

# ORTHOPAEDIC INFECTION PREVENTION AND CONTROL: AN EMERGING NEW PARADIGM

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## COMMITTEE ON PATIENT SAFETY

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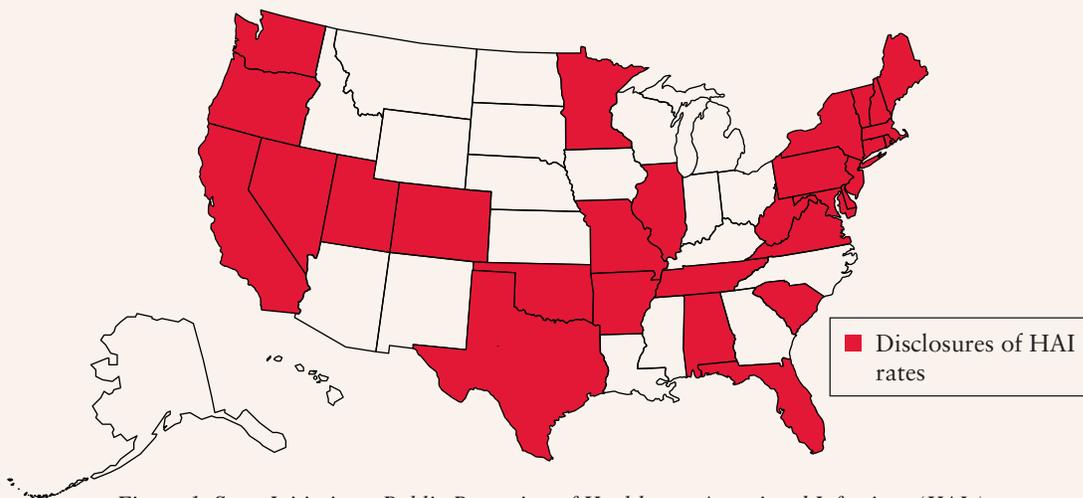
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## Nosocomial Infections - The New Epidemic

- Approximately 27 million surgical procedures are performed in the U.S.
- The Centers for Disease Control and Prevention (CDC) estimate that the rates of surgical site infection (SSI) range from 2% - 5% for clean cases. Rates may be higher (~20%) depending on procedure type, patient case-mix, and wound type (contaminated, dirty) among other factors.
- SSIs are associated with:
  - ⊕ 38% of all surgical-related nosocomial infections
  - ⊕ Other wound complications
  - ⊕ 60% higher risk of an intensive care unit (ICU) stay
  - ⊕ Five times greater risk of readmission
  - ⊕ Two- to eleven-fold higher risk of death
  - ⊕ *Staphylococcus aureus* pathogen accounts for 30% of all SSIs



## Drug Resistant Organisms

Due to increased incidence, severity, and extent of disease caused by drug resistant organisms, prevention and treatment have become a national priority.

- 20 - 22% of healthcare associated infections (HAIs) are surgical site infections (SSIs)
- Drug resistant organisms include methicillin-resistant *staphylococcus aureus* (MRSA) and vancomycin-resistant enterococci (VRE) which colonize the skin and are spread by contact
- Death rate from MRSA is 2.5 times greater than non-resistant *staphylococcus aureus*, and in 2005 18,650 MRSA deaths were recorded
- Community-associated methicillin-resistant *staphylococcus aureus* (CA-MRSA) has been a clinically distinct disease from hospital-associated MRSA (HA-MRSA)
- Approaches to prevention and control should be tailored to the patient population and care setting
- Patients with positive preoperative MRSA screening may benefit from preoperative decolonization protocol and possible change in antibiotic prophylactic regimen
- Patients colonized with VRE preoperatively may benefit from a change in antibiotic prophylaxis

## Case Studies: Methicillin-resistant *Staphylococcus aureus*

### Successful Total Knee Replacement in Patient colonized with MRSA



Figure 2. Successful Total Knee Replacement  
in Patient colonized with MRSA

- Age of patient: Mid 50s
- Modifiable risk factors: Yes - colonized with MRSA
  - ⊕ Screened for MRSA: Yes
  - ⊕ Preoperatively Decolonized: Yes
- Prophylaxis given: Cefazolin

#### Outcome

Patient successfully completed a Total Knee Replacement, with no complications from post-operative surgical site infections.

### Unsuccessful Total Knee Replacement in Patient colonized with MRSA



Figure 3. Unsuccessful Total Knee Replacement  
in Patient colonized with MRSA

- Age of patient: Mid 50s
- Modifiable risk factors: Yes - colonized with MRSA
  - ⊕ Screened for MRSA: No
  - ⊕ Preoperatively Decolonized: No
- Prophylaxis given: Cefazolin

#### Outcome

Patient underwent a Total Knee Replacement, and developed a postoperative MRSA SSI. The antibiotic given did not cover MRSA. The patient's leg was amputated after several surgical attempts to salvage. Preop screening and decolonization may have prevented the infection.

## Questions related to MRSA

### Screening

- What is the evidence? Is there any?
- Does it benefit the patient?
- Which patients should be screened?
- Why should you screen patients?
- Should medical staff be screened?

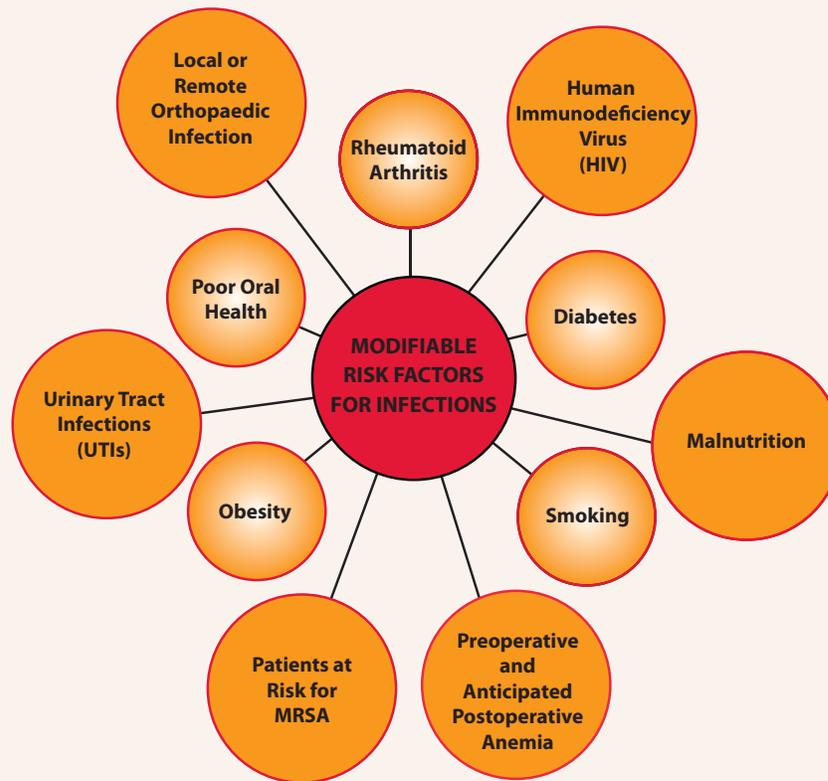
### Antibiotic Prophylaxis

- Which antibiotic should you administer?
- Did you account for gram negative coverage?
- Vancomycin? Cephazolin? Other?
- Is there a right antibiotic?
- Is there a "one size fits all" treatment?
- What is your local biogram?

### Get more of the facts about MRSA

Infection prevention and control guidelines and recommendations from the Centers for Disease Control and Prevention (CDC) and Healthcare Infection Control Practices Advisory Committee (HICPAC) are available from the CDC site: ([www.cdc.gov/ncidod/dhqp/](http://www.cdc.gov/ncidod/dhqp/)), ([www.gao.gov/new.items/d08808.pdf](http://www.gao.gov/new.items/d08808.pdf))

## Modifiable Risk Factors



### To Screen or Not Screen? That is the Question

Several investigators have studied the potential benefits of preoperative screening and decolonization protocols.

- Recent study revealed a 74% decrease in orthopaedic SSI with the implementation of a protocol that used screening of nasal carriers with RT-PCR on admission followed by treatment of screen positive patients with a combination of mupirocin nasal ointment and chlorhexidine soap bath treatment for 5 days
- Results of universal and preoperative screening have varied, but many hospitals have reported drastic overall and procedure-specific decline in rates of infection with a variety of protocols that incorporate screening and decolonization (+/- change in antimicrobial prophylaxis)
- Decolonization protocols or therapy for patients colonized with MRSA can reduce the likelihood of the patient developing an MRSA infection or transmitting MRSA
- CDC/HICPAC guidelines for reducing incidence of drug resistant organisms include contact precautions, hand hygiene, and effective environmental cleaning
- Tests for MRSA screening include:
  - ⊕ Routine culture media: 2-5 days for results
  - ⊕ Selective media results: available within 24 hours
  - ⊕ Polymerase chain reaction (PCR) results: available in 2-4 hours
- Costs of tests:
  - ⊕ Selective media costs: approximately \$5 per test
  - ⊕ PCR costs: approximately \$25 - \$30 per test
- Specimens taken from a patient's nose can identify up to 80% of colonized patients
- Although testing and decolonization may be effective, over time treatments may lead to increased antimicrobial resistance
- Prevention of 1 case of MRSA SSI could save a hospital ~ \$60,000

## What is SCIP?

- Process measures aimed at reducing preventable surgical morbidity and mortality by 25% by 2010
- Includes modules related to prevention of surgical infection, cardiovascular complications, venous thromboembolism, and respiratory complications
- In 2008, SCIP Measures were collected for primary hip and knee replacement cases and will soon affect all orthopaedic surgeries
- SCIP Measures are directly linked to reimbursement, pay for performance, and pay for reporting

### Recommendations for the Use of Prophylactic Antibiotics in Orthopaedic Surgery

#### Choice of Antimicrobial Agent

- Cephalosporin (cefazolin, cefuroxime)
- If  $\beta$ -lactam allergy, use clindamycin or vancomycin
- Consider preoperative screening for MRSA<sup>1</sup> colonization
- If infected or colonized with MRSA<sup>1</sup>, use vancomycin

#### Timing of Administration

- Start up to 60 min before incision: cefazolin, Cefuroxime, Clindamycin
- Start up to 120 min before incision: vancomycin
- Infusion completed 10 min before tourniquet inflation

#### Dosing

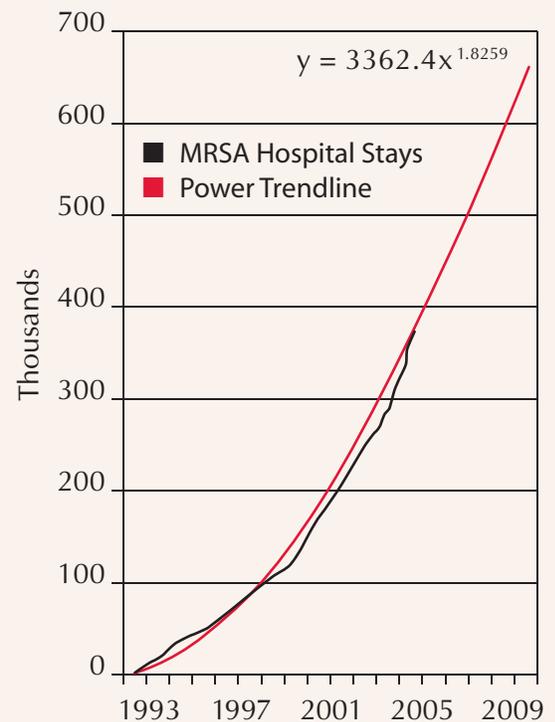
- Cefazolin, 1-2 g (2 g for patient weighing > 80 kg)
- Cefuroxime, 1.5 g
- Vancomycin and Clindamycin dosing based on patient mass
- Pediatric dosing based on patient mass

#### Duration of Antimicrobial Use

- Single preoperative dose
- Redose antimicrobial intraoperatively for prolonged procedure or significant blood loss
- When using postoperative doses, discontinue within 24 h after wound closure

1. MRSA - Methicillin-resistant *Staphylococcus aureus*

Prokuski, Laura MD 'Prophylactic Antibiotics in Orthopaedic Surgery',  
*Journal of the American Academy of Orthopaedic Surgeons* May 2008;  
16: 283-293



## What is Expected of You?

- The following SCIP Measures currently pertain to the Orthopaedic Surgery and Infection:
  - ⊕ SCIP 1: Prophylactic antibiotics within one hour prior to surgical incision
  - ⊕ SCIP 2: Prophylactic antibiotic selection for surgical patients
  - ⊕ SCIP 3: Prophylactic antibiotics discontinued within 24 hours after surgery end time
- Failure to comply with SCIP measures without proper documentation can result in no payment for services
- Please see the **AAOS Recommendations for the Use of Intravenous Antibiotic Prophylaxis in Primary Total Joint Arthroplasty** information statement for further antibiotic Prophylaxis recommendations



## Tools and Techniques

- I. **Laminar Flow or HEPA filtered air** - for total joint arthroplasty, minimum 15 turnover per minute; CDC recommends laminar flow with total joint implants
- II. **Body Evacuation Suits** - generally recommended for Total Joint Arthroplasty
- III. **Surgeon Hand Scrub** - antimicrobial soap for 2-6 minutes, dry hands and apply alcohol based product; use of alcohol product immediately reduces resident flora by 95% and continues to act for hours
- IV. **Patient Prep**
  - a) Hair removal - either no hair removal or clippers immediately before surgery, razors are not appropriate - associated with SSI rate of 3.1% - 20%
  - b) Surgical Site Prep
    - i) Chlorhexidine alcohol - recent study in NEJM found that preoperative cleansing of the patient's skin with chlorhexidine-alcohol proved to be more effective than povidone-iodine in regards to preventing surgical site infections
    - ii) Wipe with alcohol (kills transient flora)
    - iii) Povidone-iodine solution prep
    - iv) Dry surgical area
    - v) Apply one step iodophor-alcohol product (demonstrated effectiveness may improve draped adhesion)
    - vi) Chlorhexidine 4% solution
  - c) Plastic Adhesive Drapes - most studies have proven to be effective
- V. **Irrigation Techniques**
  - a) Minimum of 4 liters recommended in total joint surgery
  - b) Pulsatile lavage most effective
  - c) Antibiotic solutions - little evidence of effectiveness, detergents and povidone-iodine solution - each definitive literature
- VI. **Drains**
  - a) Controlled studies show no benefit
  - b) Meta-Analysis - shows increased transfusions and no benefit in total knee or hip
- VII. **Antibiotic Cement**
  - a) Norwegian Arthroplasty Register 2006 - evidence of effectiveness, now widely used in primary surgery in Europe
  - b) FDA approved in the US for revision surgery
- VIII. **Traffic** - multiple studies support limiting the number of and movement of OR personnel