

Prevention of Surgical Site Infection Using An Evidence Based Bundled Approach



Faculty Disclosure

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Speakers Bureau, Ethicon

Objectives

1. Describe three key practices that perioperative nurses should assess during direct surgical case observations to prevent surgical site infections (SSIs).
2. List the elements of the seven step bundle for SSI Prevention.
3. Develop a multidisciplinary team to implement the 7 S Bundle.

Recent SSI Guidelines



World Health
Organization

GLOBAL GUIDELINES FOR THE PREVENTION OF SURGICAL SITE INFECTION





World Health Organization

Introduction

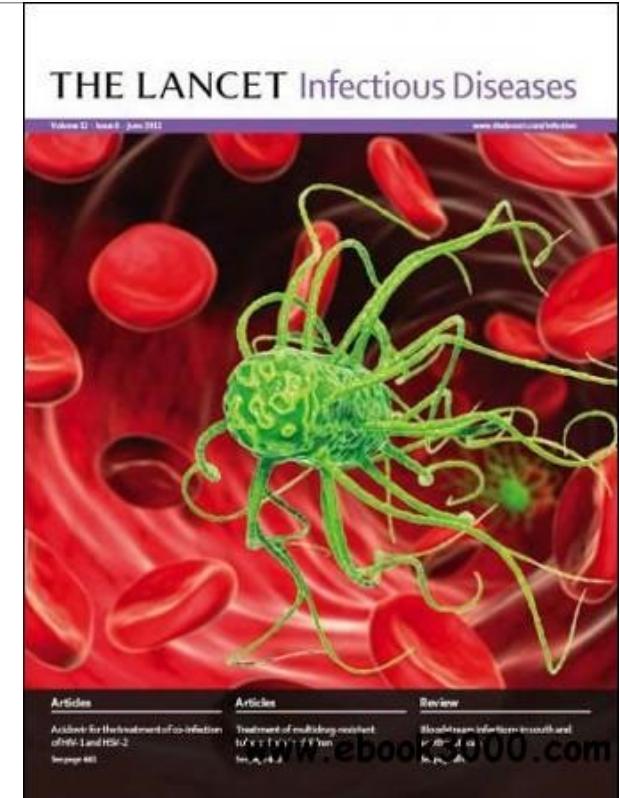
First ever Global guidelines for the prevention of surgical site infection were published on 3 November 2016.

Includes a list of 29 concrete recommendations distilled by 20 of the world's leading experts from 26 reviews of the latest evidence.

Recommendations have also been published in *The Lancet Infectious Diseases*

Designed to address the increasing burden of health care-associated infections on both patients and health care systems globally, alongside supporting tools issued by WHO.

WHO will continue to issue tools in support of guideline implementation throughout 2017.



Evidence Based Resource: Updated SSI Prevention Guidelines – WHO 2016

- Screening and nasal mupirocin recommended for *S aureus* colonized patients before total joint and cardiac procedures.
- Combination of mechanical and oral antibiotic prep is recommended for elective colorectal surgery.
- Alcohol based chlorhexidine and iodophor solutions for skin prep
- Antimicrobial **sealants** should not be used after skin prep (“Integuseal”)
- Plastic adhesive incise drapes with or without antimicrobial properties should not be used for SSI prevention (although a 2015 October prospective study with propensity match of 808 cardiac surgery patients/group: Iodine drape resulted in statistically significant reduced SSI (6.5 vs. 1.9) ($p=0.001$)
- Use of impervious plastic wound protector can prevent SSI in open abdominal surgery
- Triclosan-coated suture is recommended in any type of surgical procedure
- Do not use antibiotic irrigation solution
- (Post op) negative pressure wound therapy recommended in high risk wounds

SPECIAL ARTICLES

American College of Surgeons and Surgical Infection Society: Surgical Site Infection Guidelines, 2016 Update



Kristen A Ban, MD, Joseph P Minei, MD, FACS, Christine Laronga, MD, FACS,
Brian G Harbrecht, MD, FACS, Eric H Jensen, MD, FACS, Donald E Fry, MD, FACS,
Kamal MF Itani, MD, FACS, E Patchen Dellinger, MD, FACS, Clifford Y Ko, MD, MS, MSHS, FACS,
Therese M Duane, MD, MBA, FACS

Table 2. Prehospital Interventions

Guideline	Intervention
1.1. Preoperative bathing	Routine preoperative bathing with chlorhexidine (when not part of a decolonization protocol or preoperative bundle) decreases skin surface pathogen concentrations, but has not been shown to reduce SSI.
1.2. Smoking cessation	Smoking cessation 4 to 6 weeks before surgery reduces SSI and is recommended for all current smokers, especially those undergoing procedures with implanted materials. There is no literature to support cessation of marijuana and electronic cigarette use to prevent SSI, but cessation is recommended before surgery based on expert consensus. American College of Surgeons patient education materials support the use of nicotine lozenges, nicotine gum, and medication to aid in smoking cessation.
1.3. Glucose control	Optimal blood glucose control should be encouraged for all diabetic patients; however, there is no evidence that improved Hgb A1C decreases SSI risk.
1.4. MRSA screening	Decision about whether or not to implement global <i>Staphylococcus aureus</i> screening and decolonization protocols should depend on baseline SSI and MRSA rates. Clinical practice guidelines from the American Society of Health-System Pharmacists recommend screening and nasal mupirocin decolonization for <i>S aureus</i> -colonized patients before total joint replacement and cardiac procedures. MRSA bundles (screening, decolonization, contact precautions, hand hygiene) are highly effective if adhered to, otherwise there is no benefit. No standard decolonization protocol supported by literature; consider nasal mupirocin alone vs nasal mupirocin plus chlorhexidine gluconate bathing. Decolonization protocols should be completed close to date of surgery to be effective. Vancomycin should not be administered as prophylaxis to MRSA-negative patients.
1.5. Bowel preparations	Combination mechanical and antibiotic (po) preparation is recommended for all elective colectomies.

SSI, surgical site infection.

Table 3. Hospital Interventions

Guideline	Intervention
2.1. Glucose control	Hyperglycemia in the immediate preoperative period is associated with an increased risk of SSI. Target perioperative blood glucose should be between 110 to 150 mg/dL in all patients, regardless of diabetic status, except in cardiac surgery patients where the target perioperative blood glucose is <180 mg/dL. Target blood glucose rates <110 mg/dL have been tied to adverse outcomes and increased episodes of hypoglycemia and do not decrease SSI risk.
2.2. Hair removal	Hair removal should be avoided unless hair interferes with surgery. If hair removal is necessary, clippers should be used instead of a razor.
2.3. Skin preparation	Alcohol-containing preparation should be used unless contraindication exists (eg fire hazard, surfaces involving mucosa, cornea, or ear). No clear superior agent (chlorhexidine vs iodine) when combined with alcohol. If alcohol cannot be included in the preparation, chlorhexidine should be used instead of iodine unless contraindications exist.
2.4. Surgical hand scrub	Use of a waterless chlorhexidine scrub is as effective as traditional water scrub and requires less time, but there is no superior agent if used according to manufacturer instructions.
2.5. Surgical attire	There is limited evidence to support recommendations on surgical attire. Joint Commission and Association of Perioperative Registered Nurses policies support facility scrub laundering and the use of disposable bouffant hats. American College of Surgeons guidelines support the use of a skull cap if minimal hair is exposed, removing or covering all jewelry on the head and neck, and professional attire when outside the operating room (no scrubs or clean scrubs covered with a white coat).
2.6. Antibiotic prophylaxis	Administer prophylactic antibiotics only when indicated. Choice of prophylactic antibiotic should be dictated by the procedure and pathogens most likely to cause SSI. Prophylactic antibiotic should be administered within 1 hour before incision or within 2 hours for vancomycin or fluoroquinolones. Prophylactic antibiotic dosing should be weight-adjusted. Re-dose antibiotics to maintain adequate tissue levels based on agent half-life or for every 1,500 mL blood loss. There is no evidence that prophylactic antibiotic administration after incision closure decreases SSI risk; prophylactic antibiotics should be discontinued at time of incision closure (exceptions include implant-based breast reconstruction, joint arthroplasty, and cardiac procedures where optimal duration of antibiotic therapy remains unknown).

2.7. Intraoperative normothermia	Maintain intraoperative normothermia to reduce SSI risk. Preoperative warming is recommended for all cases, and intraoperative warming methods should be employed for all but short, clean cases.
2.8. Wound protectors	Use of an impervious plastic wound protector can prevent SSI in open abdominal surgery. Evidence is strongest for elective colorectal and biliary tract procedures.
2.9. Antibiotic sutures	Triclosan antibacterial suture use is recommended for wound closure in clean and clean-contaminated abdominal cases when available.
2.10. Gloves	The use of double gloves is recommended. Changing gloves before closure in colorectal cases is recommended, however, rescrubbing before closure in colorectal cases is not recommended.
2.11. Instruments	The use of new instruments for closure in colorectal cases is recommended.
2.12. Wound closure	No high-quality evidence about delayed primary closure vs primary closure and SSI for contaminated and dirty incisions. Purse-string closure of stoma sites recommended over primary closure.
2.13. Topical antibiotics	Topical antibiotics can reduce SSI for specific cases, including spine surgery, total joint arthroplasty, and cataract surgery, but there is insufficient evidence to recommend routine use at this time.
2.14. Supplemental oxygen	The administration of supplemental oxygen (80%) is recommended in the immediate postoperative period after surgery performed under general anesthesia.
2.15. Wound care	There is no evidence in the literature that timing of dressing removal increases SSI risk. Early showering (12 hours postoperative) does not increase the risk of SSI. Use of wound vacuum therapy over stapled skin can reduce SSI in open colorectal (abdominal incision) and vascular (groin incision) cases. Mupirocin topic antibiotic application can decrease SSI compared with a standard dressing. Daily wound probing can decrease SSI in contaminated wounds.

Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017

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for the Healthcare Infection Control Practices Advisory Committee

TABLE 1. SUMMARY OF UPDATED, KEY RECOMMENDATIONS FROM THE CENTERS FOR DISEASE CONTROL AND PREVENTION GUIDELINE FOR THE PREVENTION OF SURGICAL SITE INFECTION, 2017

Recommendation	Strength of Evidence
PARENTERAL ANTIMICROBIAL PROPHYLAXIS	
Administer antimicrobials only when indicated based on published guidelines. Time administration such that bactericidal concentration is established in serum and tissues at initial incision.	Category IB
For caesarean sections, administer the appropriate agent prior to skin incision (versus at cord clamping).	Category IA
NONPARENTERAL ANTIMICROBIAL PROPHYLAXIS	
Consider use of triclosan-coated sutures.	Category II
GLYCEMIC CONTROL	
Implement perioperative glycemic control using blood glucose target levels ≤ 200 mg/dL in both diabetic and non-diabetic patients.	Category IA
NORMOTHERMIA	
Maintain perioperative normothermia.	Category IA
OXYGENATION	
Administer increased fraction of inspired oxygen intraoperatively and in the immediate post-operative period following extubation for all patients with normal pulmonary function undergoing general anesthesia with endotracheal intubation.	Category IA
ANTISEPTIC PROPHYLAXIS	
Instruct patients to perform full body shower or bath the night before surgery (with either soap or an antiseptic agent).	Category IB
Intraoperative skin preparation should be performed with an antiseptic agent containing alcohol unless contraindicated.	Category 1A
Consider intraoperative irrigation of deep or subcutaneous tissues with aqueous iodophor solution.	Category II

Organisms and SSIs



Distribution and Rank Order of Pathogens Frequently Reported to the National Healthcare Safety Network (NHSN) – Surgical Site Infections

Pathogens Involved with SSIs	Rank
Staph aureus (includes MRSA)	1
E.Coli	2
Coagulase neg staph	3
Enterococcus faecalis	4
Pseudomonas aerug	5
Klebsiella spp	6
Bacteroides	7
Enterobacter	8
Enterococcus spp	9
Proteus spp	10
Enterococcus faecium	11
Candida albicans	12



Pathogens survive on surfaces

Organism	Survival period
<i>Clostridium difficile</i>	35- >200 days. ^{2,7,8}
Methicillin resistant <i>Staphylococcus aureus</i> (MRSA)	14- >300 days. ^{1,5,10}
Vancomycin-resistant enterococcus (VRE)	58- >200 days. ^{2,3,4}
<i>Escherichia coli</i>	>150- 480 days. ^{7,9}
<i>Acinetobacter</i>	150- >300 days. ^{7,11}
<i>Klebsiella</i>	>10- 900 days. ^{6,7}
<i>Salmonella typhimurium</i>	10 days- 4.2 years. ⁷
<i>Mycobacterium tuberculosis</i>	120 days. ⁷
<i>Candida albicans</i>	120 days. ⁷
Most viruses from the respiratory tract (eg: corona, coxsackie, influenza, SARS, rhino virus)	Few days. ⁷
Viruses from the gastrointestinal tract (eg: astrovirus, HAV, polio- or rota virus)	60- 90 days. ⁷
Blood-borne viruses (eg: HBV or HIV)	>7 days. ⁵

1. Beard-Pegler et al. 1988.. *J Med Microbiol.* **26**:251-5.

2. BIOQUELL trials, unpublished data.

3. Bonilla et al. 1996. *Infect Cont Hosp Epidemiol.* **17**:770-2

4. Boyce. 2007. *J Hosp Infect.* **65**:50-4.

5. Duckworth and Jordens. 1990. *J Med Microbiol.* **32**:195-200.

6. French et al. 2004. *ICAAC.*

7. Kramer et al. 2006. *BMC Infect Dis.* **6**:130.

8. Otter and French. 2009. *J Clin Microbiol.* **47**:205-7.

9. Smith et al. 1996. *J Med.* **27**: 293-302.

10. Wagenvoort et al. 2000. *J Hosp Infect.* **45**:231-4.

11. Wagenvoort and Joosten. 2002. *J Hosp Infect.* **52**:226-7.

Prior room occupancy increases risk of HAI

Study	Healthcare associated pathogen	Likelihood of patient acquiring HAI based on prior room occupancy (comparing a previously ‘positive’ room with a previously ‘negative’ room)
Martinez 2003 ¹	VRE – cultured within room	2.6x
	VRE – prior room occupant	1.6x
Huang 2006 ²	MRSA – prior room occupant	1.3x
Drees 2008 ³	VRE – cultured within room	1.9x
	VRE – prior room occupant	2.2x
	VRE – prior room occupant in previous two weeks	2.0x
Shaughnessy 2008 ⁴	<i>C. difficile</i> – prior room occupant	2.4x
Nseir 2010 ⁵	<i>A. baumannii</i> – prior room occupant	3.8x
	<i>P. aeruginosa</i> – prior room occupant	2.1x

1. Martinez *et al.* Arch Intern Med 2003; 163: 1905-12.

2. Huang *et al.* Arch Intern Med 2006; 166: 1945-51.

3. Drees *et al.* Clin Infect Dis 2008; 46: 678-85.

4. Shaughnessy. ICAAC/IDSA 2008. Abstract K-4194.

5. Nseir *et al.* Clin Microbiol Infect 2010

Mortality risk is high among patients with SSIs

A patient with an SSI is:

- 5x more likely to be readmitted after discharge¹
- 2x more likely to spend time in intensive care¹
- 2x more likely to die after surgery¹



The mortality risk is higher when SSI is due to MRSA

- A patient with MRSA is **12x** more likely to die after surgery²

1. WHO Guidelines for Safe Surgery 2009.

2. Engemann JJ et al. Clin Infect Dis. 2003;36:592-598.

Special Risk Population: Orthopedic Implants

- Hip or Knee aspiration
- If positive – irrigation and debridement
- Removal of hardware may be necessary
- Insertion of antibiotic spacers
- Revisions at future date
- Long term IV antibiotics in community or rehab
- Future worry about the joint
- In other words –

DEVASTATING FOR THE PATIENT AND SURGEON



A 7 S Bundle Approach to Preventing Surgical Site Infections



7 “S” Bundle to Prevent SSI

www.7sbundle.com

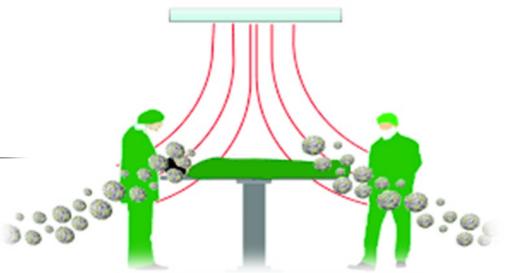
- SAFETY** – Safe OPERATING ROOM
- SCREEN** - Screening for risk factors and presence of MRSA & MSSA
- SHOWERS** – Shower - with soap or chlorhexidine - night before and morning of surgery
- SKIN PREP** – Skin preparation with alcohol based antiseptics, such as CHG/alcohol or Iodophor/alcohol
- SOLUTION** - Surgical Irrigation prior to closure to remove exogenous contaminants – use of chlorhexidine irrigant vs antibiotic irrigations
- SUTURES** – Suture closure with Triclosan coated antimicrobial sutures
- SKIN CLOSURE** – Skin adhesive to seal incision and/or antimicrobial dressing to prevent exogenous contamination in post-op period

#1 Safe Operating Room



#1 – Is it a Safe Operating Room?

- ✓ Traffic control, number staff in room
- ✓ Air handling systems: filtration, cleaning of grills, temps, humidity
- ✓ Evaluate forced air warmer hose placement and heater cooler maintenance for air current transmission
- ✓ SCIP: hair clipping, warmers, oxygenation, surgical prophylaxis, Foley catheter removal < 48 hrs
- ✓ Room turnover and terminal cleaning procedures
- ✓ Surgical technique and handling of tissues
- ✓ Instrument cleaning/sterilization process, biological indicators, ultrasonic washer
- ✓ Storage of supplies, supply bins, carts, tables, OR equipment



AORN 2017 Guidelines related to Infection Prevention

www.aorn.org – evidence based guidelines

Aseptic Practice

- Patient Skin Antisepsis
- Environmental Cleaning
- Hand Hygiene in the Perioperative Setting
- Surgical attire
- Sterile Technique

Patient and Worker Safety

Sharps Safety

Transmissible Infections

Environment of Care

Sterilization and Disinfection

- Flexible Endoscopes
- High Level Disinfection
- Instrument Cleaning
- Packaging Systems
- Sterilization

Surgical Care Improvement Program (SCIP)

1. Surgical prophylaxis: selection, time, discontinuation of abx (24hrs or 48hrs cardiac)
2. Hair clippers

AORN Guideline: Patient Skin Antisepsis

ii. Recommendation II.b.1, page 56 - The patient's hair should be removed in a location outside the operating or procedure room

3. Warming patient (pre-op, post-op) for cell function and wound healing
4. Increased oxygen – for wound healing
5. Remove Foley catheter within 48 hours

Challenges with Hair Clipping in OR

- Clipping should always be done **outside** of the OR whenever possible
- Removal of stray hairs from clipping should be done using current methods (tape and/or suction), while clipping on top of a disposable underpad
- Remove and dispose of single-use clipper head immediately after use and clean the clipper unit according to manufacturer instructions before storing
- In cases of excessive amounts of hair, use vacuum assisted suction device and associated single-use disposable tubing





Major Article

Perioperative hair removal in the 21st century: Utilizing an innovative vacuum-assisted technology to safely expedite hair removal before surgery

Charles E. Edmiston Jr PhD ^{a,*}, Russell K. Griggs MS ^b, Judith Tanner PhD ^c,
Maureen Spencer MEd, RN ^d, Gary R. Seabrook MD ^a, David Leaper DSc ^e

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Background: Perioperative hair removal using clippers requires lengthy cleanup to remove loose hairs contaminating the operative field. We compared the amount of hair debris and associated microbiologic contamination produced during clipping of surgical sites using standard surgical clippers (SSC) or clippers fitted with a vacuum-assisted hair collection device (SCVAD).

Methods: Trained nurses conducted bilateral hair clipping of the chest and groin of 18 male subjects using SSC or SCVAD. Before and during clipping, measurements of particulate matter and bacterial contamination were evaluated on settling plates placed next to each subject's chest and groin. Skin condition after clipping and total clipping/cleanup times were compared between SSC and SCVAD.

Results: The microbial burden recovered from residual hair during cleanup in the SSC group was $3.9 \log_{10}$ CFU and $4.6 \log_{10}$ CFU from respective, chest, and groin areas. Use of the SCVAD resulted in a significant ($P < .001$) reduction in both residual hair and microbial contamination within the operative field compared with SSC.

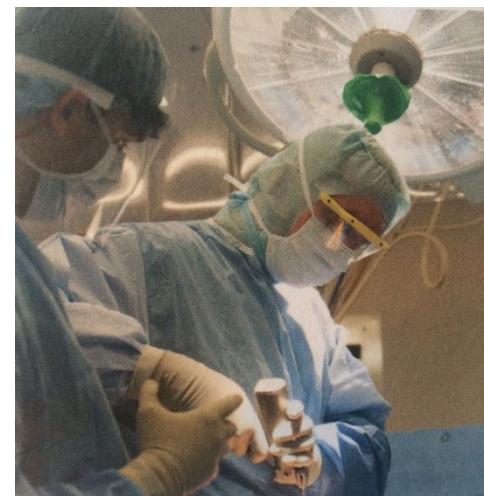
Conclusions: Use of SCVAD resulted in significant ($P < .001$) reduction in total time required to clip and clean up residual hair contaminating the operative field compared with standard practice (ie, SSC), eliminating the need to physically remove dispersed hairs, which can harbor a significant microbial burden, from within the operative field.

Surgical attire – Head Covering

- Normal individuals shed more than 10 million particles from their skin every day.
- Approximately 10% of skin squames carry viable microorganisms
- Estimated that individuals shed approximately **1 million microorganisms** from their bodies each day

Personnel entering the semi-restricted and restricted areas should cover the head, hair, ears, and facial hair

- A clean surgical head cover or hood that confines all hair and completely covers the ears, scalp skin, sideburns, and nape of the neck should be worn.
- Personnel wearing scrub attire should not remove the surgical head covering when leaving the perioperative area
- Personnel should remove surgical head coverings whenever they change into street clothes and go outside of the building.
- Reusable head coverings should be laundered in a healthcare accredited laundry facility after each daily use and when contaminated

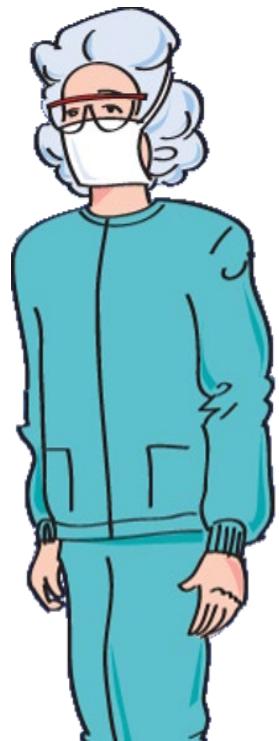


Sleeved Scrub or Jacket in Restricted Areas

In **restricted areas**, all **non-scrubbed personnel** should completely cover their arms with a long-sleeved scrub top or jacket

- Cover the arms while performing preoperative patient skin antisepsis.
- Sterile processing team member should wear scrub attire that covers the arms while preparing and packaging items in the clean assembly section of the sterile processing area.
- Long-sleeved jackets and scrub attire tops should fit closely to the arms and torso to prevent the jacket or top from potentially contaminating the surgical site during preoperative patient skin antisepsis or other activities (eg, application of surgical dressings).
- Snapped closed or buttoned up the front

Perioperative personnel should change into street clothes whenever they go outside of the building



Environmental cleaning

- Evaluate between room cleaning procedures
- Terminal cleaning procedures on evening/night shift
- Are there sufficient staff to terminally clean all OR rooms?
- Microfiber cloths versus sanicloths
- Microfiber mops versus string mops
- Evaluate contact time for disinfectants
- Consider UV room disinfection during terminal cleaning



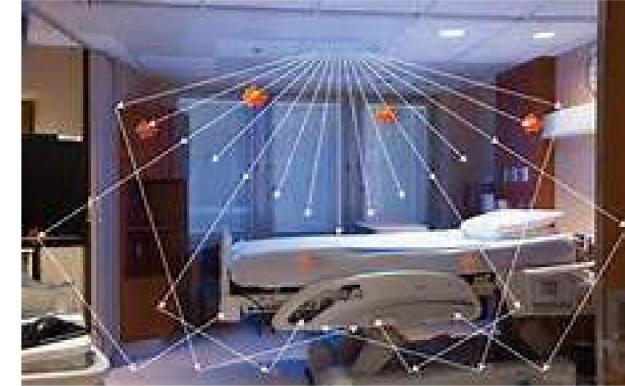
New Technology for OR Environmental Disinfection



Movable UV-C robots for OR terminal cleaning



Permanent fixture white light disinfection



Disinfecting Ceiling Light Units



Copper surfaces



24/7 air purification with UV light



Movable air treatment system with HEPA filer and UV

Challenges: Cleaning/Sterilization of Instruments

- Inspection/cleaning of Instruments
 - Lumens, grooves, sorting, hand cleaning, disassembly
- Ultrasonic washers in SPD
 - machine quality monitor (Sonacheck)
 - routine cleaning and maintenance
- Pre-soaking and rinsing of tissue and blood from the instruments in enzymatic or instrument cleaner
- Reduce immediate use steam sterilization (IUSS) - purchase additional instruments and trays
- Use new separate instruments for closing colorectal cases based on expert consensus



AORN Hand Hygiene Guideline

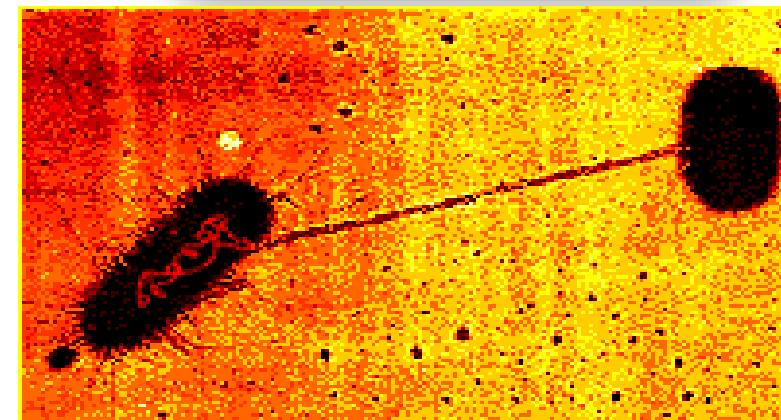
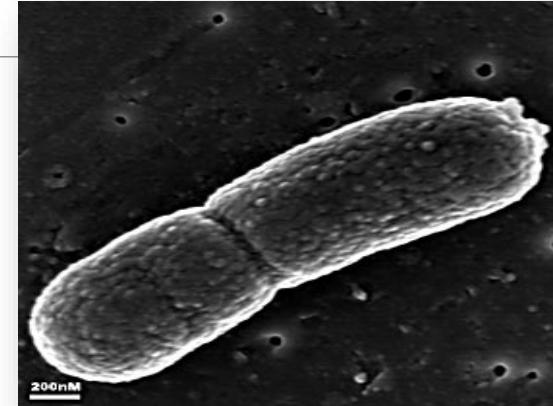
Organisms multiply every 20 minutes

Communication to pass R Factors to antibiotic resistance

III.a. Personnel should perform hand hygiene

- before and after patient contact
- before performing a clean or sterile task
- after risk for blood or body fluid exposure
- after contact with patient surroundings
- when hands are visibly soiled
- before and after eating
- after using the restroom

Changing gloves prior to closure for colorectal cases based on expert consensus



Communication between organisms to pass resistance factors

Hand Contamination of Anesthesia Providers Is an Important Risk Factor for Intraoperative Bacterial Transmission

Randy W. Loftus, MD,* Matthew K. Muffly, MD,* Jeremiah R. Brown, PhD, MS,* Michael L. Beach MD, PhD,* Matthew D. Koff, MD,* Howard L. Corwin, MD,* Stephen D. Surgenor, MD,* Kathryn B. Kirkland, MD,* and Mark P. Yeager, MD*

Table 2. Baseline Provider Hand Contamination^a

Organism	Providers N/total (%)	
MRSA	12/164 (7%)	
MSSA	13/164 (11%)	
VRE	4/164 (2%)	
Enterococcus (non-VRE)	1/164 (0.6%)	
Staph other	164/164 (100%)	
Micrococcus	110/64 (67%)	
Corynebacterium	14/164 (9%)	
Streptococcus	128/164 (78%)	
Gram negative ^b	81/164 (49%)	 ?antibiotic resistant strains

MRSA = methicillin-resistant *Staphylococcus aureus*; MSSA = methicillin-sensitive *Staphylococcus aureus*; VRE = vancomycin-resistant *Enterococcus*.

^a Samples taken upon entry to the patient environment but before patient contact and after an opportunity to perform hand hygiene.

^b *E. coli*, *Klebsiella*, *Serratia*, *Pseudomonas*, and *Acinetobacter*.

Table 3. Evidence for Intraoperative Transmission of Bacterial Pathogens from Anesthesia Provider Hands to the Anesthesia Environment and Patient IV Catheters

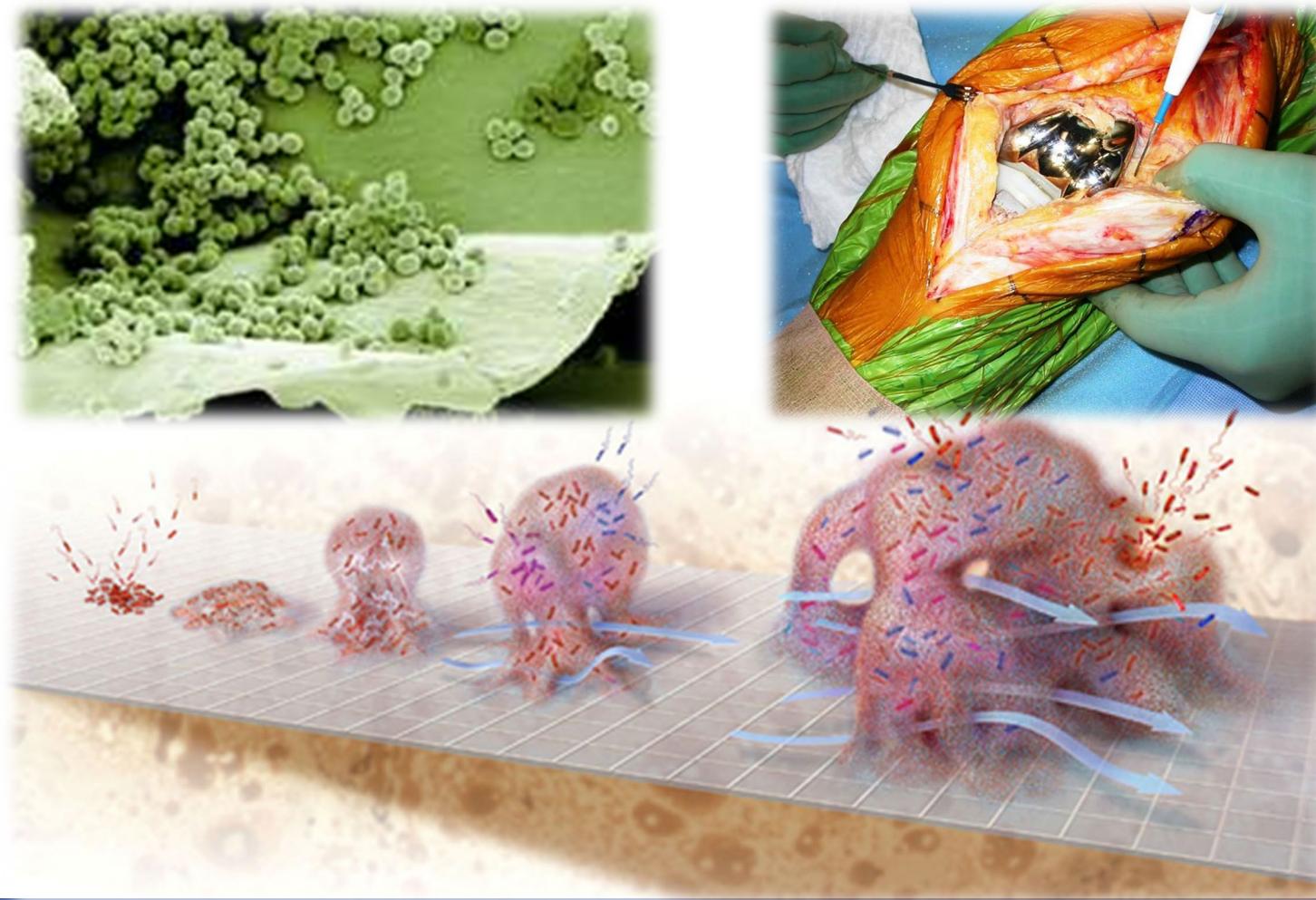
	Case 1			Case 2				
	Before case 1		End case 1		Before case 2		End case 2	
	Provider hands (site B)	Stopcock	Machine APL/D	Machine APL/D	Provider hands (site E)	Stopcock	Machine APL/D	
Direction of transmission →								
Organism								
Micro	Attending		X					
S. epi	Attending	X						
S. hae	Attending	X						
S. epi	Attending	X						
S. epi	Attending				Attending ^a			
S. epi	Attending		X			X	X	
Micro	Attending		X			X		
S. epi	Attending		X				X	
Strep	Resident	X					X	
Pseudo	Attending						X	
Pseudo	Resident		X				X	
Micro	Resident	X		X		X	X	
MRSA	Resident		X	X	Attending ^a		X	
MSSA	Resident		X				X	
S. auric	CRNA		X	X			X	
Micro	CRNA			X	Attending ^a		X	
S. epi	CRNA			X				
Micro					CRNA ^a	X	X	

Sites were cultured as described, and pathogens were found at the times and locations noted.

APL = anesthesia machine adjustable pressure limiting valve; D = anesthesia machine inhaled agent concentration dial; X = transmission event confirmed by biotype analysis; S. epi = Staphylococcal epidermidis; S. hae=Staphylococcal haemolyticus; Strep = streptococcus; Pseud = pseudomonas; MRSA = methicillin-resistant Staphylococcal aureus; MSSA = methicillin-sensitive Staphylococcal aureus; S. auric = Staphylococcal auricularis; CRNA = certified registered nurse anesthetist.

^a Provider was negative at the start of case 1; hands contaminated by bacterial organisms brought in by other providers.

Risk: Cross Contamination and Biofilm Formation on implanted material: orthopedic implants, devices, stopcocks, catheters, grafts, mesh, etc.



Abdominal Wound Protector/Retractor for Colon Surgery Shown to Reduce SSI

4.17 Wound protector devices

WHO SSI Guideline

Recommendation

The panel suggests considering the use of wound protector (WP) devices in clean-contaminated, contaminated and dirty abdominal surgical procedures for the purpose of reducing the rate of SSI.
(Conditional recommendation, very low quality of evidence)



Horiuchi et al: A Wound Protector Shields Incision Sites from Bacterial Invasion
SURGICAL INFECTIONS Volume 11, Number 6, 2010

Reid et al: Barrier Wound Protection Decreases Surgical Site Infection in Open Elective Colorectal
Surgery: A Randomized Clinical Trial DISEASES OF THE COLON & RECTUM VOLUME 53: 10 (2010)

#2 SCREEN for Risk Factors and MRSA and MSSA Colonization



Staph Nasal Colonization: MRSA and MSSA

Staphylococcus aureus nasal colonization predisposes patients to invasive *S. aureus* infections

- Nasal carriage of *S. aureus* is associated with a relative risk of 7.1 for developing SSI (Kluytmans *J Infect Dis* 1995)
- Most cases of invasive *S. aureus* infection are due to endogenous strains (Von Eiff *NEJM* 2001, Huang *CID* 2008)

Table 4. Infection risk factor

Risk factor	Odds ratio (confidence interval)	p value
Current tobacco use	3.00 (1.78 5.06)	< 0.001
Current or history of bone cancer	12.85 (4.64 35.59)	< 0.001
Diabetes mellitus	2.44 (1.55 3.82)	< 0.001
Hepatitis B	7.34 (0.96 56.1)	0.027
Hepatitis C	5.59 (2.21 14.19)	< 0.001
MRSA colonization or prior infection	7.34 (2.85 18.91)	< 0.001
MSSA colonization or prior infection	8.64 (3.75 19.89)	< 0.001
Staphylococcal colonization or prior infection	6.52 (3.41 12.51)	< 0.001
Underweight (BMI < 18.5 kg/m ²)	1.90 (0.26 13.7)	0.56
Overweight (BMI 25.0 29.9 kg/m ²)	0.60 (0.24 1.50)	0.24
Obese (BMI 30.0 39.9 kg/m ²)	0.84 (0.51 1.41)	0.52
Morbid obesity (BMI 40.0 49.9 kg/m ²)	1.28 (0.61 2.65)	0.51
Super obesity (BMI 50 + kg/m ²)	15.69 (5.97 41.21)	< 0.001
Obesity hypoventilation syndrome	10.2 (1.17 88.5)	0.01

MRSA = methicillin resistant *Staphylococcus aureus*; MSSA = methicillin susceptible *S. aureus*; BMI = body mass index.

Does Using Mupirocin Eradicate *S. Aureus* Nasal Carriage?

Systematic review (Ammerlaan HS, et al. *CID* 2009):

- 8 studies comparing mupirocin to placebo
- Short-term nasal mupirocin (4-7 days) was an effective method for *S. aureus* eradication
- 90% success at one week, 60% at longer (14-365 days) follow-up
- 1% develop mupirocin resistance

THE JOURNAL OF BONE & JOINT SURGERY



This is an enhanced PDF from The Journal of Bone and Joint Surgery

The PDF of the article you requested follows this cover page.

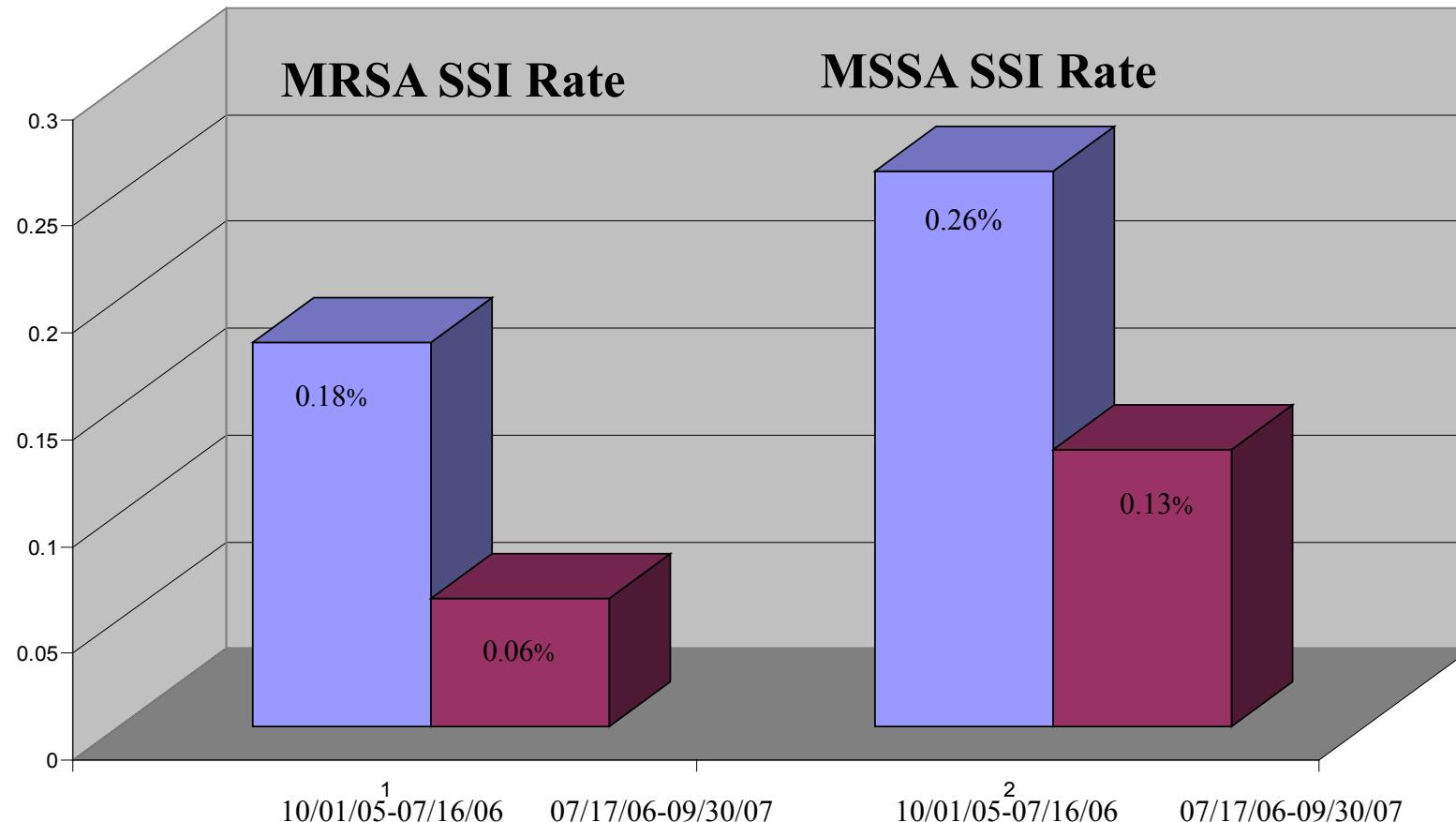
Institutional Prescreening for Detection and Eradication of Methicillin-Resistant *Staphylococcus aureus* in Patients Undergoing Elective Orthopaedic Surgery

David H. Kim, Maureen Spencer, Susan M. Davidson, Ling Li, Jeremy D. Shaw, Diane Gulczynski, David J. Hunter, Juli F. Martha, Gerald B. Miley, Stephen J. Parazin, Pamela Dejoie and John C. Richmond

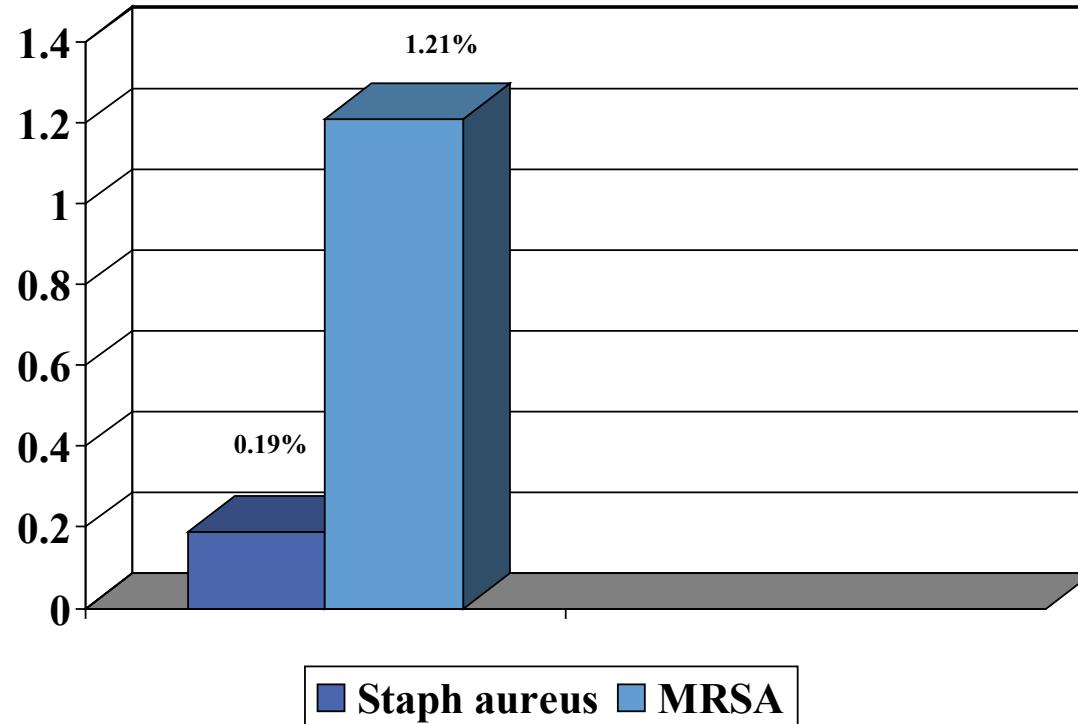
J Bone Joint Surg Am. 2010;92:1820-1826. published Jul 7, 2010; doi:10.2106/JBJS.I.01050

50% Reduction in MSSA SSI

60% Reduction in MRSA SSI



SSI– Increased Risk with MRSA Colonization



- MRSA colonized patients still had an increased risk of SSI despite decolonization
- Seven (7) *Staph aureus* infections in 2712 positives 0.19%
- Seven (7) MRSA infections in the 576 positives 1.21%
- Statistically significant difference p=<.05

Institutional Prescreening for Detection and Elimination of Methicillin Resistant Staphylococcus aureus in Patients Undergoing Elective Orthopaedic Surgery

	Control Period 10/2005-6/2006	Study Period 6/2006-9/2007	<i>p</i> value
N	5293	7019	
MRSA Infection	10 (0.18%)	4 (0.06%)	0.0315
MSSA Infection	14 (0.26%)	9 (0.13%)	0.0937
Total SSIs	24 (0.46%)	13 (0.18%)	0.0093

Alcohol Based and Iodophor Based Nasal Antiseptics



1 Remove



2 Flip



3 Reinsert



4 Shake



5 Squeeze



6 Apply



Nasal decolonization with Alcohol and Iodophor Nasal Antiseptics

- Anderson MJ et al. Efficacy of skin and **nasal povidone-iodine** preparation against MRSA and S. aureus within the anterior nares. 2015 Antimicrobial Agents and Chemotherapy 59 (5), pp. 2765-2773.
- Steed LL, Costello J, Lohia S, Spannhake EW, Nguyen S. Reduction of nasal Staphylococcus aureus carriage in health care professional by treatment with a non-antibiotic **alcohol-based nasal antiseptic**. 2014 American Journal of Infection Control 42 (8), pp 841-846
- Pre- and Post-Operative Participation of Orthopedic Patients and Surgical Staff in a Novel Intervention to Reduce Staphylococcus aureus infection. ID Week Poster October 27, 2016
69% decrease in SSI during the 9-month study period
- Preventing Surgical Site Infections: A Randomized, Open-Label Trial of Nasal Mupirocin Ointment and **Nasal Povidone-Iodine Solution**. Infection Control and Hospital Epidemiology, Vol. 35, No. 7 (July 2014), pp. 826-832 - **Reduction in SSI after arthroplasty or spine fusion**
- Mullen A, et al. Perioperative participation of orthopedic patients and surgical staff in a nasal decolonization intervention to reduce Staphylococcus spp surgical site infections AJIC Mar 2017
Mean infection rates were significantly decreased by 81% from 1.76 to 0.33 per 100 surgeries during the 15-month trial (**alcohol based nasal antiseptic**)



#3 – Showers with Soap or Chlorhexidine gluconate



Risk Factors: Bacteria on Patient's Skin

2017 AORN Guideline for Preoperative Patient Skin Antisepsis:

Recommendation I, page 53 - Patients should bathe or shower before surgery with either soap or an antiseptic.

- If using CHG cleansing:
 - Liquid chlorhexidine shower (two 4 oz bottles – night before and morning of surgery)
 - CHG impregnated washcloths (package of 6 cloths)



Empowering the Surgical Patient: A Randomized, Prospective Analysis of an Innovative Strategy for Improving Patient Compliance with Preadmission Showering Protocol

Charles E Edmiston Jr, PhD, Candace J Krepel, MS, Sarah E Edmiston, MEd, Maureen Spencer, MEd, Cheong Lee, MD, Kellie R Brown, MD, FACS, Brian D Lewis, MD, FACS, Peter J Rossi, MD, FACS, Michael Malinowski, MD, Gary Seabrook, MD, FACS

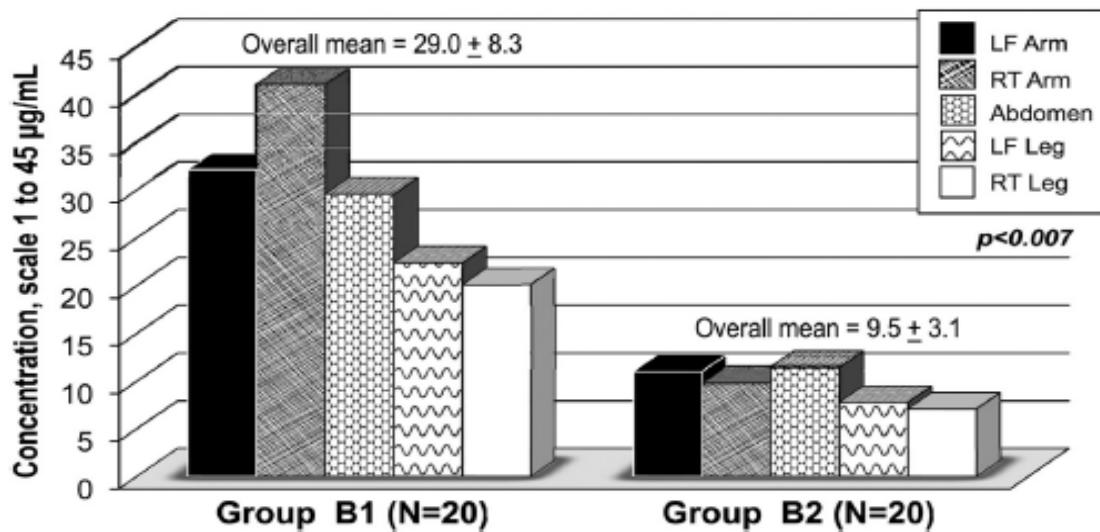


Figure 2. Mean skin-surface concentration ($\mu\text{g/mL}$) of 4% chlorhexidine gluconate after 3 preadmission showers. Group B1 subjects were alerted by short message service text, email, or voicemail. Group B2 subjects were not alerted before showering. The 90% minimum inhibitory concentration = $5 \mu\text{g/mL}$ for skin staphylococcal flora (including MRSA). LF, left; RT, right.

Liquid chlorhexidine shower
(two 4oz bottles – night
before and morning of
surgery) – leave on skin for 1
minute in shower before
rinsing

#4 Skin Prep – Alcohol based surgical skin prep



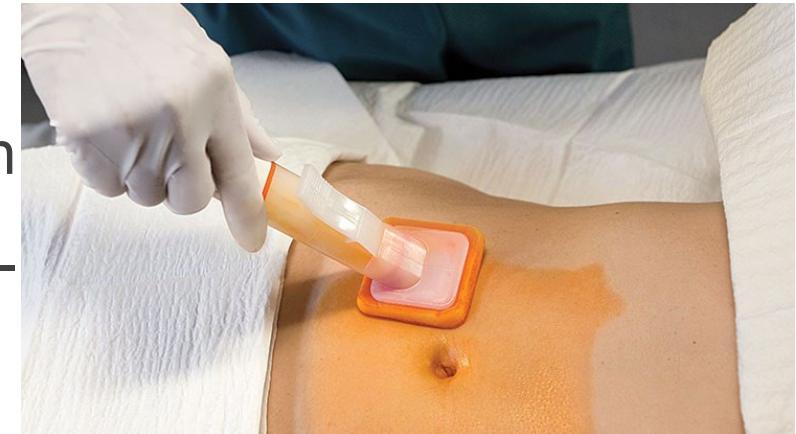


Alcohol-containing antiseptic agent

➤ Two types of preoperative skin preparations that combine alcohol (which has an immediate and dramatic killing effect on skin bacteria) with long-acting antimicrobial agents appear to be more effective at preventing SSI than povidone-iodine (an iodophor) alone:

- Chlorhexidine 2% plus alcohol 70%
- Iodophor plus alcohol 72%

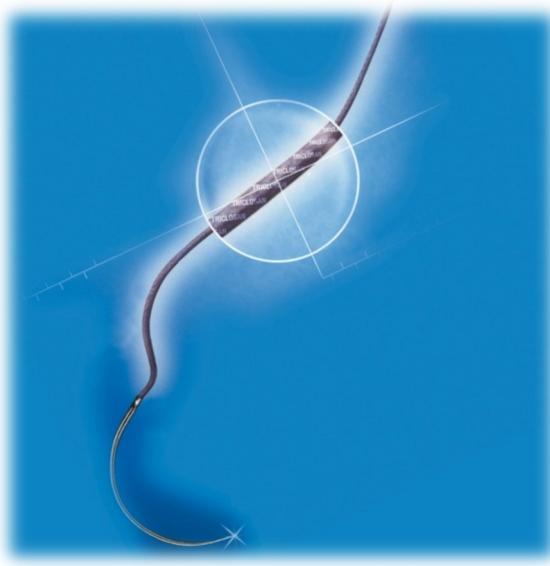
3 minute dry time for alcohol antiseptics to prevent fire



Skin Antiseptic Agents

Antiseptic agent	Rapidity of action	Persistent activity
Alcohol	Excellent	None
CHG	Moderate	Excellent
PI	Moderate	Minimal
CHG w/alcohol	Excellent	Excellent
PI w/alcohol	Excellent	Moderate

5 Sutures –Triclosan-coated antimicrobial

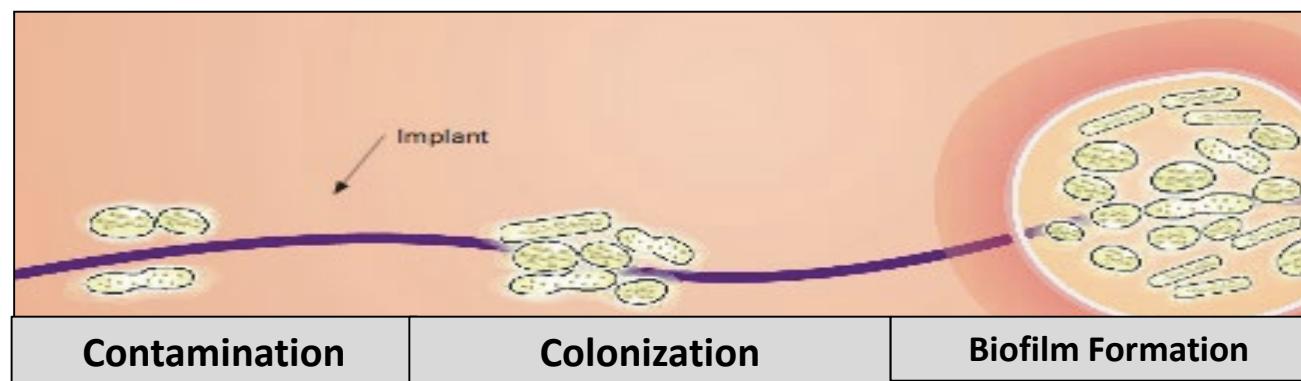


WHO Global Guideline Nov 2016	ACS-SIS SSI Update 2016	CDC Guideline 2017 Update
<p>“The panel suggests the use of triclosan-coated sutures for the purpose of reducing the risk of SSI, independent of the type of surgery.”</p> <p>Conditional Strength, Moderate Quality of Evidence</p>	<p>“The use of triclosan coated suture is recommended for wound closure in clean and clean-contaminated abdominal cases when available.”</p>	<p>“Consider the use of triclosan-coated sutures for the prevention of SSI”</p>
<p>Eighteen studies (13 RCTs and five cohort studies) including a total of 7458 patients were meta-analyzed <i>de novo</i> (and separately published as Wu 2016)</p>	<ul style="list-style-type: none"> -One RCT in colorectal surgery -2013 meta-analysis of 17 RCT (3720 pts) -2016 meta-analysis of 13 RCT (5256 pts) 	<p>14 RCT including a total of 5,388 patients were meta-analyzed</p>

Bacterial colonization of suture

Like all foreign bodies, sutures can be colonized by bacteria:

- Implants provide nidus for attachment of bacteria
- Bacterial colonization can lead to biofilm formation
- Biofilm formation increases the difficulty of treating an infection¹



On an implant, such as a suture, it takes only 100 staphylococci per gram of tissue for an SSI to develop²

1. Edmiston C, et al. Microbiology of Explanted Suture Segments from Infected and Noninfected Surgical Patients. *Journal of Clinical Microbiology*. February 2013 Volume 51 Number 2 p. 417-421
2. Mangram AJ et al. *Infect Control Hosp Epidemiol*. 1999;27:97-134..

OR Air Current Contamination – End of the Case

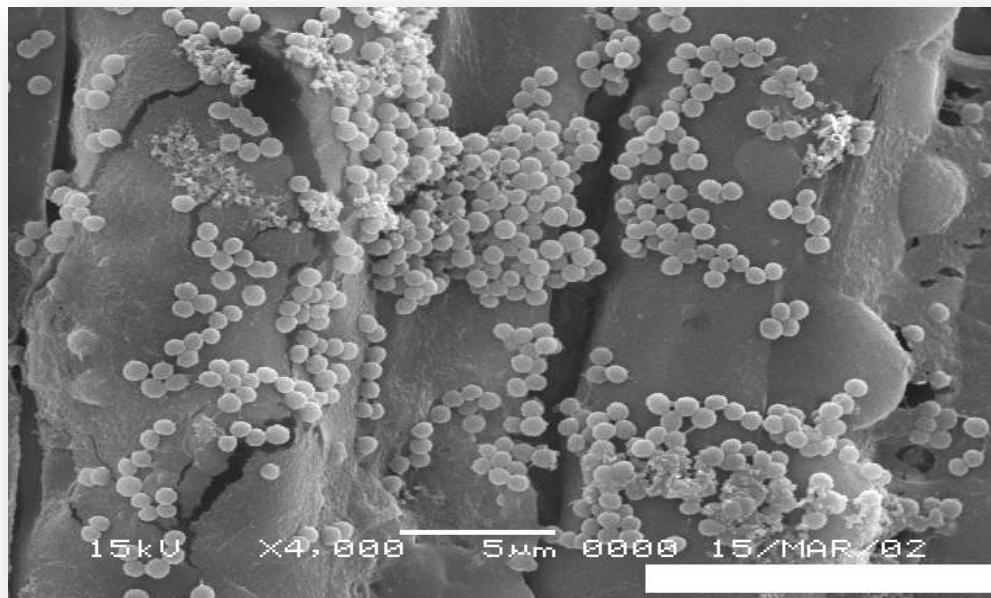
In teaching hospitals:

- Surgeon leaves room
- Resident, Physician Assistant or Nurse Practitioner work on incision
- Circulating Nurse counts sponges
- Scrub Technician preparing instruments for Central Sterile Processing
- Anesthesia move in and out of room
- Instrument representative
- Students and Visitors



Potential for Contamination of Sutures

Suture with Staphylococcus colonies



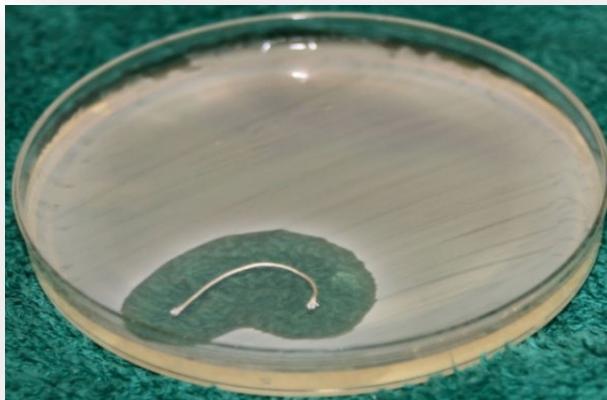
Air settling plates in the operating room at the last hour of a total joint case from the anesthesia cart, bovie cart, computer



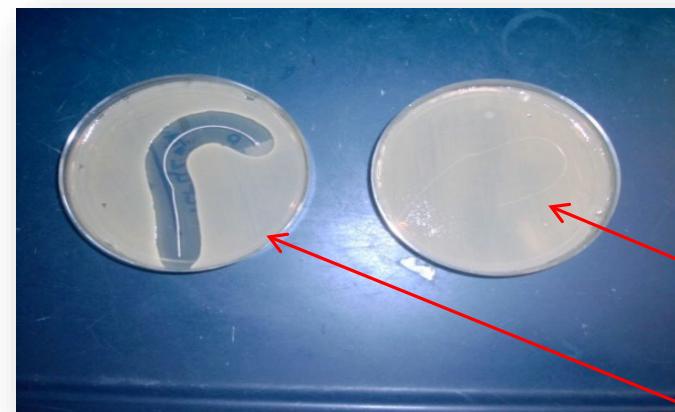
Antibacterial Suture Challenge

Studied the “zone of inhibition” around the suture

- A pure culture—0.5 McFarland Broth—of *S. aureus* was prepared on a culture plate
- An antibacterial suture was aseptically cut, planted on the culture plate, and incubated for 24 hrs – held at 5 and 10 days



5 day zone of inhibition



10 day zone of inhibition

Traditional suture

Antimicrobial suture

Is there an evidence-based argument for embracing an antimicrobial (triclosan)-coated suture technology to reduce the risk for surgical-site infections?: A meta-analysis

Charles E. Edmiston, Jr, PhD,^a Frederic C. Daoud, MD,^b and David Leaper, MD, FACS,^c Milwaukee, WI, Paris, France, and London, UK

Background. It has been estimated that 750,000 to 1 million surgical-site infections (SSIs) occur in the United States each year, causing substantial morbidity and mortality. Triclosan-coated sutures were developed as an adjunctive strategy for SSI risk reduction, but a recently published systematic literature review and meta-analysis suggested that no clinical benefit is associated with this technology. However, that study was hampered by poor selection of available randomized controlled trials (RCTs) and low patient numbers. The current systematic review involves 13 randomized, international RCTs, totaling 3,568 surgical patients.

Methods. A systematic literature search was performed on PubMed, Embase/Medline, Cochrane database group (Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, Health Economic Evaluations Database/Database of Health Technology Assessments), and www.clinicaltrials.gov to identify RCTs of triclosan-coated sutures compared with conventional sutures and assessing the clinical effectiveness of antimicrobial sutures to decrease the risk for SSIs. A fixed- and random-effects model was developed, and pooled estimates reported as risk ratio (RR) with a corresponding 95% confidence interval (CI). Publication bias was assessed by analyzing a funnel plot of individual studies and testing the Egger regression intercept.

Results. The meta-analysis (13 RCTs, 3,568 patients) found that use of triclosan antimicrobial-coated sutures was associated with a decrease in SSIs in selected patient populations (fixed effect: RR = 0.734; 95% CI: 0.590–0.913; P = .005; random-effect: RR = 0.693; 95% CI: 0.533–0.920; P = .011). No publication bias was detected (Egger intercept test: P = .145).

Conclusion. Decreasing the risk for SSIs requires a multifaceted “care bundle” approach, and this meta-analysis of current, pooled, peer-reviewed, randomized controlled trials suggests a clinical effectiveness of antimicrobial-coated sutures (triclosan) in the prevention of SSIs, representing Center for Evidence-Based Medicine level 1a evidence. (Surgery 2013;154:89–100.)

Meta-analysis

Systematic review and meta-analysis of triclosan-coated sutures for the prevention of surgical-site infection

Z. X. Wang^{1,2}, C. P. Jiang^{1,2}, Y. Cao^{1,2} and Y. T. Ding^{1,2}

¹Department of Hepatobiliary Surgery, Affiliated Drum Tower Hospital, School of Medicine, Nanjing University, and ²Jiangsu Province's Key Medical Centre for Liver Surgery, Nanjing, Jiangsu Province, China

Correspondence to: Professor Y. T. Ding, 321 Zhong Shan Road, Nanjing, Jiangsu Province, China 210008 (e-mail: dingyitao@yahoo.com.cn)

Background: Surgical-site infections (SSIs) increase morbidity and mortality in surgical patients and represent an economic burden to healthcare systems. Experiments have shown that triclosan-coated sutures (TCS) are beneficial in the prevention of SSI, although the results from individual randomized controlled trials (RCTs) are inconclusive. A meta-analysis of available RCTs was performed to evaluate the efficacy of TCS in the prevention of SSI.

Methods: A systematic search of PubMed, Embase, MEDLINE, Web of Science®, the Cochrane Central Register of Controlled Trials and internet-based trial registries for RCTs comparing the effect of TCS and conventional uncoated sutures on SSIs was conducted until June 2012. The primary outcome investigated was the incidence of SSI. Pooled relative risks with 95 per cent confidence interval (c.i.) were estimated with RevMan 5.1.6.

Results: Seventeen RCTs involving 3720 participants were included. No heterogeneity of statistical significance across studies was observed. TCS showed a significant advantage in reducing the rate of SSI by 30 per cent (relative risk 0.70, 95 per cent c.i. 0.57 to 0.85; P < 0.001). Subgroup analyses revealed consistent results in favour of TCS in adult patients, abdominal procedures, and clean or clean-contaminated surgical wounds.

Conclusion: TCS demonstrated a significant beneficial effect in the prevention of SSI after surgery.

#6 Solution – to Pollution is Dilution



Antibiotic Irrigation – Limited Evidence

- High-pressure pulsatile lavage and low-pressure pulsatile lavage result in **higher rates of deep bacterial seeding** in bone than does brush and bulb-syringe lavage¹
 - Higher irrigant pressures result in greater **osseous damage** and perhaps impairment of osseous healing¹
 - Kalteis et al. revealed that compared with brush and bulb-syringe lavage high and low-pressure pulsatile lavage resulted in **significantly ($p < 0.001$) higher rates of deep bacterial seeding in bone**²
 - **No evidence that Bacitracin/Polymixin irrigations reduce rate of SSI²**
- 1. Kalteis T, Lehn N, Schroder HJ, Schubert T, Zysk S, Handel M, Grifka J. Contaminant seeding in bone by different irrigation methods: an experimental study. *J Orthop Trauma*. 2005;19:591-6.
2. Fletcher N, et al: Prevention of perioperative infections. *J Bone Joint Surg Am*. 2007;89:1605-1618



Practice forum

Surgical wound irrigation: A call for evidence-based standardization of practice

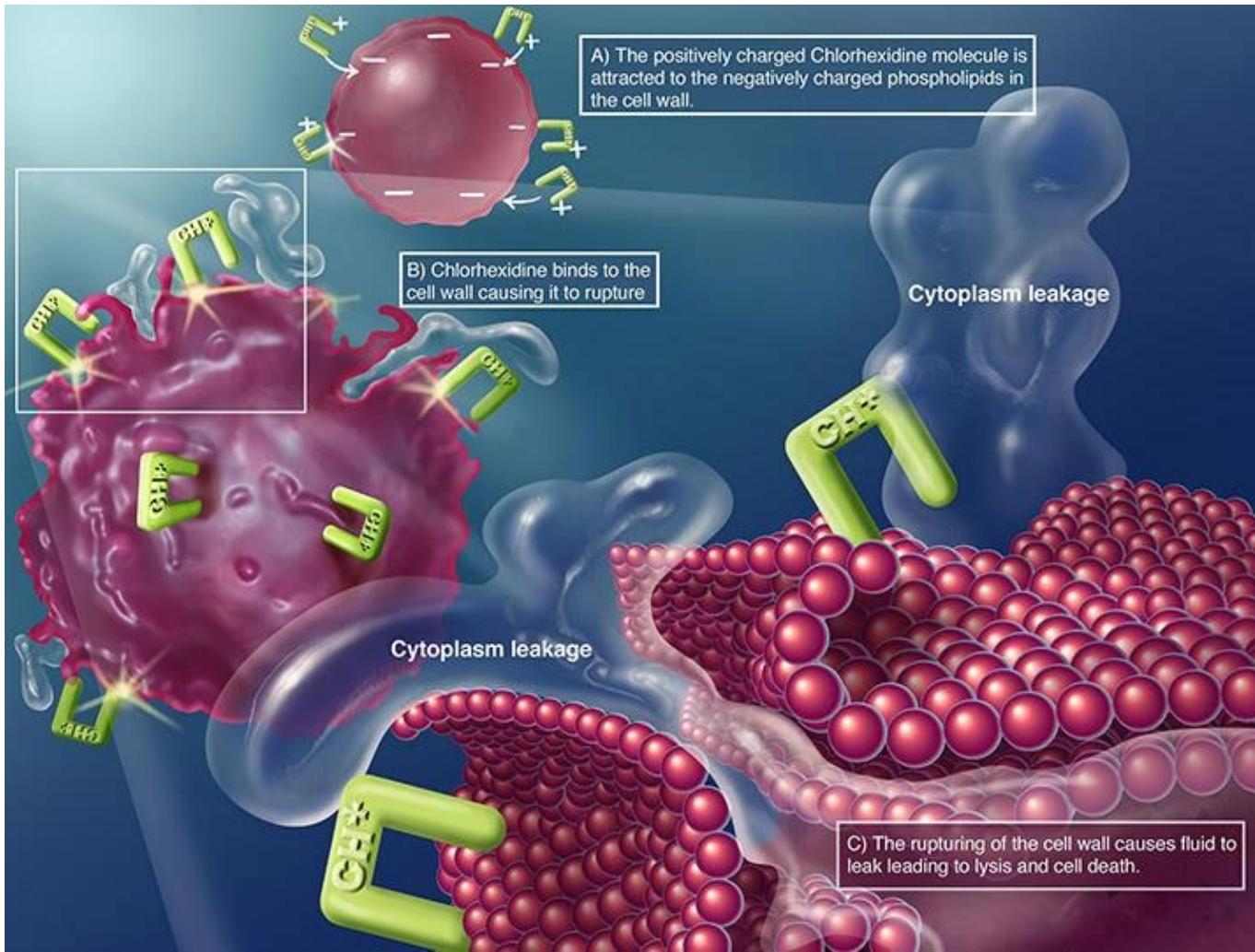
Sue Barnes RN, BSN, CIC^a, Maureen Spencer RN, MEd, CIC^b, Denise Graham^c,
Helen Boehm Johnson MD^{d,*}

- Surgeons, perioperative nurses, and infection preventionists must partner to deliver exceptional infection prevention results.
- Infection preventionists need to know more about what happens “behind the red line” and how they can support practice changes that deliver real results.
- There is currently an absence of evidence-based science addressing surgical irrigation. As a result, there is a lack of guidance and standardization in perioperative practice. Standardization must address irrigation solution type(s), volume(s), and method(s) of delivery.
- Existing published evidence is sufficient to support:
 - Elimination of antibiotic solution for surgical irrigation;
 - avoidance of surfactants for surgical irrigation
- Current existing published evidence is not sufficient to guide delivery method and volume. Expert opinion could instead be used to guide best practice.

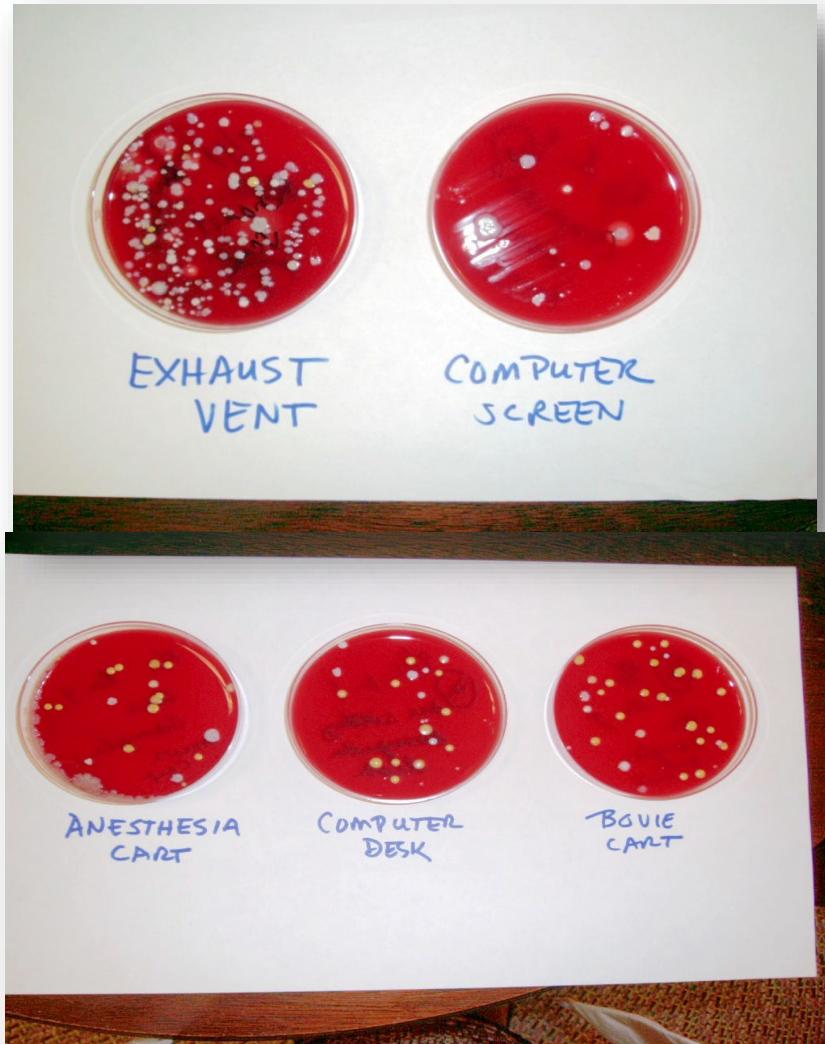
Chlorhexidine 0.05% Irrigation Solution



- Chlorhexidine Gluconate 0.05% is an excellent biocide that binds to tissues
- It has demonstrated antimicrobial efficacy and persistence in laboratory testing
- The mechanical action effectively loosens and removes wound debris
- Safe for mucous membranes – cleared by FDA



Flush contaminants before closure



CHG Irrigant leaves a persistent antimicrobial action in the tissue

Intra-Operative Surgical Irrigation of the Surgical Incision What Does the Future Hold—Saline, Antibiotic Agents, or Antiseptic Agents?

Charles E. Edmiston, Jr.¹ and David J. Leaper²

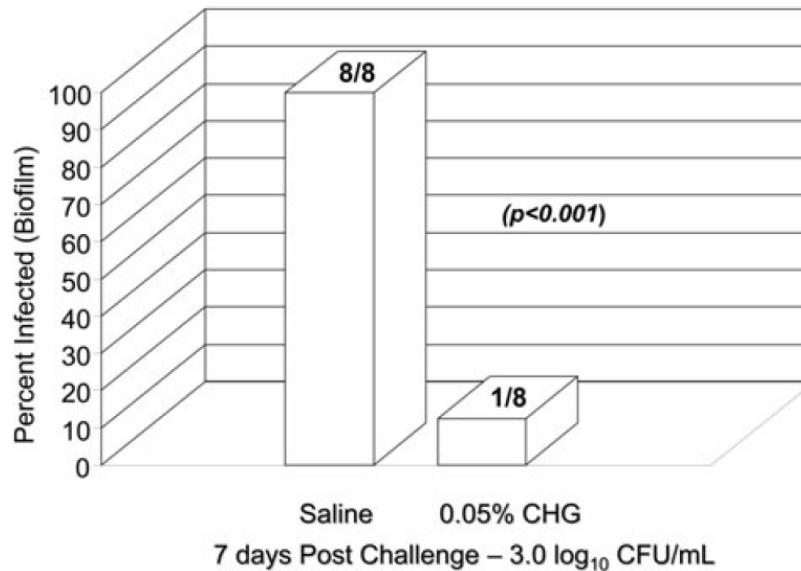


FIG. 5. Impact of Intraoperative saline and 0.05% chlorhexidine gluconate (CHG) irrigation on resolution of methicillin-resistant *Staphylococcus aureus* (MRSA) contaminated polypropylene mesh in Sprague-Dawley animal model at 7 day post-infection ($p<0.001$). Total lavage volume, 200 mL, microbial counts expressed as \log_{10} cfu/cm² surgical mesh, initial MRSA inoculum challenge, $3.0 \log_{10}$ cfu/mL. CFU=colony-forming units.

Topical Antimicrobials and the Open Surgical Wound

Donald E. Fry

Abstract

Background: Topical antiseptic and antibiotic agents have been used for the prevention of surgical site infections since Joseph Lister's original research on this subject. Although these agents are used extensively in clinical practice, evidence to support the use of topical antimicrobial agents remains limited.

Patients and Methods: The world literature on the use of antiseptic and antibiotic agents was evaluated to determine the current status of evidence to support the use of topical antimicrobial agents in the prevention of surgical site infections.

Results: Although several techniques of using topical antibiotic solutions, powders, antibiotic gauzes, and beads have some evidence for validation, there are equal numbers of reports that have failed to show benefit. There is little evidence to support the use of antiseptic solutions in the prevention of infections at the surgical site.

Conclusions: Additional clinical trials are necessary to provide evidence to support any of the methods for using topical antimicrobial agents to prevent surgical site infections. Dilute antiseptic agents should be considered in future trials when antimicrobial activity can be identified without local toxicity.

Yet another feature of chlorhexidine is the binding of the antiseptic agent to soft tissue. Chlorhexidine binds to epidermal, mucous, and subcutaneous tissues after topical application. The bound chlorhexidine has antiseptic effects that continue after the tissue binding, and it is unaffected by the local presence of blood [31]. As a dilute irrigation solution of open wounds and soft tissue infections, it can be anticipated that antiseptic effects will continue after application.



Reduction in Colon Surgical Site Infections using CHG Irrigant Solution

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 Patricia Tyrrell, RN, BSN, CNOR | Gail Pietrzyk, DNP, RN, CNOR

UHS of Delaware, Inc. a subsidiary of Universal Health Services Inc., King of Prussia, PA

AORN #138
 Boston
 April, 2017

Month - Year	August 2015	September 2015	October 2015	November 2015	December 2015	January 2016	February 2016	March 2016	April 2016	May 2016	June 2016	July 2016	August 2016	September 2016	October 2016	November 2016
Rate/100 Procedures	5.88	6.21	3.24	2.13	2.65	3.47	4.37	3.33	1.28	1.49	2.43	1.05	2.24	2.01	3.18	1.09

Clinical Issue:

- Colon surgical site infections (SSIs) have one of the highest rates of healthcare acquired infections that can lead to increased morbidity and mortality and use of hospital resources
- Numerous clinical interventions with varying levels of supporting evidence have been implemented:
 - Appropriate antibiotic prophylaxis,
 - Normo-thermia,
 - Appropriate hair removal,
 - Glycemic control
 - Wound protectors
 - Mechanical bowel preparation.
- For this project a surgical irrigating solution, using a 0.05% chlorhexidine gluconate antiseptic was introduced in a 26-facility acute care system starting in June 2015.

Pre-Implementation: May 2015

- Manufacturer of the CHG irrigation solution visit the hospitals with the highest standardized infection ratio (SIR) for Colon SSI to educate perioperative nursing staff and physicians.

Implementation:

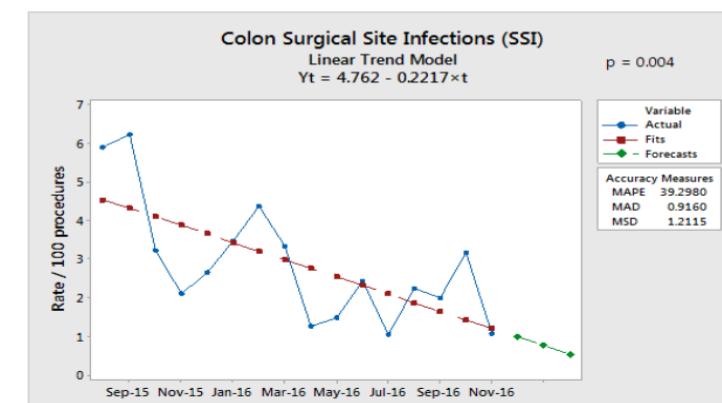
- Each Operating Room site purchased product
- Clinical Specialist contacted the OR Director and were assigned the week to visit for in-service education.
- The procedure involved irrigating the tissues after the fascia was closed with the 450ml of CHG, leaving it in the tissues for 1 minute, followed by a rinse with the 450ml of saline.

The Product Change: Irrisept CHG Irrigant

- A wound debridement and cleansing system that contains 0.05% Chlorhexidine Gluconate (CHG) in sterile water for irrigation
- Mechanism of action:
 - Mechanical action removes bacteria and debris without harming underlying tissues.
 - Bottle design allows users to control the delivery pressure of the solution through manual bottle compression. Grasping the bottle firmly, the user can control the direction and pressure needed to help remove bacteria, particulate and debris.
- Irrisept has successfully completed testing for acute systemic toxicity, cytotoxicity, neurotoxicity, skin irritation and immune allergic response.

Implications for Perioperative Nursing:

- Replaces the use of antimicrobial irrigations, such as cefazolin, vancomycin, bacitracin and polymixin.
- Facilitates compliance with hospital antimicrobial stewardship
- Pre-packaged design is more efficient for preparation and dispensing to field
- Pharmacy no longer mixing irrigations
- Since CHG is a biocide and can efficiently attach to tissues it creates a residual antibacterial effect that can last for many days in the tissues.



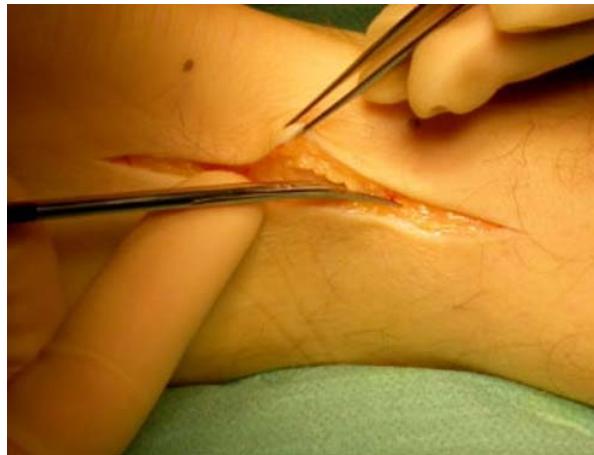
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Barnie S, Spencer M, et al. Surgical wound irrigation: A call for evidence-based standardization of practice. American Journal of Infection Control 42 (2014) S25-S9

A Case Report. Surgical Infection Case Reports 2016
 Fry D. Topical Antimicrobials and the Open Surgical Wound. SURGICAL INFECTIONS Volume 17, Number 5, 2016
 Moyer H, Minter J. Salvage of an Infected Below-Knee Amputation with Chlorhexidine and Bi-Layer Dermal Matrix.

#7 Skin Adhesive – Care of the Incision



Challenges in the Post-op Incisions

- Incision collects fluid – serum, blood - growth medium for organisms – small dehiscence
- Spine fusions -incisions close to the buttocks or neck
- Body fluid contamination from bedpans/commodes
- Heavy perspiration common with obese patients
- Friction and sliding - skin tears and blisters
- Itchy skin - due to pain medications - skin breakdown



Cesarean Delivery: Sutures vs Staples



- Prospective, randomized study of 435 c-section patients¹
 - 197 patients: staples
 - 219 patients: 4-0 MONOCRYL™ (poliglecaprone 25) Suture on PS2 needle
 - Wound separation rate: 17% (staples) vs. 5 % (sutures)
 - Wound complication rate: 22% (staples) vs. 9% (sutures)
 - **Staple closure was a significant independent risk factor for wound separation** after adjustment for all other factors (GDM, BMI >30, incision type, etc)
- Meta-analysis of 6 studies with a total of 1487 c-section patients²
 - 803 patients: staples
 - 684 patients: subcuticular suture closure
 - Staple closure was associated with a **two-fold increase in risk of wound infection or separation**

1. Bash et al. *Am J Obstet Gynecol*. 2010;203:285.e1.

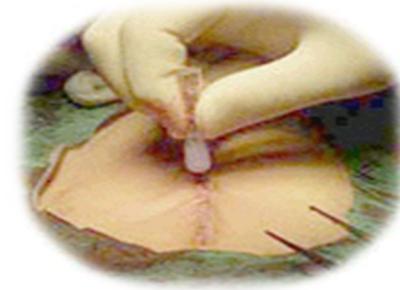
2. Tuuli et al. *Obset Gynecol*. 2011;117:682.

Sutures versus staples for skin closure in orthopaedic surgery: meta-analysis

Toby O Smith, research physiotherapist in orthopaedics, honorary lecturer Debbie Sexton, senior orthopaedic physiotherapist Charles Mann, consultant orthopaedic surgeon Simon Donell, consultant orthopaedic surgeon, honorary professor in musculoskeletal disorders

Conclusions After orthopaedic surgery, there is a significantly higher risk of developing a wound infection when the wound is closed with staples rather than sutures. This risk is specifically greater in patients who undergo hip surgery. The use of staples for closing hip or knee surgery wounds after orthopaedic procedures cannot be recommended, though the evidence comes from studies with substantial methodological limitations. Though we advise orthopaedic surgeons to reconsider their use of staples for wound closure, definitive randomised trials are still needed to assess this research question.

Consider Topical Skin Adhesive



- Wounds are most vulnerable to infection in the **first 48-72 hours¹**
- Until the epithelial barrier is complete (usually within 48 hours) wounds are solely dependent on the wound closure device to maintain integrity¹
- The extent of microbial protection depends on barrier integrity¹
- Effective barriers must maintain their integrity for the first 48 hours
- Incisional adhesive provides a **strong microbial barrier** that prevents bacteria from entering the incision site²

1. Fine and Musto. Wound healing. In: Mulholland et al. Greenfield's Surgery: Scientific Principles and Practice. 4th ed. 2005.
2. Bhende et al. Surg Infect (Larchmt). 2002;3:251-257.

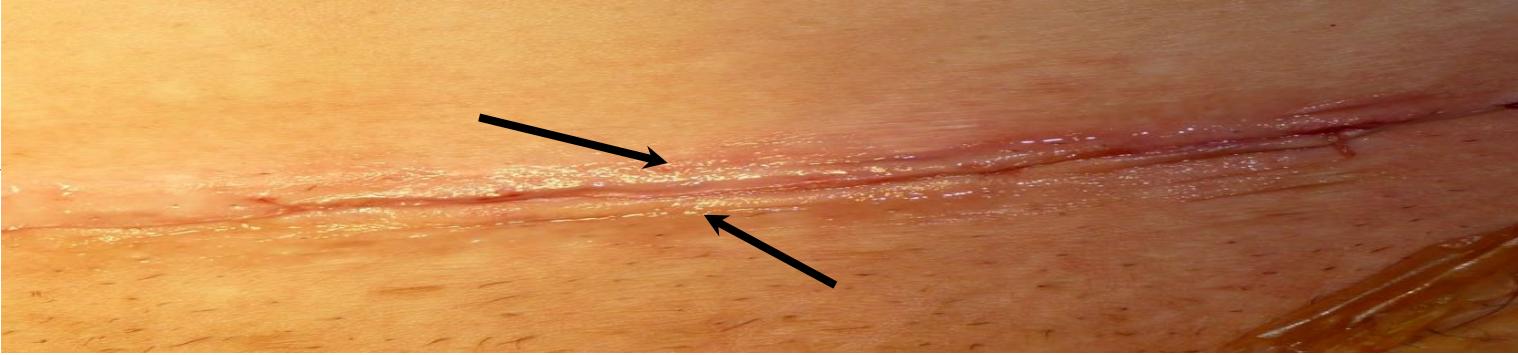
Topical Skin Adhesive: Risk Reduction

- **For Hospital Staff**
 - No time spent removing staples or sutures
 - Reduces number of suture set ups
 - Simplifies post-op wound checks
 - Reduces number of wound dressings
 - Can reduce staff suture exposures
- **For Patients**
 - **7 days of wound healing strength¹**
 - A microbial barrier with 99% effectiveness for 72 hours in vitro¹
 - Shower immediately
 - Outstanding cosmesis
 - Reduced follow-up
 - Less pain and anxiety

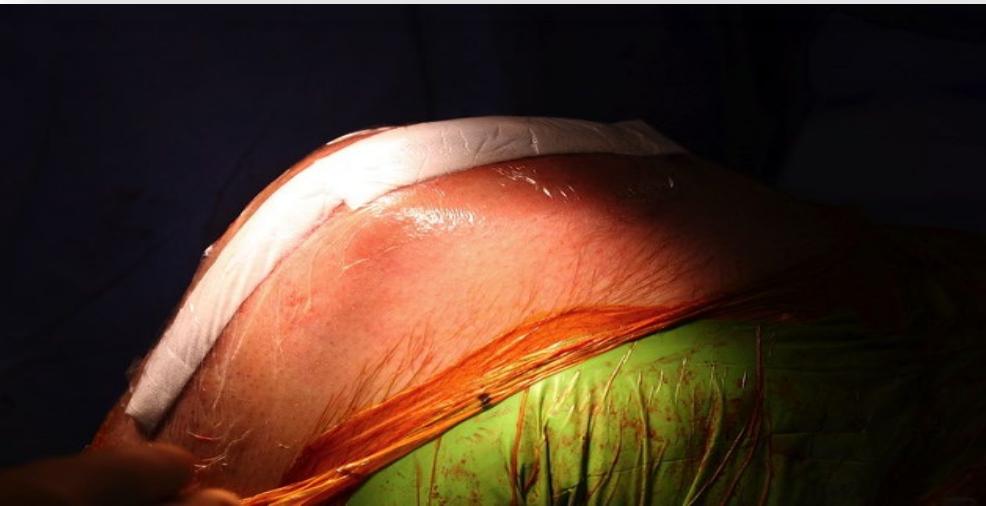


¹DERMABOND ADVANCED® Topical Skin Adhesive has been shown to seal out gram-positive, gram-negative, and drug-resistant (MRSA, MRSE) bacteria that may lead to infection. Bhende S, Rothenburger S, Spangler DJ, Dito M. In vitro assessment of microbial barrier properties of DERMABOND® Topical Skin Adhesive. Surg Infect (Larchmt). 2002;3:251-257.

C Section 6 Weeks Post-op and Beyond



Incisional Adhesive on Total Knee



Clinical Use of Incisional Adhesive in Total Joints



Hip: Sealed with adhesive covered with gauze and transparent dressing for incision protection

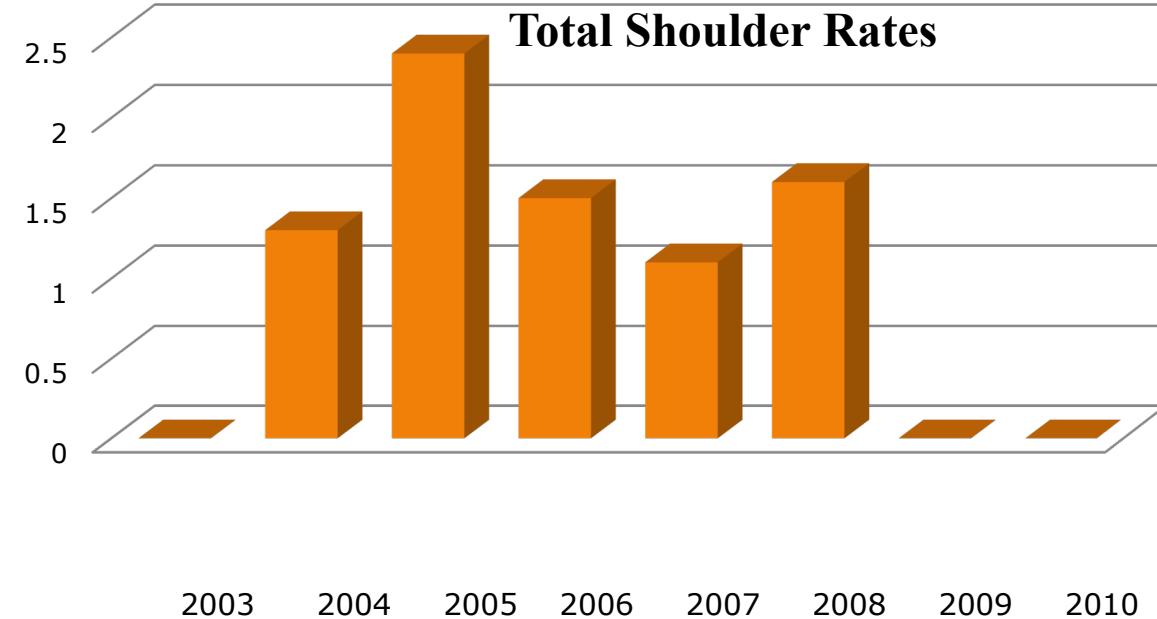
Knee: Sealed with incisional adhesive, covered with Telfa and a transparent dressing for incision protection



Healed incision



Incisional Adhesive and Total Shoulder Replacements



- Propionibacterium acnes related total shoulder infections (TSR)
- Eliminated the use of **staples** for TSR
- Instituted the use of incisional adhesive
- Covered dressing until day of discharge for protection

Which Would You Prefer???



Topical Incisional Adhesive (TSA)
Octyl Cyanoacrylate



Prineo Skin Closure System

Other Options To Consider when adhesives are contraindicated

Antimicrobial (PHMB) Dressings with Hypoallergenic Fabric Tape



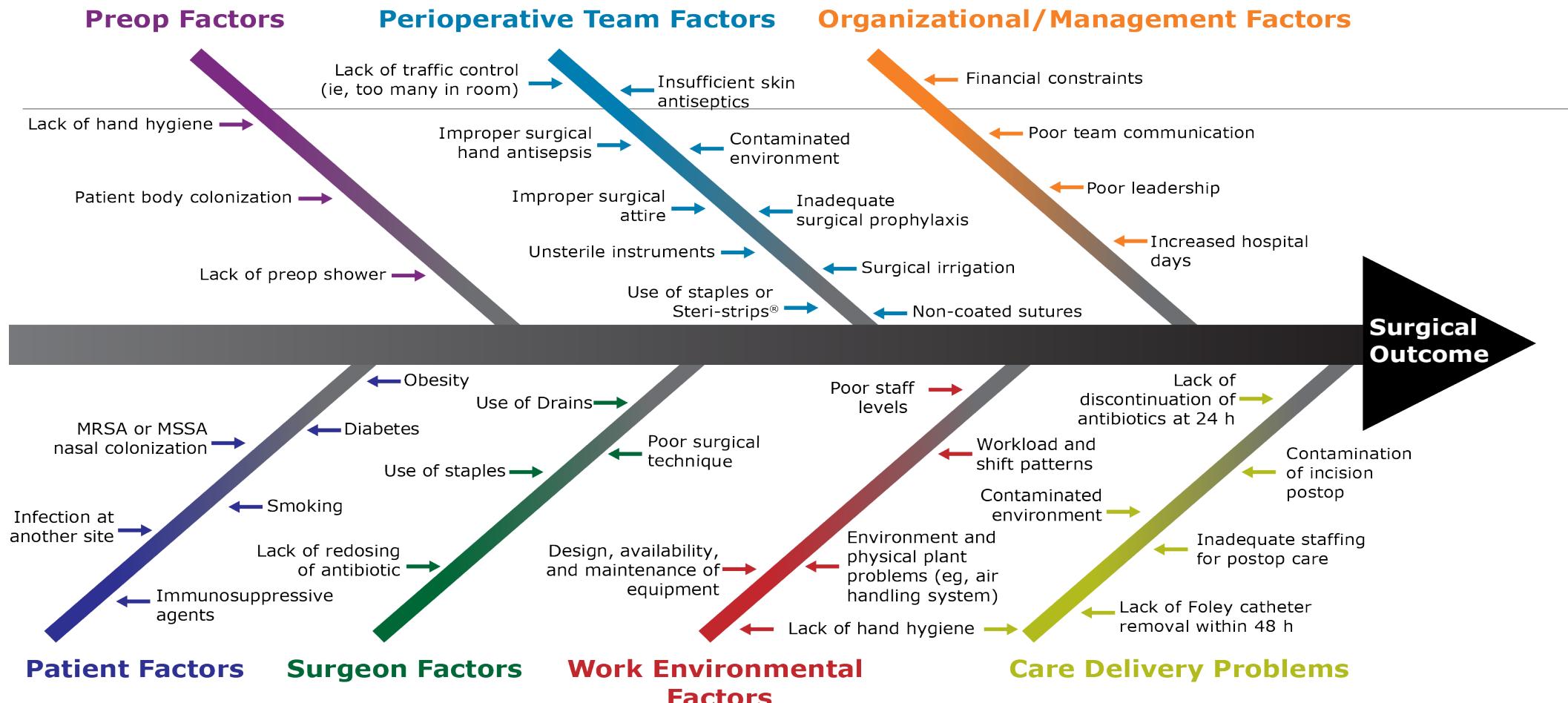
Antimicrobial Silver Dressings



Silver dressing and transparent dressing left on until discharge or up to 7 days postop – seals the incision from exogenous contaminants

In Conclusion.....

Many Risk Factors Influence SSI – Fishbone Diagram



One thing could lead to the failure

Establish a Multidisciplinary Team



The team representatives

OR nursing, CSS, Surgeons & Anesthesia, Managers from
infection control, healthcare quality, facilities and environmental services

Evaluate

Procedures and Practices

Facility design and Environment of Care Issues

Patient Risk Factors

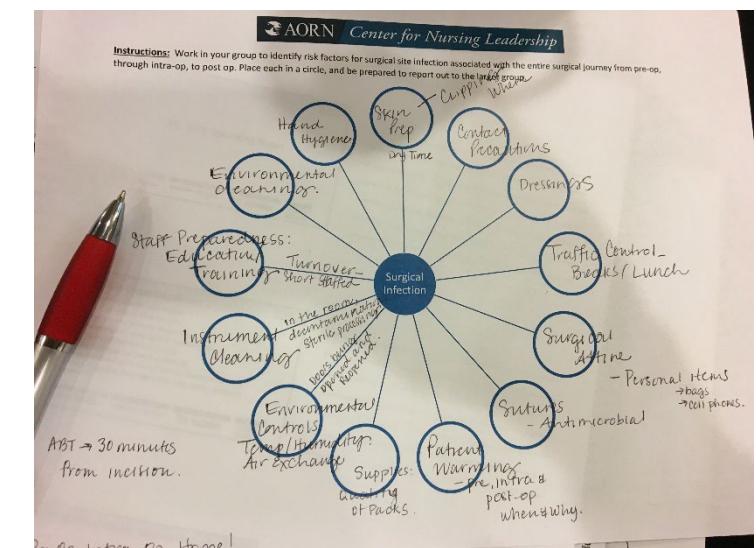
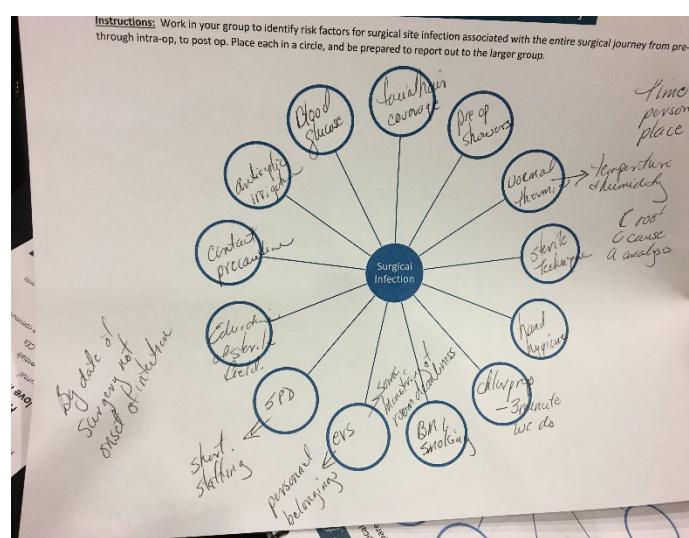
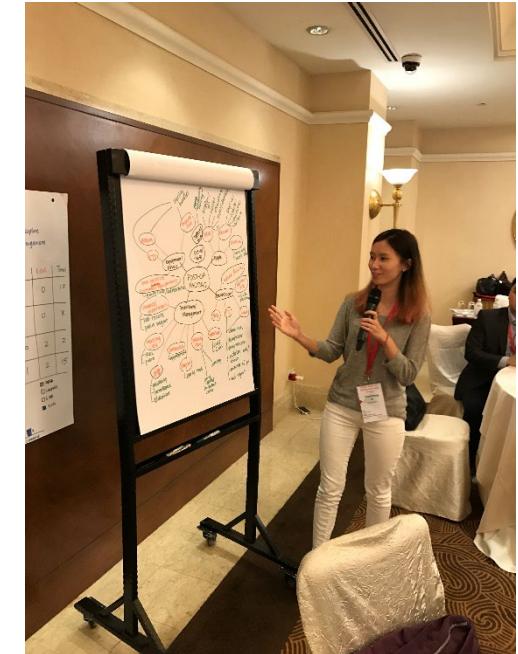
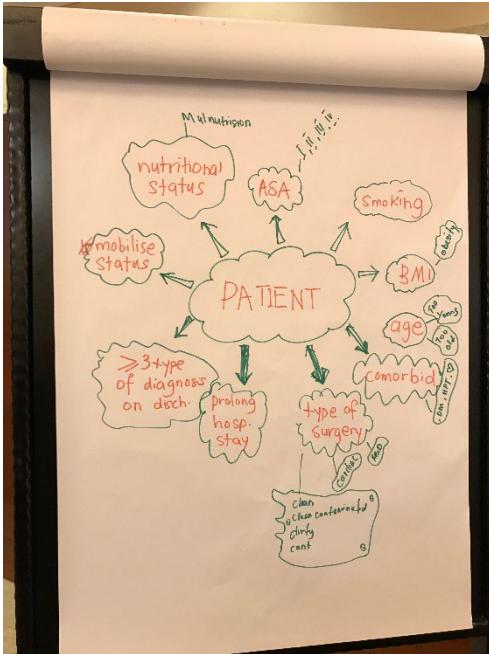
Infection Rates

Innovative Infection Prevention Products and Practices

“Zero Harm” Teams – Patient Safety Council

- Senior leadership and surgeons – must be involved and lead the effort
- Structured program with clearly defined goal of zero tolerance for HAIs
- Communication – effective and consistent
- Ongoing and creative education
- Financial support to Infection Prevention program
- Use process improvement tools (fishbone, pareto, mind-mapping) to engage key stakeholders and staff





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Thank you
