

Autolytic continuous debridement with a focus on biofilm management

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Introduction

Debridement is a key step in wound bed preparation (WBP), removing barriers to healing and facilitating successful treatment. Autolytic debridement—through topical treatment or wound dressings—may be an ideal option for many patients and their wounds. As well as removing dead tissue, slough and debris from the wound, continuous debridement can play an important role in biofilm management. With biofilm present in most chronic wounds, debridement for biofilm disruption represents a key step.

A panel of experts in the Asia-Pacific (APAC) region met in 2024 to share experience and best practice in autolytic continuous debridement, with a focus on biofilm management, resulting in a consensus document (Nair et al, 2024). This 'Made Easy' consensus document represents the information and guidance agreed on by the expert panel and summarises the full consensus document



Scan the QR code to access the full consensus document

DEBRIDEMENT: AN OVERVIEW

Debridement is 'the removal of nonviable tissue, including necrotic material, slough, microorganisms, biofilm and contaminants from or adjacent to a wound' (International Wound Infection Institute [IWII], 2022).

Non-viable tissue often presents in acute wounds (e.g. surgical wounds/skin tears) and chronic wounds (e.g. DFUs [Image 1]; venous leg ulcers [VLUs]; pressure ulcers [PUs] and ischaemic ulcers [Percival and Suleman, 2015]. Chronic wounds (Image 2 a-d) are more likely to require debridement than others, as they are more likely to contain non-viable tissue and slough that harbour microorganisms and increase the risk of infection (Nair et al, 2022).

Non-viable tissue creates an abnormal wound environment that interferes with the healing process (Vowden and Vowden, 2011) and serves as a source of nutrients for bacteria (Manna et al, 2023), promoting microbial proliferation and biofilm formation, whilst reducing the effectiveness of topical antibiotics and



Figure 1: Example of two adjacent diabetic foot ulcers with slough (photograph courtesy of Jacqui Fletcher)

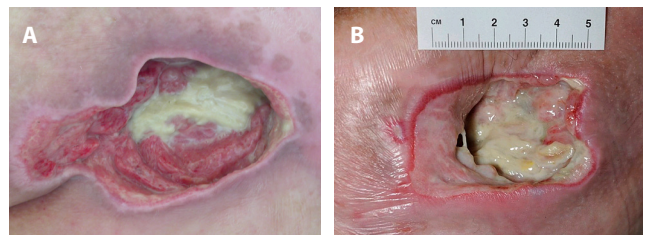


Figure 2a-b: Examples of sloughy sacral pressure ulcers (photographs courtesy of Jacqui Fletcher)

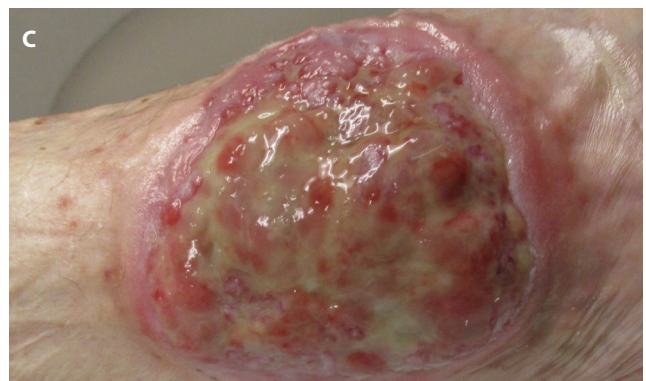


Figure 2c-d: Examples of sloughy leg ulcers (photographs courtesy of Dot Weir)

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antiseptics (Anghel et al, 2016; IWII, 2023). While removing non-viable tissue, debridement also reduces biofilm and stabilises the microbiome of the periwound skin, creating a good environment for healing and reducing the risk of infection (Young et al, 2013; Sen et al, 2021; Thomas et al, 2021). An integrated, collaborative interdisciplinary approach is required when making decisions regarding debridement; therefore, debridement is an important step in infection prevention, management and biofilm removal (IWII, 2022).

WOUND BED PREPARATION

Wound bed preparation (WBP) is a framework for the assessment, diagnosis and treatment of wounds. It involves therapeutic wound cleansing, debridement and the prevention of biofilm reformation (Haubner et al, 2012).

TIMERS (Atkin et al, 2019) is a recommended framework which provides an extension of the original TIME framework incorporating 6 elements of WBP:

- Tissue
- Inflammation/infection
- Moisture balance
- Edge of wound/Epithelialisation
- Repair and regeneration
- Social factors.

The aim of WBP is to create a balanced, moist environment, optimising conditions for debridement and wound healing, producing a well-vascularised, stable wound bed to reduce microbial load, manage exudate levels and increase granulation tissue formation (Schofield and Ousey, 2021; Barrigah-Benissan et al, 2022). Debridement and cleansing are essential to wound healing, and it is important to distinguish between the two.

CLEANSING

Effective cleansing is important to optimise debridement. Wounds should be cleansed before and after debridement. Cleansing improves the visibility of the wound bed, facilitates accurate assessment and allows access to non-viable tissue, yet it is not the comprehensive removal of devitalised tissue (that is the role of debridement; IWII, 2022). Acidic cleansers, such as hypochlorous acid cleansers, can soften slough and thus optimise the debridement process.

The purpose of cleansing is to reduce the bioburden, including bacteria, debris and contaminants and remove any loose material (e.g. dried blood, dressing residue and eliminate wound exudate; IWII, 2022). Cleansing can also support the removal of slough and necrotic tissue (Olszowski et al, 2003; Pattison et al, 2003; Brown, 2018).

Several types of solutions can be used for cleansing, including tap water, saline, povidone-iodine and agents containing

antimicrobials and/or active preservatives (e.g. hypochlorous acid [HOCl], sodium hypochlorite, octenidine dihydrochloride and polyhexamethylene biguanide [PHMB]). There is no specific recommended wound cleansing solution, as choice depends on wound assessment (e.g. aetiology, and anatomical location), risk of wound infection, goals of care and local policies and resources (IWII, 2022). Cleansing solution must remain in contact with the wound bed for the recommended time to achieve optimum cleansing (Nair et al, 2023).

Although each solution offers distinct benefits and carries various risks, as a naturally occurring molecule with a high therapeutic index, it is established that HOCl does not harm healthy tissue or cause a stinging sensation, making it suitable for frequent application (Mayer et al, 2024).

DEBRIDEMENT USE AND TECHNIQUES

Following cleansing, clinicians should consider the following questions when selecting the most appropriate method of debridement (adapted from Vowden and Vowden, 2011):

- What is wound aetiology?
- Where is it anatomically located?
- How much non-viable tissue needs to be removed?
- What is the aim of treatment?
- What are the risks and benefits of the proposed debridement method?
- What speed of debridement is required?
- Which method would be most appropriate?
- Are the necessary skills and/or equipment required to perform optimal debridement available in the practice/care setting?

Table 1 presents an overview of the mechanisms of the types of debridement methods.

DEBRIDEMENT: WHO SHOULD DO IT?

Debridement is an essential step in wound healing, which is underused in practice, possibly due to a lack of clinician knowledge, practice and sometimes confidence for some options/procedures that could be appropriate. Decisions to debride are often complex and may require input from a multidisciplinary team.

Clinicians should have appropriate training and be competent in the techniques used, in accordance with local policy. Once the decision to proceed with debridement and the preferred method has been determined, clinicians must assess their skills and competency to undertake the process.

Competent clinicians performing wound debridement are expected to have the following skills (Vowden and Vowden, 2011):

- Good knowledge of relevant anatomy
- Understanding of the range of wound debridement methods available

Table 1. Types of debridement methods (adapted and updated from Gray et al, 2011; Vowden and Vowden, 2011; Holmes et al, 2019)

Type of debridement method	Mechanism of action	Potential advantages	Potential challenges and contraindications	Care setting/skill level
Autolytic	<ul style="list-style-type: none"> • Uses the body's own enzymes to soften and liquefy devitalised tissue and slough • Can be aided by using topical agents and contemporary wound dressings that promote autolysis, including fibre-gelling, polyabsorbent fibres, as well as hydrofibre, alginate, hydrogel and medical-grade honey, dressings 	<ul style="list-style-type: none"> • Can be used before other types of debridement (e.g. sharp) and in cases where other debridement methods are inappropriate • Can be used in conjunction with other forms of debridement • Suitable for continuous debridement 	<ul style="list-style-type: none"> • Wounds may require more immediate debridement in the short term • May necessitate dressings to create a moist environment and enhance phagocytic activity • Process can be slow, potentially increasing infection and maceration • Not suitable when access to appropriate dressings is limited 	<ul style="list-style-type: none"> • Suitable for all care settings, including GP surgeries, patients' homes and inpatient facilities <p>Skill level:</p> <ul style="list-style-type: none"> • Generalists or specialists; requires low levels of skills and knowledge. However, advice should be sought for high-risk individuals
Biosurgical	<ul style="list-style-type: none"> • Uses larvae of the green bottle fly (<i>Lucilia sericata</i>) to remove moist slough, necrotic and devitalised tissue from the wound 	<ul style="list-style-type: none"> • Treatment is relatively fast and highly selective • Can be used on infected wounds 	<ul style="list-style-type: none"> • Initial costs may be higher compared to autolytic debridement • Access to larvae may be an issue • Patients may experience altered sensations while larvae are in use • Contraindicated in patients with highly exuding wounds, wounds requiring occlusion, patients with clotting issues, malignancies or wounds close to large blood vessels 	<ul style="list-style-type: none"> • Suitable for a variety of settings, including community, primary and secondary care <p>Skill level:</p> <ul style="list-style-type: none"> • Generalist or specialist practitioner with the appropriate level of skill, training and competence
Enzymatic	<ul style="list-style-type: none"> • Uses exogenous enzymes or chemicals (e.g. enzymatic debriders, wound cleaners and gels) to enhance the breakdown of devitalised tissue and hard necrotic eschar. These products contain surfactants at high or low concentrations to facilitate tissue removal 	<ul style="list-style-type: none"> • Suitable when surgical debridement is not possible • Can be combined with other therapies for enhanced efficacy 	<ul style="list-style-type: none"> • Potential risk of allergic reactions or sensitivities to the enzymatic agents used • Not suitable for large wounds with eschar, severely necrotic wounds, heavily infected wounds or patients with sepsis 	<ul style="list-style-type: none"> • Suitable for a variety of settings, but requires a controlled environment due to potential for aerosol spread <p>Skill level:</p> <ul style="list-style-type: none"> • Specialist practitioner with relevant training
Hydrosurgical (jet lavage)	<ul style="list-style-type: none"> • Uses a high-energy saline stream that creates a localised vacuum that cuts and removes devitalised tissue from the wound bed 	<ul style="list-style-type: none"> • Treatment is fast and selective • Capable of removing most, if not all, devitalised tissue without compromising healthy tissue • Allows for precise visualisation of the wound bed 	<ul style="list-style-type: none"> • Requires specialist equipment • Associated with higher costs • Potential for bacterial aerosolisation • Contraindicated in patients with dry necrotic wounds with eschar. Caution is required in highly exuding wounds, wounds close to large blood vessels, wounds needing occlusion and in patients with clotting issues or malignancies 	<ul style="list-style-type: none"> • Suitable for a variety of settings but requires a controlled environment due to the risk of bacterial aerosolisation <p>Skill level:</p> <ul style="list-style-type: none"> • Specialist practitioner with relevant training
Mechanical	<ul style="list-style-type: none"> • Involves the physical removal of devitalised tissue and debris from the wound bed • Traditional method include wet-to-dry gauze that dries and adheres to the top layer of the wound bed, which is 'pulled' away when the dressing is changed; however, this method is not generally recommended • Other methods include monofilament/microfibre debridement pads and therapeutic irrigation (4 to 15 psi) 	<ul style="list-style-type: none"> • Newer methods are available that are fast and more selective • Relatively low pain with newer methods (e.g. the use of debridement pads) 	<ul style="list-style-type: none"> • Traditional methods (e.g. wet-to-dry gauze) requires frequent dressing changes and can be painful for the patient • Not suitable for wounds with hard, dry eschar. • Caution is required for patients on anticoagulant therapy, with bleeding disorders or peripheral arterial disease 	<ul style="list-style-type: none"> • Suitable for most care settings including GP surgeries, patient's home and inpatient setting <p>Skill level:</p> <ul style="list-style-type: none"> • Requires minimal training and can be performed by both generalists and specialists. However, advice should be sought for high-risk individuals

Table 1. Types of debridement methods (adapted and updated from Gray et al, 2011; Vowden and Vowden, 2011; Holmes et al, 2019) (Continued)

Type of debridement method	Mechanism of action	Potential advantages	Potential challenges and contraindications	Care setting/skill level
Sharp	<ul style="list-style-type: none"> Involves the removal of dead or devitalised tissue using instruments such as a scalpel, curette, scissors, and/or forceps, typically cutting just above the level of viable tissue 	<ul style="list-style-type: none"> Fast and selective Can be combined with other therapies (e.g. autolytic debridement) 	<ul style="list-style-type: none"> Requires in-depth knowledge of tissue types and anatomy, as there is a risk of damaging blood vessels, nerves or tendons Topical anaesthesia or oral pain medication is often used as it can be painful for the patient Caution required around sensitive areas (e.g. exposed bone, ligaments, tendons, temporal areas, neck, axilla, groin and areas near major blood vessels, nerves, and tendons) Special consideration is needed for patients on anticoagulant therapy or with bleeding disorders 	<ul style="list-style-type: none"> Suitable for performing at the patient's bedside or in a clinic setting <p>Skill level:</p> <ul style="list-style-type: none"> Competent practitioner with specialist training
Surgical	<ul style="list-style-type: none"> Involves the excision or wider resection of non-viable tissue, sometimes removing healthy tissue from the wound margins, until a healthy, bleeding wound bed is achieved 	<ul style="list-style-type: none"> Selective Suitable for large areas where rapid removal of tissue is necessary 	<ul style="list-style-type: none"> Can be painful for the patient; general, light or local anaesthesia is usually required Generally associated with higher costs Caution required around sensitive areas (e.g. exposed bone, ligaments, tendons, temporal areas, neck, axilla, groin and areas near major blood vessels, nerves, and tendons) Special consideration is needed for patients on anticoagulant therapy or with bleeding disorders 	<ul style="list-style-type: none"> Requires a procedure room with appropriate resources to manage potential complications, such as bleeding <p>Skill level:</p> <ul style="list-style-type: none"> Physician, surgeon, podiatrist or specialist nurse with appropriate training and skills
Ultrasonic (classified as mechanical debridement)	<ul style="list-style-type: none"> Delivers ultrasound energy directly to the wound bed or through an atomised solution (mist) Most devices also feature a built-in irrigation system and offer various probes for different wound types 	<ul style="list-style-type: none"> Fast and selective Suitable for both excisional debridement and maintenance debridement over multiple sessions 	<ul style="list-style-type: none"> Limited availability due to higher costs and need for specialist equipment Requires longer setup and cleanup times, including the sterilisation of handpieces, compared to sharp debridement Full PPE required due to risk of bacterial aerosolisation Contraindicated in patients with vascular abnormalities, haemorrhagic conditions, malignancies and tissue previously treated with deep X-ray or irradiation 	<ul style="list-style-type: none"> Suitable for a variety of settings, including controlled environments <p>Skill level:</p> <ul style="list-style-type: none"> Skilled practitioner with specialist training and competence

- Capability to identify viable tissue and differentiate it from non-viable tissue
- Ability to manage pain and discomfort before, during and after the procedure
- Appropriate skills to handle potential complications (e.g. bleeding)
- Awareness of infection control procedures.

DEBRIDEMENT: FREQUENCY

A single session of debridement may be sufficient for some wounds, others need repeated (continuous) sessions to clean those wounds and to prevent them from reverting to a chronic unhealthy state, as devitalised tissue can often resurface due to underlying causes. These wounds need to be monitored at every clinical visit, a practice known as maintenance debridement (EWMA, 2004; Jones, 2018; Thomas et al, 2021).

DEBRIDEMENT: PATIENT SELECTION AND PREFERENCE

It is important to engage the patient in their care and the decision-making process so that they understand the options and make informed decisions about their care. Clinicians have a legal responsibility to explain all available debridement methods and potential outcomes – e.g. reducing the risk of infection/ the possibility of the wound getting larger in size (Haycocks and Chadwick, 2012) and ensure that patients understand. In some types of debridement, informed consent must be formally obtained; refer to local policy where necessary,

INFECTION RISK

Infection is a common and serious complication and can develop in any wound, clinicians must be skilled in recognising and assessing signs of wound infection e.g. purulent discharge, erythema, swelling, localised warmth, malodour, and new or increasing pain (IWII, 2022). It should be noted that some

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wounds are at a higher risk of infection than others (DFUs are at particularly high risk), or patients may be at higher risk (due to factors such as comorbidities or immunosuppression) and may need particular vigilance.

In immunocompromised individuals and those with chronic wounds, infection may present with subtle or covert signs, which require careful observation (IWII, 2022). Signs of wound infection to consider include overt symptoms, such as (IWII, 2022):

Erythema (which may present differently depending on the individual's skin tone) may include:

- Local warmth
- Swelling
- Purulent discharge
- Wound breakdown and enlargement
- New or increasing pain
- Increasing malodour.

More covert or subtle symptoms may also occur, such as (IWII, 2022):

- Friable, bright red granulation tissue
- Increased malodour
- New increased pain or change in sensation
- Epithelial bridging and pocketing in granulation tissue
- Delayed wound healing beyond expectations
- Wound breakdown and enlargement or new ulcerations of the periwound.

PAIN

Pain can be an indicator of ineffective wound management where the underlying causal pathology has not been identified or treated, or infection is present (Price et al, 2008). Pain can impact every aspect of an individual (e.g. quality of life, ability to function, social and psychological wellbeing; Holloway et al, 2024).

Pain management may be required as part of the debridement process itself, and the patient must be as prepared as possible for the procedure and aware of what to expect (WUWHs, 2016). Studies have shown that following the updated non-cancer pain ladder can improve patient outcomes and quality of life, as well as reduce hospital stays (Guiloff and Angus-Leppan, 2016; Anekar et al, 2023).

FOCUS ON AUTOLYTIC DEBRIDEMENT

Autolytic debridement is generally considered as the most conservative debridement method, which can be facilitated by clinicians in any care setting following a full holistic assessment. This type of debridement is a natural process by which the body's own enzymes break down necrotic tissue, inducing softening of the necrotic tissue and detachment of this tissue from the wound bed (IWII, 2022). It is a highly selective process whereby only necrotic tissue will be affected (Manna et al, 2023).

When needed, autolytic continuous debridement can be used in conjunction with other debridement techniques (e.g. mechanical/sharp debridement) as part of an ongoing care pathway (Vowden and Vowden, 2011). This can be facilitated using various wound dressings, such as polyabsorbent fibres, fibre-gelling, as well as hydrofibre, alginate, hydrogel, hydrocolloid and transparent film, dressings that promote autolysis of necrotic tissue (Sibbald et al, 2021; IWII, 2023). This requires maintaining a balanced moist environment, achieved with either moisture-retentive/moisture-donating dressings, depending on the wound; effectiveness is influenced by the amount of devitalised tissue and the size of the wound (Manna et al, 2023).

Autolytic continuous debridement can be performed using specific dressings, such as polyabsorbent fibre dressings. These dressings may or may not be impregnated with silver salts, depending on the wound's status, including any local signs or risk of infection. Dressings made of polyabsorbent fibres have demonstrated continuous debridement on slough removal (Dissemond et al, 2020a, 2020b; Meaume et al, 2014), facilitated by their high negative charge (Desroche et al, 2016).

LINK TO BIOFILM MANAGEMENT

Management of biofilm is acknowledged as a primary aim of wound care, particularly in chronic wounds. Biofilms are aggregates of microorganisms that attach to biotic (living surfaces, e.g. biological tissues), abiotic surfaces (non-living surfaces, e.g. wound dressings) or each other.

Studies suggest that between 60% and 100% of chronic wounds contain biofilm, with the 'true' prevalence likely approaching 100%, indicating that all chronic wounds may have biofilm on at least part of the wound bed (Bjarnsholt et al, 2017; Malone et al, 2017). Biofilms are not visible to the naked eye, but downstream effects can provide some clinical cues.

Effective management involves employing antibiofilm therapies and strategies to remove or disrupt both the microorganisms and the extracellular polymeric substance. This helps reduce microbial reattachment and prevents biofilm reformation.

Use of polyabsorbent fibre dressings impregnated with silver salts through a TLC-Ag matrix, which offer autolytic continuous debridement and antimicrobial properties, have been found to be a beneficial option in biofilm-based wound care, being effective against bacteria such as *Staphylococcus aureus*, MRSA, *Streptococcus pyogenes* and *Pseudomonas aeruginosa* (Desroche et al, 2016).

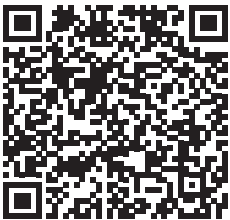
PATHWAY FOR BIOFILM MANAGEMENT

Debridement must be viewed as part of a wider care pathway for wound management, following a holistic assessment and setting

priorities and treatment goals in collaboration with the patient. This should encompass all the needs of the patient and their wound, according to a structured protocol such as T.I.M.E.R.S (Atkin et al, 2019) or local protocol.

PATHWAY FOR USE IN PRACTICE

The Pathway for Biofilm Management (provides a checklist for each stage to support clinicians in selecting autolytic debridement for wounds, particularly those that are chronic and may include biofilm. **Access the Pathway for Biofilm management by scanning the QR code below.**



Summary

- Early intervention and timely debridement improves clinical outcomes of all types of wounds.
- Debridement is underutilised in practice, potentially due to a lack of clinical knowledge and confidence amongst clinicians.
- Continuous debridement should be part of a comprehensive care plan, based on a holistic assessment and patient collaboration, using protocols (e.g. T.I.M.E.R.S.)
- Specific documentation is essential, detailing the type of debridement, rationale, and products used, ensuring communication and continuity of care.
- Biofilm should be suspected in all chronic wounds.
- Biofilm-based wound care emphasises the importance of autolytic continuous debridement, involving a two-step process of removal/ disruption and prevention of reformation.
- Dressings containing polyabsorbent fibres have been shown to provide effective continuous autolytic debridement in practice.

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