

CONTEMPORARY PEDIATRICS

Surgical Management of MRSA Soft Tissue Infections

John M. Draus, Jr., M.D.

Assistant Professor of Surgery and Pediatrics
Kentucky Children's Hospital
University of Kentucky



UNIVERSITY OF KENTUCKY



Kentucky Children's Hospital

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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.

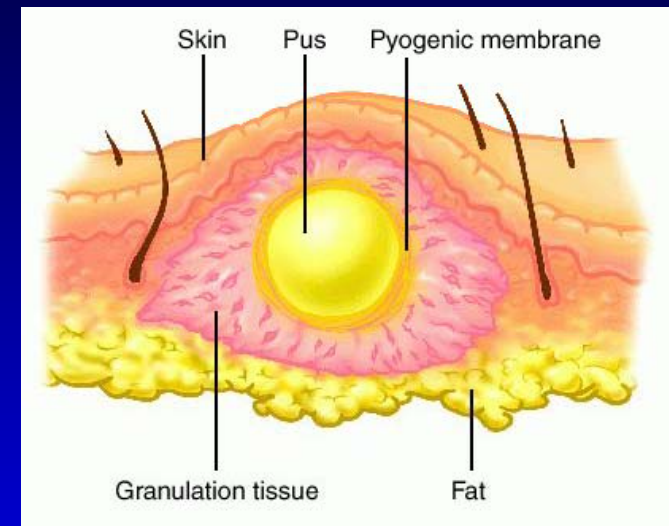
Cellulitis – diffuse infection of the soft tissues with no localized area of pus amenable to drainage.

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

Complicated SSTI – abscess that affects the perianal or perineal areas.

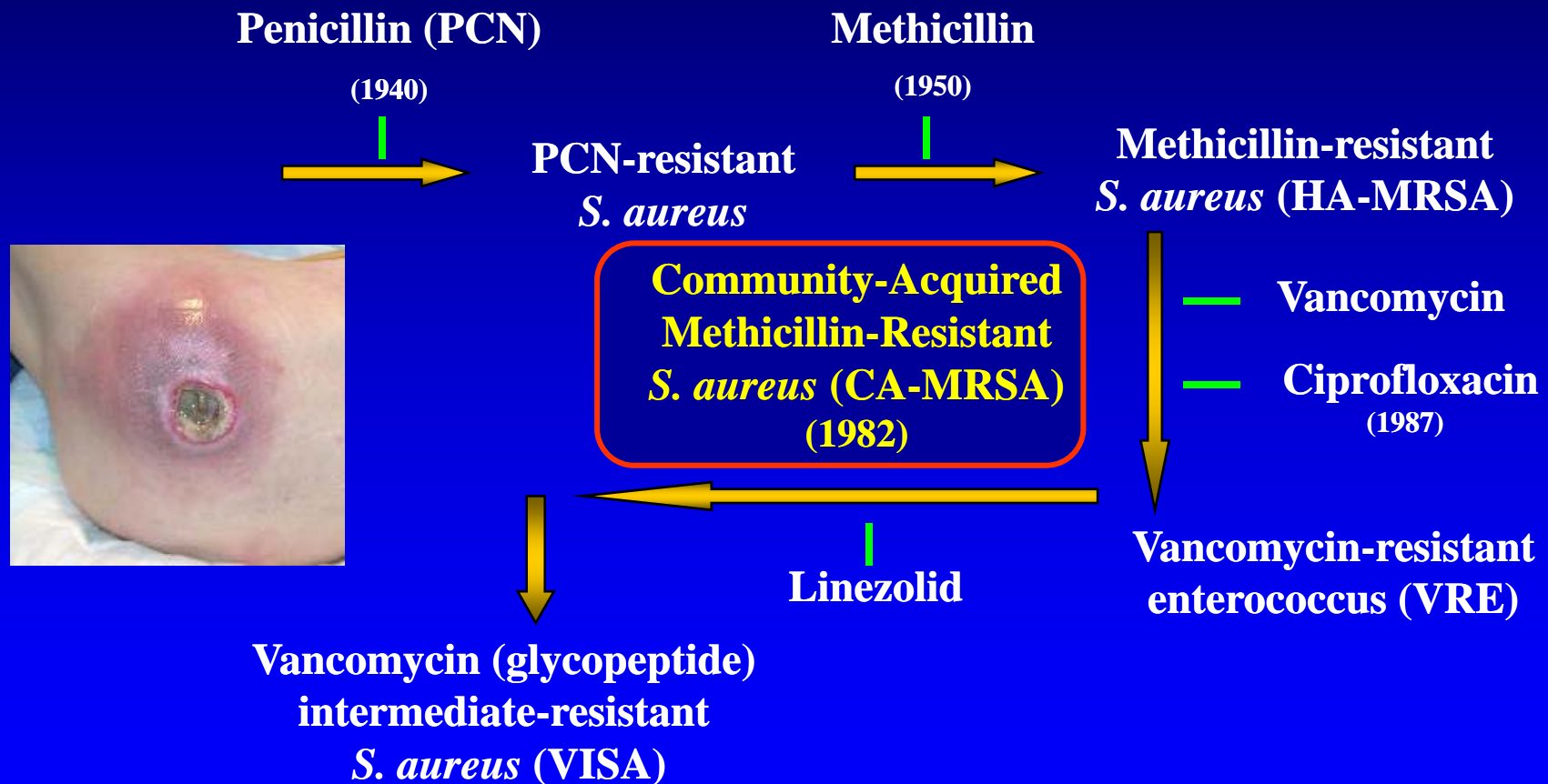
SKIN/SOFT TISSUE INFECTIONS

- 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



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

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

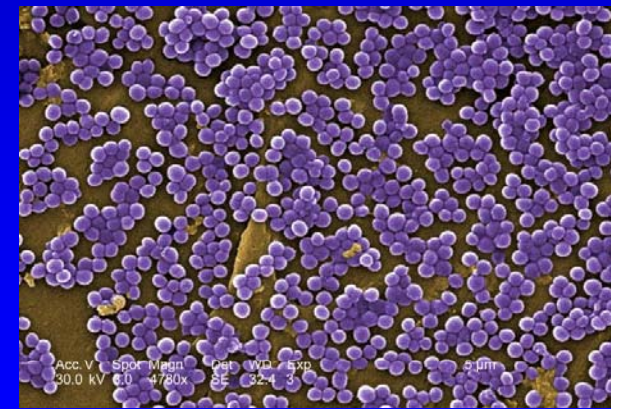
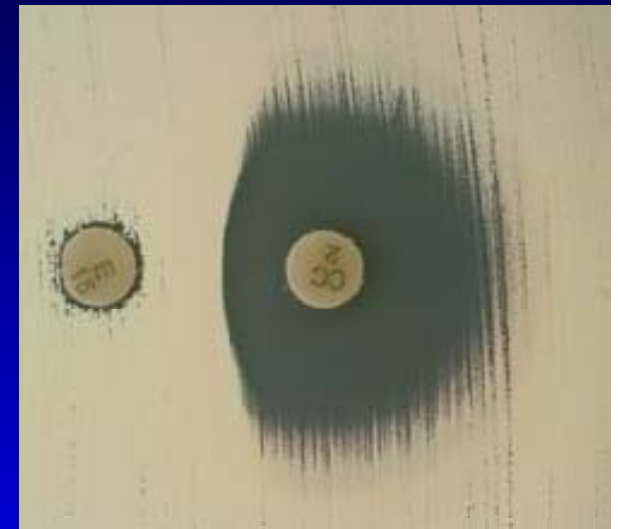
PVL Toxin

- PVL = Panton-Valentine-Leukocidin toxin
 - Implicated in skin and soft tissue necrosis
 - Attacks soft tissues
 - “Solid” mass, Cellulitis , 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

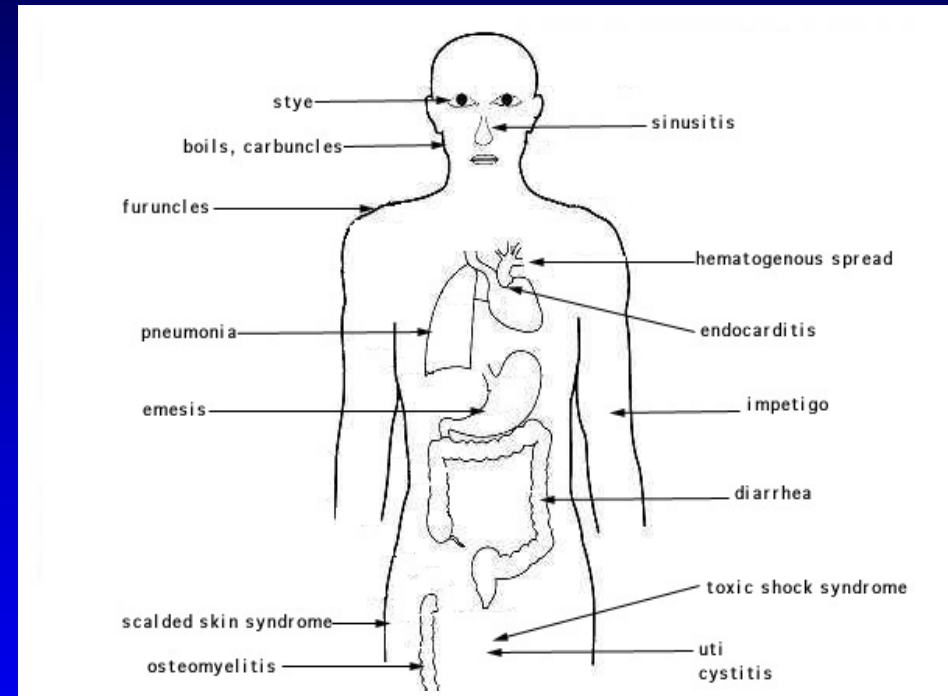
Risk Factors

- 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

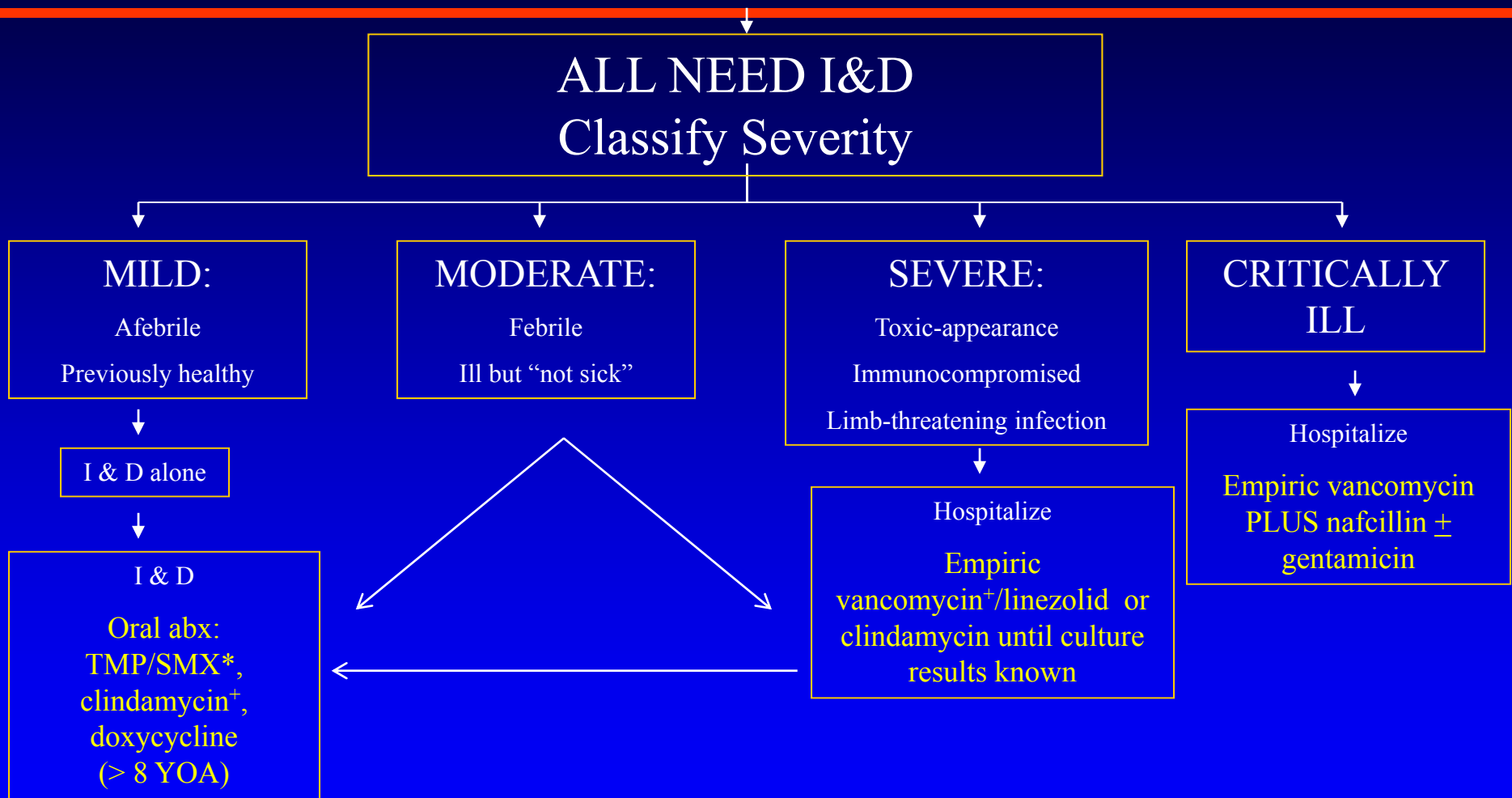
Is an antibiotic needed all the time?

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



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



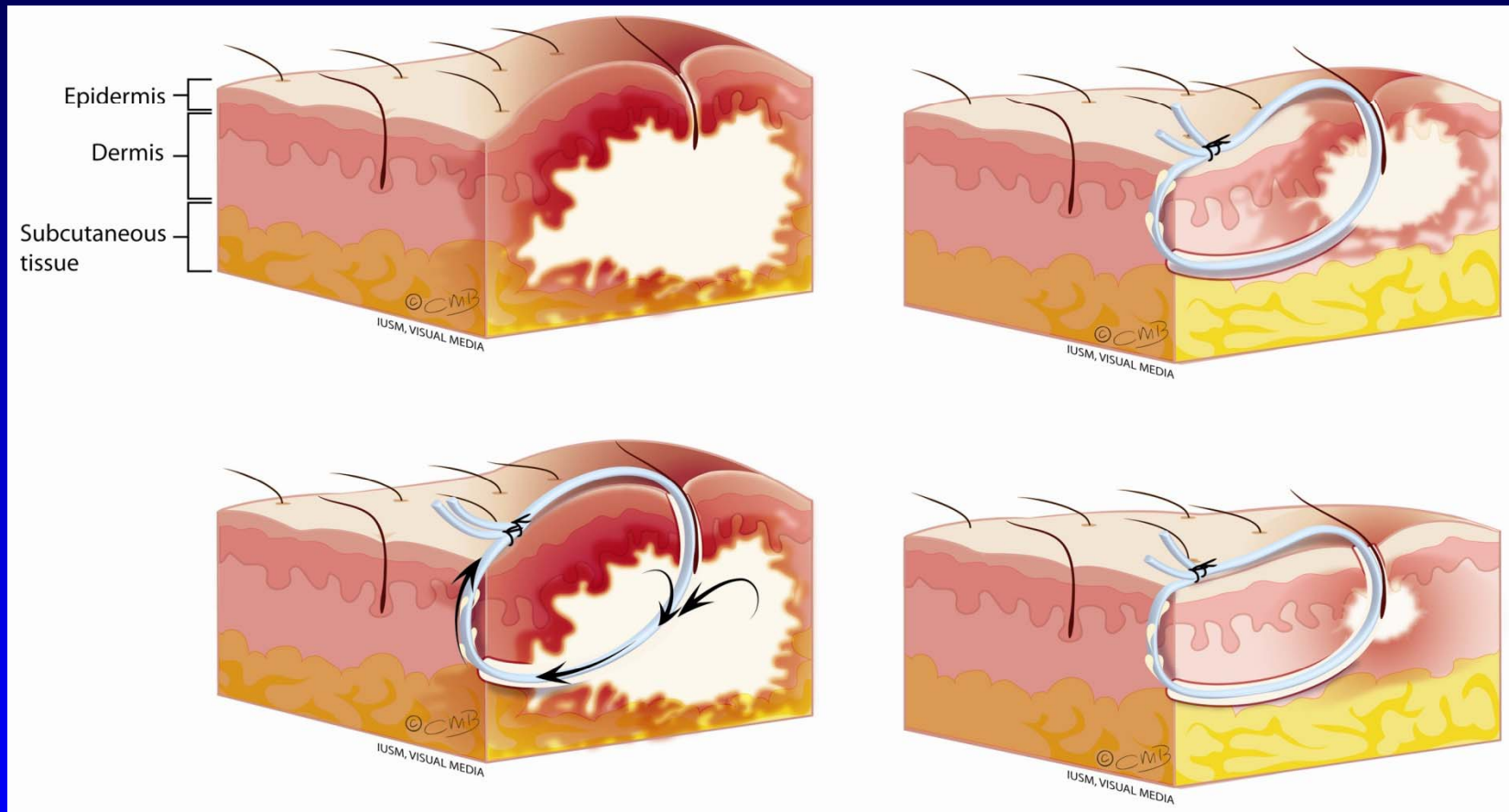
Pack tightly



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.

Minimally Invasive Technique



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



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.



A New Paradigm?

Table 1 Patient demographics, abscess location, and bacteriology

	Open I&D (n = 134)	Subcutaneous drain (n = 85)
Mean age in years	7.6 ± 7.03	6.1 ± 6.59
Sex (male/female)	58/76	27/58
Race		
Caucasian	46 (34.3%)	35 (41.2%)
African American	59 (44%)	34 (40%)
Other	29 (21.7%)	16 (18.8%)
Anatomical location	(n = 140), 6 with multiple sites	(n = 93), 8 with multiple sites
Head/neck	11 (7.9%)	2 (2.2%)
Chest/axilla/back	26 (18.6%)	13 (14.0%)
Abdomen	16 (11.4%)	7 (7.5%)
Groin/buttock/perineum	50 (35.7%)	46 (49.5%)
Upper extremities	9 (6.4%)	6 (6.5%)
Lower extremities	28 (20.0%)	19 (20.4%)
Culture results		
MRSA	79 (59%)	47 (55.3%)
MSSA	23 (17.2%)	23 (27%)
No growth	7 (5.0%)	5 (5.4%)
Other ^a	25 (17.9%)	10 (10.8%)

^a Included *Enterobacter*, *Citrobacter*, *Proteus*, *Streptococcus viridans*, *Escherichia coli*, *Klebsiella*, coagulase-negative Staph.

Table 2 Admission status, LOS, and frequency of home nursing care

	Open I&D	Subcutaneous Drain	P
Admission status			1.000
Outpatient	88 (65.7%)	56 (65.9%)	
Inpatient	46 (34.3%)	29 (34.1%)	
Home nursing required (>2 visits)	69 (51.5%)	0	<.0001

- 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. Daum,⁷ 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. Chambers^{1,2}

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 Medicine, Division of Infectious Diseases, Wayne State University, Detroit Receiving Hospital and University Health Center, Detroit, Michigan; ¹³Department of Pharmacy Practice, Wayne State University, Detroit Michigan; and ¹⁴Division of Infectious Diseases and Center for the Study of Emerging and Re-emerging Pathogens, University of Texas Medical School, Houston, Texas

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.

IDSA Guidelines

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

TREATMENT

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.

TREATMENT

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.

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

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

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

When to Refer?

Guidelines:

- Very small child
- Multiple sites
- Systemic signs (IV abx need)
- Failed office drainage
- Anytime you don't feel comfortable





CDC Guidelines



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>





CDC Guidelines



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

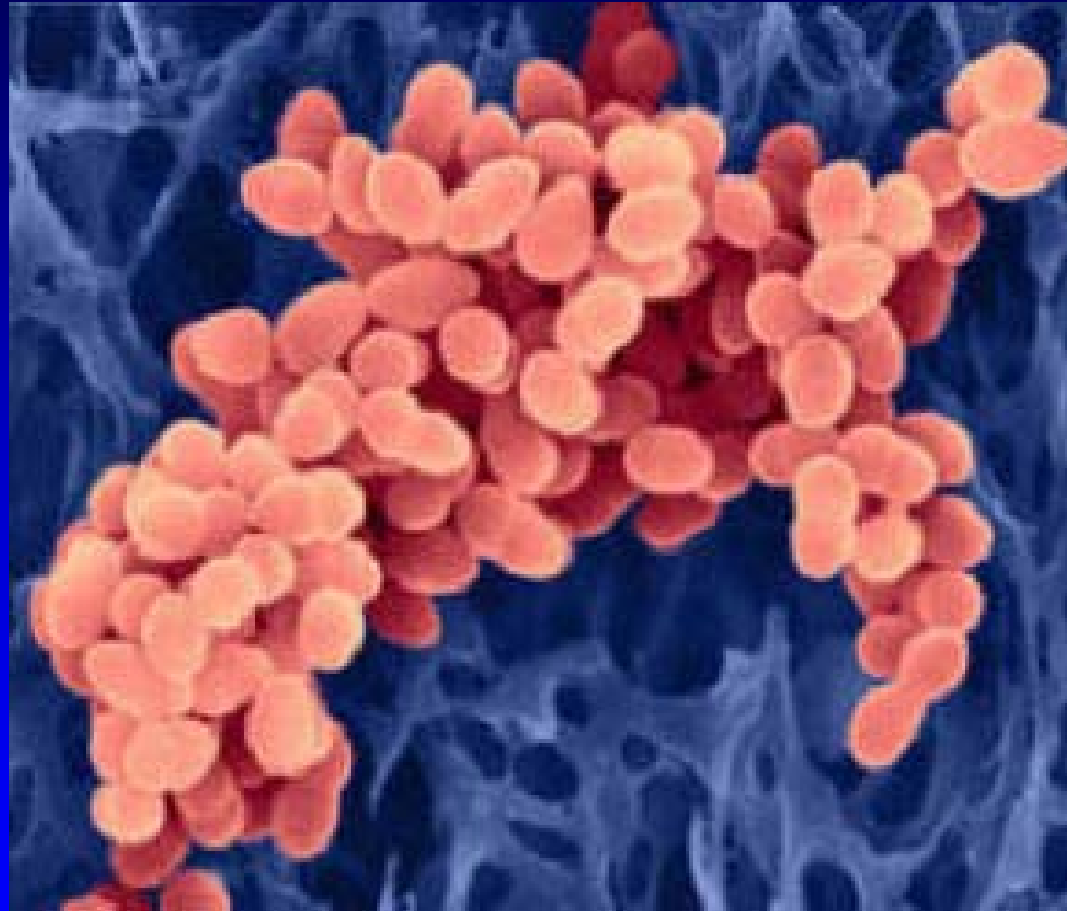
KCH Decolonization Protocol

- 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

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QUESTIONS?



Pediatric Surgery at KCH

- Joe Iocono, MD
jiocono@uky.edu
- Andrew Pulito, MD
arpuli@uky.edu
- Sean Skinner, MD
sean.skinner@uky.edu
- John Draus, MD
john.draus@uky.edu
- Kara Cole, PA-C
klcole4@email.uky.edu

Office Hours:

Monday 11-4

Friday 9-noon

859-323-5625

859-323-5289 (fax)

UKMD's: 859-257-5522

1-800-888-5533

Pediatric Surgery at KCH

