



Topical Antimicrobials in Wounds

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Abstract

Wounds are a major cause of morbidity especially diabetic foot wounds. Topical antimicrobials are frequently used in day to day practice mainly in management of wounds by various healthcare professionals ranging from general practitioner to specialist surgeons. However lot of controversies exists regarding the usage of antimicrobials. This article provides an insight on the usage of various commonly used topical antimicrobials including their mechanism of action and various side effects.

Key Words: Wounds, antimicrobials, healing

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Introduction

The life time risk for foot ulcers in people with diabetes has been estimated to be 15% [1]. Diabetic foot ulcers precede more than 80% of non traumatic lower limb amputations [2]. In a study from India, which is a developing country and which has the highest number of diabetic patients in the world, it was shown that patients with diabetic foot had to spend 32.3% of their total income towards their treatment [3]. Diabetic foot wound management requires a good surgical care. The cost of topical wound treatment can be related to the severity of ulcer, wound healing time, frequency of dressing change, transport and staff costs [4]. Infact, wound care products accounted for a significant proportion of general practitioner prescriptions in England, and in 1997, costs over \$80 millions [5].

Topical antimicrobials are very commonly used in different wounds by various health care professionals. The clinical goals of antimicrobial treatment for acute and chronic wounds like diabetic foot ulcers, venous ulcers, pressure ulcers, etc may be

- 1)prevention of wound infection
- 2)treatment of wound infection
- 3)reduction of bacterial load
- 4)preparation for grafting
- 5)improved of quality of life by reducing odour, exudates, inflammation and pain.

Today, some of the most commonly employed topical antimicrobial (Figure 1) includes chlorhexidine, hydrogen peroxide, iodine and silver compounds.

Chlorhexidine

It is a commonly used antiseptic in handwashing and as a surgical scrub. It has a bactericidal activity against a wide spectrum of bacteria. It acts by damaging outer cell layers and the semipermeable cytoplasmic membrane of bacteria thereby allowing leakage of cellular components. A few human studies have demonstrated that it has detrimental effect on healing [6]. Further clinical trials are however required before the use of chlorhexidine on open

wounds is either recommended or condemned [6]. It is preferred in those patients who are allergic to povidone iodine. It's frequently used in mouth washes.

Hydrogen peroxide

It is another widely used antimicrobial. Hydrogen peroxide has a wide spectrum of activity against bacteria. Hydrogen peroxide produces free radicals that react with lipids, proteins and nucleic acids to affect cellular constituents non specifically. Presently there is sufficient evidence to support the merits of hydrogen peroxide on wound healing. It is still used very commonly by health care professionals in cleaning the diabetic foot ulcers.

Various studies have shown that hydrogen peroxide does not have any negative effect on wound healing.

Lineaweaver et al [7] did not find any retardation of re-epithelization in a rat model after the wound underwent irrigation with three percent hydrogen peroxide.

Gruber et al [8] found acceleration of re-epithelization in a rat model and in a clinical trial.

Acetic acid

It is frequently used in wounds as a 0.25% or 0.5%. Acetic acid has bactericidal activity against many gram positive and gram negative organisms, especially pseudomonas. No delay of reepithelization has been found in animal and human models [8]. In two human uncontrolled studies, acetic acid was found to be beneficial in wounds infected with pseudomonas [9,10].

Iodine compounds

Iodine and its compounds have been broadly used for prevention of infection and treatment of wounds. The two commonly used Iodophores are povidone iodine and cadeoxmer iodine.

1.Povidine Iodine: It is a polyvinylpyrrolidine surfactant/ Iodine Complex(PVP-I). It is available in several forms [solution, cream, ointment and scrub]. It has a broad spectrum of activity against bacteria, mycobacteria, fungi, protozoa and viruses. A study showed that PVP-I lethally damaged >99% cells within 10 seconds to its exposure and as little as 2.36 x 10 thousand atoms of iodine were required to kill one bacterial cell [11].

Literature regarding the effect of PVP-I on wound healing in various animal wound models is conflicting. Briefly, in some studies, PVP-I did not show any inhibition on wound re-epithelialization [12] while in other studies it retarded healing [13].

However, there are numerous studies which showed that PVP-I did not affect wound healing. In a review of in vivo studies, Mayer and Tsapogas [14] summarized the data by concluding that PVP-I was not found to negatively influence wound healing.

In one study, it was shown that povidone iodine that is formulated in an ointment has been shown to enhance wound healing and bacterial reduction [15]. The results with the ointment formulation are believed to be due to the occlusive effect of the ointment and the sustained delivery of the iodine over time. Povidone iodine in solution does not retard healing but also does not provide a sustained iodine release in a wound because most of the antibacterial activity is quickly neutralized by wound fluid, pus and wound debris. The residual bacteria remaining within the wound then multiply over time [16]. Development of resistance against povidone iodine, in practice does not exist [17]. Povidone iodine retards healing when formulated in surfactant. Povidone iodine in scrub form contains detergent and should only be used in intact skin. The sensitization rate to povidone iodine, has found to be only 0.73% [17].

It is the most commonly used agent for preparing the skin before surgery. It is also used as a tumoricidal agent by some surgeons in certain cancer surgeries like Abdomino-perineal resection.

2.Cadexomer Iodine: Cadexomer iodine is found to be effective and beneficial to wound healing. Several studies have shown that cadexomer iodine does not inhibit healing but in fact accelerate it [17].

Cadexomer iodine is available as an ointment, as well as a dressing

Silver compounds

Silver compounds have widely been used as wound antiseptics, mainly in burns. Silver sulfadiazine and silver nitrate were among the most commonly used. Today, silver nitrate is no longer widely used whereas silver sulphadiazine remains popular.

Silver ions act by accumulating in bacterial cells. It binds to negatively charged components in protein and nucleic acids, thereby affecting the structural changes in bacterial cell walls, membranes and nucleic acid that affect viability of the bacteria.

Little controversy exists over the role of silver products in burn wounds. However, the use of silver in other wound is less widely accepted [17]. A number of wound dressings containing silver have recently been developed. These function by sustained release of low concentrations of silver ions over time and generally appear to stimulate healing, as well as inhibiting micro-organisms.

Conclusion

Topical antimicrobials are either antibiotics or antiseptics. Antibiotics are potent antimicrobial agents with high specificity. However, emergence of resistant pathogen to topical antibiotics leads to increase use of antiseptics. Sensible use of antiseptics could help decrease the usage of antibiotics, preserving their advantage for clinically critical situations.

Further, antiseptics are also considered superior to topical antibiotics when their rates of causing contact sensitization are compared. The sensitization rate to povidone iodine, has found to be only 0.73%.

However, the practice of mixing the antiseptics like povidone iodine along with hydrogen peroxide or acetic acid or chlorhexidine has not shown any added benefit and this practice should be condemned.

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