

Successful management of infected wounds using a solution and gel containing Betaine and PHMB

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ABSTRACT

Infected wounds remain one of the greatest challenges in medicine. In recent years there have been vast advances in the development of topical antiseptics for wound healing. This is largely due to the increase in the resistance to antibiotics. Modern antiseptics such as a solution and gel containing Betaine and PHMB (Prontosan®) can be used as an alternative to antibiotic treatment and as an adjunct to antibiotics for systemic infections.

Keywords: Prontosan, PHMB, Betaine, wound infection, antiseptics, antimicrobial, Serratia marcescens.

INTRODUCTION

This paper reviews Prontosan solution and gel (B.Braun) for use on wounds infected with *Serratia marcescens*.

BACKGROUND

This 55-year-old lady presented in December 2012 with bilateral leg ulcers on her shins, of three months' duration. The patient's medical history included hypertension and obesity. An arterial and venous duplex scan was performed. Results were normal.

The cause of these ulcers remained unclear; however, they were infected with *Serratia marcescens*. *Serratia marcescens* is a gram-negative bacillus. It can be found in soil, water and on plants and animals. She had two small cuts on her legs prior to gardening; therefore, the most likely cause of this infection was from soil¹.

A bacterial infection occurs when bacteria successfully invade the soft tissues through small wounds/abrasions on the skin surface².

Initially the lesions started with erythema, swelling, pain and blisters. She was diagnosed with severe contact dermatitis. Previous treatment included both systemic antibiotics and cortisone creams. However, her wounds deteriorated and she developed cellulitis, which resulted in full-thickness, necrotic ulcers (Figure 1). The surgeon expected that it would take several months for the ulcers to heal. Compression



Figure 1: 5 December 2012
Initial assessment, prior to applying Prontosan

bandaging was recommended to reduce the swelling and hasten healing; however, the patient declined.

Both wounds measured 8x8 cm with a pain score of 8/10.

DRESSING/WOUND MANAGEMENT

Prontosan Solution and Prontosan Gel were applied daily to cleanse, donate moisture and debride necrotic tissue. Daily application continued for 14 days then 2nd daily. The wound was covered with a non adherent silicone layer, Silnet (B.Braun) and Zetuvit (Hartmann).

EVALUATION

Prontosan successfully removed all of the necrotic tissue in a shorter time frame than expected, revealing a healthy granulating wound base. In addition, the patient reported a significant reduction in pain.

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Figure 2: 17 December 2012
14 days post application of Prontosan

Prontosan

Prontosan Wound Irrigation Solution and Prontosan Wound Gel are made from purified water and two active ingredients:

- **Polyhexanide (Polyhexamethylene biguanide PHMB)** — an antimicrobial agent deployed in cosmetics, baby wipes, contact lens solutions and swimming pool cleansers and, more recently, in wound care to reduce surface bioburden³.



Figure 3: 20 January 2013
46 days post application of Prontosan

- **Betaine**, a surfactant. Surfactants lower the surface tension of the medium in which they are dissolved, making it easier to lift off dirt and debris and suspend it in solution so that it does not recontaminate the wound⁴.

The combination of PHMB and Betaine has an increased ability to penetrate difficult to remove coatings, lifting dirt and debris, bacteria and biofilm from the wound⁴.

Prontosan contains a preservative that prevents bacterial growth and ensures sterility for up to eight weeks.

PHMB binds to the positively charged surface of the bacteria and then travels to the bacteria's inner cytoplasm and the cytoplasm membrane, disrupting the integrity and permeability of the phospholipid structure, leading to cell death³. This action is quick and so bacteria are unlikely to develop resistance to PHMB⁴.

PHMB has a greater antimicrobial efficacy than chlorhexidine and its antimicrobial effect is not inhibited by human wound fluid and human tissue⁵. Using microtitre assays it was demonstrated that PHMB acted synergistically with commonly used antibiotics, while chlorhexidine did not. PHMB is not absorbed systemically whilst antibiotics do reach the wound and can act locally⁵.

PHMB has a broad antimicrobial spectrum, including Gram-positive and Gram-negative bacteria, plaque-forming and biofilm-building bacteria (but not spore-forming bacteria), intracellular bacteria such as chlamydiae and mycoplasma, and fungi including *Candida spp.* and *Aspergillus spp.*⁵.

PHMB has been in use for approximately 60 years with no evidence of the development of resistance⁷. Comparative tests of PHMB's biocompatibility (measurement of an antiseptic/antimicrobial agent's activity in relationship to its cytotoxicity) against chlorhexidine, povidone-iodine, triclosan, silver and sulfadiazine have demonstrated its superiority.

Mueller and Krebsbach⁶ found its use reduced fibrin slough and prevented the build-up of necrotic tissue and so promoted connective tissue regeneration.

Unlike systemic antibiotics Prontosan does not interfere with protective bacterial flora in other parts of the body, such as the gut, and can be used as an alternative to antibiotic prophylaxis in surgical wounds for the prevention of surgical site infections⁷. PHMB can be used on sensitive or irritated skin with a low risk of allergy. Prontosan is a sterile, colourless, odourless, ready-to-use product. It is compatible with all wound dressings (except larval therapy)⁴.

HOW TO USE

Gauze pads should be soaked in the solution and applied to the wound. Contact between the wound bed and the solution needs to be maintained for 10–15 minutes to ensure maximum antibacterial action. The gel allows wound cleansing and debridement to continue until the next dressing change⁴. The gel can be applied directly to the wound, filled into cavities or dressings can be moistened with the gel prior to application⁴.

SUMMARY

Prontosan is a wound cleanser that contains PHMB and Betaine. It can be used on acute and chronic wounds to moisten, decontaminate, and remove slough, exudate and debris. It prevents the formation of biofilms.

It reduces wound infection, wound pain and odour. PHMB has been in general use for approximately 60 years with no evidence of the development of resistance. It exerts little toxicity and has been found to be safe and effective.

CONFLICTS OF INTEREST

BBraun did not supply Prontosan for the purpose of this case study. I declare that I was a former employee of BBraun and that this article

was submitted after my employment ceased. Financial sponsorship was not sought nor obtained from BBraun or any other company for this case study

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