Community-acquired/associated MRSA

Loreen A. Herwaldt, M.D.
Professor
Hospital Epidemiologist
University of Iowa
Outline

• Definitions
• Background information
• Incidence/prevalence
• Nosocomial spread
• USA300 on a burn/trauma unit
• Summary & conclusions
Definitions

Community-acquired MRSA (CA-MRSA)

Patient:
- Had a culture positive for MRSA w/in 48 hours of admission
- Was not: hospitalized, in a nursing home, in hospice care, undergoing dialysis
- Did not have: surgery, or a permanent indwelling catheter or other medical device that passes through the skin
Definitions

• Community-associated MRSA phenotype = MRSA isolates resistant to < 2 non-\(\beta\)-lactam antimicrobial agents

• Community-associated MRSA genotype = MRSA isolates that have PFGE patterns in the USA300 and USA400 groups and are positive for PVL and SCC\(mec\)IV
Table 5. Antimicrobial Susceptibility Profiles of Community-Associated and Health Care–Associated Methicillin-Resistant Staphylococcus aureus Isolates

<table>
<thead>
<tr>
<th>Type of Antibiotic</th>
<th>Community-Associated (n = 106)</th>
<th>Health Care–Associated (n = 211)</th>
<th>P Value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxacillin (methicillin)</td>
<td>0</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>84 (79)</td>
<td>33 (16)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>88 (83)</td>
<td>44 (21)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>47 (44)</td>
<td>18 (9)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>100 (94)</td>
<td>168 (80)</td>
<td>.001</td>
</tr>
<tr>
<td>Rifampin</td>
<td>102 (96)</td>
<td>199 (94)</td>
<td>.64</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>98 (92)</td>
<td>194 (92)</td>
<td>.95</td>
</tr>
<tr>
<td>Trimethoprim-sulfamethoxazole</td>
<td>101 (95)</td>
<td>189 (90)</td>
<td>.13</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>106 (100)</td>
<td>211 (100)</td>
<td>NA</td>
</tr>
</tbody>
</table>

Abbreviation: NA, not applicable.
*Tested at the Minnesota Department of Public Health Laboratory by broth microdilution using National Committee for Clinical Laboratory Standards break points.
†Refers to the statistical probability that the percentage susceptible among community-associated isolates differed from the percentage susceptible among health care–associated isolates (α = .05).

Table 5. Antimicrobial Susceptibility Profiles of Community-Associated and Health Care-Associated Methicillin-Resistant Staphylococcus aureus Isolates
Clindamycin Susceptible, Erythromycin Resistant?
Mind your “D-test”!

Efflux-mediated resistance (mef).
**Resistant** to erythromycin but **susceptible** to clindamycin

Target site modification (erm).
**Resistant** to erythromycin and inducibly **resistant** to clindamycin

Make sure your lab does the “D-test” before reporting erythro R, clinda S
CA-MRSA have unique PFGE types: Establishing a national database

S. aureus Nasal Carriage – NHANES Study, 2001-2002

- MSSA: 32.4% (95% CI, 30.7%-34.1%); population estimate 89.4 million
- MRSA: 0.8% (95% CI, 0.4%-1.4%); population estimate 2.34 million
- 75 MRSA isolates, 6 (8%) USA300 (5/6 PVL +); 1 USA400 (1/1 PVL +)

Surveillance for CA-S. aureus, Texas Children’s Hospital

- 8/1/01-7/31/04
- USA300:
  - 2000 ~50 of CA-MRSA
  - 2003 > 90% of CA-MRSA

## Iowa: Healthcare-associated vs Community-acquired MRSA

<table>
<thead>
<tr>
<th>Origin</th>
<th>SCCmec type:*</th>
<th>PVL +**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>II</td>
<td>IV</td>
</tr>
<tr>
<td>Healthcare assoc.</td>
<td>124 (93)</td>
<td>9 (7)</td>
</tr>
<tr>
<td>(N = 133)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comm. acquired</td>
<td>40 (66)</td>
<td>20 (33)</td>
</tr>
<tr>
<td>(N = 60)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>164 (85)</td>
<td>29 (15)</td>
</tr>
</tbody>
</table>

*N, (row percent); **all PVL+ isolates were SCCmec type IV.
Geographic Distribution of 17 PVL+ CA-MRSA in Iowa
SCCmec IV, PVL+ MRSA

- 15 were community-acquired:
  - 12/15 caused skin and soft tissue infections
  - All 15 had ≤ 2 co-resistances
- 2 were healthcare-associated
  - 1 nosocomial, 0 co-resistances
  - 1 LTCF associated, bloodstream infection in a 70 year old
- Most were USA400 (MW2, Minnesota cluster)
CA-MRSA phenotype in Iowa
0-1 coresistances among isolates submitted at UHL as part of mandatory reporting of “MRSA invasive disease”


p < 0.001
CA-MRSA: Risk of Nasal Carriage

- 812 soldiers
- 3% carried MRSA, 28% carried MSSA
- 9/24 (38%) CA-MRSA carriers acquired infection; 8/229 (3%) MSSA carriers acquired infection (RR, 10.7, p < 0.001)
- Previous antibiotic use was a risk factor for CA-MRSA carrier state (p = 0.03)

Hospital Transmission of Community-Acquired Methicillin-Resistant Staphylococcus aureus among Postpartum Women

Lisa Saiman,¹,⁴ Mary O'Keefe,⁴ Philip L. Graham III,¹ Fann Wu,² Battouli Saïd-Salim,⁵ Barry Kreiswirth,⁵ Anita LaSala,³ Patrick M. Schlievert,⁶ and Phyllis Della-Latta²

¹Departments of Pediatrics, ³Pathology, and ³Obstetrics and Gynecology, Columbia University, and ⁴Department of Epidemiology, New York–Presbyterian Medical Center, New York, New York; ⁵Public Health Research Institute, Newark, New Jersey; and ⁶Department of Microbiology, University of Minnesota, Minneapolis

CID 2003;37:1313
CA-MRSA-- Nosocomial Acquisition

MRSA strains sent to German national reference center 12/02-1/04:

- 9 community-acquired cases
- 19 nosocomial cases: 2 SSI; 1 sepsis on surgical ward; 1 wound infection & 1 pneumonia on Int Med; 2 wound infections on derm; 2 nasal colonization

Healthcare-associated Outbreaks & Community-acquired infections

- Area of SE Germany; 12/03-9/04
- 117 cases of PVL-MRSA colon/infection
- Outbreak I
  - 2 hospitals, 5 LTCFs, 1 home for disabled persons, 1 hemodialysis clinic, 1 transport service
  - 52 patients, 21 staff, 2 contract workers
  - 9.1% of residents and 9.7% of staff in 2 LTCFs were colonized

Healthcare-associated Outbreaks & Community-acquired infections

- Outbreak II—NICU; 5/20 (25%) patients & 3/131 (2.3%) staff
- Outbreaks I & II: 28.1% of patients & 16.6% of staff had clinical disease
  - Outbreak I: 2 pts had pneumonia, 5 device-related infection, 7 abscesses
  - Outbreak II: 2/5 clinical disease
- 34 community-acquired cases: 4 pneumonia, 25 abscesses
USA300 in a Burn Center

In November 2005, the Burn Center Director reported that several patients had multiple MRSA abscesses, a clinical presentation that the burn surgeons had not encountered previously.
## Patient Characteristics

<table>
<thead>
<tr>
<th>Age &amp; Sex</th>
<th>Admissions to unit</th>
<th>Admiss Dx</th>
<th>Admiss nares cx</th>
<th>Date USA 300</th>
</tr>
</thead>
<tbody>
<tr>
<td>43 yo male</td>
<td>10/2-11/05 10/16-25/05</td>
<td>Burn</td>
<td>-</td>
<td>NA 10/16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>33 absc</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>22 yo female</td>
<td>11/2-7/05</td>
<td>4 absc</td>
<td>-</td>
<td>11/2/05</td>
</tr>
<tr>
<td>42 yo female</td>
<td>10/28-11/15/05</td>
<td>Burn</td>
<td>-</td>
<td>11/5/05</td>
</tr>
<tr>
<td>71 yo male</td>
<td>11/21-12/23/05 1/09-1/12/06</td>
<td>Burn &gt;6 absc</td>
<td>- +</td>
<td>NA 1/9/06</td>
</tr>
</tbody>
</table>
# Clinical Syndrome

<table>
<thead>
<tr>
<th>Patient</th>
<th>Infections</th>
<th>Fever</th>
<th>WBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>43 yo male</td>
<td>2 d before 2nd admiss draining pustules; none in grafted areas</td>
<td>Subjective; + chills &amp; sweats</td>
<td>9-11.5</td>
</tr>
<tr>
<td>22 yo female</td>
<td>4 abscesses</td>
<td>100 F; 1 chill</td>
<td>8.1</td>
</tr>
<tr>
<td>42 yo female</td>
<td>Film donor site; L neck abscess</td>
<td>“febrile” 11/4</td>
<td>15.4</td>
</tr>
<tr>
<td>71 yo male</td>
<td>2 mm-3 x 3 cm abscesses</td>
<td>38.5 C</td>
<td>9-11</td>
</tr>
</tbody>
</table>
Patient #1
Culture Survey of Healthcare Workers

- Cultured 99 HCWs on unit
- 3 (3%) carried MRSA
- Only 1 had USA300
Case Finding

- Searched the MRSA database for all patients from burn unit since 2/2002 when active surveillance on admission was begun (n = 102)
- Identified 15 total patients with USA300, including the 4 patients described previously
Results

- 1/15 was a HCW; 20 yo female nursing assistant on BC:
  - Admitted 9/03, 1/04, 1/05 w/ MRSA abscesses
  - She last worked on the unit during 6/05
  - We cannot determine whether she acquired the isolate on the burn unit
  - She cared for a patient who was admitted 8/21-27/03 for a perirectal abscess
Results

- 2/15 were prisoners
- 2/15 were morbidly obese
- 9/15 (60%) were women
- Median age was 42 years

Acquisition:
- Nosocomial = 2
- Community = 9 (1 may have been acquired in another hospital
- Possible nosocomial/possible community = 3
Burn Unit CA-MRSA Genotypes

Lambda ladder
NCTC
USA300 (from CDC type collection)
Nursing student
Prior community SSTI patient
Patient 1
Patient 2
Patient 3
Patient 4
USA300 (from CDC type collection)
NCTC
Lambda ladder

All patient isolates were PVL positive and SCCmec type IV

CDC type strains kindly provide by Dr. Fred Tenover
Summary & Conclusions

- CA-MRSA tends to:
  - Be susceptible to more antimicrobial classes than nosocomial MRSA
  - Cause skin & soft tissue infections (SSTI)
- CA-MRSA can cause healthcare-associated infections
- SSTI & invasive infections caused by USA300 are increasing in Iowa
- Patients may need Rx or decolonization > 1 time