SSTI
Tropical infections caused by Staphylococcus aureus

WRAIR- GEIS 'Operational Clinical Infectious Disease' Course
Tropical infections caused by S. aureus

Outline

- Introduction
- Tropical Pyomyositis
- Cutaneous infections
- Prevention
- Bites
S. Aureus Microbiology

- Gram-positive cocci
- Grape-like clusters on gram stain
- Catalase positive
- Coagulase positive
- \( b \)-hemolysis on sheep blood agar
- MRSA
  - Identified based on oxacillin susceptibility
  - Can be identified using chromogenic agar
  - Rapid identification using PCR to detect \textit{mecA}
Community-associated MRSA Risk groups

- Household contacts of CA-MRSA infected persons
- Athletes
- Children
- Prison inmates
- Soldiers
- MSM
- IVDA

What is CA-MRSA?

Methods of description

• Epidemiological and clinical characteristics
  – Occurs in the community or <48-72h after admission
  – Absence of traditional risk factors for MRSA
  – Primarily cause skin and soft tissue infection (SSTI)

• Molecular characteristics
  – Presence of resistance and virulence factors
    • Staphylococcal cassette chromosome mec (SCCmec) type IV
    • Panton-Valentine leukocidin (PVL)
  – Pulsed-field types (PFTs) USA300
    • Predominant strain in U.S.

# Community-associated MRSA

## Molecular characteristics

<table>
<thead>
<tr>
<th>PFT</th>
<th>Location</th>
<th>SCCmec</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA300</td>
<td>Community</td>
<td>Type IV</td>
</tr>
<tr>
<td>USA400</td>
<td>Community</td>
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</tr>
<tr>
<td>USA100</td>
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<td>Type II</td>
</tr>
<tr>
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<td>Hospital</td>
<td>Type II</td>
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</tbody>
</table>

Adapted from J Clin Microbiol. 2003;41:5113.
Tropical Pyomyositis

Pathogenesis

• Pyomyositis is a primary infection of skeletal muscle
  Does not arise from contiguous site
  Result of transient hematogenous seeding
  Usually associated with abscess formation

• Pathogenesis is poorly understood

• Associated risk factors
  – Trauma
  – Immunodeficiency (but most are healthy)
  – Injection drug use
  – Concomitant parasitic infection (e.g. toxocara)
  – *S. aureus* strain virulence
Tropical Pyomyositis
Pathogenesis- Risk Factors

• HIV
  – Noted in African studies as significant independent risk factor
  – T-cell dysfunction
  – HAART toxicity
  – Primary HIV myopathy
  – Increased *S. aureus* carriage

• Others- DM, sickle cell, cirrhosis

• Injection drug use
  – Frequent *S. aureus* bacteremia
  – Increased *S. aureus* carriage
Tropical Pyomyositis

Epidemiology

- Accounts for 1-4% of hospital admissions in tropical countries
- Increasingly reported in temperate regions
  - Likely a reflection of the emergence of CA-MRSA
- More common in males (1.5:1)
- Peak age groups
  - 2-5 years
  - 20-45 years
- Peak season in the tropics appears to be July-September
Tropical Pyomyositis
Microbiology

• *Staphylococcus aureus*- 90%
  – CA-MRSA has emerged as an important pathogen

• Group A streptococcus- 1-5%

• Other pathogens
  – Non-Group A strep
  – Pneumococcus
  – Gram negative enteric (e.g., *E. coli*)
  – Mycobacterial (TB)
  – Polymicrobial
Tropical Pyomyositis
Clinical Manifestations

• Presents with fever and localized cramping muscle pain
  – Usually single muscle group
  – May be multiple in up to 20% of cases
  – Lower extremities - but any muscle group possible

• Described in 3 clinical stages
  – Stage 1 (invasive)
  – Stage 2 (suppurative) - Most patients present during this stage
  – Stage 3 (late) - systemic toxicity/infection
Tropical Pyomyositis

Clinical Manifestations

- Stage 1 (invasive)
  - Low-grade fever, mild leukocytosis
  - “Woody” muscle induration

- Stage 2 (suppurative) - 10-21 days after initial symptoms
  - Fever, high leukocytosis
  - Exquisite muscle tenderness, edema, and often fluctuance
  - Aspirate will yield purulent material

- Stage 3 (late) - systemic toxicity/infection
  - Septic shock
  - Endocarditis
  - Pneumonia
  - Abscesses
Left posterior thigh - stage 2 pyomyositis

CT fluid collection - stage 2 pyomyositis

Tropical Pyomyositis

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  • Pneumonia
  • Abscesses
Necrotizing pneumonia on a chest CT with intravenous contrast, obtained on hospital day 3 from patient 1. The CT shows multiple nodular and cavitary lesions (some of which have surrounding ground glass halos that are likely to represent hemorrhages) and left lower lobe consolidation, with small left-side pleural effusion.
Endocarditis
Septic emboli

Tropical Pyomyositis

Differential diagnosis

- Muscle contusion
- Cellulitis
- DVT
- Osteomyelitis
- Septic arthritis
- Neoplasm (osteosarcoma)
- Clostridial myonecrosis
- Necrotizing fasciitis
- Trichinosis
- Cysticercosis
Tropical Pyomyositis Diagnosis

• All patients should be evaluated for endocarditis

• Radiography
  – MRI (preferred), US, CT
  – Diagnostic guided drainage prior to antibiotics

• Labs
  – Leukocytosis
  – Elevated ESR/CRP
  – CPK usually normal

• Cultures
  – Blood cultures positive in at least 10% of cases
  – Positive in 30% of temperate pyomyositis (due to technique)
Coronal CT image of psoas abscess

Tropical Pyomyositis

Treatment

• Stage 1 (invasive) - antibiotics alone may be effective

• Stage 2 and 3
  – Drainage - percutaneous or surgical
  – Antibiotics (at least 2-3 weeks duration)
    • Vancomycin (if MRSA or suspected MRSA)
    • Oxacillin
    • Cefazolin
    • Add Gram-negative and anaerobic coverage for immunocompromised
Left hip- stage 2 pyomyositis
Left hip- stage 2 pyomyositis- post drainage

Cutaneous S. aureus infections
**Cutaneous S. aureus infections**

**Manifestations**

- **Folliculitis**
- **Furuncles (abscesses)**
  - May be multiple
  - Recurrence is common
  - Outbreak settings/families
- **Purulent cellulitis**
  - Associated with abscess/ul
- **Nonpurulent cellulitis**
  - Contribution is unknown
Folliculitis- leg
Cellulitis - knee
Abscess-foot

Photo Credit: Major Kirk Waibel, MD
Abscess - knee

Study number: 2155  Date: 5 Nov 2013
Anatomic site: Knee
Abscess - Axilla
Dermatologic conditions of the ill returned traveler: an analysis from the GeoSentinel Surveillance Network


a U.S. Naval Medical Research Unit No. 2, Jakarta, Indonesia
b Centers for Disease Control and Prevention, Atlanta, Georgia, USA
c University of Munich, Munich, Germany
d Travel and Migration Medicine Unit, Geneva University Hospital, Geneva, Switzerland
e Sheba Medical Center and Tel Aviv University, Israel
f Centre for Travel and Tropical Medicine, Toronto General Hospital, Toronto, Ontario, Canada

Received 20 August 2007; accepted 15 December 2007
Corresponding Editor: William Cameron, Ottawa, Canada

Dermatologic conditions in travelers

Epidemiology

• GeoSentinel Surveillance Network data
  – 1997-2006
  – 4742 encounters for dermatological complaints
    • 18% of all encounters

• Skin lesions in returning travelers
  – Cutaneous larvae migrans (9.8%)
  – Insect bite (8.2%)
  – Skin abscess (7.7%)
  – Infected insect bite (6.8%)

Community-Acquired Methicillin-Resistant Staphylococcus aureus in a Returned Traveler

Rabin K. Shrestha, MD,* Ravindran A. Padmanabhan, MD, MRCP,† Louis D. Saravolatz, MD, MACP,‡ Geraldine S. Hall, PhD,* and Steven M. Gordon, MD†

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- 65-year-old man who had returned from 4 wks in DRC
- Developed R leg swelling and pain during return trip
- CA-MRSA leg abscess
- CA-MRSA bacteremia
- CA-MRSA genotype, PVL+, SCCmec IV

### TABLE 2. Molecular Characteristics of Isolates, Including Pulsed-Field Types, SCCmec Resistance Genes, and ACME and PVL Virulence Genes

<table>
<thead>
<tr>
<th>Pulsed-Field Types (n)</th>
<th>SCCmec, n (%)</th>
<th>Presence of ACME, n (%)</th>
<th>Presence of PVL, n (%)</th>
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<tr>
<td>USA300 (66)</td>
<td>IV 66 (100)</td>
<td>62 (94)</td>
<td>66 (100)</td>
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<td>Type 2 (5)</td>
<td>II 5 (100)</td>
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<td>Type A (2)</td>
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<td>Type B (1)</td>
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<td>Type D (1)</td>
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<td>Type E (1)</td>
<td>IA 1 (100)</td>
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<td>Type H (1)</td>
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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. Wade¹⁰
NON PURULENT
Necrotizing Infection /Cellulitis /Erysipelas

Severe

> EMERGENT SURGICAL INSPECTION / DEBRIDEMENT
... Rule out necrotizing process

EMPIRIC Rx
- Vancomycin PLUS
  Piperacillin/Tazobactam

Moderate

INTRA VENOUS Rx
- Penicillin or
- Ceftriaxone or
- Cefazolin or
- Clindamycin

Mild

ORAL Rx
- Penicillin VK or

Severe

I & D C & S

EMPIRIC Rx
- Vancomycin or
- Daptomycin or
- Linezolid or
- Televancin or
- Ceftaroline

I & D
Paracelt

EMPIRIC Rx
- TMP/SMX or
- Doxycycline

DEFINED Rx (Necrotizing Infections)
Monomicrobial Streptococcus pyogenes
- Penicillin PLUS Clindamycin

Clostridial sp.
- Penicillin PLUS Clindamycin

Vibrio w/nicus
- Doxycycline PLUS Ceftazidime

Aeromonas hydrofilita
- Doxycycline PLUS Ciprofloxacin

Polymicrobial
- Vancomycin PLUS
  Piperacillin/Tazobactam

Purulent
Furuncle / Carbuncle / Abscess

I & D

EMPIRIC Rx
- TMP/SMX or
- Doxycycline

DEFINED Rx
MRSA
- See Empiric
  MSSA
- Nafcillin or
  Cefazolin or
  Clindamycin

MRSA
- TMP/SMX
- Dicloxacillin or
- Cephalexin

1 Since daptomycin and televancin are not approved for use in children, vancomycin is recommended; clindamycin may be used if clindamycin resistance is <10-15% at the institution.
SSTI management

Furunculosis
SSTI management

Furunculosis-outpatient

• Incision and drainage- most important intervention

• Antimicrobial therapy recommended for:
  – Severe or extensive disease
  – Signs/symptoms of systemic illness (Fever, tachycardia, leukocytosis)
  – Rapid progression
  – Extremes of age
  – Comorbid conditions/immunosuppression
  – Abscess on face, hand, groin

• Send specimen for culture

• Duration-5 days therapy

• Timely follow-up (24-72 hours)

Clin Infect Dis. 2014; epub.
Randomized, Controlled Trial of Antibiotics in the Management of Community-Acquired Skin Abscesses in the Pediatric Patient

Myto Duong, MD, MS
Stephen Markwell, MA
John Peter, MD
Stephen Barenkamp, MD

From the Cardinal Glennon Children’s Medical Center, Saint Louis University School of Medicine, Pediatric Emergency Medicine Department (Duong, Peter) and Pediatric Infectious Diseases Division, Department of Pediatrics (Barenkamp), Division of Pediatrics, St. Louis, MO; and the Southern Illinois University, School of Medicine, Division of Statistics and Research Consulting, Springfield, IL (Markwell).

Study:

- 161 Pediatric patients (80% MRSA)
- I&D + TMP/SMX vs. I&D + placebo for 10 days
- Placebo cure: 95%
- TMP/SMX cure: 96% difference NS

SSTI management

Cellulitis

• Nonpurulent cellulitis
  – Etiology- b-hemolytic streptococci (less likely *S. aureus*)
  – Empirical coverage for MRSA:
    • Evidence of MRSA
    • MRSA colonization
    • Penetrating trauma
    • Immune-compromised
    • Systemic toxicity

• Timely follow-up (24-72 hours)

Clin Infect Dis. 2014; epub.
SSTI management

Cellulitis

• Adjunctive measures
  – Elevate and rest affected limb
  – Treated tinea pedis
  – Address pre-disposing conditions
    • Extremity edema
    • Dermatological conditions

Clin Infect Dis. 2014; epub.
Clinical Trial: Comparative Effectiveness of Cephalexin Plus Trimethoprim-Sulfamethoxazole Versus Cephalexin Alone for Treatment of Uncomplicated Cellulitis: A Randomized Controlled Trial

Daniel J. Pallin,¹,² William D. Binder,³ Matthew B. Allen,¹,⁴ Molly Lederman,¹,⁵ Siddharth Parmar,¹ Michael R. Filbin,³ David C. Hooper,⁶ and Carlos A. Camargo Jr³

Study:

- 153 patients (children and adults) nonpurulent cellulitis
- Cephalexin + TMP/SMX vs. Cephalexin + placebo 14d
- Placebo cure: 82%
- TMP/SMX cure: 85% difference NS
- No benefit to MRSA coverage

Personal Prevention of MRSA Skin Infections

Protect yourself through good hygiene.
The key to preventing MRSA infections is for everyone to practice good hygiene:

1. Keep your hands clean by washing thoroughly with soap and water or using an alcohol-based hand rub.
2. Keep cuts and scrapes clean and covered with a bandage until healed.
3. Avoid contact with other people’s wounds or bandages.
4. Avoid sharing personal items such as towels or razors.

Prevent the spread of MRSA if you have it.
Prevent spreading MRSA skin infections to others by following these steps:

1. **Cover your wound.**

http://www.cdc.gov/mrsa/prevent/personal.html#
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Prevent the spread of MRSA if you have it.
Prevent spreading MRSA skin infections to others by following these steps:

1. **Cover your wound.** Establish cleaning procedures for frequently touched surfaces and surfaces that come into direct contact with your skin.
2. **Talk to your doctor.** Tell any healthcare providers who treat you that you have or had a staph or MRSA skin infection. There are things that can be done to protect people that carry staph/MRSA from getting an infection or spreading it to others when they are in the hospital or have surgery.
SSTI Prevention

Basic First Aid kit

- Adhesive bandages
- Gauze
- Adhesive tape
- Elastic bandage
- Antiseptic
- Cotton swabs
- Antibacterial ointment
- 1% hydrocortisone cream
- Moleskin
- Thermometer

CDC Yellow Book. 2010, pg 233.
Questions?

WASHING YOUR HANDS WITH SOAP AND WATER IS ONE OF THE BEST WAYS TO PREVENT DISEASES.

DON’T GIVE BACTERIA A FREE RIDE.

WHO’S PLAYING DEFENSE?

PROTECT AGAINST SKIN INFECTIONS.

Good hygiene and taking care of your skin are the best protection against skin infections.

To avoid skin infections:

- Wash your hands frequently.
- Shower after playing sports; use a clean towel.
- Keep cuts and scrapes clean and covered with a bandage.

Tell your coach or athletic trainer if you think you have a skin infection.

Wash your hands frequently.

Massachusetts Department of Public Health

www.cdc.gov/mrsa