

# Best Practice Statement

The use of topical  
antiseptic/antimicrobial agents  
in wound management

Second edition, May 2011

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## FOREWORD

This Best Practice Statement has been produced in accordance with the standards set out by the Appraisal of Guidelines for Research and Evaluation (AGREE) collaboration (AGREE, 2003).

A working group was formed in early 2010 as a result of a clear need to advise on when, why and how topical antimicrobial agents be most effectively used. A group of 29 multidisciplinary contributors met to develop the basic document, for which they were paid an attendance honorarium and travel expenses. This first meeting was funded by an unrestricted educational grant from ConvaTec Ltd and Mölnlycke Health Care and the project was directed and managed by Wounds UK. No other payments were paid to any of the contributors.

The guidelines were subsequently drawn up and circulated to a wider group of contributors who received no fee for their reviews. The document progressed through five drafts, with all comments and reviews being considered, discussed and agreed upon before reaching this final draft, which has been endorsed by the contributors before publication. This document supercedes the previous edition published in late 2010.

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## INTRODUCTION

This document has been compiled to fulfill a distinct need. The literature on the management of wound infection has been criticised for its paucity of reliable evidence. This, we believe, is because there are Cochrane-style systematic reviews drawing attention to the lack of evidence-based use for topical antiseptics from selected randomised, controlled trials (RCTs). Nevertheless, clinical practice needs persist and patients require treatment. Consequently, this exercise has been undertaken and this second edition is intended to address apparent shortcomings, and so fill the gap. In the UK, the repercussions from these systematic reviews have led to restrictions in the availability of topical antimicrobial dressings, notably those containing silver (White, 2010a). These restrictions have provoked considerable and widespread concern among clinicians, as they are not necessarily to the benefit of the patient, nor do they help clarify any alternative best practice.

This second edition of the Best Practice Statement, as well as covering acute and chronic wounds, also includes a specific section on the management of minor burns. The application of topical antimicrobial agents in paediatrics, an area of concern from the safety aspect, is also addressed as a separate topic.

It is the intention of the contributors that this document continues to develop with time, including further evidence as it becomes available. Furthermore, the contributions of a wider audience of clinicians will also serve to consolidate best practice standards. Future editions will be published as and when justification for update and revision arises.

## WHEN, WHY AND HOW TO USE TOPICAL ANTIMICROBIALS

The express intention of such agents is to reduce wound bioburden and, as such, dressings providing sustained release (i.e. over a period of days) are required. Where clinically justified preventative use of antimicrobials is indicated, this must be conducted in full recognition of the risk-benefit ratio. While not all products available on the UK market include clear instructions on the duration of use, in most instances this should be restricted to two weeks unless there is clear clinical justification to continue for longer. Topical antimicrobial agents

are not without disadvantages; these are contrasted with known advantages in *Table 1*.

The recent publication of a large clinical trial involving silver-containing dressings has proved controversial (the VULCAN Trial, Michaels et al, 2009). From the positive perspective, this study confirms that silver should not be used just to get quicker healing, which was a common theme being touted at the time the study was planned. That an agent designed and intended for short-term use in reduction of bioburden should be judged upon its capability to reduce time to healing is scientifically unreasonable. Wound infection and/or critical colonisation are known to delay, and therefore extend time to healing (White and Cutting, 2006, White et al, 2006). The articles by Michaels et al (2009) and the Drug and Therapeutics Bulletin (DTB, 2010) have served to 'mobilise' wound care experts to make their feelings, and considered opinions, clear (Leaper 2006; Leaper and Drake, 2011). A carefully reasoned article by Gottrup et al (2010) is testimony to this effect. The authors state that: 'the extended definition by Sackett (1996) may be more relevant in the wound sector: evidence-based medicine is not restricted to randomised trials and meta-analyses, but involves exploration of all types of best external evidence with which to answer our clinical question'. These sentiments echo those of Sir Douglas Black in 1998 about the limitations of evidence. This approach towards clinical evidence in wound care is certainly not new; correspondence in key journals has posed provocative questions (Maylor, 2007; Cutting, 2008; White and Jeffery, 2010; White, 2008, 2011).

Wound dressings, regulated as medical devices, should not, in our opinion, be judged as if they are pharmaceuticals; they are not. No regulatory authority in any of the developed nations currently regards them as such. This does not, however, reduce the need for the development of robust evidence to support and guide dressing use to gain the best outcomes for patients in the context of best value. The wider wound care community is now anxious to present their case for 'reasonable' and 'realistic' clinical evidence (Cutting, 2008; Cutting and White, 2008).

Similarly, the wound dressings industry has a responsibility to provide clear, evidence-based

**Table 1. Advantages and disadvantages of topical antimicrobial therapy. Adapted from Lipsky and Hoey, 2009**

Advantages	Disadvantages
▶▶ Bactericidal, sustained concentration of antimicrobial at the site of infection	▶▶ Few agents have been proven to be effective in randomised clinical trials
▶▶ Limited total amount of antimicrobial needed	▶▶ Minimal tissue penetration limits use to open wounds without cellulitis or deep soft-tissue spread of infection
▶▶ Limited potential for systemic absorption and toxicity	▶▶ Systemic absorption of some agents may occur if used on large/deep/paediatric wounds
▶▶ Can use novel agents not available for systemic use	▶▶ Some rarely cause local hypersensitivity or contact dermatitis reactions
▶▶ May enable avoidance of using systemic antibiotics, thereby reducing development of antibiotic resistance	▶▶ May interfere with wound healing processes
▶▶ Directs attention of both patient and care providers to the wound	▶▶ Possible alteration of normal cutaneous flora
▶▶ Easily applied as outpatient, by patient or caregiver, potentially reducing the need for institutional care	▶▶ Difficult to accurately dose
▶▶ Often better adherence to treatment, especially for children	▶▶ Frequent reapplications may be needed
	▶▶ May be difficult to apply, or aesthetically unacceptable to some patients

instructions for use, and to educate customers in the best practice for use of their products. On this latter point, the NHS must recognise that unless it invests in its own tissue viability workforce to provide impartial evidence-based education to its staff on effective use of dressing products, it will continue to need to rely on wound care company staff to provide training as an essential adjunct to product supply. To date, this has often been viewed with suspicion by those outside the immediate clinical arena.

In the VULCAN trial, silver antimicrobial agents were placed on wounds without a justified clinical indication for use, and were used for a prolonged period of time, i.e. 12 weeks. This practice cannot be supported as it is incompatible with current clinical practice (Greenwood et al, 2007; Lo et al, 2009; Carter et al, 2010; Fife et al, 2010). This Best Practice Statement supports the view that, except in clinically-justified circumstances, topical antimicrobial agents should be used for defined, short-term periods. Clinical 'titration' (adjusting therapy to the presence of clinical signs and symptoms of infection) of antimicrobial therapy is

not new; it would certainly apply to antimicrobial (including silver) dressings in the hands of informed clinicians.

**The basic principles of bioburden control in any wound involve debridement, as necessary; and antimicrobial treatment with careful monitoring up to a defined endpoint. This would never be dictated purely by time elapsed, but rather by sound clinical parameters.**

There is already evidence that arbitrary withdrawal of silver dressings can lead to increased incidence of septicæmia (Newton, 2010). This brings with it additional, unplanned healthcare costs, as well as the patient-related issues of morbidity and mortality.

The literature does include published reviews of the use of topical antiseptic/antimicrobial agents (Cooper, 2004; White et al, 2006; Lipsky and Hoey, 2009). There are also systematic reviews of evidence (O'Meara et al, 2001, 2008, 2010), including topical silver containing dressings (Storm-Versloot et al, 2010). This current document is the result of the first exercise of this kind conducted

according to a consensus of expert opinion and widespread clinical practice.

## TOPICAL ANTISEPTIC/ ANTIMICROBIAL AGENTS

For the purposes of this document, this term means substances capable of broad spectrum bactericidal activity (against both Gram-positive and Gram-negative, aerobic and anaerobic bacteria that are commonly found in the wound bioburden and capable of causing infection). In the light of recent research and of current thinking, this should include both planktonic bacteria and those in biofilm (sessile) colonies (Rhodes et al, 2008). Additionally, the active substances must be contained in a containment/delivery system. This would normally, although not exclusively, be a contact dressing that can be left in contact with the wound for 12 hours or more and remain active for the duration of wear time. Included in the definition are products containing/delivering chlorhexidine, iodine, silver (including the sulfadiazine SSD), polyhexamethylene biguanide (PHMB), glucose oxidase enzyme systems and honey. Other products which have microbial control effects principally by physical methods, such as sequestration, pathogen binding, toxin binding, exudate removal, and debridement

are excluded as they are neither bactericidal nor bacteriostatic.

Antimicrobial dressings all have different physical characteristics, such as the level of antimicrobial they release, the duration of effective action, the base dressing's ability to handle different levels of exudate or manage odour or pain, and specific products should be chosen to reflect the overall treatment requirements of the wound (Table 2). These actions of the dressing are important clinically (Cutting et al, 2009) and economically, but will not be reviewed here.

The topical antiseptic agents of silver, PHMB and iodine should always be used with caution in paediatric cases.

## ANTIBIOTIC RESISTANCE AND THE ROLE OF ANTISEPTICS

The management of healthcare-acquired infections (HCAIs) is complicated by both the increasing prevalence of antibiotic resistant organisms, and the immunocompromised or severely ill patient population. The prevalence and resistance profile of chemotherapeutic drug resistant pathogens continues to evolve (Nicolau, 2011). This has created the need for improved infection control and the employment of 'disinfection' regimens. Thus, the role of biocides (i.e. antiseptics, disinfectants and preservatives) and other non-antibiotic agents is increased. Resistance related to such agents is very low, provided that they are used under appropriate conditions (Meyer and Cookson, 2010). The greater use of antiseptics to reduce reliance on antibiotics is, therefore, justified (Leaper et al, 2010).

Topical antimicrobials have long been widely used for the prevention and treatment of burn wound infections with agents such as silver, honey and iodinated compounds being prominent (Dai et al, 2010). While evidence in the form of RCTs is currently weak, or lacking, it has been acknowledged that topical antiseptics do have a role in treating wound infection (Ubbink et al, 2009). Eradication of methicillin-resistant *Staphylococcus aureus* (MRSA) and *Vancomycin-resistant enterococcus* (VRE), common wound pathogens, by antiseptic agents has long been accepted as 'routine' clinical practice even if not supported by high-grade evidence (Ubbink et al,

**Table 2. Properties of an ideal topical antimicrobial for treating chronic wounds (adapted from Lipsky and Hoey, 2009)**

- ▶▶ Properly targeted antimicrobial spectrum for the particular type of infected wound
- ▶▶ Effective against multi-drug resistant organisms, e.g. MRSA, VRE, carbapenemases
- ▶▶ Rapid bactericidal activity
- ▶▶ Persistent or residual skin activity, allowing infrequent dosing, or, suitable for sustained-release
- ▶▶ Activity in the presence of body fluids and proteins in wound exudate
- ▶▶ Low likelihood of selecting for bacterial resistance
- ▶▶ Some local skin penetration but no systemic absorption
- ▶▶ No associated toxic (to host tissue) or allergic reactions
- ▶▶ Acceptable cosmetic and aesthetic qualities
- ▶▶ Low cost, i.e. cost-effective

2009; Aramwit et al, 2010; Kwakman et al, 2011; Rezaei et al, 2011).

It could be considered that further impetus for the utilisation of topical antiseptic/antimicrobials in wound care has been provided by the recent advent of carbapenemase containing bacteria ([http://www.hpa.org.uk/web/HPAwebFile/HPAweb\\_C/1294740725984](http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1294740725984)). These are plasmid-borne enzymes (e.g. NDM-1) that can be spread between Gram negative organisms conferring a dangerous new high level of wide spectrum antibiotic resistance. Carbapenemase strains have been identified across the globe. The advent of *Pseudomonas aeruginosa* isolates producing a carbapenemase in the UK (Woodford et al, 2001, 2008) is a worrying development, bearing in mind the capacity of this organism to disrupt/impede wound healing. Dr David Livermore (Health Protection Agency [HPA], 2011), director of the HPA's antibiotic resistance monitoring and reference laboratory has said: 'The emergence of carbapenem resistance is a major public health concern.... This resistance makes infections much harder to treat. What's more, NDM and the other enzymes that cause carbapenem resistance can be produced by many different types of bacteria, which can affect various body sites.'

The future is thus set for a continuing downward trajectory for the efficacy of antibiotics in all areas of medical practice. In the field of wound care, one school of expert opinion calls for the prompt and controlled utilisation of topical antiseptic/antimicrobials in some cases of low grade infection; and as an adjunct to systemic antibiotics in more invasive cases of infection. This is despite the lack of high level evidence on improved healing outcomes as raised by recent Cochrane systematic reviews. The best effect from topical antiseptic/antimicrobials may come from combining their use with serial debridement and other biofilm prevention and removal strategies.

To deploy a topical antiseptic/antimicrobial at the time most likely to produce a clinically valuable outcome requires a degree of experiential knowledge. Consistent application of that knowledge is likely to be improved by use of an algorithm or other guidance device. To date, no diagnostic tool, including microbiological studies, has been developed that provides a clear

indication of the best time to apply a topical antiseptic/antimicrobial, or to initiate a systemic antibiotic for wounds which are not healing, or are only displaying minimal signs of infection. In this current diagnostic void, the use of clinical signs and symptoms to identify wounds in need of early intervention with a topical antiseptic/antimicrobial, while imperfect, is at least one acceptable method on which to base clinical treatment decisions.

Some expert opinion considers prevention of progression from the contentious state of 'critical colonisation' to more severe levels of infection that currently would receive antibiotic therapy to be both possible and cost-effective if employed in the right place, at the right time, for the right duration. If this is true, topical antiseptic/antimicrobials, arguably, also have added advantages, including low resistance potential and minimal systemic uptake and side effects (*Table 1*; Lipsky and Hoey, 2009). The other broad area for optimum use of topical antiseptic/antimicrobials is to identify wounds at substantially greater likelihood of developing infection, perhaps in the first instance by expert consensus, so that prophylactic/early treatment can be initiated.

For the patient and their attending clinicians, the rapid relief of unpleasant symptoms, the cessation of enlargement and the re-emergence of the healing tissues are the effects that they are looking for. The eventual healing of the wound is an important, but nonetheless distant, secondary aim. For treating wounds that have a healing delay or overt infection, reducing morbidity on the route to healing is as important as either healing or preventing recurrence. This is not often addressed when searching for high level evidence of effectiveness of one product type over another. For wounds that are at greater risk of infection, preventing them slipping off a healing trajectory is an important factor for gaining patient satisfaction and cost-effective care. While expert knowledge is undoubtedly flawed and high level evidence uncommon in wound care, clinicians have a duty of care to their patients today — not tomorrow when more evidence might have emerged for treatment strategies.

In the meantime, for clinicians in practice, it would be unethical not to apply 'best practice' as defined by the sets of guidance from expert bodies in the field of wound care, even if that evidence is often based only upon expert opinion.

## WOUND INFECTION

Wound infection is without doubt the most troubling of all wound complications (Cutting, 1998). Whether present in a closed surgical wound or in a large open pressure ulcer, the impact on the patient is such that they may experience symptoms such as pain, swelling and discharge, but also may be at risk of a potentially life-threatening sepsis (Collier, 2004).

Wound infection occurs as a result of the imbalance between the patient's immune system, bacteria and the conditions within the wound, which may precipitate bacterial proliferation (European Wound Management Association [EWMA], 2006; World Union of Wound Healing Societies [WUWHS], 2008). Therefore, infection occurs when conditions in the wound are ideal for the bacteria to multiply and also when there is lowered host resistance.

In the case of elective surgical wounds that have been closed using primary closure techniques, such as clips or sutures, the wound is most likely to have been contaminated during the actual operation (Reilly et al, 2006; Leaper, 2010). There are a number of factors that could lead to peri-operative contamination, including the type of surgery. For example, in bowel surgery the risk of faecal contamination of the abdominal cavity, the length of time in theatre, the surgeon's technique, the amount of bleeding, and even the number of people in theatre can all influence the development of post-operative infection (Reilly et al, 2006). Add to this the patient's nutritional state, hydration, and the presence of concurrent conditions and lack of peri-operative warming and there is a significant group of risk factors to consider:

Chronic wounds such as pressure, leg and diabetic foot ulcers are likely to be colonised with bacteria due to the nature of the open wound and the tissue types within the wound (Howell-Jones et al, 2005). The presence of sloughy and necrotic tissue provides an ideal environment for bacterial growth, due to the availability of nutrients and oxygen that are necessary for the organism's survival.

Foot ulcer infections are common in patients with diabetes. Although infection is not considered to be a direct cause of diabetic foot ulceration (DFU), infection plays a major role in wound healing impairment, and often

leads to hospitalisation, high mortality rates and the incidence of lower extremity amputation (Falanga, 2005; Bader, 2008). Indeed, infection is reportedly the final common denominator that leads most people with chronic DFU to lower limb amputation (Lipsky et al 2004; O' Loughlin et al, 2010). Therefore, prompt recognition and early management of infection in the diabetic foot is imperative. If infection is left undetected or treatment is delayed, DFU can become limb- and life-threatening (Sheppard, 2005). There is much variability in treatment approaches to infected DFUs and, as Lipsky et al (2004) suggested, there is a need for evidence-based guidelines in this area to prevent the chronic complications and adverse outcomes associated with diabetic foot disease.

Elbright (2005) suggested that infection in wounds can present as increased local pain, cellulitis, abscesses, necrotising fasciitis, osteomyelitis, sepsis or bacteraemia. Systemic antibiotics should be administered when infection is suspected. (It should be noted that Elbright does not describe infection in the same terms as this document, e.g. critical colonisation, local and spreading infections.) Pressure ulcers provide a portal of entry for bacteria, as the bacteria will first multiply on the wound surface and then, over time, may move deeper into the tissues (Elbright, 2005). The release of toxins by the bacteria destroys local tissue and, once established in the deeper tissues, the bacteria can continue to multiply and enter the circulation.

Bryan et al (1983) examined 102 patients with decubitus ulcers who had developed bacteraemia over a period of five years in a US hospital. In 49% of episodes, pressure ulcers were thought to be the probable cause of the bacteraemia. The mortality for the groups was 55%, with 51% of these deaths attributed to infection. The findings would indicate that pressure ulcers are strongly linked to soft tissue infection, which may lead to bacteraemia.

Cooper (2005) also states that all micro-organisms require supplies of nutrients to provide carbon, nitrogen, minerals and water. In addition, some bacteria will proliferate in wounds that are either oxygen-rich (aerobes) or oxygen-poor (anaerobes), while others can adapt to both types of environment — these are known as facultative organisms (Ratliff et al, 2008).

Bacterial quality, quantity and virulence are also important factors to consider, as many Gram-

positive cocci produce excessive virulence factors, such as biofilms, adhesins and polysaccharide capsules, all of which can reduce the impact of antiseptic/antimicrobial agents on the bacteria.

In addition to the virulence of the bacteria, and central to its impact on the patient, is their susceptibility to infection. This is influenced by the patient's immune system, which can be affected by a number of factors such as the presence of concurrent chronic illness. Illnesses that affect patients over prolonged periods of time can continually erode the immune system. This decrease in immunity coupled with an increase in bacterial virulence can impact on the development of wound infection. Conditions such as diabetes, vasculitic disease and malnutrition all have the ability to lower the host resistance to infection. Other factors such as oedema can also reduce the potency of antiseptic/antimicrobial agents. Many patients who present with wounds, particularly chronic wounds, are likely to have concurrent conditions which may precipitate the wound formation or be unrelated, but either way these conditions may impact on the healing process.

## IDENTIFICATION OF WOUND INFECTION

Identifying wound infection should be viewed as a clinical skill which can be supported by laboratory findings when necessary, but it should not rely on pure laboratory science. To date, there have been few bedside tests which can identify the presence or absence of bacteria in wounds. So, armed with a thorough patient history and good clinical assessment skills, the clinician should be able to establish the reason for changes in the wound status which are indicative of infection.

Infection in the diabetic foot is common and can prove severe, placing the patient's limb and life at risk (Cavanagh et al, 2005). Practitioners should remain vigilant for subtle signs of infection to allow prompt diagnosis and implementation of management strategies. Identifying infection in the diabetic foot can, however, prove challenging. Edmonds and Foster (2006) advise that only half of infection episodes in DFU show signs of infection. This is attributed to peripheral neuropathy and ischaemia that can diminish the classic signs of infection, including pain and heat, erythema and inflammation.

The clinical signs of increased erythema, pain, swelling, and localised heat provide a fundamental guide to the outward signs of infection. However, as wounds become more complex, a number of authors have attempted to summarise the potential key features of an infected wound.

In 1994, Cutting and Harding produced a guide to identifying wound infection. In addition to the criteria of erythema, pain, swelling and localised heat, they identified the following potential signs:

- ▶▶ Increased discharge
- ▶▶ Delayed healing
- ▶▶ Wound breakdown
- ▶▶ Pocketing at the base of the wound
- ▶▶ Epithelial bridging
- ▶▶ Unexpected pain or tenderness
- ▶▶ Friable granulation tissue
- ▶▶ Discolouration of the wound bed
- ▶▶ Abscess formation
- ▶▶ Malodour.

The Applied Wound Management (AWM) assessment tool was designed to assist in the assessment of wounds using three continua, wound healing, wound infection and wound exudate (Gray et al, 2005). The infection continuum was designed to aid clinicians in considering the wound state as either: colonised, critically colonised, locally infected or with spreading infection. The state of critical colonisation is one which many clinicians recognised as being 'pre-infected', i.e. there are changes in the wound, healing has stopped or slowed down, the tissue may look unhealthy, but there are none of the normal signs of infection present (White and Cutting, 2006). In this critically colonised state, there is possibly a role for the use of antiseptic/antimicrobial agents to attempt to redress the balance, supporting the work of the immune system by disrupting bacteria on the surface of the wound (Gray et al, 2005).

The concept of Wound Bed Preparation (WBP) has also gained international recognition as a framework that can provide a structured approach to wound management. By definition, WBP is the management of a wound to accelerate endogenous healing or to facilitate the effectiveness of other therapeutic measures (Falanga, 2000; Schultz et al, 2003; EWMA, 2004). The concept focuses the clinician on optimising conditions at the wound bed to encourage normal endogenous healing (Dowsett, 2008).

It is an approach that should be considered for all wounds that are not progressing to normal wound healing. The mnemonic TIME is frequently used as summary of the main focus within WBP:

- ▶▶ **T** represents the tissue types in the wound itself. Is it non-viable or healthy?
- ▶▶ **I** refers to the presence or absence of infection or inflammation
- ▶▶ **M** addresses the issue of moisture balance, and avoiding desiccation or maceration
- ▶▶ **E** is the wound edge. Is this non-advancing or non-migrating? The aim being to promote wound healing.

### BURN INFECTION

Several factors contribute to infection, notably the destruction of the skin barrier, the presence of necrosis and sero-sanguinous exudate, and impaired immune function. The risks are commensurate with the depth and extent of the burn, the health and age of the patient, local perfusion of the tissues, and use of systemic antibiotics. An up to date overview of burn wound infection and its management is published by Gallagher et al (2007). For the purposes of this Best Practice document, it is recommended that full-thickness and deep partial-thickness burns should be referred to specialist centres/clinicians for treatment. Only superficial partial-thickness burns will be covered here.

Topical antimicrobials are effective in preventing infection (Ansermino and Hemsley, 2005). As burn eschar may be some distance from patent vasculature, systemic agents (i.e.

oral and parenteral antibiotics) are unlikely to achieve therapeutic levels at the burn site, whereas topically-applied agents, appropriately-dosed, can achieve effective bioburden control. There is published evidence for the use of many topical antimicrobials including silver compounds, metal and salts (Demling, 2008; Gravante et al, 2009; Elliott, 2010; Khundkar et al, 2010); honey (Wijesinghe et al, 2009), and PHMB (Piatkowski et al, 2011). The topical approach, and these antimicrobial agents, is now regarded by many as standard practice (Patel et al, 2008), being incorporated into reference textbooks on burn therapy, e.g. Herndon (2007).

The use of silver as an antimicrobial for topical use has been reviewed by Klasen (2000). However, since that date, a number of new dressings and important evidence has emerged. These dressings are of proven antibacterial activity. Ip et al (2006) tested five of the silver dressings available at that time against typical burn pathogenic bacteria (Table 3), however the spectrum and rapidity of action ranged widely for different dressings.

Bactericidal activities of the above silver-impregnated dressings against Gram-positive and Gram-negative common burn pathogens were determined *in vitro*. The nine strains tested were methicillin-resistant *Staphylococcus aureus* (MRSA) ATCC BAA-43; methicillin-sensitive *S. aureus* ATCC 29213; *Enterococcus faecalis* ATCC 29212; *Escherichia coli* ATCC 35218; *Proteus vulgaris* ATCC 6380; *Enterobacter cloacae* ATCC

**Table 3. Comparison of five silver dressings (Ip et al, 2006)**

Silver dressing	Content
▶▶ Aquace <sup>®</sup> Ag (ConvaTec)	▶▶ Silver-impregnated dressing with Hydrofiber composed of hydrocolloid and 1.2 % ionic silver
▶▶ Acticoat <sup>®</sup> (Smith & Nephew)	▶▶ Three-ply gauze dressing consisting of an absorbent polyester inner core sandwiched between outer layers of silver-coated, polyethylene net (nanocrystalline silver)
▶▶ Urgotul <sup>®</sup> SSD (Urgo)	▶▶ Hydrocolloid dressing consisting of a polyester web, impregnated with carboxymethylcellulose, white soft paraffin and silver sulfadiazine
▶▶ PolyMem Silver <sup>®</sup> (Ferris)	▶▶ Polyurethane membrane matrix containing F68 surfactant, glycerol, superabsorbent starch copolymer and silver (minimum 124 µg cm <sup>-2</sup> )
▶▶ Contreet antimicrobial foam (Coloplast)	▶▶ Foam dressing with ionic silver (silver sodium hydrogen zirconium phosphate)

13047; *Acinetobacter baumannii* ATCC 19606 and *A baumannii* BM4454; *Pseudomonas aeruginosa* ATCC 27853. All strains were sensitive to each silver dressing.

Where does this put silver in the spectrum of topical burn antimicrobials? While the available evidence has been criticised by Wasiak et al (2008), many clinical experts are convinced (Dunn and Edwards-Jones 2004). According to Demling (2008), '... the use of slow release silver dressing as the topical burn wound antimicrobial of choice, markedly reducing discomfort, the need for dressing changes and an overall decrease in infection. In larger, deeper burns, the approach has changed from the chronic management of an open burn wound to rapid excision and wound closure, eliminating the burn as a source of complications'. Vlachou et al (2007) added that: 'this study has confirmed our view that Acticoat products are safe for use on burns and they remain a standard part of treatment at our centre'.

## PAEDIATRIC WOUNDS

Topical antiseptic use in children, especially neonates, should be approached with caution (Metry and Herbert, 2000; Howard, 2001). Consequently, we must treat every case on its merits, with full recognition of the available evidence and risk-benefit. Although silver, in the form of silver sulfadiazine cream, and as silver salts and metal in wound dressings, has been used widely for many years, there is still controversy surrounding the clinical evidence. Most significantly, the use of topical silver-containing dressings in pre-term infants and children up to the age of five has been questioned on safety grounds. Much of this controversy has arisen because of reports of high blood silver levels in adult patients with burns (Wang et al, 2009); and children with the skin disorder epidermolysis bullosa treated at Great Ormond Street Hospital in London (Denyer, 2009). While no overt silver-related pathology has been diagnosed in these children, persistent blood levels of silver from 10x to ~100x the recommended maximum give reasonable cause for concern.

The potential safety issues relate to body surface area involved, age, body weight, skin barrier function (i.e. the nature of the skin according to disease state and age of development) and the duration of treatment (i.e. exposure). There are currently no grounds

to differentiate silver-containing dressings by silver content or chemical form. Pending further research, we recommend that each case be treated on its merits, involving a careful risk assessment and close monitoring. Infection is a leading cause of mortality, particularly in serious paediatric burns and skin disease. Duration of treatment with any other topical antimicrobial, including silver, should be limited. Consequently, it has been suggested that silver dressings be used for no longer than two weeks without sound clinical justification (White et al, 2011). Failure to respond to treatment should result in careful re-assessment and, if necessary, a change of topical antimicrobial. Referral should be considered to tissue viability, burns, or dermatology specialist practitioners where there is concern around choice of antimicrobial or wound progress.

Other topical agents which may be considered are glucose oxidase-lactoperoxidase alginate gel (De Smet et al 2009), PHMB polyhexanide (Piatkowski et al, 2011), honey (Vardi et al, 1998; Bittmann et al, 2010), and iodine compounds (Leaper and Durani, 2008; Vermeulen et al, 2009). The latter two have known drawbacks in paediatric use but are not inherently unsafe.

**There are, at present, no contraindications for the paediatric use of silver. To avoid inappropriate treatment and potential morbidity, we recommend that this Best Practice Guideline and above advice be followed pending more evidence.**

## WOUND SWABS

There is little clinical evidence to support the role of wound swabs in identifying wound infection and the topic is an ongoing subject of debate. Using a wound swab may identify some or all of the bacteria within the wound, but may not always indicate the clinically significant species. There is also a significant delay in obtaining the results, during which time the patient's condition could deteriorate if not treated (EWMA, 2006; Dow, 2008).

However, despite their limitations, wound swabs remain part of clinical practice until advanced techniques are developed and validated. Recent evidence shows the Levine technique to identify more organisms in both acute and chronic wound swabs (Angel et al,

2011), and the Copan ESwab to be superior in the recovery of coagulase-negative Staphylococci (including MRSA) and Enterococcus spp (Saegeman et al, 2011).

## MANAGEMENT OF WOUND INFECTION

*All wounds contain microorganisms, yet the majority are not infected. The spectrum of interactions between the microbial community and the host may gradually reach a point at which the wound healing process is impaired or localised detrimental host effects are initiated. When this transition occurs, immediate intervention to pre-empt infection is indicated.*  
 Vowden and Cooper, 2006

Once thorough assessment of the wound has been carried out and the wound is considered to be either critically colonised, locally infected or has spreading infection, appropriate topical antiseptic/antimicrobial treatment may be started. Depending on local protocol, a wound swab may be taken, however, as stated, this should not delay treatment.

In addition to using topical antiseptic/antimicrobial agents and/or antibiotics, other appropriate wound management techniques should be employed which can impact on the bacterial burden. Debridement of necrotic or sloughy tissue can alter the wound environment significantly, help to reduce the overall bioburden, and reduce odour (EWMA, 2006).

In wounds that are thought to be critically colonised, a topical antiseptic/antimicrobial agent may be considered. However, it is imperative to select a wound management product that is appropriate for the tissue types present, the level of exudate and patient comfort. When topical antiseptic/antimicrobial agents are utilised and consistent signs of progress towards healing are observed, antimicrobial intervention may be stopped. If the wound is unchanged after 14 days, it is recommended that an alternative topical antiseptic/antimicrobial agent is used. If the wound begins to show further signs of infection, the use of a systemic antibiotic should be considered.

In locally infected wounds where there are no signs of the infection spreading, topical antiseptic/

antimicrobial agents should be used. If the signs of infection subside and the patient shows no signs of systemic infection, the antiseptic/antimicrobial agent should be discontinued. If the wound continues to show signs of infection, a systemic antibiotic should be considered (EWMA, 2006). In patients with high risk or immunocompromised conditions, such as diabetes, or where poor vascularity may mask the cardinal signs of infection, experienced clinicians may consider the use of systemic antibiotics.

For wounds which are assessed as having spreading infection and/or systemic infection, the patient should have blood cultures taken to identify the offending organism and to assess for differential diagnosis. The patient should be

### Table 4. Glossary of terms

#### ▶▶ Antibiotics

Chemical substances produced either naturally (microorganisms) or synthetically which have the capacity, in dilute solutions, to selectively inhibit the growth of (static) or kill (cidal) other microorganisms. They tend to:

- ~ act on one specific cell target
- ~ have a narrower spectrum of activity
- ~ are relatively non-toxic
- ~ are more susceptible to losing their effectiveness to bacterial resistance

#### ▶▶ Disinfectants

A non-selective chemical agent that disinfects by killing or removing microorganisms from inert surfaces, used particularly on instruments, work surfaces, etc and are not intended for use on the tissues of the body where toxicity would impair healing

#### ▶▶ Antiseptics

A disinfectant substance that can be used on intact skin and some open wounds that either kills (cidal) or prevents the multiplication (static) of potentially pathogenic organisms. Antiseptics can be dilute disinfectants: they are not selective and therefore can be toxic to the host tissue — particularly at higher concentrations. They have the advantage of rarely selecting for resistant microbial strains, and, being topical, do not rely on the bloodstream for access to the wound — this is particularly important in ischaemic wounds (Saffle and Schnebly, 1994). They have the possible disadvantage of toxicity to the host tissues (e.g. fibroblasts, keratinocytes and possibly leukocytes) at higher concentrations (Scott Ward and Saffle, 1995)

treated with broad spectrum antibiotics which in some cases may be given intravenously. Topical antiseptic/antimicrobial dressings should also be used to help reduce the wound bioburden (EWMA, 2006).

In the case of DFU, it should be noted that medical treatment, with antibiotic therapy, and/or topical antiseptic/antimicrobial agents may be insufficient to resolve infection in the diabetic foot. Surgical incision, aggressive debridement and drainage, with or without revascularisation, are often required to effectively manage diabetic foot infection (American Diabetes Association [ADA], 2003).

The use of topical antiseptic/antimicrobial agents is one of the key ways to assist in treating patients with signs of wound infection, and without judicious use of the products, patients may be at risk. If there is a culture of fear regarding the use of antiseptic/antimicrobial agents, some patients may be at risk of untreated infection which could progress to sepsis (Newton, 2010). It is equally important to avoid using topical antiseptic/antimicrobial agents on wounds in situations where infection is not present, or where there is no significant clinical risk of infection, as discussed within this Best Practice Statement.

This Best Practice Statement is designed to give guidance to clinicians who have to make daily judgements which impact on the quality of care patients receive.

## FINAL NOTE

Whenever using any CE marked dressing or antimicrobial product, all manufacturers' instructions for use should be followed, taking into account any contraindications that are specified.

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## BEST PRACTICE STATEMENT

Statement	Reason for statement	How to demonstrate statement is being achieved
<p><b>Gateway to topical antiseptic/antimicrobial agent use:</b></p> <ul style="list-style-type: none"> <li>❖ The patient should receive the standard care for this type of wound, e.g. leg ulcer</li> <li>❖ Care should be delivered in line with national and local guidelines and local prescribing practices using the best evidence available</li> <li>❖ Baseline data should be recorded in the patient's health records</li> <li>❖ Patients presenting with a clinical picture of critically colonised, localised or spreading wound infection (hereinafter referred to as wound infection) should be considered for treatment with topical antiseptic/antimicrobial agents</li> </ul>	<ul style="list-style-type: none"> <li>❖ Failure to adhere to standard care may contribute to delayed healing or development of infection</li> <li>❖ Practice should be based on the best available evidence</li> <li>❖ This allows for continuity of assessment by other healthcare professionals</li> <li>❖ Patients who present with an established infection may benefit from the use of topical antiseptic/antimicrobial agents as part of their treatment/care</li> </ul>	<ul style="list-style-type: none"> <li>❖ Compare patient health records with local/national standards</li> <li>❖ All organisations will compare patient health records with local/national standards</li> <li>❖ The patient's health records will contain the recording of baseline data</li> <li>❖ Health records of patients who present with a clinical picture of wound infection will demonstrate that they have been considered for treatment with topical antiseptic/antimicrobial agents</li> </ul>
<p><b>Contraindications and precautions:</b></p> <ul style="list-style-type: none"> <li>❖ Manufacturers' guidelines should be followed and products used in line with license</li> <li>❖ Multiple antimicrobial products should not be used in combination, unless there is an overriding clinical indication</li> <li>❖ Products selected should reflect clinical and patient needs</li> <li>❖ Accurate baseline data and or images should be recorded at each review</li> </ul>	<ul style="list-style-type: none"> <li>❖ Failure to follow manufacturers' guidance may lead to inappropriate care</li> <li>❖ Multiple products used on the same wound are likely to be against manufacturers' guidance and may compromise the patient</li> <li>❖ Each patient will have different clinical indications and social/psychological requirements which can be met by different preparations at different times</li> <li>❖ Failure to establish accurate baseline data and/or images could result in an inability to assess the interventions' outcome</li> </ul>	<ul style="list-style-type: none"> <li>❖ The patient's health records must demonstrate that the products are being used in line with manufacturers' guidance, or will contain a rationale for not following these instructions</li> <li>❖ The patient's health records will demonstrate that the products are being used in line with manufacturers' guidance or must contain a rationale for not following these instructions</li> <li>❖ A clear rationale supporting the product selected must be recorded in the patient's health records</li> <li>❖ Sequential records should be included in the patient's records</li> </ul>

## BEST PRACTICE STATEMENT CONT.

Statement	Reason for statement	How to demonstrate statement is being achieved
<p><b>Contraindications and precautions</b> <i>continued</i></p> <ul style="list-style-type: none"> <li>❖ Unless clinically indicated the patient's treatment should be continued for the prescribed period</li> </ul>	<ul style="list-style-type: none"> <li>❖ The termination of an antiseptic/antimicrobial treatment between scheduled assessments or after transfer to another care setting, without justifiable reasons, is unlikely to contribute to optimum care for the patient</li> </ul>	<ul style="list-style-type: none"> <li>❖ The rationale for terminating treatment before the prescribed period is complete must be recorded in the patient's health record</li> </ul>
<p><b>Prescribing issues:</b></p> <ul style="list-style-type: none"> <li>❖ Patients who present with the following should be considered for treatment with topical antiseptic/antimicrobial therapy — spreading infection, local infection, history of wound infection with genuine risk of re-infection, critical colonisation and where the patient's overall condition indicates a significant risk of infection</li> <li>❖ Topical antiseptic/antimicrobial treatment is not indicated for patients being treated using standard care for their particular wound type and who have no signs of infection</li> <li>❖ The patient's health records should state why the treatment has been started, how long it is prescribed for, and provide clear treatment objectives</li> </ul>	<ul style="list-style-type: none"> <li>❖ Topical antiseptic/antimicrobial agents can help to reduce wound bioburden</li> <li>❖ Patients with recurring infection are at risk of cellulitis and spreading infection which can significantly impact on clinical outcomes and quality of life</li> <li>❖ There is a risk of selecting for bacterial resistance if antimicrobial/antiseptic agents are used inappropriately</li> <li>❖ Where standard therapy is proving successful, topical antiseptic/antimicrobial agents are not indicated</li> </ul>	<ul style="list-style-type: none"> <li>❖ Patient health records and outcomes must demonstrate the appropriate use of topical antiseptic/antimicrobial agents in the patient groups mentioned</li> <li>❖ Patients without signs of infection should not routinely be given topical antiseptic/antimicrobial agents, and this will be reflected in the patient's health records</li> <li>❖ Patient health records will include outcomes indicating appropriate treatment regimens, or not</li> <li>❖ Regular auditing of patient's health records should demonstrate accurate information regarding treatments and rationales for treatments, with timely review of each prescription</li> <li>❖ The patient's health record must accurately reflect clinical need, i.e. wound deterioration or failure to progress to healing</li> </ul>

## BEST PRACTICE STATEMENT CONT.

Statement	Reason for statement	How to demonstrate statement is being achieved
<p><b>Prescribing</b> <i>continued</i></p> <ul style="list-style-type: none"> <li>❖ For the majority of patients, the initial prescription should normally be for 14 days with a formal review of treatment objectives at around seven days. However, a review should be conducted at each dressing change by a qualified healthcare professional</li> <li>❖ No prescription should extend beyond 14 days without discussion with a local specialist, unless previously agreed or indicated by clinical need</li> <li>❖ If a prescription extends beyond 28 days, a specialist referral should be made unless previously agreed</li> <li>❖ In some cases, such as in diabetic foot disease, a patient at high risk of infection may benefit from prophylactic antimicrobial intervention</li> </ul>	<ul style="list-style-type: none"> <li>❖ To prevent clinical ambiguity, promote continuity of care and provide an auditable paper trail which can be used to collect information on prescribing data</li> <li>❖ If a wound fails to respond to treatment there may be a number of other clinical differential diagnoses, such as vasculitis or carcinoma, both of which require specialist input</li> <li>❖ Patients at high risk may develop significant infection within a short timeframe</li> <li>❖ Clinical signs of infection may be diminished due to background pathology allowing infections to progress to more advanced stages before they are recognised, leading to worse outcomes</li> </ul>	<ul style="list-style-type: none"> <li>❖ The number of individual dressings supplied under a single prescription should be 14 days divided by the change frequency</li> <li>❖ Significant rationale supported by multidisciplinary clinical assessment and specialist support must be documented within the patient's health records</li> <li>❖ Evidence of specialist referral and record of specialist consultation (notes from phone call, telemedicine record or direct patient consultation) will be found in the patient's health records</li> <li>❖ Reason for prophylactic use will be recorded in the patient's health records</li> </ul>
<p><b>Treatment plan/goals</b></p> <ul style="list-style-type: none"> <li>❖ The treatment selected should reflect both clinical and patient needs</li> <li>❖ The patient's health records should state why the treatment has been started, how long it is prescribed for and provide clear treatment objectives</li> <li>❖ The patient's health records should contain clear evidence that at each dressing change the patient has been assessed in line with the stated treatment objectives</li> </ul>	<ul style="list-style-type: none"> <li>❖ Each patient will present with different clinical indicators of infection. Product selection should be based on thorough clinical assessment and may require different preparations at different times</li> <li>❖ Failure to provide a clear rationale to support treatment selection, along with guidance on duration of treatment and treatment objectives may expose the patient to bacterial resistance</li> <li>❖ Failure to demonstrate evidence of ongoing review may contribute to delayed healing, development of an infection</li> </ul>	<ul style="list-style-type: none"> <li>❖ A clear rationale supporting the selected product must be recorded in the patient's health records</li> <li>❖ The patient's health records must demonstrate a clear auditable trail of product selection, application and review in line with manufacturers' guidelines. A clear plan of care determining expected outcomes with evidence of planned and systematic review must also be included</li> <li>❖ The patient's health records must include appropriate justifications for altering treatment plans</li> </ul>

## BEST PRACTICE STATEMENT CONT.

Statement	Reason for statement	How to demonstrate statement is being achieved
<p><b>Monitoring between and at dressing changes</b></p> <ul style="list-style-type: none"> <li>❖ The acceptability of the treatment should be assessed with particular attention paid to discomfort or pain at or between dressing changes, and the treatment plan altered accordingly</li> </ul>	<ul style="list-style-type: none"> <li>❖ Once treatment has started the clinical presentation of the wound and associated symptoms, i.e. exudate, pain may alter. Clinicians should be aware of this and treatment interventions altered accordingly</li> </ul>	<ul style="list-style-type: none"> <li>❖ The patient's health records must document any complications/adverse effects or therapy compromises associated with the treatment and demonstrate that action has been taken to reduce or change treatment to enhance patient comfort and compliance</li> </ul>
<p><b>Use of dressings with other dressings/treatments</b></p> <ul style="list-style-type: none"> <li>❖ Manufacturers' guidelines should be followed and products used in line with license</li> <li>❖ Multiple products used on the same wound are likely to be against manufacturers' guidance and may compromise the patient</li> </ul>	<ul style="list-style-type: none"> <li>❖ Failure to follow manufacturers' guidance may lead to inappropriate care</li> <li>❖ The use of multiple products is normally contraindicated by the manufacturer and should only be used in accordance with their guidelines</li> <li>❖ If multiple products are to be used, clinicians must be aware of potential risks to the patient and plan care accordingly</li> </ul>	<ul style="list-style-type: none"> <li>❖ The patient's health records must demonstrate that the products are being used in line with manufacturers' guidance or will contain a rationale for not following these instructions</li> <li>❖ The patient's health records must demonstrate that the products are being used within the manufacturers' guidelines</li> <li>❖ If multiple products are to be used, health records must demonstrate a clear rationale for not following guidelines and demonstrate an awareness of expected outcomes, complications and timelines for assessment</li> </ul>
<p><b>Assessment of treatment plans/goals</b></p> <ul style="list-style-type: none"> <li>❖ Assessment of progress towards treatment goals should be considered at every dressing change and, more formally, no less than 10 days while the patient is receiving topical antiseptic/antimicrobial treatment</li> </ul>	<ul style="list-style-type: none"> <li>❖ Failure to assess and record wound condition at each dressing change may contribute to delayed healing or development of infection</li> </ul>	<ul style="list-style-type: none"> <li>❖ The health records must demonstrate that assessment and review has been carried out and any change in patient/wound/infection condition has been acted upon</li> </ul>

**BEST PRACTICE STATEMENT CONT.**

Statement	Reason for statement	How to demonstrate statement is being achieved
<p><b>Assessment of treatment plans/goals</b> <i>continued</i></p> <ul style="list-style-type: none"> <li>❖ Specialist input should be obtained and referral considered if the treatment goals are not achieved within 14 days without obvious explanation</li> <li>❖ If the treatment has not been successful without obvious reason, the treatment should be discontinued and a new assessment and prescription started</li> </ul>	<ul style="list-style-type: none"> <li>❖ It is expected that the majority of wounds should demonstrate a significant improvement in wound condition within 14 days. If this does not occur, specialist referral should be sought to ensure appropriate and best practice is achieved</li> <li>❖ Each patient will have different clinical indications and social/psychological requirements. If the treatment is not successful, a comprehensive review of the wound/patient should occur and a new treatment plan devised to show reason for change in rationale</li> </ul>	<ul style="list-style-type: none"> <li>❖ The patient's health records must demonstrate that specialist referral has been sought</li> <li>❖ The patient's health records must show evidence of a clear and concise plan of action and rationale for change in dressing selection and ongoing treatment plan</li> </ul>

# Notes

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