MRSA Outbreak in Firefighters

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Outline

- Case Study
- Epidemiology of MRSA
- What is MRSA?
- Hospital vs. Community-Acquired MRSA
- MRSA in the Workplace
- Prevention/Control Recommendations
Case Study

- Healthy 33 year old male
- Fire academy cadet
- Multiple knee/elbow abrasions
- “pimple-like” lesions on his knees with surrounding erythema.
Skin Lesions
Case Study

- Increasing erythema, pain and fever
- Prepatellar bursa infection
- Culture (+) MRSA
- Admitted, IV Vancomycin
- Discharged after 5 days with Clindamycin/Cipro
- Returned to full duty after 1 month.
Case Study

- Over next month
  - 4 other cadets presented with similar symptoms
Progression of Methicillin Resistant Staphylococcus aureus

CDC. MMWR. 1997.
(www.cdc.gov/ncidod/hip/NNIS/AR_Surv1199.htm)
Staphylococcus aureus

- Most common staph bacteria
- Carried in skin or nose in healthy people
- 25% to 30% population colonized in the nose with staph bacteria
Virulence Factors of Staphylococcus Aureus

- **Staphylococcus**
  - Protein A
  - Capsule + or -
  - Adhesion

- **Effects on Host (local and systemic)**
  - IgG binds to Protein A
  - Toxins, Antigens, and Superantigens
    - Cell membrane damage
    - Antiphagocytic defenses
    - Mediator and cytokine release by platelets and leukocytes
  - Blood clot, damaged tissue, etc.
Methicillin-Resistant *Staphylococcus Aureus* (MRSA)

- First isolated in US in 1968
- 1% of population is colonized with MRSA
- Most MRSA infections in hospitals/healthcare settings
- Emergence of new epidemic strains of MRSA in the community in 1990s.
Hospital-Acquired MRSA vs. Community-Acquired MRSA

- Two strains:
  - HA-MRSA
  - CA-MRSA

- Genetically and phenotypically different
HA-MRSA

- Risk factors that promote antimicrobial resistance in healthcare settings include:
  - Extensive use of antimicrobials
  - Transmission of infection
  - Susceptible hosts
Established Risk Factors
HA-MRSA

Recent Hospitalization/Surgery

Medical Devices/Catheters

Dialysis

Long Term Care Residence
Community- Acquired MRSA

- **Genotype**
  - USA 300
  - USA 400

- **Produces deadly toxin**
  - Panton-Valentine leukocidin
  - Destroys white blood cells and living tissue
CA-MRSA

- Presents most commonly as skin and soft tissue infections
- Can cause severe invasive disease
  - Necrotizing pneumonia
  - Necrotizing fasciitis
  - Severe osteomyelitis
  - Sepsis syndrome
Clinical Signs/Symptoms

CA-MRSA

- Small red bumps
  - Pimples, boils (resemble spider bites)
  - Stings

- Bumps can become swollen, painful and can form abscess
MRSA from Hospital to Community?

- Unknown how MRSA in community evolved
- Drug-resistant bacteria developed from overuse and misuse of antibiotics
Evolution of Antimicrobial Resistance in Gram-Positive Cocci

- **Penicillin** ↓
  - S. aureus → Penicillin-resistant S. aureus [1960s]
- **Methicillin** ↓
  - S. aureus → Methicillin-resistant S. aureus (MRSA) [1997]
- **Vancomycin** ↓
  - Vancomycin (glycopeptide) - Intermediate Resistant S. aureus [1990s]
- **Vancomycin-resistant enterococcus (VRE)**

- **VRSA**
  - MIC >16 μg/ml
- **VISA**
  - MIC 4-8 μg/ml
CDC’s Campaign to Prevent Antimicrobial Resistant HA-MRSA
# 12 Steps to Prevent Antimicrobial Resistance Among Hospitalized Adults

- **Prevent Infection**
  - **Step 1.** Vaccinate
  - **Step 2.** Get the Catheters out

- **Diagnose & Treat Infection**
  - **Step 3.** Target the pathogen
  - **Step 4.** Access the experts
  - **Step 5.** Practice antimicrobial control
12 Steps to Prevent Antimicrobial Resistance Among Hospitalized Adults

- **Use Antimicrobials Wisely**
  
  - Step 5. Practice antimicrobial control
  - Step 6. Use local data
  - Step 7. Treat infection, not contamination
  - Step 8. Treat infection, not colonization
  - Step 9. Know when to say "no" to vanco
  - Step 10. Stop antimicrobial treatment

- **Prevent Infection**
  
  - Step 11. Isolate the pathogen
  - Step 12. Break the chain of contagion
Outbreaks of CA-MRSA

- Athletes (healthclub gyms, fire acad.)
- Military recruits
- Children
- Pacific Islanders
- Alaskan Natives
- Men who have sex with men
- Prisoners
Factors Associated with CA-MRSA Outbreaks

- Close skin-to-skin contact
- Openings in the skin (cuts, abrasions)
- Contaminated items and surfaces
- Crowded living conditions
- Poor hygiene
Transmission of CA-MRSA

"CA-MRSA skin infections are usually transmitted from person to person by direct contact with a draining lesion or by contact with an asymptomatic carrier of S. aureus... also can occur indirectly through contact with contaminated items or environmental surfaces."

The Centers for Disease Control and Prevention (2006)
Prevention and Infection Control

- Wash hands
- Keep personal items personal
- Keep wounds covered
- Cleaning equipment and surfaces
- Shower after athletic games/practices
Firefighter Cadet’s Exposures

Sharing of Equipment

Unclean Bunker Gear

Crawling

Training Activities

Kneeling
MRSA Infections: Coming to a workplace near you

- **Warnings**
  - *Uniforms can become contaminated with MRSA*
  - *Equipments can become MRSA contaminated.*

The National Institute for Occupational Safety and Health (NIOSH, 2007)
What can the Employee do?

- Practice good hygiene
- Keep hands clean
- Keep cuts and scrapes clean and covered
- Avoid contact with other people’s wounds or bandages
- Avoid sharing personal items
  - Uniforms
  - Personal protective equipment
What can the **Employer** do?

- Safety and health protection in the workplace
- Availability of adequate facilities and supplies that encourage workers to practice good hygiene
- Routine housekeeping in workplace
- Contaminated equipment and surfaces cleaned

*(NIOSH, 2007)*
Conclusions

- MRSA becoming significant public safety concern
- Using antibiotics wisely is an important part of preventing spread of antibiotic-resistant strains of bacteria
- Physicians will need to take an active role in educating patients/general community
Dr. Karen Mulloy

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Questions?