

DISCLAIMER: These guidelines were prepared by the Department of Surgical Education, Orlando Regional Medical Center. They are intended to serve as a general statement regarding appropriate patient care practices based upon the available medical literature and clinical expertise at the time of development. They should not be considered to be accepted protocol or policy, nor are intended to replace clinical judgment or dictate care of individual patients.

# ANTIBIOTIC PROPHYLAXIS IN SURGERY

## SUMMARY

Antimicrobial prophylaxis is used to reduce the incidence of postoperative wound infections. Patients undergoing procedures associated with high infection rates, those involving implantation of prosthetic material, and those in which the consequences of infection are serious should receive perioperative antibiotics. Treatment, rather than prophylaxis, is indicated for procedures associated with obvious preexisting infection (i.e. abscess, pus, or necrotic tissue). Cephalosporins (such as cefazolin) are appropriate first line agents for most surgical procedures, targeting the most likely organisms while avoiding broad-spectrum antimicrobial therapy that may lead to the development of antimicrobial resistance. Duration of prophylaxis should not exceed 24 hours.

## RECOMMENDATIONS

- **Level I**
  - A single preoperative dose of antibiotic is as effective as a full 5-day course of therapy assuming an uncomplicated procedure.
  - Prophylactic antibiotics should be administered within 1 hour prior to incision.
  - Complicated, contaminated, or dirty procedures should receive additional postoperative coverage.
- **Level II**
  - Prophylactic antibiotics should target the anticipated organisms.
  - For the majority of procedures, prophylaxis should not exceed 24 hours.
  - Prophylaxis is unnecessary if the patient is already receiving antibiotics that cover likely pathogens.
  - The timing of antibiotic administration should be adjusted to maximize prophylactic efficacy.
  - During prolonged procedures, antibiotic prophylaxis should be readministered every 3 hours (with the exception of vancomycin, aminoglycosides, and fluoroquinolones).
- **Level III**
  - None

## INTRODUCTION

Surgical site infections (SSI's) account for approximately 15% of nosocomial infections and are associated with prolonged hospital stays and increased costs. Infection develops when endogenous flora are translocated to a normally sterile site. Seeding of the operative site from a distant site of infection can also occur (especially in patients with a prosthesis or other implant). Factors influencing the development of SSI's include bacterial inoculum and virulence, host defenses, perioperative care, and intraoperative management. Unfortunately, an increasing number of resistant pathogens, such as methicillin-resistant *Staphylococcus aureus* (MRSA) and *Candida* species, are commonly implicated in surgical wound infections. For patients who have demonstrated recent infection with MRSA or vancomycin-resistant

## EVIDENCE DEFINITIONS

- **Class I:** Prospective randomized controlled trial.
- **Class II:** Prospective clinical study or retrospective analysis of reliable data. Includes observational, cohort, prevalence, or case control studies.
- **Class III:** Retrospective study. Includes database or registry reviews, large series of case reports, expert opinion.
- **Technology assessment:** A technology study which does not lend itself to classification in the above-mentioned format. Devices are evaluated in terms of their accuracy, reliability, therapeutic potential, or cost effectiveness.

## LEVEL OF RECOMMENDATION DEFINITIONS

- **Level 1:** Convincingly justifiable based on available scientific information alone. Usually based on Class I data or strong Class II evidence if randomized testing is inappropriate. Conversely, low quality or contradictory Class I data may be insufficient to support a Level I recommendation.
- **Level 2:** Reasonably justifiable based on available scientific evidence and strongly supported by expert opinion. Usually supported by Class II data or a preponderance of Class III evidence.
- **Level 3:** Supported by available data, but scientific evidence is lacking. Generally supported by Class III data. Useful for educational purposes and in guiding future clinical research.

*Enterococcus* (VRE), prophylaxis with vancomycin, linezolid (Zyvox®), or quinupristin/dalfopristin (Synercid®) should be considered.

The goal of prophylactic antibiotics is to reduce the incidence of postoperative wound infection. It is important to recognize the difference between *prophylactic* and *empiric* therapy. *Prophylaxis* is indicated for procedures associated with high infection rates, those involving implantation of prosthetic material, and those in which the consequences of infection are serious. The antibiotic should cover the most likely contaminating organisms and be present in the tissues when the initial incision is made. Therapeutic concentrations should be maintained throughout the procedure. *Empiric* therapy is the continued use of antibiotics after the operative procedure based upon the intra-operative findings. Empiric antibiotic therapy is addressed in a separate guideline. Inappropriate prophylaxis is characterized by unnecessary use of broad-spectrum agents and continuation of therapy beyond the recommended time period. These practices increase the risk of adverse effects and promote the emergence of resistant organisms.

The traumatically injured patient represents a population in which antibiotics cannot be given before bacterial contamination occurs. An important principle of antibiotic prophylaxis is violated, raising the issue of whether or not antimicrobial administration in these patients truly represents prophylaxis. As a result, both short and long-term regimens have been advocated. Numerous studies have been conducted to identify the optimal duration of therapy in this population.

In December 2005, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and the Centers for Medicaid and Medicare Services (CMS) mandated reporting of the following performance measures on a monthly basis. Compliance with reporting these performance measures is directly linked to CMS reimbursement. A hospital that does not report monthly and has no action plan for improvement will have a 3% cut in reimbursement. Additionally, JCAHO uses the data to benchmark compliance with national standards. The information is also reported publicly on the Florida Agency for Healthcare Administration (AHCA) website ([www.floridacomparecare.gov](http://www.floridacomparecare.gov)). The performance measures currently mandated are as follows:

1. Prophylactic antibiotics must be administered to the patient within 1 hour prior to surgical incision.
2. Prophylactic antibiotics must be discontinued within 24 hours from the end of surgery.

The procedures included in the CMS standards included coronary artery bypass grafting (CABG), cardiac surgery, hip arthroplasty, knee arthroplasty, colon surgery, hysterectomy, and vascular surgery. Patients who have a documented infection at the time of surgery or within 48 hours post-operatively are excluded from the 24 hour rule. Additionally, post-cardiothoracic surgery patients are allowed up to 48 hours of post-operative antibiotic therapy (5-7).

## LITERATURE REVIEW

Several studies have been performed investigating the utility of prophylactic antibiotics in surgery. A wide variety of antibiotics, either singly or in combination, have been evaluated. With regards to surgical prophylaxis, the data from these studies support several recurring themes:

- A single preoperative dose of antibiotic is as effective as a 5-day course of postoperative therapy assuming an uncomplicated procedure (1, 2, 9-11)
- Prophylactic antibiotics should target the anticipated organisms (1, 2, 11).
- Complicated, contaminated, or dirty procedures should receive additional postoperative coverage (1, 2, 5, 9-11, 22).
- During prolonged procedures, antibiotic prophylaxis should be readministered every 3 hours (1-5).
- Prophylactic antibiotics should be administered within 1 hour prior to incision (1-7).

The chart below summarizes the recommendations of several prospective, randomized controlled studies as well as several systematic literature reviews addressing the use of prophylactic antibiotics in various surgical procedures (8-25)

Procedure	Likely Pathogen(s)	Recommended Drug <sup>a</sup>	Alternative Regimen <sup>d</sup>
<b>Cardiothoracic</b>	<i>Staph epi, Staph aureus, Streptococcus, Corynebacteria</i> , enteric-Gram-negative bacilli	Cefazolin	Clindamycin
<b>General Surgery</b>			
• Appendectomy (non-perforated)	Enteric Gram(-) bacilli	Cefazolin + Metronidazole <sup>b</sup>	Clindamycin + Aminoglycoside
• Colorectal Surgery	Enteric Gram(-) bacilli, <i>Enterococcus</i> , anaerobes	Cefazolin + Metronidazole <sup>b</sup>	Clindamycin + Aminoglycoside
• High-risk esophageal <sup>c</sup> , gastroduodenal, or biliary surgery <sup>3</sup>	Enteric Gram(-) bacilli, Gram(+) cocci	Cefazolin	Clindamycin + Aminoglycoside
• Penetrating abdominal trauma	Enteric Gram(-) bacilli, <i>Enterococcus</i> , anaerobes	Cefazolin + Metronidazole <sup>b</sup>	Clindamycin + Aminoglycoside
<b>Gynecologic Surgery</b>			Clindamycin + Aminoglycoside
• C-section (after cord-clamping)	<i>Staph epi, Staph aureus, Group B Strep, Enterococcus</i>	Cefazolin	Clindamycin + Aminoglycoside
• Hysterectomy	Enteric Gram(-) bacilli, Group B <i>Strep, Enterococcus</i>	Cefazolin	Clindamycin + Aminoglycoside
<b>Head and Neck Surgery</b>	Anaerobes, <i>Staph aureus</i> , Gram(-) bacilli	Clindamycin	Cefazolin + Metronidazole
<b>Neurosurgery</b>			
• Clean	<i>Staph aureus, Staph epi</i>	Cefazolin	Clindamycin
• Skull fracture, CSF leak	Anaerobes, <i>Staph epi, Staph aureus</i>	Cefazolin	Clindamycin
• Penetrating trauma	<i>Staph, strep</i> , Gram(-) bacilli, anaerobes	Ceftriaxone, Clindamycin	N/A
• Spine	<i>Staph aureus, Staph epi</i>	Cefazolin	Clindamycin
<b>Orthopedic Surgery</b>			
• Closed fracture	<i>Staph epi, Staph aureus</i>	Cefazolin	Clindamycin
• Open fracture	<i>Staph, strep</i> , Gram(-) bacilli, anaerobes	Cefazolin + Gentamicin	Clindamycin + Gentamicin
<b>Urologic Surgery</b>			
• Genitourinary (high risk only) <sup>e</sup>	Gram(-) bacilli, <i>Enterococcus</i>	Cefazolin	Ciprofloxacin
<b>Vascular Surgery</b>	<i>Staph epi, Staph aureus</i> , Gram(-) bacilli, <i>Enterococcus</i>	Cefazolin	Clindamycin

<sup>a</sup> Administered as a single preoperative dose. Readminister every 3 hours during the procedure.

<sup>b</sup> Due to the national shortage of cefotetan, the combination of cefazolin + metronidazole is currently the preferred regimen.

<sup>c</sup> High-risk patients include those with: age > 70 years, acute cholecystitis, nonfunctioning gallbladder, obstructive jaundice, common bile duct stones, morbid obesity, esophageal obstruction, decreased gastric acidity or motility.

<sup>d</sup> Clindamycin or vancomycin may be used in patients with documented penicillin or cephalosporin allergies..

<sup>e</sup> Genitourinary High Risk Criteria: positive urine culture (or unavailable urine culture), preoperative urinary catheter, and/or transrectal prostatic biopsy.

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