



2009 EMRA
ANTIBIOTIC GUIDE

Brian J. Levine, MD
Editor-in-Chief
*Christiana Care Health System
Department of Emergency Medicine*

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330.493.4443 Fax 330.493.8677

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GUIDE**

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Michele Byers, CAE

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Publications/Events Coordinator

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This handbook is intended as a general guide to therapy only. While the editors have taken reasonable measures to ensure the accuracy of drug and dosing information used in this guide, the user is encouraged to consult other resources or consultants when necessary to confirm appropriate therapy, side effects, interactions, and contraindications. The publisher, authors, editors, and sponsoring organizations specifically disclaim any liability for any omissions or errors found in this handbook, for appropriate use, or treatment errors. Furthermore, although this handbook is as comprehensive as possible, the vast differences in emergency practice settings may necessitate treatment approaches other than presented here.

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1125 Executive Circle, Irving, TX 75038-2522

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2009 EMRA ANTIBIOTIC GUIDE

Editor-in-Chief

Brian J. Levine, MD
Associate Program Director
Emergency Medicine Residency Program
Department of Emergency Medicine
Christiana Care Health System
Newark, DE
Assistant Professor of Emergency Medicine
Jefferson Medical College
Philadelphia, PA

Senior Editors

Christian Coletti, MD
Heather Farley, MD
Jonna Gies, MD
Neil Jasani, MD
Matthew Judd, DO
Jason Nomura, MD
Michael Perraut, MD
Department of Emergency Medicine
Christiana Care Health System
Newark, DE

William Paynter, PA-C, MPAS
Clinical Assistant Professor,
Physician Assistant Program
Drexel University, Philadelphia, PA
Clinical Coordinator, Physician Assistant Students
Department of Emergency Medicine
Christiana Care Health System

Authors

Faculty and Residents
Department of Emergency Medicine
Christiana Care Health System
Newark, DE

Foreword

It is a pleasure to provide you with the 2009 *EMRA Antibiotic Guide*. In 2003, Christiana Care's emergency medicine residency program was fortunate to have Angela Siler-Fisher, MD as the EMRA president. Through her insistence and perseverance, we submitted our first proposal for the guide. We were delighted to be accepted on our second attempt in 2005. We were equally as excited to be chosen to provide this edition.

Our goal, established with the 2007 guide was to provide a handbook that is the easiest, quickest, most frequently utilized reference in the Emergency Department (ED). Based on extensive reader feedback, we wanted to enhance the content and ease even further. We continued with the simplified format and content of the book in order to maximize its utility in the fast-paced ED environment.

This endeavor was a year-long process involving the entire emergency medicine residency program at Christiana Care Health System. Each resident was assigned to author a chapter or two which was then edited by our faculty attendings. This book would not have been possible without each physician's input.

The EMRA Antibiotic Guide is designed to be a quick reference guide to antibiotic use only, not a text on the diagnosis or comprehensive treatment of disease. The contents will be organized alphabetically by organ system, followed by sections on "Special Topics" to make reference quick and easy for a particular disease process. Each organ system and special topic section will be color coded (similar to the format in the 2007 edition).

Given the current Joint Commission recommendations to avoid medical errors, we have taken this one step further. Abbreviations have been eliminated where possible. For example, you will see "two times daily" as opposed to BID. We have also attempted to simplify the sometimes complicated pediatric dosing. Whenever possible, you will see the *individual* dosing for each medication which has a pediatric indication.

An antibiogram is included as an appendix for reference. This chart will contain a listing of all antibiotics from the book and the susceptibility of common organisms to each. In the current climate of increasing antibiotic resistance, this section will enable users to better tailor drug choices to target organisms. Residents will find this resource as valuable as the chapters themselves, but we caution that one should always consult local resistance data and this guide is not a substitute for such.

We are in an era where the organisms are gaining resistance faster than humans can develop antibiotics. One such organism, CA-MRSA (Community Associated – Methicillin Resistant *Staphylococcus Aureus*) has altered our prescribing practice. We have addressed this issue, when necessary, to hopefully avoid treatment failures and provide the narrowest of spectrum possible.

The medications listing in this handbook are highly dependent on the editors' choices and may differ based on practice location. There may be other medications possible for individual indications that have been omitted. In cases where there are multiple antibiotic choices, we have chosen those that have the most data on efficacy or were least expensive. If the antibiotic choices were all considered equivalent, they were simply alphabetized. We have made every attempt to use specialty guidelines and peer-reviewed publications for each indication. It should be noted that this guide does not necessarily adhere to FDA labeled indications in all cases. The mere fact that an organism is "susceptible" *in vitro* to a particular drug (or resistance – see amoxicillin in otitis) does not necessarily mean one should or should not use it. It is our goal that every medication and dosage is as accurate as possible and we have made every attempt to avoid typographical errors (although they may occur). Patient condition should be taken into account with each antimicrobial prescribed. Alterations in dosing may be required for patients with renal or hepatic dysfunction.

We hope you find this guide helpful in the care of your patients during your daily practice. We want to regain the wonder of "how did I survive a shift without this reference in my pocket."

Brian J. Levine, MD

Acknowledgements

The first edition of this book was conceived and edited by James D. Woodburn, MD, MS, and was published in cooperation with the Society of Academic Emergency Medicine (SAEM) in 1989-1990, under the title *EMRA Guide to Antibiotic Use in the Emergency Department*. The second edition, also published with the assistance of SAEM, was edited by Janet Williams, MD, and was published in 1991-1992.

The third edition in 1996 marked a turning point for this guide. James H. Bryan, MD, PhD, assumed the editorship. Dr. Bryan doubled the content of the book, changed the format, and took on the job of producing yearly updates to the text. Dr. Bryan remained an editor of this guide until the 2003 edition. His volunteer commitment to EMRA and this guide are unparalleled. Two others were integral to the editions edited by Dr. Bryan – Jon Jui, MD, MPH, and Barbara Bryan, PhD.

In addition, Greg Henry, MD, generously assisted in reviewing the first five editions of the book, and Kenneth Dirk, MD provided invaluable assistance with the major rewrites of the fourth, fifth, and sixth editions.

EMRA also thanks the many residents and faculty who have provided comments, criticisms, and suggestions for this guide. Special thanks to John Powers, MD, an infectious disease specialist teaching and practicing in Baltimore, Maryland for his peer-review for this edition. Also, special thanks to Sherrill Mullenix, Executive Assistant, Department of Emergency Medicine, Christiana Care Health System, for her invaluable assistance in the coordination and support. Ms. Mullenix has personally committed countless hours of review and coordination toward making this edition a success. Without Ms. Mullenix, this book would have been impossible to complete.

Contributors

All contributors are affiliated with Christiana Care Health System, Department of Emergency Medicine, Newark, DE, unless noted otherwise.

Editor-in-Chief

Brian J. Levine, MD

Authors

Ketaki Abhyankar, MD

Paul Anderson, MD

*Septic Bursitis
Discitis*

Joseph Ahn, MD

Gillian Baty, MD

*Open Fracture
Osteomyelitis*

Matthew Barrett, DO

Richard Bounds, MD

*Septic Arthritis
Tenosynovitis*

Jeffrey Bell, MD

Michael Breyer, MD

*Bell's Palsy
Encephalitis*

Joshua Canning, MD

Brian Burgess, MD

*Intracranial Abscess
Spinal Epidural Abscess*

Erin Watson, MD

Leo Burns, MD

Endocarditis

Hana Choy, MD

James Carroll, MD

Meningitis

David Cook, MD

Dorothy Dixon, MD

*Acute Necrotizing
Ulcerative Gingivitis
Dental Abscess*

Laura Cook, MD

Andrew Duckworth, PA-C

*Ludwig's Angina
Mastoiditis
Otitis Externa*

Thinesh Danahayake, MD

Brian Duda, PA-C

*Otitis Media
Parotitis/Sialoadenitis*

Julie Fifer, MD

Heather Farley, MD

*Pharyngitis/Tonsillitis
Retropharyngeal Abscess*

Brian Floyd, MD

Eric Felker, PA-C

Cutaneous Abscess

Gregory Frattaroli, MD

Angelo Grillo, MD

*Sinusitis
Thrush*

Elaine Frazier, MD

Brian J. Levine, MD

*Blepharitis
Conjunctivitis
Corneal Abrasion*

Christopher Gentle, MD

Paul Krajewski, PA-C

*Orbital Cellulitis
Periorbital Cellulitis
Appendicitis*

Leila Getto, MD

Anita Hodson, MD

*Cholecystitis/Cholangitis
Diverticulitis/Inflammatory
Bowel Disease*

Jonna Gies, MD

Neil Jasani, MD

Pertussis

Ben Goodgame, MD

Steven Kushner, MD

Infectious Diarrhea

Kanika Gupta, MD

Matthew Hay, PA-C

*Intra-abdominal Abscess
Perforated Viscous*

Blake Gustafson, MD

Patrick Phelan, PA-C

Diabetic Ulcers

Antony Hsu, MD

Andrew Langsam, MD

*Pseudomembranous Colitis
Spontaneous Bacterial
Peritonitis (CAPD)*

Matthew Judd, DO

Christopher Cox, MD

*Balanitis
Bartholin's Cyst/Abscess
Endometritis
Fournier's Gangrene*

Contributors

Erik Kochert, MD
John Madden, MD
HSV
Syphilis

Ann Lagerlund, MD
Patrick Matthews, MD
UTI/Pyelonephritis
Prostatitis

Elizabeth Lee, MD
Jonathan McGhee, DO, MPH
Bronchitis/AECB
Influenza

Maaya Marri, MD
Ross Megargel, DO
Cellulitis/Erysipelas

Jaime Massucci, MD
Christopher Moen, MD
Pneumonia, Adult
Pneumonia, Pediatrics

Nisha Mathew, MD
Christopher Murphy, MD
Felon/Paronychia
Folliculitis
Gas Gangrene

John Mohline, DO
Sunanda Nabha, MD
Impetigo
Mastitis

Justin Morgan, MD
Jason Nace, MD
Tinea Infections
Zoster/Shingles

Joshua Muyderman, MD
Greg Neyman, MD
Anthrax
Yersinia

Jason Nomura, MD
Leonard Nitowski, MD
Small Pox
Botulism

Kathryn Parker, MD
Brent Passarello, MD
Tularemia

Kirti Patel, MD
William Paynter, PA-C
Malaria

Amelia Pousson, MD
Russell Queen, PA-C
Mammalian Bites

Michael Perraut, MD
David Polan, MD
Rabies
Tetanus

John Powell, MD
Gordon Reed, MD
Cervicitis/Urethritis
PID
Epididymitis/Orchitis

Lisa Preston, DO
Gordon Reed, MD
Sexual Assault Prophylaxis
Bacterial Vaginosis
Trichomonas
Candidiasis

Shane Quiterio, MD, MPH
Charles Reese, IV, MD
CMV
Cryptococcus
PCP

Nathan Rhodes, MD
Robert Rosenbaum, MD
Toxoplasmosis
Neutropenic Fever/Infections

James Rowley, MD
Donnica Scott, MD
Occupational Post
Exposures Prophylaxis

Tara Sheets, MD
Timothy Shih, MD
Epiglottitis
Scabies/Mites/Lice

Rattapol Srisinroongruang, MD
Paul Sierzenski, MD, RDMS
Pinworms
Varicella/Chicken Pox

Matthew Stofferahn, MD
Stephen Smenkowski, PA-C
Rocky Mountain Spotted Fever

Julie Sullivan, MD
Ashok Subramanian, MD
Cysticercosis
Ehrlichiosis

Jennifer Terrano, MD
Thomas Sweeney, MD
Lyme

Contributors

De Winter, MD

Eric Adkins, MD

(The Ohio State University)
Sepsis, Adult

Steven Walsh, MD

Eric Adkins, MD

(The Ohio State University)
Sepsis, Pediatric
Sepsis, Neonatal

Banu Tinjum, MD

Joseph Zaweski, PA-C

Antibiotic Cost, Pregnancy
Class, and Metabolism/
Excretion Table

Julia Tiedemann, MD

Susan Thompson, DO

Antibiotic Use during Pregnancy

Stephanie Zarefes, MD

Eli Zeserson, MD

Adverse Reactions and
Drug Interactions

William Vachon, MD

George Zlupko, MD

Cephalosporin Reference

Christian Coletti, MD

Dennis Trigueros, MD

(Univ. of California-Irvine)
Antibiogram

Peer Review

John H. Powers, MD

Infectious Disease

Clinical Assistant Professor of Medicine

George Washington University School of Medicine

Clinical Assistant Professor of Medicine

University of Maryland School of Medicine

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SEPTIC BURSTITIS

Common Organisms: *S. aureus*, *Streptococcus spp.*, *S. epidermidis*

Outpatient

- Dicloxacillin 500mg (5mg/kg) PO four times daily

Inpatient

- Nafcillin/Oxacillin 2g IV six times daily (37mg/kg IV four times daily)

If MRSA Suspected

- Vancomycin 1g IV two times daily (15mg/kg IV four times daily)
- Linezolid 600mg IV two times daily (10mg/kg IV three times daily)

If PCN Allergic

- Clindamycin 450mg PO three times daily or 600-900mg IV three times daily (7.5mg/kg PO/IV four times daily)

PEARLS

- Bursal fluid usually has WBC count of $> 50,000/\text{mm}^3$; low WBC count does not rule out infection
- Higher risk of infection in olecranon and prepatellar bursitis

Bone & Joint

DISCITIS/VERTEBRAL OSTEOMYELITIS

Common Organisms: *S. aureus*, *Streptococcus spp.*, *P. aeruginosa*, *E. coli*, *M. tuberculosis*, and Others

- Vancomycin 1g IV two times daily (15mg/kg IV four times daily) **AND** Nafcillin/Oxacillin 2g (2.5mg/kg) IV six times daily
- If *Pseudomonas* or other gram negative organisms suspected **ADD** Gentamicin 5mg/kg (2.5mg/kg) IV daily

PEARLS

- Risk factors include IVDA, endocarditis, prior spinal surgery, diabetes, corticosteroid therapy
- Fever is an inconsistent finding
- Local tenderness to gentle spinal percussion is the most reliable clinical sign
- ESR elevated >80% of cases
- Culture of blood, bone and/or disc is essential for identification of causative agent
- X-ray often normal, but may show narrowing of disc space and irregularity of adjacent vertebral end-plates
- MRI is the diagnostic imaging modality of choice

OPEN FRACTURES

Common Organisms: *S. aureus*, *S. epidermidis*, *Polymicrobial*

Open Fracture

- Cefazolin 2g (30mg/kg) IV three times daily
- Vancomycin 1g IV two times daily (15mg/kg IV four times daily)
- Clindamycin 600mg (10mg/kg) IV four times daily
- Gentamicin 5mg/kg IV once daily (suspect contaminated wounds)
- If concern for *clostridia* due to farm injury, soil contamination, or vascular injury, **ADD**
 - Penicillin G 4 million units IV six times daily (100,000 units/kg IV four times daily)**OR**
 - Clindamycin 600mg (10mg/kg) IV four times daily **OR**
 - Piperacillin/Tazobactam 4.5g IV three times daily for monotherapy (100mg/kg IV four times daily)

PEARLS

- Administer antibiotics as soon as possible post-injury
- Address tetanus status
- Grade I – open fracture with <1cm clean laceration and minimal soft tissue damage
- Grade II – open fracture with >1cm clean laceration without extensive soft tissue injury, flaps, or avulsion
- Grade III – open fracture with extensive soft tissue damage including muscle, skin, and neurovascular structures; with periosteal stripping, or with arterial injury that requires repair

OSTEOMYELITIS

Adult: Hematogenous Spread

Common Organisms: *Staphylococcus spp.*, *Streptococcus spp.*; *P. aeruginosa* in IVDA, Gram Negative Species

- Nafcillin/Oxacillin 2g IV six times daily **PLUS**
 - If MRSA suspected, Vancomycin 1g IV two times daily
 - If gram negative rods suspected, Ceftriaxone 2g IV once daily
 - If pseudomonas suspected, Cefepime 2g IV two times daily

Adult: Sickle Cell Disease

Common Organisms: *S. aureus*, *Salmonella*, Gram Negative Species

- Vancomycin 1g IV two times daily **PLUS**
 - Ciprofloxacin 400mg IV or 750mg PO two times daily **OR**
 - Levofloxacin 750mg IV/PO once daily

Adult: Diabetes Mellitus or Vascular Insufficiency

Common Organisms: Polymicrobial

- Vancomycin 1g IV two times daily **OR** Linezolid 600mg IV two times daily **PLUS**
 - Piperacillin/Tazobactam 4.5g IV three times daily **OR**
 - Levofloxacin 750mg IV once daily **AND** Metronidazole 500mg IV four times daily

Adult: Puncture Wound (nail through shoe)

Common Organisms: *P. aeruginosa*

- Ciprofloxacin 400mg IV or 750mg PO two times daily
- Levofloxacin 750mg IV/PO once daily
- Cefepime 2g IV two times daily
- Ceftazidime 1g IV three times daily

Pediatric: Neonate

Common Organisms: *S. aureus*, *Streptococcus spp.* (Predominately Group B), Gram Negative Species

- Cefotaxime 50mg/kg IV three times daily **AND** Nafcillin/Oxacillin 50mg/kg IV four times daily
- If prolonged NICU stay
 - Cefotaxime 50mg/kg IV three times daily **AND** Vancomycin 15mg/kg IV four times daily

Pediatric: Infant to 5 Years

Common Organisms: *S aureus*, *Streptococcus spp.*

- Vancomycin 15mg/kg IV four times daily **AND** Nafcillin/Oxacillin 50mg/kg IV four times daily
 - If gram negative rods, **ADD** Ceftriaxone 50mg/kg IV once daily

Pediatric: Sickle Cell Disease

Common Organisms: *S. aureus*, *Salmonella*, *Gram Negative Species*

- Vancomycin 15mg/kg IV four times daily **PLUS**
 - Ceftriaxone 50mg/kg IV once daily **OR**
 - Cefotaxime 50mg/kg IV three times daily

Pediatric: Puncture Wound (nail through shoe)

Common Organisms: *P. aeruginosa*

- Ceftazidime 50mg/kg IV three times daily
- Cefepime 50mg/kg IV two times daily

PEARLS

- Risk factors for hematogenous osteomyelitis include central lines, dialysis, UTI, and IVDA
- A combination of surgical and medical therapies may be needed for successful treatment
- Diagnosis requires 2 of the 4
 - Positive blood culture
 - Purulent material from affected bone
 - Localized classic physical findings of bony tenderness with overlying soft-tissue erythema or edema, nonunion of fracture or poor wound healing
 - Positive radiological imaging study (A normal x-ray does not exclude diagnosis. X-ray findings such as periosteal thickening, elevation, or focal osteopenia lag at least 2 weeks behind clinical infection). MRI and CT are preferred imaging modalities. Nuclear imaging studies may be used if medical hardware limits CT or MRI.

SEPTIC ARTHRITIS

Adult: Non-gonococcal

Common Organisms: *S. aureus*, *Streptococcal spp.*, *P. aeruginosa*, *Enterococcus*, *B. burgdorferi*, *Mycobacterium*

- Vancomycin 1g IV two times daily PLUS
 - Cefotaxime 2g IV four times daily OR
 - Ceftriaxone 2g IV once daily OR
 - Ciprofloxacin 400mg IV two times daily OR
 - Levofloxacin 750mg IV once daily

Adult: Gonococcal

- Ceftriaxone 1g IV once daily
- If PCN allergic: Vancomycin 1g IV once daily

Pediatric

Common Organisms: *S. aureus*, *Streptococcal spp.*, *N. gonorrhoeae*, *Enterobacter spp.*, *Gram Negative Organisms*

- Vancomycin 15mg/kg IV four times daily PLUS
 - Ceftriaxone 50mg/kg IV once daily OR
 - Cefotaxime 50mg/kg IV four times daily

Prosthesis Infection

Common Organisms: *S. aureus*, *P. aeruginosa*, *Propionibacteria*, *Streptococcal spp.*

- Rifampin 600mg PO once daily PLUS
 - Vancomycin 1g IV two times daily OR
 - Ciprofloxacin 750mg IV two times daily OR
 - Levofloxacin 750mg IV once daily

PEARLS

- Joint aspirate WBC >50,000 and PMN predominance is associated with septic arthritis although up to 1/3 may have less
- Sending aspirated fluid to the lab in blood culture bottles may increase culture yield
- Consider gonococcal infections in polyarticular arthritis
- Culture urethra, cervix, anus, throat, blood and joint fluid if gonorrhea suspected
- All patients treated for a gonococcal infection should also receive a 7 day course of Doxycycline to cover the possibility of a concurrent infection with *Chlamydia trachomatis*

TENOSYNOVITIS

Non-Gonococcal, Healthy, without Bite Wound

Common Organisms: *S. aureus*, *Streptococcus spp.*

- Cefazolin 1g IV four times daily (20mg/kg IV three times daily)
- Clindamycin 600-900mg IV three times daily (7.5mg/kg IV four times daily)

Non-Gonococcal, Immunocompromised or Bite Wound, Adult

Common Organisms: *S. aureus*, *Streptococcus spp.*, *Fusobacterium*, *Bacteroides spp.*, *P. multocida (cat)*, *Eikenella Corrodens (human)*, *Capnocytophaga Canimorsus (dog)*

- Ampicillin/Sulbactam 3g IV four times daily
- Cefoxitin 2g IV four times daily
- Clindamycin 600-900mg IV three times daily **AND** Levofloxacin 500mg IV daily

Non-Gonococcal, Immunocompromised or Bite Wound, Pediatric

Common Organisms: *As above*

- Ampicillin/Sulbactam 50mg/kg IV four times daily (max dose = 2g)
- Cefoxitin 20-40mg/kg IV four times daily

Gonococcal

- Ceftriaxone 1-2g IV daily

PEARLS

- Remember tetanus prophylaxis
- Kanavel's 4 cardinal signs: "sausage digit," held in slight flexion, tenderness along flexor tendon sheath, and pain with passive extension
- Immediate hand consult required
- If gonorrhea suspected
 - Polyarthralgias and fever are common
- Vaginal or penile discharge usually absent
- Consider culturing urethra, cervix, anus, throat, blood and joint fluid prior to treatment