WHAT TO USE IN PREOPERATIVE SKIN PREPARATION: POVIDONE-IODINE OR CHLORHEXIDINE?

O que usar no preparo cirúrgico da pele: povidona-iodo ou clorexidina?

¿Qué usar en la preparación quirúrgica de la piel: povidona-iodo o clorhexidina?

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ABSTRACT: Objective: To discuss the efficacy of chlorhexidine gluconate and povidone-iodine in aqueous or alcoholic solutions in reducing surgical site infections and skin bacterial counts in the preoperative preparation of the patient. **Method:** Reflective study about the best antiseptic to use in preoperative skin preparation. **Results:** We found that chlorhexidine and povidone-iodine are equally safe and effective and that international guidelines for good practices have recommended their use in alcoholic solutions. We observed a trend in recommending alcoholic chlorhexidine and an emergence of studies that have evaluated the sequential or concurrent use of chlorhexidine and povidone-iodine with favorable results for this practice. **Conclusion:** There is a global trend that favors the use of alcoholic chlorhexidine over povidone-iodine. However, the decision about the best antiseptic agent to use should be based on each clinical case, (contra)indications, and situation.

Keywords: Local anti-infective agents. Antisepsis. Chlorhexidine. Povidone-iodine. Ethanol.

RESUMO: Objetivo: Discorrer sobre a eficácia do gluconato de clorexidina e do povidona-iodo em soluções aquosas ou alcoólicas na redução de infecções do sítio cirúrgico e na contagem bacteriana da pele, no preparo pré-operatório do paciente. **Método:** Estudo de reflexão acerca do melhor antisséptico a ser usado no preparo cirúrgico da pele. **Resultados:** Verificou-se que tanto a clorexidina quanto o povidona-iodo são igualmente seguros e efetivos e que os manuais de boas práticas internacionais têm recomendado a sua utilização em soluções alcoólicas. Observou-se uma tendência na indicação da clorexidina alcoólica e a emergência de estudos que têm avaliado o uso sequencial ou concomitante da clorexidina e do povidona-iodo com resultados favoráveis a essa prática. **Conclusão:** Há uma tendência mundial mais favorável ao uso da clorexidina alcoólica em detrimento ao povidona-iodo. Contudo, a decisão pelo melhor agente antisséptico deve considerar cada caso clínico, (contra) indicações e situação.

Palavras-chave: Anti-infecciosos locais. Antissepsia. Clorexidina. Povidona-iodo. Etanol.

RESUMEN: Objetivo: Discutir sobre la eficacia del gluconato de clorhexidina y del povidona-yodo en soluciones acuosas o alcohólicas en la reducción de infecciones del sitio quirúrgico y en el recuento bacteriano de la piel en la preparación preoperatoria del paciente. **Método:** Estudio de reflexión acerca del mejor antiséptico a utilizarse en la preparación quirúrgica de la piel. **Resultados:** Se ha comprobado que tanto la clorhexidina como el povidona yodo son igualmente seguros y efectivos y que los manuales de buenas prácticas internacionales han recomendado su utilización en soluciones alcohólicas. Se observó una tendencia en la indicación de la clorhexidina alcohólica y la emergencia de estudios que han evaluado el uso secuencial o concomitante de la clorhexidina y del povidona-yodo con resultados favorables a esa práctica. **Conclusión:** Hay una tendencia mundial más favorable al uso de la clorhexidina alcohólica en detrimento del povidona-yodo. Sin embargo, la decisión por el mejor agente antiséptico debe considerar cada caso clínico, (contra) indicaciones y situación.

Palabras clave: Antiinfecciosos locales. Antisepsia. Clorhexidina. Povidona yodo. Etanol.

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INTRODUCTION

Surgical site infection (SSI) is a common adverse event responsible for up to 77% of all deaths of patients with infection[1], and regarded as the most frequent, costly, and studied healthcare associated infection[1,2].

The adoption of measures to prevent SSI is of fundamental importance for the patient safety and to provide quality care. Among these measures, one that stands out is patient skin antisepsis, also known as preoperative skin preparation, responsible for reducing the microbial load on the skin, which, consequently, influences the occurrence of SSI[2].

Antisepsis is the process of eliminating or inhibiting the growth of microorganisms on the skin or other living tissues. Products used for this purpose are the antiseptics[3,4].

Antiseptic selection should take the following criteria into account: significant reduction of microorganisms on the intact skin, non-irritating antimicrobial preparation, broad spectrum of activity, fast and persistent action. Meeting the requirements proposed by national and international associations, as well as regulatory agencies for health products, the antiseptic agents available on the market are formulated based on aqueous, alcoholic (tincture) and degerming solutions, in addition to active ingredients. The active ingredients used include alcohol, chlorhexidine gluconate (CHG), iodine, iodophors, parachlorometaxylenol, and quaternary ammonium compounds[3,5].

The antiseptic agents commonly recommended for preoperative skin preparation are CHG, iodine/iodophors, alcohol, triclosan, and chloroxylenol (also known as parachlorometaxylenol), being the first three the most frequently used[3,6,7].

Although they have proved to be efficient in antisepsis, many studies still compare CHG and iodophors in an attempt to determine which one is the best choice for preoperative skin preparation, and there have been even some suggestions of their associated use[8-12].

OBJECTIVE

Considering the relevance of antisepsis in SSI prevention and the search for the best evidence-based practice, this study aims to discuss the efficacy of CHG and povidone-iodine (PVP-I) in reducing SSI and skin bacterial counts, when used in aqueous or alcoholic solutions for skin, separately or sequentially/concurrently.

METHOD

Reflective study, mediated by the search for evidence-based studies about the best antiseptic to use in preoperative skin preparation, considering the reduction of microbial counts and occurrence of SSI.

DEVELOPMENT

Povidone-iodine versus chlorhexidine gluconate

CHG and iodophors are frequently used in aqueous, alcoholic, and degerming solutions[6].

Aqueous iodophors, such as PVP-I, contain iodine complexed with a solubilizing agent that, when in solution, releases free iodine. Iodine destroys microbial proteins and deoxyribonucleic acid (DNA). These products have widespread use, due to their properties, efficacy, and broad-spectrum antimicrobial safety in almost all skin surfaces, including mucous membranes, regardless of age. In aqueous solution, most iodophors require an application in two steps — smear technique and application —, and their action is limited to the contact period of the agent with the skin[6].

Aqueous CHG breaks the membrane of bacterial cells, and its action depends on concentration. In low concentrations, it has a bacteriostatic effect, changing the osmotic balance of bacterial cells; in high concentrations, it is a bactericide, precipitating their cytoplasmic contents. CHG has a broad spectrum of activity that comprises gram-positive and gram-negative microorganisms, non-spore-forming bacteria, fungi, and lipid-enveloped virus, including human immunodeficiency virus (HIV). When compared to PVP-I, CHG residual activity lasts longer and is more resistant to blood products. Its application is similar to PVP-I, except for being contraindicated in genital, ocular conjunctiva, external acoustic meatus, and meninges areas, due to the potential harm it can cause in these body parts[1,3,6,13].

CHG and iodophors diluted in alcoholic solution have quick start action due to the alcohol and prolonged sustained antimicrobial activity. Alcohol enhances the activity of each compound through protein denaturation. Its fast evaporation from the skin facilitates the application in a single step, unlike aqueous solutions. A limitation to the use of solutions based on alcohol in the operating room

(OR) is their flammability and contraindication in mucous membranes[6].

Taking into account the properties of each compound, some questions are pertinent in the daily routine of the surgical center, such as: which is the most effective antiseptic in reducing bacterial counts and SSI: CHG or PVP-I? Is the sequential or concurrent use of CHG and PVP-I possible?

We investigated the literature to find the answer to these questions, with the purpose of facilitating the adoption of evidence-based practices and, consequently, improving the quality of care provided to surgical patients.

What is the most effective antiseptic in reducing bacterial counts and surgical site infections?

The literature shows several ways to evaluate the efficacy of CHG and PVP-I. Some of them relate to the verification of skin microbial counts, while others involve the outcome variable of SSI[8]. The effectiveness of these two compounds has been compared by collecting samples from the surgical site and the hands in which these products have been used and carrying out microbiological culture to quantify the bacteriostatic and bactericidal effects triggered by them. Surgical patients have also been followed to compare the occurrence of SSI with the use of each product[8,14].

However, both the methodology of these studies and their results have been quite diverse, hindering a precise conclusion based on high-quality evidence about the most effective antiseptic (CHG or PVP-I) in reducing bacterial counts and SSI[15].

Regarding the outcome of SSI, some studies compared the use of alcoholic CHG with aqueous PVP-I, in different sample sizes, populations, product concentrations, and methodological designs, and concluded that SSI was lower with the use of alcoholic CHG[7,8,16,17]. However, for most of them, even though the SSI rate was lower, it was not statistically significant[7,16,17]. The authors of a study found similar SSI rates among patients who used alcoholic CHG and aqueous PVP-I[10].

In a systematic review[18], only three studies described the comparison between alcoholic PVP-I and alcoholic CHG. Two of them found higher reductions of bacterial counts with alcoholic CHG, but there was no difference between CHG and PVP-I in the outcome of SSI; the third showed a greater decrease of SSI with alcoholic CHG.

Another literature review[19], which considered only randomized controlled clinical trials to evaluate the effectiveness of antiseptics, described a meta-analysis with no statistical significance between alcoholic and aqueous PVP-I in reducing SSI; and another meta-analysis, in which 0.5% alcoholic CHG was more effective than 10% alcoholic PVP-I in preventing SSI.

However, there are doubts regarding the validity of the comparison of these studies since alcoholic formulations have an advantage over aqueous solutions as the first has two active agents and the second only has one[11]. Thus, in order to eliminate this difference, some studies compared alcoholic CHG with alcoholic PVP-I and found similar SSI rates between them[9,11], or lower in the group that used alcoholic PVP-I[14].

Another debatable fact in studies that concluded that CHG was more effective than PVP-I is that none of them reported the use of neutralizing substances, fundamental in eliminating the effect of some antiseptics with continuous bactericidal action after sampling. In the absence of these substances, the highest reductions in colony-forming unit (CFU) rates may not be consistent with microbial counts that would be found in their presence. CHG is an antiseptic that depends on neutralizers to eradicate its continuous effect[15].

Considering the existing evidence, international guidelines for good practices have been unanimous in recommending the use of antiseptic in alcoholic solutions[1,2,20], but they do not specifically indicate the use of PVP-I or CHG. Only the guideline for good practices on SSI prevention of the World Health Organization (WHO), released in 2016, suggested the use of alcoholic CHG, underlining, however, that the recommendation was based on evidence of low to moderate quality[2].

Although the findings favor the use of alcoholic over aqueous solutions, more specifically alcoholic CHG, it is important that the professional takes into consideration each clinical case, (contra)indications, and the experienced situation. Some religions, for example, do not accept the use of alcohol. Therefore, it should be avoided if the patient refuses it. Its availability is more limited in low- and middle-income countries, which can make its use more difficult. Furthermore, its use is not recommended on mucous membranes / cornea / ear or areas with a lot of hair, as they can compromise evaporation, which could cause an accident due to its flammability[2,21]. Iodophors are not indicated for patients with thyroid disorders, and CHG is contraindicated in mucous membranes and ear, as it could result in deafness[21].

Is it possible to combine the use of antiseptics?

CHG and PVP-I have different cellular targets and distinct mechanisms of action that complement each other, a fact that enables the effectiveness of combining them in practice.

However, there is not enough evidence regarding the effectiveness or incompatibility of combining these two agents[22].

Studies have compared microbial counts after application of CHG and PVP-I alone and in sequential combination and concluded that the latter was more effective in reducing skin microbiota during preoperative preparation of the area of surgery[12,23,24]. Another study, conducted with 1,146 patients undergoing clean cranial surgeries, concluded that the combination of PVP-I and CHG contributed more to SSI reduction than the use of PVP-I and CHG alone[25].

We also found records of the concurrent use of these two substances in aqueous solution to evaluate the interaction potential between 3% aqueous CHG and 5% aqueous PVP-I, and the effect of their combination on antimicrobial activity. The results of these experiments indicated the absence of negative impact on antisepsis and a potential benefit from their combination[22].

The emergence of evidence on the combined use of these two products is clear. However, we need more high-quality studies to support this practice in the OR. According to a systematic review of the combined use of CHG and PVP-I, out of four trials elected for a meta-analysis, only one had SSI as an outcome, the other three investigated only bacterial colonization[26].

CONCLUSION

CHG and PVP-I have a broad spectrum of activity, are equally safe and effective for use in preoperative skin preparation and are the most frequently recommended and employed antiseptics in the world.

They are used in aqueous and alcoholic solution, and international guidelines for good practices recommend their use in alcoholic solution if there are no contraindications. There is a global trend that favors the use of alcoholic CHG over PVP-I, even though the methodological performance of some studies is questionable.

Studies on their sequential or concurrent use have shown positive results in reducing microbial counts and in SSI occurrence, since their mode of action is complementary and not antagonistic. Nevertheless, the evidence is still scarce and fragile to support this practice in the OR.

In general terms, we emphasize how important it is for the professional to consider each clinical case, (contra)indications, and situation experienced before deciding which antiseptic agent to use. Also, it is essential to conduct more robust studies that could contribute to best practices, aiming at quality care for surgical patients.

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