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Andreia Davis
adavis1392@gmail.com

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Effectiveness of CHG Bathing

Andreia Davis

Murray State University

Abstract

CHG soap and other alternatives are used to remove the flora from the skin. Skin flora are the different microorganisms found on the skin. Many are bacteria that can cause infections if introduced to an environment in which they can thrive and grow. This paper goes into depth about the effectiveness of CHG soap and other alternatives at preventing healthcare-associated infections and surgical site infections. The paper includes the following aspects of effectiveness: infection risk, financial issues, the processes that should be used, and types of infection.

Effectiveness of CHG Bathing Using Wipes and Soap

Introduction

Chlorhexidine Gluconate (CHG) soap and other alternatives are used to remove the flora from the skin. According to Aly and Maibach (1976), “The normal flora of the skin, composed primarily of gram-positive cocci and diphtheroids, may represent a selective barrier against proliferation of potentially pathogenic organisms” (p. 931). So, skin flora is made up of the different microorganisms found on the skin. Numerous studies have been conducted to prove that the use of CHG helps prevent healthcare-associated infections. According to Edmiston, Okoli, Graham, Sinski, and Seabrook (2010), “The goal of skin antisepsis in the surgical patients is to reduce the microbial burden on the surface of the skin to a subpathogenic level before surgical incision, thereby reducing the risk of wound contamination” (p. 510). By removing flora from the skin, the patients are taking steps to help keep themselves from potential harm.

It is recommended that surgical patients bathe or shower the night before and the morning of their procedure to help remove the flora from their skin. If the patients are in the ICU, they should be bathed everyday using CHG. Also, if patients are having some type of device inserted, they should be wiped down in the area where device will be placed. There are many different reasons a person should use CHG, but the question being explored in this paper is as follows: When CHG soap is used properly to remove the skin flora, is it really effective at preventing numerous healthcare-associated infections?

The Use of CHG for Preventing a Surgical Site Infection

So why use CHG before a surgical procedure? According to Edmiston et al. (2010), “The ritual of perioperative skin prepping can be traced back to 1867, when Joseph Lister used a carbolic acid aerosol to disinfect the skin before surgical incision and documented a significant reduction in postoperative morbidity and mortality” (p. 510). Research tracing back this far provides effective evidence...and should be convincing enough that people want to participate in using CHG to prevent a surgical site infection. More people feel confident in a product when it has been used and proven to be effective over long periods of time. If patients are trusting their doctors to perform a surgical procedure on them, they should also trust their judgement when it comes to the preoperative prep.

According to Barnes (2015), “There are numerous formulations used for preoperative bathing, including liquid CHG, CHG-impregnated rinseless bathing cloths, and CHG-filled surgical scrub brushes (using the sponge side only for patients bathing)” (p. 10). Since there are many different formulations of CHG, there are many different ways patients could prepare their skin before a surgical procedure. Some patients may be unable to shower due to a physical disability, an open wound, or a cast that cannot become wet. Since their ability to use the bathing liquid is compromised, they could resort to using the CHG-impregnated rinseless bathing cloths. When using the cloths, the patients only have to wipe down their bodies instead of standing in the shower. When doing so they need to focus on the area that the procedure will be performed on. If patients do not have the mental capacity to remember the steps that need to be taken, then a family member should assist them in bathing with the CHG liquid soap or help them wipe down using the CHG-impregnated rinseless bathing cloths. If a family member is going to be performing the preoperative bathing it is important that they accompany the patients to their appointments, so they know the proper technique. The CHG-filled surgical scrub brushes

are only used in the operating room once the patients are brought back. Not only are the antiseptic techniques taken at home by the patients, but they are also performed once they arrive to the medial facility.

Proper Use Before Surgery

Patients are to use the CHG to clean their skin by scrubbing their body with it. They need to focus mainly on the area that will be undergoing surgery. By focusing on this area, it will help remove the most flora from that area. By removing the flora from the area, the scrubbing with CHG is reducing that patient's risk of acquiring an infection. While removing the flora from the skin, they are taking the precautions needed to help prevent them from acquiring a surgical site infection. According to Webster and Osborne (2015), "The aim of washing is to make the skin as clean as possible by removing transient flora and some resident flora" (p. 5). The microorganisms that are being removed may be the culprit to causing a nasty infection from forming in result from the surgical procedure. According to Webster and Osborne (2015), "Skin is not sterile. Indeed, thousands of bacteria live permanently on skin and contribute to health by maintaining a steady colony that inhibits establishment of harmful yeast and fungal infections" (p. 5). With information like the patients should want to remove as much of the skin flora as possible. Since the skin permanently has bacteria living is, then it could be possible that the bacteria make its way into an open wound.

Microorganisms cannot be seen with the naked eye so precautions need to be taken to help remove them from the top layer of skin that a surgeon will be cutting into. When an incision is made, the naked eye can't see if the microorganisms may make their way into the freshly opened wound. It takes time for an infection to manifest, so the surgical staff will not

know immediately if the wound has been contaminated. According to Webster and Osborne (2015), “The use of an antiseptic solution for preoperative bathing or showering is widely practiced in the belief that it will help to prevent surgical site infections from developing” (p. 2). With this being widely practiced the number of surgical site infections should be decreasing. An increase could still be seen in surgical site infections due to the patients not properly following the instructions or just not taking the time to perform the task. In order to ensure that the patients are protected it may be beneficial that all perioperative areas provide an extra step in the bathing process.

Usually the physician recommends that patients use 4% CHG soap or the CHG 2% wipes. The physician usually provides the patients with detailed instructions about how they would like them to prepare their skin. The instructions are precise and need to be followed in order for the CHG to be effective. It is important that the patients keep the paperwork that includes CHG bathing instructions provided by the physician. At some facilities it has been common for patients to show up for a surgical procedure and admit they have lost the papers. According to Abbas and Sastry (2016), “Skin decolonization with CHG is one of the measures adopted to decrease the incidence of these infections” (p. 25). Since skipping a step would cause the decolonization process to be incomplete the patients may cause more harm than good. By skipping a step, the CHG may not provide patients with the protection that they need in order to prevent the surgical site infection.

Edmiston et al. (2010) recommends washing the site with CHG soap the night before and the morning of a surgical procedure helps with the removal of germs occurs and prevention of infection. After washing with the provided soap, it should be rinsed two minutes after the

application. Once the shower is complete, the patients should not apply any lotions or deodorants to their skin after the use of the soap. The whole process should be completed twice before surgery. At some facilities, when patients arrive and are brought back to the perioperative area, they are asked to remove all of their clothing. Once the clothing is removed a staff member washes the area where the surgical procedure will take place with a CHG 2% wipe. This step helps remove the skin flora that could have been transferred from the patients clothing. When the patients are wiped with the CHG 2% wipe they, must wait until the solution is dried before placing the gown or blanket back over them. When they are being wiped down the staff member must use a firm technique to ensure that the flora is removed. Two cloths come in a pack and are each to be used for 30 seconds each. The patient's skin may have a sticky feeling after the use of CHG, but this is normal. CHG can leave this type of residue behind but the feeling will go away with time (Edmiston et al., 2010).

There are many groups of people that are at a higher risk for infections than others. When patients are at a higher risk of contracting an infection, they should be very concerned about their risk of infection. These groups need to take the time to make sure that their skin is fully prepared for their surgical procedure if possible. Medical professionals should take time to explain the added risk to this group. If these groups were educated on what could happen, they may be more applicable to follow the instructions precisely. Provided in Figure 1 below is an example of the instructions that doctors may provide their patients with on how to use CHG before a procedure.

Figure 1

Preadmission Instructions for Showering or Cleansing with Chlorhexidine Gluconate

Taking an antiseptic preadmission shower/cleansing before elective surgery can reduce the risk of surgical site infection. To make the process easier, your physician has chosen to provide you with a 4% chlorhexidine gluconate (CHG) antiseptic soap solution for showering or disposable cloths moistened with a rinse-free 2% CHG antiseptic solution for cleansing the skin surface before visiting the hospital. The steps below outline the shower/cleansing process and should be followed carefully. Your physician will indicate what process (A or B) should be followed

Process A: 4% CHG antiseptic soap

Night before admission to hospital

- Place a quarter to fifty cent piece size volume of CHG solution onto a clean washcloth and apply the solution to all body surfaces, especially the groin, underarms, and genital areas. **Caution: Do not allow the solution to come in contact with the eyes, ears, or mouth. If you accidentally get some of this material on those areas, rinse immediately.**
- Add additional CHG soap to your washcloth as needed to cover all body surfaces. **Note: If you experience any burning or irritation on the skin, rinse immediately and do not reapply.**
- Repeat this process a second time, waiting two minutes to thoroughly rinse the soap-like material off the skin surfaces.
- Do not apply any lotion or deodorant after the antiseptic shower.

Morning before hospital admission (repeat process as outlined above)

Process B: 2% CHG antiseptic cloths

Night before admission to hospital

- Open the CHG cloth package as directed. Use one cloth to completely wet the site where the surgery will be performed and adjacent areas. Gently wipe the skin for approximately 30 seconds. **Caution: Avoid touching the cloths to the eyes, ears, or mouth. If you accidentally get some of this material on those areas, rinse immediately.**
- Discard the used cloth and with a second cloth, wash the same areas for an additional 30 seconds. A broad area should be covered. For instance, if surgery is being performed on the knee, an area from the hip to the ankle should be wiped. **Note: If you experience any burning or irritation on the skin, rinse immediately and do not reapply.**
- Allow the washed areas to dry for one minute. Do not rinse with water. It is normal for the skin to have a “tacky” feeling for several minutes after the antiseptic solution is applied.
- Do not apply any lotion or deodorant after application of the antiseptic cloth.

Morning before hospital admission (repeat process outlined above)

Figure 1. Preadmission patient instructions for showering or cleansing with chlorhexidine gluconate to reduce the risk of postoperative surgical site infection.

Figure 1 Edmiston et al., 2010

Groups at Higher Risk for Surgical Site Infection

So, who is at a higher risk for post-operative infection? Patients that are diabetic, patients that need emergency operations, obese patients, and elderly patients all have a higher risk of

contracting a surgical site infection. These groups have a more difficult time when it comes to healing after a surgical procedure. According to Webster and Osborne (2015),

“Since clean wounds are less likely to become infected, SSIs following clean surgery are usually associated with either: (1) patient risk factors, such as age, nutritional status, diabetes and obesity; (2) risk factors related to the procedure: including incomplete preoperative hand and forearm antisepsis by one of the surgical team, length of surgical procedure and surgical technique; or (3) risk factors associated with preoperative preparation of the patient: for example, antimicrobial prophylaxis, preoperative hair removal and preoperative antiseptic showering” (p. 5).

This can be attributed to many different factors.

Diabetic patients have a large risk of infection without even going through a surgical procedure. According to Carey et al. (2018), “People with diabetes, particularly T1DM, are at increased risk of serious infection, representing an important population burden” (p. 513).

Diabetes causes a number of issues including impaired immune responses. When a person has impaired immune responses, it causes difficulty for them to fight off infection. According to Carey et al. (2018), they “found that patients with T2DM on insulin at baseline were at double the risk of hospitalization for infection compared with those patients not using insulin, which may reflect some misclassification of patients with T1DM as T2DM, but more likely is a marker for severity of diabetes” (p. 518). The severity of a patient’s diabetes determines how well he/she can fight off an infection. Unlike type 1 diabetes not everyone who has been diagnosed with type 2 diabetes manages the disease with insulin. If people need to manage type 2 diabetes with insulin, they are considered to have a severe case of type 2. Not everyone with diabetes has

his/her disease under control. If their diabetes is not under control this may cause the risk of infection to become higher. This could be caused by a severely suppressed immune system.

Emergency operations pose a high risk of surgical site infections due to the emergent need for surgery causing the prep for surgery to be unknown. Emergent operations happen so quickly the proper precautions may not be performed. If patients are already admitted into the hospital before this emergent surgery, the risk for infection is even higher. Without the use of proper hygiene between patients it would be easier to transfer communicable diseases between patients' care. Even if the patients were not previously admitted to the hospital while they have been in the Emergency Room, they were exposed to the germs that are lurking around in that area. One of the questions asked in the perioperative area is as follows: have you been hospitalized unexpectedly for an emergent reason for more than two days in the last year? The answer that is given will determine which antibiotics the patients will receive before surgery. The antibiotics are also used for the prevention of a surgical site infection.

Obese patients are at a higher risk for infection. According to Dhurandhar, Bailey, and Thomas (2015), "Considering the widespread occurrence of obesity and infections in the population, such interactions need to be identified and addressed" (p. 1017). Many studies have been conducted to find what infections obese people are more prone to and why they may contract them easier than others. Also, according to Dhurandhar, Bailey, and Thomas (2015) "Research has suggested that certain infections may trigger an increase in adiposity. Likewise, increased adiposity may alter the outcome of certain infections. Reduced antimicrobial effectiveness with standard dosages may also contribute to poor clinical outcomes in patients

with obesity” (p. 1017). When people are obese, they have more adipose tissue than a person whose body mass index is within normal limits.

Adipose is fat tissue located inside of a person’s body. People who are obese have more adipose tissue than people who are not obese. Since they have the extra adipose the outcome of the infection may be different. More adipose tissue may cause the medications needed to treat infections to be less effective due to the amount of surface area that needs to be treated.

According to Dhurandhar, Bailey, and Thomas (2015), “Evidence supports a role for an infectious aetiology and infection treatment for weight gain in some persons. BMI status may influence response to certain infections, as well as to preventive and treatment measures” (p. 1022). Knowing this information, it is important to know the patients correct weight before a surgical procedure. When patients are brought back to the preoperative area the staff gets a correct height and weight where BMI can be calculated.

Elderly patients are at a higher risk for infection because as people age, their immune response begins to weaken. According to Montecino-Rodriguez, Berent-Maoz, and Dorshkind (2013), “One of the most recognized consequences of aging is a decline in immune function” (p. 958). DNA is constantly being replicated throughout an individual’s life, and as time goes on the DNA becomes weaker causing the individual to “age”. In order to fight off infections an individual needs an immune system that can effectively rebound from what they may have contracted. If the immune system is over loaded with numerous infections it may not be able to fight off everything it needs to. According to Ziady (2012), “Within the first 15 minutes after bathing, an average person sheds 6×10^6 colony forming unit (CFU) of *Staphylococcus aureus*” (p. 44). Knowing that a person produces that much contamination in such a little time frame

should be enough to convince someone to use CHG. Provided in Table 1 below are examples of intrinsic and extrinsic reasons patients may contract a surgical site infection.

TABLE 1. Selected Patient and Procedural Characteristics Associated With Increased Risk of Surgical Site Infections ¹	
Patient (intrinsic)	Procedural (extrinsic)
<ul style="list-style-type: none"> ■ Age ■ Diabetes (metabolic disease) ■ Perioperative hyperglycemia ■ Tobacco use ■ Concurrent infection (distant) ■ Obesity ■ Malnutrition ■ Immunocompromise ■ Low preoperative serum albumin level ■ Corticosteroid use ■ Prolonged hospitalization before surgery ■ Prior radiation to surgical field tissue ■ <i>Staphylococcus aureus</i> colonization 	<ul style="list-style-type: none"> ■ Lack of a preoperative shower ■ Site shaving the night before surgery ■ Extended operative time ■ Flawed skin antisepsis ■ Flawed surgical prophylaxis ■ Effects of the OR environment (eg, hypothermia) ■ Break in aseptic technique ■ Hypothermia or hypoxia ■ Perioperative blood transfusion ■ Surgical technique <ul style="list-style-type: none"> ■ Hemostasis ■ Tissue trauma
<p>1. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guidelines for the prevention of surgical site infections, 1999. Hospital Infection Control Practices Advisory Committee. Am J Infect Control. 1999;27(2):97-132.</p>	

Table 1 Edmiston et al., 2010

Risks to Microorganism Removal

During the process of using CHG, many different microorganisms are being removed from the skin. Not only are harmful microorganisms removed, but helpful microorganisms may be removed as well. According to Edmiston et al. (2010), “At high concentrations, CHG

produces a rapid bactericidal effect by causing the cytoplasmic contents of the bacterial cell to precipitate, resulting in cell death” (p. 511). Even though the good bacteria are being removed it is safer for the patients in the long run.

Types of Infection Common after Surgery

A few examples of surgical site infections that can arise are MRSA (Methicillin-resistant *Staphylococcus aureus*), *Staphylococcus Aureus*, and VRE (vancomycin-resistant *Enterococci*, *Pseudomonas aeruginosa*). According to Graling and Vasaley (2013), “The Centers for Disease Control and Prevention guideline for prevention of SSI states that the use of chlorhexidine gluconate (CHG) reduces bacterial colony counts ninefold and provides prolonged skin antisepsis. Chlorhexidine gluconate is effective against fungi and gram-positive and gram-negative bacteria” (pp. 547-548). If patients have a history of these infections, then they are at a higher risk of contracting the infection again. Currently in the hospital setting if patients contract one of the hard to treat infections, the patients are placed into isolation to help prevent the spread of the infection to other patients or visitors. In order to enter an isolation room a visitor or staff member must wear the correct protective gear to prevent the spread of infection. This could include a mask, gloves, and gown. Once patients have contracted the infection even when they have officially been deemed infection free, they are still placed in isolation as a precaution to themselves and others around them.

Types of Surgical Site Infections

What is a surgical site infection? A surgical site infection occurs at or near a surgical incision. The infection can be superficial incisional, deep incisional, or organ. According to

Webster and Osborne (2015), “SSIs are classified as being: superficial incisional (involving only skin or subcutaneous tissues); deep incisional (involving deeper soft tissue and fascia); or organ/space (involving any other part of the anatomy that was opened or manipulated)” (p. 5). Superficial incisional would be considered an infection at the site the skin was opened for the procedure to take place and occurs within 30 days of procedure. Deep incisional is an infection that occurs under the incision within the muscle or other tissues and occurs within 1 year if implant is inserted. According to Gaines, Luo, Gilbert, Zaborina, and Alverdy (2017), “Recent advances in the understanding of the human microbiome have demonstrated that human microbial homeostasis predicates on a series of complex interactions involving the host and its constituent microbes, the disruption of which likely contributes to deep SSIs” (p. 505). Knowing this information should convince patients to want to remove the flora to prevent the microbes from being disturbed after an incision is made. An organ surgical site infection occurs within an organ or the space that it is in. Along with where the infection is located, they are also determined by class. According to Webster and Osborne (2015), the classification is as follows: “Class 1 (clean), Class II (clean-contaminated), Class III (contaminated) and Class IV (dirty/infected)” (p. 5). A clean-contaminated wound is located at a site that is considered contaminated which could be a bowel surgery. Fecal matter is considered hazardous which could potentially cause patients to have a Class II wound. The different classes help the healthcare providers determine if the site is contaminated or not.

There are many ways a person can contract a surgical site infection. It could be caused by an incident in the operating room, personal hygiene, and hygiene from the others interacting with the patients. An issue that could arise in the operating room that could cause the development of a surgical site infection is improper sterilization of equipment, or a foreign object getting left

inside the site. The foreign object could be contributed to a number of scenarios. A few examples are it could be a stray hair, a tool or instrument used during surgery. According to Hranjec, Swenson, and Sawyer (2010), “In fact, shaving of the surgical site the night before is associated with significantly higher SSI risks than no hair removal or use of depilatory creams” (p. 291). This could possibly be caused by stay hairs that could have been left behind and made their way into the surgical site.

Personal hygiene is a key factor when it comes to staying infection free. A person should keep their wound clean and dry. Patients should not go anywhere that might be considered a breeding ground for bacteria. Places that are considered breeding grounds include but are not limited to swimming pools, hot tubs, baths, and gyms. According to Ziady (2012), “The average swimmer contributes at least 0.14 g of fecal material to water, usually within the first 15 minutes of entering a pool. Showering with soap before swimming removes fecal material” (p. 44). Knowing this information should make anyone reconsider getting into a swimming pool after a surgical procedure. Fecal matter can be hazardous to fresh or non-healed wounds

According to Urbancic et al. (2018), “Infection control interventions, including hand hygiene, care bundles to improve line insertion procedures, and active screening and isolation of patients colonized with such organisms, have been used to reduce such health care-associated infections” (p. 109). Personal hygiene from others that will be performing some type of medical care with the patients is also vital. The patients should not allow anyone to touch their wound without performing the correct hand hygiene. Anyone that is coming into contact with a fresh or non-healed wound needs to take proper precautions to insure the safety of themselves and the patients.

Different types of surgical procedures have different rates of surgical site infections. The length of time of the surgical procedure plays a factor surgical procedure takes place plays a factor into this. Since some types of surgical procedures tend to take longer than others it may show that these types of procedures have a higher risk of surgical site infection. According to Cheng (2016), “Our review demonstrated that the majority of studies (87%) reported a statistically significant association between longer operative time and SSI” (p. 730).

According to Gaines et al. (2017), “The recommendations focused on pre-, intra-, and post-operative actions that showed evidence-based benefits while considering resource and cost limitations” (p. 504). This research provides evidence that the patients and healthcare providers need to focus on all aspects of the medical care. When patients are discharged from the hospital, they are not free from the risk of developing from developing an infection. That being said they must ensure all precautions are taken to prevent an infection.

Surgical Infections and Financial Issues

According to Edmiston et al. (2010), “It is estimated that between 750,000 and 1 million SSIs occur in the United States each year, extending hospital stays by 3.7 million extra days and generating more than \$1.6 billion in excess hospital charges each year” (p. 509). That is 750,000 to 1 million too many surgical site infections. The precautions need to be taken to prevent an infection from occurring. Not only do surgical site infections cause the patients more issues with their health they also add more financial burden. According to Graling and Vasaley (2013), “A study by Kirkland et al found that, depending on the complications caused by the infection, the costs of an SSI could be estimated to range from \$3,000 to \$29,000” (p. 547). The added cost may be more than some patients can handle. Infection could mean a longer hospital stay, increased number of medications needed, more surgical procedures, and more time off of work.

Hranjec, Swenson, and Sawyer believed (2010), “For most SSI, the pathogens originate from the endogenous flora (e.g., patient's skin, hollow viscera)” (p. 290). With this information one can gather that most surgical site infections could be caused by the flora that is present on the skin. By performing an antiseptic wash before surgical procedures patients can help reduce the number of endogenous flora they have present on the skin. Some people may not realize the danger that surgical site infections can cause. These infections can lead to many different outcomes including death. According to Hranjec, Swenson, and Sawyer (2010), “The process began with an “irritative fever,” followed by purulent drainage from the incision as well as sepsis and death” (p. 289). If an infection is not caught in enough time it could possibly lead to death. Not only does the financial burden cause issues for the patients but also their families. If a patients’ surgical site infections end in death their family may not be able to continue to live life as once before.

It takes more than just patients to prevent surgical site infections. It is a joint effort between everyone that is involved in the surgical procedure. This includes the care preoperative, during the procedure, and post-operative. According to Hranjec, Swenson, and Sawyer (2010), “Beyond the apparently simple task of utilizing these preventive measures, the path to improvement must include physicians collaborating with each other, communicating with their operating room staff/teams, and creating protocols that can be followed easily and be consistent among surgeons” (p. 292). Consistency is key in everything. If the staff is consistent when performing procedures, the steps should become second nature. According to Hranjec, Swenson, and Sawyer (2010), “Involving other departments such as pharmacy may additionally prevent errors and make the administration of appropriate medications automatic” (p. 292). By including everyone that is involved in the care even if it’s not direct patient contact things will run

smoother. Even though the pharmacy does not directly work with patients they are still a vital part of the team. If they did not perform their job, then patients would not receive the medications that they need while in a healthcare facility.

CHG and Intensive Care Unit

To be in the intensive care unit patients have to meet certain criteria. These patients are usually considered to be in critical condition. According to Derde, Dautzenberg, and Bonten (2012), “Main contributing factors are underlying immunodeficiency, co-morbidities, use of invasive devices, and the intensity of patients care. These factors, combined with extensive use of antibiotics, facilitate patients-to-patients transfer of AMRB” (p. 931-932). With these patients being sicker than most it would be more difficult for them to fight off a hospital-acquired infection. Most of the patients admitted to the intensive care unit have a compromised immune system causing them to have more difficulty fighting infections than a normal everyday person. Their compromised immune system could be caused by many different factors. If they have more than one disease or health issue this would cause them to have a harder time to fight off the contraction of something new. According to Urbancic et al. (2018), “These infections are associated with increased lengths of stay, costs and mortality, and are particularly concerning in units with a high burden of multidrug-resistant organisms (MROs), including methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant enterococci (VRE)” (p. 109).

The use of invasive devices in the intensive care unit is very common. Since the patients are considered critical, they generally need more medical attention and use of medical equipment. Some patients in the intensive care unit are intubated and hooked to a ventilator. A ventilator is a machine that breathes for the patients when they are unable to do so on their own. With this type of device bacteria could easily set up if the proper measures are not taken. If the

patients contract an infection from ventilator use their bodies may not be able to recover. If they cannot breathe on their own, then their ability to fight off any further illness is definitely going to be compromised.

When patients are hooked to these types of machines, the cords or lines leading to the patient can also be wiped using a CHG cloth (see Figure 2). Also, patients in the intensive care unit could have a peripherally inserted central catheter (PICC line) which is a more semi-permanent solution when patients need to have venous access for an extended period of time. According to Ajenjo et al. (2011), “Current guidelines recommend the use of PICCs when the anticipated duration of intravenous therapy exceeds 6 days” (p. 125) The PICC line has to have regular dressing changes to ensure that nothing enters the site. The site goes directly into the bloodstream and straight to the heart. If an infection is developed here it could cause the patients to become more critical than their already may be. According to Ajenjo et al. (2011), “Critically ill patients may have significant underlying diseases and other factors (multiple catheters, more frequent access of catheters, continuous infusions, etc) that make them more vulnerable to infection” (p. 128).

Figure 2

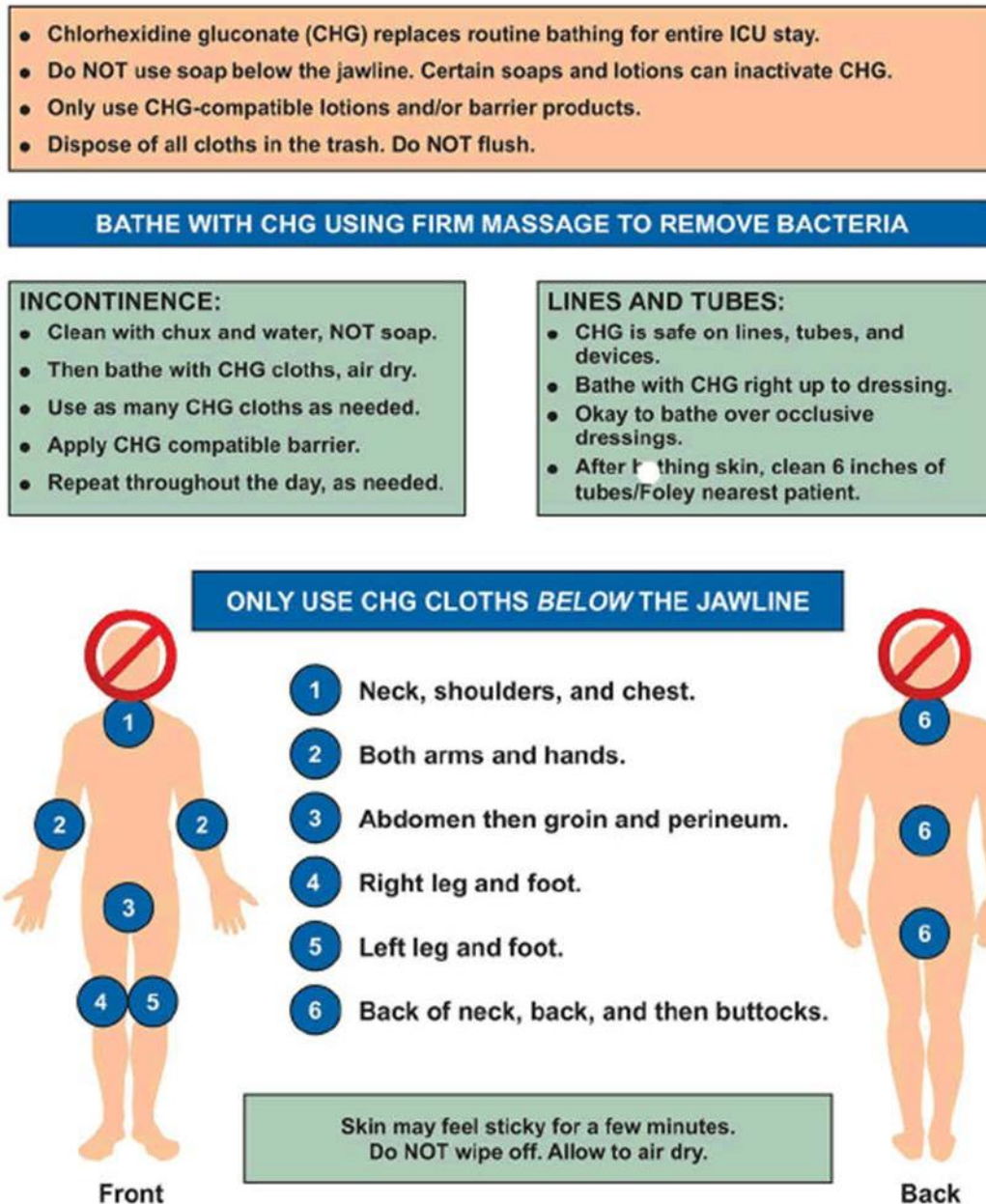


Figure 2 Universal ICU Decolonization, 2013

There have not been many studies done on PICC lines, but those that have been conducted have shown high infection rates. According to Ajenjo et al. (2011), “One hundred sixty-three PICC BSI episodes occurred in 162 patients who met the study criteria. One patient

had 2 separate infections caused by different microorganisms and related to 2 separate PICCs placed during a single hospitalization” (p. 127). These findings prove that the frequent changing of dressings using an antiseptic is needed. PICC lines are being placed to help reduce the infection rate but with the findings if the proper precautions are not being taken the change is having no positive effect.

According to Abbas and Sastry (2016), “Studies conducted in the ICU setting have also demonstrated these findings with one study showing a 51 % reduction in the acquisition of carbapenem-resistant *Acinetobacter baumannii* in patients bathed daily with CHG compared to those bathed with traditional soap and water” (p. 2). While being hospitalized patients are to be bathed at least once every 24 hours. By bathing with CHG instead of the traditional soap and water the microbial load on the patient’s skin is being reduced once every 24 hours. This allows for the barrier that CHG places on the skin to stay put to help keep the microorganisms that cause healthcare-associated infections away from the patients. According to Urbancic et al. (2018), “The use of unit-wide patients bathing with chlorhexidine gluconate (CHG) is an additional strategy that has been studied in ICUs to reduce health care-associated infections” (p. 109). When using the CHG on the patients in the intensive care unit their care is being upgraded because the staff is taking the proper precautions necessary to prevent them from contracting an infection on top of their critical illness.

It is important to know how healthcare acquired infections are calculated. According to Urbancic et al. (2018), “ICU-acquired incident cases of MRSA and VRE colonization or infection were defined as no previous history of MRSA or VRE, and an active surveillance culture or clinical specimen showing growth of MRSA or VRE was obtained more than 48 hours after ICU admission” (p. 110). This makes sense because if you have a history of an infection it

is possible that it was once counted as a healthcare acquired infection. If an infection was already once counted if it is counted again that may be considered a false accusation. Once patients contract a multiple drug resistance organism they may be susceptible to contracting the infection again.

There is a proper way to use CHG. This involves multiple steps and precautions. If the proper precautions are not taken, then the whole process could be useless. CHG should not be used above the jawline and the products that are used after a CHG bath need to be CHG compatible. If the products aren't compatible, then the soap will become inactive and lose its effectiveness. Once patients are given a CHG bath there is no need in using regular soap and water. Since CHG is an antiseptic it is replacing the need for normal bathing. After the use of CHG the patients need to air dry DO NOT dry using a towel. Located in Figure 2 is a list of key points of proper use of the CHG wipes. Located in Figure 3 are the steps and precautions that need to be taken when using CHG in an intensive care unit setting.

Figure 3

CHG Bathing Process—Key Points

- **Firmly** massage skin with CHG cloth.
 - Skin may feel sticky for a few minutes.
- Clean neck well even if it is not visibly soiled.
- The neck:
 - Commonly accumulates debris and moisture.
 - Is a high-risk area for contaminating lines.
- CHG replaces routine bathing:
 - Do NOT bathe with soap and water while using CHG.
 - Exception: hair and face washed per previous routine.
 - Avoid contact of shampoo and facial soap with body.
 - Shampoo and many soaps will inactivate CHG.
- Use CHG cloths after incontinence clean up.
- Do NOT rinse, wipe off, or dry with another cloth. Let air dry.
- CHG cloths have built-in moisturizers. Skin may feel sticky for a few minutes.
- If additional moisturizer is needed, use only CHG-compatible products.
- Certain lotions will inactivate CHG, ensure to check with manufacturer for compatibility.
- Dispose of leftover cloths.
- Do NOT save, reheat, or reuse.

Figure 3 Universal ICU Decolonization, 2013

CHG and Central Line Infections

Many people have intravenous fluids that run through an IV while hospitalized. This however is not always powerful enough for every patient. Some people need a central line placed because the medications being ran intravenously are too aggressive to be ran through an IV. In order for some medications to run a central line needs to be placed. A central line goes directly into a large blood vessel usually near the center of the body. According to Abbas and Sastry (2016), “Device-related infections account for about 25.6 % of all HAIs according to a national point-prevalence estimate” (p. 2). Central lines are used for a more temporary placement. Although they are temporary, central line-associated bloodstream infections (CLABSI) can occur. Since the device is going directly into the bloodstream this can pose major risk for the patients.

According to Abbas and Sastry (2016), “Of these, CLABSI have the most profound economic impact on the healthcare system. Multiple studies have established that daily CHG bathing leads to a significant reduction in bloodstream infections” (p. 2). With CLABSIs having such a major impact on the healthcare setting providing patients with CHG bathing allows them the protection that they need to help reduce their risk from acquiring a hospital acquired infection. The insertion site, catheter, and the hub should be cleaned with the CHG to help prevent the microbes from moving under the skin into the blood stream.

It was unknown for the longest time how blood stream infections occurred. According to Hadaway (2005), “Bacteria that attach to the catheter as it passes through the skin produce and encase themselves in biofilm a self-protective polymeric matrix. Bloodstream infection occurs when biofilm breaks away and floats freely in the bloodstream” (p. 20). When the site is not cleaned properly before insertion the microorganisms that cause infection attach to the biofilm. When CHG is continually used according to protocol while the catheter is in place, it helps prevent the further spread when the hub is used. According to Hadaway (2005), “Because microorganisms (including those from your skin) can be introduced each time you manipulate the catheter hub; minimize the number of times you handle the hub” (p. 20). If proper hygiene is not performed before each manipulation it could pose a major risk for infection to the patient. Hygiene should always be one the top priorities in a healthcare setting as it could cause potential harm to people interact with one another.

According to Urbancic et al. (2018), “An ICU-acquired positive blood culture specimen was defined as the first positive blood culture for various pathogens including MRSA and VRE obtained more than 48 hours after admission to the ICU” (p. 110). This information allows for the facility to determine if the infection was hospital acquired or community acquired. When it

is determined if the infection is hospital or community acquired, the medical staff will know if the blood stream infection was a result of cross contamination. It is possible for patients to acquire these types of infections out in the community. Knowing this information is useful because it could help prevent the spread of further infections. Even if the infection was not acquired by patients in a healthcare facility, if it is contracted by others located in the same facility it would be considered a healthcare-associated infection. This is because the patients that contracted this infection had the onset inside of a healthcare facility. This is one reason why hand hygiene between the treatment of patients is a vital step. No one wants their family members contracting an infection because of a healthcare worker being careless. Located in Figure 4 below is an example of how a positive blood culture is determined a healthcare associated or a community acquired infection. Located in Figure 5 is a list that summarizes the guidelines to using CHG to prevent CLABSIs.

Figure 4

Figure 5

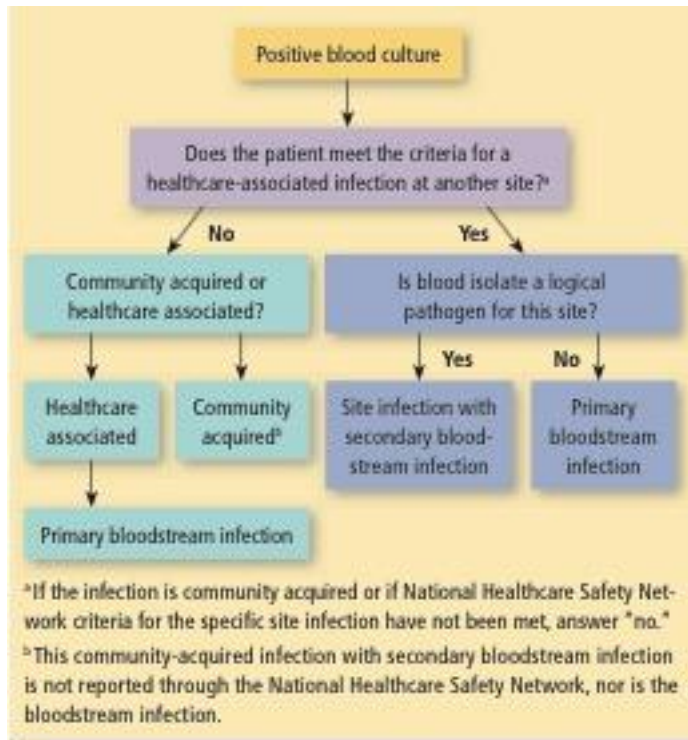


Figure 4 Boubekri, 2013

The guidelines are summarized as follows.

- Educate and train healthcare personnel who insert and maintain catheters.
- Use maximal sterile barrier precautions during central venous catheter insertion.
- Use a more than 0.5% chlorhexidine gluconate (CHG) skin preparation with alcohol for antisepsis.
- Avoid routine replacement of central venous catheters.
- Use antiseptic or antibiotic-impregnated short-term central venous catheters and CHG-impregnated sponge dressings if the rate of infection is not decreasing despite adherence to these strategies.

Figure 5 Boubekri, 2013

Showing the Effectiveness of CHG

The use of CHG the night before and morning of a procedure helps reduce the rate of surgical site infections. Even though CHG has been used for decades there is no mandated standard to the usage. A study by Graling and Vasaley (2013), "The results indicated a statistically significant ($P = .01$) overall reduction of infection in the group that received a 2% CHG cloth bath before surgery. There was also a suggested reduction ($P = .04$) in postoperative organ space infection, although the sample numbers were extremely small" (p. 549). This data shows that the use of CHG is beneficial to the patients' health. When patients are told to use CHG in their homes before surgical procedures there is no way to know if the proper methods were taken when the product was applied. This could cause issues with the findings of the

studies that are conducted using data from patients and their home use of CHG. According to Vanhoozer et al. (2019), “We found that only a minority of self-care patients was able to correctly verbalize the CHG bathing process, suggesting that a standardized and structured approach to patient self-initiated CHG bathing is needed” (p. 350). This shows in order to get accurate results for studies the usage of CHG needs to be supervised by a trained professional. If patients cannot correctly verbalize the bathing process, one can assume that the process is not being performed correctly. With that being said, studies done using the preoperative bathing at home could have false results. In order to get a more accurate result, patients need to be supervised with all applications. According to Vanhoozer et al. (2019), “The highest levels of CHG bathing compliance were observed in patients who were assisted by hospital staff during bathing” (p. 350). Knowing this information proves that patients may not understand the proper procedures to follow when instructed to perform a CHG bath.

According to Edmiston et al. (2010), “Its spectrum of activity against microbial pathogens appears to be similar to that of povidone iodine; however, unlike povidone iodine, CHG is not inactivated by blood or serum protein and exhibits a residual antimicrobial activity on the surface of the skin, suppressing microbial growth for several hours after application” (p. 510). If products like povidone iodine are inactive after they interact with blood or serum protein, then when performing a surgical procedure or cleaning the skin near a wound or device the skin would become contaminated. When the prepped skin is contaminated after the decontamination process was taken that step becomes pointless. By using CHG the patients do not have to worry about their skin coming into contact with these substances because if it happens the CHG will stay active. According to Viray et al. (2014), “Institution of daily chlorhexidine bathing in a surgical ICU resulted in a decrease in the acquisition of and infections

with *S. aureus*, including MRSA” (p. 247). With this information one can be assured that the use of CHG is effective at preventing the spread of MRSA in the intensive care unit setting. Patients being bathed every day in CHG can have a peace of mind that their chance of infection is being decreased. The last thing most people want to add to their medical history is that they acquired a healthcare associated infection or a surgical site infection. Infection prevention should be number one on any patient’s list at any time when he/she is receiving medical care. Located in Table 2 below is the information from a study proving the use of CHG is effective at reducing the spread of MRSA in an intensive care unit setting.

Table 2

Variable	Intervention (surgical) ICU ^a	<i>P</i>	Control (medical) ICU	<i>P</i>
Crude rate per 1,000 ICU-days				
Before intervention	1.96		2.19	
After intervention	1.15		1.05	
Change, %	−41.37		−51.95	
Time series model, β (95% CI) ^b				
Intervention	−0.90 (−1.40 to −0.40)	.001	−1.51 (−4.01 to 1.00)	.228
Adjusted MRSA colonization pressure	10.78 (5.41–16.15)	<.001	1.37 (−1.76 to 4.51)	.377
AR(1)	...		−0.57 (−0.91 to −0.24)	.002
AR(2)	...		−0.38 (−0.69 to −0.07)	.018
MA(5)	−0.36 (−0.62 to −0.11)	.005	...	
MA(9)	−0.30 (−0.53 to −0.08)	.009	...	
MA(10)	−0.31 (−0.57 to −0.06)	.017	...	
MA(12)	...		−0.93 (−1.00 to −0.86)	<.001
Constant	−0.13 (−1.33 to 1.06)	.822	2.32 (−0.18 to 4.82)	.068
Model parameters				
Adjusted R ²	0.42		0.70	
Durbin-Watson statistic	2.12		2.37	
Q(4)	...	.24	...	.28
Q(8)	...	.66	...	.54
Q(12)	...	.90	...	.40

NOTE. The inclusion of autoregressive (AR) and moving average (MA) terms in the model addressed serial correlation seen, as evidenced by the Durbin-Watson statistic and the Box-Ljung $Q(k)$ tests of the unadjusted model. AR(1), AR variable 1; AR(2), AR variable 2; CI, confidence interval; MA(5), MA variable 5; MA(9), MA variable 9; MA(10), MA variable 10; MA(12), MA variable 12.

^a Models are based on all available data for the surgical ICU (61 months, 2002–2007) and medical ICU (24 months, 2005–2007).

^b In the multivariate time series model, β indicates the magnitude and the direction of the variable in the model, whereas the *P* value and 95% CI indicate the precision and significance of the variable within the model.

Table 2 Viray, 2014

According to Edmiston et al. (2010), “The bactericidal effect of CHG is a result of the binding of the CHG cationic molecules to negatively charged bacterial cell walls and extramicrobial complexes” (p. 511). As the CHG is causing all of these reactions it is providing the patients skin with an invisible skin barrier to keep the microorganisms from returning. With this barrier in place the patients can have a little piece of mind that the precautions were taken with their safety being the main concern. Even though the patients have this barrier it can be disturbed if certain measures are not taken.

According to Edmiston et al. (2010), “Furthermore, the antimicrobial activity of CHG as measured by skin surface microbial log reduction persisted several hours after application compared with povidone iodine” (p. 513). Since CHG is longer lasting when the skin surfaces are tested this proves that CHG is more effective than the other skin disinfectants. The decolonization of the present bacteremia on the patient’s skin allows their skin to achieve a more sterile state. Located in Table 3 is evidence from a study comparing the effectiveness of CHG and Povidone-iodine in different types of surgical site procedures. Table 4 provides the results of skin cultures taken from patient’s pre-shower vs post shower. It shows the number of microbes that were found on the skin in time increments. The tables show evidence that CHG is more effective when compared to Povidone-iodine and bar soap. This study found that CHG was almost 2 times or more effective at removing the microbes. Most doctors would like their patients’ skin to be free of the bacteremia to ensure their safety. When patients receive medical care, they are trusting the providers with their lives. In order to achieve and keep the trust the medical providers have to ensure that they are taking whatever steps are necessary to keep the patients out of harm’s way.

Table 3

* $P < 0.025$ versus povidone-iodine/povidone-iodine and < 0.001 versus medicated soap/povidone-iodine.

involved both sites. No significant differences in infection rates were observed among the shower and scrub groups when either overall or surgery-specific rates were compared. The number of patients studied in each group was small and rates of site-specific wound infection were expectedly low. The rate of subsequent wound infection in patients with positive intraoperative cultures was almost twice that of patients with negative cultures (6.8% *v* 3.8%).

The efficacy of chlorhexidine gluconate as a skin disinfectant is well recognized. Other studies have shown marked reductions in transient skin flora with chlorhexidine washes or scrubs similar to those that were observed in the present study.¹⁵⁻¹⁷ These evaluations have shown that the antimicrobial effect of chlorhexidine is long-lasting and is enhanced when more than one application is used.¹⁷ Patients who participated in the present study showered with four applications of the disinfectant solution and an antimicrobial effect was observed for longer than 11 hours.

In a previous report, we noted a strong epidemiologic association between positive intraoperative wound

Table 3 Garibaldi et al., 1988

Table 4

* Mean log colony count.

**TABLE 6
COMPARISON OF INTRAOPERATIVE
CULTURE RESULTS AMONG THE THREE
TREATMENT GROUPS**

Shower/Scrub	% Positive
Chlorhexidine-chlorhexidine*	4%
Povidone-iodine/povidone-iodine	9%
Medicated soap/povidone-iodine	15%

the incision site. The combination of a chlorhexidine shower and scrub is also more effective than the other regimens in preventing extrinsic intraoperative wound contamination. In this study, the relatively small number of cases and low rates of infection associated with each surgical procedure did not permit us to evaluate differences among groups in this outcome parameter. However, our study was not designed with sufficient power to

Table 4 Garibaldi et al., 1988

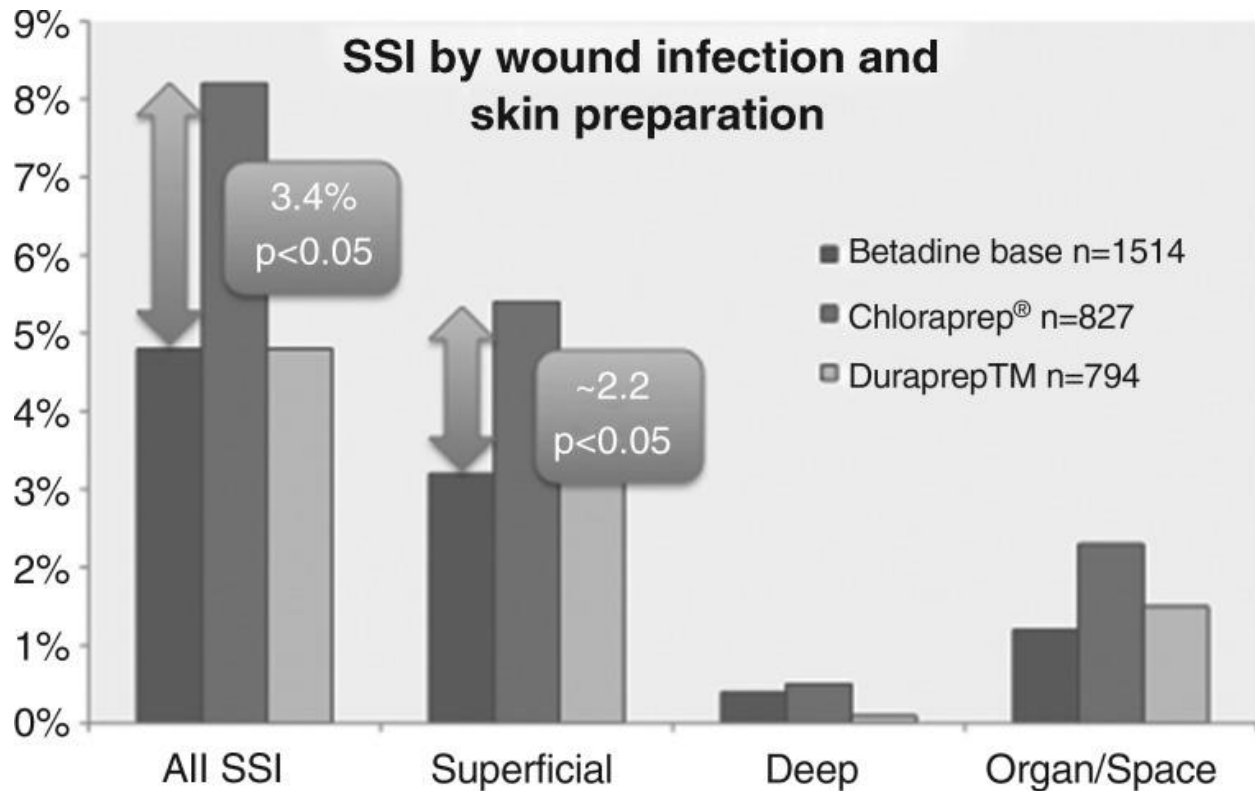
According to Kassakian et al. (2011), "In this quasi-experimental trial, which included over 70,000 patients-days, the use of daily CHG bathing was associated with a 64% relative reduction in the primary composite outcome of MRSA and VRE HAIs" (p. 241). With a reduction rate of over half the use of CHG is proving to be effective at preventing infections. Patients can encounter many obstacles while hospitalized and infection is not something that they want to endure while trying to get back to their healthy state.

Although many studies show that CHG is the best antiseptic to remove the flora from the skin, others show that there is no difference between the use in the use of CHG and other products. In Table 5 below is a graph that shows the effectiveness of skin preparation over an 18-month period at University of Virginia. This table provides the findings of a study of the effectiveness of CHG Iodine and alcohol-based products. This study showed that CHG was the

least effective when compared with iodine and alcohol-based products. This study may not be as accurate as some may hope due to the other factors that also contribute to the risk of surgical site infections. More evidence is needed to prove that the iodine-based products are more effective. As stated, before iodine-based products become inactive at the presence of blood or serum protein. If this is the case, why did this study prove that iodine-based products were better than CHG? During the procedures performed how did the staff prevent these products from being exposed to the patient's skin? It would be nearly impossible to prevent these products from coming into contact. During any type of invasive procedure blood or serum protein products are present due to the incision made into the skin.

Hranjec et al. (2010) found "After primary closure, incision sites usually are covered with a sterile dressing for 24–48 h in order to allow formation of a scab between the approximated skin edges" (p. 292). CHG is said to continue to be effective up to 24 hours after the application. CHG should continue to protect the patients even after the surgical procedure has ended. When the bandage is applied after a surgical procedure blood can still seep to the surface of the skin. If this happens and iodine-based products were used a surgical site infection may occur. Since CHG is still active up to 24 hours after the use it may be less likely to see an infection occur in patients that use this method of antiseptic. The information provided by this study seems unreliable due to the previous research.

Table 5



Resistance

Some people have feared that the use of CHG on skin may cause antimicrobial resistance. Antimicrobial resistance is when a germ can grow and the drug that normally would kill it off no longer works. According to Edmiston et al. (2010), “Although the widespread use of CHG in both clinical and commercial applications has led to a growing concern about the emergence of microbial resistance, a study involving more than 1,100 gram-positive and gram-negative clinical isolates, including strains of methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant enterococci, showed a low incidence of resistance among clinically significant strains, with no isolates expressing high-level resistance to CHG” (p. 511). Even though CHG helps kill off the flora of the skin, there has been no evidence of antimicrobial resistance.

CHG helps inhibit the environment that infections feed on for growth. According to Abbas and Sastry (2016), “Multidrug resistant organisms (MDROs) such as MRSA, vancomycin-resistant *Enterococcus* (VRE), and certain gram-negative bacilli represent a major challenge due to their high virulence and resistance profiles” (p. 2). Due to resistance of these microorganisms if the patients contract this infection it will cause longer hospital stays and other complications along the way. By using the practice of CHG these microorganisms are being removed from the skin before they cause any harm. These events are not part of patients’ plans when they enter a healthcare facility for whatever the reason may be.

According to Edmiston et al. (2010), “Current findings suggest that microbial resistance to CHG appears to be relatively low, especially among clinically significant gram-positive and gram-negative isolates associated with postoperative SSI; however, microbial resistance requires periodic surveillance” (p. 511). The steps taken to prevent healthcare-associated infections are important not only for the patients but also for the hospitals. Infections spread throughout healthcare facilities and rapidly. It is the staff’s priority to help the patients recover not cause more issues to arise. According to Abbas and Sastry (2016), “The most recent CDC guidelines for the prevention of SSIs support the use of antiseptics” (p. 2). It is important that everyone adopts the same guidelines when it comes to preventing infections. Also, according to Abbas and Sastry (2016), “Several studies have evaluated the impact of CHG bathing on skin decolonization on the rates of HAIs; a reduction in skin carriage of coagulase-negative staphylococcus, MRSA, and VRE has been observed in multiple studies” (p. 2). The more infections that are contracted the more likely it is for them to be passed throughout a facility. By practicing the use of CHG the patient’s safety is being protected.

According to Şimşek and Duman (2017), “Inappropriate usage of antiseptics and disinfection substances accelerates the process of resistance to these agents” (p. 234). This could possibly cause issues if patients are regularly using the soap at home or if they are admitted to the hospital for an extended period of time. There have been studies conducted that prove the combination of CHG and 1,8-cineole are more effective to preventing infections that have become resistant to CHG alone. Even though it is not common for microorganisms to become resistant to CHG it is good to have a backup method in the event this occurs. According to Şimşek and Duman (2017), “Eucalyptus oils (EO) and its main component 1,8-cineole are thought to act on the plasma membranes, the same target of CHG” (p. 235). Since both chemicals act on the same target it is believed that they can synergistically work together. If the bacterium becomes resistant to just CHG they believe that by adding 1,8-cineole that the two products combined can break down the plasma membranes once again. By performing this method, it is believed that once again skin antiseptics can once again be achieved. According to Şimşek and Duman (2017), “The results showed that CHG combined with 1,8-cineole demonstrated synergistic antimicrobial activity in some of the tested microorganisms” (p. 235). With these results it can be assumed that the two products can work together to further eliminate microbes from the skin. Even though CHG may not be the most favorable method when it comes to preventing antimicrobial resistance it still shows an overall reduction in the cases that are seen. Located in the Table 6 below are the results of Şimşek and Duman’s study using 1,8-cineole and CHG.

Table 6

Microorganisms (C + CHG)	MIC of C* (g/l)-CHG (mg/l) in combination/alone	FIC of C and CHG	FICI	Results
<i>Staphylococcus aureus</i>	8/128-0.25/4	0.062-0.062	0.125	Synergy
MRSA	8/128-0.125/4	0.062-0.031	0.053	Synergy
<i>Pseudomonas aeruginosa</i>	8/256-2/4	0.031-0.500	0.531	Indifference
<i>Escherichia coli</i>	4/32-0.125/2	0.125-0.062	0.187	Synergy
<i>Klebsiella pneumoniae</i>	8/64-1/8	0.125-0.125	0.250	synergy
<i>Enterococcus faecalis</i>	32/128-0.125/4	0.250-0.125	0.375	Synergy
<i>Candida albicans</i>	4/32-0.5/2	0.125-0.250	0.375	Synergy

*1,8-cineole. CHG: Chlorhexidine gluconate; MRSA: Methicillin-resistant *Staphylococcus aureus*; FICI: FIC index; FIC: Fractional inhibitory concentration; MIC: Minimum inhibitory concentration

Table 6 Şimşek and Duman, 2017

Risks of CHG

Just like many other products there are risks when it comes to using CHG. Some people may be allergic to the solution or show some type of reaction. If this happens, they will not be able to use CHG to prevent infections from occurring. According to Ziady (2012), “Reported side-effects include mainly transient reactions (contact dermatitis and photosensitivity), toxicity (inadvertent application to the inner ear via perforated tympanic membranes), and rarely, hypersensitivity” (p. 46). CHG can cause the skin to become very dry. The contact dermatitis could cause a rash and itchiness where the product was applied. According to Ziady (2012), “One study found that 58% of 111 tested workers developed chlorhexidine contact dermatitis to soaps, while use of alcohol-based cleansers was not associated with dermatitis” (p. 46). Over half of the workers developed some type of contact dermatitis this could have been a result of constant use. Since CHG can cause dry skin the constant use might trigger a rash. If staff members were to wear gloves when assisting patients on the use of CHG it may help reduce the number of contact dermatitis cases.

According to Sievert, Armola, and Halm (2011), “Chlorhexidine gluconate must be allowed to dry on the skin before a dressing can be placed to prevent an adverse skin reaction” (p. 169). If this step is not taken it could cause a reaction to occur in patients that are not truly

allergic to the product. The steps need to be taken properly to ensure that the patients are truly having an adverse reaction. By doing this it will ensure that every patient possible is being protected by the barrier that CHG places on the skin. According to Sievert, Armola, and Halm (2011), “However, rare reports of anaphylaxis and extreme allergic reactions exist. More serious adverse effects reported are related to accidental application of chlorhexidine gluconate to an organ or mucous membranes” (p. 169). Although these reactions are rare, they can be very serious. CHG should only be applied externally. Do not directly wipe a wound using CHG only wipe the skin around the open wound. Everyone who uses CHG should read the warning label and take the proper precautions if any of the events listed occur. Located in Figure6 is an example of a warning label located on a bottle on CHG that is commonly used. The label includes active ingredients, uses, warnings, directions, other information, inactive ingredients, and a number to call if you have any questions.

Figure 6

NDC 0234-0575-04

HIBICLENS®
(Chlorhexidine Gluconate solution 4.0% w/v)

Antiseptic/Antimicrobial Skin Cleanser

HIBICLENS® prevents skin infections thereby reducing the risk of cross-infection. HIBICLENS® has antiseptic activity and a persistent antimicrobial effect with rapid bactericidal activity against a wide range of microorganisms.

MÖLNLYCKE® HEALTH CARE

4 Fl.oz. (118 mL)
Distributed by Mölnlycke Health Care US, LLC
Norcross, GA 30092

Drug Facts
Active ingredient Purpose
Chlorhexidine gluconate solution 4.0% w/v Antiseptic

Uses

- antimicrobial skin cleanser helps reduce bacteria that potentially can cause disease
- for skin wound and general skin cleansing
- surgical hand scrub
- healthcare personnel handwash

Warnings
For external use only

Do not use

- if you are allergic to chlorhexidine gluconate or any other ingredients in this preparation
- as a patient preoperative skin preparation of the head or face
- in contact with the meninges
- in the genital area
- on wounds that involve more than the superficial layers of skin

Drug Facts (continued)
When using this product

- keep out of eyes, ears, and mouth. May cause serious and permanent eye injury if placed or kept in the eye during surgical procedures, or may cause deafness when instilled in the middle ear through perforated eardrums.
- if contact occurs in any of these areas, rinse with cold water right away

Stop use and ask a doctor if irritation, sensitization, or allergic reaction occurs and lasts for 72 hours. These may be signs of a serious condition.

Keep out of reach of children. If swallowed, get medical help or contact a Poison Control Center right away.

Directions

- use with care in premature infants or infants under 2 months of age. These products may cause irritation or chemical burns.
- **skin wound and general skin cleansing.** Thoroughly rinse the area to be cleansed with water. Apply the minimum amount of the product necessary to cover the skin or wound area and wash gently. Rinse thoroughly.

Drug Facts (continued)

- **surgical hand scrub.** Wet hands and forearms with water. Scrub for 3 minutes with about 5mL of the product with a brush. Rinse thoroughly under running water. Repeat. Dry thoroughly.
- **healthcare personnel handwash.** Wet hands with water. Dispense about 5mL of the product into cupped hands and wash in a vigorous manner for 15 seconds. Rinse and dry thoroughly.

Other information

- store between 20-25°C (68-77°F)
- avoid excessive heat above 40°C (104°F)

Inactive ingredients fragrance, gluconolactone, isopropyl alcohol 4% w/v, lauramine oxide, poloxamer 237, purified water and red 40

Questions? 1-800-843-8497

Lot number and expiration date printed on bottom of container.
Laundering/Cleaning Instructions: Chlorhexidine gluconate skin cleansers will cause stains if used with chlorine releasing products. Rinse completely and use only non-chlorine detergents. See website for more details. www.hibiclens.com

26000-09-MHC

7 332551 065690

Figure 6 Hibiclens n.d.

Operating Rooms and CHG

According to Gaines et al. (2017), “While the standard practices may vary slightly depending on the institution and clinical situation, maintaining an aseptic operating room environment generally focuses on environmental cleaning, hand hygiene, pre-operative skin preparation for the patient, surgical attire, and general technique while working in a sterile field” (p. 504). During a surgical procedure everything is supposed to be sterile. If something that is not sterile is placed in the room this could cause a major infection. This proves that you need to use CHG to help sterilize the skin. Once someone enters sterile field he/she has to stay “sterile”. If a person leaves a sterile room, he/she must scrub in once again to reenter. Leaving and reentering the sterile field too many times poses a higher risk for infection. To maintain good health all precautions need to be taken in order to prevent an infection from occurring.

Breaks from the sterile field are classified by types. According to Gaines et al. (2017), “Breaks in sterile technique and microbial contamination in the operating room are categorized into four types based on how quickly the event is recognized. Type 1 break is caught immediately. Types 2 and 3 are recognized progressively later. A type 4 break is not recognized at all by the operating room team” (p. 504). It is important that the break is noticed by the staff so that the proper precautions are taken to reenter the sterile technique. Breaks are not ideal, but everyone is human, and it can happen. Many different events can contribute to a break in sterile technique. This could deal with the instruments used, personal hygiene of healthcare workers, or the hygiene of the patients. According to Gaines et al. (2017), The most common breaks in sterile technique are with pre-operative instrument sterilization, placement of sterile instruments onto a designated sterile field, hand washing and drying, gloving, gowning, draping, cleansing of

the incision area, and general surgical technique” (p. 505). Ensuring that sterile technique is always used is up to the operating staff. The staff has to be 200% accountable. When someone is 200% accountable, they are not only accountable for themselves but also the others around them. If someone is not following proper precautions, they need to be held accountable for their actions.

According to Webster and Osborne (2015), “Use of a skin antiseptic on consecutive days not only reduces microbial counts from baseline measurements, but also reduces the counts progressively over time” (p. 5). In the operating room sterile technique is the utmost concern of all the staff. The last thing that any healthcare worker wants to do is cause an infection in their patients. According to Barnes (2015), “In many ORs, a primary focus of SSI prevention programs is decolonization of the patient’s skin and nose because *Staphylococcus aureus* (*S. aureus*) is responsible for the majority of SSIs” (p. 10). This proves that the main concern of healthcare workers is the patient’s health. It is believed that this is not always the case. According to Gaines et al. (2017), “Chlorhexidine gluconate and povidone-iodine are the two most common aqueous scrubs, and washing is performed in a systematic manner to prevent back contamination” (p. 504).

According to Barnes (2015), “After the patients is moved into the OR, preoperative surgical skin prep solutions are used to continue skin decolonization” (p. 10). If these workers take this extra step to help prevent infection, then the patients should take the time to use chlorhexidine gluconate before a procedure. According to Gaines et al. (2017), “Even with best practices to maintain sterility, it is impossible to eradicate all bacteria from the operating room”

(p. 505). Surgical site infections are not something anyone wants to contract. CHG soap and wipes can help prevent the startup of this issue.

According to Gaines et al. (2017), “In recent years, plastic adhesive skin barriers to protect against wound infection have gained popularity with the intent to prevent contamination of the surgical incision by the skin microbiota” (p. 504). This practice can help prevent further contamination while operating. Since CHG should not be directly applied to mucus membranes microorganisms may still be present in the open wound. If CHG is not used on the sites, then it could be possible that the microorganism from the wound could migrate to the surgical incision. It is the best practice if the open wound is covered.

While in the operating room the staff and patients must be properly dressed in what is considered sterile attire. According to Gaines et al. (2017), “The National Guideline Clearinghouse and the US Department of Human and Health Services published 12 recommendations for operating room personnel regarding the maintenance of sterile technique. Surgical gowns, gloves, and drapes should be used in the operating room, and sterile technique should be applied once gowned and draped” (p. 504). Also, according to Gaines et al. (2017), “Plastic adhesive drapes are placed over the incision site to protect the open incision from migrating skin bacteria adjacent to the surgical site” (p. 504). The drapes are providing the patients with an extra layer of protection on top of all the other precautions that are taken. The attire that is worn by staff and patients must be hospital laundered. Hospital laundered attire is heated to a certain point to make sure all of the bacteria that has attached to the laundry is killed. According to Christian, Manchester, and Mellor (1983), “Many hospitals follow the recommendations of the American Hospital Association or state requirements by maintaining

wash water temperatures at 71°C (160°F) or higher” (p. 591). With this information it is vital that along with the hospital required attire that CHG is used in the event that the attire was not properly cleaned.

Another issue in the operating room that could cause an infection is the length of surgery. The longer that patients lay on the operating table the risk of infection becomes higher. According to Cheng et al. (2017), “Pooled analyses demonstrated that the likelihood of SSI increased by close to twofold in surgeries exceeding operative cutoff times of one, two, three, or four hours, and close to threefold in surgeries exceeding five hours” (p. 725). The operating time depends on many different factors. According to Cheng et al. (2017), “There are many parameters that can impact operating time, including pre-operative planning, surgeon experience, surgeon fatigue, operating room staff experience, and access to equipment” (p. 731). While these issues may not be in the patients control the use of skin antiseptics are. By taking the step of using CHG the patients are providing themselves with an extra barrier to help in the event that a surgery takes longer than planned.

According to Cheng et al. (2017), “Nevertheless, given the importance of SSIs on patient outcome and health care economics including hospital reimbursement penalties, hospitals should focus efforts to reduce operative time”. Although these are good points of why surgical site infections should be avoided the main concern should be the patient’s outcome. Making sure he patients are properly prepped should be the upmost concern.

Conclusion

According to Gaines et al. (2017), “From the very beginning of antisepsis and surgical infection control, the primary focus has been microbial eradication” (p. 505). The effectiveness of CHG is a vital piece of the preoperative process, device placement process, and part of the ICU standard. If everyone would elect to take this step, then thousands of dollars could be saved. According to Barnes (2015), “There is ample evidence that dual agent skin prep solutions (i.e., those that combine alcohol, plus either iodine or chlorhexidine) are more effective than single agent prep solutions (e.g., povidone- iodine)” (p. 10). With this evidence the patients should see the positive effect of using this method of preparation. Patients are told to use this process to help ensure their safety throughout their procedures or hospital stays.

According to Edmiston et al. (2010), “The value of CHG as an effective perioperative skin antiseptic agent has been well documented in both the medical and surgical literature” (p. 513). Regardless of what type of surgical procedure is being performed, or if the patients just need their skin prepped for other reasons, the use of chlorhexidine gluconate will help patients prepare their skin and reduce the chance for infection. By decontaminating the surface, the spread of infection is minimized. According to Webster and Osborne (2015), “A number of bacteria are present on the skin for a short period due to transfer from other people or the environment, and these constitute the ‘transient flora’” (p. 5). Knowing that that so much bacterium live on the surface of the skin should help patients make the choice to use CHG to help prevent the spread of infection.

If the decontaminating process is skipped, the patients are at a higher risk for contracting a healthcare-associated infection. The patient’s safety is always the biggest concern of the healthcare workers, and that is why they strive to get their patients to perform this method to try

and save them from the trouble of contracting a surgical site infection. The microbes need to be removed from the skin before an invasive procedure to help reduce the microbial load located on the skin. By applying CHG this can be done and help prevent the start of a healthcare-associated infection or surgical site infection. The best protocol for using CHG is going to be determined by what the use is for. For each invasive procedure the medical staff may have a different method that they want to be used. Following the instructions is the best way to perform the task, but any amount of use would be beneficial.

After reviewing all the information collected it seems that CHG is effective when preventing infections. It may not be the number one choice for every medical provider, but the numbers do show a high reduction rate in infections if this method is used. Although some evidence shows that CHG is not effective at preventing healthcare acquired infections or surgical site infections not enough evidence has been provided to prove that theory. A healthcare-associated infection or surgical site infection is not what people are expecting to come home with, but if the proper precautions were not taken it may just be a parting gift from the hospital. In order to prevent these infections from occurring patients should take the extra time out of their day to help. Everyone should take initiative and be a part of their own medical care. By doing this you are ensuring that the proper methods are taken to their knowledge. If an infection occurs than they know everything was done to prevent one. Not every precautionary measure can be taken by the medical staff it takes a team to prevent infections and that team includes the patient!

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