Ca-MRSA Update- Hand Infections

Washington Hand Society
September 19, 2007
Resistant Staph. Aureus

- Late 1940’s - 50% S.Aureus resistant to PCN
- 1957- 80/81 strain- of S.A. highly virulent and easily transmissible strain spreads world-wide
- 80/81 carried nasally, caused septicemia in 30% of all carriers, responsible for all epidemic outbreaks in US maternity wards and 50% of all hospital based outbreaks in the UK
- 1961-incidence died down- advent of methicillin
Methicillin Resistance

- 1960-three resistant isolates discovered, 6 months after Meth. was introduced.
- 1967- resistant strains found all over Europe and India
- 1981- First Gentamycin resistant SA in US and Europe
- By 1990- sixteen strains of MRSA identified
Ca- MRSA

- 1993 - Western Australia among Aborigines not exposed to health care system.
- Entirely different class of SA from hospital acquired
Staph Aureus resistance timeline

1941 – Introduction of penicillin into treatment of infectious disease
1944 – *S. aureus* penicillin resistant
1960 – New penicillinase-resistant drugs are used to fight staph infections (i.e. methicillin)
1975 – Methicillin-resistant strains of *S. aureus* emerge
1988 – 2.4% *S. aureus* are methicillin-resistant
1989 – .3% enterococci vancomycin-resistant
1991 – 29% *S. aureus* methicillin-resistant
1993 – 7.9% enterococci vancomycin-resistant
1996 – *S. aureus* strain with intermediate vancomycin resistance reported in Japan
1998 – Man in New York dies from a staph infection
Ca MRSA vs. HaMRSA

- Ca - more susceptible to non B -lactam antibiotics
- Differ in genotype sequences USA-300/100
- Differing Meth. resistant “cassettes” (plasmids): SCCmec type IV
- Panton-Valentine virulence factor
Ha-MRSA long sequences

Ca-MRSA short sequences
Figure 3. Comparison of antibiotic susceptibilities between CA and HA MRSA isolates.
Populations Reported: high intensity physical contact

- IV Drug users
- Homeless
- Gay Men
- Prison inmates
- Military recruits
- Children in Day Care
- “Contact” Sports Teams
St Louis Rams
Kazakova NEJM 2005
single clone MRSA

• 2003 season 5/58 players on the Rams got MRSA skin and soft tissue infections
• All abscesses occurred at the site of previous injury i.e. turf burns and lacerations uncovered areas
• Transmitted by close personal contact from infected lesion or secretions-lineman, linebackers
• Use of showers, whirlpools, and shared towels and clothing, and weight room surfaces not shown to transmit.
• Teams playing the Rams got sporadic cases
Nasal Carriers?

- From 2000-2005 numerous sports teams from High School to the pro’s
  - Wrestling, soccer, football, rugby, basketball
- Originally thought to be carried nasally
- Mupirocin ointment given nasally ineffective in stemming outbreaks
- Role unclear
Vancomycin Resistance

- 1997- first HaVRSA reported
- 2002-first CaVRSA –Detroit drug user
- Conjugative transposition from co-infected patient with VRE. New York City
- van-A gene transfer from enterococcus
- VISA (intermediate sensitivities MIC>4mg/L) not clinically responsive
- Now multiple strains of VRSA identified
Lysis of cell wall

Figure 1. Trans electron micrograph of Staphylococcus aureus and antibiotic effect.
Horizontal gene transfer

- **Transformation**: Transfer of free DNA to a dead bacterium.
- **Conjugation**: Plasmid transfer by direct contact between two bacteria.
- **Transduction**: Transfer by viral delivery.
Mechanism of Resistance

- SCCmec gene produces PBP2a- cell wall B lactam insensitive
Today

- MRSA is most common antibiotic resistant pathogen in the world
- World wide rates are soaring
- 20% of all MRSA are community acquired
Ca-MRSA rate Canada
World-wide prevalence by country
Moran NEJM 2006

- 11 university affiliated ER’s around the US
- 320/422 patients with skin-st infections were S.A. (76%)
- MRSA were 59% (15-74%)
- USA-300 -97%
- SCCmec type IV, PV leukocidin toxin 98%
Ca-sensitivities

- Vancomycin?
- Clindamycin 95%
- TMP-SMX + rifampin 100%
- Tetracyclenes (doxycyclene, minocyclene) 92%
- Fluoroquinolones-60%
Clinical Manifestations

- Skin and soft tissue infections
- Septic arthritis
- Bacteremia
- Toxic Shock Syndrome
- Necrotizing fasciitis/cellulitis/pneumonia
- Traumatic wound infections
CDC Criteria

- Dx. made in outpatient setting or + culture with 48 hrs of hospitalization
- No hx of MRSA infection or colonization
- Ho hx. Of admission to health-care facility in past year or dialysis or surgery
- No indwelling catheters or implants
Diagnosis

- Detailed History r/o spider bites
- Local cultures
- Pulsed-field gel electrophoresis
- Recurrent skin infections not responsive to B lactam antibiotics
- “Polymerase chain reaction amplification” to detect virulence factors
Brown Recluse spider bites
Gel electrophoresis

Figure 1. Detection of SCCmec types I-IV and PVL by PCR assays in CDC control isolates
GRAM STAIN DIRECT
11/14/05 Rare WBC's
Many Gram positive cocci in pairs and clusters

CULTURE WOUND SUPERFICIAL W/SMEAR
Isolate: Staphylococcus aureus
Many
*Methicillin Resistant - precludes the use of all currently available beta lactam antibiotics.* This organism does not demonstrate inducible clindamycin resistance in vitro.

<table>
<thead>
<tr>
<th>Organism</th>
<th>S. aureu</th>
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<tbody>
<tr>
<td>Antibiotic</td>
<td>MIC</td>
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<tr>
<td>Clindamycin</td>
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<td>Synercid (Quinupristin/Da)</td>
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<td>Trimeth/Sulfa</td>
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<tr>
<td>Vancomycin</td>
<td>&lt;=2</td>
</tr>
</tbody>
</table>

S=SUSCEPTIBLE       I=INTERMEDIATE       R=RESISTANT POS=POS

End of Report!
Treatment-1

- If local area has high incidence of MRSA routine use of β-lactam antibiotics as a first-line drug may not be indicated
- Localized skin infection can be treated with I&D?
- 95% of MRSA sensitivity to TMP-SMZ but double the dose is used, can be used with Rifampin to lower “inducible resistance”
Treatment- 2

- Clindamycin – (children)
- Fluoroquinolones- ciprofloxacin, (moxifloxacin, gatifloxacin)--resistance
- Tetracyclines (minocyclene, doxycyclene)
- Vancomycin – mainstay
- Linezolid best for VRSA
- ?daptomycin, tigecyclene-new
Ceftobiprole

- A new class of cephalosporin binds to penicillin binding protein PBP2 allowing the B-lactam to break down the cell wall
- Is refractory to development of resistance by Staph……..so far
Treatment algorithm

Patient with MRSA in wound

Patient Education

Infection Prevention and Control Practices must be implemented

Swab of wound, and all other relevant sites

Check MRSA resistance profile in your area

Stop all antibiotics

If possible, remove all potential carrier sites, i.e., indwelling catheters, IV, central lines, etc.

Determine Source: Hospital, long term care, community, or exposure to MRSA in your practice

Wound Assessment: Are there signs of clinical infection?

YES

Oral antibiotic therapy should include 2 of the following:
- Rifampin 300mg po bid
- Septra DS po bid
- Doxycycline 100 po bid

When the wound has closed, decontamination of the nares can be achieved with Mupirocin cream bid for 5-7 days, daily washing with chlorhexidine

NO

One of the following topical anti-microbial agents can be used for local wound care: iodine, silver, chlorohexadine

When the wound has closed, decontamination of the nares can be achieved with Mupirocin cream bid for 5-7 days, daily washing with chlorhexidine

Avoid topical antibiotics that have systemic forms

Re-assess for signs of clinical infection on followup

Discontinue the antibiotic as soon as the infection has been treated

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*Immunocompromised patients may NOT show typical signs and symptoms of infections, but may require a limited course of systemic antibiotics to control critical colonization of MRSA in their wounds.*
Necrotizing Cellulitis
Necrotizing Fasciitis
Finger lesion- Patient claimed a spider bite
Wide excision needed, not an “I&D”
Prevention in group settings

- Personal and environmental hygiene
- Rigorous laundry procedures
- All cuts and open wounds need to be covered
- “Nasal” prophylaxis
One article in JHS July 2000

• Karanas and Bogdan
• 4 cases of skin infection by Ca-MRSA treated with I&D and Vancomycin
  uncomplicated course
My experience

- 7 cases in the past year
- 5 finger lesions, 1 hand, 1 forearm lesion
- 3 treated with IV Vanco as OPD
- 4 with Bactrim po
- All resolved
This is just the tip of the iceberg

- A recent study found that one in five stethoscopes used by clinicians were contaminated with Staph Aureus, including one that harbored MRSA