Orthopaedic Infection Prevention and Control: An Emerging New Paradigm

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Nosocomial Infections - The New Epidemic

- More than **65 million** inpatient and outpatient surgeries are done each year at U.S. hospitals.
- The Centers for Disease Control and Prevention (CDC) estimate that the rates of surgical site infection (SSI) range from **2% - 3%** of uninfected cases - actual rates, however, are probably higher.
- 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
  - ➢ a two- to three-fold higher risk of death
  - ➢ *Staphylococcus aureus* most often

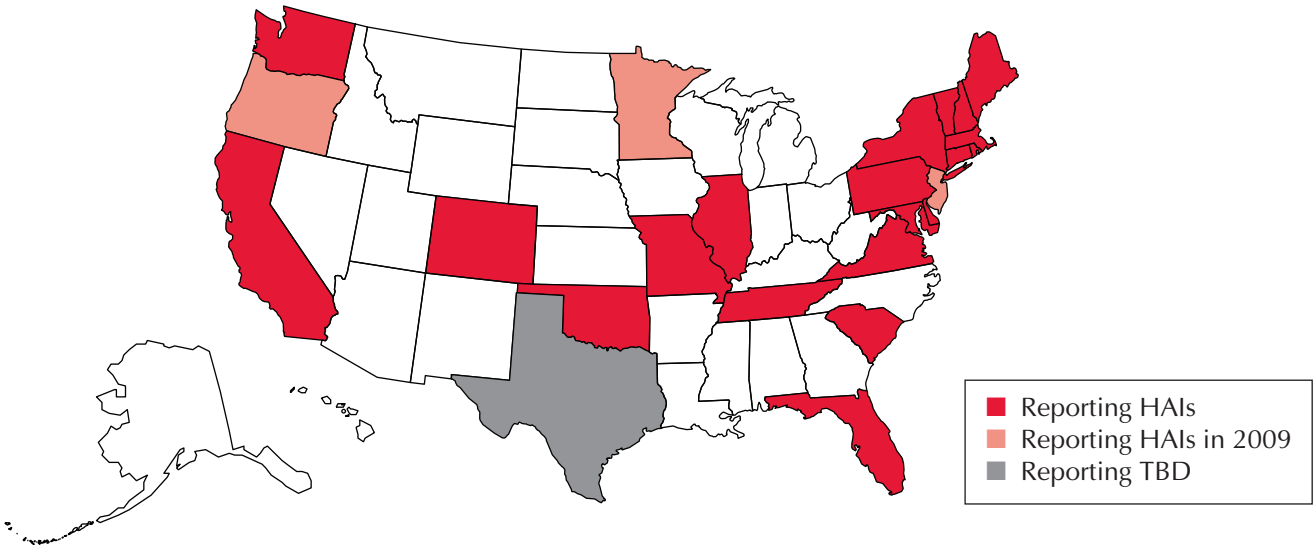


Figure 1. State Reporting of Healthcare-Associated Infections (HAIs) in Hospitals

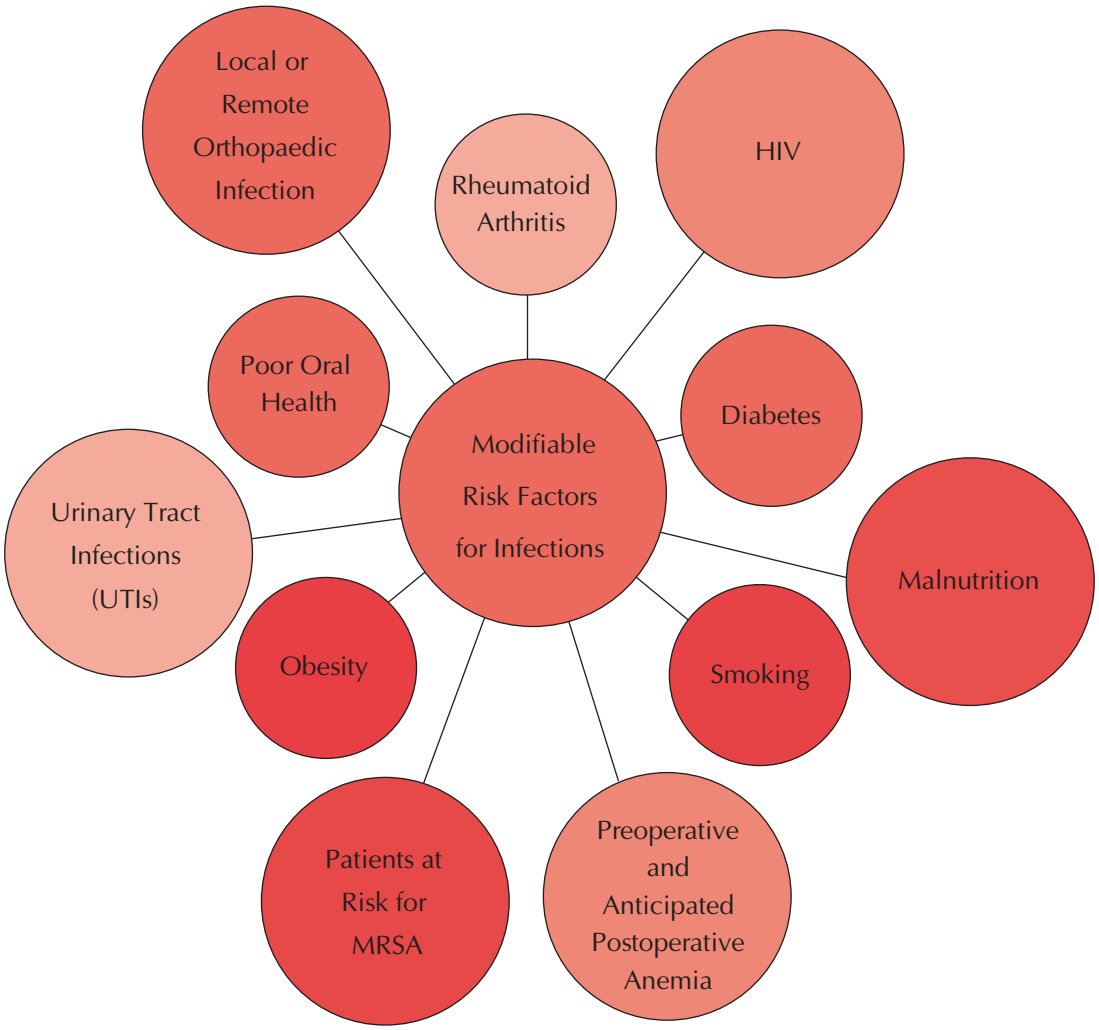
Drug Resistant Organisms

- **33% of surgical site infections are orthopedic infections.**
- **22% of healthcare associated infections (HAIs) are surgical site infections.**
- Drug resistant organisms include methicillin-resistant Staphylococcus aureus (MRSA) and vancomycin-resistant enterococci (VRE) which colonize the skin and are spread by contact.
- The death rate from MRSA is 2.5 times greater than non-resistant Staphylococcus aureus and is now greater than the 18,650 MRSA deaths recorded in 2005 and increasing.
- 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 depending on 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 to cover for VRE.

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

Modifiable Risk Factors

- Many patients have increased risks that make them more susceptible to developing infections.
- A number of those infections may be preventable through the identification and treatment of modifiable risk factors.



Case Studies: Methicillin-resistant *Staphylococcus aureus*

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

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

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

This 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 his leg. Preop screening and decolonization may have prevented the infection.

To Screen or Not Screen? That is the Question

- Several investigators have studied the potential benefits of preoperative screening and decolonization protocols
- Results of universal and preoperative screening have varied, but many hospitals have reported a drastic decline in rates of infection due to screening
- Decolonization protocols or therapy for patients colonized with MRSA reduces the likelihood of the patient contracting an infection or transmitting
- CDC guidelines for reducing incidence of drug resistant organisms include contact precautions, hand hygiene, and effective environmental cleaning the organism
- 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 MRSA resistance

Surgical Care Improvement Project (SCIP)

What is SCIP?

- Program to reduce 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 replacement cases and primary knee replacement cases and will soon affect all orthopaedic surgeries.

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.
- Please see the **AAOS Antibiotic Prophylaxis for Patients with Total Joint Replacements** information statement for further antibiotic prophylaxis recommendations

Recommendations for the Use of Prophylactic Antibiotics in Orthopaedic Surgery

Choice of Antimicrobial Agent

- Cephalosporin (cefazolin, cefuroxime)
- If ß-lactam allergy, use clindamycin or vancomycin
- Consider preoperative screening for MRSA[1] colonization
- If infected or colonized with MRSA[1], 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

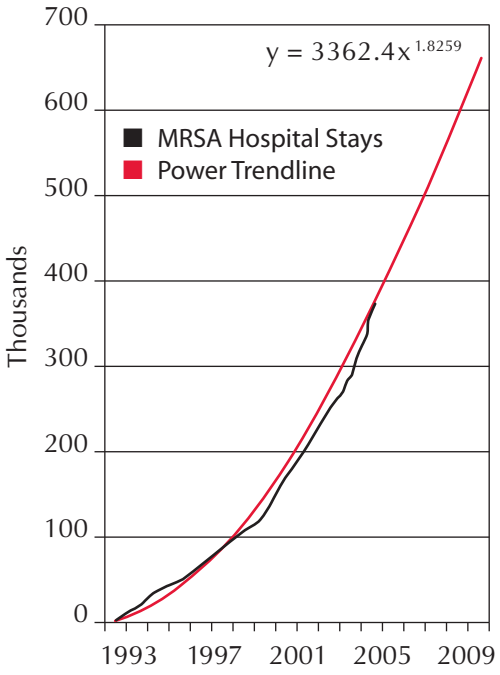
- Cefazolin, 1-2 g (2 g for patient weighing >80 kg)
- Cefuroxime, 1.5 g
- Vancomycin and clindamycin dosing based on patient mass
- Pediatric dosing based on patient mass

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.



- SCIP measures are directly linked to reimbursement, pay for performance, and pay for reporting
- Failure to comply with SCIP recommendations without proper documentation can result in no payment for services

Tools and Techniques

I. For total joint arthroplasty Laminar Flow or HEPA filtered air with minimum 15 turn-over per minute. CDC- "Consider" 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, razor use not recommended - associated with SSI rate of 3.1%-20%.

b) **Surgical Site Prep**

i) Wipe with alcohol (kills transient flora

ii) Povidone-iodine solution prep

iii) Dry surgical area

iv) Apply one step iodophor-alcohol product (demonstrated effectiveness may improve draped adhesion)

v) 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, 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 and 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.

Questions related to MRSA

Screening

- What's 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?
- 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/), (www.gao.gov/new.items/d08808.pdf)
- **The Patient Safety Instructional Course Lecture (ICL) at this meeting entitled "Infection Prevention & Control: An Emerging Paradigm."**