

SSTI

Tropical infections caused by *Staphylococcus aureus*

WRAIR- GEIS 'Operational Clinical *Infectious Disease*' Course

WRAIR

Walter Reed Army
Institute of Research

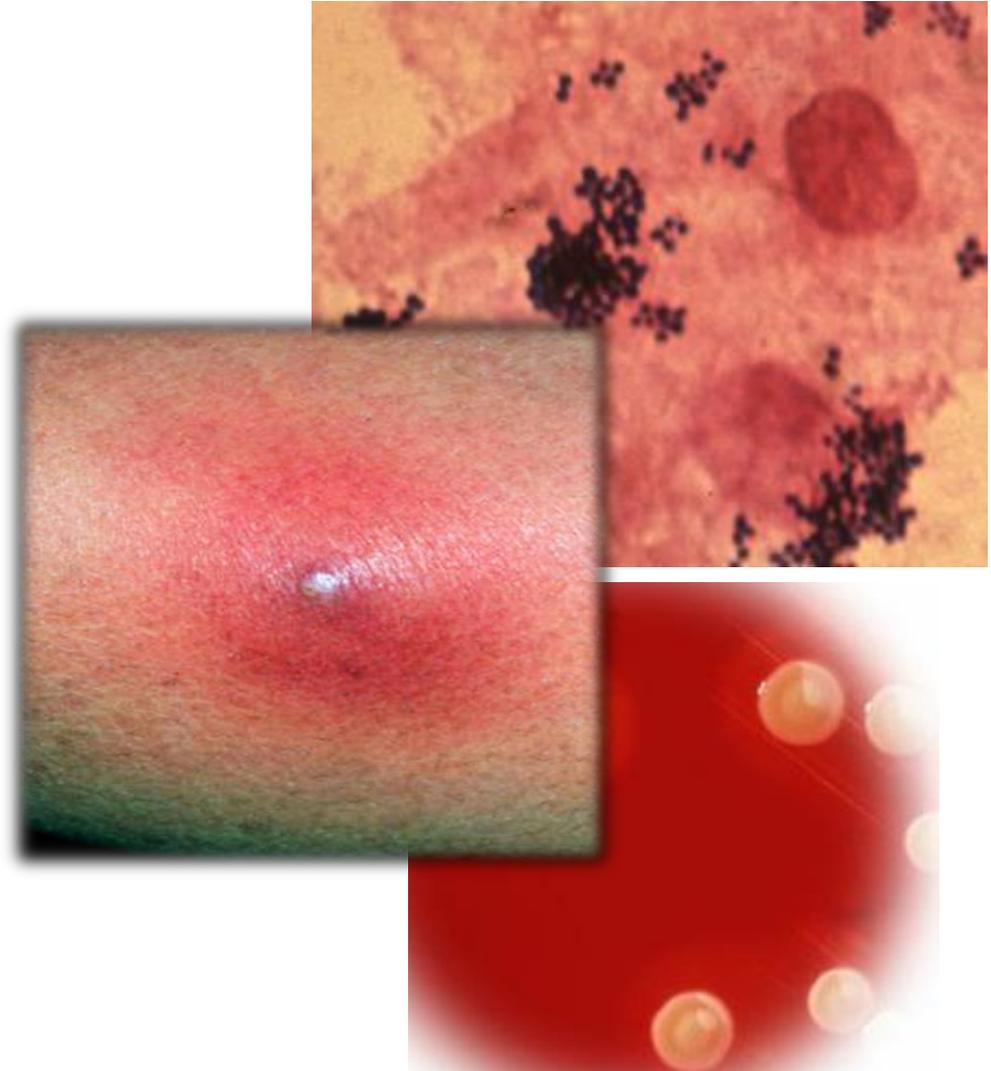
Soldier Health • World Health



Tropical infections caused by *S. aureus*

Outline

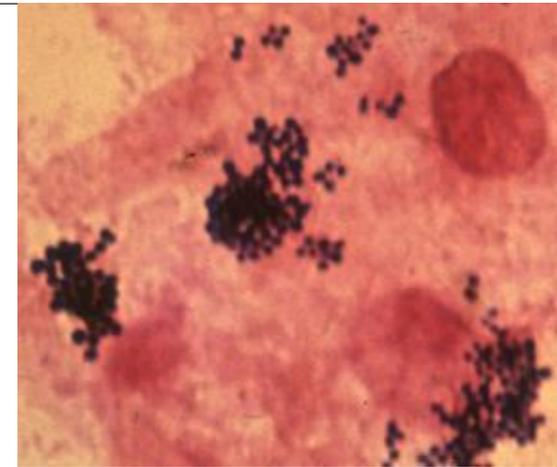
- Introduction
- Tropical Pyomyositis
- Cutaneous infections
- Prevention
- Bites



S. Aureus

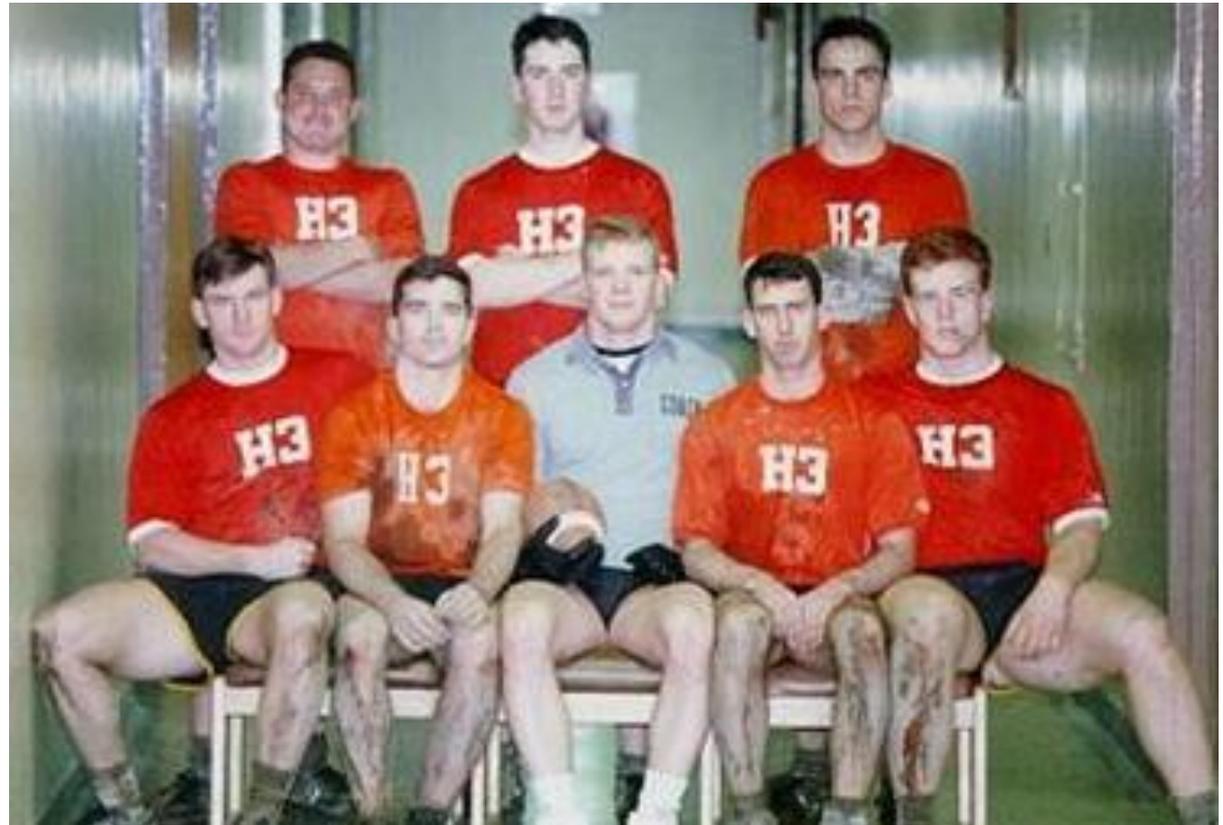
Microbiology

- 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 [*mecA*](#)



Community-associated MRSA Risk groups

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



N Engl J Med. 2007;357: 380.

What is CA-MRSA?

Methods of description

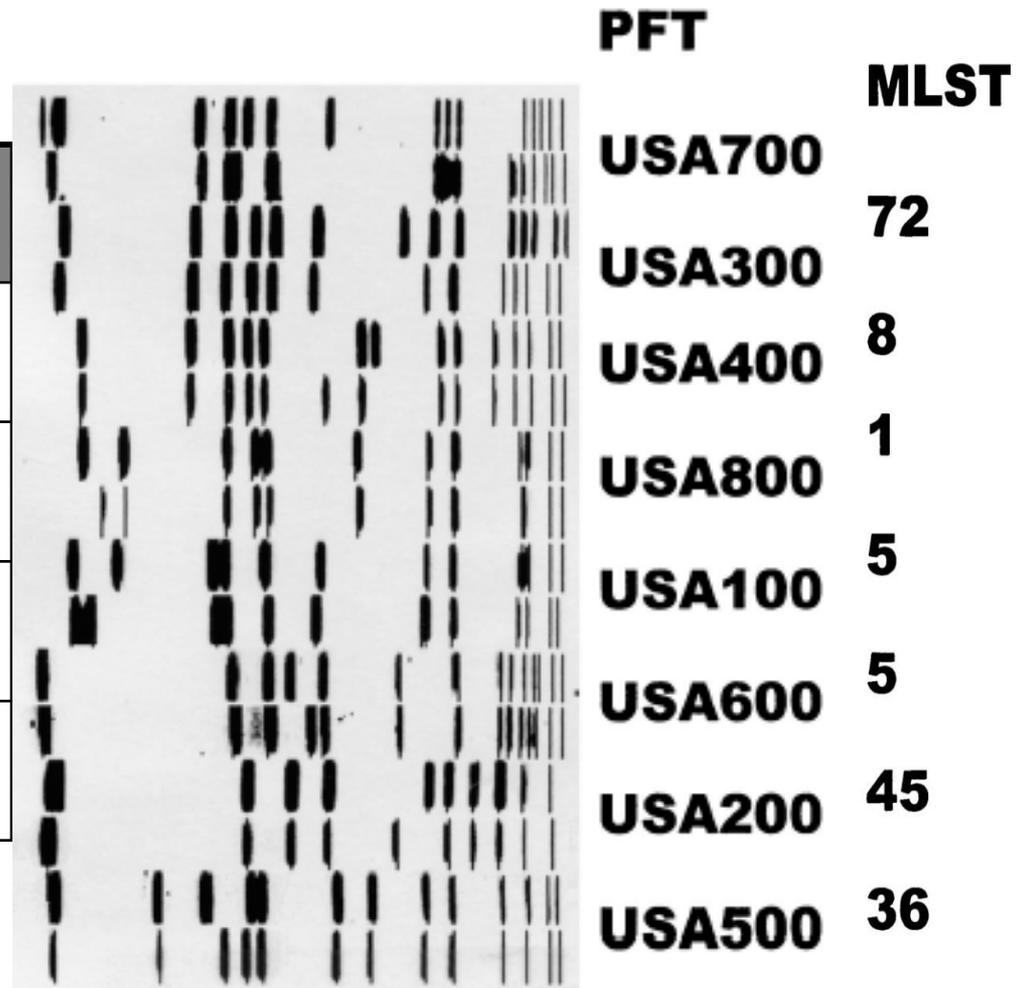
- Epidemiological and clinical characteristics
 - Occurs in the community or <48-72h after admission
 - Absence of traditional risk factors for MRSA
 - Primarily cause skin and soft tissue infection (SSTI)

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

Community-associated MRSA

Molecular characteristics

PFT	Location	SCCmec
USA300	Community	Type IV
USA400	Community	Type IV
USA100	Hospital	Type II
USA200	Hospital	Type II



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

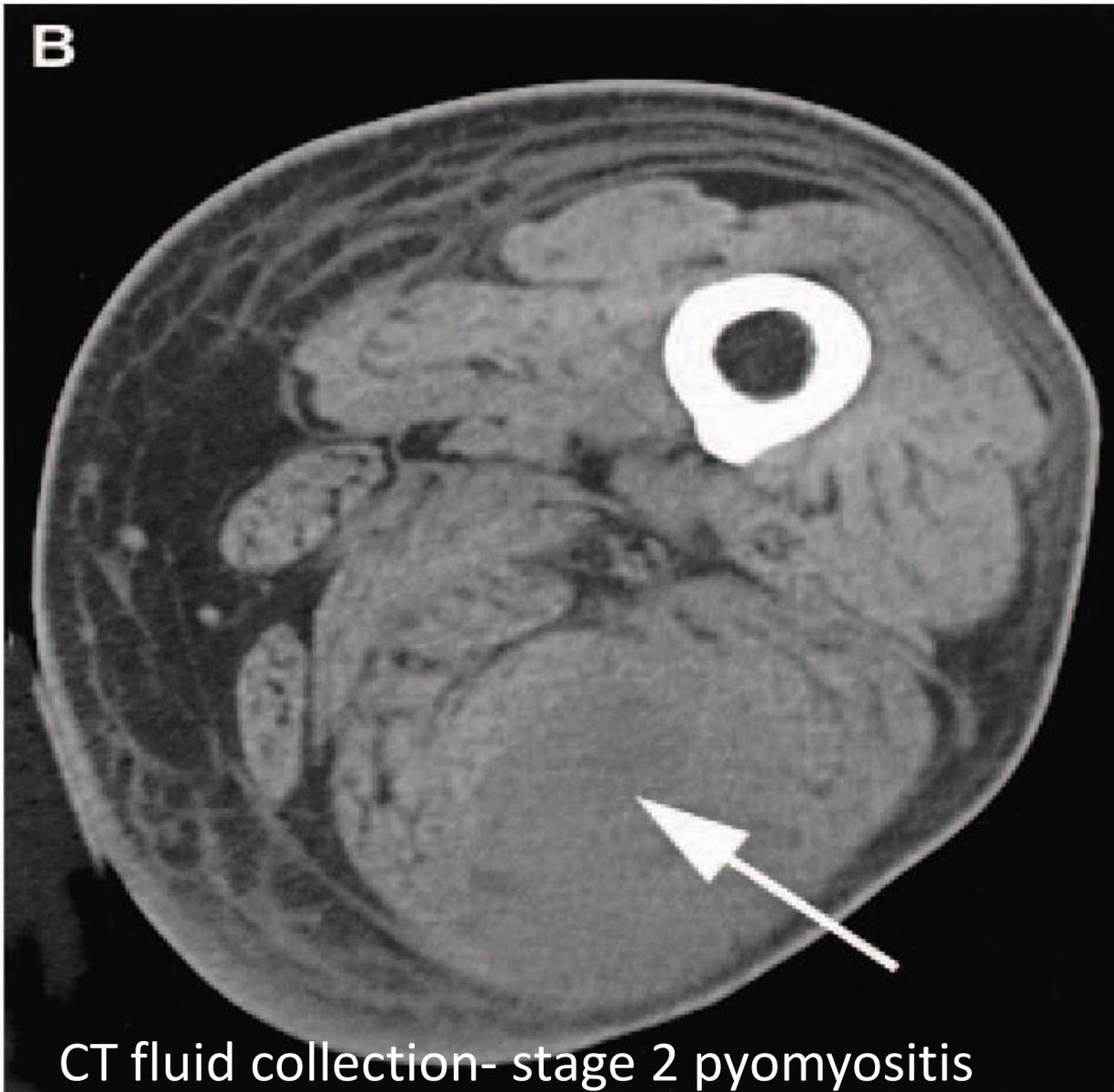
- Stage 1 (invasive)
 - Low-grade fever, mild leukocytosis
 - “Woody” muscle induration
- Stage 2 (suppurative)- 10-21 days after initial symptoms
 - Fever, high leukocytosis
 - Exquisite muscle tenderness, edema, and often fluctuance
 - Aspirate will yield purulent material
- Stage 3 (late)- systemic toxicity/infection
 - Septic shock
 - Endocarditis
 - Pneumonia
 - Abscesses



Left posterior thigh- stage 2 pyomyositis

J Amer Acad Dermatol. 2004;51: 308.

B



CT fluid collection- stage 2 pyomyositis

J Amer Acad Dermatol. 2004;51: 308.

Tropical Pyomyositis

Clinical Manifestations

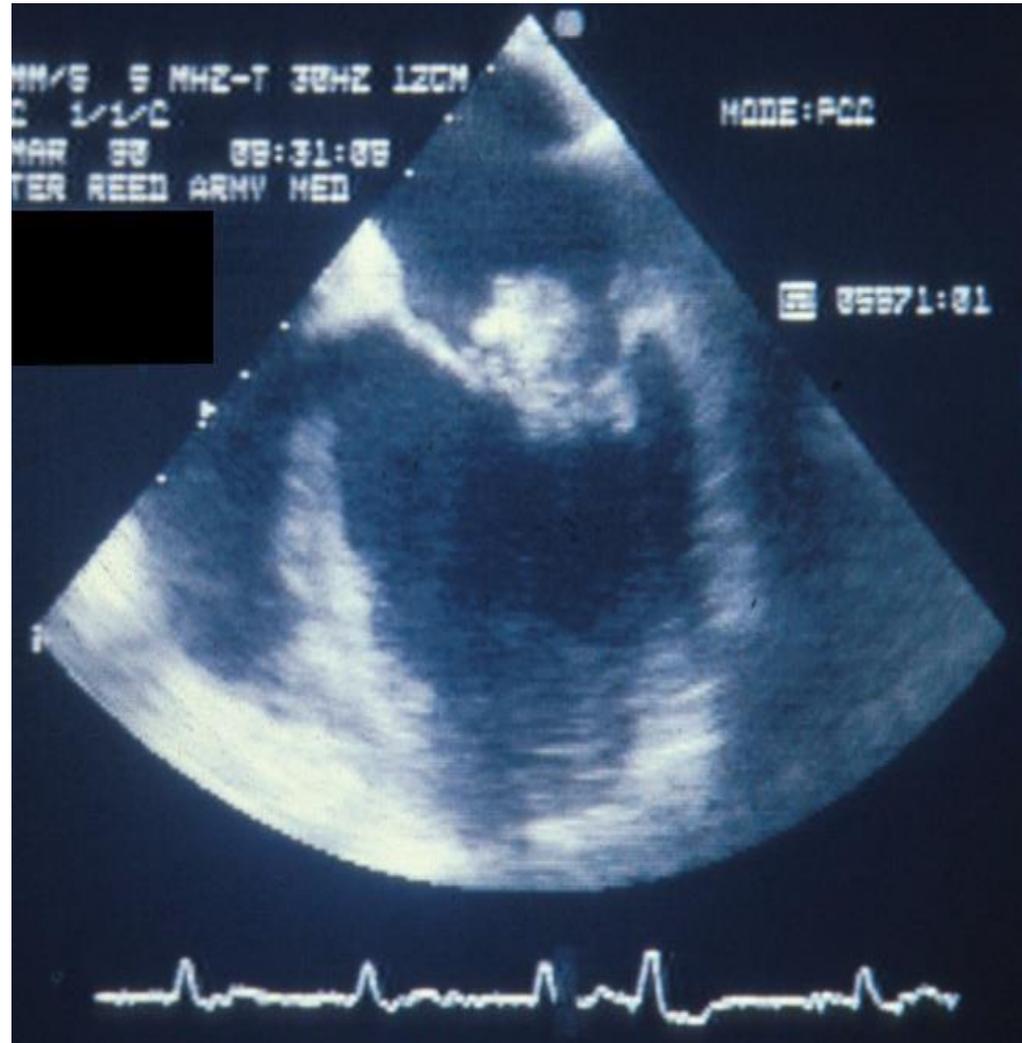
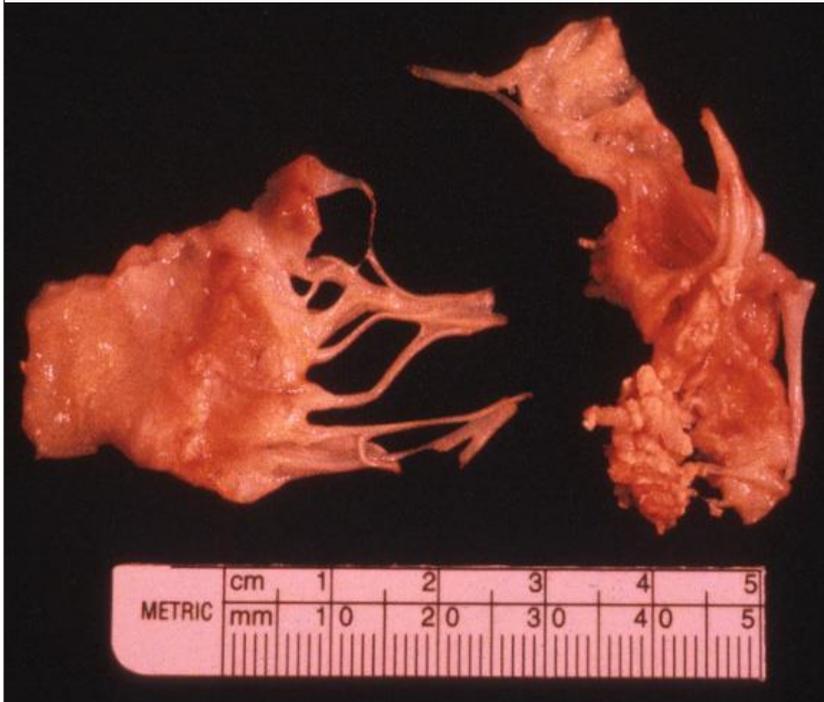
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 - Pneumonia
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Necrotizing pneumonia



. 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 consolidation, with small left-side pleural effusion.

Endocarditis



Septic emboli



Clin Infect Dis. 2005;40: 100.

Tropical Pyomyositis

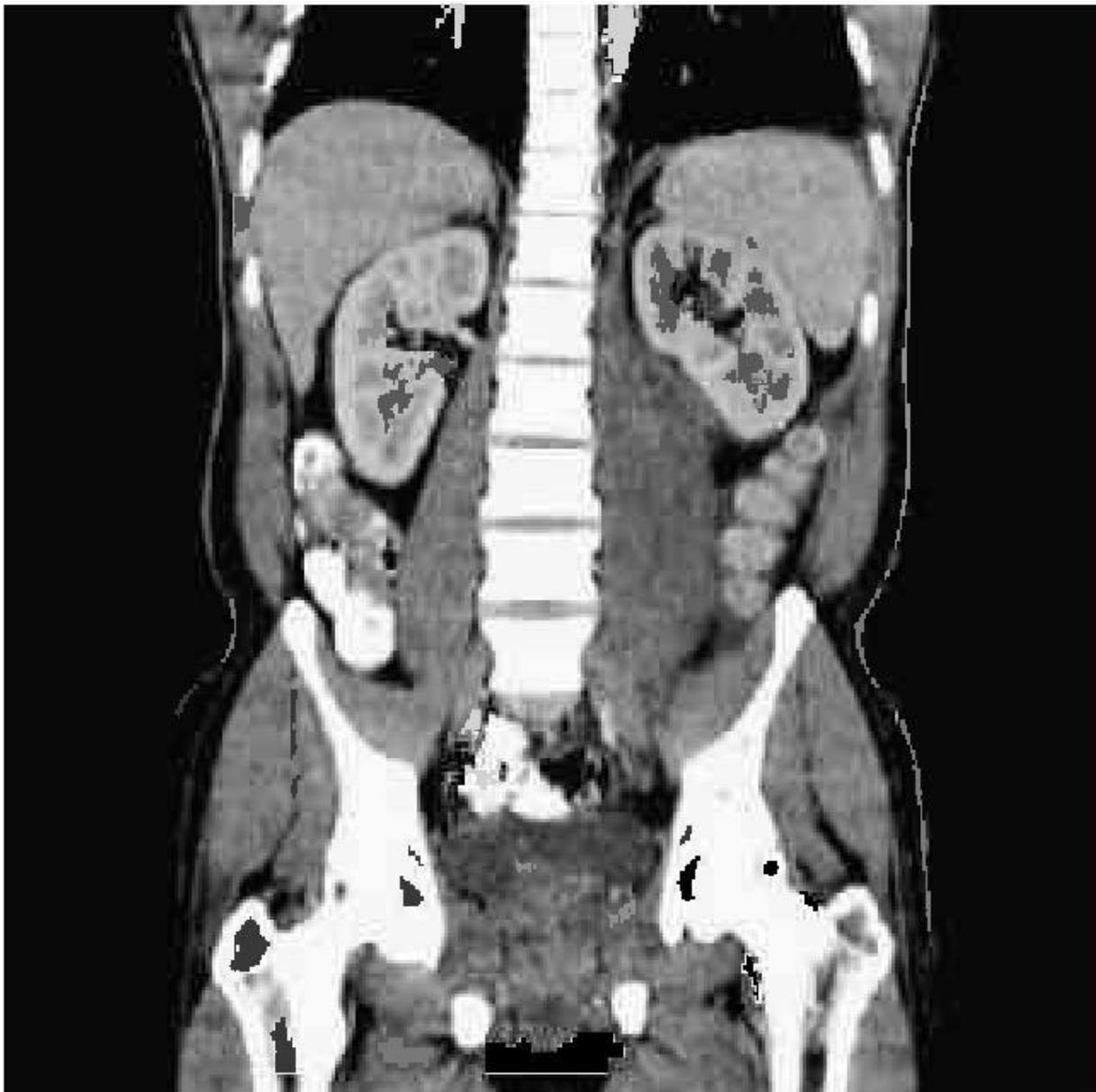
Differential diagnosis

- 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

Infect Dis Clin NA. 2005;19: 981.

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

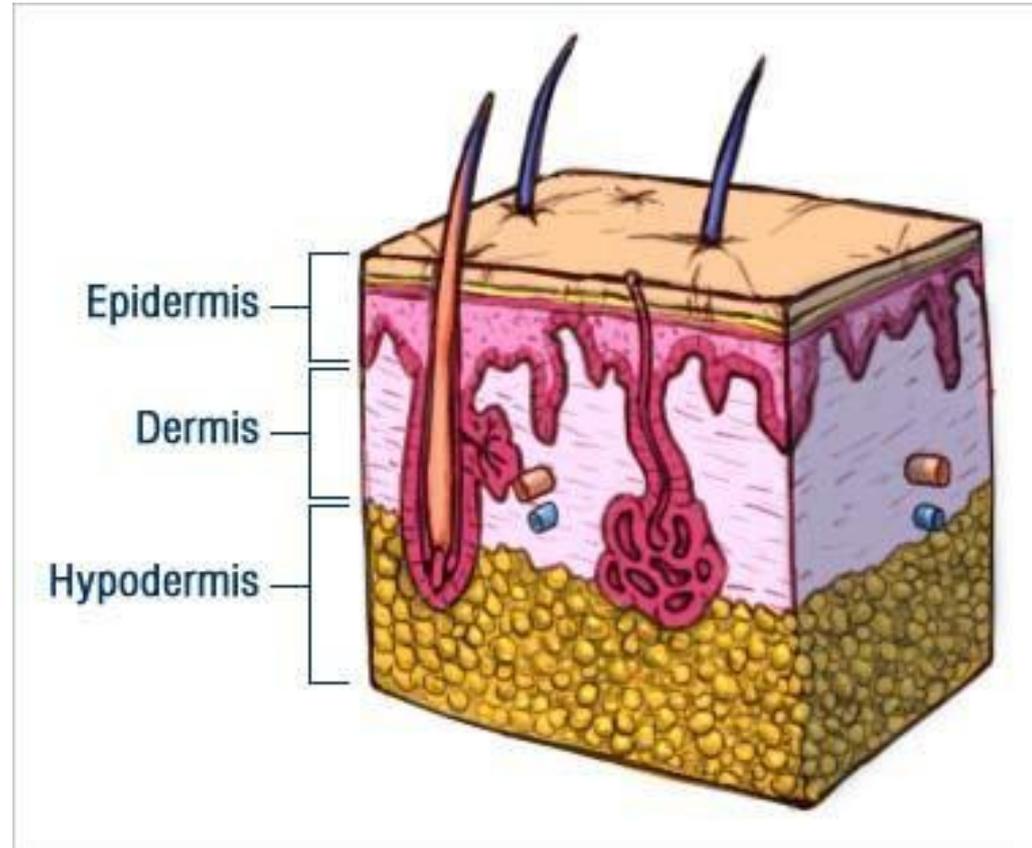


Left hip- stage 2 pyomyositis- post drainage

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



Abscess- Axilla



Dermatologic conditions of the ill returned traveler: an analysis from the GeoSentinel Surveillance Network[☆]

Edith R. Lederman^{a,b,1,*}, Leisa H. Weld^{b,1}, Iqbal R.F. Elyazar^{a,1},
Frank von Sonnenburg^{c,1}, Louis Loutan^{d,1}, Eli Schwartz^{e,1},
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Int J Infect Dis. 2008; 12: 593.

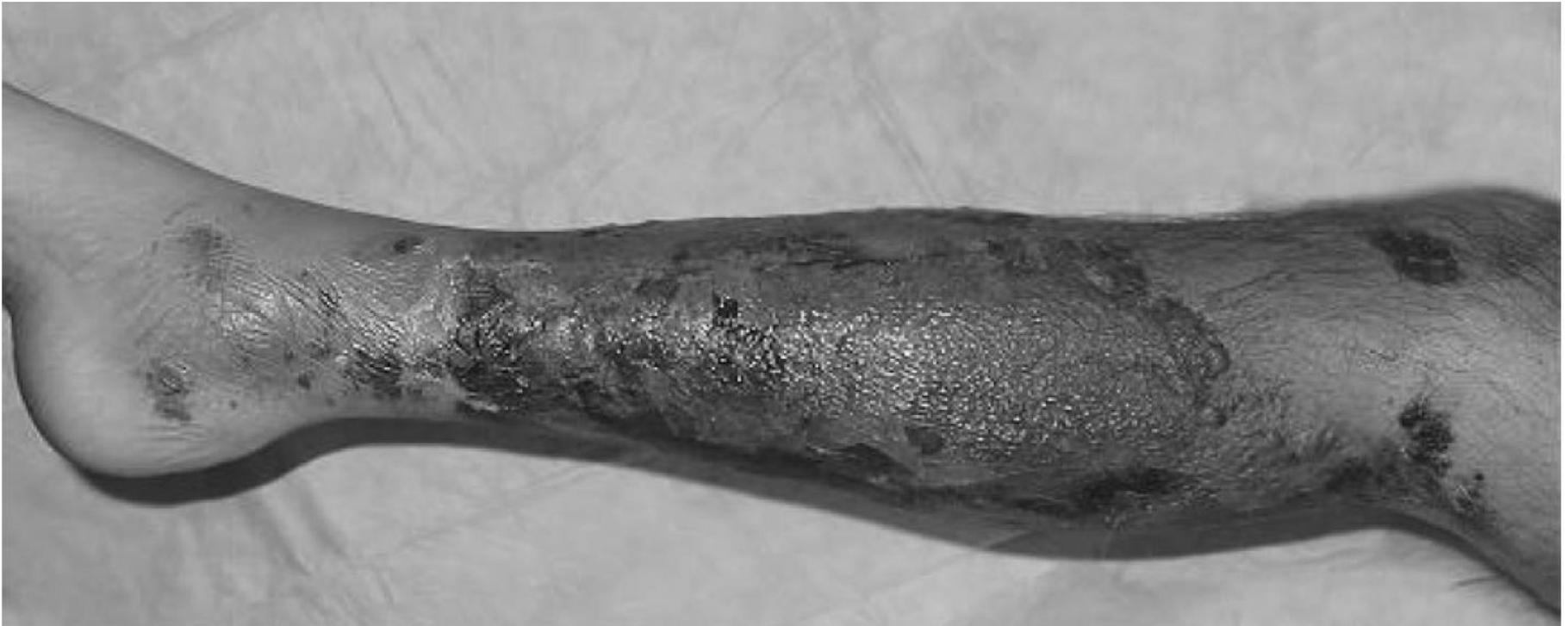
Dermatologic conditions in travelers

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†*



Infect Dis Clin Pract. 2005;13:139.

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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

Infect Dis Clin Pract. 2005;13: 139.

Methicillin-Resistant *Staphylococcus aureus* in Wound Cultures Recovered From a Combat Support Hospital in Iraq

Clinton K. Murray, MD, Matthew E. Griffith, MD, Katrin Mende, PhD, Charles H. Guymon, MS, Michael W. Ellis, MD, Miriam Beckius, MPH, Wendy C. Zera, BS, Xin Yu, MS, Edgie-Mark A. Co, PhD, Wade Aldous, PhD, and Duane R. Hospenthal, MD, PhD

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

Pulsed-Field Types (n)	SCCmec, n (%)	Presence of ACME, n (%)	Presence of PVL, n (%)
→ USA300 (66)	IV 66 (100)	62 (94)	66 (100)
USA1100 (4)	IV 2 (50), NA 2 (50)	0 (0)	4 (100)
Type 2 (5)	II 5 (100)	0 (0)	0 (0)
Type A (2)	IIIA 1 (50), IIIB 1 (50)	0 (0)	0 (0)
Type B (1)	IV 1 (100)	0 (0)	0 (0)
Type C (1)	IV 1 (100)	0 (0)	0 (0)
Type D (1)	IV 1 (100)	0 (0)	1 (100)
Type E (1)	IA 1 (100)	0 (0)	1 (100)
Type F (1)	IV 1 (100)	0 (0)	1 (100)
Type G (1)	IV 1 (100)	1 (100)	1 (100)
Type H (1)	IV 1 (100)	0 (0)	0 (0)

J Trauma. 2010;69: S1.

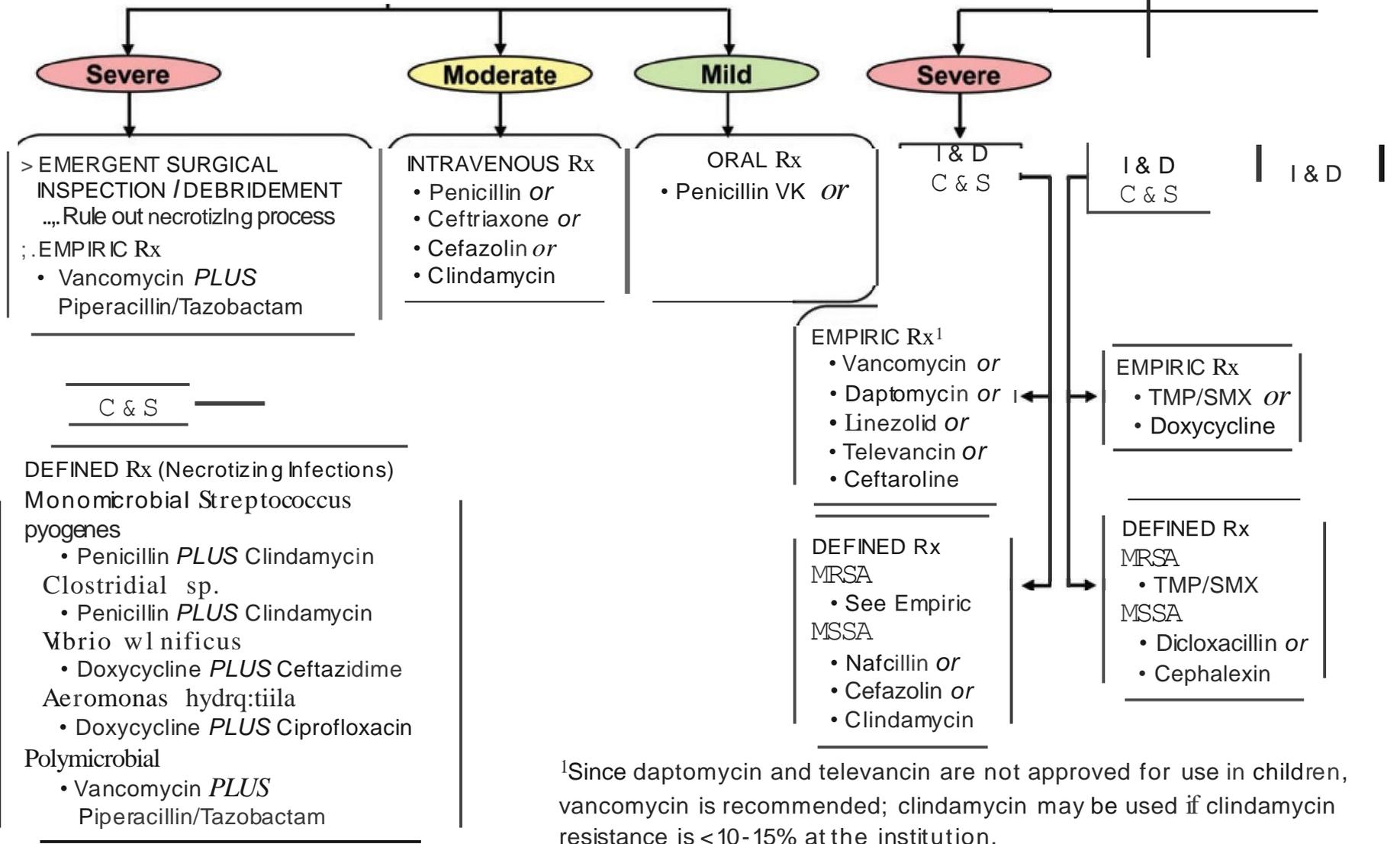
Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America

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

MANAGEMENT OF SSTIs

NON PURULENT
Necrotizing Infection /Cellulitis /Erysipelas

PURULENT
Furuncle / Carbuncle / Abscess



¹Since 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

Ann Emerg Med. 2009.

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)

SSTI management

Cellulitis

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

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

Clin Infect Dis. 2013;69: S1.



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.**



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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.
5. **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?



DON'T GIVE BACTERIA A FREE RIDE.

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



www.cdc.gov/mrsa



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.



Massachusetts Department of Public Health
www.mass.gov/dph
October 2005

