Evidence and Emerging Strategies for Utilizing Nasal Decolonization to Reduce HAIs

New Research - New Tools
Innovative New Approaches
Disclosures

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Nasal Bacterial Carriage and Impact

Transmission

Risks and Risk Reduction

Nasal Decolonization—Why does it matter?

MRSA in ICU and Surgery

Updated Guidelines 2014 – MRSA Prevention
The nose is a major reservoir for bacteria

- Nasal carriage of bacteria is present in everyone, even in healthy individuals without symptoms
- The nasal floras include both gram positive and gram negative bacteria
- ~30% of everyone carries *Staph aureus* in their nasal vestibules, including MRSA and MSSA.
Nasal Bacterial Carriage

• Hand to nose to hand is critical route of transmission and represents a primary threat to hand hygiene and source of contamination to environment
• Nose touching happens more than 240 times per day on average
• The nasal reservoir serves as a source for contamination of self, others and environment
Colonization vs. Infection

- **MRSA colonization**: A health state in which the patient carries the bacteria but has no clinical infection.

- **MRSA infection**: When a patient develops an invasive infection. Common infections include surgical site, UTI, bloodstream infections, and pneumonia.
  - **CAUTI**:
  - **CLABSI**:
  - **SSI**:
  - **VAP**:
“No doubt about it, Bob, you’re infected with tiny fighter planes. What’s worse — you’re a carrier.”
Impact

• *Staph aureus* is the most common overall cause of HAIs
  – Also most common cause of surgical site infections (30%) and ventilator-associated pneumonia (24%)
• 49-65% of healthcare-associated *Staph aureus* infections are caused by methicillin-resistant strains
• CDC reports an estimated 250,000 cases of CLABSIs occur in US each year—50% caused by MRSA.
• CDC reports over 95,000 invasive MRSA infections and 19,000 deaths per year. **Mortality rate 20%**
Visitors and Family

Staff/ Medical Staff

Rehabilitation

Physician Office

Home Care

Dialysis

Surgery Center

Long Term Care

Hospital

Patient
Factors that Facilitate Transmission

- Crowding
- Antimicrobial Use
- Contaminated Surfaces and Shared Items
- Compromised Skin
- Cleanliness
- Frequent Contact
Environmental Decontamination

- Adequate surface disinfection
- Validation of cleaning efficacy
- New technology (robots, new wipe technology, etc...)
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Risks and Risk Reduction

• Historical Risk Factors for SA/MRSA Carriage
  – Prolonged hospitalization
  – Prolonged antimicrobial use
  – Stay in an intensive care or burn unit
  – Exposure to a colonized/infected person
  – Residence in long term care or nursing home
  – Other co-morbidities (diabetes, cardiovascular disease, renal failure, cancer, auto-immune disease)
  – Presence of invasive devices (such as central venous catheters)
  – Age >65
  – History of MRSA carriage and/or infection
Nasal carriage is an important risk factor for MRSA infection

- 15-25% of carriers develop MRSA infection during ICU stay \(^1,^2\)
- 33% of carriers develop MRSA infection within 1 year \(^3\)
- 26% of MRSA infections are associated with bacteremia \(^3\)
- Risk of infection exceeded MSSA carriers by 14-24 fold \(^1,^6\)

\(^1\) Davis KA et al. CID 2004; 39:776-782
\(^2\) Keene A. Crit Care Med; 2010;28(1):109-13
\(^3\) Huang SS et al. PloS ONE. 2011;6(9):e24340
\(^4\) Cosgrove SE et al. ICHE 2005;26(2):166-74
\(^5\) Cosgrove SE et al. CID 2003;36(1):53-9
\(^6\) Zervoy FN et al. Pediatr 2014;133(4):e1015
MRSA colonization is associated with:

- Increased risk of infection even after hospital discharge \(^1\)
- Worse clinical outcomes \(^2\)
- Increased risk of death \(^2,3\)
- Increased hospital stay \(^3\)
- Higher costs of care \(^3,4\)

\(^1\) Huang SS et al. Clin Infect Dis 2003;36:53-594
\(^2\) Cosgrove SE et al. CID 2003;36(1):53-9
\(^3\) Cosgrove SE et al. ICHE 2005;26(2):166-74
\(^4\) McHugh CH et al. ICHE 2004;25:425-430
• Because MRSA colonization often precedes infection, MRSA interventions primarily have targeted two broad areas:
  – Preventing transmission from colonized to uncolonized persons – a focus of many interventions
  – Preventing infection in colonized individuals:
    • Not MRSA-specific: Strategies aimed at preventing device and procedure-associated infections (e.g., ventilator associated pneumonias, central line associated bloodstream infections, etc.)
    • MRSA-specific: **MRSA decolonization strategies**
**Screening**

**Testing methods:**

- **Culture**
  - **Pros**
    - Generally less costly
    - A common practice most labs are used to
  - **Cons**
    - May take up to 48 hours to identify MRSA colonized patients. If pre-emptive isolation not employed, may allow for transmission prior to recognizing patient as positive

- **Polymerase chain reaction (PCR)**
  - **Pros**
    - Rapid results
  - **Cons**
    - Expensive
    - Technically more challenging
Role of Screening and Decolonization

Who are we screening?

- ICU
- Hot List
- Prior history

- Pre-op
  - Day of surgery assurance of compliance

- High risk screening
Nasal Bacterial Carriage

Staph aureus impact in healthcare

Transmission

Risks and Prevention

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MRSA in ICU and Surgery

Updated Guidelines 2014 – MRSA Prevention
Some Key Recent Studies

- Universal ICU Decolonization
  - NICU research (IDWeek 2015)
- Effect of Nasal Decolonization in SSIs
- High Risk Patients
MRSA in Intensive Care
Universal ICU Decolonization

• REDUCE MRSA Trial: 3 arm cluster randomized trial
  – 74 ICUs, 43 hospitals
  – 18 month intervention (Apr 2010 – Sept 2011)
  – Screen and isolate (gold standard control)
  – Targeted nasal decolonization/CHG bathing if MRSA+
  – Universal nasal decolonization/CHG bathing for all

• Universal arm: Best Outcomes
  – Primary goal met: 37% decrease in MRSA clinical cultures
  – 44% significant decrease in all blood stream infections
  – 28% reduction in MRSA blood stream infections
  – Most cost-effective too – saves $171/patient

Huang SS et al. NEJM 2013; 368 (24):2255-65
Universal ICU Decolonization

• Cost-effectiveness of Strategies to Prevent MRSA Transmission and Infection in ICUs
  – Compared 7 strategies to standard precautions
  – Conclusions: Universal decolonization is cost-saving, preventing
    • 44% of cases of MRSA colonization, and
    • 45% of cases of MRSA infection

Benefits of Universal Decolonization

Key Takeaways:

• **protects patients** in the ICU from their own microbiota during a period of heightened vulnerability.

• **reduces the environmental burden**, reducing opportunities for patient-to-patient (also person-to-patient) transmission.

• begins on the first ICU day, **avoiding the delay** in decolonization pending results of screening tests.

• **eliminates MRSA screening tests** and the associated **contact precautions**, which interfere with care*

• **lowers ICU costs**—cost-effectiveness studies show cessation of screening, reduced contact precautions, and reduced infections results in real savings

*Except where legislative mandates require MRSA screening in the ICU
Results from the real world

Marshall Medical Center

- Replaced screen and isolate with Universal Nasal Decolonization
- Early reports-
  - Direct cost reductions
  - Significant improvements in patient care and satisfaction scores
Key Takeaways:

CP for MRSA colonization can be safely reduced or eliminated

• Eliminating CP for MRSA colonization improves patient care and satisfaction
• Eliminating CP for MRSA saves significant dollars
High Risk Patients and Nasal Colonization

• Study of risk factors for acquiring MRSA in patients with oral cancer
  – High rate of MRSA colonization and infection (77.8%)  
  – Risk factors for MRSA in oral cancer patients - systemic disease, cerebrovascular diseases, peripheral arterial catheterization, diabetes, tracheotomy, renal failure, long term broad-spectrum antibiotic use, and malnutrition.  
  – **Highest risk factors: poor hygienic care and MRSA colonization.**

**Key Takeaway:**

**Intranasal decolonization of *S. aureus* and provision of scrupulous hygienic care for high-risk patients are useful and effective measures for decreasing incidence of MRSA infection.**

• Among pediatric patients who acquire MRSA colonization while in the pediatric ICU, approximately 47% will subsequently develop MRSA infection.

• Dynamics of MRSA colonization and infection in NICU:
  – Some patients are colonized and/or infected with MRSA on admission.
  – Others face daily risk of acquiring MRSA colonization.
  – Acquisition of MRSA colonization and subsequent infection can be interrupted by nasal decolonization.
    • Ristagno et al.
    • Milstone et al.
Effect of Intranasal Mupirocin Prophylaxis on MRSA transmission and Invasive Staphylococcal Infections in a NICU

- Weekly surveillance cultures, cohorting, contact precautions, topical mupirocin, and chlorhexidine bathing for colonized infants.
- Universal, monthly mupirocin prophylaxis as an incremental prevention strategy
- Assessed MRSA transmissions and rates of invasive *S. aureus* infections before and after mupirocin implementation.
- After mupirocin prophylaxis initiated, the rate of MRSA transmissions decreased significantly
  - 23.1 events (95% confidence interval [CI]: 11.8, 41.2) to 13.2 events (95% CI: 6.9, 26.0) per 10,000 patient days (*P*=0.018)
  - 43% reduction
- Rate of invasive infection also decreased significantly
  - 3.0 infections (95% CI: 1.8, 7.2) to 0.8 infections (95% CI: 0.3, 1.5) per 10,000 patient days (*P*=0.032)
  - 73% reduction

Interesting Note: A new hand hygiene program was also adopted shortly after the mupirocin prophylaxis program was initiated
MRSA in Surgery
All SSI is not the same

- There are three categories of SSI that are defined by CDC. Each SSI definition is related to the tissue depth of the infection, as illustrated below.
S. aureus carriage and risk of surgical site infections

• SA is the leading cause of SSIs.
• Nasal carriage of SA has been consistently identified as a risk factor for development of postoperative SSIs in a large number of studies involving different populations.
• 1 in 20 patients undergoing surgery will develop an SSI.
• Up to 60% of SSIs have been estimated to be preventable by using evidence-based guidelines.
• SSIs are the most common health care associated infection and account for $3.2 billion in attributable cost per year in acute care hospitals.
• Estimated additional 11 days hospitalization for each SSI / patient.
• SSIs are the most frequent cause (20%) of unplanned readmissions after surgery.
Effect of Nasal Decolonization in SSIs

• Systematic review to determine:
  – Whether *S. aureus* screening and decolonization reduces SSIs in orthopedic patients, and
  – If implementing decolonization protocol is cost-effective

• Results:
  – All 19 studies showed reduction in SSIs – elective orthopedic and trauma patients.

Key Takeaway:
Preoperative screening and decolonization of *S. aureus* in orthopedic patients is an effective means to reduce SSIs.

Nasal Bacterial Carriage

*Staph aureus* impact in healthcare

Transmission

Risks and Prevention

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MRSA in ICU and Surgery

*Updated Guidelines 2014 – MRSA Prevention*
Clinical practice guidelines recommend:

• *universal decolonization* for ICU patients

• *intranasal S. aureus decolonization* for high-risk procedures, including orthopedic and cardiothoracic procedures, as part of an effective strategy to prevent SSIs
Nasal Decolonization Products

Nasal Antibiotics
- Mupirocin
- Retapamulin

Nasal Antiseptics
- 5% Povidone-iodine
- Alcohol-based products

Photo-disinfection
- Photosensitizer + light therapy
# Nasal Decolonization Tool Box

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So What?
Parachute use to prevent death and major trauma related to gravitational challenge: systematic review of randomised controlled trials

Objectives To determine whether parachutes are effective in preventing major trauma related to gravitational challenge.

Data sources: Medline, Web of Science, Embase, Pubmed, and the Cochrane Library databases; appropriate internet sites and citation lists.

Study selection: Studies showing the effects of using a parachute during free fall.

Main outcome measure Death or major trauma, defined as an injury severity score > 15.

Results We were unable to identify any randomised controlled trials of parachute intervention.

Conclusions As with many interventions intended to prevent ill health, the effectiveness of parachutes has not been subjected to rigorous evaluation by using randomised controlled trials. Advocates of evidence based medicine have criticised the adoption of interventions evaluated by using only observational data. We think that everyone might benefit if the most radical protagonists of evidence based medicine organised and participated in a double blind, randomised, placebo controlled, crossover trial of the parachute.

BMJ 2003;327:1459 0.
Most common reaction to new information and opportunities
Let’s Rethink ICU

• We know universal patient decolonization reduces infections 44% – saves $171/patient on average

• Antibiotic nasal solutions violate my Antibiotic Stewardship Guidelines

• How does our protocol contribute to resistance?
• Topical pre-op antibiotic protocols have notoriously poor compliance, resistance issues
• Risk of infections acquired Post Op
• What about our staff? And the at home caregivers?

*What if I go to day of surgery decolonization and continue it post op? How about my staff?*
Let’s Rethink MRSA Contact Precautions

By Eliminate Screening and Isolating-

• I could
  • improve patient care substantially
  • Improve satisfaction scores
  • Save the facility significant $

Why would I NOT try to eliminate CP for MRSA colonization?
Let’s Rethink High Risk

• Nasal Colonization is one of the key factors in high-risk patient infections
• Infections in high risk patients are more dangerous, more difficult to manage, more expensive
• Universal, long term decolonization is now a possibility

Why not decolonize everyone in my high risk units- patients, staff, visitors?
Conclusions

Don’t be afraid to rethink your current strategies.

With new knowledge and new tools – and some creativity and common sense, we can
- Reduce infection
- Improve patient care/satisfaction
- Reduce facility costs