Surgical Wound Irrigation & The Importance of Sterile Solution

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Disclosures

Speaker is employed by Becton Dickinson, a medical device company

Disclaimers

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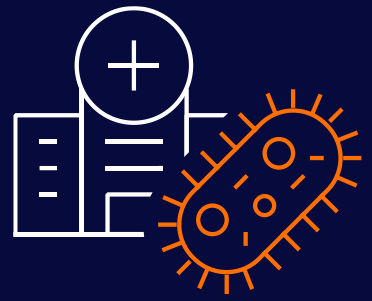
The Burden of SSIs

Can increase patient mortality by **up to 11x**[3]

Can increase a patient's post-operative hospital stay by **7–11 days**[3]

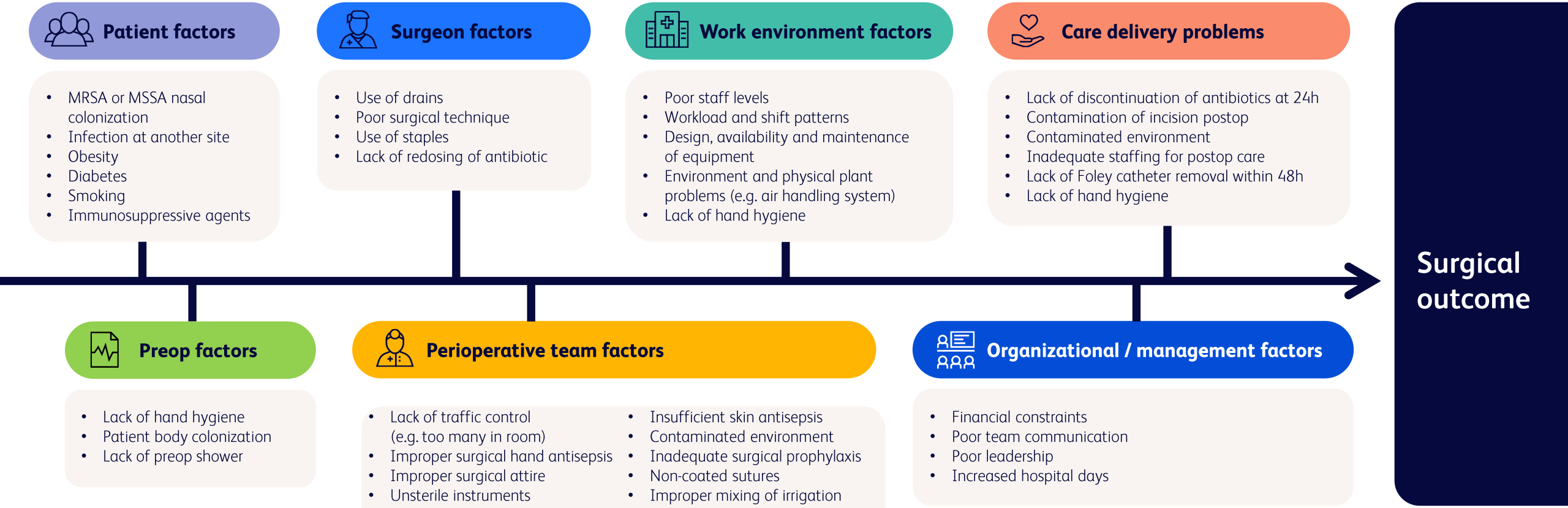


Account for **1 of 5 HAIs** globally[2]

Cost hospitals **U.S. $11,874–$34,670** per patient on average[1]

1. Scott RD. *2009 The Direct Medical Costs Of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention.* Centers for Disease Control and Prevention. Accessed in Jan, 2023, at https://www.cdc.gov/hai/pdfs/hai/scott_costpaper.pdf
2. Ban KA, Minei JP, Laronga C, et al. American College of Surgeons and Surgical Infection Society: Surgical Site Infection Guidelines, 2016 Update. *J Am Coll Surg.* 2017;224(1):59-74. doi:10.1016/j.jamcollsurg.2016.10.029
3. Anderson DJ, Podgorny K, Berríos-Torres SI, et al. Strategies to prevent surgical site infections in acute care hospitals: 2014 update. *Infect Control Hosp Epidemiol.* 2014;35(6):605-627. doi:10.1086/676022

The clinical challenge in the OR: multiple factors contribute to SSI/HOB risk[1]



One factor could lead to failure

- There are many different strategies that are required to **reduce SSI risk to the lowest extent possible**
- The **most successful method of implementation** to prevent SSIs is the use of **bundles**, i.e, addressing multiple risk factors simultaneously

Perioperative

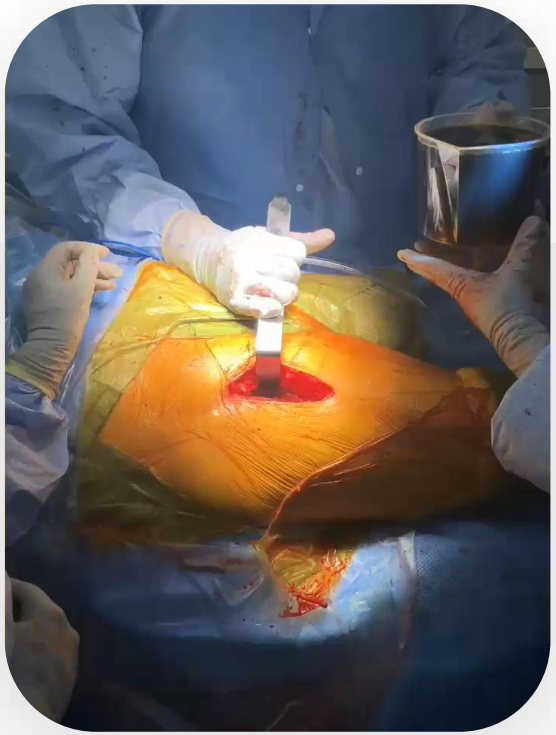
- The time period of a patient's procedure, from pre-op to post-op

- **1.** Adapted from Spencer M. Working Toward Zero Healthcare Associated Infections. http://www.workingtowardzero.com/uploads/4/6/4/2/ 4642325/aorn1929_going_forward_-_preventing_ssis__dec_2014.pdf.

Addressing the clinical challenge requires a holistic approach[1-3]

1. Berríos-Torres SI et al. *JAMA Surg.* 2017;152(8):784-791. **2.** World Health Organization. Accessed in September 2022 at https://apps.who.int/iris/handle/10665/277399.
3. Calderwood MS et al. *Infect Control Hosp Epidemiol.* 2023;44(5):695-720.

Why do we irrigate?



Use of liquids in a surgical field **to improve visualization and remove debris** from surgical field and deeper tissues[6]

Goals of irrigation[1,2]

- Remove debris (tissue, bone fragments, stool)
- Expose healthy tissue (debridement)
- Keep tissue moist
- Reduce microbial contamination
- **Reduce the risk of SSI**

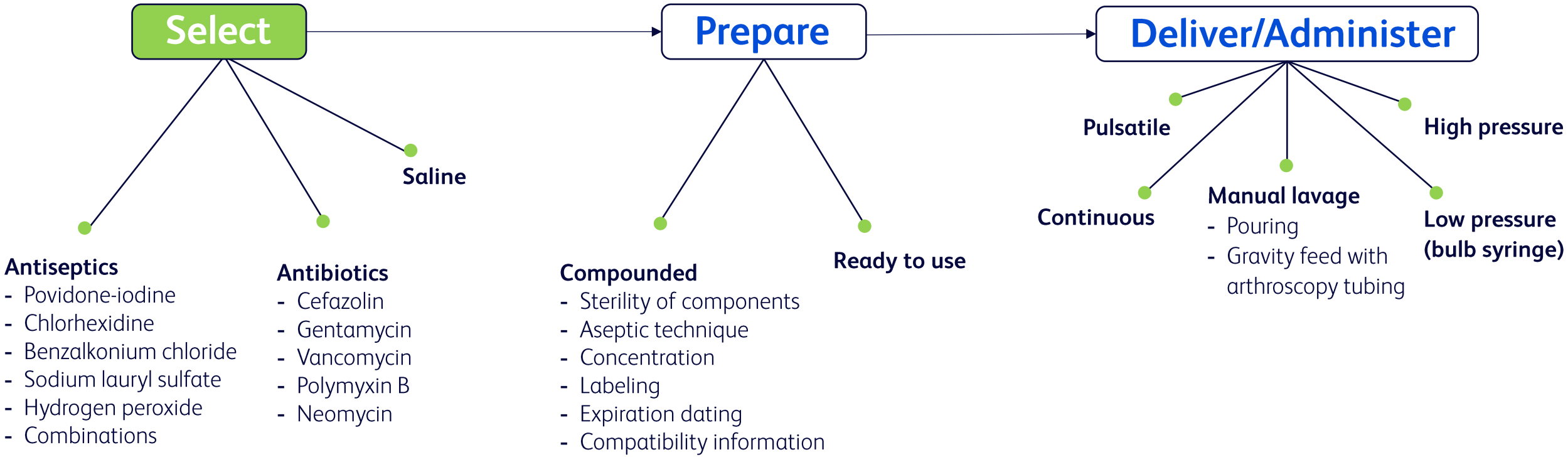
Common irrigation solutions

- Saline
- Antibiotic solutions (Bacitracin, Cefazolin, Gentamicin, Vancomycin)
- Antiseptics (dilute CHG, PVP-I, PHMB, H202, hypochlorous acid/sodium hypochlorite)
- Detergents (SLS, BZK)

CHG = chlorhexidine; PVP-I = povidone-iodine; PHMB = polyhexanide; SLS = sodium lauryl sulfate; BZK = benzalkonium chloride

1. Papadakis M. Wound irrigation for preventing surgical site infections. World J Methodol. 2021;11(4):222-227. Published 2021 Jul 20. doi: https://doi.org/10.5662/wjm.v11.i4.222;
2. Manna B, Nahirniak P, Morrison CA. Wound Debridement. In: StatPearls. Treasure Island (FL): StatPearls Publishing; September 19, 2022

Key Decision-Points in Surgical Wound Irrigation



Antiseptics
- Povidone-iodine
- Chlorhexidine
- Benzalkonium chloride
- Sodium lauryl sulfate
- Hydrogen peroxide
- Combinations

Antibiotics
- Cefazolin
- Gentamycin
- Vancomycin
- Polymyxin B
- Neomycin

Compounded
- Sterility of components
- Aseptic technique
- Concentration
- Labeling
- Expiration dating
- Compatibility information

Manual lavage
- Pouring
- Gravity feed with arthroscopy tubing

The solution you select for surgical wound irrigation is critical

Saline[1]

Antiseptic solution[1]

Antibiotic solution[1]

⚠ Not all wound irrigation options are created equal[1]

1. Centers for Disease Control and Prevention (CDC). Guideline for Hand Hygiene in Health-Care Settings. Morbidity and Mortality Weekly Report, October 2002, 51:RR–16.

Which antiseptic should I choose?

Wound irrigation guidelines

Guidelines	Recommendation
World Health Organization (WHO)[1]	• Insufficient evidence to recommend for or against saline • Suggests considering the use of aqueous PVP-I before closure to prevent SSI • Antibiotic irrigation should not be used for the purpose of preventing SSI
US Centers for Disease Control and Prevention (CDC)[2]	• Consider intraoperative irrigation with aqueous iodophor solution to prevent SSI
Society for Healthcare Epidemiology of America (SHEA) / Infectious Diseases Society of America (IDSA) / Association for Professionals in Infection Control and Epidemiology (APIC)[3]	• Irrigation is an “Essential Practice” • Recommend the use of dilute povidone-iodine lavage over saline lavage • Make sure that sterility is maintained during preparation and administration • Surgeons should educate themselves as to their options and to carefully weigh the risks and benefits of using povidone-iodine solutions given the dearth of “sterile” PVP-I
International Consensus Meeting (ICM)[4]	• There is ample evidence to support the World Health Organization’s (WHO) and Centers for Disease Control and Prevention’s (CDC) recommendations that advocate the use of dilute betadine for the irrigation of wounds during surgical procedures. • Super Majority, Strong Consensus
American Academy of Orthopedic Surgeons (AAOS)[5]	• Some evidence suggests that betadine is the optimal solution for reducing bacteria while maintaining healthy tissue • Before closure of the wound, irrigation with sterile dilute betadine (0.35%) has been shown to decrease risk of SSI in joint replacement and spine procedures with no adverse reported outcomes.

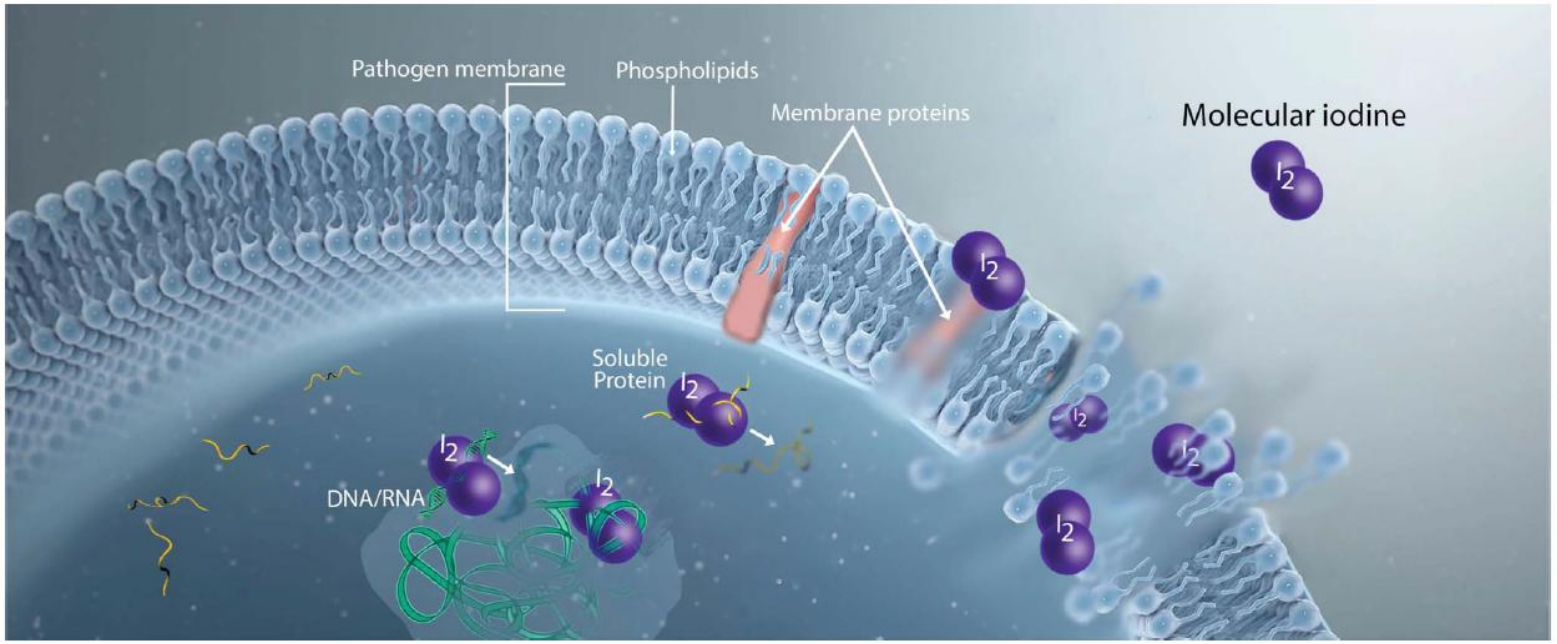
1. World Health Organization. 2018 Global guidelines for the prevention of surgical site infection. World Health Organization. Accessed Oct 25, 2023, at https://apps.who.int/iris/handle/10665/277399;
2. Berríos-Torres SI, Umscheid CA, Bratzler DW, et al. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017 [published correction appears in JAMA Surg. 2017 Aug 1;152(8):803]. JAMA Surg. 2017;152(8):784-791. doi:10.1001/jamasurg.2017.0904
3. Calderwood MS, Anderson DJ, Bratzler DW, et al. Strategies to prevent surgical site infections in acute-care hospitals: 2022 Update. Infect Control Hosp Epidemiol. 2023;44(5):695-720. doi: https://doi.org/10.1017/ice.2023.67
4. Parvizi J, Gehrke T. Proceedings of the Second International Consensus on Muskuloskeletal Infection. 2018; pp. 139-141 ISBN: 978-1-57400-157-0.
5. AAOS Toolkits / Intraoperative Irrigation. Accessed Oct 22, 2024, at https://www.aaos.org/quality/quality-programs/quality-toolkits/intraoperative-irrigation/.

Dilute Povidone-Iodine Irrigation: The Science of Molecular Iodine (I_2) Kinetics and Its Antimicrobial Activity

Meehan 2025

- PVP-I = PVP + I_2
- I_2 diffuses off the carrier and oxidizes fatty/amino acids, nucleotides, and cytosolic enzymes in the respiratory chain, causing them to become denatured and deactivated

Simultaneous attack against multiple molecular targets = no resistant organisms



- Broad spectrum activity: G+ and G-, fungi, protozoa, viruses and even some spores

Meehan, John P. 2025. "DILUTE POVIDONE-IODINE IRRIGATION: THE SCIENCE OF MOLECULAR IODINE (I2) KINETICS AND ITS ANTIMICROBIAL ACTIVITY." *Journal of the American Academy of Orthopedic Surgeons;* 33: 65-73.


Efficacy
Safety

Systematic Review and Meta-Analysis of Randomized Controlled Trials Evaluating Prophylactic Intra-Operative Wound Irrigation for the Prevention of Surgical Site Infections

de Jonge, *et al.* 2017

PVP-I vs Saline Irrigation

Systematic review & meta-analysis on infection outcomes from 7 RCTs with 941 out of 1897 patients receiving PVP-I irrigation ***(all subspecialties)***

Findings suggest irrigating with PVP-I solution before closure for the purpose of preventing SSI, particularly in clean and clean-contaminated wounds— ***50 fewer SSIs per 1000 procedures***

de Jonge SW, Boldingh QJJ, Solomkin JS, et al. Systematic Review and Meta-Analysis of Randomized Controlled Trials Evaluating Prophylactic Intra-Operative Wound Irrigation for the Prevention of Surgical Site Infections. *Surg Infect (Larchmt)*. 2017;18(4):508-519. doi:10.1089/sur.2016.272

Does intraoperative wound irrigation with diluted povidone-iodine prevent surgical site infection in spine surgery?

Mu, *et al.* 2024

Systematic review & meta-analysis on infection outcomes from 14 RCTs with 6777 total patients (comparing varying dilutions of PVP-I to primarily saline control)

IOWI with PVP-I resulted in lower rates of overall post-op SSI

✓*Decreased incidence of both deep & superficial infections.*

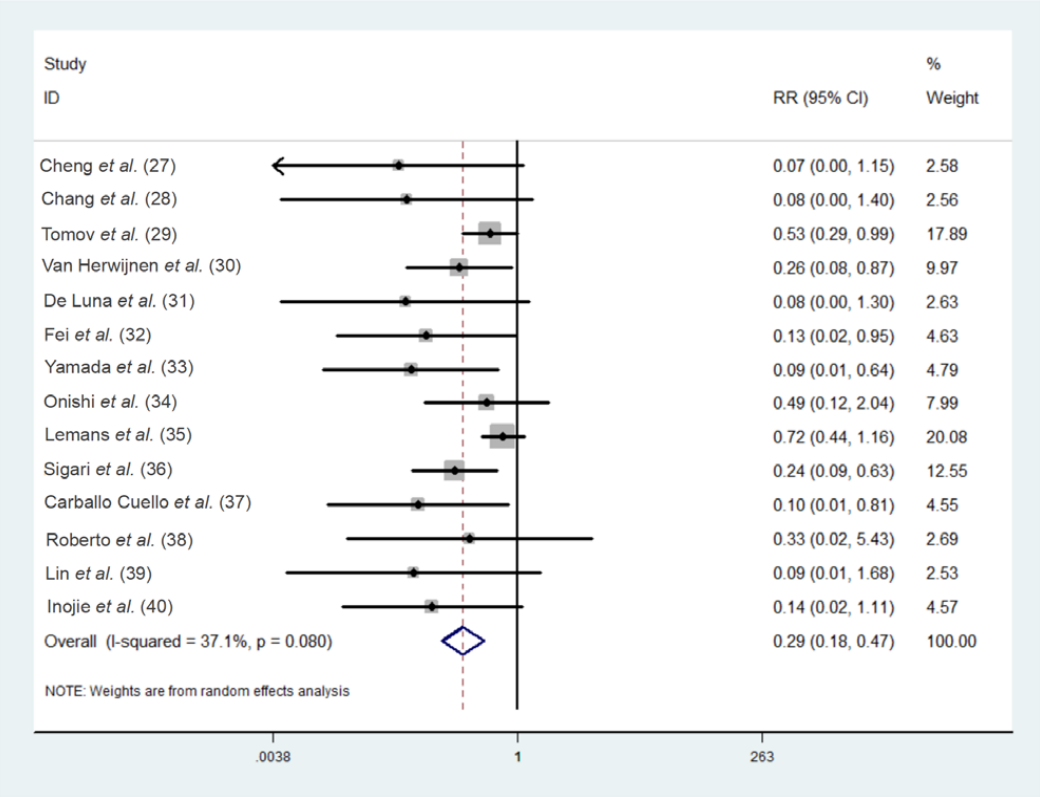


Figure 2

Forest plot of the meta-analytic estimate for the overall rate of postoperative SSI.

Mu X, Wei X, Li Z, Wei M, Wei J. Does intraoperative wound irrigation with diluted povidone-iodine prevent surgical site infection in spine surgery?. *EFORT Open Rev.* 2024;9(11):1087-1096. Published 2024 Nov 8. doi:10.1530/EOR-24-0091

Dilute Povidone-Iodine Irrigation Reduces the Rate of Periprosthetic Joint Infection Following Hip and Knee Arthroplasty: An Analysis of 31,331 Cases

Shohat, et al. 2022

- Retrospective study of all consecutive primary total knee & hip arthroplasties between 2009-2019 @ a single institution (Rothman Orthopaedic Institute at Thomas Jefferson University) 8659/31,331 receive PVP-I irrigation

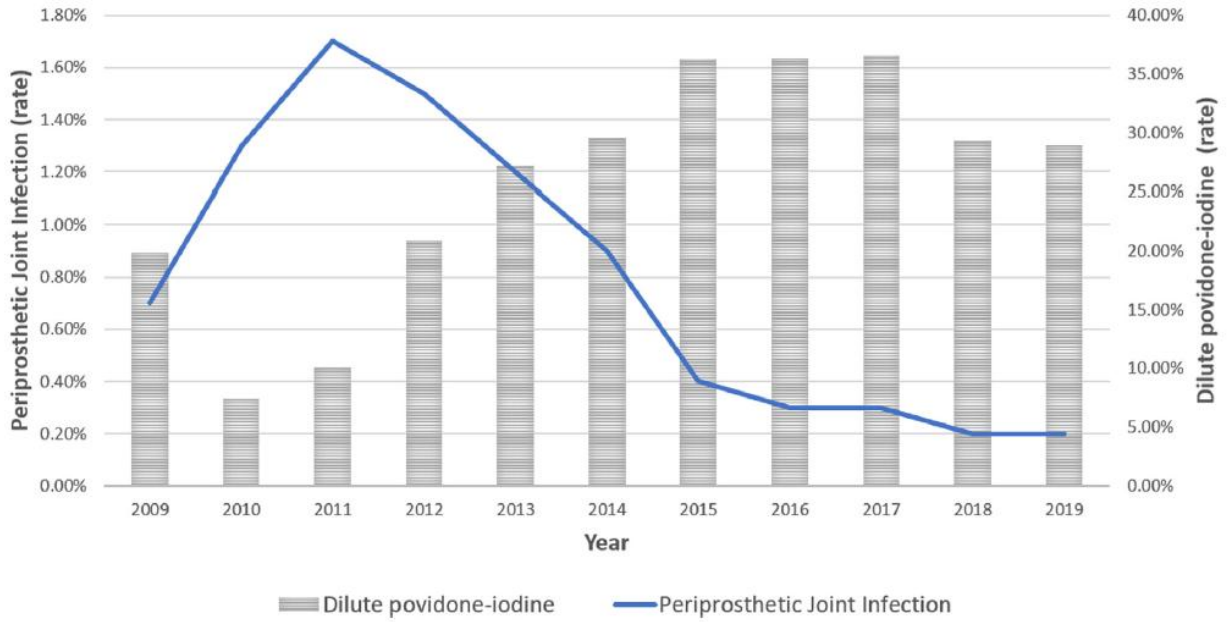


Fig. 1. Periprosthetic joint infection and dilute povidone-iodine irrigation rates throughout the study period.

PJI rates throughout the study period alongside the use of dilute povidone-iodine irrigation

Shohat N, Goh GS, Harrer SL, Brown S. Dilute Povidone-Iodine Irrigation Reduces the Rate of Periprosthetic Joint Infection Following Hip and Knee Arthroplasty: An Analysis of 31,331 Cases. *J Arthroplasty*. 2022;37(2):226-231.e1. doi:10.1016/j.arth.2021.10.026

Efficacy of common antiseptic solutions against clinically relevant microorganisms in biofilm

O'Donnell et al. 2021

Zimmer-sponsored study tested antiseptic irrigants against nascent (4-hour) and mature (3-day) single-species biofilm on titanium strips

Dilute PVP-I (0.35%)
Irrisept
Bactisure
Prontosan
Vashe

vs

MRSA
Staph epi
Pseudomonas
C. acnes

PVP-I was the most effective antiseptic to reduce immature biofilm

Both Bactisure and PVP-I performed very well against mature biofilms, Irrisept performed the worst

Table III. Four-hour nascent biofilm results after lavage exposure.

Test microorganism	Saline control average, CFU/ml	Post-treatment average, CFU/ml	Reduction compared to control, %	Reduction compared to control, %
Povidone-iodine¶				
Staphylococcus aureus (MRSA)	3.45E + 05	3.73E + 02	99.89	88.24
Staphylococcus epidermidis	5.19E + 05	6.53E + 03	98.74	85.50
Pseudomonas aeruginosa	4.69E + 06	3.52E + 05	92.51	71.88
Cutibacterium acnes	1.11E + 04	1.80E + 03	83.83	90.78
Irrisept*				
S. aureus (MRSA)	3.45E + 05	9.00E + 04	73.92	36.18
S. epidermidis	5.19E + 05	6.65E + 04	87.19	7.00
P. aeruginosa	4.69E + 06	4.65E + 05	90.09	59.76
C. acnes	1.11E + 04	3.02E + 03	72.84	86.35
Bactisure†				
S. aureus (MRSA)	3.45E + 05	4.23E + 04	87.73	79.85
S. epidermidis	5.19E + 05	4.59E + 03	99.12	99.04
P. aeruginosa	4.69E + 06	9.00E + 05	80.83	97.42
C. acnes	1.11E + 04	8.96E + 02	91.95	90.93
Prontosan‡				
S. aureus (MRSA)	3.45E + 05	1.05E + 05	69.53	40.15
S. epidermidis	5.19E + 05	8.36E + 04	83.90	88.81
P. aeruginosa	4.69E + 06	1.20E + 05	97.44	51.88
C. acnes	1.11E + 04	2.06E + 03	81.47	33.32
Vashe§				
S. aureus (MRSA)	3.45E + 05	5.30E + 04	84.64	46.18
S. epidermidis	5.19E + 05	8.54E + 03	98.35	71.63
P. aeruginosa	4.69E + 06	2.91E + 05	93.80	74.47
C. acnes	1.11E + 04	2.72E + 03	75.56	8.78

4-hr nascent biofilm

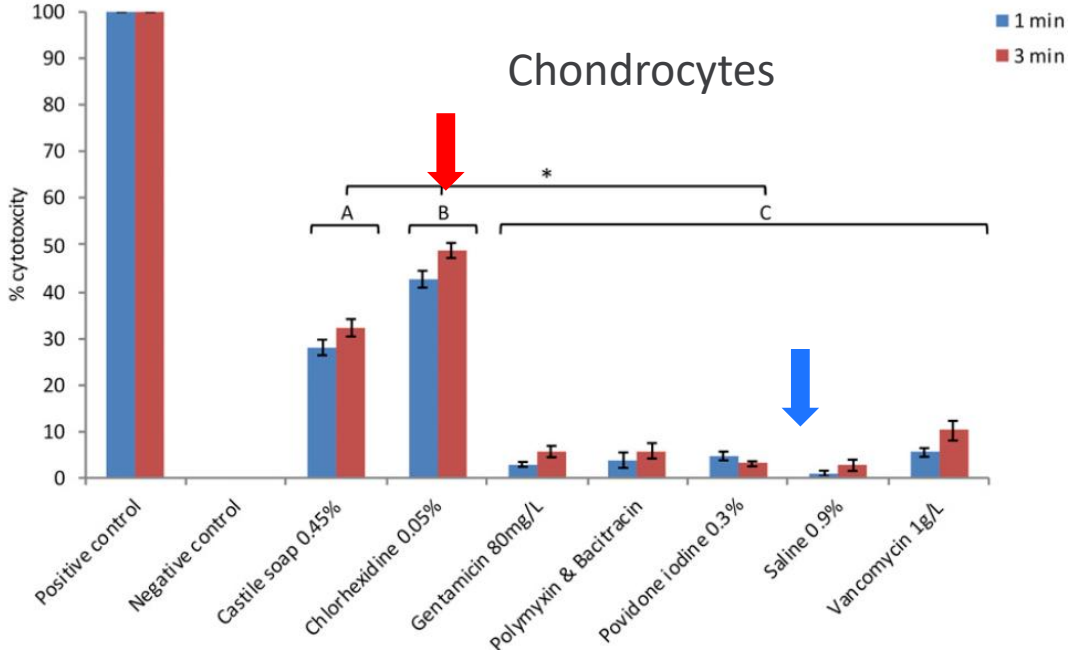
72-hr 'mature' biofilm results

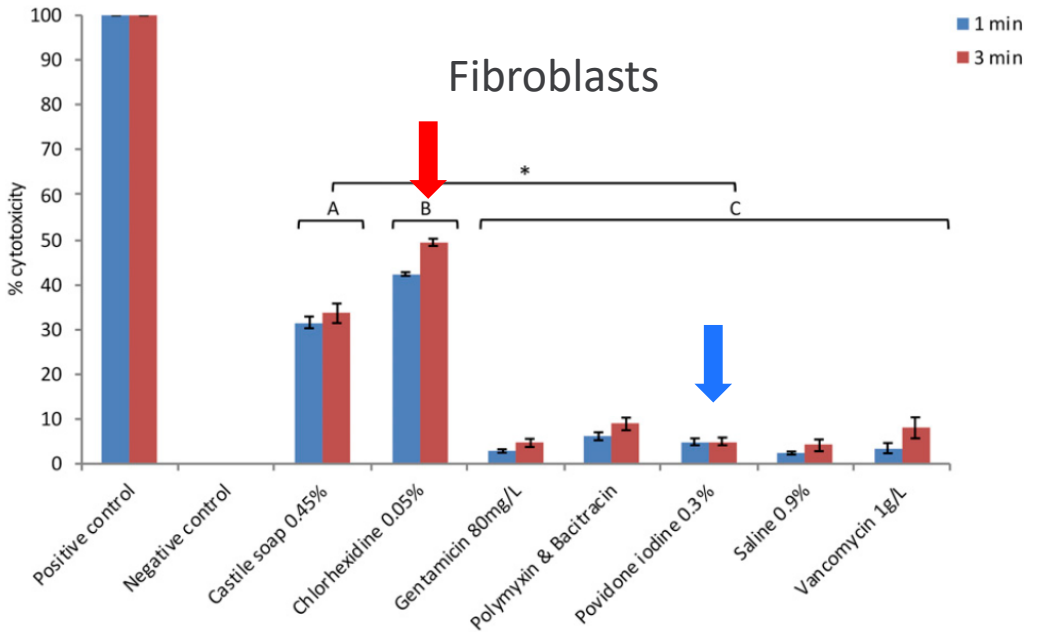
O'Donnell JA, Wu M, Cochrane NH, Belay E, Myntti MF, James GA, Ryan SP, Seyler TM. Efficacy of common antiseptic solutions against clinically relevant microorganisms in biofilm. Bone Joint J. 2021 May;103-B(5):908-915. doi: 10.1302/0301-620X.103B5.BJJ-2020-1245.R2. PMID: 33934664.

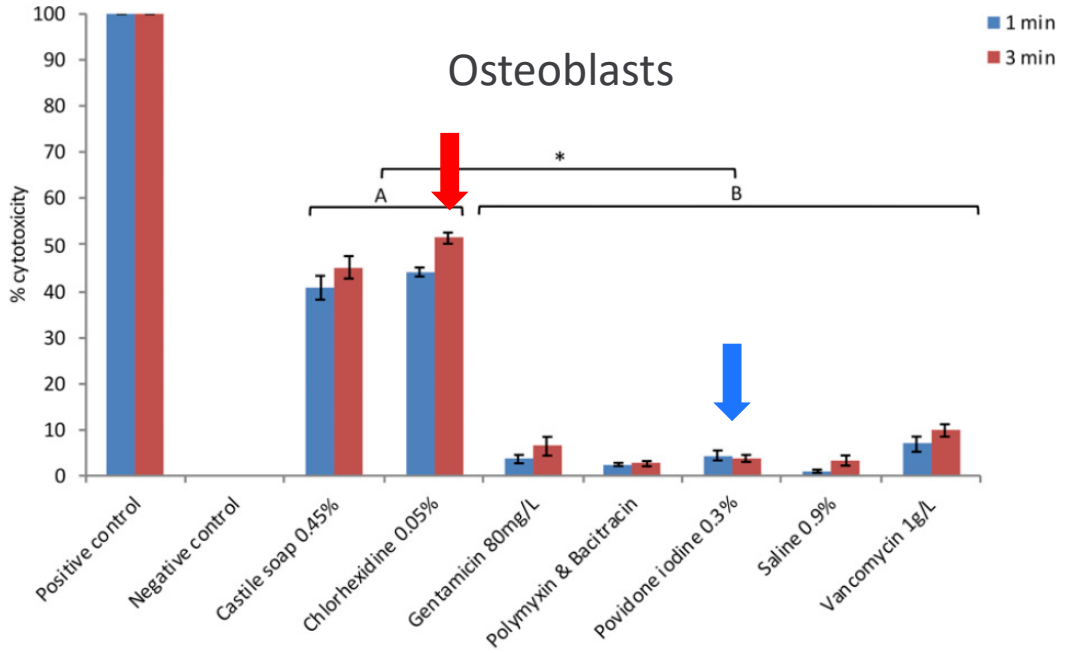

Efficacy
Safety

Polymyxin and Bacitracin in the Irrigation Solution Provide No Benefit for Bacterial Killing

Goswami et al. 2019







Chlorhexidine was significantly more toxic than all other solutions when tested against chondrocytes, osteoblasts, and fibroblasts.

PVP-I was the least cytotoxic of the efficacious solutions.

Goswami K, Cho J, Foltz C, et al. Polymyxin and Bacitracin in the Irrigation Solution Provide No Benefit for Bacterial Killing in Vitro. *J Bone Joint Surg Am*. 2019;101(18):1689-1697. doi:10.2106/JBJS.18.01362

Allergies to Antiseptics

Common misconception among patients and clinicians

PVP-I Misconceptions & Reality

Misconception: Allergies to PVP-I are common.

Reality:

- ***Only 0.4% of individuals have an allergy to PVP-I***
  - *Presenting as contact dermatitis.*[1]
- ***Only 9 cases of anaphylaxis over 25 years.***[2]

An allergy to pure iodine is impossible. It is an essential trace element, **which is biologically necessary for human life.**

Cross-reactivity Misconceptions

Misconception:

Shellfish allergy = Contrast dye allergy = PVP-I allergy.

Likely Origin of Misconception: Historically, a higher incidence of allergy to contrast dye in people with known shellfish allergy.

Reality:

- Shellfish allergies are due to its protein, tropomyosin, which is unrelated to iodine.[3]
- **There is no known cross-reactivity between shellfish allergy and PVP-I allergy.**[3]

What Can Be Done

- ✓ Clinician and nurse **education** to dispel myths about iodine
- ✓ Thorough **patient assessments** to determine whether previous reactions were specific to a product
- ✓ Preoperative product **patch testing**

1. Lachapelle JM. A comparison of the irritant and allergenic properties of antiseptics. Eur J Dermatol. 2014 Jan-Feb;24(1):3-9. doi: 10.1684/ejd.2013.2198. PMID: 24492204.
   Stewart MW. Doctor I Have an Iodine Allergy. Ophthalmol Ther. 2022 Jun;11(3):931-938. doi: 10.1007/s40123-022-00502-1. Epub 2022 Apr 24. PMID: 35461399; PMCID: PMC9114274.
2. Leow SKH, Knight D, Cooter R. Perioperative anaphylaxis to povidone-iodine in breast prosthesis surgery: a case report. AJOPS. 2023;6(1):1-3. doi:10.34239/ajops.v6n1.70223
3. Bailey, LS. Clarifying Misconceptions About Iodine "Allergies" for Perioperative Patient Care. AORN Journal. 2025 Jan 121(1): 72-78.

Allergies to Antiseptics

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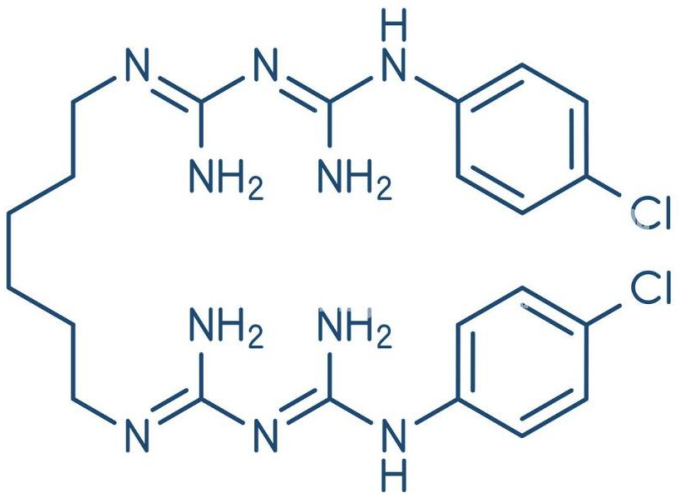


chlorhexidine

CHG Misconceptions & Reality

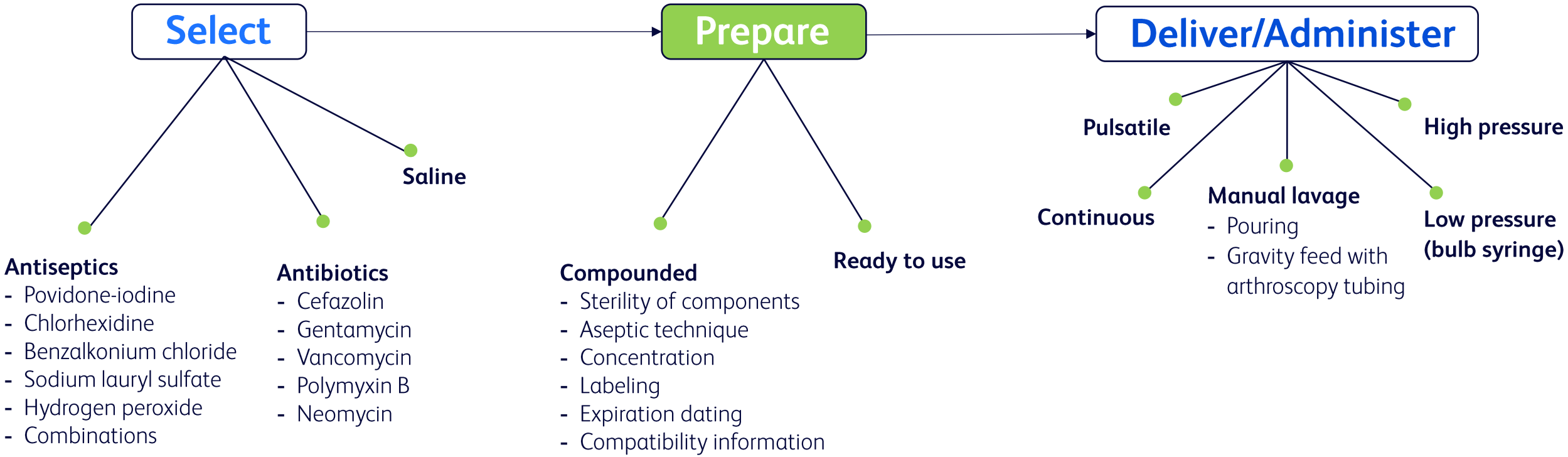
Misconception: Allergies to CHG are less common than those to PVP-I.

Reality: ***Allergy rates between antiseptics are comparable.***
Rates of allergy to CHG are between 0.47 – 1%[1]

- The majority of reactions are cutaneous.
- Overall rates of perioperative anaphylaxis are between 0.05% and 2%[3], and allergies to antiseptics account for an even smaller percentage.

1. Leysen J, Bridts C, Sabato V, Vercauteren M, Ebo D. Anaphylaxis during general anaesthesia: ten-year survey from a Belgian allergy clinic. European Academy of Allergy and Clinical Immunology, 16-20. June 2012, Geneva (poster 291).
2. Lachapelle JM. A comparison of the irritant and allergenic properties of antiseptics. Eur J Dermatol. 2014 Jan-Feb;24(1):3-9. doi: 10.1684/ejd.2013.2198. PMID: 24492204.

Key Decision-Points in Surgical Wound Irrigation



Antiseptics
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- Combinations

Antibiotics
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Compounded
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- Aseptic technique
- Concentration
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- Expiration dating
- Compatibility information

Manual lavage
- Pouring
- Gravity feed with arthroscopy tubing

Preparation of Irrigation Solutions

Compounded in the pharmacy

Antiseptic solutions
Antibiotic solutions

☒ ***Fluid conservation***

PVP-I diluted on back table in OR

Bulk solution,
PVP-I packets (unsterilized and sterilized)

☒ ***Fluid conservation***

Ready-to-use solutions

Surgiphor
Irrisept
Bactisure

☑ ***Fluid conservation***

Every variation in preparation can increase risk

1. **Non-sterile formulations[1]**
2. **Bacterial contamination[2]**
3. **Medical errors[2]**
4. **Non-standard irrigation concentrations[1]**
5. **Inconsistent aseptic technique[2]**

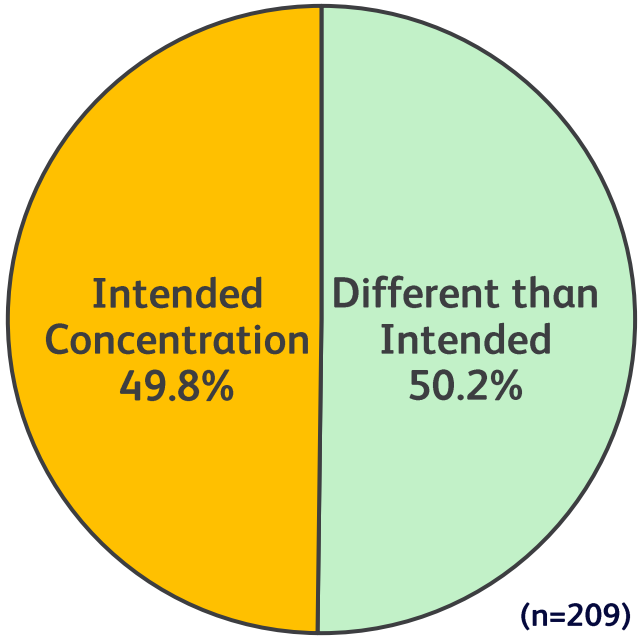
1. Barnes S, Spencer M, Graham D, Johnson HB. Surgical wound irrigation: a call for evidence-based standardization of practice. Am J Infect Control. 2014;42(5):525-529. doi:10.1016/j.ajic.2014.01.012
2. USP. Pharmaceutical compounding – sterile preparations <797>. Rockville, MD: USP; November 1, 2023. DOI: https://doi.org/10.31003/USPNF_M99925_07_01; 10.

A Look at ‘Homebrew’ Practices in the United States

Operating Room Mixing of Irrigation Solutions Survey (OR-MISS) 2024

A national quantitative investigation of homebrew surgical irrigation practices conducted by online survey.[1]

Final Homebrew Concentration (PVP-I)



1. * Unpublished Data. REF-72009 Homebrew Surgical Irrigation Quantitative Summary Report 2024

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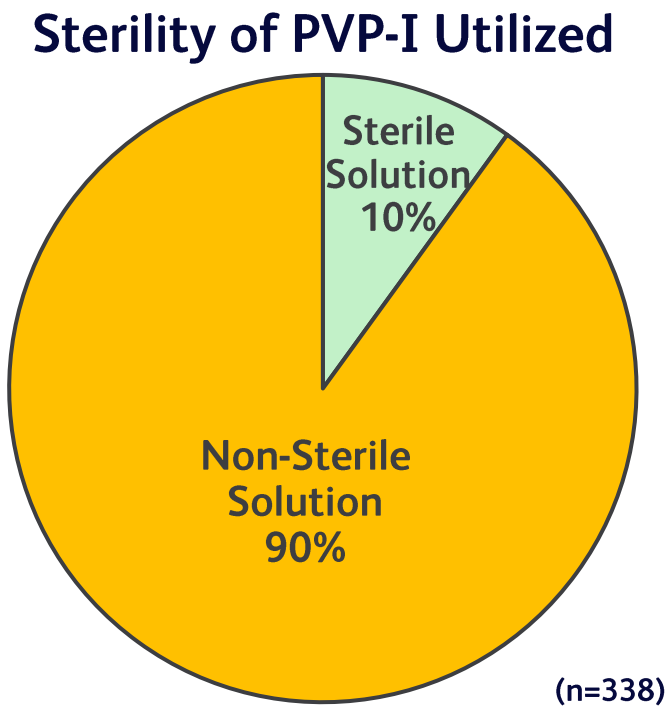
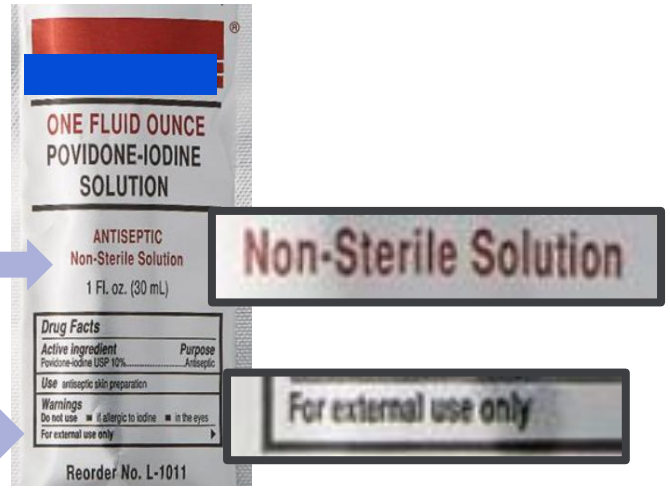
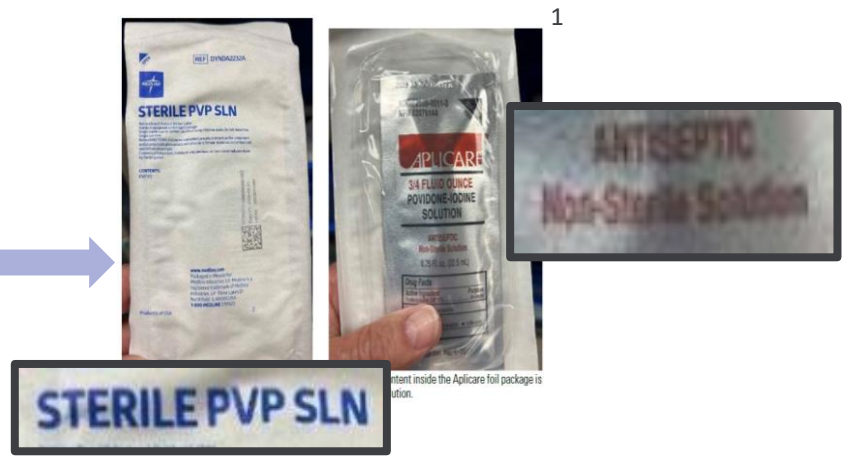


1. * Unpublished Data. REF-72009 Homebrew Surgical Irrigation Quantitative Summary Report 2024

Label knowledge is important for irrigation antiseptics

- Labeled as non-sterile
- Labeled for external use only
- Sterile convivence kits contain non-sterile solution
- **Allows low levels of bacteria, yeast, and mold**





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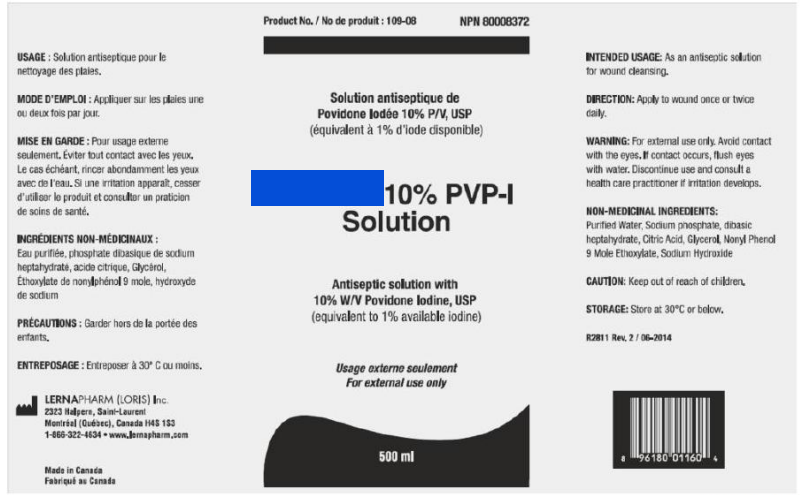
Label view



Page 1 of 2

Technical Data Sheet - Loris 10% PVP-I Solution, Bottle 500 mL Issued: May 27, 2019

Chemical / Biological Analysis

Test	Method	Specification
Description	TL-S-QUA-012	Bottle containing brown liquid
Visual inspection	TL-S-QUA-012	The solution is free of dirt, hair, precipitates, and other foreign matter
pH	USP<791>	1.5 - 6.5
Available iodine	TL-S-QUA-012	0.85% w/v - 1.20% w/v
Identification (A)	TL-S-QUA-012	A deep blue color is produced
Identification (B)	TL-S-QUA-012	No blue color appears within 60 seconds
Total Aerobic Microbial Count (TAMC)	TL-S-QUA-028	Report < 10 cfu/mL
Total Combined Yeast and Molds Count (TYMC)	TL-S-QUA-028	Report < 2 cfu/mL
S.aureus	TL-S-QUA-053	Absence
P.aeruginosa	TL-S-QUA-053	Absence
B.cepacia	TL-S-QUA-053	Absence

1. Institute for Safe Medication Practices (ISMP). Confusion over sterility of povidone-iodine solution. Nurse AdviseERR. 2024;22(1):3-4.
2. Loris Technical Data Sheet.

1

AJIC brief reports

Contaminated iodophor in the operating room

Eileen O'Rourke, MT(ASCP), CIC
Debbie Runyan, MT(ASCP), CIC
Judy O'Leary, MT(HEW)
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The Infection Control Department reviews microbiology reports daily as part of the critical care surveillance methods used to participate in the National Nosocomial Infections Study (NNIS). In June 2001, the infection control practitioners noted the presence of several unusual gram-negative rods from surgical specimens. While investigating the source of these organisms, *Staphyloccocus aureus* was serendipitously identified on the inside lip of multiuse iodophor (Betadine; Purdue Pharma LP, Stamford, Conn) jugs.

the same hood and stored in the same incubator, these instruments did not appear to be related to the problem. There were no new technologists or students, and procedures for handling specimens were the same. In an effort to determine the source of these isolates, cultures were taken from following areas of the Microbiology Laboratory and then evaluated:

- Uninoculated chopped meat glucose (CMG) from current lot (Remel, Lenexa, Kan); CMG is a medium used to enhance anaerobic growth
- CMG with swab from BBL Port-A-Cul (Becton

Debunking The Myth:

Antiseptics are "self-sterilizing"

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Microbial Stowaways in Topical Antiseptic Products

Christina Y. Chang, M.D., M.P.H., and Lesley-Anne Furlong, M.D.

In the 1970s, the Food and Drug Administration (FDA) developed regulatory pathways for a number of active drug ingredients that were on the market but had not been approved by the FDA. Antiseptic drug products fall into one class of drugs that was included in the regulations that resulted from the expert reviews of the 1970s. At the time, it was assumed that antiseptic drug products were free of microbial contamination because of their pharmacologic activity. The need for sterile manufacture for these products was therefore not considered. In recent years, however, there have been published reports linking outbreaks of infection to antiseptic products that

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Notes from the Field: Contamination of Alcohol Prep Pads with *Bacillus cereus* Group and *Bacillus* Species --- Colorado, 2010

Weekly
March 25, 2011 / 60(11);347

In October 2010, a child at The Children's Hospital (TCH) in Aurora, Colorado, with newly diagnosed leukemia developed clinical sepsis 24 hours after insertion of an implanted vascular access device. The child also developed extensive cellulitis at the insertion site, requiring surgical debridement, intensive care, antibiotics, prolonged wound management, and outpatient treatment. Cultures of the child's blood and tissue specimens grew *Bacillus cereus*. An investigation found neither breach of infection control procedures nor any violations of sterile surgical technique.

In November 2010, an afebrile infant with congenital heart disease was admitted to TCH for respiratory distress and developed fever and became clinically septic 4 days after an internal jugular line was placed. Four blood cultures from the infant grew *B. cereus*. The line was removed, and the infant had an extended hospital stay for treatment with intravenous antibiotics before being discharged.

The subsequent TCH investigation into the two cases focused on the following three single-use, disposable items used in the treatment of both patients: 1) sterile syringes prefilled with sterile saline solution, 2) sterile applicators packaged with a 2% chlorhexidine gluconate/70% alcohol solution for skin preparation, and 3) pledgets packaged with 70% isopropyl alcohol (alcohol prep pads [APPs]). The APPs were not labeled as either sterile or nonsterile on the outside of the individual APP packages or the box the APPs were contained in. Bacterial cultures of samples from three saline syringes and the liquid and pads from nine packages of chlorhexidine gluconate/alcohol skin preparation applicators were negative. The internal alcohol pads from 60 APPs, obtained from various locations around TCH, also were cultured. Hospital investigators found that 40 of 60 pads, representing eight of 10 different manufacturing lots, yielded *B. cereus* or *Bacillus* spp. All of the pads were supplied by a single manufacturer. TCH contacted the Colorado Department of Public Health and Environment, which notified CDC and the Food and Drug Administration and performed confirmatory testing of TCH laboratory findings.

Twenty-nine *B. cereus* isolates, 21 from cultured APPs and eight from TCH patients with positive cultures during May--November 2010, were characterized by pulsed-field gel electrophoresis. Wide diversity was observed among the isolates, and no patient isolates matched APP isolates. Given this diversity and the time lapse between positive patient specimens and subsequent APP sampling, the lack of a match between the two groups was not considered to rule out APPs as the source of the *B. cereus* isolated from patients.

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Synopsis

Polyclonal *Burkholderia cepacia* Complex Outbreak in Peritoneal Dialysis Patients Caused by Contaminated Aqueous Chlorhexidine

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Cite This Article

Abstract

Whether *Burkholderia cepacia* complex should be an objectionable organism in antiseptic solutions with acceptable total bacterial counts is controversial. By using next-generation sequencing, we documented a polyclonal *B. cepacia* complex outbreak affecting peritoneal dialysis patients in Hong Kong that was caused by contaminated chlorhexidine solutions. Epidemiologic investigations at a manufacturing site identified a semiautomated packaging machine as the probable source of contamination in some of the brands. Use of whole-genome sequencing differentiated the isolates into 3 brand-specific clonal types. Changes in exit site care recommendations, rapid recall of affected products, and tightening of regulatory control for chlorhexidine-containing skin antiseptics could prevent future similar outbreaks. Environmental opportunistic pathogens, including *B. cepacia* complex, might be included in regular surveillance as indicator organisms for monitoring environmental contamination.

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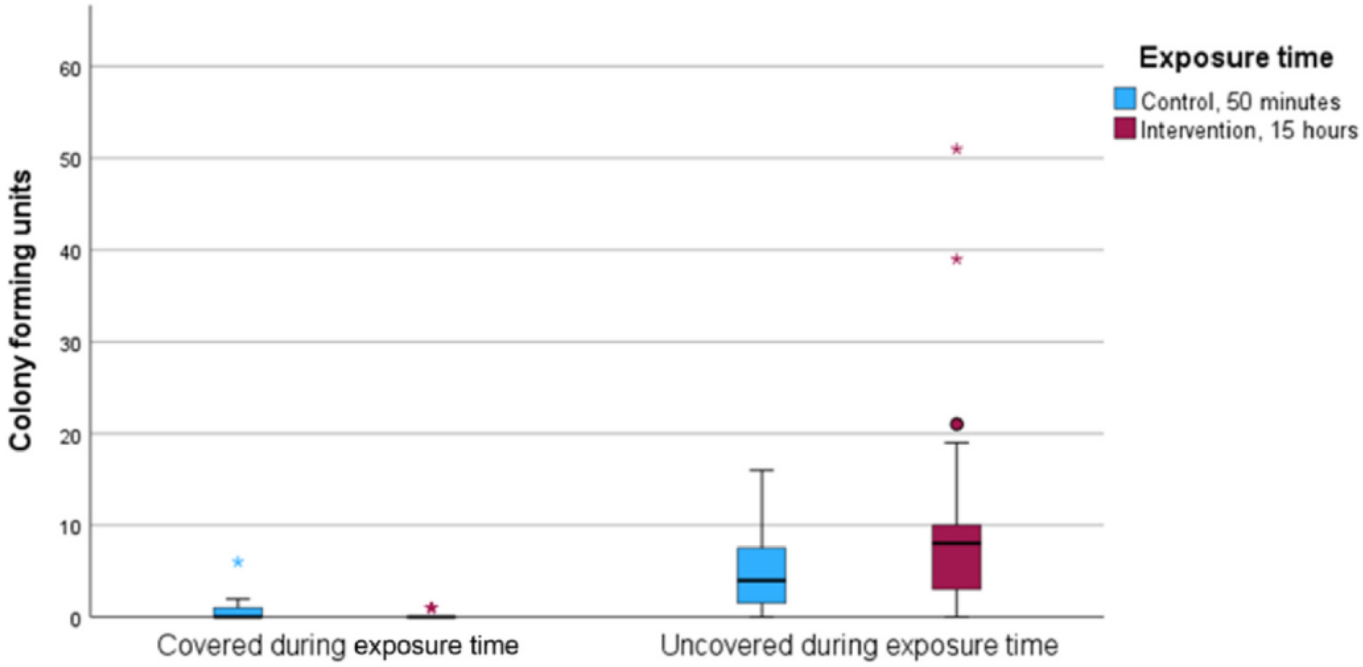
Bacterial air contamination and the protective effect of coverage for sterile surgical goods: A randomized controlled trial[1]

Wistrand et al. 2025

- Cardiothoracic OR in Sweden
- Sterile set-up prepared & allowed to sit covered vs uncovered
  - Average only one door opening from corridor
    - **Average rate of door openings in orthopedic operations ranges from 12.6 – 41.4 per hour[2]**
- Bacterial air contamination occurred on sterile goods over time when left unprotected.
  - Some of the bacteria isolated from the agar plates were drug resistant



Bacterial contamination from the air in the OR can happen in as little as 50 minutes

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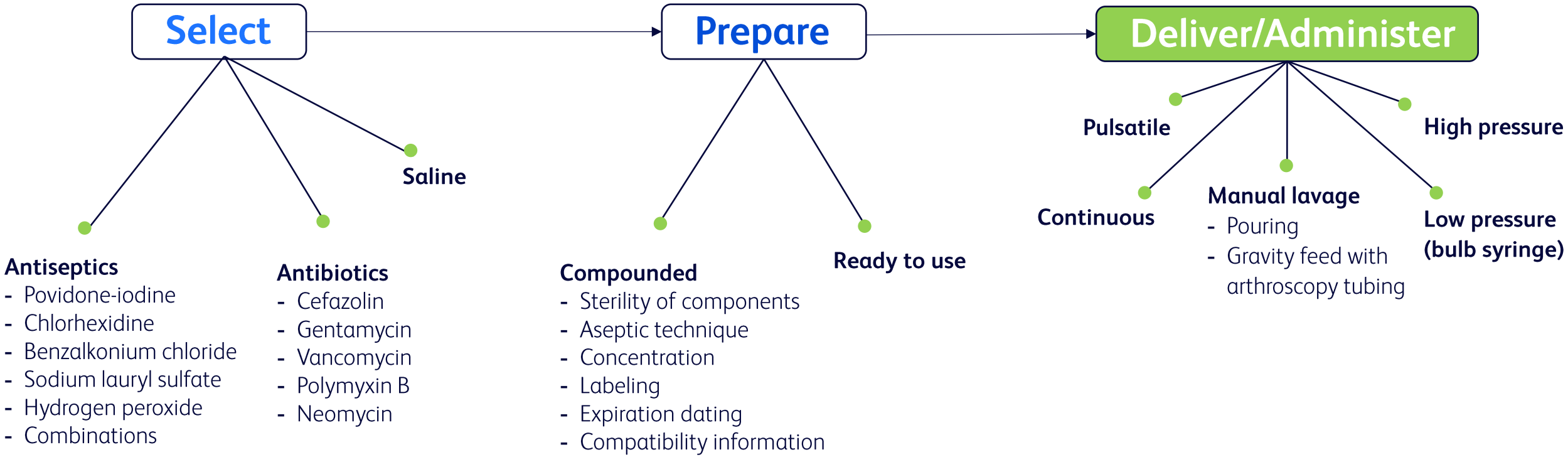
Key Decision-Points in Surgical Wound Irrigation



Delivery Systems

Manual Lavage

Low Pressure
(Pouring/Gravity/Bulb Syringe)

<4 PSI

Ready-to-Use

4-15 PSI

Pulsed/Pulsatile/Powered Lavage

4-30 PSI

Pulsed Lavage in Wound Cleansing

Luedtke-Hoffman KA, Schafer, DS. 2000

Table 1.
Commonly Used Wound Cleansing Methods, Associated Pressures, Effects, and Limitations

Method	Pressure (psi)	Effects	Limitations
Pour bottle	0–1	Removal of loose surface pathogens and debris	Insufficient pressure to achieve wound cleansing[14,18–26]
Bulb syringe	0–1	Removal of loose surface pathogens and debris	Insufficient pressure to achieve wound cleansing[14,18–26]
Piston syringe	8	Effective cleansing of traumatic wounds[27,28]	Small reservoir requires repeated filling; may prove time-consuming Single stream of fluid delivered
Piston irrigation system[a]	4–8	No controlled studies available	Output pressures are at lower end of cleansing efficacy[2]
Whirlpool agitation	Unknown	Removal of surface pathogens from intact skin[29] Limited removal of bacteria from burn wounds[30]	Clinicians unable to calibrate output or impact pressures Immersion may cause: · increased systemic demands on patients' cardiovascular and respiratory systems[31–35] · periwound skin maceration[36,37] · dependent edema[3,38,39] · cross-contamination[40–43]
Whirlpool hose sprayer	Unknown	Removal of surface pathogens from intact skin[29] Limited removal of bacteria from burn wounds[30]	Clinicians unable to calibrate output or impact pressures

[a] Canyons Wound Irrigation System, Canyons International, 1226 E 2nd Ave, Salt Lake City, UT 84103.

The AHCPR guideline recommends irrigation pressures ranging from 4 to 15 psi.

It suggests that:
Irrigation pressures <4 psi may be insufficient to remove surface pathogens and debris

Irrigation pressures >15 psi may cause wound trauma and drive bacteria into wounds.

AHCPR = The Agency for Healthcare Policy and Research

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Conclusions

Select

- Not all antiseptics are created equal
- Povidone-iodine is effective at reducing SSI with minimal cytotoxicity

Prepare

- Sterility matters
- Back table mixing is risky practice

Deliver

- Bulb syringe and hand pouring irrigation is inadequate according to AHCPR
- Ready-to-use solutions provide ideal PSI

Thank you!

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