# Best Products for Skin Antisepsis

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# Antiseptic Topics for Discussion

- **Preoperative bathing**
- **Surgical site preparation**
- **Surgical hand scrubs**
- **Daily CGH bathing in ICU**
- **Prevention of Infection during intravascular access**

# Preoperative Bathing

- **Meta-analysis of bathing or showering with any antiseptic preparation vs non-antiseptic preparation, and impact on surgical site infection (SSI)**
  - **No clear benefit of bathing or showering with chlorhexidine (CHG) preoperatively**
  - **Note: studies using 2% CHG-impregnated cloths were not included**

- **CDC Guideline for prevention of surgical site infections**
  - **Randomized controlled trial evidence suggested uncertain trade-offs between the benefits and harms regarding the optimal timing of the preoperative shower or bath, the total number of soap or antiseptic agent applications, or the use of chlorhexidine gluconate washcloths for the prevention of SSI. (No recommendation/unresolved issue)**

- **Meta-analysis of 8 RCTs conducted from 1983-2009**
  - **Comparisons of 4% CHG vs soap, or 4% CHG vs soap vs placebo**
  - **Studies varied in timing, number of baths and rinses, amount of product used**
  - **No study reported amount of time skin was exposed to CHG**
  - **Conclusion: No significant differences in SSI rates between 4% CHG and soap or placebo**

**Webster J et al. Cochrane Database 2015:CD004985**
**CDC Guideline for Prevention of SSIs JAMA Surg 2017:152:784**
**de Castro Franco LM et al. Am J Infect Control 2017;45:343**

# Preoperative Bathing

- **Study included from 1-5 applications using 2% CHG-impregnated cloths with measurement of skin concentrations of CHG and use of electronic reminders**
  - **2 or more applications resulted in skin concentrations well above the CHG MIC of *S. aureus***
  - **Volunteers receiving electronic reminders had the highest CHG concentration on skin**

- **Edmiston et al. conducted prospective study of standardized methods of showering with 4% CHG, with skin concentrations of CHG after showering as outcome**
  - **Variables included volume of CHG used, number of showers, and timing before rinsing**
- **Results: Use of 118 ml of 4% CHG per shower, a minimum of 2 sequential showers, and a 1-min pause before rinsing resulted in maximal skin concentrations of CHG**
  - **Lack of data on achievable levels of patient compliance and impact on SSIs suggests the need for a practical trial of showering with 4% CHG with SSIs as outcome**

- **Compliance with instruction is a problem with both 2% CHG–impregnated cloths and 4% CHG**

Edmiston CE et al. Infect Control Hosp Epidemiol 2016;37:254
Edmiston CE et al. JAMA Surg 2015;150:1027
Alawadi ZM et al. JAMA Surg 2015;150:1003
Supple L et al. Infect Control Hosp Epidemiol 2015;36:1095

# Preoperative Bathing

- **2 non-randomized series of patients undergoing total hip or knee replacement compared periprosthetic infections following 2 preadmission protocols**
  - **2% CHG-impregnated cloths night before & morning of admission, with instructions**
  - **Standard soap & water bathing night before admission, with instructions**
- **Results:**
  - **After total hip replacement, infection rate was lower with CHG (0.6%) than with control protocol (1.6%) (p = 0.03)**
  - **Infection rates stratified by risk category were not significantly different**
  - **After total knee replacement, infection rate was lower with CHG (0.3%) than with control protocol (1.9%) (p = .002)**
  - **Infection rate was significantly lower in medium-risk category, but not in low & high risk pts**
- **Randomized controlled trial of patients undergoing total hip or knee replacement compared the same 2 preadmission protocols**
- **Results:**
  - **Infection rate was significantly lower with CHG than with standard protocol (p = 0.049)**

**Kapadian BH et al. Clin Orthop Relat Res 2016;474:1583**
**Kapadian BH et al. Clin Orthop Relat Res 2016;474:1592**
**Kapadian BH et al. J Arthroplasty 2016;31:2856**

# Surgical Site Preparation

- **WHO Guideline on Prevention of Surgical Site Infection**
  - Recommends alcohol-based antiseptic solutions based on CHG for surgical site skin preparation in patients undergoing surgical procedures
  - Concern regarding 6 studies on which recommendation was based

- **CDC 2017 Guideline for Prevention of Surgical Site Infections**
  - Use alcohol-based antiseptic for skin preparation unless contraindicated (Category IA)

- **SHEA/IDSA 2014 Practice Recommendations**
  - Use alcohol-containing preoperative skin preparatory agents if no contraindication exists

WHO SSI Prevention Guideline http://www.who.int/gpsc/ssi-prevention-guidelines/en/
Maiwald M Obstet Gynecol 2017;129:750
CDC Guideline for Prevention of SSIs JAMA Surg 2017:152:784
Assadian O et al. J Hosp Infect 2016;94:399
SHEA/IDSA Practice Recommendation on Prevention of SSIs Infect Control Hosp Epidemiol 2014;35:605

# Surgical Site Preparation

- **Randomized controlled trial of surgical site prep solutions for C section surgery**
  - Study with 932 patients compared alc. CHG with aqueous PVI paint & scrub
  - SSI rates: alc. CHG – 6.3%  PVI – 7%  (p = 0.38)

  - Study involving 1147 patients compared alc. CHG vs alc. povidone-iodine (PVI)
  - SSI rates:  alc. CHG – 4%  alc. PVI – 7.3% (p = 0.02)

  - Study with 1404 patients compared alc. CHG vs alc. PVI vs sequential use of both
  - SSI rates:  alc. CHG – 4.5%  alc. PVI – 4.6%  alc. PVI -> alc. CHG – 3.9%  (p = 0.8)

- **Retrospective study of 4259 patients undergoing abdominal hysterectomy**
  - Alc. CHG compared with PVI using multivariate analysis & propensity score matching
  - SSI rates were 35% to 44% lower with alc. CHG than with PVI

Springel EH et al.  Am J Obstet Gynecol 2017;217:463e1
Tuuli GM et al.  N Engl J Med 2016;374:647
Ngai IM et al.  Obstet Gynecol 2015;126:1251
Uppal S et al.  Obstet Gynecol 2017;130:319

# Surgical Site Preparation – Sequential Protocols

- **Davies BM et al. conducted a systematic review and meta-analysis**
  - **A total of 18 trials were reviewed**
  - **One trial (Ngai et al.) assessed SSIs as outcome after C section**
    - **Overall, PVI followed by CHG was not better than alc. CHG or alc. PVI**
    - **In subgroup of obese patients, PIV + CHG yielded significantly lower SSI rate**
  - **3 trials assessed impact of sequential applications on skin decolonization**
    - **CHG followed by PVI yielded 90% reduction in skin colonization**
    - **CHG alone reduced skin colonization by 65%**
    - **PVI alone reduced skin colonization by 47%**
- **Randomized controlled trial with 600 total joint arthroplasty patients**
  - **Group 1: alcohol followed by PVI before application of drapes**
  - **Group 2: alcohol followed by PVI before draping, then alc. PVI before final adhesive drape**
  - **Rate of superficial (but not deep/organ space) SSIs was significantly lower with 2nd application**

**Davies BM et al. Surg J 2016;2:e70**
**Ngai IM et al. Obstet Gynecol 2015;126:1251**
**Morrison TN et al. J Arthroplasty 2016;98:405**

# Surgical Hand Antisepsis

- **Systematic review and meta-analysis of surgical hand antisepsis found 4 studies that compared protocols and reported SSI rates**
  - **Soap & water vs alcohol rub with H2O2**
  - **Alcohol vs aqueous CHG or PVI**
  - **Alcohol hand rub with 1% CHG vs aqueous CHG**
  - **Alcohol hand rub formulation vs aqueous CHG or PVI**
- **None of the studies found a significant difference in SSI rates between products**

- **SHEA/IDSA 2014 Practice Recommendation**
  - **Use appropriate antiseptic agent to perform preoperative surgical scrub**

- **CDC 2017 Guideline to Prevent Surgical Site Infections**
  - **Perform surgical hand/forearm antisepsis according to manufacturer's recommendations**
  - **Surgical hand antisepsis using either an antimicrobial soap or an alcohol-based hand rub with persistent activity is recommended before donning sterile gloves**

**Tanner J et al. Cochrane Database 2016;CD0044288**
**SHEA/IDSA Practice Recommendation on Prevention of SSIs Infect Control Hosp Epidemiol 2014;35:605**
**CDC Guideline for Prevention of SSIs JAMA Surg 2017:152:784**

# Surgical Hand Antisepsis

- **WHO 2016 Guideline for Prevention of Surgical Site Infections**
  - **Surgical hand preparation should be performed either by scrubbing with a suitable antimicrobial soap and water or using a suitable ABHR before donning sterile gloves**
  - **The guideline did not make any recommendations about specific products with or without a sustained effect**
    - **Lack of evidence that sustained effect of products impacts surgical site infection rates**

- ***In vivo* comparison of 4 surgical hand antisepsis products**
  - **4% CHG rinse-off liquid**
  - **Alcohol + CHG rub (61% ethanol + 1% CHG leave-on gel)**
  - **Alcohol rub A (70% ethanol hand rub leave-on gel)**
  - **Alcohol rub B (80% ethanol hand rub leave-on liquid)**
- **On day 5, only alcohol A met FDA requirement for 3-log reduction immed. after use**
- **Alcohol rub A and alcohol + CHG were not significantly different at any time point**
- **Product formulation has the greatest effect on efficacy of surgical scrub products**

**WHO SSI Prevention Guideline** http://www.who.int/gpsc/ssi-prevention-guidelines/en/
**Macinga DR et al. AORN J 2014;100;641**

# Surgical Hand Antisepsis

- **Comparison of two surgical hand antisepsis preparations using EN-12791 method in randomized cross-over study of volunteers**
  - **Product A: Alcohol-only containing ethanol and n-propanol + emollients**
  - **Product B: 61% Ethanol + 1% CHG**

- **Product A (without CHG) achieved greater log reductions of bacteria on hands than Product B (with CHG) immediately and at 6 hrs after use**

- **Review of surgical hand antisepsis and SSIs suggested**
  - **SSI and bacterial reduction studies support the equivalency or superiority of alcohol-based rubs over CHG**
  - **Demonstration of a cumulative effect is not required for a surgical hand antiseptic**
    - **CHG is often cited as having a cumulative effect**

**Hennig T-J et al. Antimocrob Resist Infect Control 2017;6:96**
**Oriel BS et al. Surgical Infect 2016;17:632**

# Daily CGH Bathing in ICU

- **4 systematic reviews and/or meta-analyses have discussed the impact of daily CHG bathing of patients in intensive care units (ICUs)**
  - **Reviews included cluster-randomized crossover trials and before/after studies**
  - **All 4 reviews concluded that CHG bathing reduced one or more types of healthcare-associated infections and/or transmission of pathogens**
  - **Infections most commonly reduced were central line-associated bloodstream infections (CLABSIs), often due to MRSA**
- **Compliance with bathing policies may affect their impact on HAIs**


O'Horo JC et al. Infect Control Hosp Epidemiol 2012;33:257
Frost SA et al. Crit Care 2016;20:379
Afonso E et al. Euro Surveill 2016;21:30400
Huang H-P et al. Korean J Intern Med 2016;31:1159
Hines AG et al. Infect Control Hosp Epidemiol 2015;36:993
Musuuza JS et al. BMC Infect Dis 2017;17:75

# Daily CGH Bathing in Non-ICU Units

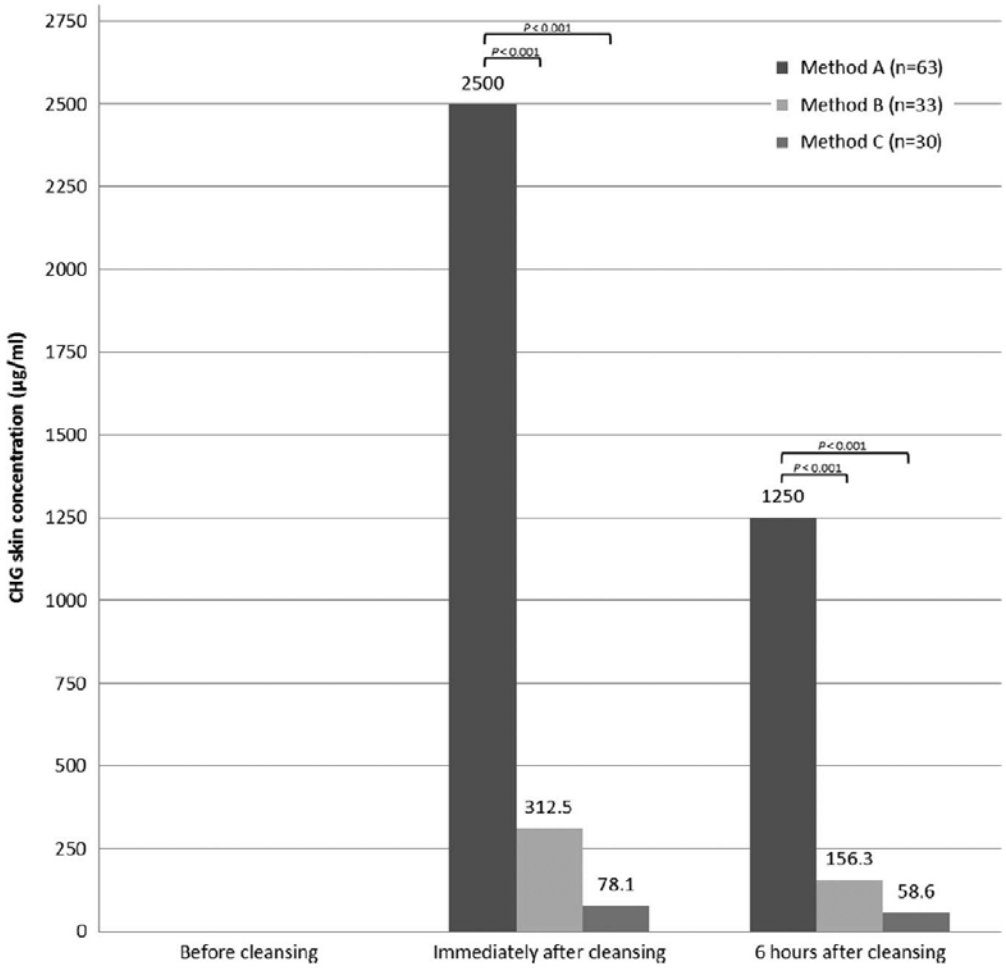
- **2-arm cluster-randomized (ABATE) trial involving 194 noncritical care units in 53 hospitals was conducted with 1 yr baseline and 21-month intervention period**
  - **All noncritical care units in a hospital were assigned to the same strategy**
  - **Routine bathing products and frequency**
  - **Daily bathing with 2% CHG impregnated cloth or showering with 4% rinse-off CHG**
  - **Universal ICU decolonization was in place in all facilities**
  - **Primary outcome: MRSA and VRE isolates; secondary outcome: all-cause bloodstream infections**
- **Results:**
  - **No significant difference in primary or secondary outcomes between 2 arms of the study**
  - **Further analysis of high-risk groups is warranted**

- **Prospective crossover study on 4 medical inpatient units**
  - **2% CHG-impregnated cloths vs non-antimicrobial soap & water basin bathing**
  - **Hospital-acquired colonization and infections by MRSA and VRE were significantly reduced**

**Huang SS et al. Open Forum Infect Dis 2017**
**Lowe CF et al. Am J Infect Control 2017;45:255**

# Comparison of 3 Methods of Applying CHG to Skin

- **Prospective, randomized 2-center study with blinded assessment**
- **3 study methods of application to forearms**
  - **A) 2% CHG-impregnated cloths**
  - **B) 4% liquid CHG applied with cellulose/polyester cloth**
  - **C) 4% liquid CHG applied with cotton washcloth**
    - **4% liquid CHG was rinsed after applications**
- **Results**
  - **2% CHG impregnated cloths yielded greatest concentrations of CHG on skin at zero and 6 hrs**
  - **Lowest density of bacteria on skin**
- **Authors concluded that the impact of the findings on clinical outcomes has not yet been established**




Rhee Y et al. Infect Control Hosp Epidemiol 2018;39:405

# Prevention of Infection During Intravascular Access

- **IDSA 2011 Guideline for Prevention of Intravascular Catheter-Related Infections**
  - Prepare clean skin with an antiseptic (70% alcohol, tincture of iodine, an iodophor or chlorhexidine gluconate) before peripheral venous catheter insertion
  - Prepare clean skin with a > 0.5% chlorhexidine preparation with alcohol before central venous catheter and peripheral arterial catheter insertion and during dressing changes. If there is a contraindication to chlorhexidine, tincture of iodine, an iodophor, or 70% alcohol can be used

- **SHEA/IDSA 2014 Practice Recommendation**
  - Use an alcoholic chlorhexidine antiseptic for skin preparation

- **Randomized controlled trial in 11 ICUs involving 2349 patients requiring at least one central catheter, hemodialysis catheter or arterial catheter**
  - Skin antisepsis: alc. CHG vs alc. PVI
  - Results: alc. CHG was associated with lower rate of catheter-related infections (p = .0002)

Mimoz O et al. Lancet 2015;386:2069

# Prevention of Infection During Intravascular Access-Dressings

- **SHEA/IDSA 2014 Practice Recommendation**
  - Use a CHG-containing dressing for central venous catheters in patients greater than 2 months old
- **Meta-analysis of intravascular catheter dressings**
  - There is high-quality evidence that use of CHG-impregnated dressings results in fewer catheter-related infections when compared to all other dressings types
- **2 prospective controlled studies in hemodialysis patients**
  - CHG-impregnated dressings resulted in fewer catheter-related infections
- **Randomized trial in 304 preterm infants of antiseptics for central line insertion**
  - Alc. CHG was compared with PVI
  - No significant difference in incidence of catheter-related infection
  - No CHG-related adverse skin reactions noted
- **Additional studies of the use of CHG dressings in neonates are needed**

SHEA/IDSA 2014 Practice Recommendation Infect Control Hosp Epidemiol 2014;35:753
Ullman AJ et al. Cochrane Database 2015;:CD010367
Rigetti M et al. J Vasc Access 2016;17:417
Apata IW J Vasc Access 2017;18:103
Kieran EA, et al. Arch Dis Child Fetal Neonatal Ed 2018;103:F101–F106

# Summary

- **Preoperative bathing**
  - Hospitals currently recommending preoperative showering with 4% CHG or use of CHG-impregnated cloths should provide patients with clear instructions and monitor compliance
  - A large randomized controlled trial is needed to compare the impact on SSI rates
    - **Showering with soap & water or with 4% CHG liquid soap, or use of 2% CHG-impregnated cloths**

- **Surgical site prep**
  - Use an alcohol-containing solution for surgical site prep
  - It is not clear if alcoholic CHG is more effective than alcoholic PVI
  - Additional research on use of sequential prep protocols (CHG + PVI) appears warranted

- **Surgical hand scrubs**
  - Perform surgical hand antisepsis using either an antimicrobial soap or an alcohol-based hand rub
  - Evidence suggests that persistent activity is not necessary

# Summary

- **Daily CHG bathing in ICU**
  - Daily CHG bathing of patients in ICU is recommended
  - Use either 2% CHG-impregnated cloths or 4% CHG soap
  - CHG-impregnated cloths yield higher skin concentrations, but relative impact on HAIs is unclear
  - Randomized trial of 2% CHG-impregnated cloths vs standardized 4% CHG soap is warranted

- **Additional studies of daily CHG bathing in non-ICU patients are needed**

- **Prevention of infection during intravascular access**
  - Prepare clean skin with a > 0.5% chlorhexidine preparation with alcohol before central venous catheter and peripheral arterial catheter insertion and during dressing changes
  - Use CHG-containing dressing at insertion site