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It's TIME to get to grips with wound assessment...

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Accurate and ongoing wound assessment today

New national indicators for 2017–19 include 'improving the assessment of wounds', with community services placing a greater emphasis on wound care to ensure better patient and system outcomes (NHS England, 2016). This volume of *Wound Care Today* is tailored to helping nurses in the community undertake systematic and thorough wound assessment to get better outcomes and thus meet performance targets in line with the CQUIN framework.

By focusing on the principles of the acronym TIME (tissue, infection/inflammation, moisture imbalance and edge of wound), the articles each explore and explain these inter-related clinical components of wound bed preparation, including the recent addition of 'S' (surrounding skin) to this framework (*pp. 44–45*). How this model can be used in practice is demonstrated through a patient story (*pp. 48–50*), while the importance of measuring patients' ankle brachial pressure index (ABPI) on a regular basis is also highlighted (*pp. 51–52*).

Throughout the journal there are snapshot learning features, providing a quick and easy guide to using products in practice.

This issue is also available for free on our website (www.jcn.co.uk), along with other educational materials to improve your understanding of wound assessment, such as the wound assessment module endorsed by the European Wound Management Association (EWMA) (www.jcn.co.uk/learning-zone/units/lesson/88/97). All activity counts towards CPD, so remember to log it in your free JCN revalidation e-portfolio, as evidence of continued learning (www.jcn.co.uk/revalidation).

Binkie Mais, editor, *Wound Care Today*

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In each issue of *Wound Care Today* we investigate a hot topic in wound care. Here, we explore why...

It's TIME to get to grips with wound assessment in the community

A key study by Guest et al (2015) into the realities of wound care service provision in the UK identified inconsistencies in the assessment and management of wounds, and the opportunities to improve both efficiency of working and patient outcomes.

The records of 1000 patients with wounds and 1000 patients without were randomly selected from The Health Improvement Network (THIN) database. Information concerning wound-related health outcomes and healthcare resources used was analysed and costed at 2013/14 prices.

The study revealed that in 2012/13, 2.2 million wounds and associated comorbidities were managed by the NHS at an estimated cost of £5.3 billion — a cost equal to the management of obesity. These costs were attributed to the management of wounds that healed (£2.1 billion) and remained opened (£3.2 billion) during the study year, respectively.

Two-thirds of the total cost was attributed to nurse-led, community-based wound care, which included:

- 18.6 million practice nurse visits
- 10.9 million community nurse visits
- 7.7 million GP visits
- 3.4 million hospital outpatient visits
- 97.1 million drug prescriptions
- 262.2 million dressings
- 73.4 million bandages
- 9.0 million compression bandages (Guest et al, 2015).

However, the findings also revealed that of the 2.2 million wounds managed during the study year, 30% lacked a differential diagnosis. For example, of the wounds recorded as being a leg ulcer, 19% did not have any further characterisation; they were not recorded as being venous, arterial or mixed. It is easy to recognise the negative impact that this lack of information could have on management and patient outcomes and, in some cases, could result in harm.

On this point, Guest et al (2015) noted that existing best practice guidelines for the management of leg ulcers and diabetic foot ulcers state that the assessment of peripheral perfusion is a recognised requirement for leg ulcer and diabetic foot management, yet only 16% of all cases with a leg or foot ulcer had a Doppler ankle brachial pressure index (ABPI) recorded in their records.

This means that 84% of patients who should have had peripheral perfusion assessed didn't and/or findings were not documented in the patient notes.

Working as a community nurse today is not for the faint-hearted. Caseloads are busier than ever and patients have many complex comorbidities, making care delivery challenging. It is easy for community nurses to undertake wound care that is ritualistic, rather than based on structured holistic patient assessment. This is due to the considerable demands being made on the community nursing teams and sometimes it is easier to continue with current care, rather than undertaking an assessment or reviewing the outcomes of wound care delivery, which can be seen as too time-consuming. However, this may result in false economy, as the patient will continue to have a non-healing wound and need time-consuming visits. Investing time in a structured holistic assessment will, in the long term, contribute to reducing healing rates, lessening the need for lengthy visits and delivering clinically effective wound care. It will also result in better patient outcomes.

Kirsty Mahoney, clinical nurse specialist, wound healing, Cardiff and Vale University Health Board

Wound care is a major aspect of community nursing. As patients may be treated by numerous healthcare professionals, it is vital that an appropriate wound care document is accurately completed to facilitate continuity of care and enhance healing rates. It is essential that wounds undergo a thorough baseline assessment, utilising a wound chart to document findings, and that ongoing assessment and documentation occurs regularly to identify effectiveness of the care plan and to facilitate a change in care if necessary. In addition, holistic assessment will aid identification of the cause, guide the most appropriate treatment plan, and identify any factors that may inhibit healing. In relation to leg ulcers, the 'gold standard' is that a Doppler assessment is undertaken once a wound has been present for two weeks. This assessment will indicate if compression can be used safely, and if so, this treatment will aid healing, reduce nursing input and save money. Doppler assessment should be undertaken by a suitably trained professional, so in view of the benefits that can be gained, investment must be made into the training and professional development of nurses.

Annette Bades, district nursing specialist practitioner, Lancashire Care NHS Foundation Trust

Twelve per cent of all wounds included in the study had no diagnosis recorded at all, making wound type unidentified in the note.

These findings are alarming and raise the question of how wounds can be managed and monitored effectively if assessment is not carried out and documented. On what basis are treatment decisions made and against what baseline is progress monitored?

Unsurprisingly, only 43% of chronic wounds healed during the year of the study. It is well known that healing rates vary depending on wound type and the general health and comorbidites of the individual patient, but the majority of wounds for the majority of people should heal within three months with accurate assessment and appropriate management decisions. When wounds become chronic (for example, a venous leg ulcer is defined as chronic if present for longer than four weeks), assessment should be carried out to identify the route cause and to guide management decisions, and findings recorded as a baseline against which to measure progress.

Wounds should not simply be allowed to become chronic for prolonged periods without questioning why healing is not occurring and what can be done to improve the situation. For those patients for whom healing is not a goal, symptom management should be the aim.

Guest et al (2015) concluded that their findings are reflective of the practical difficulties experienced by non-specialist healthcare professionals in the community, and highlighted a need to raise awareness of the impact of wounds on the healthcare system and to train non-specialist clinicians in the principles of wound assessment and management.

These recommendations have now been acted upon in England; 'improving the assessment of wounds' has been specified as a key goal of the Commissioning for Quality and Innovation (CQUIN) scheme for 2017–2019 (NHS England, 2016).

This means that a proportion of a healthcare service provider's income will be conditional on demonstrating improvements, such as reducing the number of wounds that have failed to heal after four weeks of treatment, by focusing on wound assessment and documentation, and introducing targeted healing rates.

Indeed, using CQUIN guidance and taking the time to conduct a full holistic assessment of the patient and their wound will save time and improve practice in the long term.

With an ageing population and declining district nurse workforce (Royal College of Nursing [RCN], 2012), it is clear that now, more than ever, there is a need for efficiency in community wound care service provision if increasing demand and reduced funding are not to impact on the quality of care provided. The CQUIN target for 2017–19 ultimately aims to reduce wound care workload by improving practice and patient outcomes. WCT

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CQUIN and wound assessment: what does it mean for you?

Holistic wound assessment is crucial if wound healing and symptom management are to be achieved within a recognised timeframe, yet a study by Guest et al (2015) illustrated that there are gaps in practice and no standardisation in approach. In England, a CQUIN indicator has been set for 2017–19 to improve the assessment of wounds. Here, Jackie Stephen-Haynes and Rosie Callaghan, highlight what that means for you.

A systematic approach to holistic wound assessment is essential for the delivery of high quality wound care. The findings of thorough assessment are key to gathering information on patients and their wounds. This information should be documented at each review so that it can act as a baseline against which wound progress can be tracked and used to guide management decisions.

Inaccurate or total lack of assessment can result in inappropriate care and delayed healing, unnecessary patient suffering, poor outcomes and the inadequate use of resources.

CURRENT GAPS IN CLINICAL PRACTICE

Research by Guest et al (2015) highlighted that in 2012/13, 4.5% of the population had a wound, accounting for 40.6 million healthcare visits. However, it also revealed issues with wound assessment and documentation. For example, over 30% of patients did not have a differential diagnosis of their wound. Importantly, more than half of patients with wounds did not heal within the study year (Guest et al, 2015). Thus, the study revealed that there is significant scope for the improvement of clinical outcomes as well as achieving essential financial savings. These findings have gone some way to putting wound care on the map and has led to the development of a CQUIN indicator for the assessment of wounds.

What is CQUIN?

- CQUIN is an acronym for Commissioning for Quality and Innovation. It is a system designed to make a proportion of any healthcare provider's income dependent on the provider being able to demonstrate planning to deliver quality and improvement in an agreed area of patient care.

WHY CQUIN?

NHS England has introduced the first set of two-year CQUIN indicators 2017–19 (NHS England, 2017). The object of this timescale is to 'provide greater certainty and stability on the CQUIN goals leaving more time for health communities to focus on implementing the initiatives' (NHS England, 2017). The overall aim of setting 13 CQUIN indicators for this period is to help achieve the goals of the NHS mandate (Department of Health [DH], 2017), in which the Government sets out priorities for NHS England to ensure it is fit for purpose.

Importantly, the mandate to NHS England has gone further than previously to ensure that the best care is delivered to NHS patients, and that the reform and renewal needed to sustain the NHS for the future is actioned. Thus, the overall objective of the CQUIN indicators for 2017–19 is to enhance quality and improve outcomes for patients. This includes reducing health inequalities, encouraging collaboration across different providers, and improving the working lives of NHS staff.

CQUIN indicators give a clear framework for healthcare professionals to follow, ensuring cross-country standards for care within targeted therapeutic areas. Interestingly, CQUINs only operate with NHS England. Wales, Scotland and Northern Ireland have devolved health care to their local governments.

CQUIN INDICATOR: IMPROVING THE ASSESSMENT OF WOUNDS

The CQUIN indicator for improving the assessment of wounds aims to improve the assessment process in patients with a wound that is still unhealed following four weeks of treatment. Continual reassessment and documentation of a minimal data set of findings will be required to meet CQUIN targets.

There will an initial audit in the autumn of 2017 with the first report in November 2017 with a second audit in Spring 2018. The financial aspect of the CQUIN will be based upon demonstrating an improvement in care provided and will be agreed with local clinical commissioning groups (CCGs).

WHY IS IMPROVING WOUND ASSESSMENT IMPORTANT?

There are two principle reasons why wound assessment has been targeted: a need to improve the quality and consistency of care delivered, and a need to reduce the cost burden of wounds. NHS England is driven by achieving the best clinical outcomes for patients, while also focusing on financial outcomes that are justified.

While literature and best practice documents regarding wound assessment exist, there are currently no nationally accepted guidelines that will allow the comparison of wound assessment across regions. To rectify

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this, NHS England has supported a literature review and robust consensus process for the development of the *Generic Wound Care Assessment Minimum Data Set* (Coleman et al, 2017) to underpin wound assessment documentation and clinical practice. A total of 24 articles were reviewed by a panel of experts, with 68 potential assessment items identified and consensus agreement reached to include 37 areas within five key domains within the minimal data set. The five key domains focus upon (Coleman et al, 2017):

- General health
- Baseline information
- Wound assessment
- Wound symptoms
- Specialist referral.

This minimum data set will need to be collected and documented for all patients to meet wound assessment CQUIN targets.

WILL CQUIN IMPROVE CARE?

For clinicians currently delivering best practice wound care that includes thorough wound assessment and documentation, the CQUIN will not dramatically impact on healing rates. However, the evidence presented by Guest et al (2015) demonstrated discrepancies in care and outcomes that will be improved by implementation of CQUIN.

IMPLEMENTING WOUND ASSESSMENT

NHS England acknowledges that further education may be required in relation to wound assessment if targets are to be met. Further guidance on competencies and education for wound assessment and management is currently being developed and NHS England advise that this will be shared when available. In the interim, clinicians need to ensure that they have the appropriate skills and knowledge concerning wound assessment.

There are many existing resources that facilitate a systematic approach to thorough and holistic wound assessment, which meet the criteria set out by Coleman et al (2017), including TIME.

SPECIFIC WOUND ASSESSMENT

The concept of wound bed preparation (Schultz et al, 2003) and the TIME framework (Dowsett, 2009) offer a logical and systematic approach to the assessment and delivery of wound care and have been implemented widely in clinical practice for years.

TIME was developed by an international advisory panel as a tool that offers a structured approach to the key components of wound assessment, namely:

- Tissue: non-viable or deficient
- Infection: or inflammation
- Moisture: moisture imbalance
- Edge: non-advancing or undermined.

More recently, the Triangle of Wound Assessment (Dowsett et al, 2015; World Union of Wound Healing Societies [WUWHS], 2016) has been developed, which also incorporates key criteria for the assessment of the wound bed, wound edge and periwound skin.

Although different tools exist, they all act as a framework to be integrated into holistic wound assessment so that it is done thoroughly and consistently.

DOCUMENTATION

All observations, assessments, measurements and photograph images, management plans and review times should be documented clearly, signed, timed and dated. The use of a specific wound assessment chart which incorporates all the aspects of the minimum data set will support clinicians in achieving the CQUIN for wound assessment.

CONCLUSION

In England, the CQUIN for wound assessment will improve clinical practice and wound outcomes where needed. Outside of England, where CQUIN is not implemented, it is still timely to consider how wound assessment is carried out and if improvements in the process will result in increased efficiency and cost-savings. It is important to remember that whether you are measured against CQUIN targets or not, getting wound assessment right makes a real difference to patients and their lives. As healthcare providers and clinicians, we should embrace the opportunity that CQUIN brings to enhance care delivery to the benefit of both patients and trusts. **WCT**

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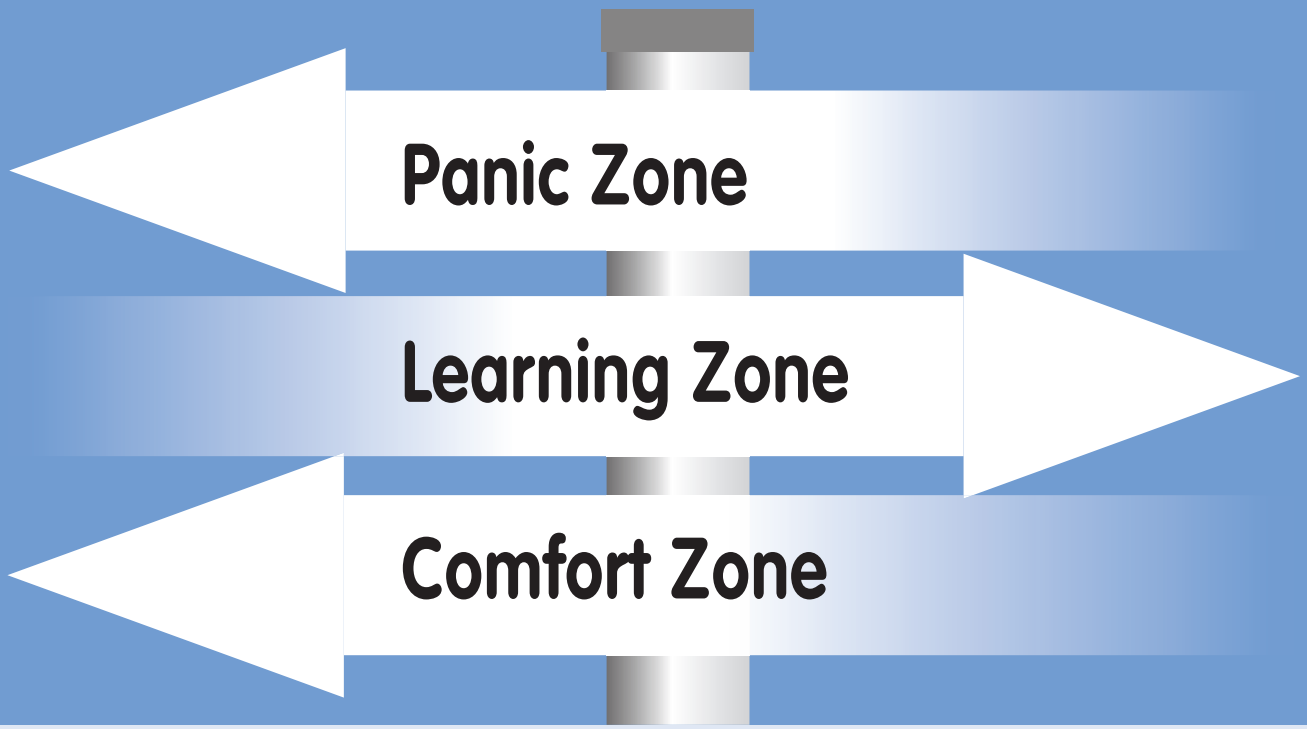

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IN BRIEF

- TIME is an acronym that supports systematic wound assessment.
- The 'T' of TIME represents 'Tissue types present' as a reminder to assess the types of tissue present in the wound bed, and in what quantity, usually recorded as a percentage of the whole wound bed.
- Documentation of these values and communicating to colleagues means that at each assessment the success or failure of wound management decisions can be evaluated and reviewed if needed.

KEY WORDS:

- TIME
- Tissue type
- Wound bed preparation
- Necrosis/slough
- Debridement

TIME to identify and manage tissue types present in the wound bed

Kathryn Vowden

Wound bed preparation describes the process of preparing a wound to heal and is a concept outlined by Schultz et al (2003). This concept was then developed into an acronym: TIME (*Box 1*) (Dowsett, 2008). More recently, 'S', which stands for surrounding skin, has been added to the principle of TIME (Wounds UK, 2016; see *pp. 44–45*).

TIME provides a framework to guide structured local wound assessment as part of an overall holistic assessment of the patient. The findings of assessment should then be used by the clinician to guide treatment of both the patient and their wound. Repeated reassessment and documentation of findings allow practitioners to systematically apply appropriate management strategies which can then be adapted as the wound progresses or deteriorates.

The importance of the assessment process has been recognised in the recently introduced CQUIN for wound assessment – Indicator 10 (NHS England, 2017), which aims to ensure that patients receive a full wound assessment if their wound has not healed within four weeks.

In addition to allowing effective wound management, the assessment process is a communication tool between healthcare professionals. Therefore, it is important that the assessment process uses a common and consistent series of terms to describe and document the wound.

To this end, a core minimum data set has been developed to support the CQUIN (Coleman et al, 2017). The minimum data set consists of several domains, one of which is wound assessment, which states that the tissue type present within the wound bed should be identified and documented. Documentation should be supported by diagrams, illustrations or photography whenever possible in line with local policy (Vowden and Vowden, 2015; Vowden, 2016).

Box 1

- *T issue: non-viable or deficient*
- *I nfection: inflammation or biofilm*
- *M oisture imbalance*
- *E dge: advancing or undermining*

Box 2

Necrosis is caused by factors external to the cell or tissue, such as ischaemia, infection, toxins, or trauma that result in the unregulated digestion of cell components.

Eschar (coagulative necrosis)

- Structure similar to healthy human dermis with interspersed areas of disruption and degradation
- Inflammatory infiltrate: leucocytes secreting proteolytic enzymes
- Staining demonstrates protein degradation but a maintained fibrous structure.

Slough

Creamy yellow often stringy adherent fibrous material derived from the breakdown of proteins, fibrin and fibrinogen (Tong, 1999), which can recur after wound cleansing or debridement.

Necrotic tissue may undergo liquefaction to form a viscous gel-like material and in the presence of infection may produce pus.

Kathryn Vowden, lecturer, University of Bradford; honorary nurse consultant, Bradford Teaching Hospitals NHS Foundation Trust

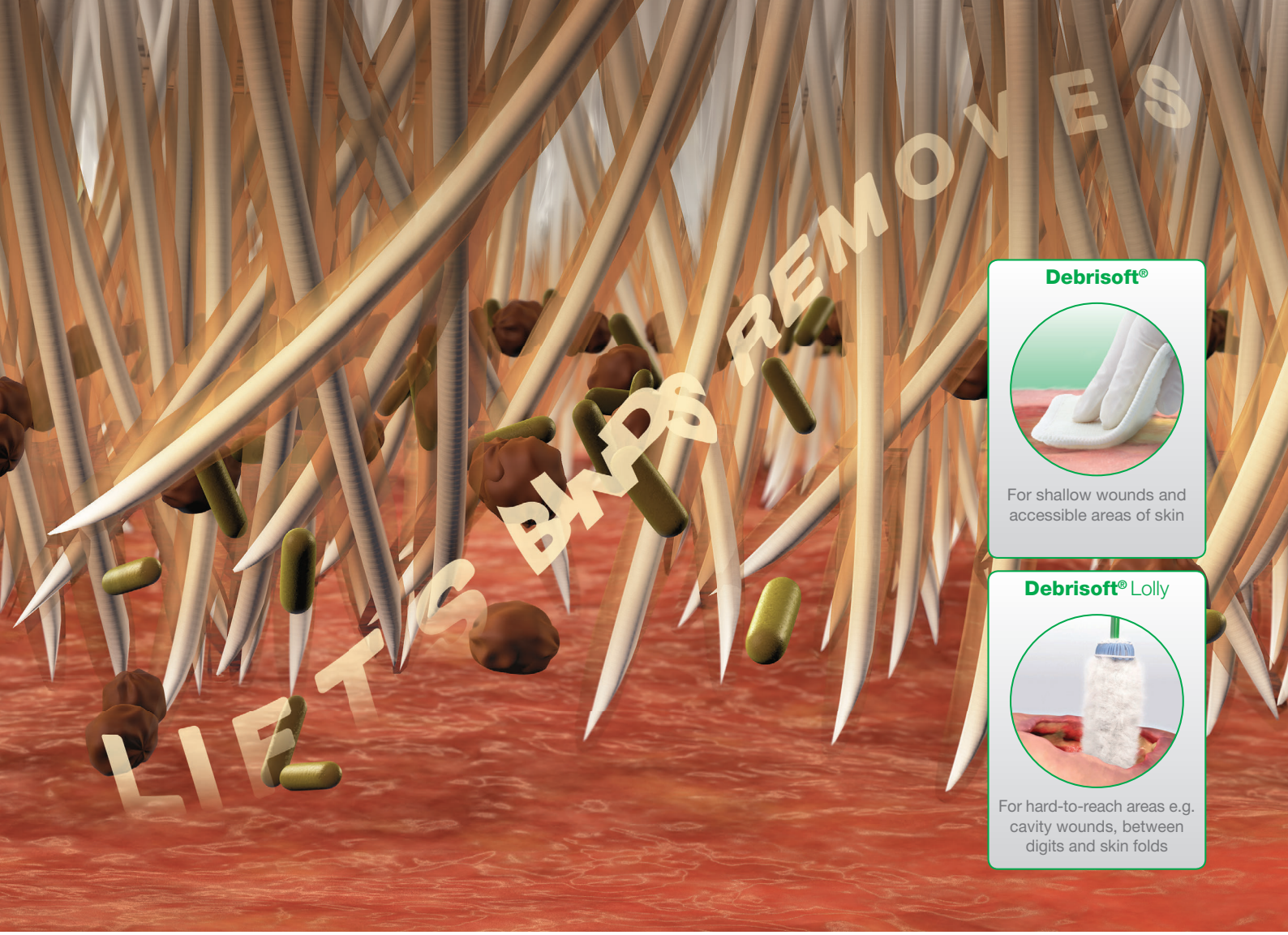

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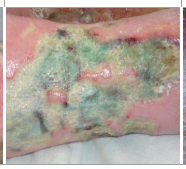
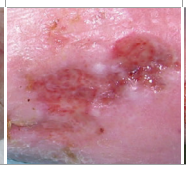
Table 1: Tissue description within the wound bed (adapted from Gupta et al, 2017)

	Necrotic tissue		Slough		Granulating tissue		
	Black	Brown/grey	Green	Yellow/white	Red	Pink	Friable red
Hydration	Dry	Wet	Moist to wet		Moist to wet	Moist	Moist to wet
Description	May be partial or full-thickness eschar with or without a defined edge. May be adherent or partially separated	Soft adherent necrotic tissue. May be boggy with fluctuant areas. May have a high bioburden	Adherent often stringy material varying from green to yellow in colour. May have a high bioburden	Thin, often recurring slough that may have islands of red visible within. May have a light to moderate bioburden	Granulation tissue present. May have islands of yellow/white slough. Likely light bioburden	Healing wound with progressive epithelialisation. Light bioburden	Unhealthy granulation tissue possibly indicating high bioburden
Depth	Unknown	Suspected full-thickness	Suspected full-thickness	May be full-thickness	Superficial to full-thickness	Superficial	Superficial or raised tissue
Picture							

Note: an individual wound may have a variety of tissue types visible in the wound bed. A healing wound will usually progress from left to right as healing occurs. An individual wound may regress, i.e. the wound descriptors move from right to left. This should trigger a complete reassessment and raise the possibility of an increasing bioburden, wound ischaemia or increasing inflammation.

TISSUE TYPES

Description of the tissues types found in the wound area should include details relating to:

- The periwound skin
- The wound margins/edges
- The wound bed.

Tissue type present within the wound bed is key when determining treatment aims and methods. It is important to note that more than one type of tissue may be present at the same time. Chronic wounds frequently accumulate necrotic tissue and slough within the wound bed and at the wound margin (see *Box 2*). The appearance and depth of necrotic tissue and slough can vary, as can its moistness. This is because the volume of wound exudate produced will influence the degree of hydration seen. The tissues likely to be seen in the wound bed are set out in *Table 1*.

As healing progresses, the quantity of necrotic and sloughy tissue will reduce, as granulation tissue increases. Healing can only occur when the wound bed is covered with healthy granulation tissue.

Therefore, the goals of management should be to remove devitalised and dead tissue from the wound bed, while protecting and maintaining moisture balance to encourage granulation.

At each wound assessment, the percentage of tissue type present within the wound should be recorded and compared with previous assessment findings to mark progress.

Several factors may influence the depth and appearance of the wound bed. It is important to recognise and consider these factors during the assessment process.

For example, the structure and function of skin varies; the skin of the leg and trunk is thinner and differs from that of the sole of the foot where it is thicker and lacks hair follicles. Age, comorbidities and medication, such as steroids, can also affect the skin, changing its appearance, thickness and susceptibility to damage and ability to heal. Tobin (2017) has recently reviewed the effect of aging on skin function and skin regeneration, highlighting the changes in cellular, vascular and immune function.

The anatomical location and depth of a wound will also define what structures are likely to be encountered in the base of the wound. For example, tendons are close to the surface over the dorsum of the foot and bone is in close proximity to the skin surface on the heel, elbow and knee where there is little or no fatty tissue. Note should also be taken of previous surgery, as implanted material or sutures may be present within the wound. These structures need to be recognised and recorded in the wound description, along with a definition of their viability. Care should be taken to define their viability and maintain their function if possible, escalating care when necessary.

The structure and colour of necrotic and sloughy tissue varies. Thomas et al (1999) found that areas of eschar appeared to have a general structure similar to that of healthy human skin, with scattered regions where the normal structure appeared disrupted and degraded. Slough refers to a type of necrotic tissue that is separating itself from the wound site and may be white, yellow or grey in colour. It is usually a combination of leucocytes, devitalised tissue debris and bacteria.

Necrotic tissue of all types is recognised as a physical barrier to

Table 2: Debridement methods (adapted from Vowden and Vowden, 2011)

Type	Mechanisms of action	Advantages	Disadvantages	Who/where	Action
Autolytic	A naturally occurring process in which the body's own enzymes and moisture rehydrate, soften and liquefy hard eschar and slough. Occlusive or semi-occlusive dressings (hydrogel, hydrocolloid, alginate or Hydrofiber®) help to achieve moisture balance, by absorbing excess exudate or donating moisture	Provide a continuous method of debridement. Can be used before or between other methods of debridement (e.g. a hydrogel could be applied to soften tissue before larval therapy), when there is a small amount of non-viable tissue in the wound, i.e. maintenance debridement	The process is slow, increasing potential for infection and periwound maceration	Generalist and specialist can implement this	Debride using appropriate dressings for moist wound healing
Mechanical	Traditional wet-to-dry method is not recommended in the UK. Newer methods include removing non-viable tissue from a wound using a monofilament fibre pad, e.g. Debrisoft®, L&R	Monofilament fibre pads provide a method of intermittent debridement. For example, using Debrisoft® can be more selective, quick and easy. It can achieve effective removal of hyperkeratosis from the periwound area. Little pain is experienced. Patients can use it under supervision	Not suitable for use on hard, dry eschar. Can be used as a precursor or follow-up to larval therapy or sharp debridement. Not suitable for already painful wounds	Generalist and specialist. Can be done in the community, the clinic or at the bedside, and is a useful addition to autolytic debridement at dressing changes	Debride using Debrisoft® 0R autolytically debride and organise Debrisoft® for next time
Larval therapy (biosurgical)	Larvae of green bottle fly (*Lucilia sericata*) remove moist devitalised tissue from the wound. Larvae are also able to ingest pathogenic organisms present. Larvae are available loose or in a 'bagged' dressing	Continuous debridement while applied to wound. Can also assist in managing bioburden and may stimulate healing. Highly selective and rapid	Unit costs higher than for autolytic debridement but treatment time is short. Needs to be planned in advance. Not suitable for all patients or wounds, e.g. malignant lesions; wounds that bleed easily; those that communicate with a body cavity of an organ or are near major blood vessels; wounds with dry devitalised tissue; wounds with excessive exudate or where the larvae cannot be protected from being crushed. Exercise caution with patients on anticoagulants	Generalist or specialist practitioner with minimal training. Bagged larvae method reduces the skill level required and can be left in place for 4–5 days. Contraindicated for use in anticoagulated patients at home. See manufacturer's instructions on use with antibiotics	Debride if equipment is available, OR plan to have the equipment and autolytically debride in meantime, OR refer if time-sensitive
Sharp	Removal of dead or devitalised tissue using a scalpel, scissors and/or forceps to just above the viable tissue level. Undertaken in conjunction with other therapies (e.g. autolytic debridement). The most commonly used form of debridement in managing the diabetic foot	Selective and quick intermittent physical method of debridement. No analgesia normally required. Works best on harder eschar that can be grasped with forceps	Practitioners must be able to distinguish tissue types and understand anatomy as procedure carries risk of damage to blood vessels, nerves and tendons. Not as effective on soft adherent slough. Does not result in total debridement of all non-viable tissue	Skilled practitioner (podiatrist, specialist nurse) with specialist training. Can be done by appropriately trained practitioners in the community	Refer if non-specialist
Surgical	Excision or wider resection of non-viable tissue, including the removal of healthy tissue from the wound margins, until a healthy bleeding wound bed is achieved	Selective intermittent method. Best used on large areas where rapid removal is required	It can be painful for the patient and anaesthetic is normally required. Associated with higher costs related to theatre time	Must be performed by a surgeon, podiatrist or specialist nurse with appropriate training, in the operating theatre	Refer
Ultrasonic	Devices deliver ultrasound either in direct contact with the wound bed or via an atomised solution (MIST®; Celleration) Most include a built-in irrigation system and are supplied with a variety of probes for different wound types	Immediate and selective. Can be used for excisional debridement and/or maintenance debridement over several sessions. Has some antimicrobial activity	Availability limited due to higher costs and requirement for specialist equipment. Requires longer set-up and clean-up time (involving sterilisation of hand pieces) than sharp debridement. May require multiple treatments	Specialist training needed to perform procedure. Can be used in a variety of settings, depending on local protocol. Not often used outside the clinic due to infection control/contamination issues	Refer if non-specialist
Hydrosurgical	Removal of dead tissue using a high energy saline beam as a cutting implement	Short treatment time and selective. Capable of removing most, if not all, devitalised tissue from the wound bed without compromising healthy tissue. Can also remove hyperkeratotic tissue from wound margins	Requires specialist equipment and training. Potential for aerosol spread of infection. Can be painful. Not always available and associated with higher costs, although is often cost-effective when compared with surgical debridement, since it does not require theatre time	Specialist practitioner with relevant training. Can be used in a variety of care settings, depending on local protocol. It is not often used outside the clinic due to infection control/ contamination issues	Refer if non-specialist

healing, obstructing epithelial cell migration and providing a focus for ongoing inflammation (Dowsett and Newton, 2005). Debridement, that is the removal of devitalised tissue and any foreign material from the wound, is therefore considered a vital component of wound bed and wound edge management and this fact is reflected in current guidance and best practice statements on debridement (Chadwick et al, 2013; Strohal et al, 2013).

Necrotic tissue also acts as a potential source of wound and systemic infection (Baharestani, 1999). Wolcott et al (2010) emphasises the importance of the frequent physical removal of necrotic tissue and slough in the control of biofilms. Wilcox et al (2013) confirmed this by demonstrating the value of frequent debridement in optimising time to heal and infection control. As a result of these and other studies, biofilm guidelines (World Union of Wound Healing Societies [WUWHS], 2016; Wounds UK, 2017) now recommend that frequent and regular debridement is seen as a necessary part of biofilm management.

As wounds progress, an increasing proportion of the wound bed should be covered in granulation tissue. Treatment aims at this stage are focused on maintaining a moist wound environment and protecting the delicate developing granulation tissue, encouraging progressive epithelialisation.

The wound bed cannot be considered in isolation and forms only part of the management strategy outlined in the TIME concept (Falanga et al, 2008), which also focuses on inflammation, infection, moisture balance and the wound edge and forms a systematic approach for assessing chronic wounds (Harries et al, 2016). Management of the wound edge and the periwound skin is intimately linked to treatment of the wound bed and often requires a common management approach whether that be by debridement, infection or inflammation treatment, or moisture management. Allowing hyperkeratotic skin to build up in the periwound area or at the wound edge could increase the risk of infection and act as a barrier to healing (Vowden, 2012). These overlapping assessment and treatment actions will be covered in more detail in other sections of this publication on TIME.

DEBRIDEMENT

Debridement can be either continuous or intermittent, for example only occurring at dressing change. Autolytic debridement, enzymatic degradation of necrotic material, is a naturally occurring continuous process that can be enhanced by maintaining a moist wound environment and the selection of appropriate dressings (Vowden and Vowden, 2011). Most dressings facilitate continuous autolytic debridement. The choice of dressing is dependent upon other wound factors such as the volume of exudate, the presence of a high bioburden and the desired treatment outcome. Although safe, the process of autolytic debridement is slow, and therefore, to optimise wound bed management, it is often combined with another intermittent debridement method at dressing change, such as sharp or mechanical debridement (see *Table 2* for details on debridement methods). Larval therapy is an alternative method of continuous debridement that is applicable in all care settings. Pritchard and Nigam (2013) have reviewed and confirmed the potential benefits of larval therapy in both debridement and healing, the therapy having the potential not just to remove necrotic tissue but also to reduce inflammation, reduce bioburden and promote cell signalling and the formation of new blood vessels, or angiogenesis.

The most commonly utilised forms of intermittent physical debridement suitable for use in the community are mechanical or conservative sharp debridement. Conservative sharp debridement offers the most rapid and often cost-effective method of debridement (Strohal et al, 2013). It does, however, require staff with specific competencies and training which can limit availability. Mechanical debridement with products such as monofilament fibre pads provide staff with a more readily accessible form of therapy to manage both the wound bed and periwound skin (Bahr et al, 2011) and are particularly useful where soft necrosis or slough are present. These pads, however, are unlikely to be effective for hard or very adherent eschar or callus (Strohal et al, 2013).

The choice of debridement method will be defined by the nature and extent of the necrotic tissue or slough, the speed with which debridement is required, the healthcare professional's competencies, available material and equipment, the local environment, local policies, safety issues and patient preference (Vowden and Vowden, 2011). Current clinical European and UK guidance (Strohal et al, 2013; Chadwick et al, 2013) emphasises that if the assessment process suggests that the optimal method of debridement is not available to that healthcare professional, onward referral may be appropriate. Vowden and Vowden (2011) have listed a range of wounds that are at risk of complications during the procedure and should not be debrided, particularly by conservative sharp debridement, without specialist involvement. These include patients with wounds on their face and hand, those with lower limb wounds and peripheral arterial disease, patients with inflammatory conditions such as *pyoderma gangrenosum,* and patients where there is a change in anatomy such as malignant wounds.

Falanga et al (2008) stated that it may be necessary to repeat intermittent physical debridement periodically to ensure a healthy wound bed is preserved. This process is frequently termed maintenance debridement and is additional to ongoing continuous autolytic debridement. Biofilm management pathways (Wounds UK, 2017) also emphasise the importance of repeated intermittent physical debridement and continuous autolytic debridement with or without antimicrobial therapy.

When considering a debridement method for the wound bed, also bear in mind what is appropriate for the wound margin and the periwound skin to prevent complications, preserve the skin function and encourage epithelialisation. When callus is present, as in the case of a diabetic foot ulcer, sharp debridement may be the only suitable method of management and may require the involvement of a podiatrist or the diabetic foot team in the patient management (FDUK expert working group, 2014).

Documentation should not only record the wound bed status, but also if debridement was considered necessary (or unnecessary), the method of debridement used, the type of consent obtained, the outcome of debridement, including a description of the tissue removed, and whether tissue was sent for culture or histology, and the state of the wound bed at the end of the debridement procedure. Photography can be a useful method of recording changes in the wound bed (Vowden and Vowden, 2015).

CONCLUSION

Tissue management within a wound cannot be effective unless the other elements of TIME are considered and integrated into a holistic plan of care that is appropriate for an individual patient. Tissue management is an ongoing process that must be adapted as the wound progresses towards healing, and requires that healthcare professionals respond to changes in wound condition and also to non-healing or wound deterioration appropriately. This can only be achieved by careful wound assessment, recognition of tissue types, good documentation and effective communication between members of the multidisciplinary team and patient. WCT

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WHAT IS DEBRISOFT®?

Debrisoft® and Debrisoft® Lolly are debridement products recommended by NICE, that use unique technology to remove barriers to healing by lifting slough and debris from the wound.

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In both Debrisoft and Debrisoft Lolly, the fleecy contact layers are made up of millions of extremely flexible monofilament fibres:

- The fibres are cut to a specific thickness, length and density to enhance debris removal
- The angled tips of the fibres allow them to reach uneven areas of the skin or wound bed.

WHY DEBRIDE?

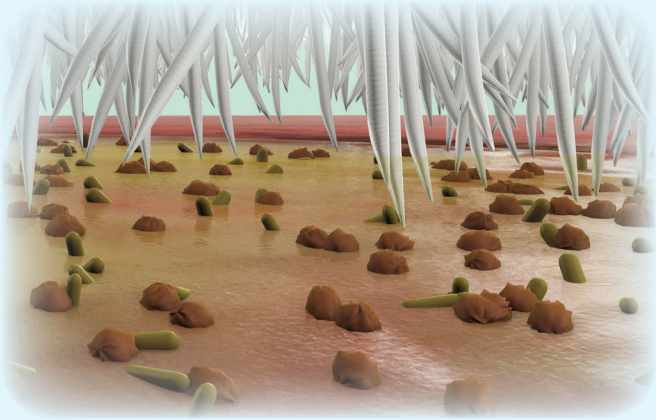
Debridement plays a key role in wound bed preparation, as it:

- Removes devitalised tissue such as slough, necrosis and hyperkeratosis from the wound bed or skin
- Decreases the bacterial load and biofilm, thus reducing the risk of infection
- Removes the barriers to healing.

HOW DEBRISOFT WORKS

The Monofilament Fibre Technology helps promote healing because the fibres:

- Lift up superficial slough and debris, including biofilm, quickly and easily
- Bind debris between the fibres for easy removal
- Remove barriers to healing, such as superficial slough and debris, including biofilm
- Leave the area clear and promote the development of healthy tissue
- Are safe to use on new granulation tissue and epithelial cells.



CLINICAL EVIDENCE

The use of Debrisoft can speed up the debridement process, saving money and time and improving care for the patient. The National Institute for Health and Care Excellence (NICE, 2014) stated that using Debrisoft on appropriate wounds would result in quicker debridement, with fewer nurse visits, compared with other debridement methods. Debrisoft also:

- Significantly reduces debridement time (Bahr et al, 2011)
- Effectively removes debris, slough and dried exudate and crusts from the wound bed (Bahr et al, 2011; Gray et al, 2011a; Haemmerle et al, 2011)
- Effectively binds and locks away debris and exudate (Bahr et al, 2011; Wiegand et al, 2014)

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- Effectively removes haematoma from the wound (Gray et al, 2011a)
- Effectively removes hyperkeratosis from the periwound skin (Gray et al, 2011a)
- Does not damage new epithelial and granulation tissue (Haemmerle et al, 2011)
- Results in minimal pain on use (Gray et al, 2011b; Haemmerle et al, 2011)
- Does not require specialist training or setting (Gray et al, 2011b; Haemmerle et al, 2011)
- Is considered an easy, fast and efficient debridement method by clinicians (Bahr et al, 2011; Gray et al, 2011b; Haemmerle et al, 2011)
- Is cost-effective (NICE, 2014).

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HOW TO USE

DEBRISOFT

- If emollient has been applied, wash the limb to remove it
- Open the Debrisoft single use, sterile pack
- Fully moisten the soft fleecy side of Debrisoft with 20–40ml (1–2 egg cups) of tap water or saline
- With light pressure as if exfoliating, use the soft fleecy side of Debrisoft to gently debride (using circular motions on wounds or long, sweeping strokes on skin) for approximately 2–4 minutes
- Use a new piece of Debrisoft for each separate wound/area of skin
- Dispose of the used Debrisoft in normal clinical waste.

DEBRISOFT LOLLY

- Open, then fully moisten the head of the Debrisoft Lolly while in the packet with 5–15ml of tap water or saline, which is equivalent to 1–3 teaspoons

- Clean the wound and/or hard-to-reach areas by applying gentle pressure with the soft, fibre head of the moistened Debrisoft Lolly

- Use a new Debrisoft Lolly for each separate area. If necessary, clean the skin surrounding the wound with a moistened Debrisoft pad. Dispose of the used Debrisoft Lolly (and pad) in normal clinical or household waste.

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IN BRIEF

- Wound infection is one of the most challenging and frequently reported complications of wound care.
- Wound infection may delay healing and requires appropriate and timely treatment and management.
- Systematic and structured holistic assessment is vital to identify risk factors that may contribute to a patient developing wound infection.

KEY WORDS:

- Wound infection
- CQUIN targets
- Systematic assessment
- TIME framework
- Antimicrobial dressings

Infection and inflammation: assessment and treatment

Kirsty Mahoney

Wound care contributes a significant burden to NHS resources. Several studies examining patient databases across England and Wales have sought to understand the economic impact of wounds. Guest et al (2015) used data from the Health Improvement Network (THIN) and estimated that the cost of managing wounds in the UK was between £4.5 and 5.1 billion, while Phillips et al (2015) gathered data from the Secure Anonymised Information Linkage (Sail) and concluded that wound care represented 6% of the NHS budget in Wales. Guest et al (2015) indicated that the majority of wounds were looked after by nurses in the community, and that the lack of holistic clinical assessment and differential diagnosis may contribute to escalating costs. This article seeks to describe the clinical presentation of wound infection and inflammation and discuss the importance of using a systematic framework for wound infection to meet targets identified within the Commissioning for Quality for Innovation (CQUIN) framework.

CQUIN TARGETS FOR WOUNDS

The figures identified by Guest et al (2015) identified that there is a requirement for wound care practice to be improved. A key target for CQUIN identified 'improving assessment for wounds' within its 2017–2019 framework. This framework focuses on wound assessment, documentation and targeted healing rates (Scott-Thomas et al, 2017).

Accurate assessment and diagnosis is essential if wound care is to be safe, effective and improve patient outcomes and experience. All of which are essential to meet the requirements within the CQUIN framework. Failure to demonstrate aspects of the framework may result in penalty or reduced funding to a service (Department of Health [DH], 2010).

Dowsett et al (2017) suggest that a holistic wound assessment should not just focus on the wound, but also on underlying factors that may contribute to delayed wound healing. These factors may include comorbidities, medication, psychological status, diet and wound infection. Through ongoing assessment, healthcare professionals should also be able to identify any changes in a patient's wound status and act on these changes in a timely manner to prevent further wound deterioration, or unwanted wound symptoms such as pain, exudate and odour. Wound infection is a change within the wound that may delay healing, cause unpleasant symptoms for the patient and requires appropriate, timely treatment and management.

WHY CORRECT IDENTIFICATION OF INFECTION IS IMPORTANT

Wound infection is one of the most challenging and frequently reported complications of wound care (Gottrup et al, 2013). It is often misdiagnosed and treated inappropriately. The consequences of misdiagnosis may lead to delayed wound healing, increased costs,

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poor outcomes for patients due to uncontrolled symptoms, poor quality of life and, in the worst case scenario, may lead to sepsis and death (Gottrup et al, 2013). Inappropriate treatment, such as over prescribing of antibiotics, is also of global concern, as there is an increase in bacterial resistance due to over prescribing of antibiotics (European Wound Management Association [EWMA], 2005; Gottup et al, 2013).

Several factors are thought to contribute to the misdiagnosis of wound infection. Currently, there is no agreed criterion for recognising wound infection (International Wound Infection Institute [IWII], 2016), which may lead to some confusion in clinical practice. There are also some wound types which may not display any signs and symptoms of infection, e.g patients with diabetes who have a reduced inflammatory response (Gottrup et al, 2013). Poor knowledge and lack of understanding of wound infection has also been identified as a factor that contributes to misdiagnosis and inappropriate management (Dowsett, 2009). It is therefore essential that nurses treating patients with wounds have an adequate understanding of wound infection and use a systematic approach for assessing/reassessing wounds.

WHAT IS A WOUND INFECTION?

White cells (neutrophils and macrophages) are responsible for debriding and removing microorganisms from the wound bed by phagocytosis in the inflammatory phase of wound healing (Menke et al, 2007). The increased presence of bacteria within the wound causes a continual influx of neutrophils, which leads to a persistent state of inflammation and further facilitates the proliferation of microorganisms. Wound infection occurs when microorganisms start to increase in numbers and overwhelm the host's immune response. This response may be localised within the wound bed or systemic (IWII, 2016).

Bacteria further compromise the delicate cellular balance within the wound bed by competing for oxygen and nutrients (Warriner and Burrell, 2005), and also produce enzymes that destroy growth factors and further extend the inflammatory response (Percival and Cutting, 2011). Literature reviews have indicated that delayed healing has been linked with unresolved inflammation — one factor contributing to this is a high bacterial load (Menke et al, 2007).

The effect bacteria has on a wound may be influenced by the:

- Number of bacteria present
- Virulence or species of the bacteria
- Capability of the patient's immune system to combat the infection (IWII 2016).

Certain factors may also increase a patient's risk of developing wound infection (*Table 1*).

Table 1: Risk factors for developing wound infection

Patient-related factors	Wound-related factors
Comorbidities that may reduce oxygen perfusion (cardiovascular/respiratory/anaemia)	Duration of the wound
Metabolic disorders that may impair immune response (e.g. diabetes)	Size of the wound
Medication (e.g. corticosteroids or cytotoxic therapy which will reduce neutrophil activity and effect immune response)	Anatomical site of wound (wounds in highly contaminated areas such as the anus are at risk)
Age: increasing age contributes to slower wound healing, while the very young have immature immune systems	Type of wound, e.g. surgical wounds that result from long or contaminated surgery
Psychological factors which may lead to poor lifestyle choices such as poor diet /smoking/poor hygiene	Wounds containing devitalised tissue

Practice point

Early identification and treatment of wound infection will promote safe and cost-effective wound care and prevent delayed wound healing and unwanted symptoms.

The wound continuum describes the progression of wound infection across a continuum and assists healthcare professionals in identifying the stage and severity of the wound infection (IWII, 2016; *Table 2*).

DIAGNOSIS OF WOUND INFECTION

A systematic, structured holistic patient assessment is essential to establish a diagnosis and identify possible risk factors that may impede wound healing (Dowsett et al, 2017). For assessing the patient, Harding et al (2007) suggested using the pneumonic HEIDI (history, examination, investigations, diagnosis and indicators/interventions). The use of the TIME (Dowsett and Newton, 2005) framework (tissue, infection/inflammation, moisture, edge) can be used in conjunction with HEIDI to assess wound-related factors (see *patient story, p. 25*).

Clear and concise documentation of wound indicators, such as wound measurements, tissue type within the wound bed, exudate volume, pain and condition of surrounding skin contributes to safe and effective wound care. These will assist the healthcare professional in establishing clinical goals that are appropriate and achievable, and provide a baseline against which to evaluate the progress or deterioration of the wound.

Wounds should be reassessed regularly depending on the clinical indicators present. Wound reassessment should also determine the suitability of the dressing regimen and effectiveness of any

Table 2: How a wound may present across the wound healing continuum (IWII, 2016)

Stage	Description of wound
Contamination: presence of bacteria, without multiplication	› All wounds will be contaminated with bacteria; the wound will progress to healing within a timely manner
Colonisation: bacteria start to multiply, but no host reaction	› Wound continues to heal without being delayed
Local infection: bacteria start to invade wound tissue and multiply delaying wound healing. The signs of infection may be subtle 	› Increasing signs of infection which may include: • increasing odour, pain or exudate › Healing no longer progressing normally Intervention is required at this stage
Spreading infection 	› Overt signs of local infection, discharge of pus with swelling, pain, erythema and local warmth › Evidence of surrounding tissue involvement; wound appears unhealthy, or deteriorating › Cellulitis, lymphangitis or gangrene may be present › Patient may be generally unwell and have pyrexia Urgent intervention is required at this stage
Systemic infection	› Bacteria spread throughout the body causing sepsis. May lead to organ failure › Can be limb- or life-threatening Urgent intervention is required at this stage

other adjunctive treatments, such as compression, offloading or pressure redistribution.

EWMA (2005) used a Delphi technique with experts within the field of wound care to identify different criteria that may be present within six different wound types (acute wounds, diabetic foot ulcers, arterial leg ulcers, venous leg ulcers, pressure ulcers and burns). This is an interesting approach and demonstrates that there may be subtle differences in clinical signs of infection between different wound types, including acute and chronic wounds.

Clinical indicators for wound infection that have been suggested to be present in all wound types, especially acute wounds, include oedema, erythema, pain, increased temperature and purulent exudate (Gottrup et al, 2013). EWMA (2005) recognised that additional indicators may be present in chronic wounds. These additional signs and symptoms specific to chronic wounds are:

- Serous exudate with inflammation
- Delayed healing
- Friable granulation (granulation tissue that bleeds easily)
- Discoloured granulation
- Pocketing at the wound bed base (strips of granulation tissue that appear at the base of the wound, as opposed to uniform spread of granulation across the whole wound)
- Odour
- Wound breakdown/delayed wound healing.

Some wounds may even appear to be asymptomatic, leading to difficulties in identifying the existence of wound infection.

DO I NEED TO SWAB A WOUND?

Use of wound swabbing is controversial, as it may only reveal surface bacteria and not resident bacteria in deep tissues that may cause infection; conversely, it may also identify organisms that are present but not problematic (Angel et al, 2011). The use of wound swabbing is therefore not recommended in routine wound care (IWII, 2016).

Remember:

- Acute wounds in a healthy individual usually heal in a timely manner and have no underlying aetiology that may delay healing (e.g. surgical, trauma wounds).
- Chronic wounds, on the other hand, delay healing due to underlying aetiology, such as arterial and venous disease.

Wound swabs are only useful if the correct technique is used (Levine technique) and in conjunction with clinical patient assessment.

The IWII (2016) indicates the following where wound swabbing may be helpful:

- Acute wounds with signs and symptoms of infection
- Chronic wounds with signs and symptoms of spreading infection
- Infected wounds that have failed to respond to antimicrobial treatment
- In the surveillance of drug-resistant microbial species
- Wounds where the presence of certain bacteria would cause significant problems if a surgical procedure was performed (e.g. meticillin-resistant *Staphylococcus aureus* [MRSA]).

BIOFILMS IN CHRONIC WOUNDS

Over the past few years, much interest has been placed on biofilms and chronic wounds. Bjarnsholt et

Practice point

- Local infection may respond to topical antimicrobial agents
- Spreading infection will require systemic antibiotics in conjunction with topical antimicrobial agents
- Topical antimicrobial agent selected will depend on the requirements of the wound and local formulary availability.

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Patient story: holistic assessment using HEIDI and TIME

History

John is a 79-year-old gentleman who has lymphoedema. He had a previous history of angioplasty five years ago. His ulcer has worsened over the last few weeks and has become malodourous with elevated exudate. He has non-insulin dependent diabetes with HbAIc of 50mmols. His current medication includes metformin, bisoprolol and aspirin.

Examination using TIME

- T = the wound bed is 70% slough, with devitalised tissue and the wound bed appears unhealthy measuring 10x7cm
- I = friable tissue within the wound bed, which bleeds easily on contact. There is strong odour and John has increasing pain
- M = moderate exudate, which has increased over the past few days, slighty green colour noted
- E = rolled edges with no signs of epithelialisation.

Investigations

- Ankle brachial pressure index (ABPI) is 0.67, with muffled monohasic sounds
- C-reactive protein (CRP) is 30, elevated neutrophils and haemoglobin (HB) is 85.

Diagnosis

Mixed aetiology ulcer with lymphoedema, leg ulcer and local infection.

Indications for infection

John's risk factors for infection are; diabetes, age, peripheral vascular disease (PVD), low Hb, elevated CRP and neutrophils, presence of devitalised tissue. Signs and symptoms of local infection include: poor wound healing, odour, increasing pain and exudate.

Intervention

Patient-related factors include:

- Referral to vascular team for review of vascular status
- Addressing low Hb
- Analgesia to manage pain
- Controlling hyperglycemia.

Wound-related factors include:

- Debriding devitalised tissue
- Applying antimicrobial dressing to reduce bacterial load
- Secondary absorbent dressing may be required to manage exudate
- Reviewing treatment within two weeks; if no improvement, review antimicrobial regimen.

Did you know...

Elevated CRP is an indicator of inflammation and may indicate an inflammatory response (this will also be raised if the patient has an inflammatory disorder such as Crohn's disease or rheumatoid arthritis), so should not be used in isolation.

al (2008) indicated that as many as 70% of chronic wounds may have delayed healing due to biofilm presence.

What is a biofilm?

Bacteria that is identified on wound swabbing is usually free floating or planktonic. Over time, the planktonic bacteria attach themselves to the surface of the wound bed and surround themselves with an extra cellular polymeric substance (EPS). The EPS protects the bacterial colony from the host's natural defences, antibiotic and antimicrobial penetration (Bjarnsholt et al, 2008). As the colony grows and becomes mature, the body's natural defences recruit further neutrophils and other substances, such as cytokines and proteases, which provide nutrients to the biofilm and result in the wound being in a constant state of inflammation, resulting in delayed wound healing (Cutting and McGuire, 2015). The mature

Levine technique

- Cleanse wound to remove surface debris/bacteria
- Moisten culture tip with saline
- Obtain specimen from the cleanest part of the wound
- Press swab into the wound bed and rotate
- Ensure that there is relevant clinical information included on the swab form to assist the microbiologist, e.g. site and type of wound.

biofilm now disperses planktonic bacteria back into the wound environment (*Figure 1*).

Biofilms represent a significant challenge to healthcare professionals, as:

- They are not detected by wound swabbing
- They do not respond to antibiotics
- They are not eradicated by antimicrobial dressings.

How do we know if a biofilm is present?

Phillips et al (2010) suggested that the following criteria may indicate the presence of a biofilm (*Figure 2*).

- Excessive exudate
- Poor quality granulation
- Signs and symptoms of local infection
- Recurring infection following antibiotic cessation
- Negative wound culture\no healing despite optimal wound and host support
- Infection lasting more than 30 days
- Gelatinous material that is easily removed from wound surface.

Treatment of biofilms

Biofilms are not easily removed by standard cleansing techniques (Atiyeh et al, 2009). Phillips et al (2010) and Wounds UK (2017) suggest a 'clean and cover technique'. Here, rigorous disruption of the biofilm by debridement is recommended, which may be frequently required due to the rapid reformation of the biofilm. The methods of debridement will depend on the skill and knowledge of the healthcare professional, availability of resources and patient preference (Atkin, 2015; *Table 3*). Once the wound has been debrided, a suitable antimicrobial dressing, for example, one that irreversibly binds and removes bacteria from the wound, can be selected to reduce planktonic bacteria.

TREATMENT OF WOUND INFECTION

Topical antimicrobial dressings

There is often confusion regarding when to use antibiotics in wound infection. Antibiotics are usually recommended when clinical infection is clearly evident (IWII, 2016), as indicated in *Table 2*. However, in some patients who may have a reduced immune response, it may be necessary to consider treatment with antibiotics as well as topical antimicrobials.

The use of topical antimicrobials is considered key when treating patients with signs and symptoms of wound infection (EWMA, 2005; IWII 2016), and may be sufficient when treating a patient with local wound infection (*Table 2*). It is essential to record the rationale and clinical indicators for selecting an antimicrobial in the patient's healthcare documentation. A date for reassessment should also be evident to prevent over or inappropriate use of antimicrobial dressings.

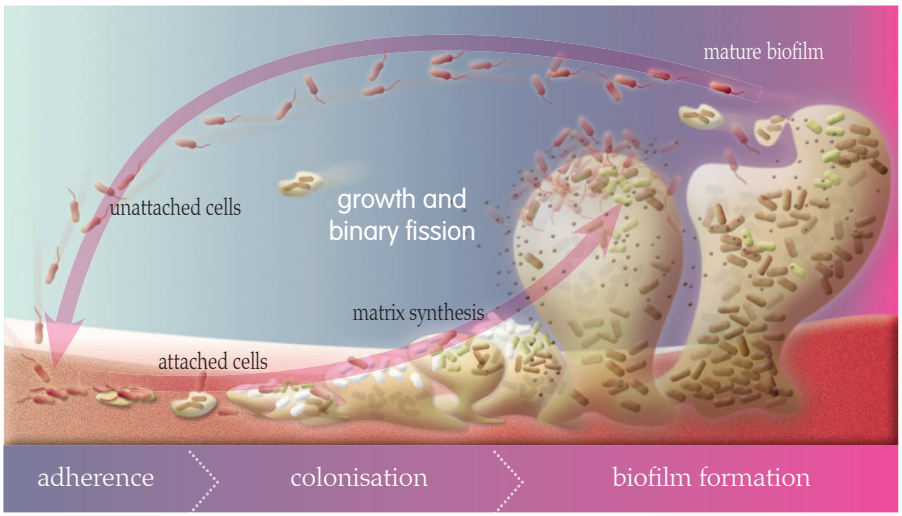

Figure 1. *Cycle of biofilms.*

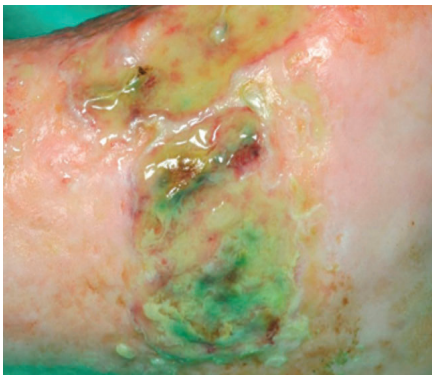

Figure 2. *Wound with possible biofilm presence.*

The antimicrobial property of a dressing may vary according to type of product and composition. Examples of antimicrobial compounds in wound dressings include iodine, silver, honey, polyhexamethylene biguanide (PHMB), octenidine dihydrochloride, and dialkylcarbmoylchloride (DACC) technology. Dressings coated with DACC, a hydrophobic substance, are able to bind and then remove microorganisms when the dressing is changed, and are a safe option for the management and prevention of wound infection (Totty et al, 2017).

Choice of antimicrobial product will depend on formulary availability, patient requirements and physical properties required from the dressing selected, e.g. its ability to handle exudate, odour, pain or debridement (Wounds UK, 2010). Healthcare professionals should be aware of the mode of action of the dressing selected and consider efficacy, hypersensitivities and contraindications.

Red Flag

Antimicrobials will not address systemic factors for delayed healing, such as poor diet, ischaemia, uncontrolled diabetes etc, which should be identified and addressed through holistic assessment.

Table 3: Types of debridement within the community setting

Types of debridement	Advantages and disadvantages
Sharp/surgical debridement	› Risk of bleeding › Requires very skilled healthcare professional › Painful for the patient
Mechanical debridement with monofilament pad or cloth	› Easy to use › May be painful for the patient › May depend on formulary availability
Larvae	› Requires training › Patients may not like this method › Can be expensive › Caution is needed if the patient is on warfarin
Use of cleansing surfactants, e.g. Prontosan® solution (B Braun), octenidine® (Schülke)	› Easy to use in practice › Will depend on formulary availability

CONCLUSION

Wound infection can pose a significant challenge to healthcare professionals. If treated inappropriately, it can lead to increased costs and poor patient outcomes. Using a structured systematic approach to wound assessment can help to ensure that wound infection is diagnosed and treated effectively within a timely manner. Alongside this, robust documentation will guide clinical decision-making to provide effective and efficient wound care. WCT

Top tip:

If topical antimicrobials are used, the wound should be reassessed after two weeks. If no improvement, reconsider antimicrobial as an alternative product or antibiotic therapy may be needed. If infection unresolving, consider referral to specialist service.

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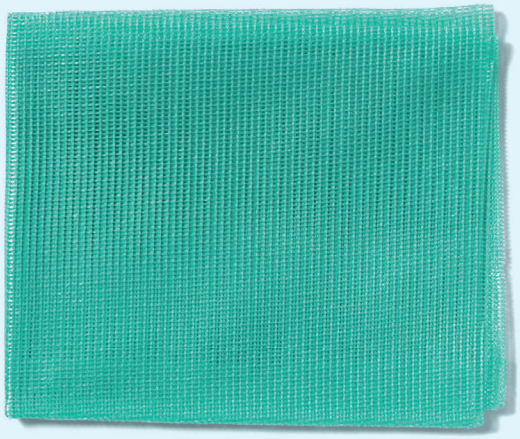
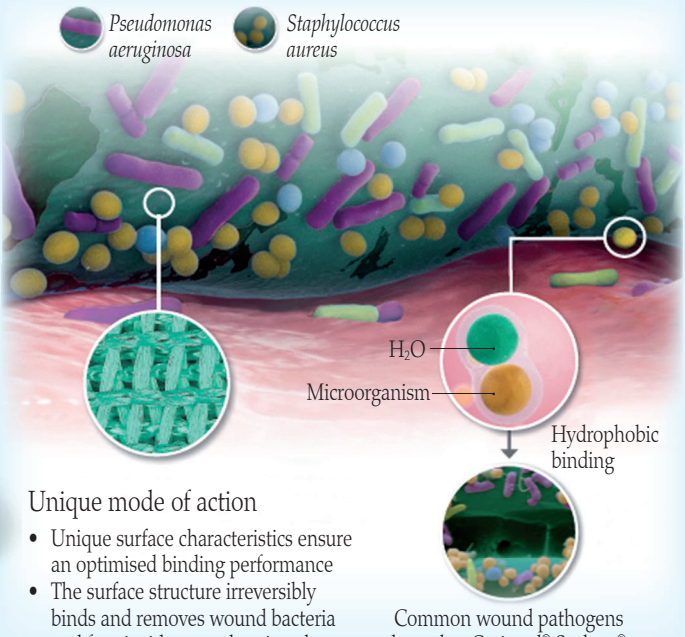


SORBACT TECHNOLOGY

These Sorbact Technology-coated antimicrobial dressings do not depend on antimicrobial or antiseptic agents to remove bacteria from an infected wound. As such, they do not have any of the side-effects or contraindications of other antimicrobial dressings which contain chemically active agents, such as silver.

How it works

Sorbact Technology binds and removes bacteria and fungi by a simple physical mode of action, known as hydrophobic interaction. This is due to the dressing being coated with a fatty acid derivative, dialkylcarbamoylchloride (DACC). This means that in the moist environment of an infected wound, bacteria and fungi, many of which have hydrophobic characteristics (Ljungh et al, 2006), are attracted to each other and irreversibly bind to the dressing's fibres and become inert.



Common wound pathogens bound to Cutimed® Sorbact®

Unique mode of action

- Unique surface characteristics ensure an optimised binding performance
- The surface structure irreversibly binds and removes wound bacteria and fungi with every dressing change

Then, at each dressing change, these organisms are removed without leaving any cell debris in the wound (Butcher, 2011), thereby reducing the bacterial load to the wound bed without the use of any chemical agents (Ljungh et al, 2006). Cutimed Sorbact has also been found to have positive results in the management of biofilms and multi-resistant organisms (Cooper and Jenkins, 2009).

BENEFITS OF CUTIMED SORBACT

- Modified surface characteristics enable the dressing to bind and remove microorganisms from the wound (Cutting and McGuire, 2015)
- No healing delays due to bacterial cell debris or endotoxin release (Cutting and McGuire, 2015)
- No known contraindications (Bateman, 2015)
- Low risk of allergy (Bateman, 2015), so safe to use on babies, pregnant women and breastfeeding mothers (Ljungh et al, 2006)
- No risk of bacterial or fungal resistance developing, as the dressings contain no cytotoxic substances
- Suitable for repeated use and prolonged treatments, as no chemicals are donated into the wound bed (Bateman, 2015).

HOW TO USE CUTIMED SORBACT

After thorough wound assessment, the most appropriate product from the Cutimed Sorbact range should be selected, considering wound type, size and volume of exudate being produced (Probst et al, 2012). Before applying Cutimed Sorbact (green side down), it is important to thoroughly cleanse the wound and surrounding skin to ensure that any ointments or creams are completely removed, as these can reduce the effect of the hydrophobic interaction (Powell, 2009). Also, to bind microorganisms effectively, the dressing must be applied so that it directly contacts the wound surface. A degree of moisture is required for the hydrophobic interaction to work, so, in dry wounds, a hydrogel should be used in combination with Cutimed Sorbact or Cutimed Sorbact Gel.

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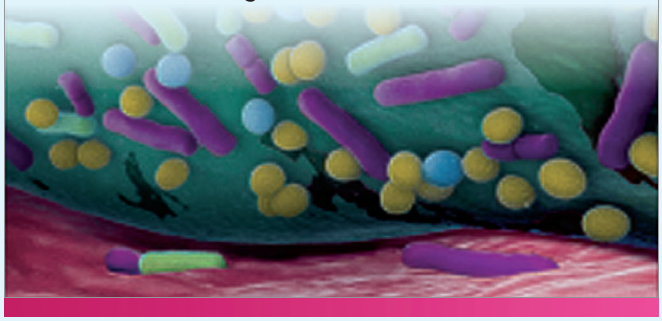
Snippet

Sorbact Technology gives Cutimed Sorbact its hydrophobic properties — the more virulent the wound, the more hydrophobic the dressing becomes. By employing the natural binding characteristics of bacteria, Cutimed Sorbact offers an innovative alternative to traditional methods of controlling bacterial bioburden in wounds.



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IN BRIEF

- Maintaining a moist wound healing environment is a key component of wound management.
- Wound exudate is produced as part of the normal healing process, however, in chronic wounds, its components change and can result in further damage to the wound and surrounding skin.
- Wound exudate volume, colour, consistency and odour should be evaluated and documented as part of holistic wound assessment.
- Excess exudate management should focus on addressing any underlying conditions that may be contributing to excess production, and local wound and skin management.

KEY WORDS:

- Wound exudate
- Wound bed preparation
- Chronic wound exudate
- Assessment
- Moisture balance

Moisture balance: why it matters and how to achieve it

Sarah Pankhurst, Alison Parnham

Achieving moisture balance is essential for the maintenance of skin integrity and wound healing. During wound assessment, it is crucial that the volume, colour, consistency and odour of exudate are recorded and findings used to guide treatment decisions (Dowsett and Newton, 2005). Understanding the role and appearance of exudate in the normal healing process is important to identify when the wound is showing signs of problems caused by moisture imbalance. This article will explore the impact of both acute and chronic wound exudate on wound healing and consider how exudate can be assessed accurately to aid decision-making in clinical practice.

Sarah Pankhurst, head of tissue viability; Alison Parnham, clinical nurse specialist and lecturer practitioner tissue viability, both at Nottingham CityCare

ROLE OF EXUDATE IN WOUND HEALING

Normal wound exudate

When wounding occurs, exudate is produced. Within the first few days of acute injury, the production of exudate has two functions:

- To physically clean the wound bed by promoting the proliferation of white blood cells and enzymes (Myers, 2012), which clear the wound of microorganisms, tissue debris and foreign bodies introduced on wounding
- To support wound healing by transporting growth factors, oxygen and nutrients to the wound bed.

Generally, as healing progresses, and the need for these functions reduces, the volume of exudate produced decreases (World Union of Wound Healing Societies [WUWHS], 2007).

Chronic wound exudate

For some patients, including those with comorbidities, wound chronicity may occur; wound healing is delayed and the components of normal wound exudate shift so that it becomes a potential wounding agent to both the wound bed and surrounding skin (Wounds UK, 2013).

Chronic wound exudate contains elevated amounts of tissue-degrading enzymes as a result of abnormally high quantities of white blood cells and a low volume of growth factors, in addition to senescent, under-active, non-communicative cells, thereby creating a barrier to wound healing (Schultz et al, 2003). Chronic wound exudate is often associated with the presence of non-viable

Remember:

Not all exudate is bad. A certain amount of wound fluid is necessary (Tickle, 2016), as it is full of substances needed for healing, such as water, electrolytes, growth factors, nutrients, protein-digesting enzymes (matrix metalloproteinases [MMPs]), inflammatory mediators and white blood cells.

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Table 1: Exudate assessment (adapted with permission from Cutting, 2004)

Underlying cause	Type	Volume	Description		Interpretation
Acute injury to superficial or partial-thickness wounds	Serous	Low–moderate	Clear, thin, watery, amber-coloured exudate		Inflammatory exudate normal within the first five days of acute injury
Acute injury with presence of bacteria or superficial non-viable tissue	Fibrinous	Low-high	Creamy, cloudy, thin exudate with the presence of fibrin protein strands		Inflammation or local infection
Acute injury, post operatively or trauma on dressing removal	Serosanguinous	Low–moderate	Clear, watery, thin, pink-coloured exudate		Inflammatory exudate with mild capillary damage
Acute injury, post operatively or trauma on dressing removal	Sanguinous	Low–moderate	Watery, thin, red-coloured exudate		Trauma to blood vessels
Chronic wound with non-viable tissue present	Seropurulent	Moderate–high	Yellow/grey/green, thick exudate		Local or possibly spreading infection. Liquefaction of necrotic sloughy tissue
Acute wound dehiscence or chronic wound with non-viable tissue	Purulent	Moderate–high	Yellow/grey/green, thick exudate		Indicative of bacterial infection, e.g. *Pseudomonas aeruginosa*
Acute wound dehiscence or chronic wound with non-viable tissue	Haemopurulent	Moderate–high	Viscous, thick, sticky red/brown exudate		Confirmed spreading infection
Acute deep wound trauma or chronic wound with extensive non-viable tissue	Haemorrhagic	High	Thick, dark red exudate		Vessel damage from trauma or chronic wound infection. Capillaries are friable and spontaneously bleed

tissue, a large volume of bacteria in the wound and malodour (Wounds UK, 2013).

NEGATIVE IMPACT OF WOUND EXUDATE

The presence of wound exudate can be the most distressing aspect of having a wound for an individual and their carers. The impact of copious exudate and odour on the individual's quality of life in many cases is intolerable, and empirical evidence demonstrates heightened anxiety, depression, embarrassment and social isolation in patients with wet, malodorous wounds (Franks et al, 2003; Eagle, 2009; Meaume et al, 2017). Tissue damage resulting from exposure to exudate, such as maceration and excoriation (see *practice point boxes*) causes pain, discomfort and delayed healing (Whitehead et al, 2017).

In addition to the negative impact on patient quality of life, exudate can result in significant expense as a result of attempts to mask odours and contain the fluid. Protective sheets and towels, replacement bedding, footwear or clothing and increased washing may be necessary where exudate is uncontrolled, which is time-consuming and distressing for patients and carers. And, indeed, can be challenging for those patients who are physically less able (Tickle, 2016).

LOCAL WOUND ASSESSMENT

Moisture is required by the wound throughout the wound healing process. It promotes the natural autolysis of devitalised tissue in the destructive phase of healing and enhances epithelialisation in the latter stages (Dowsett and Newton, 2005). However, there is a subtle balance between the wound bed being too wet or too dry; a dry wound will have reduced cell proliferation, while a wet wound will have non-viable macerated cells preventing epithelialisation from the wound edge (Myers, 2012). Both sets of conditions will result in delayed healing which increases the risk of local and systemic infection.

While acute wound exudate is a normal response within the inflammatory stage of healing, chronic wound exudate is either a symptom of a local problem with the wound, such as critical colonisation, biofilm formation or infection, and/or results from an underlying condition such as venous disease, oedema, hypoalbuminaemia or organ failure.

Establishing why the wound is producing copious exudate is a prerequisite to establishing effective treatment goals for the individual. Consequently, as part of holistic wound assessment, the volume, colour, consistency and odour of exudate should be evaluated and recorded, along with its effects, if any, on the skin surrounding the wound (WUWHS, 2007)(*Table 1*).

Top tip:

Exudate is a good indicator of the state of a wound. Changes in colour, amount, viscosity or smell can be a trigger to reassess the wound.

Exudate volume

It is important to remember that exudate volume will vary depending on the wound type, size and underlying tissue damage; for example, a sinus wound may have a small aperture but produce a large volume of exudate (Timmons and Cooper, 2008).

The amount of exudate produced by a wound is partly influenced by its size; large wounds will produce more exudate. Similarly, certain wound types are thought to produce copious exudate, e.g. burns, venous leg ulcers, and skin donor sites. However, these are often large wounds so would be expected to produce higher volumes of fluid (Thomas et al, 1996).

Conversely, a systemic condition such as dehydration may result in less exudate being produced than expected for the wound type (WUWHS, 2007), which could cause the wound bed to dry out.

Table 2: Assessment and management of wound exudate

Visual indicator	Clinical description	Underlying cause	Practical considerations
	Chronic sloughy wound bed with maceration to the wound edge and surrounding skin High exudate volume	Moisture imbalance not addressed effectively Underlying oedema may be the cause of increasing exudate volume	› Assess and manage underlying oedema › Cleanse surrounding skin › Debride devitalised tissue in the wound bed › Irrigate wound bed › Apply a dressing product to absorb exudate which does not wick laterally/ consider if the dressing should be cut to the shape of the wound › Apply a barrier to wound edge
	Sloughy wet wound in the skin fold with maceration and excoriation High exudate volume	Moisture imbalance not addressed effectively and compounded by urinary incontinence	› Cleanse surrounding skin › Irrigate wound bed › Debride devitalised tissue in the wound bed › Fill cavity gently to absorb exudate and deslough the wound bed › Treat surrounding excoriation › Protect surrounding skin with a topical barrier cream
	Periwound maceration and surrounding excoriation High exduate volume	Moisture imbalance not addressed effectively Underlying venous disease and varicose eczema	› Address the underlying venous disease › Cleanse surrounding skin › Irrigate wound bed › Remove excess skin scales and non-viable detaching macerated tissue › Cover with absorbent dressing › Consider compression therapy
	Non-healing wound with wet granulation tissue High exudate volume	Sinus wound with small aperture post surgical dehiscence	› Irrigate wound bed to flush to the base of sinus › Gently fill the sinus with a ribbon dressing to the base of the sinus, leaving a 2cm tab at the wound margin to ensure safe removal › Cover with superabsorbent dressing
	Macerated non-viable epidermis Moderate exudate volume	Moisture imbalance not addressed effectively Underlying venous disease and surrounding hyperkeratosis	› Address the underlying venous disease › Cleanse surrounding skin › Debride devitalised tissue in the wound bed › Irrigate wound bed › Gently abrade surface macerated tissue and surrounding skin scale › Apply a non-adherent antimicrobial to dry the wound bed › Consider compression therapy
	Sloughy wet wound bed with dried exudate (sero crusting) at the wound edge Moderate exudate volume	Moisture imbalance not addressed effectively	› Cleanse surrounding skin › Irrigate wound bed › Gently abrade sero crusts › Apply a dressing product to absorb exudate which does not wick laterally › Apply a barrier to wound edge › Cover with absorbent secondary dressing
	Dry wound bed post trauma and haematoma formation Low exudate volume	Dried haematoma will harbour bacteria and delay wound healing	› Cleanse surrounding skin › Irrigate wound bed › Apply a dressing product to donate moisture to rehydrate and aid debridement › Apply an emollient to moisturise surrounding skin › Cover with secondary face dressing

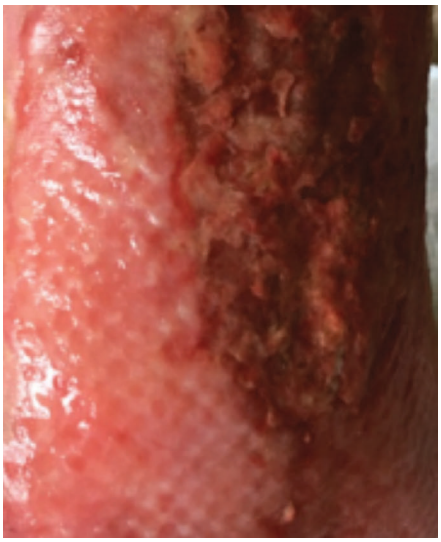

Figure 1. *Uncontrolled wound exudate causes periwound maceration.*

The volume of exudate produced should be recorded at each review, and although quantifying its volume is subjective, it should be documented accurately and consistently to make it meaningful to all clinicians who access the patient's notes.

Exudate colour

The colour of exudate can identify if the wound is progressing or deteriorating. *Table 1* highlights the different colours of exudate encountered in practice and what they reveal about the patient and their wound.

Exudate consistency

The consistency of exudate can also help to provide clues as to the presence of factors that might delay healing. For example, a thick, purulent exudate may indicate infection, while thin, watery exudate may be a sign of underlying venous or cardiac disease (WUWHS, 2007).

What is excoriation?

Excoriation describes damage caused to the skin by the proteolytic enzymes present in chronic wound fluid (Wolcott et al, 2008).

It presents as red, inflamed skin (erythema), with a loss of skin integrity.

Odour

Healthy exudate is clear, straw-coloured and odourless. If malodour is present, this could be because of:

- Infection
- The presence of necrotic tissue
- An enteric or urinary fistula (WUWHS, 2007).

Like exudate volume, the assessment of odour is subjective, so should be recorded according to local protocol.

LOCAL WOUND MANAGEMENT

To obtain moisture balance, the condition of the wound bed should be optimised, along with the medical management of any comorbidities that may be contributing to exudate production. Unfortunately for some patients, e.g. those with a malignant wound or arterial leg ulcer, there may be no treatment for the underlying cause of the wound so exudate management should focus on skin protection and the relief of symptoms such as pain and malodour (Vowden et al, 2015).

In clinical practice, exudate balance is mainly achieved by the judicious use of wound care dressings and the regularity with which they are changed in relation to the volume of exudate being produced to maintain a moist wound healing environment (Cook and Barker, 2012; Dowsett, 2012).

When a wound is producing a moderate to high volume of exudate, a wound dressing is needed that can absorb a large volume of fluid. In some circumstances, the dressing will need to retain fluid under pressure, such as when worn under compression or on a weight-bearing part of the body (Tickle, 2016).

If the wound requires frequent dressing changes to manage the exudate produced, a superabsorbent dressing may be needed. Superabsorbent dressings are designed to absorb a large volume of wound exudate and retain it within the dressing structure,

What is maceration?

Periwound maceration, which presents as white, soggy skin within 4cm of the wound edge (Dowsett and Allen, 2013) is caused by over hydration of the epidermis.

It occurs when dressings are left *in situ* for too long, or if they are unable to handle the volume of exudate being produced, resulting in prolonged contact of moisture with the skin.

thereby protecting the wound and surrounding skin from damage (WUWHS, 2007). This also helps to reduce dressing change frequency, which again not only protects the periwound skin by reducing the risk of skin stripping (Drewery, 2015), but also provides a cost-effective option as a result of reduced nursing time — an important consideration in today's health care.

In addition to its ability to absorb and retain exudate, the ideal dressing should also:

- Be comfortable to wear, without interfering with activities of daily living
- Be easy to apply and remove
- Reduce pain
- Reduce odour
- Be clinically and cost-effective
- Be available in a variety of sizes (WUWHS, 2007).

Patient preference should always be considered when choosing dressings, so that they can feel partners in their own care.

REASSESSMENT

It is important to continually reassess the wound, because as it heals, the characteristics of exudate will change (Dowsett, 2008). Accurate assessment and interpretation of wound progress (*Table 1*) are therefore crucial to the development of appropriate management strategies (Ousey and Cook, 2012).

Patients should also be advised to routinely assess periwound skin for signs of damage so that they can alert their healthcare professional if there is any breakdown in the skin's integrity. It may be appropriate to consider a barrier cream or film to protect the periwound area from further maceration, ensuring that there are no allergen-associated preservatives in the product.

In addition to treating the wound locally, the underlying cause, type and volume of exudate need to be investigated and recorded. Maceration and excoriation (see *boxes*) are recognised indicators of moisture-related damage associated with chronic wound exudate. Alternatively, periwound damage can be seen as a result of under hydration, resulting in serocrusting at the wound margin (*Table 2*).

CONCLUSION

The drive to sustain effective moisture balance is a fundamental aspect of wound management. Assessment of the colour, volume, consistency and odour of exudate is a key part of wound assessment, along with identifying any comorbidities which may be contributing to exudate problems. It is imperative that clinicians can recognise that a wound is failing-to-heal and remember that chronic wound exudate can signify wound stasis, prolonged inflammation or infection and cause harm to the surrounding skin. Appropriate choice of wound dressing will promote and sustain moisture balance at the wound surface, as long as there is accurate assessment, a competent plan of intervention and timely evaluation. WCT

Practice point

Encouraging patients to become involved in their own care can engage and empower them to help reduce any problems associated with excess exudate.

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Practice point

Look at the existing dressing to see how it is performing.

Leakage: is the dressing leaking? Is the patient having to modify the dressing to manage the exudate produced, e.g. by using plastic bags to contain the fluid? Is exudate leaking onto clothing?

Primary dressing: Look at the dressing in place. Is it staying in position? Is any fluid visible through the back of the dressing (strikethrough?) On removal, check the colour and consistency of exudate and if odour is present.

Secondary dressing/bandages: Is there any exudate strikethrough?

Dressing type: Is the dressing appropriate for the patient and wound? Is it conforming to the wound?

Frequency: How long has the dressing been in place? Has the frequency of dressing changes increased recently?

(From WUWHS, 2007)

Timmons J, Cooper P (2008) How to systematically assess a patient with a cavity wound. *Wounds UK* 4(2): 4–18

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Snapshot learning

Vliwasorb® Pro

This snapshot learning introduces Vliwasorb® Pro. Read the feature, then go online and complete the accompanying e-learning module to find out more about using this superabsorbent dressing in day-to-day clinical practice — the CPD points gained count towards revalidation.

(www.jcn.co.uk/learning-zone/units/lesson/47/40)

WHAT IS VLIWASORB® PRO?

Vliwasorb® Pro is a conformable, superabsorbent dressing for wounds producing a moderate-to-high volume of exudate. Its high absorbency and retention capacity enables it to protect wound edges from maceration (Wobler et al, 2017), while also promoting a moist wound healing environment.

The dressing has evolved from Flivasorb®, but with new, enhanced features at no extra cost:

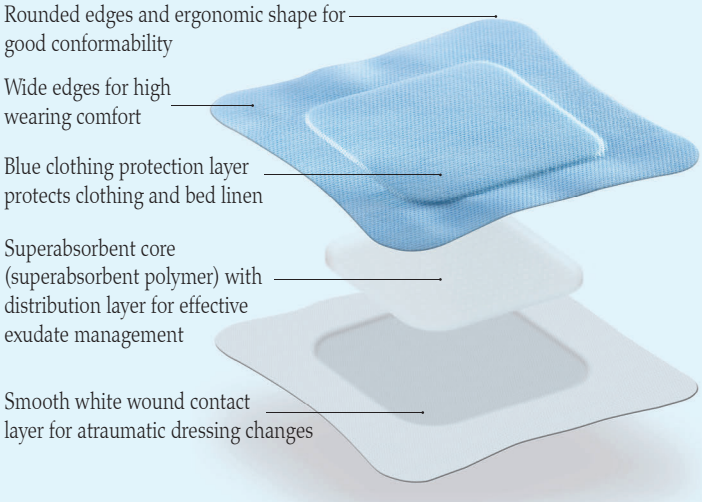
- Wider border and a more ergonomic shape, making it easy and safe to use even on difficult-to-treat areas of the body (Efstathios et al, 2017)
- New structure to the superabsorbent polymers (SAPs), making the wound pad (absorbent core) both softer and more absorbent, which in combination with the improved border/shape, not only increases conformability and comfort, but also enhances the dressing's fluid-handling capability (Bailey et al, 2017; Efstathios et al, 2017).

Vliwasorb Pro retains many of the existing features of Flivasorb, including (Verrall et al, 2010; Faucher et al, 2012):

- The same tried and tested product materials of Flivasorb
- Non-woven, breathable outer protection layer to prevent exudate from leaking through the dressing and causing discomfort, or infection risk
- Smooth, integrated wound contact layer, which is flexible and skin friendly, to ensure atraumatic dressing changes and removing the need to use an additional wound contact layer, which incurs increased dressing costs
- Distribution layer to ensure that exudate is evenly distributed throughout the dressing, maximising absorbency potential and maintaining comfort.

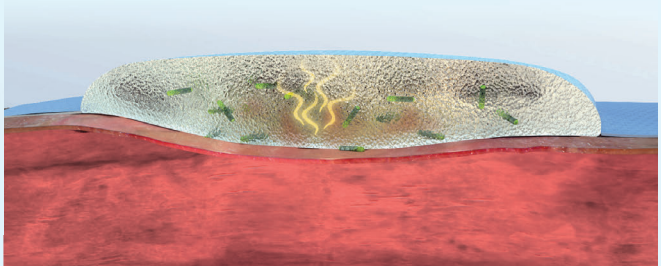
The dressing is suitable for use on wounds producing a moderate-to-high volume of exudate, such as:

- Chronic wounds, e.g. leg ulcers, pressure ulcers, diabetic ulcers and oncological wounds
- Acute wounds, e.g. partial-thickness burns, postoperative wounds healing by secondary intention, trauma wounds, skin graft donor sites.



HOW VLIWASORB PRO WORKS

When in contact with exudate, the superabsorbent polymer forms a gel which traps exudate, bacteria, toxins, fibrin slough and pro-inflammatory cytokines (Wiegand et al, 2017). This, in turn, helps to reduce microbial burden and odour and, by keeping these barriers to healing away from the skin, promotes a better environment for healing and prevents further wound deterioration.



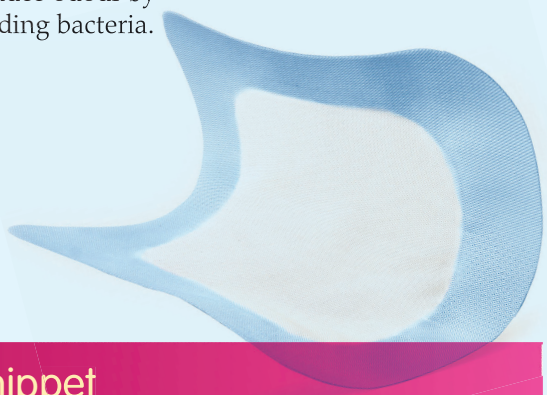
Following assessment of the wound, the most appropriate shape and size of Vliwasorb Pro should be chosen. It is also important that the dressing overlaps the wound by approximately 3cm, with the wound being completely covered by the superabsorbent wound pad. Compression systems can also be used with the dressing (e.g. Actico®). If compression is not indicated, a suitable retention bandage should be used.

Vliwasorb Pro should be changed when the absorbent capacity of the dressing has been reached, which is dependent upon the individual wound condition.

BENEFITS OF VLIWASORB PRO

- Ergonomic shape and flexible design promotes:
  - Comfort and flexibility for patients and carers
  - Ease of retention.
- Effective exudate management — high absorption and retention capacity helps to:
  - Protect the wound and surrounding skin from maceration
  - Promote a moist wound healing environment
  - Reduce frequency of dressing changes — this results in less disturbance to the wound bed allowing for healing progression, and saves both on nursing time and costs.
- Proactive cleansing effect with anti-inflammatory properties helps to
  - Reduce microbial burden
  - Reduce odour by binding bacteria.
- Outer blue protection layer and integrated wound contact layer respectively provide:
  - Protection from embarrassing leaks, and the infection risk which strikethrough presents
  - Atraumatic dressing changes for patients.

The combination of these benefits means that Vliwasorb Pro not only promotes an optimal wound healing environment, but also improves quality of life for patients with highly exuding wounds.



Snippet

Mismanagement of wound exudate can cause anxiety, depression, embarrassment, low self-esteem, negative body image and even social isolation (Upton and South, 2011). Thus, a dressing that helps to absorb and retain wound fluid both promotes wound healing and improves patient wellbeing.

Learn more about Vliwasorb Pro and gain CPD points with the JCN learning zone

Reinforce and reflect on what you know about Vliwasorb Pro by completing the JCN e-learning module and answering the 10 online multiple choice questions. If you get 70% correct, you can download a certificate as evidence of your continued learning.

All activities, including reading this feature, count towards CPD time and revalidation and can be recorded in your JCN revalidation e-portfolio (www.jcn.co.uk/revalidation).

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IN BRIEF

- Recognition, understanding and addressing factors that contribute to wound chronicity is integral to successful wound management.
- Early identification of delayed healing should prompt specialist assessment; therapies should focus on diagnosis and address identified barriers to healing.
- Wound healing is a complex multifactorial process; education of healthcare professionals enables correct and timely interventions.

KEY WORDS:

- Wound healing
- Wound assessment
- Objective setting
- Measuring progress

Edging quickly towards wound closure: optimising the 'E' of TIME

Jeanette Milne

In normal wound healing, granulation tissue forms at the base and edges of deeper wounds and/or from islands of epithelial tissue that originate from intact skin appendages (hair follicles and sweat glands) in superficial wounds (Shultz et al, 2003). Concurrent contraction minimises the size and depth of the defect, reducing wound volume and area. These processes result in the addition of tissue to the edges and base of the wound until it closes. In many chronic wounds (those with underlying pathophysiology, e.g. pressure ulcers, diabetic foot ulcers and leg ulcers), the process becomes disorganised, with new tissue that is deposited becoming chronically remodelled due to high levels of inflammatory mediators (World Union of Wound Healing Societies [WUWHS], 2016).

Jeanette Milne, lead nurse tissue viability, Northumbria Healthcare NHS Foundation Trust

'Examination of the edge of a wound and periwound tissue, although not a diagnostic test, can help to identify the wound's origin and cause.'

Chronic wounds have been found to have a high volume of inhibitory factors, which results in tissue that is fragile, prone to repeated injury, does not support epithelial migration and, in turn, leads to failed closure (Shultz et al, 2003). This can cause secondary complications, such as wound infection and/or biofilm formation (WUWHS, 2016). An open wound is a portal of entry for bacteria. An individual's ability to fight wound infection is closely linked to the body's immune response to the attack launched by the invading pathogens.

ASSESSING THE EDGE OF THE WOUND

Examination of the edge of a wound and periwound tissue, although not a diagnostic test, can help to identify the wound's origin and cause (*Table 1*). For example, venous leg ulcers are shallow and generally irregular in shape, whereas arterial ulcers are often well defined and occur over pressure points (Ashby et al, 2014). Rolled and/or raised wound margins or tissue in the wound bed should alert the clinician to the possibility of malignancy. If this is suspected, the clinician should refer the patient to a specialist service in order that a biopsy of the affected tissue can be taken and analysed. Once an accurate diagnosis is achieved, this may dictate treatment options.

Assessment of the edge of the wound also gives clues to other wound complications. For example, redness and swelling are indications of wound infection when present with other symptoms such as an unexplained increase in wound exudate, pain and odour. This should prompt the clinician to apply a topical antimicrobial dressing to rebalance the microbial load. However, if this is linked with systemic symptoms, e.g. feeling unwell, fever, or malaise, treatment with systemic antibiotics is appropriate (WUWHS, 2008). Some authors advocate that in addition to assessing the edge of the wound and the surrounding skin, patients with wounds should also be assessed for other skin conditions,

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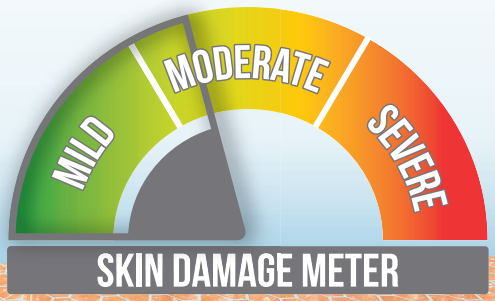

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Practice point

During healing, skin cells cover the wound surface — a process called epithelialisation. To facilitate and optimise this, wound edges should be intact and the wound bed moist and level with the surrounding skin.

such as eczema or psoriasis, and that these should be treated accordingly (Dowsett et al, 2015).

Accurate assessment of the wound perimeter not only provides indicators of the underlying aetiology of the wound, but also if the current management plan is effective with the wound progressing to healing in a timely manner. Factors affecting this complexity can be grouped as:

1. Patient factors
2. Wound factors
3. Healthcare professional skills and knowledge
4. Resources available.

Clinical assessment and documentation of the findings of any clinical observations associated with the edge of the wound is key to determining the cause and allows clinicians to promptly plan care that addresses the identified problem.

DELAYED HEALING

Given the correct set of circumstances, a wound should progress to healing in a timely and predictable fashion (Margolis et al, 2004). Any signs of delayed healing should be acted upon as soon as they are apparent to the caregiver. Healing rates are individual and vary between wound types and patient groups, and so factors that affect healing must be recognised and addressed to optimise outcomes, i.e:

- Removing callus
- Cleansing dried exudate from the periwound skin
- Debriding slough and devitalised tissue and cellular debris
- Removing any physical barrier to the progression of epithelial cells across the wound bed, such as adhered dressing materials, callus.

Wound size should be assessed at first presentation and weekly thereafter. The surface area and/or volume of the wound should be estimated. This is achieved by multiplying the longest diameter in one plane by the longest diameter in the plane at right angles (area) and the deepest dimension (volume). Although the simplest, it should be acknowledged that this is not the most precise method of wound measurement (WUWHS, 2016). Local policies and procedures should always be referred to, with team discussions agreeing on a consistent approach, i.e. the use of north to south/east to west, or clock faces, to ensure reproducibility. Patient positioning, body curvature, dried exudate, adhered dressing materials, or vast changes in dimensions of a circumferential wound as the limb narrows, can also affect the accuracy of techniques. However, comparison of weekly dimensions provides a quick Occam's razor to assess a wound's progress or deterioration. Stalled or deteriorated wounds warrant expert assessment and the consideration of advanced therapies.

The length of time a wound has been open is recognised in wound care as an indicator of chronicity (Gohel et al, 2005). In chronic wounds, some cells integral to the wound healing process become senescent in that they are unable to respond to cell-to-cell signalling and fail to replicate. Fibroblasts are one cell that is commonly affected by senescence; fibroblasts are essential to the deposition of the extra cellular matrix, collagen structure (granulation tissue) and wound contraction (Shultz et al, 2003; WUWHS, 2016).

If a wound fails to heal despite what is considered to be appropriate treatment, this could be an indication of cell senescence. However, as there is no simple bedside test for this, onward referral should be made to confirm the suspicion. Options for treatment in cases where the diagnosis is confirmed focus on the identified barriers to healing, these can often be referred to as addressing T.I.M. of the TIME concept (Schultz, 2003). If tissue non-viable (T) is the most dominant factor, debridement is key to reducing cell senescence. If infection (I) is the causative factor, this should be addressed. In turn, both these factors will have an impact on the moisture (M) levels in a wound, or it may be that compression therapy is needed to reduce venous hypertension which, subsequently, reduces exudate at the wound site as periwound oedema and fluid is moved back into the venous and lymphatic system.

Furthermore, in the author's clinical experience, the number of clinicians involved in the care of wounds, the plethora of products in use and the lack of definitive evidence in relation to the relative merits of one product over another, often lead to confusion, inappropriate choices and variation in practice, which, in turn, contribute to chronicity.

Other causes linked to failed healing are abnormal skin cells at the edges and base of the wound (malignancy), and the presence of autoimmune disorders, whereby the cells from the person's immune system attack and destroy skin cells. In some wounds, the edges are worn away or damaged. For example, in diabetic foot or pressure ulcers, the combination of pressure and shear

Practice point

By assessing the edges of the wound, healthcare professionals can gauge if wound contraction and epithelialisation are progressing and thereby confirm that the treatment regimen is proving effective, or if re-evaluation is needed (Leaper et al, 2012).

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Table 1: Clinical presentation

Clinical presentation	Description	Clinical impact	Treatment options
Maceration	Environmental damage from excess volume of exudate left on the periwound skin, as the enzymes break down the stratum corneum	Periwound extension Inflammation Skin susceptible to damage from trauma	Exudate management Treatment that addresses the underlying cause of the wound and thereby minimises the volume of exudate Compression Absorbent dressings
Excoriation	Environmental damage/loss of skin from abrasion	Inflammation Pain Skin susceptible to damage from trauma or skin stripping from exudate and adhesives	Skin protection with barrier products, adhesive removers/silicone adhesives
Papillomatosis	Skin surface elevation caused by hyperplasia and enlargement of the dermal papillae	Reduced hydration and inelasticity	Diagnosis of underlying condition Emollients to maintain elasticity and hydration
Hyperkeratosis	Thickening of the stratum corneum (outermost layer of skin) secondary to chronic inflammation	Excess development of the stratum corneum or delayed exfoliation Dryness Fissures	Diagnosis of the underlying condition Debridement cloths Emollients
Callus	Localised thickening of the epithelium because of pressure or friction	Increases pressure Can lead to sub-callous ulceration Prevents accurate assessment Prevents epithelial migration	Offloading Sharp debridement
Eczema/dermatitis	Irritation of the skin secondary to inflammation, caused by underlying pathology or application of allergens	Erythematous, small blisters, weeping and crusting Often itchy Can lead to scratching and hyperkeratosis	Diagnosis of the underlying cause Treatment targeted at underlying pathology Avoid common irritants Simple emollients to rehydrate the skin Topical corticosteroids

result in reduced perfusion, which damages surrounding tissues and prevents the creation and attachment of new skin cells (Dowsett and Newton, 2005; Leaper et al, 2012).

TREATMENT

To promote wound edge progression, clinicians must establish a differential diagnosis and offer treatment that addresses the underlying cause of the wound, for example, correcting venous hypertension with compression in patients with venous ulceration (O'Meara et al, 2012; Ashby et al, 2014), or offloading of the diabetic foot. Furthermore, it is essential that the chosen treatment addresses local wound symptoms identified in *Table 1*, as otherwise patients may struggle to concord with treatment (Price, 2013).

Remember:

Epithelial advancement is a clear indication that a wound is healing.

It is common for patients to be labelled as non-concordant when, in fact, it is the clinician's failure to address symptoms, i.e. successful diagnosis of the type of wound pain and its management, or breaking the itch–scratch cycle associated with periwound eczema.

Critical to success is concomitant treatment of underlying conditions that negatively impact on healing — often termed, optimising the host. Examples of this may be addressing nutritional deficiencies to achieve tight glycaemic control and/or managing underlying conditions, e.g. diabetes, heart failure, autoimmune disorders, that impact on the host immune system. In tandem, prevention of complications associated with wounds, such as infection, excoriation or maceration, is critical for patient concordance and achieving positive outcomes. Unfortunately, misdiagnosis or having treatment for a wound of unknown origin is not uncommon (Drew, 2007; Guest et al, 2015; 2017).

Damaged periwound skin is common in chronic wounds. It has been linked to delayed healing, pain and discomfort, and failure to address issues can lead to extension of the wound margins (Ousey and Cook, 2011). Thus, clinicians should protect the periwound skin, establish the correct cause and plan corrective care, for example, minimising contact with moisture or rehydrating dry tissue with emollients. Managing excess exudate is vital if clinicians want to reduce the risk of periwound skin damage (Dowsett et al, 2015). Excess moisture can affect the barrier function of the skin and is linked to continued skin breakdown, maceration and dermatitis. Chronic wound exudate is high in pro-inflammatory mediators, and it alone can be a wounding agent (Schultz et al, 2003; Leaper et al, 2012).

Addressing the 'T' (tissue non-viable) of TIME in relation to the use of debridement of devitalised skin, callus, necrosis and slough is also a key component of encouraging migration of the edge of the wound. Periwound callus and scabs, i.e. hard plaques of skin, can cause pressure when the patient is walking or beneath compression, and, as such, should be

removed to avoid extension of the wound margins. Removal must be carefully executed to avoid trauma to the wound edge and epithelial tissue.

In addition, cleansing periwound skin and applying barrier creams, sprays and emollients to maintain skin barrier function and hydration can prevent complications associated with maceration, as well as addressing eczematous changes and rehydrate hyperkeratosis.

Knowledge of wound healing and the range of and access to treatment has increased in the past two decades. As a result, it is now possible to predict healing trajectories (Margolis et al, 2004). Healthcare professionals' knowledge and skills influences their ability to:

- Assess the complexity of the wound
- Choose appropriate interventions and manage patient symptoms
- Prevent deterioration
- Alleviate any problems that arise (*Table 1*).

CONCLUSION

The impact of non-healing wounds has been studied in relation to its effect on patient health, wellbeing, and quality of life (International Consensus, 2012). The cost associated with non-healing wounds in relation to the health economy is also established. This paper has explored the importance of managing the edge of the wound to optimise healing. Vulnerable skin is susceptible to damage, and so preventing wound extension through judicious use of appropriate therapy is key to achieving healing and preventing/minimising complications. WCT

Red Flag

Healthy wound edges enable epidermal cells to migrate. However, this is not always the case, for example:

- There may be undermining of the wound edge where tissue becomes eroded and so it extends beneath the top layer of the skin, i.e. pockets develop. Probes will need to be used to determine the extent of the tissue damage. This particularly occurs in infected, chronic wounds (Dowsett and Newton, 2005)
- Unusual, raised wound edges may be a sign of malignancy and so should be referred for further investigation.

Top tip:

Epithelialisation, the final stage of wound healing, will only occur if the wound bed is prepared. Thus, healthcare professionals should always consider the T, I and M first for optimum outcomes (Dowsett and Newton, 2005).

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IN BRIEF

- Wound management can affect the surrounding skin and, conversely, the skin's condition can affect the wound healing process.
- The 'S' of TIME(S) represents 'Surrounding skin' to prompt healthcare professionals to assess its condition and address any issues.
- Structured assessment and regular reassessment can help to prevent skin breakdown.

KEY WORDS:

- Surrounding skin
- Assessment
- Management
- Debridement
- Self-care

Structured skin assessment: introducing the 'S' of TIMES

John Timmons

While it is important to establish the underlying cause of a wound, there is also a need to assess the surrounding skin, specifically in patients with lower limb conditions such as oedema or underlying venous or lymphatic complications (Tickle, 2016). A recent expert panel recognised this and added 'S' (surrounding skin) to the TIME framework to ensure that healthcare professionals do not overlook the condition of the periwound skin until damage has already occurred (Wounds UK, 2016).

The integrity of fragile skin around a wound can easily be impaired if conditions within the wound are not managed appropriately, e.g. excess exudate can cause maceration/excoriation, or repeated dressing changes, skin stripping (Brown, 2016). Other intrinsic and extrinsic factors can also affect skin integrity, and should be considered and documented during assessment and reassessment (*Table 1*).

John Timmons, head of clinical services, L&R Medical UK

STRUCTURED SKIN ASSESSMENT

Structured, systematic assessment involves careful observation of the skin to identify any conditions so that appropriate treatment can be put in place. In the presence of infection, the skin may appear red, hot to touch and the patient may be experiencing an increase in pain. Local oedema may also be present. Cold pale skin can be a sign of poor blood supply.

Common skin complaints that can occur and will worsen if not managed appropriately, include:

- Hyperkeratosis (*Figure 1*)
- Dermatitis
- Maceration/excoriation
- Cellulitis.

Hyperkeratosis

This occurs as a result of over-proliferation of keratin-producing cells over the surface of the skin, which results in increased thickening of the epidermis and dermis. To avoid further deterioration, the affected area should be washed regularly with soap substitutes and then exfoliated to remove the dead tissue (Whitaker, 2012). This can be safely and easily done with a monofilament debridement pad/cloth, which patients can also do themselves as part of their skin care regimen (Pidcock and Jones, 2013; *Figure 2*). Any stubborn plaques can be removed by softening with emollients and then gently removed with forceps (Wounds UK, 2015).

Figure 1. *Hyperkeratosis before treatment with Debrisoft® debridement pad.*

Figure 2. *After treatment with Debrisoft.*

Dermatitis

This is an itchy epidermal and dermal inflammatory reaction of the skin. While there can be many causes, the main reasons in patients with venous disease are:

Table 1: Risk factors affecting skin integrity

Intrinsic risk factors	Extrinsic risk factors
Disease, e.g. arterial, venous, lymphatic, diabetes	Pressure
Medication, e.g. steroids make the skin fragile, anticoagulants increase the risk of bruising	Shear
Dehydration and malnutrition	Friction
Age, i.e. with age, the skin becomes thinner and more friable and thus far more fragile and vulnerable to damage	Moisture, e.g. wounds producing copious exudate, lymphorrhoea
	Irritants, e.g. chemicals, adhesive products, dressings and creams

- Venous dermatitis
- Irritant contact dermatitis
- Allergic contact dermatitis.

Venous dermatitis

This is also known as venous eczema or venous stasis dermatitis, and often occurs secondary to oedema.

Irritant contact dermatitis

This can be a complication of venous eczema and can be caused by exposure to an irritant, which breaks down the skin's barrier function.

Allergic contact dermatitis

This results from an allergen sensitising the skin, and is most common in patients with venous disease and chronic leg ulcers.

It is important that any potential allergens, e.g. moisturisers, emollients and creams containing lanolin or parabens, are removed, and that the patient maintains their compression therapy. Depending on severity, a moderate-to-high potency steroid can be introduced, with the effect of treatment being recorded. Referral to a dermatologist might be needed for patch testing.

Maceration/excoriation

Maceration/excoriation can occur in chronic wounds when the dressing chosen is unable to cope with the volume of exudate being produced and so overflows onto the surrounding skin (Romanelli et al, 2010). Thus, products which can manage wound fluid while also maintaining a moist wound healing environment should be selected, remembering that the volume of exudate can change during the wound healing process, and hence the importance of regular reassessment (Brown, 2016). If dressings are having to be changed frequently, or removed incorrectly, or if harsh adhesives have been used, this can cause skin stripping (i.e. lifting off the outer layer of the epidermis).

Practice point

Opportunistic inspection of the skin can also be done during routine daily care, such as when helping patients to wash, dress or during repositioning.

Cellulitis

Cellulitis is an acute, painful infection of the skin and subcutaneous tissue, which is often misdiagnosed as venous eczema (Wingfield, 2012). Thus, it is important to establish a differential diagnosis to avoid unnecessary hospital admissions and antibiotic treatment.

SKIN CARE

To prevent and manage skin conditions, patients should have a good skin care regimen, i.e. encouraged to assess, cleanse and moisturise. Barrier products can also be used to protect the periwound skin.

Skin care in patients with hyperkeratosis involves careful cleansing, descaling the skin with a monofilament debridement pad and application of emollients before applying compression therapy.

CONCLUSION

Patients with lower limb conditions are susceptible to skin problems, which if not treated appropriately can result in 'leaky legs' and chronic venous leg ulceration (Tickle, 2016). Assessment and management should always address the surrounding skin, as overlooking this vulnerable area can lead to trauma and pain for the patient and cause further deterioration and extension of the wound (Mudge et al, 2008). WCT

Remember:

Remember, any break in the skin's integrity potentially acts as a portal of entry for bacteria.

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Snapshot learning

Self-care solutions for venous leg ulcers

This snapshot learning introduces L&R's hosiery kits and ReadyWrap™ for the management of venous leg ulcers. Read the feature, then go online and complete the accompanying e-learning modules to find out more about using these compression therapy options in day-to-day clinical practice — the CPD points gained count towards revalidation.

(www.jcn.co.uk/learning-zone/units/lesson/86/96
www.jcn.co.uk/learning-zone/units/lesson/98/106)

WHY IS SELF-CARE IMPORTANT?

Since the publication of the *Five Year Forward View* (NHS England, 2014), there has been increasing emphasis on encouraging patients to become experts in their own care. This enables people living with long-term conditions to manage their health effectively, having greater choice and control over the care they receive. Furthermore, engaged and informed patients are less likely to make demands on services, thus reducing costs to the NHS.

Venous disease, often leading to leg ulceration and chronic oedema, is a long-term condition, which can be challenging to manage, have a negative impact on patient wellbeing and quality of life and place a considerable economic burden on healthcare resources (Hopman et al, 2016; European Wound Management Association [EWMA], 2016). Compression therapy is key to the treatment and long-term management of this condition.

HOW CAN HOSIERY KITS AND VELCRO WRAP-AROUND COMPRESSION DEVICES HELP?

While four-layer compression bandaging (historically seen as 'gold standard' treatment) has to be applied by skilled clinicians, L&R's hosiery kits are quick and easy to apply, and patients and carers can be trained in how to put them on.

The range includes:

- Activa Leg Ulcer Hosiery Kit for patients **without** oedema
- ActiLymph® Hosiery Kit for patients **with** oedema, without limb shape distortion.

The kits provide a consistent compression level of ~40mmHg when the two layers are worn together, but without the bulk or discomfort of bandaging, meaning that patients can wear their normal shoes (Lazelle and Joyce, 2017). Showering is also easier than when using bandaging, helping patients to maintain their independence and personal hygiene (Tickle, 2014). Being comfortable and more cosmetically appealing also promotes concordance with treatment (Tickle, 2014; Lazelle and Joyce, 2017). The kits enable patients and carers to take a far more active role in their own care, as they are no longer dependent on nurses to apply bandaging, but can don and doff the garments themselves and carry out their own skin care regimens at home. This frees up time for skilled practitioners to focus on the management of more complex patients who require bandaging.

Indeed, A randomised controlled trial (Ashby et al, 2014) has proven that two-layer compression hosiery kits are as effective as four-layer bandaging for treating venous leg ulcers, but at lower costs, and are associated with lower recurrence rates. Thus, due to their effective symptom management, economic benefits and positive impact on patient quality of life, hosiery kits have been recommended as a first-line treatment option for patients with venous leg ulcers (Wounds UK, 2016).

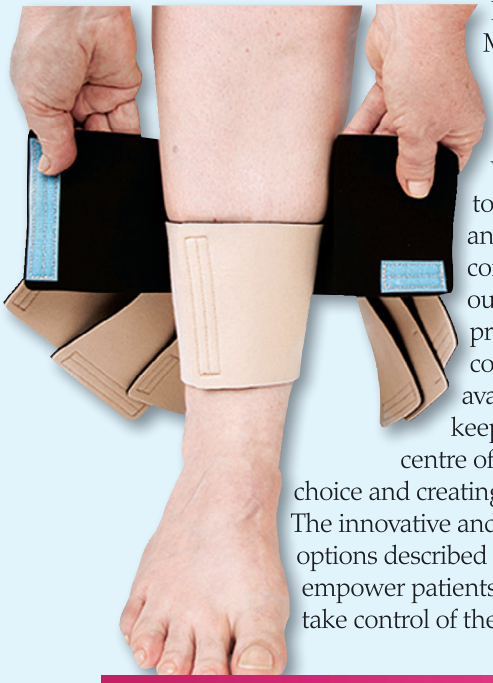
Snippet

Recent research has estimated that the annual cost of wound care and associated morbidities to the NHS is £5.3 billion, and that leg ulcers are the most commonly treated wound (Guest et al, 2015).

ReadyWrap™, an adjustable Velcro compression wrap device, is another quick and easy way for patients to apply therapeutic compression. ReadyWrap can be used for the treatment phase for oedema reduction or venous leg ulcer management where significant oedema is present, and in the maintenance phase to prevent recurrence of symptoms. It is ideal for carer-assisted and self-care application. Its benefits include:

- Colour-coded Velcro fastening system to help with easy application
- Breathable, soft material which encourages concordance
- 50% overlap straps for oedema containment and control, minimising risk of gapping and application error
- Sewn-in wide blocked spine to provide calf support at the back of the calf
- Black and beige colour options to aid patient choice
- Low profile design so that it can be worn under normal clothes and footwear
- Similar pressure profile to cohesive short-stretch bandage systems
- Potential cost-savings due to reduced nursing input.

The wrap system enables patients to take an active role in their own care, with the added advantage that as limb size reduces, patients can easily adjust the device so that they consistently receive the desired level of compression without having to wait for a nurse visit. This also helps to increase patients' awareness about their condition, encouraging them to take responsibility for treatment and prevention, which, in turn, promotes independence and quality of life (Kuijper-Kuip and Muldoon, 2017).



CONCLUSION

With the current drive to maximise resources and efficiency without compromising patient outcomes, healthcare professionals need to consider all options available, while also keeping patients at the centre of care by offering them choice and creating a working partnership. The innovative and safe compression options described here can help to empower patients by enabling them to take control of their care.

Remember...

Self-care improves self-esteem (Sneddon and Lewis, 2007).

Learn more about L&R's hosiery kits and ReadyWrap and gain CPD points with the JCN learning zone

Reinforce and reflect on what you know about these compression therapy options by completing the JCN e-learning module and answering the 10 online multiple choice questions. If you get 70% correct, you can download a certificate as evidence of your continued learning.

All activities, including reading this feature, count towards CPD time and revalidation and can be recorded in your JCN revalidation e-portfolio (www.jcn.co.uk/revalidation).

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IN BRIEF

- The acronym TIMES provides a structured approach to wound bed preparation.
- Systematic assessment helps to develop a care plan that is patient-centred and tailored to the patient's wound.
- Enabling patients to self-care can increase concordance with treatment.
- Ongoing assessment and treatment review is an essential component of care.

KEY WORDS:

- Holistic assessment
- TIMES
- Documentation
- Self-care
- Compression hosiery kits

TIMES in practice: the assessment and management of a patient with a VLU

Joy Tickle

TIMES is an acronym that can be used to guide the clinician through assessment of the wound bed and surrounding skin as part of overall holistic assessment of a patient presenting with a wound (Dowsett and Newton, 2005; Stephen-Haynes, 2007; Chamanga, 2017).

Findings from all components of holistic assessment should be documented and acted upon where necessary (Simon, 2015). This documentation also acts as a guide to the progress of the patient and their wound, and should be referred to at each review so that management choices can be amended if needed. Here, the use of TIMES as a framework for overall holistic assessment and management of a patient with a wound is presented.

Joy Tickle, tissue viability specialist, Shropshire Community Health NHS Trust

'... documentation also acts as a guide to the progress of the patient and their wound, and should be referred to at each review so that management choices can be amended if needed.'

HOLISTIC ASSESSMENT

As said, holistic assessment is necessary to determine how best to treat the patient. Assessment of the patient (Ian) discussed here focused on three areas:

- General assessment: This included:
  - Medical and family history
  - Lifestyle issues
  - Psychosocial issues.
- Leg assessment: This focused on vascular assessment to determine ankle branchial pressure index (ABPI), along with the shape and size of the limb, and the presence and extent of oedema. Ian's mobility was also reviewed.
- Wound and skin assessment: The type and cause of the wound was considered, and local assessment of the wound bed and surrounding skin was carried out using the principles of TIMES as a guide.

Meet the patient

This patient (Ian) was an ex-nurse, who presented to the leg ulcer team with a venous leg ulcer secondary to a deep vein thrombosis (DVT). Immediately after the DVT, for which he was admitted and treated, he experienced severe oedema and skin breakdown, which led to referral for leg ulcer management.

ASSESSMENT FINDINGS

General assessment

Ian is an ex-nurse who lives with his wife. He had previously developed ulceration on the left leg following a deep vein thrombosis (DVT) in January 2014. A subsequent DVT in the right leg led to immediate,

Remember:

Accurate assessment leads to accurate treatment, thus reducing appointment times and costs of treatment (Franks and Barker, 2016).


Ian's leg ulcer at presentation.

T The wound bed was covered with yellow slough, which provides an ideal environment for bacterial growth and thus should be debrided.

I The wound's appearance indicated that biofilm may be present, and be a possible cause for the deterioration/delayed healing of the wound.

M The wound was producing a large volume of exudate, putting Ian at increased risk of wound and skin breakdown.

E The edge of the wound was typical for a venous ulcer, being shallow and irregular in shape.

S Some hyperkeratotic plaques were present secondary to underlying oedema.

Figure 1. *Findings of wound and skin assessment using the principles of TIMES.*

severe oedema and skin breakdown. Following discharge from hospital, the ulcer was managed by the local general practice nurse using wound dressings and analgesia.

After three months the wound was deteriorating and the limb remained oedematous, so referral to the local leg ulcer specialist service was made and compression therapy started. The ulcer was producing a large volume of exudate and dressings were required so bandaging was selected.

Ian recalled being daunted at first, but eventually got used to the bandages, resigning himself to the fact that they were a 'necessary evil'. However, despite the use of compression bandaging, the wound continued to progress slowly, largely due to ongoing issues with infection. Suddenly, in January 2015 the wound deteriorated significantly (*Figure 1*).

Wound assessment

The findings of wound and skin assessment are presented in *Figure 1*.

Leg assessment

Ian's limb was oedematous, which would precipitate a change in his gait, ability to mobilise and reduce the effectiveness of the calf muscle pump, and Doppler ultrasound to determine his ankle brachial pressure index (ABPI) revealed a reading within the normal range of 0.8–1.3, making him eligible for full compression.

MANAGEMENT

DVT is an identified risk factor for the development of venous disease and, in Ian's case, this had happened. His failing venous system had resulted in skin breakdown, oedema and hyperkeratosis, all of which could be managed using compression therapy. However, despite the application of compression bandaging, the wound had deteriorated, indicating a possible problem with wound and skin infection. Referral was made to a dermatologist who prescribed a course of prophylactic antibiotics, which were to be taken over a four-month period. The wound began to improve and the oedema reduced, aided by the combination of bandaging and antibiotics.

By May 2015, Ian's ulcer had significantly improved and reduced in size (*Figure 2*). The oedema, exudate volume and pain had all reduced. He and his wife were planning a holiday, but he was concerned about how his compression bandaging could be reapplied safely and effectively while away.

A hosiery kit was recommended following discussion with Ian. According to Ashby et al (2014), compression hosiery kits can be used as a first-line approach for VLU management and may aid patient self-care.

As Ian's limb was oedematous, ActiLymph™ (L&R) hosiery kit was prescribed.

Ian reported feeling relieved when trying the kit on that he could


Figure 2. *Ian's ulcer improved following compression bandaging and antibiotics.*

go away on holiday without the risk of his leg deteriorating as a result of being unable to have his bandaging applied. On his return, he continued to wear the hosiery kit and one month later the ulcer had healed (*Figure 3*). He stated:

> *Being able to wear a hosiery kit rather than bandages made me feel so much more human; more normal and civilised. The kit also felt more comfortable than the compression bandages and I could again do things that I once took for granted, like showering and wearing normal shoes.*
>
> *As well as healing the ulcer, I feel that wearing the hosiery kit has helped me to understand the rationale behind wearing compression hosiery and, in some way, has given me a greater confidence in what hosiery can achieve.*

PREVENTION OF RECURRENCE

Ian continued to wear a hosiery kit on each leg to prevent DVT and ulcer breakdown. The use of hosiery kits both for first-line and maintenance therapy has been found to improve concordance (Ashby et al, 2014), as they are more comfortable than bandaging, more cosmetically appealing and encourage self-care — all of which lead to greater patient empowerment (Tickle, 2015).

Self-care has been found to reduce recurrence rates (Guest et al, 2015) and, as well as compression therapy, patients should be encouraged to maintain a good skin care regimen, to mobilise as much as possible (Harding et al, 2015), and eat a healthy diet (Wounds UK, 2016).

Figure 3. *Ian's healed venous leg ulcer.*

CONCLUSIONS

By carrying out holistic assessment, the reasons for delayed wound healing and subsequent wound deterioration were identified and a treatment plan put in place that managed underlying causes, including venous disease and infection. Local wound management focused upon resolving problems identified during wound assessment. General assessment and speaking to the patient identified his reluctance to undergo compression bandaging, but that he was able to tolerate it in the short-term. Once some of the symptoms of his infection and underlying venous disease had resolved, the wound progressed towards healing, which enabled a decision to be taken with Ian to use a compression hosiery kit. This was conducive to self care, aiding patient concordance with compression therapy. WCT

The case presented in this paper was originally published in the Journal of Community Nursing — *Hutchinson K (2015) What is the patient experience of healing in a hosiery kit?* J Community Nurs *29(5): 64–5*

Self-care...

The promotion of self-care for patients with venous leg ulcers can have a number of benefits, including:

- Greater involvement in treatment decisions
- Improved understanding of disease process
- Empowering: 'I can help myself'
- Improved outlook and improved outcomes
- Reduced dependence
- Less time spent travelling to clinics
- Less travelling for district and community nurses.

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IN BRIEF

- Vascular assessment should be the final aspect of holistic review to eliminate any arterial involvement.
- Taking ankle brachial pressure index (ABPI) readings is essential for planning treatments to rule out arterial involvement
- It is important to perform ABPI measurements on an ongoing basis so that any worsening in the patient's arterial status can be identified and acted upon.

KEY WORDS:

- Ankle brachial pressure index (ABPI)
- CQUIN targets
- Holistic wound assessment
- Reassessment
- MESI ABPI MD

ABPI: simplifying an essential component of holistic wound assessment

Natalie Freeman

Community nurses spend a great deal of time caring for patients with leg ulceration in their day-to-day duties (Adderley and Thompson, 2015). Chamanga et al (2014) reported that this is a significant burden on community nurse caseloads and resources. A recent paper by Guest et al (2015) evaluated the prevalence of patients living with a wound in the UK and the cost of managing these wounds to the NHS. The study highlighted that wounds pose a huge financial burden on the NHS, and that 33% of patients had a leg ulcer. This amounted to 730,000 individuals, with 19% of these wounds being unspecified with no differential diagnosis.

Indeed, Guest et al (2015) also identified that 84% of patients with a wound to the foot or leg have no recorded ankle brachial pressure index (ABPI). Thus, it is important to address this lack of assessment and identify fast, simple and accurate ways to measure ABPI. While there is a lack of knowledge as to why the number of patients with wounds to the lower limbs do not receive an ABPI measurement on initial assessment, a study of community nurses' experiences of treating leg ulcers concluded that this was due to insufficient time to complete assessments (Chamanga et al, 2014). Furthermore, practitioner variables linked to competency have also been discussed as affecting accurate ABPI (Worboys, 2006).

Following Guest et al's findings (2015), NHS England included, 'Improving the assessment of wounds' as a specified key goal of the Commissioning for Quality and Innovation (CQUIN) framework scheme for 2017–2019 (NHS England, 2016). This CQUIN aims to improve care delivery and healing rates by introducing performance targets and new standards, which place greater emphasis on wound care. This includes a strong focus on thorough, holistic assessment to ensure effective and appropriate care planning in leg ulcer management (Fox, 2003), involving:

- Ulcer history, including previous treatments and experience
- Wound assessment
- Medical history
- Current medication
- Known allergies and sensitivities
- Nutritional status
- Physical, psychological and social risk factors
- Presence of pain
- Mobility level (Harding et al, 2015).

MEASURING ABPI

To establish the underlying aetiology of a leg ulcer, alongside the above elements of wound assessment, a full visual examination of the limb should be completed and ABPI measured (Beldon, 2010). While ABPI will not diagnose a venous ulcer (Wounds UK, 2016), it will identify or exclude peripheral arterial disease (PAD) and is therefore an essential part of wound assessment. An ABPI of less than 0.8 indicates PAD, highlighting the need for specialist vascular review. If the ABPI is within the expected range, this indicates an absence of any significant arterial disease and the patient will often be treated as having a venous ulcer, i.e. with graduated compression therapy, as identified in the Scottish Intercollegiate Guidelines Network clinical guidelines (SIGN, 2010).

Compression therapy for venous ulceration should provide 40mmHg at the ankle to achieve healing and prevent recurrence, which can be delivered via hosiery, bandages or adjustable wrap devices. Where ABPI

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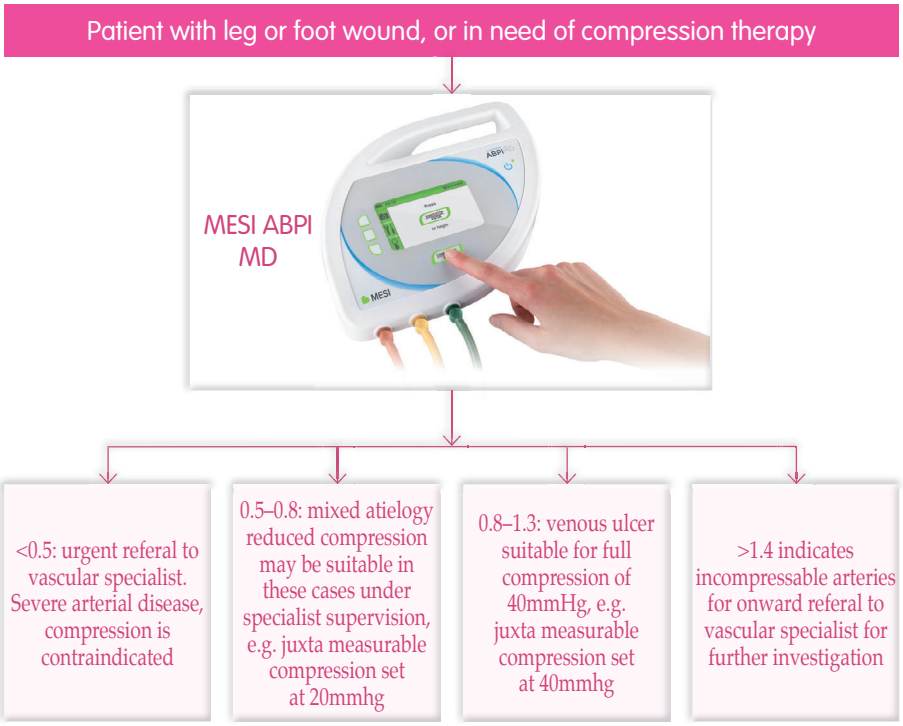

Figure 1. *ABPI results and appropriate treatment.*

is less than 0.8 but greater than 0.5, reduced or modified compression can be applied with specialist supervision or guidance (*Figure 1*).

Leg ulcer assessment should be ongoing until a wound has healed, including regular measuring of a patient's ABPI. Furthermore, after healing has occurred and the patient has been fitted with maintenance compression garments to prevent recurrence, ABPI recordings should continue to be taken at regular intervals. The Royal College of Nursing (RCN, 2006) guidelines suggest three monthly reviews, including ABPI. A recent Best Practice Statement (Wounds UK, 2016) suggested that patients should be reassessed at three, six or 12 monthly intervals, depending on patient needs, initial assessment outcome and cardiovascular risk factors, or in line with local guidance. This will confirm that there are no alterations in arterial status and that patients remain suitable for compression therapy. Any deterioration identified should be referred to specialist services as soon as possible.

A simple way of measuring ABPI with no need for resting the patient beforehand, as required with traditional Doppler devices, is using the MESI ABPI MD (available from medi UK; *Figure 1*). A simple start button is pressed after placing cuffs, which simultaneously inflate and deflate to give an accurate ABPI reading, along with blood pressure (BP)/pulse and waveforms within one minute. The device is also portable and powered with a lightweight battery, making it a safe and useful tool for any community nurse's armamentarium. WCT

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Table 1: ABPI indicators for compression therapy

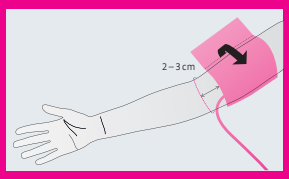
ABPI > 1.0–1.3	No indicators of peripheral vascular disease	*Apply high levels of compression therapy*
ABPI = 0.81–1.0	Mild peripheral disease	*May have high levels of compression therapy — monitor ABPI*
ABPI = 0.51–0.8	Significant arterial disease	*May have reduced compression — refer to specialist nurse/vascular specialist*
ABPI = < 0.5	Severe arterial disease	*No compression — urgent referral to vascular specialist*
ABPI > 1.3	Measure toe pressures or refer to specialist	*May have compression therapy — liaise with specialist nurse/vascular specialist*

Young patients may have high ABPI not indicative of PAD (8) | *(Adapted from Harding et al, 2015)*

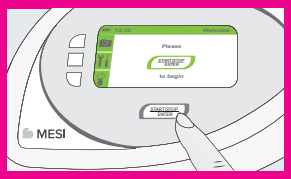
MESI ABPI MD

ABPI reading within 1 minute!

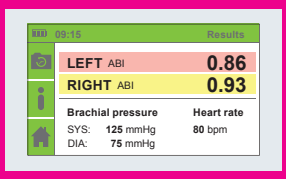
Helps you with your assessment and allows you to compress with confidence.



Step 1
Place cuffs on arm and legs



Step 2
Press START button to run measurement



Step 3
See the results

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Snapshot learning

MESI ABPI MD

This snapshot learning introduces MESI ABPI MD, an automated ankle brachial pressure index (ABPI) measuring device for quick and objective diagnosis of lower limb peripheral arterial disease (PAD). Read the feature and find out more about using this new screening tool in day-to-day clinical practice — then reflect on what you have learnt for your individual CPD time.

WHY MEASURE ANKLE BRACHIAL PRESSURE INDEX?

Calculating ankle brachial pressure index (ABPI), i.e. comparing ankle and brachial systolic blood pressure, is a key component of comprehensive, holistic wound assessment, particularly for venous leg ulceration (VLU). While it is not a diagnostic test, results are vital to determine the absence or presence and extent of lower limb peripheral arterial disease (PAD), which is crucial when deciding on treatment options, i.e. if compression therapy can be introduced and, if so, at what level. Traditionally, this test has been carried out with the use of a handheld Doppler device by a skilled clinician (Beldon, 2010).

Recent research has highlighted that ABPI assessment is an area which healthcare professionals need to address and improve (Guest et al, 2015). Indeed, guidelines recommend that the test should be performed not only at initial assessment, but on an ongoing basis to ensure that there has been no deterioration in a patient's arterial status (National Institute for Health and Care Excellence [NICE], 2013; Wounds UK, 2016).

WHAT IS MESI ABPI MD?

MESI ABPI MD (available from medi UK) is a new, portable, automated screening tool for effectively and easily measuring a patient's ABPI. The device not only takes accurate ABPI measurements, but also provides the patient's blood pressure and heart rate in one reading. Its colour-coded cuffs simplify use, as the different colours indicate where each should be placed, i.e.:

- Red on the upper arm
- Green on the right ankle
- Yellow on the left ankle.

These conical-shaped cuffs fit well to ensure accuracy and are available in medium and large sizes. As the cuffs inflate simultaneously, there is no delay between separate measurements being taken, thereby supporting accurate ABPI readings.

The device is lightweight and battery powered, so can be used out in the community — 30–50 readings can be taken from a fully charged battery.

The device also comes with a MESIresults application, which means that healthcare professionals can connect it to a computer for an electronic copy or print-out of the ABPI result. This also allows for patient information (name, address, etc) to be included on measurement reports.

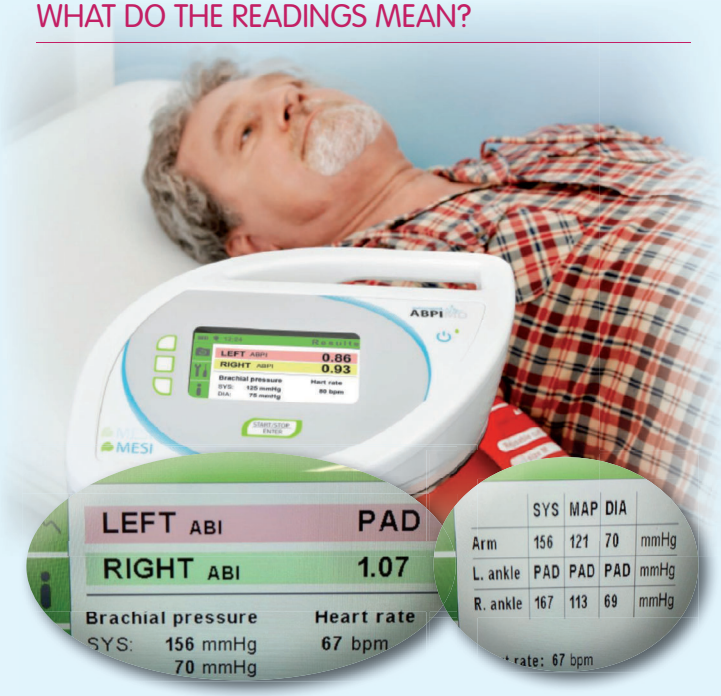
How to use in three simple steps

One: Ensure that the patient is lying down comfortably and then place the colour-coded red, yellow and green cuffs correctly on the patient (each cuff is clearly labelled and has a diagram to ensure correct placement)

Two: Just press the start button

Three: Read the results in one minute.

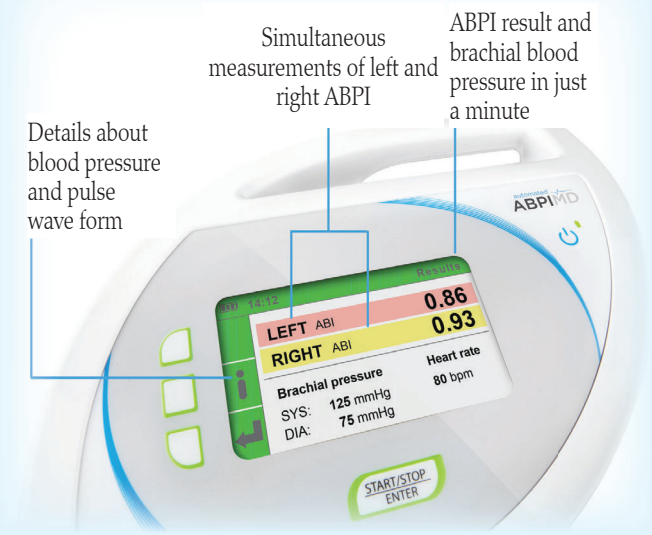
WHAT DO THE READINGS MEAN?



ABPI	INDICATION
>1.3 or non-occluding arteries	Arterial disease, walls of arteries hardening or oedema present
1.0–1.3	Normal arterial blood flow
0.8–1.0	Arterial blood flow adequate for high compression
<0.8–0.5	A level of arterial disease for which compression therapy should not be used
0.5 or <0.5	Severe ischaemia, compression should not be used

ABPI screening reference scale

1.41 or more	1.40–1.00	0.99–0.91	0.90–0.51	0.50 or less
non-compressible	normal	borderline	abnormal	severe



BENEFITS OF MESI ABPI MD

- ABPI and blood pressure recorded at the same time
- Pulse wave forms also recorded to aid ABPI interpretation
- Can measure blood pressure in the ankles
- Smart software prevents false results even in cases of critical ischaemia
- Easy to use (three simple steps), thus reducing risk of human error, and minimal training is needed
- Accurate and objective results seen in one minute
- No risk of misinterpretation
- Report print-out
- Lightweight with long-lasting battery to ensure maximum portability
- Error detection system alerts the user to any irregularities which may occur during the measuring process, i.e. if the cuffs have not been applied properly, or the patient has moved during the measurement. By pressing the 'return' key, a message will appear describing the problem.

CONCLUSION

Venous leg ulcers have been found to account for up to 1% of health budgets in the West (Pascarella and Shortell, 2015) — indeed, one in 170 adults in the UK are indicated to have a VLU (Guest et al, 2015) and prevalence increases with age (Simon, 2015). An ageing population and the demands that wound care place on healthcare professionals' time necessitates the need for fast, accurate and safe screening tools so that they can competently and confidently assess arterial status as part of comprehensive holistic wound assessment. This, in turn, will lead to appropriate treatment choices and better patient outcomes.

The characteristics of this new device meet these requirements, while also addressing the three areas of quality where the Commissioning for Quality and Innovation (CQUIN) framework (NHS England, 2016) want innovation to be seen, namely:

- Safety
- Effectiveness
- Patient experience.

Remember...

No risk of misinterpreting results due to the screen displaying the ABPI reading, or simply stating 'PAD' in red.

Snippet

MESI ABPI MD:

- Improves wound assessment so healthcare professionals can offer compression therapy with confidence
- Does not require patient to rest before testing
- Records accurate ABPI, blood pressure and heart rate in just one simple reading.

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