

Clean to heal concept and experiences in practice

The 'clean to heal' concept focuses on the importance of cleansing the wound to facilitate healing. An expert advisory panel met on 19 February 2024 to discuss the concept, share experiences in practice and provide best practice guidance to clinicians managing wounds. The group also discussed Hydrocyn Aqua® (Bactiguard) as a suitable solution for use in practice to support the concept of 'clean to heal'.

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Gregory Schultz (in memoriam)

Special acknowledgement to Greg Schultz, a wonderful person and true pioneer in wound care

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‘Clean to heal’ is a simple and proven concept: cleaning the wound is essential to healing (“if you want the wound to heal, you need to clean it”). In this context, ‘cleaning’ effectively means removing barriers to healing, which may include slough, debris, necrotic tissue, bioburden and/or biofilm (see **Box 1** for detailed definitions of cleaning versus cleansing for the purposes of this meeting report).

‘Clean to heal’ aligns with the principles of wound bed preparation (WBP), a multifaceted approach incorporating cleansing and debridement, which are well established. Therefore, the focus should be on the importance of cleaning as a step within this existing process, as it prepares the wound for healing and creates an optimal wound-healing environment. Debridement may involve oxidative agents; a process known as oxidative debridement. Depending on their concentration, oxidative agents can

help degrade, soften or eliminate necrotic tissue and/or slough (Nair et al, 2023). Clear guidelines are needed to support decision-making on optimal cleaning options for the individual patient and their wound, appropriate product selection and integrating effective wound cleaning into existing treatment pathways.

In practice, ‘clean to heal’ should be integrated into a structured ‘step-down then step-up’ approach to treatment, as part of a full treatment pathway [Figure 1].

Holistic assessment

All wound management must start with a thorough and accurate assessment. Looking at the whole patient and communicating with them about their needs, preferences and expectations is key. A comprehensive assessment of the wound bed to determine appropriate cleansing, guide WBP and select dressing options should be incorporated into

Declarations

This advisory board consensus meeting report is supported by Bactiguard.

Box 1. Definitions: wound cleansing versus cleaning (adapted from IWII, 2022)

Wound ‘cleansing’ generally refers to the removal of contaminants, debris and external material from a wound’s surface. Often involving techniques such as rinsing, soaking and irrigation, the purpose of wound cleansing is to create an environment that is optimal for wound healing.

Wound ‘cleaning’ in the broader sense can also refer to the use of disinfectants and other non-specific substances that are applied to inanimate objects, such as surfaces and instruments, to kill microorganisms. In the context of wounds for the purposes of this report, ‘cleaning’ encompasses cleansing principles and the use of disinfectants or solutions.

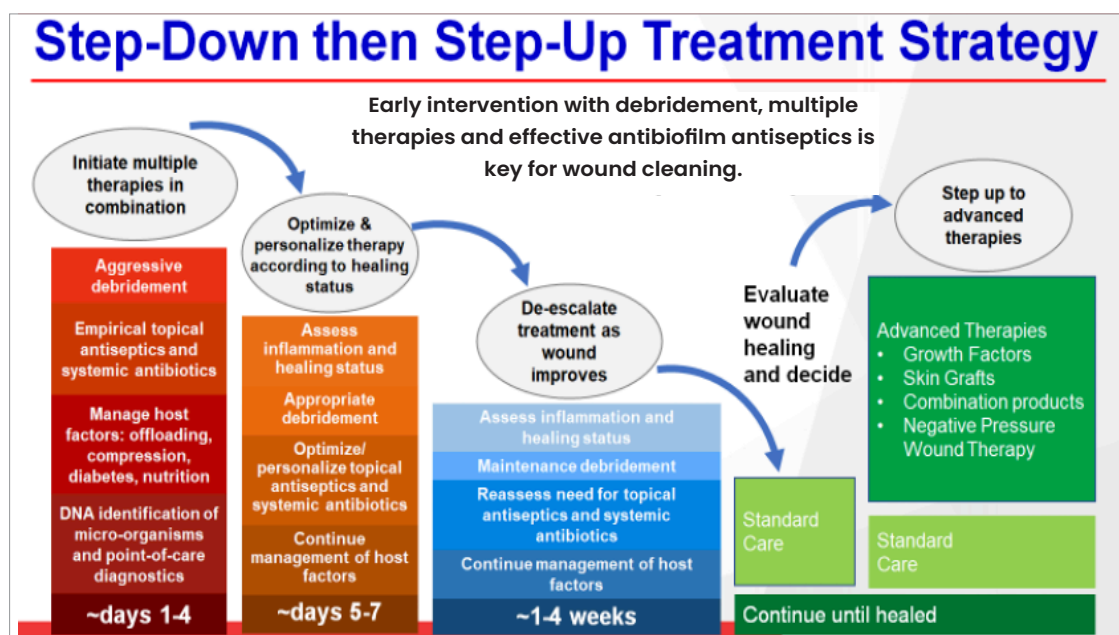


Figure 1. ‘Step-down then step-up’ treatment strategy (modified from Schultz et al, 2017)

a structured assessment framework, such as the Triangle of Wound Assessment (Protz and Drouard-Segard, 2015), TIMERS (Atkin et al, 2019), or M.O.I.S.T. (Dissemond et al, 2022). It is important to select the right treatment plan and wound care based on the identified barriers to healing.

The advisory panel emphasised the importance of the periwound skin and that this should not be overlooked, both during the assessment stage and as treatment progresses [Box 2]. The periwound was flagged as an area that can be neglected in practice but is an important factor in overall wound healing and skin health.

LeBlanc et al (2021) defined the periwound skin as “the area around the wound that may be affected by wound-related factors and/or underlying pathology”.

While clinicians need to provide consistent and evidence-based care by following local policies and procedures, it is important to use clinical judgement and establish what the individual and their wound need and ‘thinking outside of the box’ where necessary. Care should always be tailored to the individual: their wound, their general health and their practical circumstances (WUWHS, 2020).

Communication with the patient is vital, making sure to listen to their perspective and emphasising decision-making as a shared process [Box 3]. The patient should be asked about their overall health, lifestyle, medical/skin history, as well as the wound itself, taking into account how this may impact their daily life and their expectations throughout the treatment phase.

Cleaning options in practice

Traditionally, the most common solutions for cleaning wounds have been tap water, saline and Ringer’s solution. On a global level, saline remains the most widely used solution for chronic wound cleaning in clinical practice; however, *methicillin-resistant Staphylococcus aureus* and *Pseudomonas aeruginosa* can grow and survive in saline (Dong et al, 2020). Studies have shown the benefits of using antiseptic agents over saline or water (Kramer et al, 2018). Additionally, the advisory board explicitly stated that while saline is not always the best option for wound cleaning, and while this does not constitute ‘the whole picture’, it is an important step that can be optimised for the individual patient and their wound.

As published research has increased – particularly in terms of biofilm awareness – antiseptics have come to play an increasingly important role in ensuring more effective wound cleaning (Sakarya et al, 2014). A variety

Box 2. The importance of periwound skin (Le Blanc et al, 2021)

Periwound management is an important but frequently overlooked area, despite the impact it has on WBP and wound healing. Periwound breakdown delays wound healing and increases pain. It is imperative that conditions and risk factors are identified early to prevent the decline in wound progress.

Box 3. Questions to consider at the assessment stage (adapted from Dhoonmoon et al, 2021)

- What is the wound/periwound skin like in comparison to the surrounding skin?
- Are there any differences in colour?
- Does the skin feel warm/cool? Are there any changes in temperature?
- Does the skin feel spongy or firm to the touch?
- Does the skin look or feel shiny or tight?
- Is there any swelling or inflammation?
- Are there any changes in the texture of the skin and underlying tissue?
- What is the overall condition/integrity of the skin?
- Is there any pain, itchiness or change in sensation?

of topical antiseptics are commonly used in practice to clean and irrigate wounds, including chlorhexidine, octenidine (OCT), hypochlorite, polyhexamethylene biguanide (PHMB), povidone-iodine (PVP-I) and hypochlorous acid (HOCl), among others (Snyder et al, 2017).

In clinical practice, antiseptics may be used in various scenarios (Nair et al, 2023), including:

- **Prevention of acute wound infection:** e.g. traumatic wounds, skin tears, bites and gunshot wounds
- **Prevention of post-surgical wound infections,** such as surgical site infection (SSI), particularly in cases with a high risk of infection – e.g. traumatic and contaminated wounds
- **Treatment of clinically manifested wound infections** that show clinical signs and symptoms of local or spreading infection – e.g. locally infected wounds
- **Decolonisation of wounds** colonised with multi-drug resistant bacteria
- **Preparation for – or in conjunction with – surgical, sharp, or conservative-sharp debridement** or wound cleansing of chronic wounds, as part of a biofilm-based treatment approach.

Cleaning techniques

The wound should be cleaned at every dressing change. It should be noted that wound cleaning should be performed carefully to avoid causing further trauma to the wound (Alves et al,

2021). However, the advisory board noted that it is crucial to clean the wound thoroughly, employing proper cleaning techniques, as opposed to 'just getting the wound wet'.

Contact time (i.e. how long the wound is exposed to an antimicrobial) can be a controversial topic: this can be limited by constraints on how much time the clinician has available with the patient, and findings from *in vitro* and animal model studies may not accurately reflect clinical practice in real-world settings – for example, contact time in laboratory research often exceeds 24 hours, which does not apply to real-world scenarios (Johani et al, 2018).

There is increasing evidence that for some antiseptics, such as HOCl, an exposure time of 3–10 minutes is sufficient to penetrate and impact biofilms (Day et al, 2017; Harriott et al, 2019; Robson, 2020), suggesting it is a viable option for real-world practice.

Hydrocyn Aqua

Hydrocyn Aqua solution supports the 'clean to heal' concept. It is indicated as a debridement agent that cleans the wound, removes bacteria and biofilm and accelerates wound healing (Nair et al, 2019). The solution can be used in conjunction with Hydrocyn Aqua gel to optimise the full WBP process (cleansing, debridement and moisturising of the wound bed and surrounding skin).

Hydrocyn Aqua's active component is HOCl, which is non-toxic when used in low concentrations, and exhibits potent and rapid antimicrobial activity to accelerate wound healing (Wolcott and Fletcher, 2014). See **Box 4** for more information on HOCl.

HOCl's antimicrobial effect is effective and rapid, with a close to 100% reduction in the number of microbial species observed within 60 seconds (Bactiguard, 2023).

In practice, HOCl meets the requirements for a topical antiseptic for wound care use. It has been proven to be fast-acting, non-toxic to humans at concentrations of use, easy to apply, cost-effective, non-irritating and non-sensitising (CDC, 2021). In comparison to iodine, HOCl has been found to have favourable effects on fibroblast and keratinocyte migration, making it an ideal active agent for improved wound healing (Sakarya et al, 2014).

Non-toxicity

When selecting a product for clinical use, it is vital to balance efficacy with patient safety. The ideal antimicrobial agent should release concentrations low enough to minimise toxicity while effectively destroying or inhibiting microorganism growth (IWII, 2022). The expert

Box 4. Active component: hypochlorous acid (HOCl; adapted from Nair and Ousey, 2023)

HOCl is active against a wide range of bacteria, viruses, and fungi through the process of osmotic shock. HOCl is electrically neutral, while the cell walls of pathogenic microorganisms are negatively charged. HOCl penetrates the pathogen cell wall, destroying vital cell components and ensuring that water flows into cells to equalise the osmotic gradient. As a result, osmotic shock occurs, whereby the rise in internal pressure causes pathogens to burst (Andrés et al, 2022).

group agreed that Hydrocyn Aqua provides an effective option without causing harm to the patient or their wound.

As HOCl is naturally occurring and is produced by the body's own neutrophils, Hydrocyn Aqua mimics the immune system to kill bacteria, fungi and viruses. Hydrocyn Aqua is biocompatible, tissue-friendly and inhibits different cellular processes within bacterial species to reduce biofilm and increase oxygen perfusion (Nair et al, 2019).

Antimicrobial stewardship

Antimicrobial stewardship (AMS) is an important consideration, and Hydrocyn Aqua has not been found to contribute to antimicrobial resistance. Hydrocyn Aqua is suitable for 'hard-to-heal' wounds (characterised by inflammation, potential infection, and ischaemia); a focus on early intervention in cleansing these wounds may help to reduce risk and prevent infection from developing, which reduces the need for further treatment such as systemic antibiotics. A 'back to basics' approach, with an emphasis on cleansing, is the foundation of an AMS-informed approach (Fletcher et al, 2020).

The World Health Organization has identified HOCl as the most potent disinfectant effective against a wide range of pathogens, while being environmentally safe and not contributing to antimicrobial resistance (WHO, 2020).

Presentations and aetiology

Hydrocyn Aqua is suitable in a wide range of wounds, including acute and chronic wounds, cuts, lacerations/abrasions, locally infected wounds, stage 1–4 pressure injuries/ulcers, venous stasis ulcers, diabetic ulcerations, surgical wounds (both intraoperative and postoperative) and burns.

Hydrocyn Aqua is also indicated for a broad range of tissue types, including joints, tendons, cartilage, bones, and ligaments as well as sensitive areas such as ears, eyes, nose, mouth, skin, mucosa and the peritoneal cavity.

The advisory board noted anecdotally that Hydrocyn Aqua is useful in peritoneal lavage procedures.

Conclusions

The advisory board agreed that a focus on cleaning wounds makes a positive difference in practice, facilitating healing and improving outcomes for patients. For clinicians, it is important that the decision-making process is made as simple as possible through clear guidance, with clinical judgement applied to the individual patient and their holistic needs. The 'clean to heal' concept should be integrated into existing pathways, with a focus on cleaning wounds and removing the barriers to healing.

Hydrocyn Aqua provides an ideal option in practice to clean wounds and promote healing in a range of presentations and aetiologies. ●

References

- Alves PJ, Barreto RT, Barrois BM et al (2021) Update on the role of antiseptics in the management of chronic wounds with critical colonisation and/or biofilm. *Int Wound J* 18(3): 342-58
- Andrés CMC, Pérez de la Lastra JM, Juan CA (2022) Hypochlorous acid chemistry in mammalian cells: Influence on infection and role in various pathologies. *Int J Mol Sci* 23(18): 10735
- Atkin L, Bucko Z, Conde Montero E et al (2019) Implementing TIMERS: The race against hard-to-heal wounds. *J Wound Care* 28(Suppl 3): S1-S49
- Bactiguard (2023) VMD-HSR-004 An In-Vitro Time Kill Evaluation. Internal report
- Centers for Disease Control and Prevention (2021) Expert Committee on Selection and Use of Essential Medicines. Available at: https://cdn.who.int/media/docs/default-source/essential-medicines/2021-eml-expert-committee/expert-reviews/a18_hypochlorous-acid_rev2.pdf?sfvrsn=cc8d0fb3_11 (accessed 5.03.2024)
- Day A, Alkhalil A, Carney BC et al (2017) Disruption of biofilms and neutralization of bacteria using hypochlorous acid solution: An in vivo and in vitro evaluation. *Adv Skin Wound Care* 30(12): 543-51
- Dhoonmoon L, Fletcher J, Atkin L et al (2021) Best Practice Statement. Addressing skin tone bias in wound care: Assessing signs and symptoms in people with dark skin tones. *Wounds UK*
- Dissemond J, Malone M, Ryan H et al (2022) Implementation of the M.O.I.S.T. concept for the local treatment of chronic wounds into clinical practice. *Wounds International* 13(4): 34-43
- Dong D, Thomas N, Ramezanzpour M et al (2020) Inhibition of Staphylococcus aureus and Pseudomonas aeruginosa biofilms by quatsomes in low concentrations. *Exp Biol Med* 245(1): 34-41
- Fletcher J, Edwards-Jones V, Fumarola S et al (2020) Best Practice Statement: Antimicrobial stewardship strategies for wound management. *Wounds UK*

Key benefits of Hydrocyn Aqua (adapted from Nair and Ousey, 2023)

- Moistening and soothing effect
- Helps maintain an optimal wound healing environment
- Broad-spectrum efficacy
- Reduces and prevents bacterial growth
- Assists in rapid wound healing
- Non-toxic, non-cytotoxic and non-irritant
- Reduces pain
- Reduces malodour
- Promotes patient comfort.

- Harriott MM, Bhindi N, Kassis S et al (2019) Comparative antimicrobial activity of commercial wound care solutions on bacterial and fungal biofilms. *Ann Plast Surg* 83: 404-10
- International Wound Infection Institute (2022) Wound infection in clinical practice. *Wounds International*
- Johani K, Malone M, Jensen SO et al (2018) Evaluation of short exposure times of antimicrobial wound solutions against microbial biofilms: from in vitro to in vivo. *J Antimicrob Chemother* 73(2): 494-502
- Kramer A, Dissemond J, Kim S et al (2018) Consensus on Wound Antisepsis: Update 2018. *Skin Pharmacol Physiol* 31(1): 28-58
- LeBlanc K, Beeckman D, Campbell K et al (2021) Best practice recommendations for prevention and management of periwound skin complications. *Wounds International*
- Nair HKR, Choudhury S, Ramachandram K et al (2019) Investigation and review on the efficacy of super-oxidized solution (HYDROCYN Aqua) against biofilm. *Wounds International*
- Nair HKR, Mrozikiewicz-Rakowska B, Sanches Pinto D et al (2023) Use of wound antiseptics in practice. *Wounds International*
- Nair HKR, Ousey K (2023) Hydrocyn Aqua Made Easy. *Wounds International*
- Protz K, Drouard-Segard M (2015) Triangle of Wound Assessment Made Easy. *Wounds International*
- Robson MC (2020) Treating chronic wounds with hypochlorous acid disrupts biofilm. *Wound Prevention and Management* 66(5): 9-10
- Sakarya S, Gunay N, Karakulak M et al (2014) Hypochlorous acid: an ideal wound care agent with powerful microbicidal, antibiofilm, and wound healing potency. *Wounds* 26(12): 342-50
- Schultz G, Bjarnsholt T, James GA (2017) Consensus guidelines for the identification and treatment of biofilms in chronic nonhealing wounds. *Wound Repair Regen* 25: 744-57
- Snyder RJ, Bohn G, Hanft J et al (2017) Wound biofilm: Current perspectives and strategies on biofilm disruption and treatment. *Wounds* 29: S1-17
- Wolcott R, Fletcher J (2014) The role of wound cleansing in the management of wounds. *Wounds International* 5(3): 25-31
- World Health Organization (2020) Hypochlorous acid (HOCl) for disinfection, antisepsis, and wound care in Core Categories 15.1, 15.2, and 13. Available at: https://cdn.who.int/media/docs/default-source/essential-medicines/2021-eml-expert-committee/applications-for-addition-of-new-medicines/a18_hypochlorous-acid.pdf (accessed 5.03.2024)
- World Union of Wound Healing Societies (2020) Optimising wound care through patient engagement. *Wounds International*

