently, maintaining effective hemostasis, maintaining vascularity, avoiding hematomas, avoiding unnecessary injury, preventing hypothermia, removing devitalized tissues, eradicating dead and other unperfused spaces, avoiding foreign bodies, using drains and suture material appropriately, and minimizing the operative time. A drainage tube should be placed with a separate incision and with a closed suction system.

Strategies for postoperative care to prevent infection include washing the hands before changing a dressing, ensuring adequate incision wound care, providing proper fluid intake and nutrition, and properly educating the patient/family at discharge planning.15

2.4. Principles of AMP

AMP and antibiotic therapy are different issues. AMP is only one of several measures to prevent infections and
can never compensate for proper hygiene and operative techniques. On the other hand, antibiotic therapy is for treatment of a clinically suspected or microbiologically proven infection.

The advantage of AMP is to minimize perioperative infectious complications and costs. The drawbacks of overuse of antibiotics include drug side effects, microbial resistance, and increased medical expenditures.9 In general, these guidelines follow regulations of the National Health Bureau, Taiwan.16 However, the European, American, and Japanese guidelines are applied whenever appropriate.7–9

Antimicrobials can be administered either parenterally or orally. The parental dose should be given within 30 minutes before an operation.7–9,15 Oral administration is as effective as the intravenous route, and it is recommended for some procedures when the patient can easily take the drug 1–2 hours before a procedure. An additional dose should be used every 3 hours during surgery. The duration of AMP in each procedure has not yet been adequately addressed; therefore, this issue is unresolved. In principle, the duration of AMP should be minimized.

First-generation cephalosporins are generally recommended for operations not involving the gastrointestinal (GI) tract. Second-generation cephalosporins are recommended for procedures involving the GI tract. Gentamicin, aztreonam, clindamycin, and vancomycin are suggested in cases of penicillin allergy.

The agent is not discussed in this article do not preclude their appropriate use, depending on specific situations that include medical intolerance, agent compatibility, a history of a previous infection, and community resistance patterns.

2.5. Classification of surgical wounds

Traditionally, surgical wounds are classified into four types: clean, clean-contaminated, contaminated, and dirty-infected wounds. Clean wounds refer to uninfected primarily closed surgical wounds that do not enter the urinary tract (e.g., simple nephrectomy or adrenalectomy). Clean-contaminated wounds are those that enter the urinary tract under controlled conditions without the presence of infected tissues or bacteria (e.g., radical prostatectomy, pyeloplasty, cystectomy, or nephroureterectomy). Contaminated wounds are surgeries involving untreated infections, including UTIs, or procedures using the GI tract such as the ileal conduit.15 Dirty-infected wounds are those involving existing clinical infections during an operation (e.g., removal of a perinephric abscess or repair of an open traumatized urinary tract).8,9,15 However, the traditional classification of surgical procedures applies to open surgery but not to endourological interventions.8,9 Because of the above-described characteristics of urological surgeries, the classification of transurethral surgery is still controversial.

3. Results

The panels’ recommendations of a prophylactic regimen for each procedure are summarized as follows.

3.1. Open and laparoscopic surgeries (Table 1)

3.1.1. Clean-wound surgery

In clean-wound surgery, none or a single dose of first-generation cephalosporins before the incision is recommended. Postoperative AMP is not necessary for patients with no risk factors. For patients with risk factors, first-generation cephalosporins or gentamicin for less than 1 day are recommended. For intrascrotal surgery, one dose of first-generation cephalosporins or gentamicin is recommended for the high complication rate in scrotal surgery.17

3.1.2. Clean-contaminated or large clean surgery

For clean-contaminated surgery such as a radical nephrectomy, radical prostatectomy, pyeloplasty, cystectomy, or nephroureterectomy, first-generation cephalosporins and/or gentamicin with a duration of 1–3 days are recommended.18,19 We also recommend first-generation cephalosporins and/or gentamicin with a duration of 1–3 days in large clean wound operations8 because of massive tissue destruction and reactions and a possibly worse sequel of infection with operations such as open nephrectomy.

3.1.3. Use of intestine in urologic surgery

Because the risk of infection in intestine-employed surgery is high,20 we recommend first- or second-generation cephalosporins combined with aminoglycoside and/or metronidazole for a duration of 1–4 days in cases undergoing such a surgery, e.g., ileal conduit.

3.1.4. Prosthesis implantation

For prosthesis implantation surgery, first- or second-generation cephalosporins combined with aminoglycoside for a duration of 24 hours are suggested.21

3.1.5. Laparoscopic surgery

The recommendation for AMP in laparoscopic surgery is the same as that for open surgery.22

3.2. Investigative Procedures (Table 2)

3.2.1. Cystoscopy, simple ureteroscopy, and urodynamic studies

For cystoscopy, simple ureteroscopy, and urodynamic studies, AMP is not necessary except in patients at risk. Risk factors of infection are a neurogenic bladder, transplant
Table 1  Recommendations for antimicrobial prophylaxis in open and laparoscopic urological surgery

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Prophylaxis indicated</th>
<th>Antimicrobial(s) of choice</th>
<th>Alternative antimicrobial(s)</th>
<th>Duration of therapy (hr)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean-wound surgery</td>
<td>None or a single dose of 1&lt;sup&gt;st&lt;/sup&gt; gen. cephalosporin</td>
<td></td>
<td></td>
<td></td>
<td>In patients at risk, 1&lt;sup&gt;st&lt;/sup&gt; gen. cephalosporin and/or gentamicin, ≤24 hr</td>
</tr>
<tr>
<td>Large clean surgery</td>
<td>All</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; gen. cephalosporin+ gentamicin</td>
<td></td>
<td>≤72</td>
<td></td>
</tr>
<tr>
<td>Clean-contaminated surgery</td>
<td>All</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; or 2&lt;sup&gt;nd&lt;/sup&gt; gen. cephalosporin+ aminoglycoside ± metronidazole</td>
<td></td>
<td>≤96</td>
<td></td>
</tr>
<tr>
<td>Use of intestine in urologic surgery</td>
<td>All</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; or 2&lt;sup&gt;nd&lt;/sup&gt; gen. cephalosporin+ aminoglycoside</td>
<td></td>
<td>≤24</td>
<td></td>
</tr>
<tr>
<td>Prosthesis implantation</td>
<td>All</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; or 2&lt;sup&gt;nd&lt;/sup&gt; gen. cephalosporin+ aminoglycoside</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laparoscopic surgery</td>
<td>All</td>
<td></td>
<td></td>
<td></td>
<td>As for open surgery</td>
</tr>
</tbody>
</table>

*Risk factors include both general and urological risk factors. gen. = generation.

Table 2  Recommendations for antimicrobial prophylaxis for investigative procedures

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Prophylaxis indicated</th>
<th>Antimicrobial(s) of choice</th>
<th>Alternative antimicrobial(s)</th>
<th>Duration of therapy (hr)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cystoscopy, ureteroscopy, simple urodynamic study</td>
<td>None</td>
<td></td>
<td>Gentamicin 1 day + 1&lt;sup&gt;st&lt;/sup&gt; gen. cephalosporin orally for 5 d Single dose gentamicin+ fluoroquinolone orally for 3 d</td>
<td></td>
<td>In patients at risk, 1&lt;sup&gt;st&lt;/sup&gt; gen. cephalosporin and/or gentamicin, ≤24 hr</td>
</tr>
<tr>
<td>Transrectal prostate biopsy</td>
<td>All</td>
<td>Single dose fluoroquinolone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESWL</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td>In patients at risk, 1&lt;sup&gt;st&lt;/sup&gt; gen. cephalosporin ± gentamicin, ≤24 hr</td>
</tr>
</tbody>
</table>

*Risk factors include both general and urological risk factors. gen. = generation; ESWL = extracorporeal shock wave lithotripsy.
patients, immunocompromised patients, prosthetic joints, increased post-voiding residual urine, and vesicoureteral reflux.\textsuperscript{23–25}

### 3.2.2. Transrectal prostate biopsy

AMP is indicated in all patients undergoing a prostate biopsy, and several regimens are recommended: (1) single dose fluoroquinolones,\textsuperscript{26} e.g., levofloxacin; (2) two doses of gentamicin at a 12-hour interval combined with first-generation cephalosporins orally for 5 days; and (3) a single dose of gentamicin combined with fluoroquinolone orally for 3 days.\textsuperscript{4–6,27} To date, there is no consensus on an enema to reduce the infection rate after a transrectal prostate biopsy.\textsuperscript{28,29}

### 3.2.3. Extracorporeal shock wave lithotripsy (ESWL)

The policy of antibiotic prophylaxis prior to SWL in patients with sterile pretreatment urine cultures is efficacious in reducing the rate of post-SWL UTIs. However, the strategy of antibiotic prophylaxis is not cost-effective when taking into consideration mild post-SWL UTIs, if encountered, in most patients.\textsuperscript{30} For ESWL, AMP is not indicated in the absence of preoperative UTIs. AMP is recommended for patients at risk. High-risk factors include patients with known infectious stones, a past history of symptomatic UTIs or bacteremia after ESWL.

### 3.3. Endoscopic surgery (Table 3)

#### 3.3.1. Percutaneous nephrolithotripsy

For percutaneous nephrolithotripsy, the recommended agent is first-generation cephalosporins given intravenously combined with aminoglycoside for a duration of no longer than 3 days. For patients at risk, oral-form first-generation cephalosporins for a further 3–7 days are suggested. Alternative agents are second- or third-generation cephalosporins and fluoroquinolone.

#### 3.3.2. Ureteroscopic lithotripsy, transurethral resection of a bladder tumor, and cystolithotripsy

First-generation cephalosporins given intravenously for less than 24 hours are recommended. For patients at risk, oral-form first-generation cephalosporins for a further 3 days are suggested. Alternative agents are aminoglycoside and second-generation cephalosporins.\textsuperscript{31,32} AMP is still controversial for patients receiving ureteroscopic lithotripsy with or without insertion of a JJ catheter.

#### 3.3.3. Transurethral resection of the prostate and various types of laser prostatectomies

First-generation cephalosporins and/or gentamicin given parenterally for ≤ 72 hours are recommended. Oral-form

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**Table 3** Recommendations for antimicrobial prophylaxis in endourological surgery

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Prophylaxis indicated</th>
<th>Antimicrobial(s) of choice</th>
<th>Alternative antimicrobial(s)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percutaneous nephrolithotripsy</td>
<td>All</td>
<td>1st gen. cephalosporin</td>
<td>2nd or 3rd gen. cephalosporin + fluoroquinolone</td>
<td>≤ 72 h in patients at risk &amp; patients with a stent or PCN tube</td>
</tr>
<tr>
<td>Ureteroscopic lithotripsy</td>
<td>All</td>
<td>1st gen. cephalosporin</td>
<td>Aminoglycoside</td>
<td>≤ 24 h in patients at risk &amp; patients with a large stone, 1st gen. cephalosporin orally for a further 3–7 d</td>
</tr>
<tr>
<td>Cystolithotripsy</td>
<td>All</td>
<td>1st gen. cephalosporin</td>
<td>Aminoglycoside</td>
<td>≤ 24 h in patients at risk &amp; patients with a large stone, 1st gen. cephalosporin orally for a further 3–7 d</td>
</tr>
<tr>
<td>TUR of bladder tumor</td>
<td>All</td>
<td>1st gen. cephalosporin</td>
<td>Aminoglycoside</td>
<td>≤ 24 h in patients at risk &amp; patients with a large tumor, 1st gen. cephalosporin orally for a further 3–7 d</td>
</tr>
<tr>
<td>TUR of prostate, various types of laser prostatectomy</td>
<td>All</td>
<td>1st gen. cephalosporin</td>
<td>2nd or 3rd gen. cephalosporin + fluoroquinolone</td>
<td>≤ 72 h in patients at risk &amp; patients with a large tumor, 1st gen. cephalosporin orally for a further 3–7 d</td>
</tr>
</tbody>
</table>

**Remarks:**

- Risk factors include both general and urological risk factors. TUR = transurethral resection; gen. = generation; PCN = percutaneous nephrostomy.
first-generation cephalosporins for a further 3–7 days are also suggested. Alternative agents are aminoglycoside, second- or third-generation cephalosporins, and fluoroquinolone. This principle should also be applied to various types of laser prostatectomy.

4. Discussion

AMP is widely employed in surgical procedures to prevent SSIs. However, its use is controversial in urological surgeries. Although a variety of prophylactic antibiotic regimens have been suggested, these recommendations were often based on anecdotal evidence or on data collected unscientifically. In recent years, there have been many guidelines for AMP in urological surgery. Among them, there are inconsistencies concerning timing, the route of administration, the duration of the regimen, and the choice of antibiotics.

Choices of antimicrobial agents differ in American, European, and Japanese guidelines. Second- or third-generation cephalosporins are antimicrobials of optimal choice for surgical prophylaxis whenever appropriate in urology as recommended by the European Association of Urology, compared with fluoroquinolones recommended by the American Urological Association. On the other hand, fluoroquinolones, penicillin/beta-lactamase inhibitors, and first- or second-generation cephalosporin, which are used whenever appropriate on various occasions, are recommended as first-line options by the Japanese Urological Association. To date, there is no convincing evidence in terms of efficacy, validity, risks of microbial resistance, and medical economics to lend support to the superiority of one regimen over another or the primary choice of appropriate prophylactic agents.

First-generation cephalosporins, usually not recommended in American and European guidelines, have long been recommended as first-line AMP for urological surgeries for many years in Taiwan. They appear to be effective for AMP in both general surgery and urology. We have not observed any serious side effects apart from the occasional allergic reaction as with all antibiotic medications. In addition, the significant relationship between microbial resistance and overuse of antibiotics justifies the use of first-generation cephalosporins for AMP. More research is required to verify the equal effectiveness between first-generation cephalosporins and fluoroquinolone or third-generation cephalosporins that are usually recommended in American and European guidelines.

Clearly, there is a need for evidence-based guidelines in each country. To date, there is little convincing scientific evidence accounting for the validity of these recommendations. In the future, controlled trials employing well-designed protocols may clarify the efficacy and safety concerning AMP for urological procedures. Practical guidelines based on clinical studies could then be updated. In conclusion, the advantages and disadvantages of AMP should be carefully weighed. Details of recommendations for AMP for each urological procedure are provided and should be carefully followed.

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(3) Southern panel

References


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