Outpatient Management of Skin and Soft Tissue Infections in the Age of Community-Associated MRSA

Michael P. Stevens, MD, MPH
Assistant Professor of Medicine
Division of Infectious Diseases
Associate Hospital Epidemiologist
Director, Antimicrobial Stewardship Program
VCU Medical Center
Disclosure Statement

• Nothing to Disclose
Learning Objectives

- Describe the epidemiology of community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA) infections, with an emphasis on skin and soft tissue infections
- Identify appropriate outpatient therapy for skin and soft tissue infections
- Discuss management of recurrent infections
Learning Objectives

• Primary focus of this talk is on the outpatient management of skin and soft tissue infections with a special focus on MRSA
• Only discussing adult therapy
Methicillin-Resistant *Staphylococcus aureus* (MRSA)

- MRSA infections are more common than MSSA infections

MRSA in the Community

- Skin and soft tissue infections (SSTIs) have become more common in general, with the number of ER visits for SSTIs more than doubling between 1993 and 2005.
- MRSA has become the predominant cause of purulent SSTIs presenting to US emergency rooms.

MRSA in the Community

- Study by Talan et al that looked at patients presenting with acute, purulent SSTIs to 12 emergency rooms across the United States in August 2008
- Compared these patients to those from a similar study from 2004

619 Episodes of Purulent Skin and Soft Tissue Infection: Types of Infections

- Abscesses: 9%
- Infected Wounds: 6%
- Cellulitis with Purulent Exudate: 85%

Organisms Involved in 619 Purulent Skin and Soft Tissue Infections From 12 U.S. Emergency Rooms

Percentage of All Purulent Skin and Soft Tissue Infections Due to MRSA: August 2008

MRSA in the Community

- 98% of the MRSA isolated were pulsed-field type USA 300 (c/w “community” associated MRSA)

## MRSA Drug Susceptibility

<table>
<thead>
<tr>
<th>Drug</th>
<th>Susceptibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clindamycin</td>
<td>344/366 (94%)</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>326/326 (100%)</td>
</tr>
<tr>
<td>Levofloxacin</td>
<td>155/346 (45%)</td>
</tr>
<tr>
<td>Linezolid</td>
<td>326/326 (100%)</td>
</tr>
<tr>
<td>Trimethoprim-sulfamethoxazole</td>
<td>366/367 (99%)</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>326/326 (100%)</td>
</tr>
</tbody>
</table>

# Methicillin-Resistant Staphylococcus aureus (MRSA)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Healthcare-Associated (HA)</th>
<th>Community-Associated (CA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidemiologic Distinction</td>
<td>Hospitalized, in a long-term care facility, surgery or dialysis in the past year, the presence of an indwelling device</td>
<td>No HA-MRSA risk factors</td>
</tr>
<tr>
<td>Genotypic Distinction</td>
<td>Type II staphylococcal chromosomal cassette; USA100, USA 200</td>
<td>Types IV or V staphylococcal chromosomal cassettes; USA300, USA400</td>
</tr>
<tr>
<td>Phenotypic Distinction (susceptibility profile)</td>
<td>Multi-drug resistant</td>
<td>Often susceptible to TMP/SMX, tetracyclines, +/- clindamycin</td>
</tr>
<tr>
<td>Clinical Distinction</td>
<td>Wide range of infections</td>
<td>Typically skin and soft tissue infections; can cause necrotizing skin and soft tissue infections and pneumonia</td>
</tr>
</tbody>
</table>

CA-MRSA Phenotype

<table>
<thead>
<tr>
<th>Tissue Culture</th>
<th>Micro Reports</th>
<th>Susceptibilities</th>
<th>Specimen</th>
<th>Action List</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Methicillin Resistant Staphylococcus aureus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>MICINTERP</td>
<td>MICDIL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Erythromycin*</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Gentamicin</td>
<td>S</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Oxacillin</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Tetracycline*</td>
<td>S</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Trimethoprim / Sulfamethoxazole</td>
<td>S</td>
<td>0.5 ug/mL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Vancomycin</td>
<td>S</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CA-MRSA Clinical Presentation

- Can not differentiate between MRSA and MSSA based on clinical presentation
- Patients often present with purulent skin and soft tissue infections
- Patients often c/o a “spider bite” irrespective of ever seeing a spider

Learning Objectives

• Describe the epidemiology of community-associated methicillin-resistant Staphylococcus aureus (CA-MRSA) infections, with an emphasis on skin and soft tissue infections

• Identify appropriate outpatient therapy for skin and soft tissue infections

• Discuss management of recurrent infections
Clinical Practice Guidelines by the Infectious Diseases Society of America for the Treatment of Methicillin-Resistant *Staphylococcus Aureus* Infections in Adults and Children

Catherine Liu,1 Arnold Bayer,2,3 Sara E. Cosgrove,6 Robert S. Daum,7 Scott K. Fridkin,8 Rachel J. Gorwitz,9 Sheldon L. Kaplan10, Adolf W. Karchmer,11 Donald P. Levine,12 Barbara E. Murray,14 Michael J. Rybak,12,13 David A. Talan,4,5 and Henry F. Chambers1,2

1Department of Medicine, Division of Infectious Diseases, University of California-San Francisco, San Francisco, California; 2Division of Infectious Diseases, San Francisco General Hospital, San Francisco, CA; 3Division of Infectious Diseases, Harbor-UCLA Medical Center, Torrance, CA; 4Divisions of Emergency Medicine and Infectious Diseases, Olive View-UCLA Medical Center, Sylmar, CA; 5Department of Medicine, David Geffen School of Medicine at University of California Los Angeles; 6Division of Infectious Diseases, Johns Hopkins Medical Institutions, Baltimore, Maryland; 7Department of Pediatrics, Section of Infectious Diseases, University of Chicago, Chicago, Illinois; 8Division of Healthcare Quality Promotion, Center for Emerging and Zoonotic Infectious Diseases, Centers for Disease Control and Prevention, Atlanta, Georgia; 9Department of Pediatrics, Section of Infectious Diseases, Baylor College of Medicine, Houston, Texas; 10Division of Infectious Diseases, Beth Israel Deaconess Medicine Center, Harvard Medical School, Boston, Massachusetts; 11Department of Medicine, Division of Infectious Diseases, Wayne State University, Detroit Receiving Hospital and University Health Center, Detroit, Michigan; 12Department of Pharmacy Practice, Wayne State University, Detroit Michigan; and 13Division of Infectious Diseases and Center for the Study of Emerging and Re-emerging Pathogens, University of Texas Medical School, Houston, Texas

Evidence-based guidelines for the management of patients with methicillin-resistant *Staphylococcus aureus* (MRSA) infections were prepared by an Expert Panel of the Infectious Diseases Society of America (IDSA). The guidelines are intended for use by healthcare providers who care for adult and pediatric patients with MRSA infections. The guidelines discuss the management of a variety of clinical syndromes associated with MRSA disease, including skin and soft tissue infections (SSTI), bacteremia and endocarditis, pneumonia, bone and joint infections, and central nervous system (CNS) infections. Recommendations are provided regarding vancomycin dosing and monitoring, management of infections due to MRSA strains with reduced susceptibility to vancomycin, and vancomycin treatment failures.
Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America

Dennis L. Stevens, 1 Alan L. Bisno, 2 Henry F. Chambers, 3 E. Patchen Dellinger, 4 Ellie J. C. Goldstein, 5 Sherwood L. Gorbach, 6 Jan V. Hirschmann, 7 Sheldon L. Kaplan, 8 Jose G. Montoya, 9 and James C. Wade, 10

1Division of Infectious Diseases, Department of Veterans Affairs, Boise, Idaho; 2Medical Service, Miami Veterans Affairs Health Care System, Florida; 3San Francisco General Hospital, University of California; 4Division of General Surgery, University of Washington, Seattle; 5University of California, Los Angeles, School of Medicine, and R. M. Alden Research Laboratory, Santa Monica, California; 6Department of Community Health, Tufts University, Boston, Massachusetts; 7Medical Service, Puget Sound Veterans Affairs Medical Center, Seattle, Washington; 8Department of Pediatrics, Baylor College of Medicine, Houston, Texas; 9Department of Medicine, Stanford University, California; and 10Geisinger Health System, Geisinger Cancer Institute, Danville, Pennsylvania

A panel of national experts was convened by the Infectious Diseases Society of America (IDSA) to update the 2005 guidelines for the treatment of skin and soft tissue infections (SSTIs). The panel’s recommendations were developed to be concordant with the recently published IDSA guidelines for the treatment of methicillin-resistant Staphylococcus aureus infections. The focus of this guideline is the diagnosis and appropriate treatment of diverse SSTIs ranging from minor superficial infections to life-threatening infections such as necrotizing fasciitis. In addition, because of an increasing number of immunocompromised hosts worldwide, the guideline addresses the wide array of SSTIs that occur in this population. These guidelines emphasize the importance of clinical skills in promptly diagnosing SSTIs, identifying the pathogen, and administering effective treatments in a timely fashion.
Case Study

- 18 year old high school football player presents to an ER with a 3 day history of a painful, swollen area on his right forearm. Exam reveals a non-toxic, afebrile patient with a 4x4 centimeter area of focal fluctuance with no surrounding erythema on the dorsal surface of his right forearm.
Abscess Management: When to Give Antibiotics

Case Study

• 18 year old high school football player presents to an ER with a 3 day history of a painful, swollen area on his right forearm. Exam reveals a non-toxic, afebrile patient with a 4x4 centimeter area of focal fluctuance with no surrounding erythema on the dorsal surface of his right forearm.
  – I&D alone
Case Study

- A 43 yo morbidly obese female with poorly controlled diabetes presents to the ER with a 6x6 centimeter abscess on her L calf at the site of a “spider bite.” There is a small area of erythema/warmth/tenderness to palpation surrounding the abscess. She is afebrile, has no leukocytosis and no drug allergies.
Skin & Soft Tissue Infections: Empiric Antibiotics

Purulent?

- Yes
  - CA-MRSA Coverage

- No
  - β-hemolytic Streptococcal Coverage

## Which Antibiotic to Choose?

<table>
<thead>
<tr>
<th>MRSA Coverage</th>
<th>MRSA &amp; β-hemolytic Streptococcal Coverage</th>
<th>β-hemolytic Streptococcal Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antibiotics</strong></td>
<td><strong>Antibiotics</strong></td>
<td><strong>Antibiotics</strong></td>
</tr>
<tr>
<td>TMP/SMX</td>
<td>Doxycycline</td>
<td>Clindamycin</td>
</tr>
<tr>
<td>Clindamycin</td>
<td></td>
<td>Linezolid</td>
</tr>
<tr>
<td>Linezolid</td>
<td></td>
<td>Tedizolid</td>
</tr>
<tr>
<td>Tedizolid</td>
<td></td>
<td>Amoxicillin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cephalexin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clindamycin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Linezolid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tedizolid</td>
</tr>
</tbody>
</table>

Case Study

- A 43 yo morbidly obese female with poorly controlled diabetes presents to the ER with a 6x6 centimeter abscess on her L calf at the site of a “spider bite.” There is a small area of erythema/ warmth/ tenderness to palpation surrounding the abscess. She is afebrile, has no leukocytosis and no drug allergies.
  - I&D + trimethoprim/sulfamethoxazole + amoxicillin
Case Study: Give Clindamycin with this Antibiogram?

<table>
<thead>
<tr>
<th>Micro Reports</th>
<th>Susceptibilities</th>
<th>Specimen</th>
<th>Action List</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Methicillin Resistant Staphylococcus aureus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Clindamycin</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Erythromycin</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Gentamicin</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Oxacillin</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Tetracycline</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Trimethoprim / Sulfamethoxazole</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Vancomycin</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Daptomycin</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Linezolid</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MIC INTERP: S - Sensitive, R - Resistant
Inducible Clindamycin Resistance

- Double-disk diffusion test ("D-test") should be performed on all isolates that appear susceptible to clindamycin but are erythromycin resistant
- Isolates have *erm* genes that encode resistance to macrolides and lincosamides
- Erythromycin disk is placed near a clindamycin disc; erythromycin acts as an inducing agent for isolates expressing the *erm gene*
<table>
<thead>
<tr>
<th>Category/ grade</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength of Recommendation</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Good evidence to support a recommendation</td>
</tr>
<tr>
<td>B</td>
<td>Moderate evidence to support a recommendation</td>
</tr>
<tr>
<td>C</td>
<td>Poor evidence to support a recommendation</td>
</tr>
<tr>
<td>Quality of Evidence</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Evidence from ≥ 1 properly randomized, controlled trial</td>
</tr>
<tr>
<td>II</td>
<td>Evidence from ≥ 1 well-designed clinical trial, without randomization; from cohort or case-controlled analytic studies (preferably from &gt; 1 center); from multiple time-series; or from dramatic results from uncontrolled experiments</td>
</tr>
<tr>
<td>III</td>
<td>Evidence from opinions of respected authorities, based on clinical experience, descriptive studies or reports of expert committees</td>
</tr>
</tbody>
</table>

Trimethoprim-sulfamethoxazole (TMP/SMX)

- A combination of 2 antimicrobials that interfere with bacterial folic acid metabolism
  - 1 double strength (DS) tablet = 160 mg trimethoprim/ 800 mg sulfamethoxazole
- Bactericidal against *Staphylococcus aureus*
- Does not provide reliable β-hemolytic Streptococcal coverage
- NOT FDA approved for the treatment of staphylococcal infections
- A-II recommendation by IDSA for uncomplicated purulent SSTIs

Trimethoprim-sulfamethoxazole (TMP/SMX)

- Data on efficacy are from retrospective and observational reports
- There is a theoretical concern that treatment failure can occur when thymidine released from damaged host cells undermines the effect of the drug on bacterial folate synthesis

Trimethoprim-sulfamethoxazole (TMP/SMX)

Trimethoprim-sulfamethoxazole (TMP/SMX)

- Trimethoprim (TMP)
- Sulfamethoxazole (SMX)

PABA

Dihydrofolate

N5,N10-THF

dUMP

dTMP

Thymidine

DNA replication

*Concern is theoretical
*Failures occur with large burden of infection or undrained abscesses
*TMP/SMX use is an A-II recommendation

Trimethoprim-sulfamethoxazole (TMP/SMX)

- Optimal dosing for MRSA SSTIs unknown
  - Guidelines do not provide a solid recommendation here; give a range (1-2 DS tablets po bid)
  - Adverse drug events with TMP/SMX are dose-related

Trimethoprim-sulfamethoxazole (TMP/SMX)

- A nested case-control study by Jose Cadena et al. of 291 patients presenting to a public, academic tertiary care center in San Antonio between May and September 2008 with SSTIs compared TMP/SMX dosed 2 DS tablets [320 mg/1,600 mg] po twice daily versus 1 DS tablet [160 mg/800 mg] twice daily (both for 7-15 days)

Trimethoprim-sulfamethoxazole (TMP/SMX)

- The 2 groups were similar except the high dose group had a higher proportion of trauma on admission.
- The proportion of patients with clinical resolution was not different in the 2 groups (88/121 [73%] versus 127/170 [75%], \( P = 0.79 \)).
  - The lack of significance remained for patients with abscess stratified by whether or not surgical drainage occurred.
- Authors conclude that “a higher dose of TMP/SMX may not be necessary to treat patients with skin and soft tissue infections” caused by MRSA.

Trimethoprim-sulfamethoxazole (TMP/SMX)

- Side effects:
  - Common:
    - Nausea/vomiting
    - Rash
    - Pseudo-elevation in creatinine
  - Occasional:
    - Reversible hyperkalemia
    - Bone marrow suppression
    - Hepatitis
    - Methemoglobinemia (with severe G6PD deficiency)

Trimethoprim-sulfamethoxazole (TMP/SMX)

- Side effects:
  - Rare:
    - Stevens-Johnson syndrome, toxic epidermal necrolysis
    - Aseptic meningitis
    - Pancreatitis
    - Sweet’s syndrome
Trimethoprim-sulfamethoxazole (TMP/SMX)

- Pregnancy category C/D
- Not recommended for women in 3rd trimester

Doxycycline (Long-Acting Tetracycline)

- Long-acting tetracyclines include doxycycline, minocycline
- Inhibit protein synthesis at the 30S ribosomal subunit; bacteriostatic
- Good empiric coverage for CA-MRSA
- Do not have reliable β-hemolytic streptococcal coverage
- Data on efficacy are from retrospective and observational reports

Doxycycline (Long-Acting Tetracycline)

- FDA approved for SSTIs secondary to *Staphylococcus aureus*; not specifically MRSA
- A-II recommendation from IDSA for uncomplicated purulent SSTIs
- Dosing is 100 mg po bid

Doxycycline

- Side effects:
  - Occasional:
    - GI intolerance
    - Photosensitivity
  - Pregnancy category D

Clindamycin

- Lincosamide antibiotic that inhibits protein synthesis by binding to the 50S ribosomal subunit; bacteriostatic
- FDA approved for treatment of serious infections due to *Staphylococcus aureus*; not MRSA
- A-II recommendation by IDSA for SSTIs
- (Potentially) active against CA-MRSA and active against β-hemolytic Streptococcal species

Clindamycin

• Inducible resistance can occur while on therapy (for MRSA)
  – A “D” test must be performed to see whether inducible resistance is present
  – If the isolate is erythromycin resistant do not trust clindamycin “susceptibility” without a D test!!!
  – Many laboratories now routinely run a D test: find out what your referral laboratory does
• Dosing is 300-450 mg po tid

Clindamycin

- Side effects:
  - Common:
    - Diarrhea ([not from C. dif] in 10-30%)
    - Nausea, vomiting, anorexia
  - Occasional:
    - Rash
    - C. difficile colitis (6%)

Clindamycin

- Side effects:
  - Rare:
    - Stevens-Johnson syndrome
    - Allergic reactions in patients who have aspirin hyper-sensitivity
  - Pregnancy category B
Fluoroquinolones

- Do NOT use for CA-MRSA
- Although some strains are susceptible resistance can develop rapidly when exposed to drug
- Resistance to these agents is already widespread and therefore they are not reliable empiric agents
Rifampin

- Active against many strains of MRSA
- Should not be used as monotherapy as resistance can develop rapidly on therapy
- Currently not recommended as part of combination therapy for SSTIs due to MRSA

Linezolid

- Completely synthetic oxazolidinone antibiotic
- Inhibits ribosomal assembly at the 50S subunit (inhibits protein synthesis); bacteriostatic
- FDA approved for the treatment of skin and soft tissue infections due to MRSA, also community and hospital-acquired pneumonia
- Oral form with excellent bioavailability
- A-II recommendation by IDSA for SSTIs

Linezolid

- Equivalent to vancomycin for complicated skin and soft tissue infections and pneumonia
- Very expensive
- Toxicity:
  - Bone marrow suppression, especially thrombocytopenia
  - Peripheral neuropathy and optic neuritis
  - Lactic acidosis
  - Issues with serotonin syndrome when used with SSRIs
- Pregnancy category C

Tedizolid

- Oxazolidinone antibiotic
- Inhibits ribosomal assembly at the 50S subunit (inhibits protein synthesis); bacteriostatic
- FDA approved for the treatment of skin and soft tissue infections
- Oral form with excellent bioavailability
- A six day course was non-inferior to linezolid for 10 days for skin and soft tissue infections
- Very expensive
- Pregnancy category C

<table>
<thead>
<tr>
<th>Agent</th>
<th>Antibiotic class</th>
<th>Mechanism of action</th>
<th>Comments</th>
<th>Use for CA-MRSA?</th>
<th>Use for Strep?</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMP/SMX</td>
<td>Other, sulfonamide</td>
<td>2 drugs that interfere with folic acid production; bactericidal</td>
<td>*Theoretical concerns for treatment failure *Severe rash</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>Tetracycline</td>
<td>Inhibits protein synthesis; bacteriostatic</td>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>Lincosamide</td>
<td>Inhibits protein synthesis; bacteriostatic</td>
<td>*Inducible resistance possible; need “D” test *Risk for <em>Clostridium difficile</em> colitis</td>
<td>Yes/Maybe</td>
<td>Yes</td>
</tr>
<tr>
<td>Levofloxacin</td>
<td>Fluoroquinolone</td>
<td>DNA gyrase inhibitor; bactericidal</td>
<td>*Resistance in MRSA is widespread *Resistance can emerge on therapy</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Rifampin</td>
<td></td>
<td>Inhibits RNA synthesis; bactericidal</td>
<td>*Resistance develops rapidly on therapy</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Linezolid</td>
<td>Oxazolidinone</td>
<td>Inhibits protein synthesis; bacteriostatic</td>
<td>*Drug interactions *Toxicity *Expensive; off patent in 2015</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Agent</td>
<td>Antibiotic class</td>
<td>Mechanism of action</td>
<td>Comments</td>
<td>Use for CA-MRSA?</td>
<td>Use for Strep?</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>TMP/SMX</td>
<td>Other, sulfonamide</td>
<td>2 drugs that interfere with folic acid production; bactericidal</td>
<td>*Theoretical concerns for treatment failure</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Severe rash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doxycycline</td>
<td>Tetracycline</td>
<td>Inhibits protein synthesis; bacteriostatic</td>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>Lincosamide</td>
<td>Inhibits protein synthesis; bacteriostatic</td>
<td>*Inducible resistance possible; need “D” test</td>
<td>Yes/ Maybe</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Risk for <em>Clostridium difficile</em> colitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Levofoxacin</td>
<td>Fluoroquinolone</td>
<td>DNA gyrase inhibitor; bactericidal</td>
<td>*Resistance in MRSA is widespread</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Resistance can emerge on therapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rifampin</td>
<td></td>
<td>Inhibits RNA synthesis; bactericidal</td>
<td>*Resistance develops rapidly on therapy</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Linezolid</td>
<td>Oxazolidinone</td>
<td>Inhibits protein synthesis; bacteriostatic</td>
<td>*Drug interactions *Toxicity *Expensive; off patent in 2015</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Cost Per Day of Therapy

- TMP/SMX: $3.64
- Doxycycline: $2.3
- Clindamycin: $19.84
- Linezolid: $183.94
- Tedizolid: $295

## CA-MRSA: Oral Antibiotic Overview

<table>
<thead>
<tr>
<th>Agent</th>
<th>Dosing</th>
<th>Miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMP/SMX</td>
<td>1-2 DS tablets po bid</td>
<td>Pregnancy category C/D; do not use in 3rd trimester</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>100 mg po bid</td>
<td>Pregnancy category D</td>
</tr>
<tr>
<td>Minocycline</td>
<td>200 mg po x1 then 100 mg po bid</td>
<td>Pregnancy category D</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>300-450 mg po tid</td>
<td>Pregnancy category B; relatively high incidence of <em>Clostridium difficile</em> colitis</td>
</tr>
<tr>
<td>Linezolid</td>
<td>600 mg po bid</td>
<td>Very expensive</td>
</tr>
<tr>
<td>Tedizolid</td>
<td>200 mg po daily</td>
<td>Very expensive</td>
</tr>
</tbody>
</table>

Learning Objectives

- Describe the epidemiology of community-associated methicillin-resistant Staphylococcus aureus (CA-MRSA) infections, with an emphasis on skin and soft tissue infections
- Identify appropriate outpatient therapy of skin and soft tissue infections
- Discuss management of recurrent infections
What about Recurrent Skin Infections Due to MRSA?

- Education:
  - Keep wounds covered
  - Maintain good personal hygiene
  - Avoid sharing or reusing personal items that have come in contact with infected skin
  - Environmental hygiene

What about Recurrent Skin Infections Due to MRSA?

- Decolonization:
  - Little evidence suggests this leads to decreased recurrence of infections in this setting (recurrent skin/soft tissue infections)
  - Optimal regimen, frequency of application and duration of treatment are unknown

What about Recurrent Skin Infections Due to MRSA?

- When to consider decolonization:
  - After optimizing wound care practices and hygiene
  - Ongoing transmission is occurring among household member or close contacts

What about Recurrent Skin Infections Due to MRSA?

- How to decolonize:
  - Nasal mupirocin twice daily for 5 days
  - Nasal mupirocin twice daily for 5 days + daily chlorhexidine washes for 5 days OR dilute bleach baths (¼ cup per ¼ tub for 15 minutes twice weekly for 3 months)
- Oral antibiotics NOT recommended for decolonization
- Surveillance cultures following decolonization are not recommended

Learning Objectives

• Describe the epidemiology of community-associated methicillin-resistant Staphylococcus aureus (CA-MRSA) infections, with an emphasis on skin and soft tissue infections
• Identify appropriate outpatient therapy for skin and soft tissue infections
• Discuss management of recurrent infections
Contact Information

Michael Stevens, MD, MPH
VCU Medical Center
mstevens@mcvh-vcu.edu


*** = Recommended further reading
References


References


*** = Recommended further reading
References


*** = Recommended further reading
References


References


*** = Recommended further reading