Surgical Management of MRSA Soft Tissue Infections

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OBJECTIVES

- To describe the continued emergence of MRSA in the community as a public health problem.
- To discuss the current management of MRSA skin and soft tissue infections.
- To provide recommendations as to when surgical consultation should be obtained.
SKIN & SOFT TISSUE INFECTIONS (SSTI)

**Folliculitis** – purulence limited to the epidermis, usually in body areas prone to friction and heavy perspiration.

**Furuncle** – purulence surrounding the hair follicles and extending to subcutaneous tissue.

**Carbuncle** – the coalescence of several furuncles.

**Cellulitis** – diffuse infection of the soft tissues with no localized area of pus amenable to drainage.

**Abscess** – collection of pus within the dermis, associated with erythema and fluctuance.

**Complicated SSTI** – abscess that affects the perianal or perineal areas.
SKIN/SOFT TISSUE INFECTIONS

- Skin bacterial colonization
- Trauma (minor break or puncture)
- Bacterial proliferation
- Inflammatory reaction
  - Bacterial enzymatic activity → necrosis, liquefaction, leukocytic response.
  - Immune system forms cavity to contain the infection.
- Interior of abscess liquefies & pus develops (dead cells, proteins, bacteria, & other debris).
- Area expands, creating tension & inflammation of the overlying skin.
SKIN/SOFT TISSUE INFECTIONS

Overuse of antibiotics has led to resistance – Ubiquitous SMART BUG

- **Penicillin (PCN)** (1940)
  - PCN-resistant *S. aureus*
- **Methicillin** (1950)
  - Methicillin-resistant *S. aureus* (HA-MRSA)
  - Vancomycin-resistant enterococcus (VRE)
  - Linezolid
- **Vancomycin (glycopeptide)**
  - Intermediate-resistant *S. aureus* (VISA)

- **Vancomycin**
  - Ciprofloxacin (1987)
  - Vancomycin-resistant enterococcus (VRE)
Hospital Acquired-MRSA

- Infection isolated after 48-72 hours of admission to healthcare facility or present at admission in recently discharged patient or present in a resident of a long term health care facility (HA=health care associated)
- Multiple drug resistance
- Already “sick” patient
- No PVL gene
- **NOT WHY WE ARE HERE**
Community Acquired-MRSA

- Infection isolated in outpatient setting or within 48-72 hours of admission to healthcare facility
- No previous MRSA infection
- No permanent medical devices
- Otherwise healthy child
- PVL gene expressed
- No previous history in last year (admission, dialysis, surgery)
CA-MRSA vs. HA-MRSA Comparison

- Different bug? 1990’s
  - Genomic differences, different antibiotic resistance
  - PVL toxin

- Different host
  - Healthy hosts

- Different presentation
  - Skin and soft tissue most likely place
CA-MRSA vs. HA-MRSA Comparison

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<thead>
<tr>
<th></th>
<th>CA-MRSA</th>
<th>HA-MRSA</th>
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<tbody>
<tr>
<td>Virulence Factors,</td>
<td>(+) PVL</td>
<td>(-) PVL</td>
</tr>
<tr>
<td>Toxins</td>
<td>Many toxins expressed</td>
<td>Few toxins expressed</td>
</tr>
<tr>
<td>Resistance</td>
<td>Limited: B-lactams,</td>
<td>Broad</td>
</tr>
<tr>
<td></td>
<td>erythromycin, clindamycin</td>
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<tr>
<td>Susceptibility</td>
<td>Bactrim, rifampin,</td>
<td>Limited: vancomycin,</td>
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<tr>
<td></td>
<td>clindamycin*, tetracyclines</td>
<td>linezolid and</td>
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<td>and sometimes</td>
<td>quinupristin/dalfopristin</td>
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<td>erythromycin and</td>
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<td></td>
<td>fluoroquinolones</td>
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<td>Spectrum of disease</td>
<td>Predominantly Skin and Soft</td>
<td>Predominantly Blood,</td>
</tr>
<tr>
<td></td>
<td>Tissue infections</td>
<td>Respiratory and Urinary</td>
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<td>Tract infections</td>
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PVL Toxin

- PVL = Panton-Valentine-Leukocidin toxin
  - Implicated in skin and soft tissue necrosis
  - Attacks soft tissues
  - “Solid” mass, Cellulitus, no fluctuance, necrosis
    - “spider bite”
  - Other toxins
- Not liquid pus
**Inducible Clindamycin Resistance**

- Appear clindamycin-susceptible and erythromycin-resistant on routine testing.
- Can readily be induced to express clindamycin resistance.
- Can occur in patients not pre-treated or co-treated with erythromycin.
- Treatment failures have occurred.
  - If empiric clindamycin therapy initiated and D-zone testis positive, assess response to treatment.
- AT UK, less than 10% of MRSA express inducible clindamycin resistance.
EPIDEMIOLOGY

Clusters of outbreaks
- Sports teams
- Inmates
- Daycare attendees
- Health care workers (families)
- Tattoo / piercings

Risk Factors
- Age <2
- Previous exposure
- Crowding
- Poor hygiene
- Moist environments
CA-MRSA Presentation

- Skin and Soft Tissue Infection (SSIs)
- Pneumonia
- Osteomyelitis
- UTIs
- Sinus infection
- Wound Infection
PRESENTATION

- Redness
- Swelling
- Warmth
- Pain/tenderness
- Complaint of “spider bite”

- Is the lesion purulent?
  - Fluctuance—palpable fluid-filled cavity, movable, compressible
  - Yellow or white center
  - Central point or “head”
  - Draining pus
  - Possible to aspirate pus with needle and syringe
PRESENTATION

SINGLE OR MULTIPLE
OUTPATIENT MANAGEMENT

Soft Tissue Abscess:
- Drain the lesion
- Send wound drainage for culture and susceptibility testing
- Advise patient on wound care and hygiene
- Discuss follow-up plan with patient
- Consider antimicrobial therapy with coverage for MRSA in addition to I&D
  - systemic symptoms
  - severe local symptoms
  - Immunosuppression
  - failure to respond to I&D

Cellulitis without abscess:
- Provide antimicrobial therapy with coverage for *Streptococcus* spp. and/or other suspected pathogens
- Maintain close follow-up
- Consider adding coverage for MRSA (if not provided initially), if patient does not respond
CA-MRSA: Skin & soft tissue infections

Is an antibiotic needed all the time?

Consider:

- Severity and rapidity of progression/cellulitis
- Signs/symptoms of systemic illness
- Associated co-morbidity
- Extremes of patient age
- Location of abscess
- Lack of response to I&D alone
Signs of Systemic Disease

ALL NEED I&D
Classify Severity

MILD:
Afebrile
Previously healthy

MODERATE:
Febrile
Ill but “not sick”

SEVERE:
Toxic-appearance
Immunocompromised
Limb-threatening infection

CRITICALLY ILL

I & D alone
I & D

Oral abx: TMP/SMX*, clindamycin+, doxycycline (> 8 YOA)

Hospitalize
Empiric vancomycin+/linezolid or clindamycin until culture results known

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PROBLEM IN KENTUCKY?

- Scope of problem at KCH
- Number of ORs with CPT codes 10060-61 (SSI drainage):
  - 2003-04 ~40
  - 2006-07 275
  - 2007-08 296
  - 2008-09 261
  - 2009-10 282

Costs:
- Hospital stay with IV antibiotics
- OR time/cost
- +/- PO antibiotics at home
- Open wound care
- Parents lost work time
- Follow-up visits
- Recurrent infections – 20% return with new abscess (different location)
Surgical Intervention

- “Office”
  - Bedside – No sedation
  - Single site, very small
  - Young or older child
  - Local analgesia

- “Operating Room”
  - Sedated, monitored setting
  - PICU, ER, OR, Recovery room
  - Face, genitalia, multiple sites, younger
KCH Surgery Treatment Algorithm

1. Child arrives with SSI
2. KEEP NPO until discussion with surgery (and sedation team when/if available)
3. Start IV and hydration and obtain CBC (and blood culture if febrile or less than 2 months)
4. Start IV Vancomycin or Clindamycin
5. Drain, irrigate, and pack abscess (timing depends on NPO, availability of surgeon and availability of place to do procedure).
6. Wait at least 12 hours. Remove Pack, initiate soap and water baths, send home on Bactrim PO for 5-7 days if cellulitis or fever still present
7. See back in office for wound check and referral to Peds ID if recurrent.
Operative Incision & Drainage

Prep and Drape

Incision over most fluctuant area

Break-up all loculations

Irrigate

Pack tightly
Minimally Invasive Technique

- Drainage of abscess through peripheral stab incisions.
- Cavity debridement and irrigation.
- Placement of vessel-loop drain through drainage incisions.
- Topical wound care BID without packing.
- Drain removal after resolution of cellulitis and drainage.

Ladd AP, et al. JPS 45:1562–1566, 2010
Minimally Invasive Technique

Ladd AP, et al. JPS 45:1562–1566, 2010
A New Paradigm?

- Children's Hospital of Illinois (Peoria, IL)
- Retrospective study, January 2002 – October 2007
- Results:
  - 115 patients
  - Age 4.25 years (19 days to 20.5 years)
  - Length of hospital stay 3 days (1-39 days)
  - Duration of procedure 10.8 minutes (4-43 minutes)
  - Drain duration 10.4 days (3-24 days)
  - Number of postoperative visits 1.8 (1-17)
  - Culture data available for 101 patients: 50% MRSA, 26% MSSA, and 9% streptococcal species.

- Conclusions:
  - Loop drains safe & effective treatment of subcutaneous abscesses.
  - Expected cost savings with simplified wound care

Tsoraides SS, et al. JPS 45: 606-609, 2010
A New Paradigm?

- Riley Hospital for Children (Indianapolis, IN) & Arnold Palmer Hospital for Children (Orlando, FL)
- Retrospective study, January 2006 – August 2007
- Results:
  - 128 patients
  - Females to males 1.25:1
  - Age 51.5 months (5 weeks to 18 years)
  - Length of hospital stay 1.5 days, 30 outpatients
  - MRSA identified in 76% of cultured specimens
  - Drain duration 9 days (5-29 days)
  - No local recurrences of subcutaneous abscesses
- Conclusions:
  - Successful technique for drainage/treatment of abscesses with limited, postoperative wound care and no morbidity or recurrence.

Ladd AP, et al. JPS 45:1562–1566, 2010
A New Paradigm?

Women & Children’s Hospital of Buffalo
Retrospective study, November 2007 – July 2008
219 patients
Subcutaneous drains safe & equally effective alternative to traditional I&D.

Post-Operative Care

- **Day 1-10**
  - Soap and water irrigations TID to QID
  - “Floss” drain
  - Follow-up for drain removal in clinic

- **Advantages:**
  - Simplified wound care
  - Less worry about keeping skin edges open
  - Decreased hospital stay
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,3,5 Sara E. Cosgrove,6 Robert S. Daum7 Scott K. Fridkin,8 Rachel J. Gorwitz,9 Sheldon L. Kaplan,10 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. Chambers12

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**IDSA Guidelines**

- Evidence-based guidelines for the management of patients with methicillin-resistant *Staphylococcus aureus*.
- Expert Panel of the Infectious Diseases Society of America (IDSA).
- Endorsed by the Pediatric Infectious Diseases Society, the American College of Emergency Physicians, and the American Academy of Pediatrics.

TREATMENT

Minor Skin Infections:

- Simple abscesses or boils
- Incision & drainage is the primary treatment
- Mupirocin 2% topical ointment can be used
- Additional data are needed to further define the role of antibiotics.

## Conditions in which Antimicrobial Therapy is Recommended after Incision and Drainage of an Abscess due to Community-Associated Methicillin-Resistant *Staphylococcus aureus*

- Severe or extensive disease (eg, involving multiple sites of infection) or rapid progression in presence of associated cellulitis
- Signs and symptoms of systemic illness
- Associated comorbidities or immunosuppression (diabetes mellitus, human immunodeficiency virus infection/AIDS, neoplasm)
- Extremes of age
- Abscess in area difficult to drain completely (eg, face, hand, and genitalia)
- Associated septic phlebitis
- Lack of response to incision and drainage alone
Purulent Cellulitis:

- Cellulitis associated with purulent drainage or exudate in the absence of a drainable abscess
- Empirical therapy for CA-MRSA is recommended pending culture results.
- Empirical therapy for infection due to β-hemolytic streptococci is likely to be unnecessary.
- Five to 10 days of therapy is recommended but should be individualized on the basis of the patient’s clinical response.

Nonpurulent Cellulitis:

- Cellulitis with no purulent drainage or exudate and no associated abscess.
- Empirical therapy for infection due to β-hemolytic streptococci is recommended.
- The role of CA-MRSA is unknown.
- Empirical coverage for CA-MRSA is recommended in patients who do not respond to β-lactam therapy and may be considered in those with systemic toxicity.
- Five to 10 days of therapy is recommended but should be individualized on the basis of the patient’s clinical response.
KCH Antibiotic Guidelines

MRSA not suspected

- Cephalexin
  - Peds: 25-50mg in 3-4 doses MAX 1-4g/day
  - Adult: 500mg po qid
  - Provides GABHS coverage
  - Empiric coverage for MRSA is recommended if patients do not respond to β lactam therapy.

Courtesy of Laura P. Stadler, M.D.
University of Kentucky Department of Pediatrics
**KCH Antibiotic Guidelines**

- **Clindamycin**
  - Adult: 300-450mg po tid
  - Peds: 10-13mg/kg/dose po q6-8h MAX: 40mg/kg/day
  - C. diff may occur
  - Poor palatability in liquid

- **Sulfamethoxazole/Trimethoprim**
  - Adult: 1-2 DS po bid
  - Peds: TMP 4-6mg/kg/dose, SMX 20-30mg/kg/dose po q12h

Courtesy of Laura P. Stadler, M.D.
University of Kentucky Department of Pediatrics
KCH Antibiotic Guidelines

- **Minocycline**
  - Adult: 200mg x1, then 100mg po bid
  - Peds: 4mg/kg po x1, then 2mg/kg/dose po q12h
  - >8 years of age
  - Pregnancy category D
  - Photosensitivity may occur
KCH Antibiotic Guidelines

- Doxycycline
  - Adult: 100mg po bid
  - Peds: < 45kg: 2mg/kg/dose po q12h
    > 45 kg: 100mg po bid
  - > 8 years of age
  - Pregnancy category D
  - Photosensitivity may occur

Courtesy of Laura P. Stadler, M.D.
University of Kentucky Department of Pediatrics
KCH Antibiotic Guidelines

Complicated SSTI:

- **Vancomycin**
  - Adult: 15-20mg/kg dose IV q8-12h
  - Peds: 15mg/kg IV q6h
  - Trough goal: 15-20

- **Clindamycin**
  - Adult: 600mg po/IV tid
  - Peds: 10-13mg/kg/dose po/IV q8h
    - MAX: 40mg/kg/day
  - C. diff may occur
  - Poor palatability in liquid

Courtesy of Laura P. Stadler, M.D.
University of Kentucky Department of Pediatrics
When to Refer?

**Guidelines:**
- Very small child
- Multiple sites
- Systemic signs (IV abx need)
- Failed office drainage
- Anytime you don’t feel comfortable
Prevent the spread of MRSA:

- **Cover your wound.**
  Keep wounds that are draining, or have pus, covered with clean, dry bandages until healed. Bandages and tape can be discarded with the regular trash.

- **Clean your hands.**
  Frequent hand washing with soap and water or use an alcohol-based hand rub, especially after changing the bandage or touching the infected wound.

- **Do not share personal items.**
  Avoid sharing personal items, such as towels, washcloths, razors, clothing, or uniforms, that may have had contact with the infected wound or bandage. Wash sheets, towels, and clothes that become soiled with water and laundry detergent. Use a dryer to dry clothes completely.

- **Maintain a clean environment.**
  Establish cleaning procedures for frequently touched surfaces and surfaces that come into direct contact with skin.

http://www.cdc.gov/mrsa
Closing to Clean or Disinfect

- In general, it is not necessary to close schools to "disinfect" them when MRSA infections occur. MRSA skin infections are transmitted primarily by skin-to-skin contact and contact with surfaces that have come into contact with someone else's infection. Covering infections will greatly reduce the risks of surfaces becoming contaminated with MRSA.

Excluding Students with MRSA Infections from School

- Unless directed by a physician, students with MRSA infections should not be excluded from attending school.
- Exclusion from school and sports activities should be reserved for those with wound drainage ("pus") that cannot be covered and contained with a clean, dry bandage and for those who cannot maintain good personal hygiene.

http://www.cdc.gov/mrsa
KCH Decolonization Protocol

- **Hygienic Measures:**
  - Cut fingernails short
  - Change daily: sleep wear, underwear, towels, pillows, sheets, & wash cloths

- **Eradication of nasal colonization:**
  - Apply mupirocin ointment to nares bid x 2 wks

- **Eradication of skin colonization:**
  - Bathe in Chlorox® bleach (1 tsp/gallon) approx 2 x/wk for 15 min x 1 wk *
    - Wait for drained abscesses to heal before bathing abscess in bleach

*Courtesy of Christopher T. Nelson, M.D.
University of Kentucky Department of Pediatrics.*
KCH Decolonization Protocol

- Oral antibiotic treatment of ongoing illness & body colonization:
  - Rifampin 10 mg/kg/dose bid x 2 days
- Consider treatment of family members & family pets
  - Family members & pets serve as potential reservoirs

Courtesy of Christopher T. Nelson, M.D.
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REFERENCES


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