POCKET GUIDE, JANUARY 1, 2014 VERSION

UROLOGIC SURGERY ANTIMICROBIAL PROPHYLAXIS

Best Practice Policy

Efforts currently are centered on improving patient safety and reducing costs by standardizing antimicrobial prophylaxis and encouraging proper application including timing of administration and duration of prophylaxis. The following recommendations should help initiate the decisions regarding use of antimicrobial prophylaxis in urologic surgery, the selection of agent, and determination of appropriate dosing while considering the patient's specific circumstances.

Principles of surgical antimicrobial prophylaxis

- Surgical antimicrobial prophylaxis is the periprocedural systemic administration of an antimicrobial agent intended to reduce the risk of postprocedural local and systemic infections.
- The potential benefit of surgical antimicrobial prophylaxis is based on:
  - Patient-related factors (ability of the host to respond to bacterial invasion) (Table 1). These factors can be additive, compounding their impact.
  - Procedural factors (likelihood of bacterial invasion at the operative site) (Table 2). Urinary procedures are considered "clean-contaminated."
  - The potential morbidity of infection.
- Surgical antimicrobial prophylaxis is recommended only when the potential benefit exceeds the risks and anticipated costs.
- The antimicrobial agent used for prophylaxis should be effective against the disease-relevant bacterial flora characteristic of the operative site. Cost, conveniences and safety of the agent also should be considered.
- The duration of surgical antimicrobial prophylaxis should extend throughout the period in which bacterial invasion is facilitated and/or is likely to establish an infection.
  - Begin infusion of the first dose within 60 minutes of the surgical incision (with the exception of 120 minutes for intravenous fluoroquinolones and vancomycin).
  - Do not extend prophylaxis beyond 24 hours after a procedure except when a prosthetic material is being placed, an external urinary catheter is present prior to or is placed at the time of the procedure in patients with certain risk factors, or with documented bacteriuria.
  - With an existing infection, a therapeutic course of antimicrobials should be administered in an attempt to sterilize the field or at least to suppress the bacterial count. If urine culture shows no growth, prophylaxis can be omitted.

Antimicrobial Prophylaxis Recommendations

Patients Undergoing Urologic Surgery

- Antimicrobial prophylaxis for genitourinary procedures solely to prevent infectious endocarditis is no longer recommended by the American Heart Association; the risk of adverse events exceeds the benefit.
- The efficacy of oral fluoroquinolones for prophylaxis is unique to urologic surgical procedures.
- Choose an antimicrobial agent that is effective against the disease-relevant bacterial flora characteristic of the operative site. Consider cost, convenience and safety of the agent.
  - Tables 3, 4 and 5 provide specific recommendations for the settings in which antimicrobial prophylaxis is indicated and the agents of choice.
  - The agent should achieve serum and tissue levels that exceed the minimum inhibitory concentration of the organism characteristic of the operative site, have a long half-life, and be safe, inexpensive and not likely to promote bacterial resistance. For the urinary tract, the cephalosporins, oral flouroquinolones and aminoglycosides generally meet these criteria.
  - Absence of an agent from the Tables should not preclude its appropriate use, depending on the situations such as: medication intolerance, agent compatibility, prior infection and community resistance patterns.
  - In some cases, prophylaxis should be limited to patients with specific risk factors.
  - For surgical prophylaxis, all antimicrobials should be administered IV except for the oral administration for fluoroquinolones, trimethoprim-sulfamethoxazole, bowel preparation agents and some agents given at catheter removal; in addition, intramuscular administration for antimicrobials for transrectal prostate biopsy is acceptable.
- Table 6 presents standard dosing regimens; however, more frequent dosing may be needed. Adjust some drug doses to the patient's body weight (or corrected dosing weight) or body mass index. Additional doses are required intraoperatively if the procedure extends beyond two half-lives of the initial dose.

Patients with Orthopedic Considerations

- Use antimicrobial prophylaxis to reduce risk of the following:
  - Hematogenous total joint infection in patients who meet both sets of criteria in Table 7.
  - Other infections in some patients who do not meet both sets of criteria in Table 7.
- Do not use antimicrobial prophylaxis:
  - On the basis of orthopedic pins, plates and screws.
  - For total joint replacement on that basis alone.
- The recommended antimicrobial regimen:
  - A single systemic level dose of a fluoroquinolone orally one to two hours preoperatively.
  - Ampicillin 2 g IV (or vancomycin 1 g IV in penicillin allergic patients, over one to two hours) plus gentamicin 1.5 mg/kg IV 30 to 60 minutes preoperatively.
  - Consider additional or alternative agents against specific organisms and/or other infections

TABLE 1.

Patient-related Factors Affecting Host Response To Surgical Infections

Factor	Result
Impair natural defense mechanisms	
Advanced age Anatomic anomalies of the urinary tract Poor nutritional status Smoking Chronic corticosteroid use Immunodeficiency	↓ natural defense mechanisms of the urinary tract and immune system
Increase local bacterial concentration and/or spectrum of flora	
Externalized catheters Colonized endogenous/exogenous material Distant coexistent infection Prolonged hospitalization	↑ local bacterial concentration and/or spectrum

Modified from Schaeffer AJ and Schaeffer EM: Infections of the urinary tract. In: Campbell-Walsh Urology, 9th ed. Edited by AJ Wein, LR Kavoussi, AC Novick, AW Partin and CA Peters. Philadelphia: Saunders-Elsevier 2007; vol 1, pp 223-303. Reprinted with permission from Elsevier Ltd.

TABLE 2.

Surgical Wound Classification

Clean	Uninfected operative site, with primary skin closure
Clean-contaminated	Entry into respiratory, alimentary, genital or urinary tracts
Contaminated	Fresh accidental wounds, major break in sterile technique, gross spillage from gastrointestinal tract or presence of acute but nonpurulent inflammation at the operative site.
Dirty-infected	Old accidental wound with devitalized tissue or presence of clinical infection or perforated viscera at the operative site. This definition implies that organisms that might cause postoperative infection were present at the operative site before surgery.

Adapted from Mangram AJ, Horan TC, Pearson ML, Silver LC and Jarvis WR: Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee. Infect Control Hosp Epidemiol 1999; **20:** 250.

TABLE 3.

Prophylaxis for Lower Tract Instrumentation

Procedure (organisms)[1]	Prophylaxis Indicated	Antimicrobial(s) of Choice[2]	Alternative Antimicrobial(s)[2]
Removal of external urinary catheter,[3,4] (GU tract)	Patients with risk factors[5]	Fluoroquinolone, Trimethoprim-sulfamethoxazole	Aminoglycoside ± Ampicillin 1st/2nd gen. Cephalosporin Amoxicillin/Clavulanate
Cystography, urodynamic study or simple cystourethroscopy (GU tract)	Patients with risk factors[5]	Fluoroquinolone, Trimethoprim-sulfamethoxazole	Aminoglycoside ± Ampicillin 1st/2nd gen. Cephalosporin Amoxicillin/Clavulanate
Cystourethroscopy with manipulation[6] (GU tract)	All patients	Fluoroquinolone, Trimethoprim-sulfamethoxazole	Aminoglycoside ± Ampicillin 1st/2nd gen. Cephalosporin Amoxicillin/Clavulanate
Prostate brachytherapy or cryotherapy (Skin)	Uncertain	1st gen. Cephalosporin	Clindamycin
Transrectal prostate biopsy (Intestine)	All patients	Fluoroquinolone, 1st/2nd/3rd gen. Cephalosporin	TMP-SMX Aminoglycoside (Aztreonam)

Key: gen., generation; GU, genitourinary.

1 Organisms common to the GU tract – *E. coli, Proteus sp., Klebsiella sp., Enterococcus;* Intestine – *E. coli, Klebsiella sp., Enterobacter, Serratia sp., Proteus sp., Enterococcus,* and Anaerobes; Skin – *S. aureus, coagulase negative Staph. sp.,* Group A *Strep. sp.*
2 Order of agents is not indicative of preference.
3 If urine culture shows no growth prior to procedure, antimicrobial prophylaxis is not necessary.
4 Or full course of culture-directed antimicrobials for documented infection (treatment not prophylaxis).
5 Risk factors-see Table 1.
6 Includes transurethral resection of bladder tumor and prostate, and any biopsy, resection, fulguration, foreign body removal, urethral dilation or urethrotomy, or ureteral instrumentation including catheterization or stent placement/removal.

TABLE 4.

Prophylaxis for Upper Tract Instrumentation

Procedure (organisms)[1]	Prophylaxis Indicated	Antimicrobial(s) of Choice[2]	Alternative Antimicrobial(s)[2]
Shock-wave lithotripsy (GU tract)	If risk factors	Fluoroquinolone, trimethoprim-sulfamethoxazole	Aminoglycoside ± Ampicillin 1st/2nd gen. Cephalosporin Amoxicillin/Clavulanate
Percutaneous renal surgery (GU tract and skin)	All patients	1st/2nd gen. Cephalosporin, Aminoglycoside + Metronidazole or Clindamycin	Aminoglycoside/ Sulbactam Fluoroquinolone
Ureteroscopy (GU tract)	All patients	Fluoroquinolone, trimethoprim-sulfamethoxazole	Aminoglycoside ± Ampicillin 1st/2nd gen. Cephalosporin Amoxicillin/Clavulanate

Key: gen., generation; GU, genitourinary.

1 Organisms common to the GU tract – *E. coli, Proteus sp., Klebsiella sp., Enterococcus;* Skin – *S. aureus,* coagulase negative *Staph. sp.,* Group A *Strep. sp.*

TABLE 5.

Prophylaxis for Upper Tract Instrumentation

Procedure (organisms)[1]	Prophylaxis Indicated	Antimicrobial(s) of Choice[2]	Alternative Antimicrobial(s)[2]
Vaginal surgery (GU tract, skin and Group B *Strep*.)	All patients	1st/2nd gen. Cephalosporin Aminoglycoside + Metronidazole or Clindamycin	Ampicillin/Sulbactam Fluoroquinolone
Involving entry into the urinary tract (GU tract and skin)	All patients	1st/2nd gen. Cephalosporin Aminoglycoside + Metronidazole or Clindamycin	Ampicillin/Sulbactam Fluoroquinolone
Without entering urinary tract (skin)	Patients with risk factors[3]	1st gen. Cephalosporin (single dose)	Clindamycin (single dose)
Involving intestine[4] (GU tract, skin, and intestine)	All patients	2nd/3rd gen. Cephalosporin, Aminoglycoside + Metronidazole or Clindamycin	Ampicillin/Sulbactam Ticarcillin/Clavulanate Pipercillin/Tazobactam Fluoroquinolone
Involving implanted prosthesis (GU tract and skin)	All patients	Aminoglycoside + 1st/2nd gen. Cephalosporin or Vancomycin	Ampicillin/Sulbactam Ticarcillin/Clavulanate Pipercillin/Tazobactam

Key: gen., generation; GU, genitourinary.

1 Organisms common to the GU tract – *E. coli, Proteus sp., Klebsiella sp., Enterococcus;* Intestine – *E. coli, Klebsiella sp., Enterobacter, Serratia sp., Proteus sp., Enterococcus,* and Anaerobes; Skin – *S. aureus,* coagulase negative *Staph. sp.*, Group A *Strep. sp.*
2 Order of agents is not indicative of preference.
3 Risk factors - see Table 1.
4 For surgery involving colon, bowel preparation with oral neomycin plus either erythromycin base or metronidazole can be added to or substituted for systemic agents.

TABLE 6.

Antimicrobial Agents and Doses for Periprocedural Use

Fluoroquinolones	Levofloxacin: 500 mg PO single dose Ciprofloxacin: 500 mg PO [q12h] Ofloxacin: 400 mg PO [q12h]
Aminoglycosides	Gentamicin: 5 mg/kg IV single dose Tobramycin: 5 mg/kg IV single dose Amikacin: 15 mg/kg IV single dose
1st Generation cephalosporins	Cephalexin: 500 mg PO [q6h] Cephradine: 500 mg PO [q6h] Cefadroxil: 500 mg PO [q12h] Cefazolin: 1 g IV [q8h]
2nd Generation cephalosporins	Cefaclor: 500 mg PO [q8h] Cefprozil: 500 mg PO [q12h] Cefuroxime: 500 mg PO [q12h] Cefoxitin: 1 - 2 g IV [q8h]
3rd Generation cephalosporins (oral agents not listed)	Ceftizoxime: 1 g IV [q8h] Ceftazidime: 1 g IV [q12h] Ceftriaxone: 1 - 2 IV single dose Cefotaxime: 1 g IV [q8h]
Others	Amoxicillin/clavulanate: 875 mg PO [q12h] Ampicillin: 1 - 2 g IV [q6h] Ampicillin/sulbactam: 1.5 - 3 g IV [q6h] Aztreonam 1 - 2 g IV [q8h] Clindamycin: 600 mg IV [q8h] Erythromycin base (for bowel preparation): 1 - 2 g PO [variable] Metronidazole: 1 g IV [q12h]; (for bowel preparation) 1 - 2 g PO [variable] Neomycin(for bowel preparation): 1 - 2 g PO [variable] Pipercillin/tazobactam: 3.375 g IV [q6h] Ticarcillin/clavulanate: 3.1 g IV [q6h] Trimethoprim-sulfamethoxazole: 1 double-strength tablet PO [q12h] Vancomycin: 1 g IV [q12h]

Key: g, gram; h, hour; IV, intravenous; kg, kilogram; mg, milligram; PO, orally; q, every.

TABLE 7.

Criteria for antimicrobial prophylaxis for patients with orthopedic conditions

Criteria	
Increased risk of hematogenous total joint infection	**Increased risk of bacteremia associated with urologic procedures**
Within 2 years of prosthetic joint replacement Immunocompromise and prosthetic joint replacement • Inflammatory arthropathies (e.g., rheumatoid arthritis, systemic lupus erythematosus) • Drug-induced immunosuppression • Radiation-induced immunosuppression Comorbidity • Previous prosthetic joint infection • Malnourishment • Hemophilia • HIV infection • Diabetes • Malignancy	Stone manipulation (includes shock-wave lithotripsy) Transmural incision into urinary tract (does not include simple ligation with excision or percutaneous drainage procedure) Endoscopy of upper tract (ureter and kidney) Procedures including bowel segments Transrectal prostate biopsy Urinary tract entry (except for urethral catheterization) in individuals with higher risk of bacterial colonization: • Indwelling catheter or intermittent catheterization • Indwelling ureteral stent • Urinary retention • History of recent/recurrent urinary tract infection or prostatitis • Urinary diversion

Adapted from American Urological Association; American Academy of Orthopaedic Surgeons: Antimicrobial prophylaxis for urological patients with total joint replacements. J Urol 2003; **169:** 1796.