

## **BC Provincial Antimicrobial Clinical Experts (PACE) Committee**

### ***Surgical Antibiotic Prophylaxis – Adults (FAQ)***

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*The PACE Committee has developed provincial surgical antibiotic prophylaxis recommendations and recently shared the first three sections of the guideline, covering drug dosing, general surgery and urology with interested health care professionals, for feedback.*

*Feedback from interested physicians and pharmacists was considered and resulted in several modifications to the draft recommendations. This document summarizes themes identified from the feedback accompanied by the rationale for the final recommendations and reference(s).*

*This is to be considered a living document. Additional information will be added as more sections are published and as more input is received.*

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# 1. GENERAL PRINCIPLES OF SURGICAL PROPHYLAXIS

## General Principles (covering drug dosing, redosing)

- Cefazolin weight-based dosing (obesity) – Recent evidence suggests that the cefazolin 3 g IV x 1 dose pre-op discussed in the American Society of Health-System Pharmacists (ASHP) 2013 guideline is not necessary in patients weighing greater than 120 kg.  
**Final recommendation: cefazolin 2 g IV pre-op for all adults, regardless of body weight.**  
*References: Am J Health-Syst Pharm 2013; 70: 195-283; Obstet Gynecol 2015; 126: 708-15; Surg Infect 2017; 18: 485-490; Obes Surg 2022; 32: 3138-3149; Obes Surg 2019; 29: 159-165*
- Cefazolin weight-based dosing less than 80 kg – Guidelines recommend cefazolin 2 g IV pre-op for adult patients. While cefazolin 1 g IV may be adequate to prevent Gram positive infections, such as those caused by streptococci and staphylococci, pharmacokinetic/pharmacodynamic studies suggest cefazolin 2 g is needed to prevent Gram negative infections.  
**Final recommendation: cefazolin 2 g IV pre-op for all adults, regardless of body weight.**  
*References: Am J Health-Syst Pharm 2013; 70: 195-283; Int J Antimicrob Agents 2023; 61: 106751*
- Gentamicin / tobramycin weight-based dosing – While gentamicin / tobramycin 1.5-2 mg/kg and 4.5-5 mg/kg IV pre-op are both recommended in guidelines, in colorectal surgery, when combined with metronidazole, gentamicin 4.5 mg/kg IV is superior to 1.5 mg/kg IV to achieve adequate concentrations at time of closure and prevent post-operative infections and is the preferred dosing regimen.  
**Final recommendation: gentamicin or tobramycin 4.5 mg/kg IV x 1 dose pre-op dosing.**  
*References: Am J Health-Syst Pharm 2013; 70: 195-283; Antimicrob Agents Chemother 2002; 46: 3026-3030; J Hosp Infect 2000; 46: 135-140; South Australia Expert Advisory Group on Antimicrobial Resistance (SAAGAR)(July 12, 2021). Surgical Antimicrobial Prophylaxis Clinical Guideline. Version No. 3.0. Government of South Australia. Found at: [hyperlink](#)*
- Prophylactic antibiotic dosing and traumatic blood loss – Guidelines recommend intra-operative redosing for some antibiotics with major blood loss greater than 1500 mL or during prolonged procedures.  
**Opinion (PACE consensus): Difficult to assess intraoperative blood loss volume associated with traumatic wounds could be assessed using packed red blood cell requirements.**  
*Reference: Am J Health-Syst Pharm 2013; 70: 195-283; J Obstet Gynaecol Can 2021; 43: 19-25; Clin Ther 2004; 26: 271-281; Arch Surg 1996; 131: 1165-1172; Acta Orthop Traumatol Turc 2021; 55: 53-6; Surg Infect 2022; 23: 332-338*

- Cephalosporin and true penicillin allergic patients and antibiotic prophylaxis recommendations – Non-beta-lactam antibiotic prophylaxis results in higher surgical site infections, adverse effects and costs. Most beta-lactam antibiotic allergic patients can safely receive cefazolin because cefazolin does not appear to cross-react with penicillins, other cephalosporins or carbapenems. Cross-reactivity between penicillins and cephalosporins (e.g. amoxicillin and cephalexin) and between different cephalosporins (e.g. cefazolin and ceftriaxone) appears to be R1 side chain dependent. For example, cephalexin and amoxicillin have the same R1 side chain resulting in significant cross-reactivity. Whereas, cefazolin does not share a side chain with any penicillin or cephalosporin, resulting in very low cross-reactivity.

**Exceptions: documented allergy to cefazolin, severe non-IgE mediated reactions to any beta-lactam antibiotic should receive vancomycin for Gram-positive coverage, gentamicin or tobramycin for Gram negative coverage and metronidazole for anaerobic coverage.**

*References: J Oral Maxillfac Surg 2018; 75: 2223-2229; Acta Orthopaedica 2017; 88: 562-567; Clin Infect Dis 2018; 66: 329-36J Allergy Clin Immunol 2014; 133: 790-6; Ann Transl Med 2018; 5: 100 (1-8); Ann Surg 2012; 256: 1089-1092; J Allergy Clin Immunol Pract 2019; 8: 2722-2738; BC Med J 2019; 61: 350-351*

- Antibiotic prophylaxis recommendations in patients already receiving antibiotics (e.g. biliary obstruction undergoing an ERCP). For patients with an actively treated infection who require surgery, in most cases, the guidelines do apply, as the antibiotics administered are considered “treatment” not “prophylaxis”. However, if the antibiotic given for treatment (e.g. ciprofloxacin) does not have good Gram positive coverage against skin organisms, antibiotic prophylaxis with cefazolin, for example, might be required to prevent a post-op SSI. There is no mention of this scenario in guidelines or primary references.

**Final recommendation: Decisions about antibiotic prophylaxis/treatment in this situation would need to be made on a case-by-case basis.**

## 2. GENERAL SURGERY

### General Surgery

- Pancreaticoduodenectomy (Whipple’s procedure) – Guidelines recommend antibiotic prophylaxis with cefazolin 2 g IV x 1 dose pre-op ± vancomycin 15 mg/kg IV x 1 dose. A 2023 RCT showed piperacillin-tazobactam 3.375 g IV pre-op superior to cefoxitin 2 g IV x 1 dose pre-op for this procedure.

**Final recommendation: Add piperacillin-tazobactam 3.375 g IV x 1 dose pre-op option.**

*Reference: JAMA 2023; 329:1579-1588*

- Gastrointestinal endoscopy and need for enhanced Gram negative coverage? – For gastrointestinal endoscopy, the 2015 ASGE Standards of Practice indicate high risk endoscopic procedures are associated with bacteremia caused by pathogens commensal to the mouth, such as viridans streptococci. For this purpose, Up-To-Date (2022) recommends amoxicillin 2 g PO x 1 dose or ampicillin 2 g IV x 1 dose. The S. Australia guideline (2021) opts instead for cefazolin instead of ampicillin.

**Final recommendation: cefazolin 2 g IV x 1 dose pre-op.**

*References: South Australia Expert Advisory Group on Antimicrobial Resistance (SAAGAR)(July 12, 2021). Surgical Antimicrobial Prophylaxis Clinical Guideline. Version No. 3.0. Government of South Australia. Found at: [hyperlink](#)*

- Peroral endoscopic myotomy (POEM) and antibiotic prophylaxis. Evidence from 2 RCTs support no post-operative antibiotic prophylaxis for POEM. One RCT justified cefazolin antibiotic prophylaxis indicating that during this clean-contaminated procedure, the mediastinum is exposed to the esophageal lumen and contents of commensal organisms of the oropharynx and upper GI tract.

**Final recommendation: cefazolin 2 g IV x 1 dose pre-op.**

*Reference: Gastrointest Endosc 2021; 94: 922-9*

- Breast Surgery, low risk and use of “optional” antibiotic prophylaxis? The 2015 American Assn of Plastic Surgeons consensus statement recommends antibiotic prophylaxis for cosmetic, aesthetic breast surgery, although those receiving tissue expanders and breast implants benefit most. The 2017 American Society of Breast Surgeons recommend antibiotic prophylaxis (1<sup>st</sup> gen cephalosporin) for most breast procedures (e.g. mastectomy with or without axillary node excision or reconstruction, partial mastectomy for cancer with or without lymph node or axillary dissection), but optional antibiotics for excision biopsy and for brachytherapy catheter placement. For this reason, we left use of cefazolin as optional for biopsy or lumpectomy. However, others have commented on this as well.

**Final Recommendation: No routine antibiotic prophylaxis required.**

*Reference: Breast Oncol 2022; 29: 2202-2208*

- Timing of antibiotic prophylaxis in patients already receiving antibiotic treatment for an infection (e.g. ERCP and receiving antibiotic treatment for cholangitis) –In contaminated surgeries or surgery performed during an active infection, antibiotic administration constitutes treatment not prophylaxis and the guidelines would not apply. However, if the antibiotic given for treatment (e.g. ciprofloxacin) that does not have good Gram positive coverage against skin pathogens, cefazolin prophylaxis might be needed to prevent a post-op SSI.

**Opinion (PACE consensus): Decisions about antibiotic treatment/prophylaxis in this situation would need to be considered on a case-by-case basis.**

### 3. UROLOGY

#### Urology

- Recommendations contain use of +/- antibiotic prophylaxis for some procedures such as open or laparoscopic surgery with or without prosthetic material – include when to add a second antibiotic– The 2013 ASHP, 2019 American Urological Association (AUA) for open and laparoscopic procedures recommend +/- an aminoglycoside or cephalosporin. and 2021 S. Australian Guidelines recommends cefazolin + gentamicin.

**Final recommendation: cefazolin +/- an aminoglycoside – each health authority or surgeon can decide if dual therapy is required.**

*References: South Australia Expert Advisory Group on Antimicrobial Resistance (SAAGAR)(July 12, 2021). Surgical Antimicrobial Prophylaxis Clinical Guideline. Version No. 3.0. Government of South Australia. Found at: [hyperlink](#) Am J Health-Syst Pharm 2013; 70: 195-283; AUA – Best practice policy statement on urological procedures and antimicrobial prophylaxis (2019): [hyperlink](#)*

- Transrectal prostate biopsy and risk factors for carriage of resistant *E. coli* and need for augmented antibiotic prophylaxis- The 2017 AUA White Paper indicated antibiotic exposure 6-months prior to biopsy promulgates presence of resistant organisms. Other risk factors listed: comorbidities/immunosuppression, recent travel to India and SE Asia, colonization with fluoroquinolone (FQ)-resistant organism.

**Final recommendation: antibiotics in the last 6 months, recent (6 month) travel to S or SE Asia, previous resistant organism (infection or colonization), FQ- or cotrimoxazole-resistant *E. coli* >20% in target population.**

*Reference: J Urol 2017; <http://dx.doi.org/10.1016/j.juro.2017.01.10>*

- Transrectal prostate biopsy and fosfomycin plus ciprofloxacin or co-trimoxazole(augmented prophylaxis) if risk factors for FQ- or co-trimoxazole-resistant *E. coli*- Fosfomycin has good prostate penetration and is effective against *E. coli* FQ-resistant strains but has unreliable activity against non-*E. coli* Gram-negative pathogens. A 2018 Canadian study showed fosfomycin monotherapy prophylaxis was inferior to ciprofloxacin and appeared to select for *Klebsiella spp.* post-op UTIs and sepsis. Ciprofloxacin is added to fosfomycin to prevent infection from other Gram negative pathogens (augmented prophylaxis). Therefore, fosfomycin mono-prophylaxis is not recommended.

**Final recommendation: ciprofloxacin 500 mg PO x 1 dose pre-op or co-trimoxazole 800/160 mg PO x 1 dose pre-op; Add fosfomycin 3 g PO x 1 dose (1-4 h pre-op) if risk factors for ciprofloxacin or co-trimoxazole resistance.**

*Reference: J Glob Antimicrob Resist 2016; 17: 112-6*

- Ureterscopy ± stent and routine use of cefazolin, ceftriaxone or gentamicin prophylaxis – Guidelines recommend antibiotic prophylaxis for this procedure but acknowledge the evidence supporting antibiotic prophylaxis to prevent urinary tract infection and sepsis is low-quality.

**Final recommendation: cefazolin 2 g IV x 1 dose pre-op or ceftriaxone 1 g IV x 1 dose pre-op or gentamicin 1.5 mg/kg IV x 1 dose pre-op.**

*References: EAU Guidelines on Urological Infections (2022): [hyperlink](#); AUA – Best practice policy statement on urological procedures and antimicrobial prophylaxis (2019): [hyperlink](#)*

- Radical cystectomy with ileal conduit –cefazolin ± metronidazole. The 2019 AUA guidelines recommend cefazolin prophylaxis for cystectomy involving small bowel conduit but list alternative therapy with clindamycin + an aminoglycoside, amoxicillin-clavulanate + metronidazole suggesting need for anaerobic coverage. The 2021 Australian guidelines recommend cefazolin plus metronidazole for open or laproscopic procedures that entry the bowel lumen (like ileal conduit).

**Final recommendation: Pre-op cefazolin 2 g IV + metronidazole 500 mg IV.**

*References: South Australia Expert Advisory Group on Antimicrobial Resistance (SAAGAR)(July 12, 2021). Surgical Antimicrobial Prophylaxis Clinical Guideline. Version No. 3.0. Government of South Australia. Found at: [hyperlink](#); AUA – Best practice policy statement on urological procedures and antimicrobial prophylaxis (2019): [hyperlink](#)*

- Radical prostatectomy and cefazolin prophylaxis + metronidazole antibiotic prophylaxis? – The 2019 AUA guidelines recommend cefazolin, co-trimoxazole, or an aminoglycoside +metronidazole or clindamycin to cover the most common pathogens associated with post-op infections: *E. coli* (mostly), *Proteus spp.*, *Klebsiella spp.*, and *Enterococcus* (possibly). As this procedure does not enter the bowel, anaerobic coverage appears unnecessary.

**Final recommendation: cefazolin 2 g IV x 1 dose pre-op.**

*Reference: AUA – Best practice policy statement on urological procedures and antimicrobial prophylaxis (2019): [hyperlink](#)*

- Nephrostomy tube insertions – oral options for interventional radiology use – The IR Interventional Radiology guidelines recommends antibiotic prophylaxis directed against urinary pathogens like *E. coli*, *Klebsiella spp.*, *Proteus spp.* and *Enterococcus spp.* Oral amoxicillin-clavulanate does not adequate pharmacodynamic parameters / exposure to cover the usual Gram negative pathogens. Parenteral agents are listed as well as they are mentioned in the guideline (e.g. ceftriaxone, gentamicin) but as noted, IR is unlikely able to administer IV antibiotics although IM administration is also an option.

**Final Recommendation: Use ciprofloxacin PO or co-trimoxazole.**

*Reference: J Vasc Interv Radiol 2018; 29: 1483-1501*

- Nephrostomy tube exchanges – low risk – no prophylaxis required – While antibiotic prophylaxis is recommended for nephrostomy tube exchanges in high-risk patients, interventional radiology guidelines state that routine tube changes in low risk patients do not require antibiotic prophylaxis.

**Final recommendation: add nephrostomy tube changes – low risk patients – prophylaxis not routinely indicated (for clarity).**

*Reference: J Vasc Interv Radiol 2018; 29: 1483-1501*

- Suprapubic tube insertion – antibiotic prophylaxis if risk factors for infection like urethral catheter in situ and probable bacterial colonization – The 2020 British Association of Urological Surgeons suprapubic catheter practice guidelines indicated that although not routinely required, antibiotic prophylaxis should be considered in patients with potential colonization (recent UTI or instrumentation such as multiple failed catheter attempts) or comorbidities that would increase infection risk.

**Final recommendation: Add new section for suprapubic catheter insertion with risk factors for infection: recent UTI, urethral catheter, recent instrumentation, multiple failed catheter attempts- cefazolin 2 g IV x 1 dose pre-op.**

*Reference: BJU Int 2020; 126: 416-422*

- Scrotal surgery (epididymal cyst excision, inguinal orchiectomy, hydrocele repair) and penile surgery (circumcision, dorsal slit, penile biopsy) – cefazolin prophylaxis in all cases? –For penile surgery, the 2019 AUA best practice policy statement and S. Australia guidelines recommend no antibiotic prophylaxis. However, for inguinal and scrotal surgery (e.g. vasectomy, reversals, varicocelectomy, hydrocelectomy), the guidelines differ, with the AUA recommending cefazolin and the S. Australia guidelines recommending no antibiotic prophylaxis (for open or laparoscopic procedures when the urinary tract is not entered, such as scrotal surgery).

**Final recommendation: Penile surgery – no routine antibiotic prophylaxis; Scrotal surgery: cefazolin 2 g IV x 1 dose pre-op.**

Reference: AUA – Best practice policy statement on urological procedures and antimicrobial prophylaxis (2019): [hyperlink](#); South Australia Expert Advisory Group on Antimicrobial Resistance (SAAGAR)(July 12, 2021). Surgical Antimicrobial Prophylaxis Clinical Guideline. Version No. 3.0. Government of South Australia. Found at: [hyperlink](#);

- Penile implant surgical prophylaxis – include MRSA coverage option? For implanted prosthetic devices (penile implants, artificial urinary sphincters, sacral neuromodulators), the AUA guidelines recommend an aminoglycoside plus 1<sup>st</sup> or 2<sup>nd</sup> generation cephalosporin or vancomycin (not routine).

**Final recommendation: gentamicin or tobramycin 4.5 mg/kg IV + cefazolin 2 g IV pre-op; Add vancomycin 15 mg/kg if MRSA colonization or past infection.**

Reference: AUA – Best practice policy statement on urological procedures and antimicrobial prophylaxis (2019): [hyperlink](#)

- Open or laparoscopic procedures with entry into the vagina- need for anaerobic coverage? The 2017 AUA guidelines recommend use of 2<sup>nd</sup> generation cephalosporins such as cefoxitin to provide better anaerobic coverage than cefazolin but indicate that cefazolin is equivalent coverage for vaginal anaerobes in sling procedures. Cefoxitin has lost predictable activity against anaerobic Gram negative bacilli, *S. aureus* and Gram negative bacilli like *E. coli*. Therefore, to achieve good activity against potential pathogens such as *S. aureus*, streptococci and vaginal anaerobes, cefazolin + metronidazole is recommended. This is consistent with gynecological procedures that involve entry into the vagina.

**Final recommendation: cefazolin 2 g + metronidazole 500 mg IV pre-op.**

Reference: AUA – Best practice policy statement on urological procedures and antimicrobial prophylaxis (2019): [hyperlink](#)

- Cystoscopy with risk factors or cystourethroscopy with manipulation, break in mucosal barrier, dilatation, biopsy, fulguration, resection or urethral instrumentation and enhanced Gram-negative or ESBL *E. coli* or enterococcal – The 2017 AUA guidelines recommend trimethoprim-sulfamethoxazole, amoxicillin-clavulanate, 1<sup>st</sup> or 2<sup>nd</sup> generation cephalosporins + an aminoglycoside ± ampicillin to cover potential urinary pathogens such as such as *E. coli*, *Proteus spp.*, *Klebsiella spp.* and *Enterococcus spp.* Although amoxicillin-clavulanate would cover enterococci, it is not recommended because of unreliable Gram-negative pathogen coverage. The S. Australian guidelines recommend cefazolin plus gentamicin for open or laparoscopic procedures in which entry into the bowel lumen is not expected, which would include cystoscopy.

**Final recommendation: cefazolin 2 g IV plus gentamicin 1.5 mg/kg IV pre-op.**

Reference: South Australia Expert Advisory Group on Antimicrobial Resistance (SAAGAR)(July 12, 2021). Surgical Antimicrobial Prophylaxis Clinical Guideline. Version No. 3.0. Government of South Australia. Found at: [hyperlink](#)



- There is a paucity of evidence supporting antibiotic prophylaxis for cystourethoscopy with manipulation etc. leading the AUA guideline to state that need for antibiotic prophylaxis is uncertain. The degree of manipulation, patient risk factors for infection and prior antibiotic exposure selection for resistant organisms should be considered in selection of antibiotic prophylaxis on a case-by-case basis.

**Final recommendation: Cefazolin 2 g, ceftriaxone 1 g, or gentamicin 4.5 mg/kg IV pre-op.**

*Reference: AUA – Best practice policy statement on urological procedures and antimicrobial prophylaxis (2019): [hyperlink](#)*

- Methicillin-resistant *S. aureus* (MRSA) risk and antibiotic prophylaxis – The General Principles section – 7. Previous MRSA infection or colonization recommend addition of vancomycin 15 mg/kg IV x 1 dose pre-op. The 2013 ASHP guidelines state that routine vancomycin prophylaxis is not recommended but may be considered when a cluster of MRSA cases is detected or in patients with known MRSA colonization or high risk of MRSA colonization in the absence of surveillance data (e.g. recent hospitalization, hemodialysis patients, nursing home residents). Data also suggests that vancomycin alone is inferior to cefazolin to prevent infections caused by MSSA. Therefore, vancomycin is often used in combination with cefazolin to prevent both MSSA and MRSA infection in high risk patients.

**Final Recommendation: Vancomycin prophylaxis is a top consideration when *S. aureus* surgical site infections are prominent such as in cardiac and orthopedic surgeries and surgeries involving medical devices.**

*Reference: Am J Health-Syst Pharm 2013; 70: 195-283*

- Fluoroquinolone (FQ) use and risk of serious adverse reactions – We noted the EAU guidelines provide alternative recommendations for jurisdictions where FQ are no longer licenced. The relationship between serious musculoskeletal (tendon rupture), neurological, cardiovascular, metabolic adverse reactions and FQ exposure associated with antibiotic prophylaxis has not been well studied. We found 1 case-controlled study that explored various degrees FQ exposure and risk of tendon rupture indirectly suggesting the risk associated with FQ antibiotic prophylaxis dosing is low.
- In this 2003 UK case-controlled study, FQ exposure described using the defined daily dose (DDD) illustrated a DDD of 0.01-0.75 DDD (as would be associated with ciprofloxacin 500 mg po x 1 dose pre-op equal to 0.5 DDD) was not statistically more likely to result in Achilles-tendon rupture compared to controls (OR 1.7, 95% CI 0.7-4.1) but was more likely to occur with higher doses and longer treatment regimens. For example, >1.25 DDD was associated with a 12.5 times greater odds of developing Achilles-tendon rupture compared to controls (OR 12.5, 95% CI 2.3-68.3). Therefore, there would be increased risk of tendon rupture if post-op ciprofloxacin is given, which is not recommended by any international guideline. Similar evidence for other serious FQ adverse effects was not found.

**Opinion (PACE consensus): While PACE advocates avoidance of unnecessary FQ use minimize serious adverse effects and resistance, we could not find sufficient evidence that a single prophylactic dose of ciprofloxacin 500 mg PO was associated with development of serious adverse effects.**

*Reference: Arch Intern Med 2003; 163: 1803-1807*

- Shock wave lithotripsy and risk factors should include presence of a nephrostomy tube?  
**Final recommendation: Nephrostomy now added to the risk factors necessitating antibiotic prophylaxis for shock wave lithotripsy [based on local research]**
- Transperineal prostate biopsy and need for antibiotic prophylaxis?  
**Final recommendations: For transperineal biopsy, evidence suggests that antibiotic prophylaxis is not needed.**  
*Lancet Infect Dis 2022; 22: 1465-1471*