

Practical Recommendations for Preoperative Skin Antisepsis

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Abstract

The search for strategies for the reduction of Surgical Site infection (SSI) is a priority, given the impact those infections have on the outcome of the patients. The preoperative patient skin antisepsis, has recently gained greater significance in the prevention of SSI, as one of the critical factors, which can be intervened and can reduce the risk of infection. In recent years, comprehensive investigations have been published, not only dedicated to the comparison of antiseptic solutions, application techniques, but also about the importance of preoperative washing, use of surgical tapes and dressings impregnated with antiseptics, and preoperative shaving. This review outlines the key findings related to the preoperative patient's skin antisepsis and offers a protocol with practical recommendations to be implemented in the institutions of our country. It provides evidence based recommendations about the use of antiseptic solutions (povidone iodine, chlorhexidine, chlorhexidine plus alcohol, etc.) with emphasis on the advantages and disadvantages of each one.

Keywords: Preoperative care, disinfection, Anti-Infective agents, Surgical Wound Infection

Introduction

Since the publication in 1867 by Lister about the practice of antisepsis with carbolic acid (phenol) to the present day, the decrease in surgical site infection (SSI) is a subject of great interest, given the impact it has on the outcomes of patient care^{1,2}. Each case of SSI in a patient is associated with a 7 to 10 day increase in length of hospital stay, increased risk for requiring intensive care management, readmission to a hospital, and death (2 to 11 times). In addition, the attributable costs are estimated between \$3,000 and \$29,000 USD, depending on the surgical procedure, country and type of causative microorganism⁵.

Approximately 30 million surgeries are performed annually in the United States, and despite the measures taken in pre-surgery care, between 300,000 and 500,000 patients present SSI⁶. In Bogota, according to the District Health Secretary, SSI

is the most frequent cause of health care associated infections (HAI) (25.8% of all HAI reported). In other reports this percentage varies between 2.6% and 13.8%⁸⁻¹². The picture grows more complex given the fact that many times these infections are associated with the presence of resistant germs, which makes appropriate antibiotic therapy difficult; In a cohort study by Weigelt et al. Patients presenting with methicillin-resistant *Staphylococcus aureus* (MRSA) had a higher mortality rate (1.4% vs 0.8%, $P = 0.03$), hospital stay (median 6 vs 5 days, $P < 0.0001$), and higher hospital costs (\$ 7,036 vs. \$ 6,134 USD, $P < 0.0001$). Alvarez et al. Described the circulation of community acquired MRSA in five hospitals in Colombia, mainly through bacteremia and SSI, also associated with a higher mortality rate¹⁰.

It is now known that the pathogenesis for the development of an SSI depends on a complex relationship between a number of intrinsic and extrinsic risk factors such as the type of

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wound, inadequate antibiotic prophylaxis, surgical time inadequate hair cutting prior to surgery, virulence of the microorganism, concomitant infections, previous colonization, perioperative residence time, hand washing and antiseptic preparation of the skin prior to the procedure, perioperative hypothermia, among others (Table 1)¹⁴.

Therefore, the World Health Organization with its strategy "Safe Surgery Saves Lives" and, other scientific institutions have tried to establish recommendations to minimize the risk of SSI by the intervening in modifiable associated factors prioritizing those with the greatest impact¹¹⁻¹³.

As an example, the Surgical Care Improvement Project recommends the follow-up of 6 outcome and process indicators to reduce SSI: prophylaxis pre-surgical antibiotics (time of administration, antimicrobial selection and duration of the antimicrobial), glucose control, adequate hair removal and normothermia in colorectal surgery^{14,15}.

On the other hand, one of the points that has become relevant in the prevention of SSI is the pre-surgical preparation of the skin of the patient as one of the factors in which it is possible to intervene and reduce the risk. Over the past few years' exhaustive reviews have been devoted not only to the comparison of antiseptic solutions and their application technique, but also to the importance of the pre-surgical baths, the use of tapes and surgical compresses impregnated with antiseptics and shaving (pre-surgical hair trimming)¹⁵⁻²¹.

The aim of the preoperative preparation of the patient's skin is to reduce the risk of SSI by reducing microorganisms in the skin flora for the longest possible time and causing the least irritation. The most relevant aspects of this preparation are described in a practical way as follows, to update and unify the practice in our context. This paper emphasizes those recommendations with a strong recommendation

level in the literature, although they are taken from different sources, they were unified based on the classification proposed by Anderson DJ et al²². Briefly, the strength of the recommendation ranged from A to C, A being a recommendation with a good level of evidence, B moderate and C with poor evidence to support its use. Regarding the classification of the quality of evidence, I is used when controlled randomized double-blind studies or meta-analyses were found; II for well-designed clinical studies without randomization, analytical studies (cohorts and cases and (cohorts and cases and controls), time series, among others; III when based on clinical experience, descriptive studies or expert committees (Table 2).

Recommendations

A. Before entering the surgery room

1. Either at home or in the hospital, the patient must follow the preoperative orders of surgeon.
2. It is recommended that the surgeon orders the patient to take a bath or shower with antiseptic the night before surgery and / or the morning of surgery (grade C II)^{16,17,23}. In this regard, there is controversy about its effectiveness in reducing the SSI rate in all types of surgical procedures. The systematic review by Webster and Osborne^{17,23} evaluated 7 controlled studies involving 10,157 patients did not find a statistically significant difference in favor of the general use of this practice (RR (Relative Risk) 0.91 (95% confidence interval (CI) 0.80 - 1.04), this revision met most of the validity criteria, but including randomized studies with high risk of bias, when a sub analysis of the best quality tests was performed, no statistically significant difference was found with this strategy RR 0.95 (95% CI 0-82-1.10). This reason, the authors of this study conclude that there is no conclusive evidence of the benefit of the preoperative bath with chlorhexidine compared to other products for washing, such as normal soap for SSI prevention; However, this measure could be useful in reducing the rate of colonization by resistant germs for whom conventional cefazolin prophylaxis would not be adequate, especially in patients with prior hospitalization. It should be noted that frequent colonization of community acquired MRSA in of healthy individuals with is each time more frequent, thus it is not easy to predict such colonization. In recent studies conducted in Colombian hospitals, it was found that up to 33% of skin and soft tissue infections in the community and even SSIs were produced by this microorganism. The above criteria would justify this behavior in our usual practice, especially in clean surgeries, in which the previous decolonization for SSI (e.g. cardiovascular surgeries)¹⁸ has a greater impact (Degree of recommendation C III)

In the case of recommending pre-surgical washing, both the CDC (Centers for Disease Control and Prevention) and AORN (Association of Periodic Registered Nurses) recom-

Table 1. Risk factors for developing operative site infection

Patient Related	Procedure Related
Age	Length of surgical wash
Alcoholism	Skin antisepsis
DM Type 2	Skin preparation
Hypoalbuminemia	Length of operation
Immunosuppression	Antimicrobial prophylaxis
Nutritional status	Ventilation of OR
Infection at remote site	Lack of adequate sterilization of surgical instruments
Microorganism culture (specially <i>S. aureus</i>)	Surgical drainage
Length of prep stay	Surgical technique
	Poor hemostasis
	Deed space
	Titular trauma

(Adapted by Mangram A, Horan T, Pearson M Et al. Guideline for Prevention of Surgical Site Infection. 1999 Vol 20 N4: 247-278)

Table 2. Strength of the recommendation and quality of evidence

Strength of recommendation	
A	Good evidence to support a recommendation
B	Moderate evidence to support a recommendation
B	Poor evidence to support a recommendation
Quality of evidence	
I	Evidence > 1 appropriate and controlled randomized study or target analysis.
II	Evidence of well-designed clinical trial Not randomized, analytical studies (cohorts, cases and controls), time series, amongst others.
III	Evidence based on clinical experience (expert opinions, descriptive studies or expert committees)

Taken and adapted from DJ, Kaye KS, Classen D, Arias KM, Podgorny K, Burstin H, et al. Strategies to prevent surgical site infections in acute care hospitals. *Infect Control Hosp Epidemiol.* 2008 Oct;29 Suppl 1:S51-61

mend the use of a soap with Gluconate 4% chlorhexidine (GCH) or 2% HCG-impregnated compresses, due to their residual effect, which is higher than iodopovidone^{6,21} (Degree of recommendation B II). The higher benefit for this measure is obtained when the procedure is done twice before admission (e.g. the previous night and in the morning of the surgical procedure) and when the application is properly documented and explained to the patient (Table 3).

Recently Edmiston CE et al. found that when the application of 4% HCG is duplicated and there is a one minute pause before removal, the highest concentrations of HCG (16.5 pg. / cm²) are sufficient to inhibit bacterial growth²⁵.

For patients who are going to undergo head surgical procedures the use of 2 previous baths with 4% chlorhexidine shampoo is recommended. However, precautions should be taken to avoid contact with the eyes and other mucous membranes.

3. The patient should be questioned about allergies to materials used in the surgical procedure (latex, antiseptic solutions, especially those containing iodine and those associated with latex).

4. The patient should be advised not to shave the surgical site the night before or in the morning of surgery. The best available study to give a recommendation on this topic is a systematic review of "The Cochrane Library" which includes 11 randomized controlled trials, three trials that gathered 625 patients compared hair removal using depilatory creams or machines with no hair removal, found no difference in the groups in SSI events, three tests with 3193 people compared shaving with a shaving machine and trimming, finding a greater risk of SSI in the first one with a statistically difference (RR 2.02, 95% CI 1.21-3.36), seven clinical studies involving 1213 people with shaving and hair removal with depilatory cream found more risk of SSI in shaved patients (RR 1.54, 95% CI 1.05 - 2.24) (Grade A 1 recommendation)²⁶. A recent update of this meta-analysis included 19 studies and confirmed not only the lack of benefit of depilation in reducing SSI, but removal of machine hair or chemical depilation compared to shaving has a lower risk (RR 0.55 95% CI 0.38-0.79; RRO.60, IC 95% 0.36-0.97, respectively) (Grade of recommendation A 1)²⁷.

5. Advise the patient not to apply any make-up or to remove it if using it. Prior nail cutting should be recommended in hands and feet surgeries as well as the removal of artificial nails or nail polish.

B. In the operating room:

1. Pre-surgical antiseptic hand washing (hand hygiene) for 2-5 minutes, per the recommendation Of WHO (28) (Figure 1) and the use of sterilized gloves by health personnel involved in both the preparation of the skin and the surgical procedure.
2. The surgeon should check the skin to identify dirt or debris, check for and report on the presence of nevus, warts or other skin alterations. The effectiveness of antiseptics on the skin depends on the cleansing of the skin; The removal of debris, organic material and transient flora prior to the application of the antiseptic reduce the risk of wound contamination.

The night before admission to the hospital or the clinic	Remove jewelry or external material (such as a piercing) located in the area where the procedure is to be performed. Place half the volume of the soap solution with 4% chlorhexidine in a compress and apply the solution throughout the body, neck down, especially in the groin, forearms and genital area, keeping the solution one minute. If you experience any burning sensation or skin irritation, wash immediately and do not apply again. Avoid contact of the solution with eyes, ears and mouth. If you accidentally come into contact with any of these sites, wash immediately for 15 minutes. Repeat the process a second time, waiting at least one minute to rinse and remove the soap scum from the skin. This process is necessary to diminish the possible irritation of the skin. Follow the skin with a clean dry towel. Do not apply lotions or deodorants after bathing with the antiseptic, although they may inactivate the antiseptic effect of chlorhexidine. After the bath, wear clean clothes or pajamas. 8. An alternative to ban ° with chlorhexidine is to perform a proper cleaning in shower with soap and water.
The morning prior to admission to the hospital or clinic	Repeat the process described above Important: Do not shave the night before or the day of the surgery; increases the risk for infections.

- Some areas may have more debris than others (e.g. the navel, behind the nails or subungual region, foreskin, among others). The cleaning of these areas separately from the preparation of the surgical site prevents the distribution of microorganisms from those areas to the surgical site, so it should be done obligatorily when these areas are involved in the surgical field.
- If there is a urinary or intestinal stoma in the surgical field, it must be cleaned separately from the rest of the preparation of the skin. The products made of povidone iodine are inactivated with the presence of organic material.
- Cleansing the skin prior to antiseptic preparation for surgery was more effective in reducing the bacterial load than using only the antiseptic application ^{21,29}). However, Lefebvre et al. Performed a review and meta-analysis (7 studies with 1650 patients) in order to evaluate the advantage of applying a thorough cleansing prior to the application of the antiseptic solution with respect to SSI risk and found no differences (RR 1.02, 95% CI 0.82, 1.26). (Degree of recommendation A I)
- If the patient did not perform the recommended pre-surgical washing mentioned above or another previous washing process, or if the incision site is dirty, the surgical team should wash the surgical site in the pre-surgical area or immediately prior to the application of the antiseptic agent (Grade of recommendation AI). The purpose of this washing is to ensure that there is no debris or fat that prevents the action of the antiseptic; This cleansing is important because it improves the antiseptic effect and can remove spores that are not neu-

- tralized by it. In case the patient has applied a facial cosmetic, it should be removed with a non-irritating agent.
 - Any jewelry or foreign material should be removed at the surgical site (e.g. piercing). Its presence increases up to 10 times the risk of colonization. It is recommended to do the removal before cleaning the skin. In hand and forearm surgeries at the time of washing, artificial nails and nail polish should be removed.
 - The surgeon should evaluate the presence of hairs at the site of the incision, which should only be removed if they alter the field of vision and make it difficult to access the incision site. In those patients, whose hair makes the surgery difficult, the hair should be cut, never shaved with a razor blade, since this procedure increases the risk of SSI.
 - Hair cutting should be done using a hair cutting device or by means of a depilatory agent, which does not generate abrasions to the skin (Degree of recommendation A ^{05,22,27,28}) However, it should be kept in mind that depilatory creams can cause chemical burns or hypersensitivity.
 - Hair cutting should be done in the shortest possible time before the surgical procedure (2 hours) and preferably in a place outside the operating room, doing so in the room can increase the risk of contamination. Hair should not be removed with adhesive tape since it can cause micro abrasions that facilitate the contamination.
3. The surgical site should be checked prior to skin preparation. This check minimizes the risk of pre-stopping the skin in the wrong area, which in turn can help to perform the surgery in the wrong place.

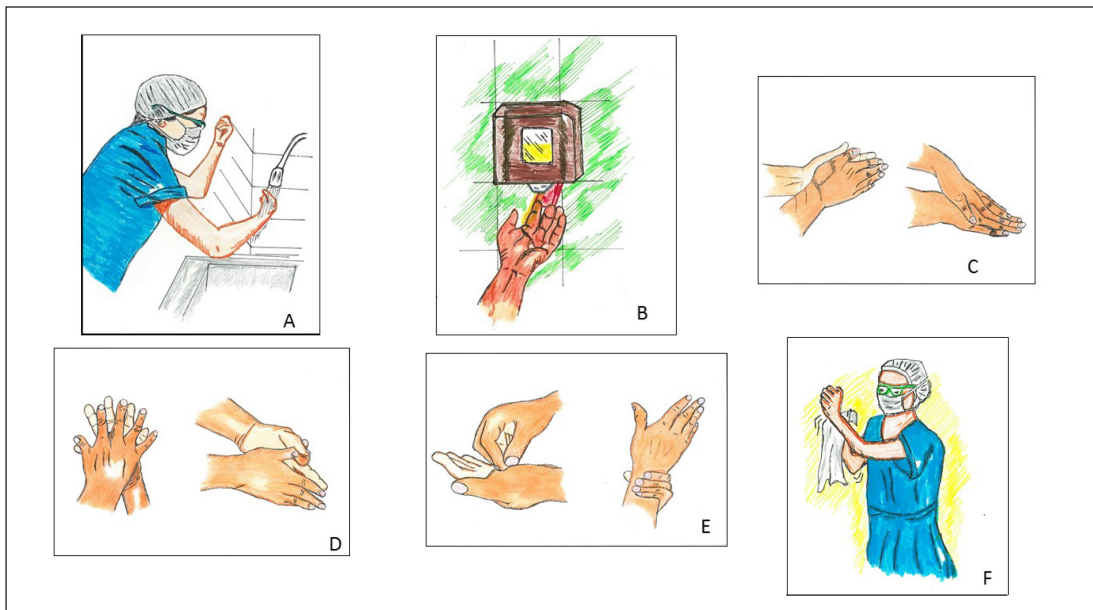


Figure 1. Recommendations for pre-surgical antiseptic washing by health personnel. Recommendations for preoperative antiseptics of the hands. Before starting the asepsis, process remove rings, watches and bracelets. A. If the hands are visibly dirty, wash them with a common soap before proceeding to preoperative antiseptics. Wet your hands with water. B. Place sufficient amount in the palm of the hand to cover all surfaces of the hands and forearms. C. Rub the palm of the right hand against the back of the left hand interlacing the fingers and vice versa. D. Rub the palms of your hands together with your fingers intertwined. Rub the left thumb by rotating it with the palm of your hand Right and vice versa. E. Rub the tip of the fingers of the right hand against the palm of the left hand, making a rotating movement and vice versa. F. Dry with a single-use towel and wait 1 minute before putting on sterile gloves.

4. If the surgical site is going to be marked, this should NOT be done with pen type markers, as these can cause trauma to the skin. It is preferred to label the skin with an alcohol based marker that does not disappear with patient washing and has a lower risk of colonization with MRSA²¹.
5. Skin preparation: For skin preparation, prior to the incision, different products have been used over time. Currently we have iodinated solutions, alcohol with chlorhexidine and chlorhexidine, each with different chemical characteristics with different advantages and disadvantages (Table 4). In general, the Food and Drugs Administration (FDA) considers it an effective pre-analgesic antiseptic for the skin, which can reduce the number of transient and permanent microorganisms in the surgical field quickly (2 log, 10 minutes after the application) and suppresses its growth until 6 hours. Therefore, when selecting the antiseptic product, it should be considered that the selection significantly reduces the number of microorganisms in contact with the skin, does not cause irritation, with a broad spectrum, rapid action and have a persistent effect.
 - For the selection of the antiseptic, the characteristics of the patient should be prioritized, checking for allergies, irritation prior to an antiseptic, skin site for preparation, the presence of organic material such as blood, wound type and surgical procedure. It should be considered that some antiseptics are neutralized with organic material (e.g. povidone iodine), others cannot be used in the ear (chlorhexidine) and if used in mucous membranes, consideration should be given to the concentration of the preparation²¹. (Table 4).
 - In general, antiseptic alcohol, which acts by the denaturation of proteins, is the most effective and fastest agent, but with little residual effect. For this reason, it is not recommended to wash the patient unless it is combined with another antiseptic such as chlorhexidine (chlorhexidine alcohol solutions). Alcohol solutions (alcohol 70%) containing HCG greater than 0.5% and ideally

ly at 2% have a residual effect like that of chlorhexidine alone, but benefiting from the potency and immediate effect of alcohol. Although there is controversy between the efficacy of chlorhexidine versus iodine povidone, it has recently been shown that the combination of alcohol plus chlorhexidine compared with iodine povidone¹⁴ was shown to be superior. For the preparation of the skin in the performance of contaminated clean surgeries, there was no adequate information available to evaluate the efficacy between HCG and povidone iodine. In 2010 the study by Darouiche et al., Took patients undergoing contaminated clean surgeries (thoracic, abdominal) urological and abdominal) and the preparation of the skin with 2% HCG plus 70% isopropyl alcohol (GCAI) vs Aqueous solution with 10% povidone iodine (IPV) found that the percentage of SSI (superficial and deep). In the group of GCAI was 9.5%, while the group of IPV presented 16.1% with a statistically significant difference (P = 0.004 - RR = 0.59)¹⁴. In addition, a more recent study, through a meta-analysis and a cost study that included information on 3614 patients, also demonstrated the superiority of the alcoholic solution of HCG compared to povidone iodine, not only in the reduction of SSI OR, 0.64, IC95% 0.51-0.80)¹⁹ and on the positivity of post-application skin cultures (OR, 0.44 95% CI 0.35-0.56) but also in the Cost savings (19). In another meta-analysis that included 5031 patients comparing chlorhexidine against povidone iodine, the patient's pre-surgical lavage showed the superiority of the former (OR 0.68 CI 95% 0.50-0.94)¹⁶. Finally, a meta-analysis that included studies with different comparisons for clean surgery identified benefit in the use of alcoholic solution with 0.5% chlorhexidine compared to an alcoholic solution of povidone iodine with a reduction in the risk of infection of 53% 0.47, IC95% 0.27-0.82³⁰ Furthermore, a study comparing the difference between chlorhexidine + alcohol Vs iodine povidone + alcohol and the risk of infection of the surgical site in 1147 cesarean women showed a

Table 4. Antiseptic solutions for preoperative care. Taken and adapted by Boyce JM, Pittet D. MMWR Recomm Rep 2002 Oct 25;51(RR-16):1-45

Antiseptic	Mechanism of Action	Speed of action	Residual activity	Activity		Effectivity in contact with biological substances	Adverse events
				Gram positive	Gram negative		
Povidone iodine	Releases free iodine that binds to bacteria	Moderate	Minima	++++	+++	Reduces action in presence of blood	Pain, irritation
Chlorhexidine	Rupture of the cellular membrane causing cytological and physiological changes and producing death of the bacteria	Moderate	High	++++	+++	Does not loose effectivity in the presence of blood.	Irritation - Corneal damage, neurotoxicity ototoxicity
Povidone iodine plus alcohol	Idem iodine povidone	Fast	Not proven	++++	++++		Potentially inflammable
Chlorhexidine plus alcohol	Idem Chlorhexidine	Fast	High	++++	++++	No efficacy is lost in presence of blood	Potentially Inflammable

superiority of Chlorhexidine (relative risk of 0.55, 95% CI, 0.34 to 0.90, $P = 0.02$).

- In general, for the antiseptic preparation of the skin of the surgical site it is recommended to use an alcoholic solution (70% isopropyl alcohol) of 2% HCG.28 (Degree of recommendation A I).
- If the decision is to use GCH 2% alcohol based solution, it is recommended to check the manufacturer's instructions, since some instructions may vary per the solution used.

General considerations with the use of antiseptic solutions:

- a. The use of alcoholic solutions in mucous membranes is not recommended. However, the use of GCH alone at lower concentrations (0.12%) has been shown to be safe in oral mucosa and in the vaginal mucosa. There are studies confirming the safety of HCG at concentrations of 0.05%, 1 % Up to 4% in perinatal care and hysterectomy, respectively (Grade of recommendation A II) (18, 31). For surgery of eyelids, ears, mouth, mucous membranes, use of 5% povidone iodine in cleaning is used²⁵. In cases of neurosurgery it is possible to use GCH 2% more alcohol 70%, if the protocol is strictly adhered to, especially allowing drying to reduce the risk of neurotoxicity and it is preferred to apply the antiseptic with a swab (Grade of recommendation C). An alternative option is the use of iodine povacrylex + Alcohol.
 - b. Alcohol solutions and povidone iodine should be used when the patient's skin is visibly dirty or contaminated with protein debris, since the antimicrobial action of the alcohol is diminished and in the case of povidone iodine it is inactivated. Therefore, if the patient has not undergone pre-chromatic washes with HCG or if dirt or grease on the skin is evident, wash with antiseptic soap and allow to dry before applying the alcoholic solution. For the technique of washing with surgical wax (e.g. 4% Chlorhexidine), use the same technique described above, considering rinse and dry for the subsequent application of the antiseptic.
 - c. Protective measures should be implemented to prevent damage or injury caused by prolonged contact with the antiseptic solution. Solutions containing alcohol should be allowed to air dry before placing them in the surgical fields. This recommendation minimizes the risk of burn injuries to the patient, especially if electrocautery or laser is used. In the case of iodine solutions, the iodine is free and cause chemical irritation in the skin when it is covered without allowing it to dry. In a series of burns caused by povidone iodine, it has been reported that blemishes from clothing, masking tape or soaked gauze. The antiseptic agent should be allowed to follow and its vapors dissipate prior to placement of the surgical field, electro surgery, laser or other heat source, since the antiseptic agent maintains its inflatable properties until completely followed. The entrapment of the solution or vapors below the surgical site may increase the risk of fire or burns.
- d. The sheets and the positioning equipment of the patient should be protected from dripping and contact with the antiseptic agents used for the preparation of the patient's skin, around and below it.
 - e. Care should be taken when the patient is in the lithotomy position because the antiseptic solution can move towards the gluteus and this can go unnoticed. The use of a cloth with adhesive tape under the patient's gluteus may decrease the risk
 - f. Electrodes placed on the patient's skin should be protected from direct contact or dripping by antiseptic agents.
 - Antiseptic solutions on contact with electrical devices can cause chemical or thermal burns. The adhesive material of these keeps the skin in permanent contact with the antiseptic solution and does not allow to follow. This contact increases the impedance and increases the risk of deo to the equipment or its malfunction.
 - If the antiseptic solution contacts the electrode, the electrode must be removed, the antipyretic solution must be wiped from the patient's skin and a new electrode must be used.
 - g. If a tourniquet is used, the cuff, padding and skin under the patient's band should be protected from contact with antiseptic solutions. The contacts of these solutions against the skin increase the risk of producing chemical burns.
 - h. The use of a waterproof tourniquet protector or the use of masking tape may prevent contact of the antiseptic solution on the skin.

C. Recommendations for the implementation of the patient's skin antisepsis protocol

1. Hand washing must be done before beginning the preparation of the skin of the surgical area. Hand hygiene prevents the contamination of the zone prepared in case of rupture of the gloves.
2. The use of antiseptic agents for the preparation of the skin must be performed with sterile supplies. There is insufficient evidence to determine that the use of only clean (non-sterile) supplies is safe practice.
3. Sterile gloves should be used for the application of the antiseptic solution in the preparation of the skin, unless it has a sufficiently long device that does not allow the non-sterile glove to contact the skin.
4. If the personnel responsible for washing the antiseptic preparation of the patient's skin is the same as the person who is to perform the procedure, do not wear the sterile gown or gloves to be used for the procedure during the procedure. Washing the patient. The risk of contamination of the gloves and the sterile gown is high.

5. The antiseptic agent should be applied to the skin of the surgical site and around to minimize contamination, preserve skin integrity and prevent tissue damage.
6. For the application of the antiseptic, it is possible to only paint or to rub the skin. It has not been shown that there is any advantage with any of the methods although in the literature there are studies designed to find this difference (Grade of recommendation A 11). In general, it should be remembered that it is a matter of "painting" the patient with the antiseptic solution, not washing him or her. It is recommended to use products that contain tincture that allow the surgeon to know the area that needs to cleaning with the antiseptic and in this way, reduce the risk of contamination. The time of the application depends on the indications of the manufacturer and the antiseptic used; In general the times can be from 30 to 120 seconds.
7. The application of the antiseptic to the skin should be from the incision site towards the periphery in a circular form with larger and larger circles. In most surgical procedures, the incision site is near anatomical areas that contain a high count of microorganisms (e.g. laparotomy and navel / groin incision, neck and mouth / nose, ankle / Foot, shoulder / armpit, hand / nails). When performing the procedure from the site of the incision towards the periphery, the re-introduction of microorganisms from these areas to the surgical site is avoided. In case the procedure involves the penis, the foreskin should be retracted and cleaned; After cleaning Should be placed in its place again to avoid vascular alterations. (Figure 2)
8. In cases where a highly-contaminated site (e.g., anus, colostomy) is close to the surgical site without being a part of it, it should be isolated from the area subject to cleaning. The isolation of the contaminated area allows to reduce the risk of contamination; In these cases, a fluid-resistant adhesive or tape may be useful for insulation of the area.
9. The applicator, gauze or sponge should be used for a single application and then discarded. Subsequent applications should be made with a new sponge or applicator to avoid contamination of the incision site. The most important principle to consider during the antiseptic preparation of the skin to always move from a clean to a contaminated area and never in the opposite direction. Although the time of application of the antiseptic depends on the solution used and the recommendations of the manufacturer, it is generally advised that the antiseptic preparation of the skin be for at least three minutes.
10. When using a commercial applicator, refer to the manufacturer's instructions for uniform dispensing of the antiseptic. It should be remembered that it is a question of cleaning the skin and not of flooding the patient, use sponges or compresses with the antiseptic. At the end of the wash, the patient should be on a dry bed.
11. Special consideration should be given when the incision site is more contaminated than the surrounding skin. If a highly-contaminated area is part of the procedure, the area with the lowest bacterial count should be prepared first and then the area of greatest contamination (incision site). In this case the washing technique is reversed: from the periphery to the incision site.

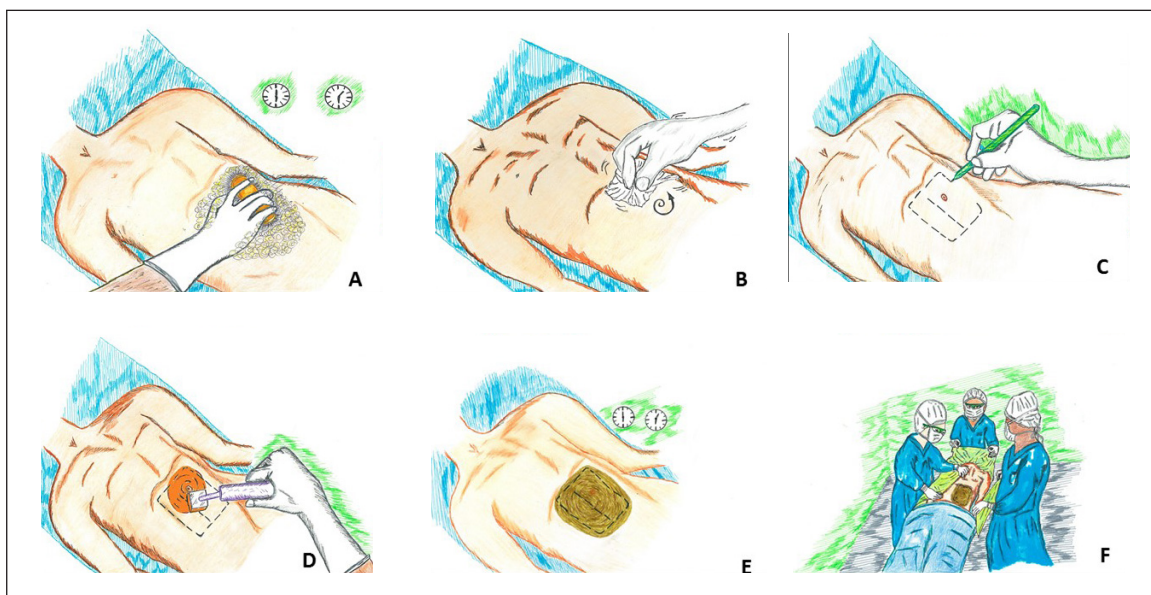


Figure 2. Recommendations for the implementation of the antisepsis protocol of the patient's skin. A. If the patient does not apply the pre-surgical bath or if the incision site is dirty, the surgical site should be cleaned prior to the application of the antiseptic agent by applying an antiseptic soap and holding for one minute. B. Remove antiseptic soap with saline solution and press the incision site with a compress making sure the area is dry. C. If you decide to mark the surgical site it is preferred to use a marker on an alcoholic base. D. The application of the antiseptic on the skin should be from the incision site to the periphery in a circular form with increasingly larger circles, considering that the objective is to "paint" the surgical area with the antiseptic. E. Once the antiseptic is applied, it MUST be allowed to dry to the environment or wait 3-5 minutes before the incision of the skin. F. Operating room staff should be familiar with the inflammatory characteristics of the antiseptic agent and the use of electrical or heat sources used during the operative procedure

12. In the preparation of the anus, vagina, stoma, paranasal sinuses, ulcer or an open wound, the sponge or gauze should be applied only once to the area and then discarded. A sponge soaked in the antiseptic solution can be kept on the stoma after cleaning while the preparation of the surrounding skin is made and removed once the process is completed. In cases in which the patient has a Bogota bag or laparostomy, a normal saline solution of 0.9% or a 0.5% or 1% alcohol free solution of chlorhexidine should be used given the risk of introducing the solution in the abdominal cavity.
It is not recommended to use iodinated solutions, since these surfaces form folds to accumulate detritus, limiting the action of these products.
13. For irrigation of open traumatic wounds irrigation with normal saline solution is recommended. Once the washing is finished, compresses or dry sheets should be placed below the patient.
14. Vaginal preparations for chemical procedures in which the abdomen is to be incised should be performed by avoiding that the antiseptic agent expelled from the vagina is sprayed onto the abdomen wall. In abdomino/perineal surgeries, once the perineum or vein is prepared, it must be covered with a sterile compress while the abdomen is prepared.
15. For the washing of deep and narrow navels that do not allow for proper cleaning with the use of gauze or fingers, applicators must be used, ensuring complete cleaning and removing any debris found there. If necessary and possible, re-use it to ensure its cleanliness. The accumulation of the antiseptic agent in the navel or groin should be avoided since it cannot be dried adequately or requires longer periods for its evaporation; if the accumulation occurs, the excess solution must be removed.
16. The preparation of the skin for eyes and face may require alternative antiseptic solutions to chlorhexidine or dilute regular solutions to avoid harming the patient. At normal concentrations, HCG and iodinated solutions are contraindicated for the face, eyes, and ears because they can cause injury if there is accidental contact. It is recommended to use warm sterilized water as a rinse and 5% povidone iodine solution.
17. The preparation of the skin area should extend to a larger area contemplating the possibility of the extension of the incision, additional incisions and potential sites for drains or the need to convert a minimally invasive procedure to an open procedure. If not considered, there may be contamination of the incision later.
18. Adhesive dressings for the incision may decrease the risk of contamination of the surgical wound with residual flora of the skin. Adhesive fields may be advantageous in sealing the surgical field. However, the usefulness of iodine-impregnated fields has not been shown to be useful in the reduction of surgical site infection¹⁵.
19. Once the antiseptic is applied, it should be left to dry in the room or wait 3-5 minutes before the incision is made.
20. If insertion of a urinary catheter is considered, its placement should be performed using an aseptic technique to prevent the risk of contamination of the genitourinary tract.
21. Devices or supplies touching the surgical area after preparation should be sterilized to prevent the introduction of microorganisms.
22. It is recommended that the patient washing process is documented in the clinical history.
23. At the end of the surgical procedure if there is evidence of residual antiseptic solution at a site other than the surgical site, it is recommended to remove it before removing the patient from the surgery room or in the recovery area to reduce the risk of irritation, especially if povidone iodine is used.

D. Final Recommendations

If the antiseptic agent contains alcohol, additional precautions should be taken to minimize the risk of a surgical burn and burn injuries to the patient. Hospital staff should be familiar with the inflammatory characteristics of the antiseptic agent and the use of electrical or heat sources used during the operative procedure.

When an alcoholic solution is used for the preparation of the skin, they should preferably be packed in small amounts or presentations for just one single application to minimize the risk of moistening the adjacent materials and limit the amount of agent discarded. Materials moistened with the solution should be removed from the operating room before using electrical or heat sources to minimize the risk of fire.

If the institution decides to use alcohol based solutions, it should train all the surgical team on the inherent risks and the precautions that must be taken with its use. Training programs for the members of the surgical team should include the inflammable characteristics of the alcoholic solution and the inclusion in the practice of the imperative need for the application site be completely dry before placing the surgical fields as the most important safety measure for the patient.

Disposal of antiseptic agent residues should be carried out in accordance with local regulations, to reduce the risk of fire. These can be disposed without biological risk. Residues of alcoholic antiseptic solutions should be disposed of in the hazardous materials chemical containers outside the surgical room or immersed in water.

Antiseptic agents should be stored in their original containers to reduce the risk of contamination. These containers should not be recharged or reused. Prolonged use of a container or multiple uses, transferring solutions to secondary containers, may facilitate the contamination of microorganisms such as entero- bacteria, including *Pseudomonas aeruginosa*²¹ and

*Achromobacter spp*³³. These microorganisms can survive for long periods of time and have given rise to the transmission of the organism inside the institutions, even causing outbreaks of intra hospitalary infections.

Finally, both to implement and to maintain compliance with the asepsis and antisepsis protocol of the skin, the surgical team must be under constant training³³. In this regard, it is essential that the personnel involved get trained and validate competences in skin preparation, selection of antiseptic agents and patient evaluation, among others. This validation of competencies must be reviewed at least once a year and it is suggested to include in the patient safety processes, quality indicators related to compliance with this process.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this investigation.

Confidentiality of data. The authors declare that no patient data appears in this article.

Right to privacy and informed consent. The authors declare that no data that enables identification of the patients appears in this article.

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Conflict of interest

The authors have no conflict of interest to declare.

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