ANTIMICROBIAL PROPHYLAXIS IN ELECTIVE SURGERY

The contents of this clinical practice guideline are to be used as a guide. Healthcare professionals should use sound clinical judgement and individualize patient care. This CPG is not meant to be a replacement for training, experience, CME or studying the latest literature and drug information.

Key principles:

1) **ADEQUATE TISSUE CONCENTRATION**: The concentration of the antimicrobial agent must stay above the minimal inhibitory concentration (MIC) of common flora during the **entire procedure**. This means the antimicrobial may need to be re-administered during prolonged procedures. Obese patients may require a higher dose (See dosing guidelines).

2) **RIGHT DRUG**: The antimicrobial must target the flora at the surgical site, penetrate the surgical site, and achieve minimal adverse events.

3) **RIGHT TIME**: the antimicrobial should be administered within 1 hour prior to the incision to allow penetration into tissues.

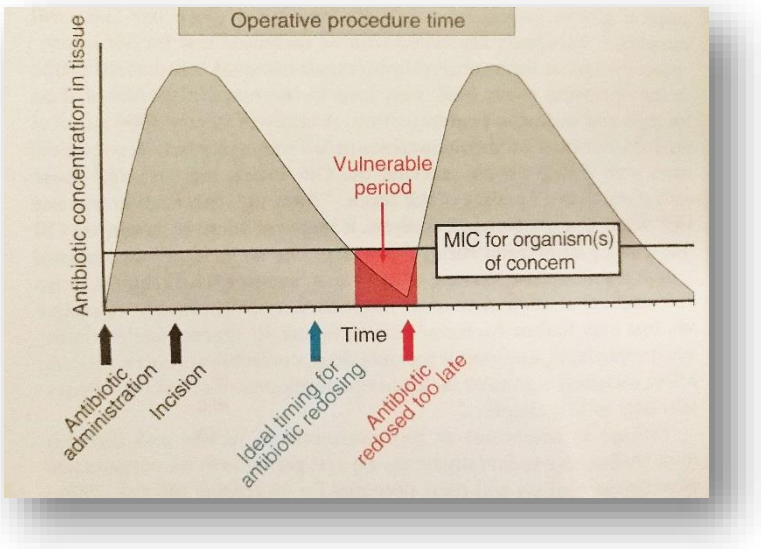
4) **RIGHT DURATION**: Once the incision is closed or by 24 hours at the latest, the antimicrobial therapy must be stopped.

5) Prophylaxis that targets resistant organisms may be warranted in select situations such as patients having a history of infection or colonization by those organisms. In patients with known MRSA colonization, vancomycin should be considered the appropriate antimicrobial.

6) If the patient is already on antibiotics, giving an extra dose prior to the incision might be necessary. If the current regimen does not target the flora at the surgical site, a dose of an appropriate agent needs to be given.

7) Adherence to key principles of antimicrobial prophylaxis is used to assess overall quality of care and reimbursement from third-party payers.

Figure 1: Tissue antibiotic concentration over time



After an initial dose of antibiotic, tissue concentrations reach a peak rapidly, with a subsequent decline overtime. As illustrated, the goal of antibiotic prophylaxis is to have tissue concentration above the minimal inhibitory concentration (MIC) for the specific pathogens of concern at the time of the incision and throughout the procedure. Antibiotics should be redosed in prolonged procedures to prevent a period with tissue levels below the MIC blue arrow). Failure to redose antibiotic appropriately (red arrow) may result in a period during which the wound is vulnerable.

TYPICAL MICROBIOLOGIC FLORA & RECOMMENDED ANTIMICROBIAL DRUGS FOR SURGICAL PROPHYLAXIS

SURGICAL PROCEDURE	TYPICAL MICROBIOLOGIC FLORA[a]	RECOMMENDED ANTIMICROBIAL[b]	ALTERNATIVE REGIMEN
ORTHOPEDIC SURGERY	S. aureus, Coagulase-negative Staph	Cefazolin	Vancomycin or Clindamycin
NEUROSURGERY	S. aureus, Coagulase-negative Staph	Cefazolin	Vancomycin or Clindamycin
BARIATRIC SURGERY[c]	S. aureus, Coagulase-negative Staph, Enteric gram-negative bacilli, Streptococci	Cefazolin	Vancomycin + Aztreonam
COLORECTAL SURGERY	Enteric gram-negative bacilli, Anaerobes (especially Bacteroides fragilis), Enterococci, S. aureus, Coagulase-negative Staph	**DAY PRIOR :** Erythromycin & Neomycin @1PM, 2 PM & 11PM **DAY OF SURGERY :** 1st choice: Cefoxitin 2nd choice: Ceftriazone + Metronidazole (better coverage of enteric gram (-) bacilli and anaerobic and less redosing requirement) 3rd choice: Ertapenem *(restricted to patient with history of ESBL/increases risk of C. difficile)*	**DAY PRIOR :** Erythromycin & Neomycin @1PM, 2 PM & 11PM **DAY OF SURGERY :** Levofloxacin + Metronidazole
GYNECOLOGIC SURGERY: C-SECTION	S. aureus, Coagulase-negative Staph, Group B Strep, Enterococcus	Cefazolin	Clindamycin + Gentamicin
GYNECOLOGIC SURGERY: HYSTERECTOMY	S. aureus, Coagulase-negative Staph, Group B Strep, Enterococcus, Vaginal anaerobes	Cefazolin or Cefoxitin	Clindamycin + Gentamicin
THORACIC (NON-CARDIAC)	S. aureus, Coagulase-negative Staph	Cefazolin	Vancomycin or Clindamycin
UROLOGIC SURGERY (HIGH RISK ONLY)	Gram-negative bacilli Enterococcus (rarely)	Ciprofloxacin[d]	Ciprofloxacin
BILIARY TRACT[e] Open & Laparoscopic (high risk) **procedure:**	Gram-negative bacilli (less commonly Anaerobes and Enterococci)	Cefazolin or Cefoxitin	Clindamycin + Gentamicin
APPENDECTOMY (uncomplicated appendicitis)	S. aureus, Coagulase-negative Staph, Gram-negative bacilli, Anaerobes	Cefoxitin	Levofloxacin + Metronidazole
VASCULAR	S. aureus, Coagulase-negative Staph	Cefazolin	Vancomycin or Clindamycin

a. *Staphylocci will be associated with surgical site infections after all types of surgery.*
b. *For patients known to be colonized with MRSA, it is reasonable to add a single preoperative dose of vancomycin to the recommended agent.*
c. *Patient with increased gastric pH are at a higher risk of postoperative gastroduodenal infections (i.e. those receiving histamine H_2- receptor antagonists, or proton pump inhibitors).*
d. *Due to increased resistance of Escherichia coli to fluoroquinolones, local population profile should be reviewed prior to use (i.e. patients with history of fluoroquinolone resistant E. coli infections).*
e. *Additional antimicrobial coverage might be necessary with infected biliary tract.*

Recommended Doses & Dosing Intervals for Commonly Used Antibiotics

ANTIMICROBIAL (intravenous)	RECOMMENDED DOSE FOR ADULTS	RECOMMENDED REDOSING INTERVAL
Ampicillin-sulbactam	3 g	2 hours
Aztreonam	2 g	4 hours
Cefazolin	2 g for weight < 120 kg 3 g for weight ≥ 120 kg	4 hours
Cefoxitin	2 g	2 hours
Ceftriaxone	2 g	N/A
Ciprofloxacin	400 mg	N/A
Clindamycin	900 mg	6 hours
Ertapenem	1 g	N/A
Gentamicin	5 mg/kg *(not indicated if CrCl <20 mL/min)*	N/A
Levofloxacin	750 mg	N/A
Metronidazole	500 mg	N/A
Piperacillin-tazobactam	4.5 g	2 hours
Vancomycin	15 mg/kg	N/A
ANTIMICROBIAL (oral)		
Erythromycin base	1 g	Given the day prior (3 doses)
Neomycin	1 g	Given the day prior (3 doses)

References:

Mandell, Douglas and Bennett's Principles and practice of Infectious diseases (eighth Edition).

Clinical practice guideline for antimicrobial prophylaxis in surgery. (American journal of health-system pharmacy; 2013; 70: 195-283).(available on IDSA website)

These guidelines were developed jointly by the American Society of Health-System Pharmacists (ASHP), the Infectious Diseases Society of America (IDSA), the Surgical Infection Society (SIS), and the Society for Healthcare Epidemiology of America (SHEA).

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