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Wound Essentials

Providing wound care knowledge for the everyday clinician

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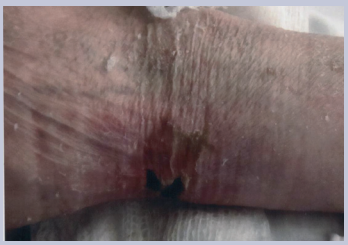

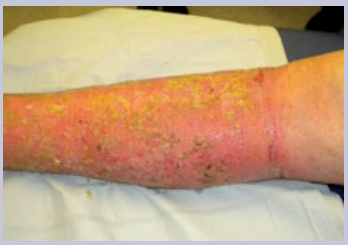

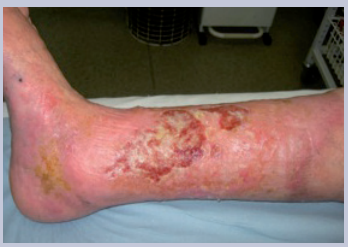

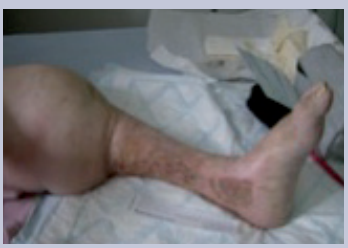

ACUTE WOUNDS

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Are you a safe practitioner?

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I'm sure there isn't a nurse or healthcare assistant (HCA) in the UK who isn't aware of the situation that arose at Mid Staffordshire NHS Foundation Trust. An enquiry was prompted by an escalation in the number of deaths, however, the resultant report and key recommendation by Robert Francis QC will have a far-reaching effect on all caregiving staff – both registered general nurses (RGN) and HCAs, in the NHS and private sector.

The overriding theme of the Francis Report (www.midstaffspublicinquiry.com/report) is that patients must always be the priority and they should receive care from staff who are compassionate and committed to ensuring the patient is protected from avoidable harm. Standards of care must be obvious and staff who do not comply with the new care framework, should this result in harm befalling a patient, could be prosecuted.

It is clear, therefore, that staff will need to familiarise themselves with specific aspects of care, the most fundamental of which is the protection of the vulnerable individual against pressure damage. Indeed, NHS Trusts are required to document all serious pressure damage, category III or IV pressure ulcers (European Pressure Ulcer Advisory Panel, 2009).

Every nurse signs a contract with their employer that compels them to adhere to a set of policies and procedures. Failure to do so would find the nurse in breach of contract under employment law and can lead to dismissal.

Therefore, it is important that all RGNs and HCAs undertake appropriate training to ensure their knowledge is up to date, and that they are competent not only in pressure ulcer risk assessment, but to instigate care to protect the patient, evaluating that care. Nothing less is acceptable to either the public or employer.

There have been recent calls for more robust regulation of RGNs, which is entirely appropriate, as well as calls to regulate HCAs, which will undoubtedly happen and not before time. It is unacceptable to only have part of the caregiving workforce of any organisation, NHS or private, regulated and compelled to work to a standard of care.

These changes to the way care is viewed and administered beg the following questions: "Is your knowledge up to date?" "When did you last attend training in pressure ulcer prevention?" "Are you competent in risk assessment and able to select appropriate pressure-relieving equipment and other tools to ensure you protect your patient?" With these questions in mind, now is the time to act. You should approach your team leader, whether ward manager, nursing home manager, or community team leader, and make your request for training. Inaction could lead to an individual in your care coming to harm and, in the worst case scenario, a loss of your livelihood.

Therefore, you must look for resources to enhance and update your practice; *Wound Essentials* is just one. There are numerous study days held by the Tissue Viability Society, local Trusts, and *Wounds UK*. In essence, take every step available and necessary to ensure you are a knowledgeable and competent practitioner! WE

Reference

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If you would like to contribute to a future issue of *Wound Essentials*, please contact: Adam Bushby, Deputy Managing Editor, at adam.bushby@woundsgroup.com

Understanding wound swab results

Wound swabbing is a simple procedure and is frequently undertaken in a variety of healthcare settings, including the hospital and in the community. That said, there is currently no national guidance on how to collect a wound swab. This article stresses the importance of standardising the procedure so clinicians are comfortable with the protocol, thus achieving reliable results.

All wounds contain micro-organisms, but only once infection is suspected should further investigation occur. Inappropriate investigation is not only a waste of valuable resources, but can also produce confusing and misleading microbiological results which, in turn, may lead to the administration of unwarranted antibiotic treatment and contribute to the growing problem of antibiotic-resistant micro-organisms.

Therefore, it is essential that healthcare staff have a good understanding of wound infection, what to do when wound infection is suspected, and how to interpret microbiology results to ensure the most appropriate wound management strategy is used.

Understanding normal wound healing

The microbial bioburden (the number of micro-organisms present) in a wound can range from contamination, colonisation, critical colonisation, and infection.

These definitions indicate that wound infection is much more than the mere presence of micro-organisms in a wound site; diagnosing wound infection also involves assessing the patient and their wound for clinical signs and symptoms (Vowden and Cooper, 2006).

These signs and symptoms include:

- Pain.
- Erythema.
- Oedema.
- Heat.
- Purulent discharge.
- Serous discharge with inflammation.
- Delayed healing.
- Discolouration of granulation tissue.
- Friable granulation tissue (tissue that easily tears or bleeds).
- Pocketing in the wound bed.
- Malodour.
- Wound breakdown.

However, these should not be confused with the signs of normal wound healing, when the damaged skin or tissue repairs itself.

Normal wound healing comprises four stages. The inflammatory phase (Dealey, 2005) sees bacteria and any debris that is present in the wound phagocytosed (the process of surrounding and "eating up" bacteria that is present in the wound site; Tortora and Grabowski, 2003). During this stage, there is increased blood flow to the wound site, due to widening of the blood vessels (known as vasodilation), which is needed to aid healing (Johnstone et al, 2007).

As a result of these normal physiological processes, the patient

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will experience redness, swelling, and localised heat sensations around their wound site during the early stages of the healing process. In addition, the patient will also experience pain due to damaged nerve endings, chemical reactions and/or pressure from a build-up of fluid (Dealey, 2005).

Pain

The degree of pain will vary from one patient to another, depending on individual pain thresholds, but it normally subsides as the wound heals. Therefore, if these signs are observed or the patient raises concern about their wound at this point, it is important to explain to the patient that these signs are normal during the early stages of wound healing and do not indicate wound infection.

When a wound is infected, the patient may feel generally unwell, complain of increased pain around the wound site, and experience increased discharge which, in some cases, may have malodour, potentially causing the patient distress. Monitoring the patient closely is important, including accurate assessment of their pain levels. Pain can be objectively monitored and assessed using a pain scale, for example a numerical scale ranging from 1–10, in line with local guidelines.

Factors influencing wound infection

Wound infection is influenced by a number of factors, such as the wound's shape, size, and location, the presence of contaminating foreign bodies or haematoma (blood clot), number and type of micro-organisms, and also the susceptibility of the individual patient to infection (White et al 2001; Scanlon 2005). The greater the vulnerability of the patient, the greater the risk of wound infection arising. Wound healing may be adversely influenced by age (older skin takes longer to heal), and chronic illness, such as renal failure and diabetes, as these are associated with reduced immune response, impaired blood flow, and poor diet (Hess, 2005). In contrast, the likelihood of wound infection arising in a healthy individual is less likely as they are better able to mount an adequate immune response.

Investigating wound infection

When wound infection is suspected (i.e. the patient has increased pain or delayed wound healing), the causative micro-organisms should be confirmed, along with possible antibiotic sensitivities, so the most appropriate treatment regimen can be initiated. Wound investigation can be undertaken in a variety of ways, but there are no national guidelines or consensus currently in place (Kingsley and Jones, 2008).

Tissue biopsy can be undertaken to establish both the type and number of micro-organisms present in a wound. It has been suggested that 100 000 micro-organisms per gram of tissue may be a predicator of wound infection (Healy and Freedman, 2006). However, it should be remembered that some wounds containing high numbers of microorganisms will still heal without any adverse effect and, conversely, some wounds containing few micro-organisms will still cause infection (i.e., Group A *Streptococci*, which is known to be pathogenic [disease producing]) even in small numbers.

Despite these limitations, tissue biopsy is regarded as one of the most valuable wound investigations as it provides information about micro-organisms present in the wound bed, although from a practical point of view, biopsies cannot be carried out readily as part of everyday clinical practice.

In contrast, wound swabbing is a simple procedure, which is frequently undertaken in a variety of healthcare settings. Wound swabbing can provide information about the type of micro-organism(s) present, as well as limited information about the number of micro-organisms present, often reported as scanty, moderate, or heavy growth, although this may vary depending on the reporting systems used by different microbiology laboratories.

Wound swabbing involves running a sterile, cotton-tipped microbiological swab over the patient's wound site. In the absence of national guidance, it is important for all healthcare providers to have a written protocol, to ensure clinicians collect wound swabs in a standardised way. By standardising the procedure, staff variability is reduced and the results are more accurate.

See below for a suggested protocol:

- Explain the procedure and its purpose to the patient. Request verbal consent.
- Gather the appropriate equipment (i.e. sterile, microbiological wound swab, cleansing agent if required, wound dressing pack, and trolley) to create a clean/sterile field.
- Place equipment at the bedside ready for use.
- Pull the curtains around the bed-space/close the door to the single room, as appropriate, to ensure patient privacy and dignity.
- Decontaminate hands, using liquid soap and running water or alcohol hand rub/gel, prior to clinical contact with the patient (Pratt et al, 2007).
- Position the patient comfortably, ensuring the wound area is accessible.
- Remove equipment from outer packaging and place on top of dressing trolley, taking care not to cross-contaminate.
- Remove the outer bandaging/dressing, if applicable.
- Decontaminate hands, using liquid soap and running water or alcohol hand rub/gel.
- Put on disposable gloves and plastic apron (an apron may not be necessary if the wound is small and easily accessible, e.g. on the patient's hand).
- Cleanse the wound if required (i.e. wounds should be cleansed if there

is heavy exudate, debris, or any other foreign matter present in the wound site, using sterile normal saline or tap water, depending on the type of wound).

- Remove the swab from outer packaging.
- Pre-moisten the swab with sterile water/sodium chloride solution to increase the "pick-up" rate by helping the micro-organisms to adhere to the swab (Sibbald, 2003).
- Gently rotate the swab in a zig-zag motion over the wound, covering the whole wound from the centre outwards (Patten, 2010). For large wounds, swab the area of the wound that appears infected, rather than tissue that appears dry and healthy (Wilson, 2006).
- Remove the top from the culture tube and place the swab inside.
- Re-dress the wound, in line with the patient's care plan.
- Remove disposable gloves and apron.
- Discard used items, in line with local waste disposal guidelines and policies.
- Decontaminate hands using liquid soap and running water or alcohol hand rub/gel after clinical contact with the patient and their surroundings, in line with the World Health Organization's *Five Moments for Hand Hygiene* (National Patient Safety Agency, 2008; *Figure 1*).
- Label the swab correctly and complete a microbiology request form (this may be a paper or electronic version depending on local systems). Ensure patient identifiers are completed, such as name and date of birth, and indicate the location of the patient, (i.e. name of ward and hospital). Indicate the date and time of swab collection, location of the wound, reason for collecting the swab (i.e. clinical signs and symptoms), whether the patient is on antibiotic therapy, and the investigation required, namely, microbiology culture and sensitivity.

As with other types of wound investigation, wound swabs should not be collected routinely as they have limited value in the absence of clinical signs and symptoms of wound infection. Although, it may be necessary to carry out routine wound swabbing when screening for the presence of drug-resistant micro-organisms, such as methicillin-resistant *Staphylococcus aureus* (MRSA) and in this scenario, swabbing should be undertaken in line with local guidelines.

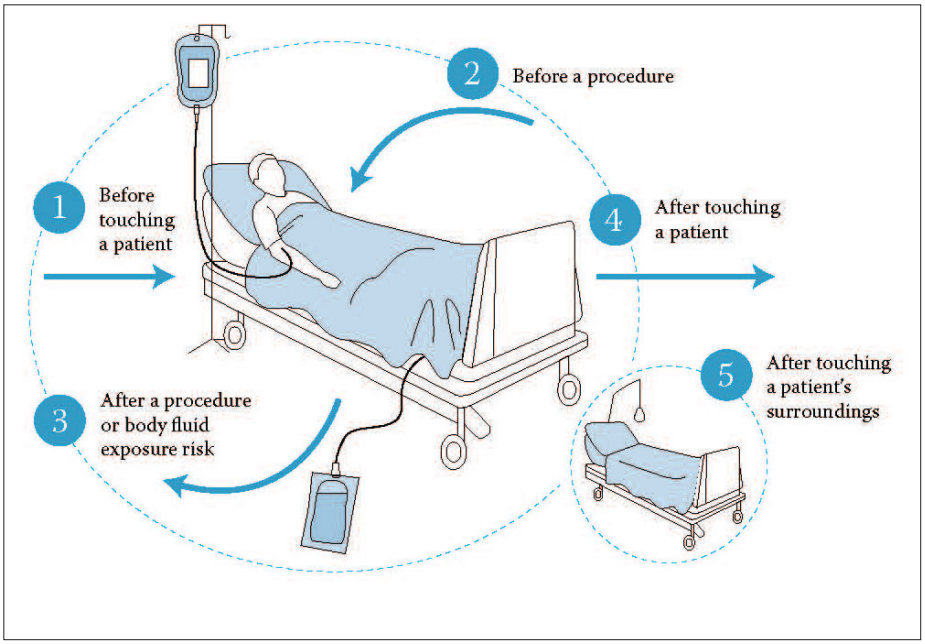

Figure 1. ***The World Health Organization's* Five Moments for Hand Hygiene *(adapted from National Patient Safety Agency, 2008).***

C-reactive protein

Medical staff may also carry out blood sampling, to identify whether the patient has other signs of systemic infection (i.e. a raised white blood cell count – white blood cells are released by the body as part of the normal inflammatory response, commonly in response to the presence of infection). In addition, blood sampling will also identify the level of serum C-reactive protein (CRP). CRP is not normally present in blood serum, however, during inflammatory conditions and when wound infection is present, CRP levels will be raised. However, CRP sampling is a non-specific marker of inflammation and does not identify where the inflammation is located or what is causing it (Kinglsey and Jones, 2008).

Therefore, CRP levels can only be used to aid wound infection diagnosis, along with other wound investigation, coupled with clinical assessment of the patient and their wound for clinical signs and symptoms.

Interpreting microbiology results

Accurate interpretation of microbiology results is important for appropriate patient management.

Wound swab results may be positive (i.e. MRSA or other pathogenic micro-organisms may be grown and identified in the microbiology laboratory), however, in the absence of clinical signs and symptoms, this result should be regarded as colonisation, rather than infection.

Therefore, it is essential that where a positive microbiology result is obtained, healthcare staff assess the patient for clinical signs and symptoms of wound infection, rather than assuming the positive result indicates wound infection, and must not routinely ask medical staff to

prescribe antibiotics. In the absence of clinical signs and symptoms of wound infection, antibiotic treatment is inappropriate and may increase the risk of patients developing other antibiotic-associated infections, such as *Clostridium difficile* (a mild to severe diarrhoeal infection), as well as contributing further to the problem of antibiotic-resistant micro-organisms.

However, when pathogenic micro-organisms are identified, staff should remain vigilant, as these organisms have the ability to cause disease, and colonisation/critical colonisation may act as precursors to wound infection. Therefore, clinicians should monitor the patient carefully for the onset of clinical signs and symptoms of wound infection (although it is important to consider that not all patients will display overt signs and symptoms, for example, patients with immunosuppression (poor immune response), such as those on long-term steroid therapy.

Conversely, wound swabbing may report "no growth", however, such results by themselves do not prove that wound infection is absent. Patient assessment is required and in the presence of clinical signs and symptoms that suggest wound infection, a microbiology report of "no growth" should be interpreted as a false negative. False negatives may arise for a number of reasons, for example, a poor swabbing technique, whereby the surface exudate is swabbed, rather than the wound bed.

Micro-organisms may not survive the collection, storage, transportation, or processing of the samples (Kingsley, 2003), or micro-organisms may be present, but in small numbers and, therefore, not detectable in the microbiology laboratory.

Conclusion

Healthcare staff must have an understanding of the normal wound healing process, so that the signs of normal wound healing are not confused with wound infection. When wound infection is suspected, it is crucial to assess the patient and their wound for clinical signs and symptoms, alongside giving careful consideration of wound swab results, in order to accurately determine the presence or absence of infection. We

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Wound cleansing: Clean or sterile solutions?

Wound cleansing is a key element of delivering good wound care, and can be undertaken in a variety of ways depending on the nature of the wound and the clinical setting. Here, the author examines the different at the clinician's disposal for cleaning varying types of wound.

Wound cleansing has been variously defined as "the use of fluids to remove loosely adherent debris and necrotic tissue from the wound surface (Fernandez et al, 2007)" and "the application for fluid to aid the removal of exudates, debris, slough and contaminants" (Platt, 2005). Beside the need to cleanse wounds to remove debris and prevent infection, wounds are also cleansed to obtain a better look at the wound bed to determine how the wound should be managed (Paone, 2009).

The first step when selecting a fluid to clean a wound is to decide if the wound needs to be cleaned at all. Newly formed, simple surgical wounds do not routinely need to be cleansed; the old dressing can be removed and replaced with a new sterile dressing. By contrast, new traumatic wounds need substantial cleansing.

Chronic wounds that contain debris, slough, and loose macerated skin need to be cleaned. Just as ulcers need good wound cleansing, the healthy skin surrounding the wound needs an effective skin care regimen. For these wounds, cleansing is an essential component of preparing the wound for healing. Good wound cleansing is as important as debriding a wound. Generally, this task should be performed with vigour to ensure that as much debris is removed as possible and a substantial amount of cleaning solution should be used. The clinician must be mindful of the patient's tolerance to pain when cleansing a wound, as this takes priority.

Once the need to cleanse the wound has been established, selecting the most appropriate wound cleanser is the next important decision to be made by the clinician. As an extension to this decision, the clinician must decide whether the cleansing solution needs to be sterile or not.

Tap water or sterile saline?

Sterile cleansing solutions must be used when cleansing newly formed surgical wounds once the need for cleansing has been established. Best practice dictates that these wounds have a waterproof sterile dressing applied in theatre and this should be left undisturbed for 5 days. The wound will rarely require cleansing before the sutures or clips are removed and the dressing should be left in place until this time.

Surgical wounds that dehisce should be cleansed with a sterile solution. Irrigation using a 10-ml syringe (with no needle) will provide enough force for the fluid to lift loose debris from the wound without damaging the wound

"Once the need to cleanse a wound has been established, selecting the most appropriate wound cleanser is the next important decision to be made."

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bed. This technique is appropriate to use in areas where the clinician's gloved hand cannot reach, such as sinuses and cavities, and when the patient is in pain if the wound is touched, however gently.

If the patient's pain is well controlled and the wound can be fully visualised and is accessible, it is best to clean wounds more vigorously, using a sterile gloved hand with sterile gauze, moistened with sterile fluid. A good analogy is cleaning dishes: simply putting dirty plates underneath the tap will not clean the plate, but the hand movement with the dish cloth or the brush will get the dishes clean. Sterile solutions should always be used in the immunosuppressed patient.

Sterile technique

The sterile (aseptic) technique involves practices that promote maximum reduction in microbes, such as washing hands, using sterile fields, sterile gloves, sterile tools, and sterile saline. Touching any non-sterile surface or product is to be avoided (Ferreira and de Andrade, 2008). In this technique, sterile solutions for cleaning wounds are used, such as sterile water or sterile saline.

Sterile saline

0.9% saline comes in sachets or pods, is sterile and expensive (Drug Tariff price: £5.63). Therefore, establishing when this product should be used is important from a financial perspective.

If the wound requiring cleansing is a newly formed surgical wound, 0.9% saline (also known as normal saline) should be used. This solution is isotonic, meaning that it neither donates fluid nor draws it away, so cells do not burst when in contact with saline. 0.9% saline does not impede normal healing, damage tissue, cause allergy or alter the normal bacterial flora of the skin (Gannon, 2007).

Sterile water

Sterile water should be used if saline is contraindicated by the manufacturer's instructions for specific certain dressings. For example, when using Acticoat® (Smith & Nephew), sterile water should be used to activate the dressing, not saline.

Clean technique

The water used to clean chronic wounds is usually tap water and is not sterile. This is called clean wound cleansing or clean wound technique. This technique involves the use of procedure gloves while cleansing with tap water. Once the wound is clean, sterile dressings and/or tools are used where necessary to dress the wound. The water used must be clean enough to drink: the maxim being that if it is good enough to drink, it is good enough to be used on a wound.

If wounds are exposed regularly to water for extended periods, they maybe detrimentally impacted by osmosis. Osmosis is a process by which molecules of a solvent (i.e. the water) pass through a semipermeable membrane (the cell wall) from a less concentrated solution into a more concentrated one. This process can burst the cell; as cells rupture, more exudate is created, leading to more frequent dressing changes and possible maceration of the periwound. Thus, the wound must not be immersed in water for an extended period of time.

Especially for patients with chronic wounds, washing is more complex than simply focusing on their wounds. Some patients will have lived with chronic wounds for a number of weeks, months, or even years and being able to shower or bathe can dramatically improve their quality of life. In practice, this translates to the fact that water can be used to clean chronic wounds, such as leg ulcers or pressure ulcers, by removing all dressings and allowing the patient to enjoy a shower or a bath. While it is not advisable for them to soak in a supermarket bubble bath, the use of emollients can be recommended. Advice on the use of appropriate soaps and emollients should be provided to this group of patients (Kirsner and Froelich, 1998; Dermatology UK, 2007).

With regards to surgical wounds, once they have healed (when clips or sutures are removed), the patient can shower and this is generally considered a milestone in the patient's recovery. A head wound, for example, is notoriously difficult to dress. Once the sutures are removed, washing the hair and the crust off becomes a real necessity for the patient's wellbeing and their self-esteem.

Other cleansing solutions

Prontosan

Prontosan® (B. Braun) wound irrigation solution is a relatively new wound cleansing solution that became available on the Drug Tariff at the end of 2006. It comes in 350 mL or 40 mL ampoules.

Using a washing-up analogy again, Prontosan is the washing-up liquid of wound care. It contains two key ingrediants; an antimicrobial and a surfactant. The surfactant dissolves oils present in wounds. Gauze soaked in Prontosan must be left on the wound for 10–15 minutes to kill bacteria and dissolve the debris in the wound (Horrocks, 2006). Prontosan should not be rinsed off, the wound can be dressed after treatment.

Anecdotally, Prontosan is fast becoming the sterile cleanser of choice in many Trusts. Prontosan is equal in price to 0.9% saline and some Trusts are using this product to clean all wounds.

Debrisoft

While Debrisoft® (Activa Healthcare) is not a cleansing solution, it is a helpful adjunct to the process of wound cleaning. Debrisoft is a soft fleecy pad, which is moistened and cleanses the wound of debris when gentle pressure, using circular motion is applied. Debrisoft can be moistened with Prontosan, saline, or tap water,

depending on the wound type and clinician preference.

Vinegar

Vinegar has historically been used to cleanse wounds when other solutions were not available. Vinegar acts by lowering the pH of the wound environment, making it less hospitible to microbes. A 0.25% to 0.5% solution of vinegar (e.g. 25 mL of vinegar in 5 L of tap water for a 0.05% solution) can be used to clean chronic wounds, such as leg ulcers, and can be used as a short-term treatment for superficial wound infection with *Pseudomonas aeruginosa,* which is typically characterised by lurid green exudate.

Diluted vinegar soaks for 15 minutes per day are reported to reduce wound malodour (Landis, 2008). Advice from a tissue viability specialist should be sought prior to commencing any treatment using vinegar.

Potassium permanganate

Potassium permanganate is an antiseptic with astringent (drying out) properties. The only evidence for its use is on weeping eczema (Morison, 1997). The treatment is usually commenced under the supervision of a dermatologist. Potassium permanganate should not be used long term (Anderson, 2003); usually not more than 3–5 days (Lawton, 2001). This is due to the fact that after 3–5 days, the weeping should have subsided.

The challenge when using this solution is correct dilution: the recommendation is that it should be diluted to a "pale pink" (Morison et al, 1997) and can cause burns if not properly diluted. However, what one clinician views as "pale pink" may differ from a colleague's point of view.

Potassium permanganate stains the skin, making it difficult to assess wounds as it dyes the wound bed brown. The solution can cause staining to clothes and soft furnishing and, anecdotally, some community teams have banned its use after incidents of spilling this product on patients' carpets were reported. Potassium permanganate has a place as a cleansing solution where weeping eczema has been firmly diagnosed and always under strict supervision from a wound specialist and for a limited number of days.

Pain

Chronic wounds can be painful and wound cleansing with any solutions may exacerbate the pain. Some patients may find all the above cleansing techniques painful, from a slight stinging sensation to unbearable pain. Wound cleansing is an essential part of good wound care, but patients should not be in excessive pain every time their dressing is changed and their wound cleansed. Clinicians should familiarise themselves with the World Union of Wound Healing Societies' (WUWHS, 2007) principles of best practice in pain relief and develop pain relief strategies tailored to the individual patient.

Conclusion

There are a number of solutions that can be used to cleanse wounds. Firstly, it is important to ascertain if cleansing is required. In newly formed surgical wounds this is usually not necessary. Sterile solutions should be used in acute wounds, while non-sterile wounds can be cleansed with non-sterile products, such as tap water.

Vinegar and potassium permanganate have been used for many decades, at times a little too vigorously, but under the strict supervision of a wound care specialist, these products still have a place.

Finally, pain management is essential to good wound cleansing. If pain is kept under control, the wound can be cleansed effectively and healing can occur in a more timely fashion. We

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A PATIENT-CENTRED APPROACH TO MANAGING INFECTED WOUNDS

Infection is a common complication faced by patients with wounds and a challenging problem to manage. The diagnosis of wound infection is made on the presenting signs and symptoms and treatment centres on topical and/or systemic antimicrobial therapy. This article considers the impact of pain, exudate, and malodour associated with wound infection on patients' wellbeing and some of the management strategies used to address these problems.

It is recognised that all wounds will be contaminated with micro-organisms (European Wound Management Association [EWMA], 2005). Despite this, many will go on to heal successfully. However, in some wounds, these micro-organisms will multiply and invade tissues causing damage, delayed healing, or even systemic illness, if not treated.

The risk of wound infection is influenced by the patient's immune status, the number of bacteria present, and the virulence of the bacteria (World Union of Wound Healing Societies [WUWHS], 2008). Frail patients who have comorbidities (such as diabetes or vascular disease), are malnourished or immunocompromised, are at greater risk of wound infection.

Identifying wound infection

The diagnosis of wound infection should be made based on the clinical presentation of the signs and symptoms of infection, not on the basis of a wound swab result (Patel, 2010). Increasing bacterial load is often shown as a continuum (*Table 1*) – from contamination to colonisation to critical colonisation and finally infection – and criteria have been developed to assist in identifying wound infection. Broadly, the traditional signs of wound infection are: pyrexia, localised erythema, oedema, pain, heat, increased exudate or pus, abscess. Additional, more subtle, criteria are: delayed healing, bridging of the epithelium or soft tissue, dark/discoloured granulation tissue (brick red, dull). friable tissue that bleeds easily, unexpected pain or tenderness, wound breakdown, pocketing at the base of the wound ,and malodour (Cutting and Harding, 1994).

Guidance on diagnosis, controlled use of antimicrobials, optimum length of treatment, mode of action, and risks of toxicity, have been published elsewhere (EWMA 2005; 2006; WUWHS 2008; Best Practice Statement, 2011) and will not be discussed in this article.

Problems caused by wound infection

An infected wound is of concern because of the risks of wound breakdown and systemic toxicity if not treated, and it can have a negative impact on a patient's wellbeing. Pain, exudate, and malodour are three key areas associated with wound infection that distress patients and will be focused on here.

"Frail patients who have comorbidities, are malnourished, or immunocompromised, are at greater risk of wound infections."

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Table 1. Wound infection spectrum (adapted from Vowden et al, 2011).

Term	Definition	Antimicrobial treatment
Contamination	Micro-organisms are present on the wound surface, but do not multiply and do not compromise healing	Not indicated
Colonisation	Micro-organisms multiply, but do not compromise wound healing	Not indicated unless there are concerns about a patient's immune function
Critical colonisation	Micro-organisms multiply and impair wound healing. Classic signs of infection may not be present, but more subtle signs, such as friable, bleeding tissue, dull granulation tissue, and stalled healing, may be present	Topical antimicrobials are indicated
Infection	Micro-organisms multiply and overcome host defences. Wound breaks down and classic signs of infection are present	Topical antimicrobials are indicated to control bacterial growth. Systemic antibiotics may also be required

Pain

Pain is commonly reported to be the worst problem experienced by patients with wounds (Hofman, 2006). There are many different causes of wound pain and, for this reason, a comprehensive patient assessment is needed to establish the underlying cause and inform appropriate treatment. For example, pain may be caused by arterial insufficiency to a lower limb, arthritis, sensitivity to a dressing product, or poorly managed exudate.

Wound infection will almost always cause some degree of pain and is often the first indication before other signs and symptoms become apparent (Gardner et al, 2001; Mudge and Orsted, 2010). For this reason, any new pain or change in the nature/intensity of the pain should be a warning sign that the wound may be infected. Caution is recommended with patients who have neuropathy, however, as pain may be absent even in the presence of established infection.

Micro-organisms within the wound trigger the release of inflammatory mediators that can induce pain through the stimulation of nociceptors (pain receptors) in the wound (Mudge and Orsted, 2010). Pain may also arise from the swelling that occurs as part of the inflammatory process, or from the release of harmful proteases, such as matrix metalloproteases.

Chronic wound exudate, which increases with infection, contains enzymes that are corrosive to healthy tissue and can cause a stinging or burning sensation when in contact with the skin.

Pain associated with wound infection would be expected to reduce once antimicrobial treatment is commenced, due to the bacterial load in the wound being reduced. Topical antimicrobial treatments available for managing local wound infection include iodine, honey, silver, and polyhexamethylene biguanide. However, it should be noted that some products – particularly iodine and honey – have been reported to cause pain on application, which may not be tolerable for the patient (Hofman, 2006).

It is important that the choice of antimicrobial dressing takes into account wound factors other than local infection, such as tissue type and exudate levels. A dressing with suitable autolytic debridement or absorbent properties should be selected if that is required. Local guidelines on the use of topical antimicrobials should be followed.

Slough and necrosis in a wound do not necessarily mean that the wound is infected, and antimicrobial dressings should not be used routinely when these are present. However, the presence of sloughy or necrotic tissue in a wound provides an effective growth medium for bacterial proliferation (White et al, 2006) and effective wound care practice should, therefore, included the removal of these debris. There are a variety of methods for achieving this (*Table 2*).

Fear and pain can be associated with debridement by some patients and care should be taken in selecting with the patient an effective, but tolerated, method.

Clinicians should be mindful that pain during dressing procedures can cause a great deal of anxiety and fear in the patient. A gentle, unhurried approach by the clinician, with explanation and reassurance, can alleviate much pain and anxiety. Gentle soaking to remove dressings can make the procedure

more comfortable for the patient, and reduce trauma. Gentle handling of the limb, or wound area, is essential and the removal of adhesive dressings should be carried out in the correct manner, to reduce pain and avoid skin stripping. Inflamed wounds will be sensitive and in these cases, a soft, nonadherent silicone dressing may be beneficial.

Patients experiencing wound pain should be encouraged to take regular analgesia and not wait until they are in pain. Reassurance and allaying anxiety about taking regular analgesia may be needed, as well as attention to managing side effects as these are often reasons why patients are reluctant to take medication. If dressing procedures are particularly painful, then short-acting analgesia, such as Oramorph® (Boehringer Ingelheim) or sublingual fentanyl, may be helpful. Dressing changes should be timed around the administration of analgesia.

Strategies for managing wound pain are presented in the WUWHS consensus documents (2004) and EWMA (2002). Pain caused by wound infection is expected to resolve as the infection is treated and the microbial burden is reduced.

Exudate

Exudate is essential for wound healing (WUWHS, 2007). However, in the presence of infection, exudate levels tend to increase. Indeed, a sudden increase in exudate levels can be an indicator of wound infection. Exudate is normally straw coloured but a change in colour or consistency should alert the clinician to a possible infection. Thick, viscous, purulent exudate usually indicates infection. Some bacterial infections impact exudate colour in a distinctive way, for example *Pseudomonas aeruginosa* infection typically causes exudate to become a vivid green.

"Wet" wounds (i.e. highly exuding wounds) can be unpleasant and distressing for patients. The fear and embarrassment of leakage from dressings can prevent patients from performing their usual daily activities. Leaking onto clothing or bedding necessitates frequent washing, which can be exhausting for patients who are unwell or frail, or can place additional burdens on family and carers. Frequent dressing changes can also be detrimental to the surrounding skin – the removal of adhesives or tapes can cause skin stripping. Inadequate exudate management will also result in excoriation and maceration of surrounding skin, which may cause a stinging/burning pain and can contribute to further tissue breakdown and wound extension.

"Strikethrough" describes any evidence of staining on the outside of a dressing. However, this term is not always used correctly. Many modern wound dressings (e.g. foam dressings) have a bacteria-proof, waterproof outer layer and, while staining might be visible, this does not mean the outer layer has been breached. Often,

Table 2. Some methods of debridement (adapted from Vowden and Vowden, 2011).

Method	Comments
Sharp debridement	This is a rapid method, but should only be performed by specialist nurses, podiatrists, or other clinicians who have received training in this procedure and are deemed competent. As it involves removal of dead tissue it should not be painful, but simple analgesia may be indicated.
Autolytic debridement by dressings	Examples include hydrogels, hydrocolloids, cadexomer iodine, and honey dressing. Some hydrogels have been reported to exert a soothing, cooling effect on the wound and surrounding skin and can offer some pain relief (Young and Hampton, 2005). Iodine and honey may initially increase local pain on application. Hydrofibers and alginates will assist the autolytic debridement of wet wounds.
Larvae (maggots)	This is an effective and rapid method of debridement of moist, thick, adherent, soft slough, or necrosis. Some patients have reported pain associated with the use of larvae, possibly from the effects of enzymes in the larvae's saliva that are secreted into the wound. It is important to ensure the surrounding skin is well protected from exposure to these enzymes with barrier products or hydrocolloids, as per local Trust and manufacturer's guidelines. Simple analgesia may be helpful in the period immediately after application.
Mechanical debridement	Traditional "wet-to-dry" method is not recommended in the UK. Newer methods include the removal of nonviable tissue using a monofilament pad (Debrisoft®; Activa Healthcare). Using Debrisoft can be more selective, it is the most rapid method (Strohal et al, 2013) and easy to use, and little pain is experienced by the patient. It can achieve effective removal of hyperkeratosis and slough (Wounds UK, 2013).

dressing manufacturers will use the amount of visible staining as a guide to the frequency of dressing change required, preventing unnecessary changes of dressing.

True strikethrough occurs when a fibre-type product that does not have a waterproof backing layer (i.e. gauze) is used. Exudate can then soak through the fibres onto the outside, creating a pathway for the migration of bacteria into the wound bed. This places the wound at risk of infection and dressings should be changed before they reach this stage.

There have been recent developments in the wound care industry to address the problems of heavily exuding wounds, and a range of super-absorbent dressings are now available that absorb and lock away significantly larger volumes of exudate, thereby reducing the risk of strikethrough, and the need for daily or even twice daily dressing changes (Gray, 2012). Most foam dressings are suitable for low to moderately exuding wounds, and generally are not suitable for large volumes of exudate. Saturated dressings will hold exudate against the skin, increasing the risk of excoriation and infection; dressings that draw exudate away from the skin and hold it within the dressing structure are to be preferred.

Negative pressure wound therapy (NPWT) is an additional therapy available for managing highly exuding wounds. Primarily used for accelerating wound closure in large surgical wounds, or diabetic foot or pressure ulcers. NPWT can be used to manage large volumes of exudate by drawing fluid away from the wound into a sealed canister. The closed system also reduces the risk of infection. While NPWT is relatively costly per unit, when the wider costs of nursing time, dressing use, quicker healing, and reduced complications are taken into consideration, NPWT has been shown to be a cost-effective option (Dowsett et al, 2012).

A holistic assessment will identify other factors contributing to high levels of exudate, which must also be addressed alongside containment dressings (i.e., compression bandaging [if indicated] and leg elevation).

Malodour

Malodour does not necessarily indicate that a wound is infected, but can be a sign of infection. Other causes of malodour include saturated dressings that need changing, interaction of some dressings with wound exudate (such as hydrocolloids), or a by-product of the breakdown of necrotic tissue. The malodour associated with infection can be caused by the fermentation of amino acids by anaerobes, therefore, measures to reduce the bacterial load in a wound will reduce the malodour (Jones, 2012).

Malodour can be very distressing for patients (Jones et al, 2008). As with pain, odour is subjective and it is important that clinicians take patients' reports of malodour seriously, even if the odour does not seem particularly offensive to them personally. Anxiety that others around them might be able to smell their wounds can lead patients to avoid social contact and intimacy and become isolated.

Describing malodour can be difficult because of its subjective nature, but the method proposed by TELER® may be helpful (Browne et al, 2004; *Table 3*).

Strategies for managing wound malodour centre on systemic or topical metronidazole, topical antimicrobials, and charcoal dressings (Grocott, 2000). Metronidazole is particularly effective against anaerobic bacteria (Fletcher, 2008). Available as a gel, it can be difficult to apply to a wet wound and care is needed to avoid increasing the moisture levels of an already-wet wound. Managing exudate with effective absorbant dressings may be of most benefit in terms of malodour management.

Activated charcoal dressings work by attracting small gas molecules and bacterial spores to carbon in the dressing by electrical forces, and holding them there (known as adsorption; Morris, 2008). Charcoal dressings can be used as primary or secondary dressings and have the advantage of being able to be reused for up to one week, provided the dressing remains dry. However, once wet, the dressing's effectiveness is reduced.

Conclusion

Infection is a common wound complication that can have serious consequences if not identified and managed appropriately. Every effort should be taken to prevent infection where possible, and early signs of infection identified and treated. This will involve the use of topical and/or systemic antimicrobials, wound debridement to remove slough and necrosis, wound cleansing to remove debris, and good hygiene practice to prevent cross-contamination (WUWHS, 2008). Optimising the patient's immune response through improving nutritional intake and

Table 3. TELER® odour scale (Browne et al, 2004).

Score	Assessment
5	No odour.
4	Odour is detected on removal of the dressing.
3	Odour evident on exposure of the dressing.
2	Odour evident at arm's length from the patient.
1	Odour evident on entering the room.
0	Odour evident on entering house/ward/clinic.

hydration, and achieving good glycaemic control for patient with diabetes, are also essential in preventing and managing wound infection (Vowden et al, 2011).

The impact of wound infection on the patient's wellbeing must not be overlooked. Pain, exudate, and malodour are the most common problems associated with wound infection reported by patients and all can have a significant negative impact on patients' quality of life. Effective management of the bacterial burden in the wound will improve these symptoms. Acknowledging these problems and offering psychological support alongside practical management strategies is vital when caring for patients with infected wounds. WE

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Choosing the appropriate dressing: Honey

Honey has a long history of being used in Chinese medicine and its medicinal properties are also mentioned in both the Bible and the Quran (Thomas, 2010). This article examines the benefits and use of honey in a range of wounds and its effectiveness as a wound dressing.

"Clinicians need a good knowledge of the physiology of wound healing and an understanding that dressings do not heal wounds, but can influence and address issues in the wound environment."

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The selection of any dressing is dependent on a thorough and holistic assessment determining the cause of the wound, addressing any underlying factors that hinder healing, such as dependent oedema, and preparing the wound bed for healing. Dressings should not be used in isolation and should be chosen for a specific purpose. All dressings work to some degree, but when they fail to meet the clinician's expectations this may actually be due to poor choice of dressing and lack of understanding of a dressing's indications for use.

The clinician needs to have a good knowledge of the physiology of wound healing and an understanding that dressings do not heal wounds, but can influence and address issues in the wound environment. Patients can influence their wound healing by eating a well-balanced diet, drinking an adequate amount of water, and reducing smoking.

There are many categories of dressings, such as:

- Alginates.
- Antimicrobials.
- Foams.
- Honey.
- Hydrocolloids.
- Hydrofibers® (Convatec).
- Hydrogels.

Here, honey-based dressings and products will be discussed.

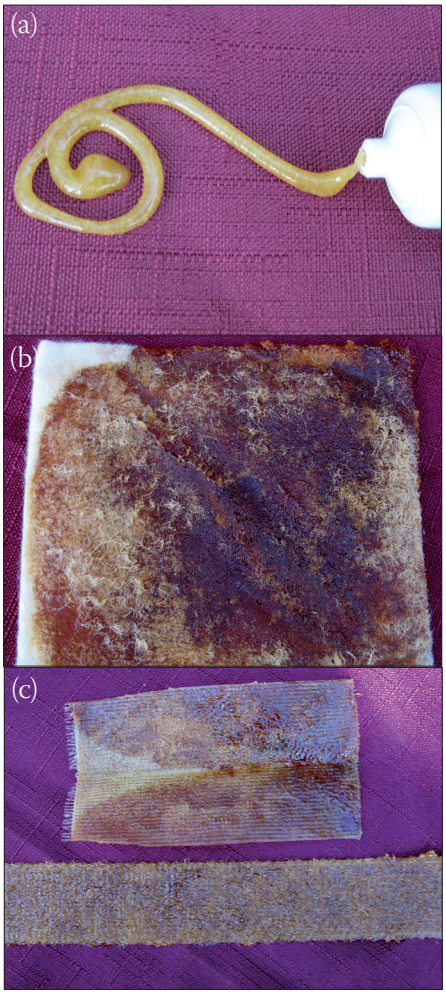
Honey

Honey is not a new wound care product, having been used medicinally for more than 2000 years. During World War II, people in Shanghai used a mixture of honey and lard to treat their wounds. Honey and fat were also used together to treat ulcers, burns, fistulas, and boils in Germany and this was published later in 1954 (Thomas, 2010). Honey was introduced commercially in the UK in the 1970s as a tulle dressing by M&M Tulle (Malam Laboratories). The honey was mixed with cod liver oil. During the 1980s–90s honey began to be used more widely in the wound care field.

Honey is obtained from different floral sources, the most common for the purposes of use in wound care products being manuka honey gathered from the nectar of manuka plants known as the tea tree.

Honey for use in wounds is produced as a gel (*Figure 1a*)where it can be mixed with plant waxes to make balms. There are honey-impregnated tulle sheets for low-exuding wounds and honey-impregnated alginate dressings (*Figure 1b*) for more exuding wounds. All of these require

Figure 1. ***a) Honey gel. (b) Honey alginate. (c) Honey tulle and honey ribbon.***



a secondary dressing for exudate management. A ribbon dressing with probe applicator has been developed for cavity wounds (*Figure 1c*).

Dressings are produced in different preparations and shapes and sizes for a whole range of wounds. Familiar honey dressings are: Medihoney® (Derma Sciences) range, Algivon® (Advancis Medical) and Activon® (Advancis Medical) range, L-Mesitran® (Aspen Medical) range and Sanoskin® Melladerm® (Ideal Medical Solutions) ranges.

Modes of action

Honey has become a popular dressing due to its antimicrobial properties. It is effective against common organisms that can colonise and infect a wound, including *Pseudomonas aeruginosa, Staphylococcal aureus, Candida albicans, Escherica coli,* and methicillin-resistant *S. aureus* (MRSA; Stephen-Haynes and Callaghan, 2011).

Another one of Manuka honey's attributes is in the management of biofilms where its antibacterial action can reduce bacterial growth by preventing bacterial cell division and causing bacterial cell death (Jenkins et al, 2011).

Biofilms are communities of multiple species of adherent microorganisms that are embedded within a blanket of slime in a wound bed (Cooper, 2010). They are known to delay wound healing and efforts should be made to remove biofilms and prevent them reforming (Phillips et al, 2011).

Honey aids autolytic debridement by creating a moist environment by drawing out lymph fluid through osmotic action to rehydrate the wound bed. Hydrogen peroxide is produced in honey by the enzyme glucose oxydase, which is thought to aid the debridement process (Pieper, 2009). Lymph fluid contains proteases that contribute to the debriding activity of honey (Cutting, 2007).

A prolonged inflammatory response can inhibit healing and cause further tissue damage (Stephen-Haynes and Callaghan, 2011). Honey has properties that are thought to help modulate inflammation and reduce pain, oedema, and exudate.

Highly colonised or infected wounds can be malodourous. Honey has been shown to be effective at deodorising wounds by reducing bacterial burden (Molan and Betts, 2004)

Honey has been reported to aid the physiological response to infection and inflammation, which is necessary for wound healing (Tonks et al, 2007). Honey is a topical way of reducing bacterial content in the wound and can be used in patients who have frequent wound infections in an attempt to avoid the need for repeated systemic antibiotics, which can increase the risk of the patient developing MRSA and *Clostridium difficile* infections (Wounds UK, 2010).

Clinical indications and wound types

Honey provides a moist environment for wound healing and does not adhere to the wound bed. Honey dressings are generally chosen for their antibacterial properties in managing locally infected wounds and wounds that are highly colonised. They are used on wounds that are static and failing to heal. Honey dressings are suitable for use on necrotic or sloughy wounds (*Figure 2*).

Honey is suitable for use on chronic wounds, such as diabetic foot ulcers, leg ulcers, and pressure ulcers. Honey can also be used on burns, donor and recipient graft sites, and surgical wounds.

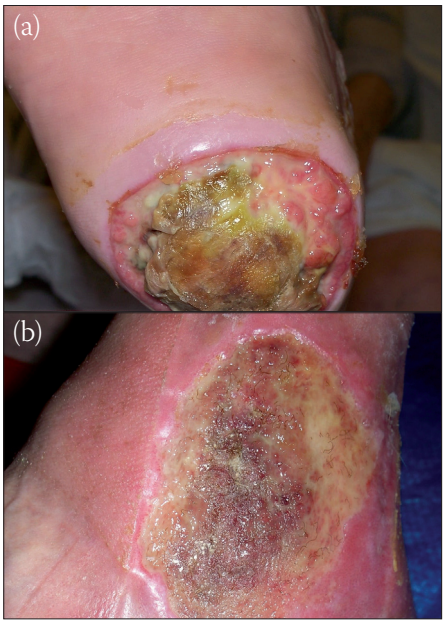
Where a cavity is present, the wound should then be probed to establish size and depth before packing the wound. Where the wound bed cannot be determined, further investigations should be undertaken by the clinician, such as a sinogram.

Considerations and contraindications

Before using a honey dressing, the clinician should be aware of the following:

- The use of honey dressings should be avoided among patients with a history of allergy or sensitivity to honey, bee venom, or alginate dressings.
- That honey is contraindicated in deep wounds with tracking sinuses due to the potential of plant waxes to block sinuses. (Clinicians must ensure that the wound has been thoroughly investigated for sinuses).
- As with all debriding agents, the patient must be warned prior to use that the wound may appear larger following treatment.

Figure 2. ***Honey can be used on (a) necrotic, or (b) sloughy wounds.***



- Some patients may experience pain caused by the sensation of osmotic drawing and this may be intolerable.
- Honey dressings can be used in diabetic patients with wounds: there is no evidence that the topical use of honey will increase blood sugar levels (Simon et al, 2006).
- Honey can be used in paediatric wound management as no toxicity has been reported.
- Honey can increase wound exudate and there is a risk of maceration if exudate is not managed. More frequent dressing changes may be needed and the surrounding skin may need to be protected with a barrier film.
- Honey can be used on leg ulcers and under compression bandages, but the clinician should consider that when a patient is mobile, exudate may increase and gravitate downwards and cause maceration of the leg or foot.
- Over-the-counter pots of Manuka honey are not equivalent to the medical-grade Manuka honey used in wound dressings. Non-medical-grade honey is not sterile and carries a small risk of fungal or bacterial contamination (Thomas, 2010). Patients should be discouraged from using over-the-counter honey topically.

Method of use

Products need to be selected to suit the characteristics of the wound. Depending on the exudate level, the clinician should choose an alginate for absorbency and tulles for light-exuding wounds. Dressings can be cut to shape to overlap the wound edges, especially if there is some inflammation present. The honey dressing or gel must be in contact with the wound bed, while the ribbon-style dressing should be placed into cavities. Dressings can be left in place for up to 7 days, but as honey has an osmotic effect, the wound may produce more exudate and the dressing may, therefore, need to be changed more frequently.

When the wound is showing signs of healing, the honey dressing can be discontinued. Ideally, antimicrobial dressings should be re-evaluated on a regular basis for efficacy; if there is no improvement after 4 weeks, the wound must be reassessed (Wounds UK, 2010).

Conclusion

Honey is a useful tool in the management of wounds. Wound dressing choice remains a challenge for the clinician due to the many products available. Local wound care formularies are produced to guide the clinician's choice. However, the usefulness of a given product is dependent on the appropriateness of its use in a given wound, which is based on thorough assessment of the patient and the wound and the goals of treatment. A good knowledge of holistic wound management is vital for achieving positive outcomes.

Wound dressings are only one part of managing a wound and it is essential to identify other factors that may prevent or hinder healing. Underlying disease management is essential for wound healing. WE

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Management of pain associated with leg ulceration

Patients with leg ulceration can present with significant pain, which can have a detrimental impact on their psychological and physiological status. Assessment of the severity, intensity, and site of the pain is an important part of the assessment of these patients. However, this is often not considered by the clinician to be as important as the leg ulcer assessment itself. This article will explore the impact of pain on patients with leg ulceration and examine the management options.

"Pain can significantly affect a person's quality of life, both physically and emotionally, and remains an area that is not well addressed in clinical practice."

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Patients can experience both acute and chronic pain associated with leg ulceration, which significantly affects their quality of life. Pain presents in many ways and is a subjective experience. Chronic pain is estimated to affect nearly 20% of the adult population in the UK (Breivik et al, 2006), while studies of patients with venous leg ulcers indicate that as much as 80% of the UK's adult population may have experienced acute or chronic wound pain that is "moderate" to "the worst pain possible" (Briggs et al, 2012).

In this article the significance of pain in leg ulcer patients linked to underlying pathology and pain pathophysiology will be explored. It will also identify pain management techniques for this patient group and how treatment regimens can be tailored to individual needs.

When defining pain, it can be difficult to capture the personal nature of the experience. McCaffery (1968) provides the following definition of pain as "what the patient says it is and [it] exists whenever a patient says it does". The International Association for the Study of Pain (IASP; 1979) went on to describe pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage; or described in such terms as damage".

Regardless of the definition used, it is recognised that pain can significantly affect a person's quality of life, both physically and emotionally, and remains an area that is not well addressed in clinical practice (Vermeulen et al, 2007; Taylor, 2010).

Types of pain

There are three classes of pain: nociceptive, pathological, and dysfunctional (Woolf, 2010).

Nociceptive pain – also known as inflammatory pain – is caused by stimulation of peripheral nerve fibres and is associated with tissue damage and the infiltration of immune cells.

Nociceptive pain is further divided into three categories:

- Visceral pain, which is difficult to locate and is usually described as a sickening, deep, and dull pain. (Urch and Suzuki, 2008).
- Deep, somatic pain, which is when nociceptors are stimulated in the

ligaments, tendons, bones, or blood vessels, causing dull, aching, poorly localised pain.
- Superficial pain, which is initiated by nociceptors in the skin or superficial tissue, and is sharp, well defined, and clearly located. (Spanswick and Main, 2000).

Pathological pain is caused by damage to the nervous system and is often described as neuropathic pain. It can affect any part of the body and elicits feelings that may be described as burning, tingling, stabbing, or pins and needles (Paice, 2003).

Dysfunctional pain is described by its abnormal function, such as in irritable bowel syndrome and fibromyalgia (Woolf, 2010).

Pain can be "acute" – when it resolves quickly and lasts less than 30 days – or "chronic", when it affects an individual for >6 months (Thienhaus and Cole, 2002).

The challenge for many clinicians is how to diagnose and manage the complexities of pain in patients with leg ulceration.

Pain and leg ulcers

The underlying pathology of leg ulceration can significantly affect the nature and intensity of the pain that patients experience. In patients with venous leg ulceration, the prevalence of pain has been reported to be as high as 64% and is described as being persistent and exacerbated by wound dressing procedures (Hofman et al, 1997; European Wound Management Association [EWMA], 2002). The pain associated with venous disease can be linked to oedema in the lower leg, the presence of lipodermatosclerosis, atrophie blanche, superficial or deep phlebitis, or infection (Woo and Bloomberg, 2010).

Where wound exudate is present on the surrounding skin, causing maceration or tissue erosion, Blackburn-Munro (2004) found that subjects registered higher levels of background pain.

Pain in patients with arterial leg ulcers is associated with narrowing of the arteries, causing claudication, ischaemia, and vasospasm. With this condition, pain increases with exercise and elevation, especially at night. The degree of ischaemia and the specific symptoms experienced depend not only on the site of arterial occlusion, but also the presence of effective collateral circulation. At rest, a patient may be able to tolerate up to 70% occlusion of an artery without pain. However, when walking, an increased demand for oxygen in the muscles cannot be met, causing intermittent, cramp-like pains in the calf region, known as claudication (Morison and Moffatt, 2004).

People with diabetes can present with chronic or acute episodes of neuropathic pain (Veves et al, 2008). However, more commonly, they present with painless ulceration due to impairment of the nerve structures and function. In neuropathy, normal pain pathways can be impaired due to nerve dysfunction (Newton, 2008).

Factors influencing pain in leg ulcer patients

Stress and anxiety

Stress and anxiety can lower a person's pain threshold and tolerance. Individuals that experience high levels of stress or anxiety in anticipation of pain rate the actual pain experience as more intense (Woo and Bloomberg, 2010). This may be the case for patients with leg ulceration who become anxious prior to dressing change and, therefore, are anticipating high levels of pain, especially if they have had a previous traumatic experience.

Pain and stress may slow down wound healing. McGuire et al (2006) suggest that chronic wound pain constitutes a psychological stressor that triggers the hypothalamic–pituitary–adrenal axis promoting the production of vasopressin and cortisol. Vasopressin is a potent vasoconstrictor and compromises the delivery of oxygen and nutrients required for wound healing.

Cortisol reduces the immuno-inflammatory response, suppresses cell differentiation and proliferation, inhibits the regeneration of endothelial cells, and delays collagen synthesis (Johnson, 1995). All of these factors have the potential to delay wound healing.

Patient–clinician relationship

It has been suggested that a therapeutic relationship between the clinician and the patient can enhance treatment adherence and optimise patient outcomes (Robinson et al, 2008; Woo et al, 2008). Where there is trust and effective communication between patient and clinician, this helps to minimise anxiety and reduce stress which can, in turn, lead to a reduction in the patient's pain.

Wound care

Wound dressing removal can be painful when the primary dressing layer adheres to the wound bed. The use of cold cleansing solutions and wound debridement can be painful (Hansson, 1993; Wounds UK, 2004). Pain can also be increased in the presence of wound infection as a result of the inflammatory response stimulated by the infecting micro-organisms (Mudge and Orsted, 2010).

Managing pain

Despite advances in tools for its management, many patients continue to suffer unnecessary pain (Taylor, 2010). Pain management has a strong evidence base, however, this is not necessarily translated into practice. Anecdotal evidence suggests the assessment of patients

with leg ulceration remains primarily focused on the ulcer, rather than on the patient and, as such, their pain is often poorly managed (Briggs, 2007).

A best practice statement by Wounds UK (2004) identifies discrepancies between clinicians' knowledge about the reasons why patients experience wound pain and tissue trauma, and the implementation of evidence-based, patient-centred care in their day-to-day practice. This illustrates the contrasts that so often exist between theory and clinical practice.

Woo and Sibbald (2008) suggest that pain is common in patients living with chronic wounds. Woo et al (2008) place an emphasis on the need to assume that all chronic wounds are painful, unless the patient indicates otherwise.

Topical treatment

Topical preparations can also have an impact on pain reduction. Using warm fluids to cleanse and irrigate ulcers reduces pain as does using wound dressings that are non-adherent. Some patients may find it easier to remove their own dressings in the shower or while soaking their legs. If dressings are sticking to the ulcer bed, consideration needs to be given to the appropriateness of the wound dressing and whether an alternative would reduce the levels of pain. Alternatively, adjusting the frequency of dressing and bandage change may affect a patients pain levels.

Infection

When leg ulcers become clinically infected early interventions with appropriate antibiotics will help to minimise the pain. Antimicrobial dressings will also help to reduce bacteria, especially in critically colonised wounds.

Treatment of the wound infection by reducing bacterial load should result in pain reduction, however, this may take several days (Mudge and Orsted, 2010). Providing analgaesia prior to dressing changes can help to manage this.

A Cochrane wounds group review found no trials that identified which dressings were most effective in relieving pain in venous leg ulcers. However, there is some evidence for the use of dressings containing ibuprofen for painful venous leg ulcers, whereby the ibuprofen is only released when the wound exudates (Briggs et al, 2012).

In some cases, debridement of a leg ulcer is required and this, in turn, can increase the levels of pain experienced by the patient. Topical EMLA® (Astra Zeneca) cream 5% appears to provide an effective pain relief during the debridement process (Briggs et al, 2012).

However, Briggs et al's (2012) systematic review did highlight the need for further research in addressing pain in leg ulcer management using topical therapies.

It is important to undertake a thorough assessment of the patient's pain, which should include the duration, nature, and severity of the pain to determine the underlying cause. Use of a specific pain scale can assist the patient in identifying pain severity. Examples include a visual analogue scale, where patients must define their pain level from 1 (no pain) to 10 (worst pain possible); and a verbal rating scale, which rates pain according to a description such as "no pain" to "severe pain" (Taylor, 2010).

Pain and arterial disease

Pain associated with underlying arterial disease is more complex and its management requires a multidisciplinary approach. The aim is to improve the blood supply to the lower leg and this can be achieved through radiological angioplasty and or vascular surgery with a bypass graft. Patients with arterial disease tend to find it more comfortable to keep their legs lowered rather than elevated as this increases the blood supply to the lower leg and reduces pain.

Worsening pain in a patient with venous leg ulceration may indicate the presence of arterial disease or the development of infection. If arterial disease is excluded and the limb remains oedematous, the appropriate application of compression bandages will alleviate associated pain (NICE, 2012).

An algorithm for management

The World Health Organization's three-step analgaesic ladder (WHO, 1990) – originally devised for use in cancer patients – has been adapted for use in other conditions. Step 1 is used at the onset of pain, but can be missed out if pain is more severe at onset. It suggests a simple analgaesic, such as paracetamol or a non-steroidal anti-inflammatory (NSAID), be taken. However, NICE (2012) suggests that NSAIDs should not routinely be prescribed in the first instance for patients with venous leg ulcers. Step 2 recommends the use of weak opioids, such as tramadol or codeine, when pain persists or worsens after step 1. Step 3 is initiated when pain persists after step 2 or is increasing in intensity and duration. Strong opiods are recommended, such as morphine, fentanyl, or oxycodone.

At each step, adjuvant drugs, such as antidepressants (amitriptyline), can be added to the treatment regimen as they are also effective in managing pain.

There are a number of key principles that also need to be applied to maximise effective pain control, including regular, rather than

ad hoc, administration of pain treatments, individualised to the needs of the patient.

Conclusion

Pain associated with leg ulceration is common, yet its management can be complex when the underlying reason for the pain is not well understood. There are clear links to the impact of pain on a patient's psychological status and emotional wellbeing and clinicians must be mindful of the need to listen to their patients and work with them to effectively manage their pain. WE

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Compression therapy for venous leg ulceration: Part 4 – hosiery kits and maintenance hosiery

This is the fourth and final article in a series that has examined the various options of therapeutic compression for the individual with a venous leg ulcer. Previous articles examined the role of the padding layer in ensuring protection from pressure damage and reshaping the limb, as well as the use of both elastic, and inelastic, short-stretch compression bandaging.

"Some individuals will be eager to manage their ulcer independently, with minimal supervision from their clinician. Others, however, may not have the confidence to manage the dressing change or apply hosiery."

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In order to achieve a successful patient outcome for the individual with a venous leg ulcer it is important that their lifestyle and limitations are considered. For those in full-time employment, compression bandaging may not be a practical solution, as they would be required to regularly visit their practice nurse. For these patients, provided they are willing and able, a hosiery kit may be the best solution for self-management.

In addition, hosiery kits allow the patient the freedom to shower as desired. Although the initial cost of a hosiery kit is greater than that of bandaging, the kit is reusable and so represents cost savings in terms of both product and clinician time.

Following a thorough assessment of the patient – including Doppler ultrasound to check for any arterial problems – a discussion between the patient and the clinician regarding their lifestyle, mobility, ability to apply stockings etc, will help determine whether the patient's venous leg ulcer can be managed by a compression hosiery kit or not. Some individuals will be eager to manage their ulcer independently, with minimal supervision from their clinician. Others, however, may not have the confidence in their own ability either to manage the dressing change or apply the hosiery and this should be respected by the clinician.

Hosiery kits usually comprise two separate compression stockings, which together apply approximately 40 mmHg pressure at the ankle and less at the calf as the leg naturally widens and this reduces the pressure. Kits can vary though – some contain stockings that apply 20 mmHg each, others have a liner stocking of 10 mmHg with a second stocking of 30 mmHg.

If an ulcer is large or heavily exuding, the hosiery will become saturated quickly, resulting in a wet mess for the patient and potentially a loss of confidence in the clinician's judgement. An adhesive bordered dressing is ideal as this allows the patient to remove the hosiery and

shower, however, if the patient reports a previous sensitivity or allergy to this type of dressing, then the choice should be reconsidered (Lim et al, 2007). The hosiery itself may be sufficient to keep a nonadhesive bordered product *in situ* over the ulcer.

Patient management

The patient must be educated regarding how the hosiery kit works and how often they will need to change their dressing and wash the hosiery. Manufacturer's instructions will be provided, but the patient may also benefit from written instructions provided by the clinician regarding their ulcer care. Information provided should include a recommendation to remove the outer stocking at night to lessen the compression. This will be more comfortable for the patient, enabling them to get a better night's sleep.

It is also vital the patient understands the importance of hand hygiene (Patel, 2012), in order to minimise the risk of infection. Possible signs of infection should be stressed to the patient so that, should a problem arise, they know to contact their clinician for assistance.

The patient will require a sufficient amount of wound dressings of an absorbent nature to apply, as well as more than one hosiery kit: "one to wear, one to wash" is a good adage to adhere to.

The patient should remain under the clinician's supervision, but the use of the hosiery kit may mean that instead of having three visits to the surgery per week, the patient sees the nurse every 2–3 weeks.

Selecting the hosiery kit

Deciding which hosiery kit is appropriate for the patient will depend on any associated factors with their ulcer (such as oedema). Personal preference is also important as some people may prefer to have a dark colour, while others are happy to wear their socks on top, however that can make footwear uncomfortable.

Once the ulcer is fully healed and the newly formed skin is sufficiently robust, the patient will be ready to wear maintenance hosiery. This is a process that should not be rushed into; if the patient is more comfortable wearing their hosiery kits for some weeks post healing, this should be accommodated.

Maintenance compression hosiery

It is recommended that patients who have successfully undergone compression therapy for a venous leg ulcer wear compression stockings to maintain their skin integrity and prevent recurrence of their ulceration (Royal College of Nursing, 2006).

It is advisable that the nurse explains to the patient at the beginning of their venous ulcer treatment that they will need to wear hosiery to prevent their ulcer from returning. The patient may not welcome this information initially, therefore it is advisable for the clinician to reinforce this explanation at subsequent treatments to familiarise the patient with the idea that prevention is preferable to ulcer recurrence (Anderson, 2013).

Several factors can influence the clinician in deciding which specific hosiery would be advisable for the patient. Older people may struggle to apply their hosiery and if they have fragile skin there is a risk of skin trauma development. In these cases, it may be advisable for the older person to use class 1 hosiery, while ensuring they regularly sit with their legs elevated.

If the patient has reported previous skin sensitivities, they may require a hosiery product without rubber or dye and few companies are able to accommodate this (*Table 1*), limiting choice. However, if the clinician approaches a company, in some cases they may be willing to accommodate the patient and produce hosiery free from dye. Rubber/latex-free hosiery is currently available on prescription.

Compression hosiery may be British or European standard (sometimes known as RAL) and there is a plethora of different hosiery available to suit a range of different lifestyles. For instance, the individual may have a particularly active lifestyle or job, thus requiring more robust hosiery.

It is important to stress to the patient that wearing hosiery is not easy and that it takes time to become accustomed to applying and wearing hosiery. Patience is required, especially in the early days.

The patient may benefit from a stocking application device (i.e. ActiGlide™ [Activa Healthcare], Mediven 2in1 [medi UK]), to enable greater independence and allow the patient to put the stocking on without assistance. These devices are available on prescription and can aid compliance with hosiery.

The clinician must arrange to see the patient following the prescribing of hosiery to ensure they are capable of application; the length and size are correct; and no problems have developed. Patients should be reminded that there are lots of different types of hosiery available and while the first choice may not suit them for whatever reason, there are others that may prove suitable.

Conclusion

Venous leg ulcers occur across all age groups. Young patients are likely to be in employment and will require an independent means of managing their ulcer with minimal supervision from a clinician. Therefore, therapeutic hosiery kits are a means of enabling independence for these patients.

Table 1. Therapeutic compression hosiery kits.

Kit name	Company	Action	Sizes available	Colours available
Leg Ulcer Hosiery Kit	Activa Healthcare	A 10 mmHg stocking liner, followed by a British Standard Class 3 stocking 30 mmHg. Combined pressure approx 40 mmHg.	Five sizes: small, medium, large, extra large, extra extra large See company website for full details.	Either: two sand liners with black stocking per box, or two white liners with sand stocking per box. Separate liner stockings are also available in a box of three.
ActiLymph® Hosiery Kit	Activa Healthcare	A 10 mmHg stocking liner, followed by a class 2 Actilymph stocking (23 mmHg–32 mmHg). To control oedema.	Four sizes: medium, large, extra large, extra extra large. See company website for full details.	Two white liners with sand-coloured stocking per box.
Carolon Multi-layer Compression System	H&R Healthcare	Two different compression levels available: 30 mmHg–35 mmHg or 35 mmHg–40 mmHg.	Seven sizes: ankle: 18 cm–20 cm, 20 cm–22.5 cm, 22.5 cm–25.5 cm, 25.5 cm–28 cm, 28 cm–30.5 cm, 30.5 cm–33 cm, 33.5 cm–35.5 cm.	Each box contains two white understockings and either a sand-coloured or black overstocking. Separate liner stockings are also available in box of three.
mediven® Ulcer Kit	medi UK	20 mmHg stocking liner, followed by 20 mmHg stocking.	Seven sizes: ankle: 18 cm–20 cm, 20 cm–22 cm, 22 cm–24 cm, 24 cm–26 cm, 26 cm–28 cm, 28 cm–30 cm, 30 cm–33 cm.	Each box contains one understocking and one overstocking. Available in short and regular lengths.
SIGVARIS UlcerX	SIGVARIS	Low pressure understocking with an 30 mmHg–40 mmHg overstocking	Three sizes available, with different calf widths: Ankle: 19 cm–23 cm; calf: 31 cm–36 cm or 35 cm–40 cm. Ankle: 23 cm–26 cm; calf 34 cm–39 cm or 39 cm–44 cm. Ankle: 26 cm–29 cm; calf: 37cm–42 cm or 43 cm–48 cm.	Each box contains one liner and one overstocking. Liner stockings are also available in a box of four.

When considering maintenance hosiery for the older person, it is vital to educate on application and removal of hosiery and the feasibility of this. Any assistance required, whether physical or device-related, should also be considered. In addition, the older person will have more fragile skin, possibly requiring an inner liner (noncompression) to protect the skin from friction.

Once healed, the patient will need maintenance hosiery. While fitting a patient for maintenance hosiery may signal the end of an episode of care to the clinician, it is only a continuation to the patient who needs to have continued support as and when needed. WE

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Chronic oedema and lymphovenous disease explained

One in 1 000 people are reported to have lymphoedema, although the exact number is unknown and prevalence is thought to rise with age – possibly to 5.4 per 1 000 in those aged over 65 years (Moffatt et al, 2003). The condition is often not recognised or mistakes are made in differential diagnoses, which can lead to incorrect management decisions (Upton and Solowiej, 2011). Similar numbers of people are reported to have venous disease a feature of which is oedema due to venous insufficiency (Anderson, 2008). Many people will have a combination of both conditions, known as lymphovenous disease. This article will focus on differentiating between lymphoedema, chronic oedema, and lymphovenous oedema and not specifically on other causes, such as cardiac and renal disease, and cancer-related oedema, which are also important to identify and treat.

There is a range of terminology related to oedema. This article aims to clarify different types and focuses specifically on non-cancer-related lymphoedema, predominantly lymphovenous disease. Uncontrolled oedema can give rise to skin breakdown, infection, pain, and discomfort. Unfortunately, it is often not recognised and complications arise unnecessarily.

Chronic oedema is said to exist when oedema has been present for >3 months and changes from making the leg soft and "pitting" when pressed, to being hard and showing signs of thickening and flaking of the skin (hyperkeratosis). One common method of testing for chronic oedema is by trying to pinch the skin at the base of the second toe. If the skin can be lifted, the oedema has not progressed to a chronic stage; if the skin cannot be lifted this is called a positive Stemmer's sign and indicates a chronic condition (Moffatt et al, 2007). It is important to treat oedema before it becomes chronic.

Oedema in the leg can lead to infection if not managed. As the fluid builds up it may begin to leak through multiple tiny blisters on the skin. This is called lymphangioma (Timmons and Bianchi, 2008). Leakage of lymph fluid from the blisters is called lymphorrhoea, more commonly known as "leaky legs". This condition can also be due to cardiac or renal failure (Timmons and Bianchi, 2008) so the assessment has to be detailed to identify the underlying cause of the oedema.

If the oedema becomes chronic there will be increasing fibrosis in the tissues and skin changes. This condition is called lipodermatosclerosis (Moffatt et al, 2007). Initially, this can present as a painful red leg and is sometimes

"Uncontrolled oedema can give rise to skin breakdown, infection, pain, and discomfort."

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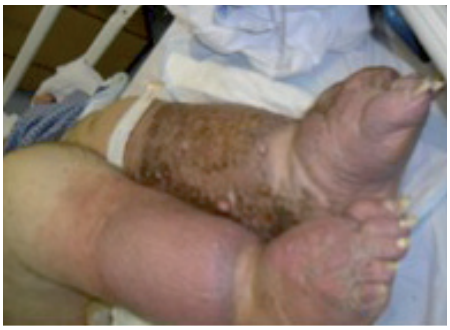
***Figure 1.** An example of papillomatosis of the legs of a patient with lymphoedema. Photo used with permission of Pauline Beldon.*



mistaken for infection (cellulitis), resulting in the unnecessary use of antibiotics, possibly hospital admission, and stress and worry for the patient. If the condition is allowed to worsen, the leg can become so fibrosed and hard that the shape of the leg changes, the skin deteriorates, and the inflexibility of the skin and tissue, as well as the swelling, can lead to difficulty walking properly and a high risk of skin damage (e.g. a leg ulcer).

Lymphoedema is caused by a failure of the lymphatic system. It is non-pitting and does not resolve when the legs are elevated and can result in ulceration. Difficulty in correctly diagnosing the condition arises in part because other types of lower-limb oedema can become non-pitting as they become more chronic. With lymphoedema there are profound skin changes; deep folds occur in the skin and the skin can take on the appearance of cobblestones, which is called papillomatosis (Moffatt et al, 2007; *Figure 1*). One study found that a third of people with venous ulcers also had lymphoedema (Moffatt et al, 2004).

Diagnosing the type of oedema is therefore quite complex, but important. Venous disease is characterised by oedema, but if the patient also has lymphoedema due to a failure of the lymphatic system, the management of this condition becomes more complex. Oedema due to venous disease is managed principally by elevation, exercise, and compression. Lymphoedema management requires a more intensive treatment regimen. For instance, this may include using higher levels of compression, and specialist bandaging of the whole leg, as well as specialised padding techniques, manual lymphatic drainage, and additional support for managing the effects of their condition (British Lymphology Society [BLS], 2010).

The key issue in identifying the cause of oedema is patient safety. If the patient needs diuretics and other management of a cardiac and/or renal problem, this must be monitored. In the presence of these conditions, there may be risks associated with using compression therapy as it may push extra fluid into the system, possibly overloading the heart and kidneys (European Wound Management Association, 2003).

To safely and effectively treat oedema, the underlying condition(s) must be diagnosed and treatment plans accordingly. Untreated venous disease can lead to lymphatic failure, which will cause the patient to suffer co-existing lymphoedema. Therefore, we must be more proactive in treating oedema (Williams and Mortimer, 2007).

Categorising lymphoedema

There are two main categories of lymphoedema. Primary lymphoedema refers to a lymphatic system that has not properly developed. Secondary lymphoedema refers to a previously normally functioning lymphatic system that has become damaged (*Table 1*). The damage may be due to surgery, trauma, or radiotherapy.

The lymphatic system, as well as the venous system, is responsible for managing fluid in tissues (filtration and absorption). The lymphatic system drains fluid from the interstitial spaces in the tissue.

The lymphatic system, through blind-ended lymph vessels, drains fluid from the upper dermis (Cowen and Ugboma, 2011). The lymph vessels here contain valves that close when the vessel is full (i.e. when the pressure rises). The fluid is carried to vessels deeper in the dermis and then on to larger lymph vessels that have unidirectional valves and rely on contraction from tissue and muscles to propel fluid to lymph nodes and larger vessels, eventually draining into the venous circulation (Williams and Mortimer, 2007).

Similar to the process in venous disease (Anderson, 2008), if the lymph vessels are damaged or overfull, the fluid cannot be drained from the tissue and will leak from vessels back into the tissue, resulting in swelling, skin changes, and eventually leakage of fluid into the skin, as well as ulceration (Williams and Mortimer, 2007).

If venous disease is also present, the capillaries and veins will also experience high pressure (called hydrostatic pressure) and be unable to drain, adding to the oedema (Anderson, 2008). If the condition is not managed, it becomes chronic and the oedema is more difficult to manage, and the likelihood of skin changes and ulceration rises dramatically (Williams, 2003). The patient will experience heaviness and discomfort, possibly pain, and is at risk of becoming seriously unwell through infection and skin breakdown.

Elevation

For a healthy person, simply elevating the leg for a while allows any excess fluids in the tissues to drain back into the lymphatic system and the swelling resolves. This may be experienced on a long flight or car journey (i.e. sitting still for a long period of time) and the person may have difficulty putting shoes back on or flexing the ankle. Elevating feet allows gravity to aid the draining of fluid to the heart and the pressure in the blood and lymph vessels reduces, allowing more fluid to be reabsorbed from the tissues and, therefore, the oedema resolves.

When these systems are compromised, elevation of the feet makes little

Table 1. Causes of lower limb oedema.

Cause of oedema	Description	Summary of management
Primary lymphoedema	Abnormal development of the lymphatic system.	
Secondary lymphoedema	Damage to a normal system caused by surgery, trauma, or radiotherapy.	
Venous oedema	Due to venous disease. There will be indicative signs such as ankle flare, varicose veins, staining of the leg, skin changes and hardening of the tissues (Anderson, 2008).	Compression therapy (if appropriate) (Moffatt et al, 2007). Leg elevation to increase venous return and reduce oedema; exercise (walking is ideal, but flexing and roatating the ankle joint can increase venous return); skin care (i.e. careful leg washing and moisturising with a simple emollient to prevent dry skin build up).
Dependency oedema	Swelling of the ankles (and legs as the condition worsens) caused by immobility and the legs not being elevated, possibly even overnight if the patient is not going to bed). This would usually affect both legs but may be more pronounced if there is a specific problem affecting a limb (e.g. left or right side weakness).	Identify the reason for leg dependency. Hip and knee pain may make leg elevation difficult. There may be many practical reasons why a patient does not sleep in a bed at night, therefore, the clinician needs to ascertain the underlying cause. (Moffatt et al, 2007).
Obesity-related oedema	Oedema is a common feature of obesity and often affects the whole leg.	All of the factors identified for venous and dependency oedema, as well as support and encouragement relating to diet and exercise.
Heart failure/renal-related oedema	Acuteheart failure can result in bilateral ankle oedema. There can also be sacraloedema. It can be difficult to differentiate with dependency oedema although a thorough assessment should detect signs of heart disease, such as ischaemia or cardiomyopathy.	Review of medication including diuretics where indicated for cardiac disease. Specialist involvement in treatment regime. Extreme caution with compression therapy to ensure extra fluid load is not pushed into the system which could be catastrophic (EWMA, 2003).
Oedema related to advanced cancer	In relation to leg oedema, the cause is often advanced disease affecting the pelvis and abdomen. The oedema is often soft and can extend from the lower leg to the abdomen, including genitalia.	Palliative support as tolerated by the patient, which may include reduced compression. Skin care and pain control.

difference. In such cases, there needs to be a manual shifting of fluid and this is primarily achieved with compression bandages or hosiery. Sometimes patients are given diuretics in an effort to reduce the fluid level, but if the problem is capacity and vessel damage – rather than cardiac or renal problems – then little difference will be made. The patient may become dehydrated and their discomfort may increase because they have to visit the toilet more often. If the oedema is cardiac- or renal-related this must be identified and the patient needs a medical assessment and management to ascertain the disease process causing the oedema and monitoring of the effects of treatment, such as diuretics (BLS, 2010).

Lymphoedema is different to chronic oedema because it also involves fibrosis and fat in the tissues and is irreversible. This affects the leg and the foot down to the metatarsal/phalangeal joint and is sometimes known as a "buffalo hump" (Easterbrook and Walker, 2002; *Figure 2*) due to the "humped" appearance of the top of the foot. In practice, lymphoedema and chronic oedema coexist as lymphovenous disease.

Lipoedema

For the purposes of differential diagnosis, it is important to be aware of lipoedema, which affects females almost exclusively and is characterised by an abnormal

accumulation of fat, primarily between the hip to ankle. The fat accumulates around the ankle particularly, but the foot is unaffected (Todd, 2010). Both legs are involved and there is often a family history of this condition (Tiwari et al, 2003). However, as the condition becomes more chronic, oedema can develop on top of the existing condition and is known as lipolymphoedema (BLS, 2010).

Assessment

The following clinical investigations can help determine the cause of oedema:

- Lymphoscintigraphy involves injecting a radio-labelled protein and following the flow through the lymphatic system using a gamma camera (Williams and Mortimer, 2007).
- Computed tomography (CT) scanning can identify soft tissue changes and fibrosis.
- Magnetic resonance imaging (MRI) can help differentiate lymphatic, venous, and lipoedema causes of swelling as it identifies a typical honeycomb pattern of dermal thickening in lymphoedema (also applied to CT scanning).

However, Williams and Mortimer (2007) caution that results can be inconclusive. In many cases the key action is to exclude arterial disease and then proceed with management. This can be done with handheld Doppler ultrasound to calculate the ankle–brachial pressure index or a toe–brachial pressure index (Cooper, 2013), but in reality this can be challenging due to the extent of the swelling in the limb, even when a 5 mmHz probe is used (recommended for larger limbs). Pulse oximetry might be useful if Doppler assessment is not possible (Bianchi and Douglas, 2002). Duplex scanning can identify venous disease (Easterbrook and Walker, 2002).

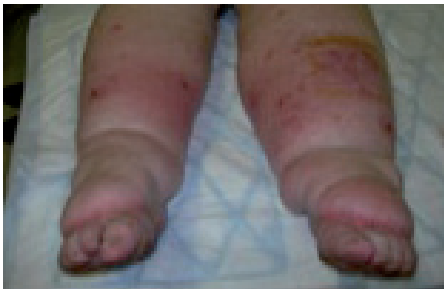


Figure 2. ***Example of lymphoedema.***

There are methods of assessing limb volume and scanning techniques to assess the effectiveness of therapy, but a simple method of assessing the effectiveness of interventions is to measure the circumference of the limb at predetermined and consistently used points (Easterbrook and Walker, 2002). Improvements in the skin condition and texture should also be noted, as well as wound healing. Pain and discomfort must always be taken seriously. The effect of interventions must also be monitored and outcomes acted on if the patient is not experiencing alleviation of symptoms.

It is also important to bear in mind that people with ankle and foot oedema will have impaired mobility and may be more likely to fall or trip. Their skin is also extremely vulnerable to damage and must be protected.

Management

Identifying the cause of oedema involves compiling a careful and detailed history, and undertaking clinical investigation. It also needs input from the healthcare team according to the suspected and identified underlying cause, often involving vascular, medical (e.g. cardiac, renal etc), and dermatology specialists. Due to the chronic and complex nature of oedema it is also vital that those treating the condition are at least competent and ideally are highly skilled in management especially bandaging techniques and skin care, and have a sound understanding of what this condition means for the patient to ensure they get the best advice and support available.

Keeley (2008) reviewed the role of medication in oedema formation, highlighting that corticosteroids, antidepressants, calcium antagonists, and non-steroidal anti-inflammatory drugs can contribute to oedema due to the drug increasing hydrostatic pressure (the pressure in the vessel caused by fluid), which means less fluid is able to be reabsorbed into the lymphatic system from the tissues.

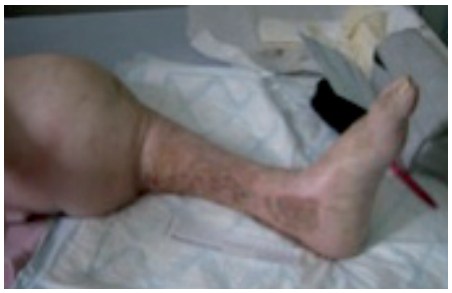
However, these side effects do not affect everyone and the need to treat other conditions must be balanced against the risk of causing oedema (Keeley, 2008). If fluid retention is the cause of oedema, due to heart failure or medication that cannot be reduced or withdrawn, then a diuretic might be used, but diuretics are not effective for "pure" lymphoedema or lymphovenous oedema (Moffatt et al, 2007).

Timmons and Bianchi (2008) describe a disease progression tool for lymphatic and venous disease. The tool indicates the signs of disease and then usefully indicates the level of intervention required according to the clinical presentation. For instance, early signs of venous disease, such as ankle flare and mild swelling, indicate a preventative phase to help stop disease progression, whereas chronic oedema, papillomatosis, and skin folds are signs of severe disease requiring intensive management. Ideally, early and effective intervention would reduce the number of people progressing to the chronic form of the condition.

The Lymphoedema Framework (2006) employed this type of severity model to establish a consensus view on the use of compression in the management of lymphoedema. They came to the following conclusions: frailer patients and those with lipoedema or arterial disease receive a reduced form of compression. Patients with more pronounced disease have more intense intervention dependent on their overall medical condition, age and mobility. The key interventions are compression therapy and skin care. Crucially, these are often required more than weekly in the intense therapy stage (Lymphoedema Framework, 2006).

Venous disease gives rise to a condition called lipodermatosclerosis, which

Figure 3. Example of lipodermatosclerosis.



is visible as staining of the skin (hyperpigmentation), dry, flaky skin changes and fibrosis of underlying tissue making the skin appear uneven and hard to the touch. As the lipodermatosclerosis progresses, the leg can change shape with the calf becoming larger and the gaiter and ankle area narrowing (an inverted champagne bottle shape; *Figure 3*). In lymphoedema, the skin changes are more "cobblestone" in appearance and there are pronounced folds in the skin. Over time, the skin changes, becoming thickened and the rough, called papillomatosis (Tiwari et al, 2003).

Both conditions can cause the leg to appear red and inflamed, which may be mistaken for infection, or correctly identified as cellulitis. In venous disease the most common cause of this "red leg" is the acute phases of lipodermatosclerosis, whereas in lymphoedema cellulitis is quite common (BLS, 2010). Where possible patients with an acute infection should continue compression therapy, but at a reduced level as tolerated in order to maintain control of oedema (Lymphoedema Framework, 2005).

Chronic oedema may take as long as 3 months of intensive therapy to be controlled and for improvements in the skin condition to be seen, so it does require commitment from clinicians and patients. If no improvements are seen, the assessment and management strategy needs to be looked at critically and specialist help sought.

It is important that, when the intensive phase has been successful, the patient is helped to be as fully engaged with their long-term care as possible to maintain the reduced oedema and skin condition. Compression therapy for ongoing maintenance of the improved limb status needs to be at a sufficiently high pressure and monitored for effectiveness.

Conclusion

The cause of lower-limb oedema must be identified and a full patient assessment undertaken so that a comprehensive management package can be instigated. Prompt management of oedema and monitoring of the effectiveness of treatment will help reduce skin breakdown and disruption to people's lives. Practitioners must be knowledgable about the conditions affecting the patient and skilled in management techniques, such as compression therapy, to ensure patient safety and effective treatment. WE

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Medical device-related pressure ulcers: What they are and how to prevent them

A medical device-related pressure ulcer (MDRPU) is tissue damage that can be directly attributed to the use of a piece of medical equipment. Any patient requiring the use of a medical device is at risk of MDRPU development. This article examines preventative measures that can be put in place, with an emphasis placed on scrutinising MDRPU in the same way as any pressure ulcer before a decision is made as to whether the ulcer was avoidable.

Pressure ulceration not only has a detrimental effect on an individual's health and wellbeing, but also adds extra cost burden on the NHS (McIntyre et al, 2012). Studies have shown potential cost savings for the NHS associated with a reduction in pressure ulcer incidence (Bennett et al, 2004; Chambers, 2009; Ross, 2009).

There is currently a national drive to reduce pressure ulcer incidence in all care settings – community and hospital, NHS and private. Therefore, all clinicians have a responsibility to be aware of all possible causes of pressure damage. Most potential causes of pressure damage are identified with pressure ulcer risk assessment tools (Waterlow, 1985).

In January 2011, the Quality, Innovation, Productivity and Prevention Safe Care (Safety Express) programme set the goal of reducing pressure ulcer incidence in the UK by 80% in the acute setting and 30% in the community. This drive continued through the "harm free care" concept and the Patient Safety Thermometer (NHS, 2012).

The most common sites of pressure ulcer development are bony prominences, such as the coccyx, ischial tuberosity, and sacrum. As this is common knowledge, much emphasis has been placed recently of the prevention of these types of pressure ulcers. However, there is evidence that medical devices can be a source of pressure damage and greater awareness among clinicians about the potential risks to the patient is needed (Wounds UK, 2013)

A medical device is defined by the European Commission in the EU Medical Devices Directive (2009) as: "Any instrument, apparatus, appliance, software, material or other article, whether used alone or in combination […] intended by the manufacturer to be used for human beings."

What are MDRPUs?

A medical device-related pressure ulcer (MDRPU) is tissue damage that can be directly attributed to the use of a piece of medical equipment. The medical device rubs against the individual's skin and creates damage secondary to friction and/or shearing forces.

"There is evidence that the medical devices required for treatment can be a source of pressure damage and greater awareness among clinicians about the potential risks to the patient is needed."

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The same equipment may also create pressure on soft tissue and this, too, can cause skin damage (Jaul, 2010). Some medical devices must be secured to the body and the adhesives used to fix the device into position can cause irritation and damage (Black et al, 2010).

It is important that every clinician understands that any equipment used in caring for a patient has the potential to cause harm. The scope of medical devices can range from a simple continence pad to an invasive central venous pressure line, or fine bore nasogastric tube.

Contributory factors in MDRPU development

Any patient requiring the use of a medical device is at risk of MDRPU development. However, there are those at greater risk due to predisposing factors, such as diabetes, airways disease, or cardiac failure. It is the responsibility of the clinician to ensure an appropriate risk assessment is implemented to reduce the risk of pressure ulcer development.

Therefore, risk assessment should not only include the well-established contributory factors of pressure ulceration, but also any medical devices required for care.

Medical devices play an essential part in a patient's treatment regimen and, as such, MDRPU damage is often more difficult to prevent than more common pressure ulcers. For example, a heel ulcer may be avoided with the use of a pressure-relieving boot, however, a face mask delivering much-needed oxygen must not be removed. One example of this given by Fletcher (2012) is the use of a continuous positive airway pressure (CPAP) mask that must have a tight seal. The seal cannot be compromised, but the mask may lead to an MDRPU on the bridge of the nose, especially if the patient is oedematous (Black et al, 2010).

Circumstances may arise when pressure damage is unavoidable as a consequence of saving someone's life (Wounds UK, 2010; NHS Midlands East, 2012). To establish that the pressure ulcer is unavoidable, it must be clearly demonstrated that any risks were recognised and all measures had been taken to safeguard the patient from harm (*Table 1*).

MDRPU risk areas

In the healthcare setting, it is vital that clinicians understand that on repositioning, they must ensure the patient's skin is free from external pressure. Similarly, the clinician visiting a patient at home must ensure that any medical devices used – whether urinary catheters, compression bandages, or adhesive wound dressings, for instance – are used appropriately and risk to the patient is minimised.

It is not only older people or the acutely ill who are at a higher risk of MDRPU development. In the case of the paediatric patient, for example, it has been estimated that 50% of pressure ulcers are device related (Wounds UK, 2013). Young children may be left with visible reminders of an

Table 1. Contributory factors of pressure ulcer development (adapted from Norman, 2013).

Risk factor	Problem arising from risk factor	Solution
Reduced/mobility/ immobile	Inability to reposition and therefore unable to relieve pressure. Hoist required for transfer, incorrect size sling may cause medical device-related pressure ulcer (MDRPU).	Therapist input; encouragement to reposition; pressure relieving equipment; skin assessment. Ensure hoist sling not left under patient. Correct size hoist sling must be used.
Reduced nutritional intake	Severe weight loss. Pressure areas become more prominent.	Dietetic assessment. Supplements introduced. Increase proteins in diet.
Incontinence	Excoriation from urine or faeces. MDRPU can result from urinary catheter tubes lying under patients.	Continence assessment, barrier creams prescribed if needed. Clinicians must ensure patient is not lying on tubing.
Ageing skin	Less collagen and reduced elasticity leading to fragile skin. Wound dressings and adhesive tapes may cause MDRPU on removal.	Less vigorous handling; use of simple, non-perfumed cleansing products; pat skin dry. Minimise use of adhesive wound dressings/tapes. Remove using adhesive solvent.

MDRPU, leading to a negative effect on wellbeing due to scarring, underlining the need for greater vigilance in this age group (Kozierowski, 1996).

The neonate is also at increased risk due to the thinness of their skin. Pre-term infants (>30-week gestation) have two or three layers in the stratum corneum (within the epidermis), compared to 10–20 in infants and adults, with less fibrils connecting the epidermis to the dermis (Wounds UK, 2013). As a pre-term infant's skin is more fragile, it is at greater risk of blistering from friction and trauma. Any adhesive tapes/fixation devices required to secure a medical device can have a stronger bond than that between the epidermis and the dermis of the pre-term infant and can, therefore, cause full stripping of the epidermal layer on removal (Butler, 2006).

It is important that young people's skin is monitored closely and dermal gel pads, dressings, and barrier creams are used appropriately to reduce the risk of MDRPU development. The use of a more gentle silicone tape or adhesive dressing should be considered and water-based solvents used in the removal of adhesives to minimise tissue damage (Wounds UK, 2013).

Preventing MDRPUs

Some MDRPUs may be unavoidable due to the device being necessary to sustain life. If measures to prevent the pressure ulcer are not undertaken or documented, however, it can be argued that the caregiver caused harm to the person in their care.

To promote the delivery of high-quality care across all healthcare settings, it is vital there is an open discussion critiquing healthcare provision for those with a pressure ulcer. It is important that in these cases, all preventative interventions are documented and a root cause analysis (RCA) undertaken (*Table 2*).

The completion of the RCA should be guided by underpinning evidence and best practice guidelines. The completed RCA for the MDRPU must be treated in the same way as one for other pressure ulcers, with the same level of scutiny employed. Only then can a decision be made regarding the avoidability of the skin damage.

The need to assess the skin for discolouration, indentations, differences in texture, and hot regions should be standard practice in the prevention of MDRPUs. The skin should be reassessed during interventions or at least at every staff shift change, especially underneath or around medical device sites. All tubing should be sighted and documented as to where it is placed anatomically to ensure it is regularly repositioned (Wounds UK, 2013).

Many medical devices require adhesive dressings and tapes to be fixed to the person's skin and these can also cause skin damage. If signs of irritation are present, such as red colouration around the dressing, the dressing should be

Table 2. Medical devices and their potential risks to skin (adapted from Norman, 2013).

Medical device	Area at risk of skin damage	Solution
Anti-embolism stockings *(Figure 2)*	Lower-limb, below knee	Risk assessment regarding necessity and alert for contraindications. Clinician should trained in measurement and selection of correct sizes. Daily removal and skin inspection.
Oxygen/continuous positive airway pressure masks/nasal cannula	Nose, forehead, eyebrows, cheeks-	Correctly fitting mask/device, use of dermal padding/hydrocolloid dressing to relieve pressure padding/barrier cream on skin, regular skin assessment. Check tension from straps and loosen at least once per shift for skin assessment (Fletcher, 2012).
Continence pad	Buttocks, thighs, back	Continence assessment. Ensure correct size pad worn. Use of one pad, use of barrier cream, regular skin inspection.
Simple retention bandage *(Figure 1)*	Limbs	Apply from base of toes to below knee, without over stretching; observe for oedema. Use tubular bandage as alternative.
Urinary catheters/leg bags	Thighs, legs, labia, penis, buttocks, lower back	Continence assessment; slacking of tubing when securing; ensure leg bag is secured; regular skin inspection; ensure it is not left under patient.

Figure 1. ***Pressure ulcer resulting from bandage damage.***

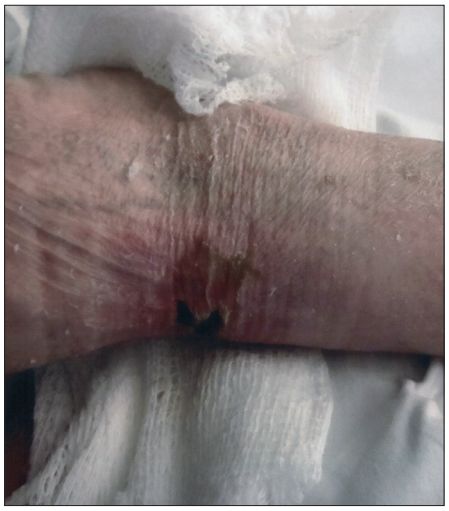
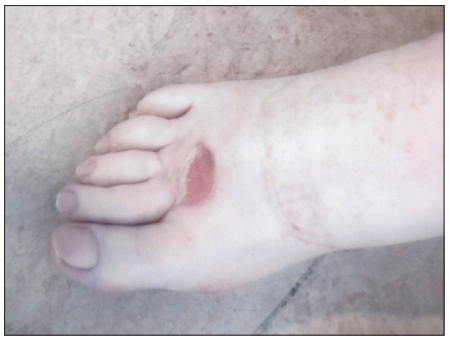


Figure 2. ***Pressure ulcer resulting from anti-embolism stockings.***



removed and an alternative used. Any patient requiring a medical device for a long period of time should automatically be given a skin assessment, while preventative measures should be put in place to avoid skin damage (i.e. barrier creams – such as Cavilon® [3M] and Proshield® [H&R Healthcare] – padding, gel pads, and dressings to protect the skin beneath the medical device).

Despite putting these preventative measures in place, any increase in odema will affect the pressure exerted onto the skin by the medical device. There needs to be an understanding that a previously well-fitting tube inserted pre-odema may become taut and create more pressure. If the patient is not reassessed or repositioned, this could result in underlying skin damage.

Conclusion

Medical devices are a necessary and sometimes lifesaving part of patient care. This being the case, every caregiver must be aware the risk of damage. Clinicians must take action to prevent harm during each patient interaction and document this activity accordingly. If an ulcer develops, it is vital that documentation is clear and concise to aid the completion of the RCA, which will establish whether the damage was avoidable and highlight any areas that may have been lacking.

Equally, device manufacturers should be encouraged to reassess their products, via lobbying if necessary, with the aim of producing a more improved device that is less detrimental to the skin. The creation of less rigid or cushioned tubing, or even a new alternative to tubing would undoubtedly be welcomed by patients and clinicians alike. WE

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Understanding the differences between barrier products and emollients

Good skin care is the cornerstone of nursing care. With an ever-increasing amount of specialist skin care products available, clinicians can confuse emollients and barrier products. This article explains the differences between barrier products and emollients, examining the difference between traditional barrier creams and newer silicone-based versions.

"The terms 'emollient moisturisers' and 'barrier creams' are often – incorrectly – used interchangeably."

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Under normal circumstances, the epidermis (the upper layer of the skin) provides the first line of defence, acting as a physical barrier between the external environment and the body. When intact, the epidermis prevents the entry of pathogenic organisms, minimises the absorption of harmful substances, and prevents excessive water loss from the body (Benbow, 2007; Voegeli, 2010).

However, where there is over-hydration of the skin from prolonged exposure to moisture – such as occurs during urinary or faecal incontinence, highly exuding wounds, or excessive perspiration – skin integrity becomes compromised and breakdown occurs (Flynn and Williams, 2011; Voegeli, 2013).

By contrast, changes in the skin associated with ageing can lead to thinning and dryness, and the need to add moisture (Wounds UK, 2012).

A range of products are available to address both over- and under-hydration of the skin. However, in the author's experience, clinicians are often unsure about the differences between a barrier product and an emollient. This is supported by Voegeli (2007) who stated that the terms "emollient moisturisers" and "barrier creams" are often – incorrectly – used interchangeably.

In order to provide a high standard of skin care, it is essential to understand the differences between a barrier product and an emollient, as both have different mechanisms of action. Crucially, a barrier product is designed to protect the skin from over-hydration, while emollients are used to hydrate the skin. Although some barrier products have mild hydrating properties, they are predominately meant to protect the skin and not hydrate it and, therefore, should not be used as a substitute for an emollient. Vice versa, emollients are designed to hydrate the skin and should not be used as a substitute for a barrier product (Voegeli, 2010).

Emollients

The term "emollient" is derived from the Latin meaning "to soften" (Voegeli, 2010). The terms "emollients and "moisturisers" are often used interchangeably due to their similar primary function, namely, to soothe, smooth and hydrate the skin, and

both are indicated for dry or scaling skin conditions (Voegeli, 2010; British National Formulary [BNF], 2013).

Emollients are available in the form of bath additives, sprays, lotions, creams, and ointments, and are variations on an oil-and-water emulsion, – either oil-in-water or water-in-oil – with oil-in-water emulsion being the most common (Benbow, 2007; Voegeli, 2010).

Emollients provide a lipid film on the surface of the skin, which allows water to be trapped in the stratum corneum. This, in turn, allows the cells to swell and helps restore the skin's permeability, flexibility, and barrier function. The choice of emollient is dependent on the severity of the skin condition and patient choice. The most effective emollient is one that the patient is confident using (Lawton, 2004).

It should also be noted that the effect of an emollient is short lived and should, therefore, be re-applied frequently (three to four times daily; Lawton, 2009).

To reduce the risk of bacterial contamination, emollient in a tub must be removed with a clean spoon or spatula. Enough emollient to make the skin glisten should be applied in the direction of hair growth to prevent the risk of folliculitis (inflamed or infected follicles).

It is also important to note that the use of emollients with high paraffin content (e.g. emulsifying ointment, 50% liquid paraffin, 50% soft white paraffin), can be a fire hazard. This risk increases if the product is applied to large areas of the body, where clothing can become saturated with the product and could be ignited by a naked flame. Therefore, patients should always be informed of the risk of fire with the use of these products (Lawton, 2009; BNF, 2013).

Barrier products

Unlike emollients, barrier product are designed to form an occlusive barrier between the skin and noxious substances (e.g. as urine and/or excessive wound exudate) to which the skin may be exposed (Beldon, 2012).

Various barrier products are available to help prevent skin damage from over-hydration, which are available as creams, films, or wipes. They are used as part of the treatment regimen for patients who are at risk of skin damage from prolonged exposure to moisture (Bardsley, 2012). There are several different types of barrier products available, ranging from traditional generic products (such as zinc oxide), to the more recently launched silicon-based products (Voegeli, 2010).

Ideally, a barrier product should be suitable for use on both intact and broken skin, it should be hypoallergenic, transparent, easy to apply, breathable, have protective properties, and minimal discomfort on application (Voegeli, 2008; Flynn and Williams, 2011).

However, not all barrier products are suitable for everyone; Metanium® (Thornton & Ross) and Drapolene® (Chefaro UK), for example, are indicated for nappy rash in babies and infants and may, therefore, be inappropriate for use with adults (Bardsley, 2012).

Traditional barrier products are available in the form of creams and consist of a lipid–water emulsion base with the addition of metal oxides, such as zinc or titanium (Voegeli, 2010).

Although these traditional products are effective in repelling moisture, there are disadvantages to their use. These include:

- Some ingredients can cause allergic reactions in some individuals. For example, zinc and castor oil cream contains arachis (peanut) oil, which some people are allergic to (Voegeli, 2010; Bardsley, 2012).
- Paraffin-based products can be flammable if used in large quantities (Bardsley, 2012).
- Barrier creams may clog continence pads (Voegeli, 2007). However, Bolton (2004) states that clogging of continence products is more likely to be due to inappropriate application.
- Zinc oxide creams can make observing the skin difficult.
- Zinc oxide can be difficult to remove from the skin surface, which may lead to further skin damage.
- Zinc oxide can also interfere with the adherence and retention of dressings (Penzer, 2009; Bardsley, 2012).

New generation barrier products

Since the mid 1990s, a variety of new dimethicone barrier products have become available. Dimethicone is a silicone oil used in a number of medical device applications. The barrier formulations provide a thin, semi-permeable, protective polymer film to the skin. These products are available as creams, films, mousse, and wipes (Voegeli, 2008; Beldon, 2012).

Studies have demonstrated that the dimethicone-based barrier products are as efficacious as traditional barrier products (Flynn and Williams, 2011; Guest et al, 2011). However, despite the fact that they are more expensive, a number of studies suggest that dimethicone barrier products are more cost effective than traditional barrier products (Guest et al, 2011).

Dimethicone barrier products are easier to apply than traditional products and, therefore, reduce the amount of clinician time. They also last longer, resulting in less product being used. They are hypoallergenic and alcohol free, which makes them more comfortable for the patient (Guest et al, 2011; Beldon, 2012). Examples of traditional barrier products, dimethicone-based barrier products, and emollients are displayed in *Table 1*.

Barrier product application

Prior to the application of any product, it is important that the clinician undertakes a holistic assessment of the patient to ensure that the product selected is appropriate for their needs. The application of any product

should be undertaken in line with the manufacturer's instructions.

Any contributory or undelrying factors should be addressed where possible (e.g. addressing incontinence issues, managing excess wound exudate, etc)

The use of fluid collection devices and selection of appropriate dressing should also be a priority. The application of barrier products to protect the periwound skin is, therefore, only part of the treatment regimen, and should not be viewed as the only option (World Union of Wound Healing Societies, 2007).

Peristomal skin

Where deemed appropriate, there are silicone-based barrier wipes that have been specifically designed to be used under adhesive stoma products to protect the skin from trauma. Wipes generally provide greater flexibility than traditional barrier products; patients generally find them easier to use as they make adhesion of the appliance easier than traditional barrier creams (Voegeli, 2008; Burch, 2011).

Incontinence

Prior to the application of the barrier product, the skin should be cleansed. However, washing with soap, particularly following frequent episodes of incontinence, can lead to dryness and cracking of the skin (Voegeli, 2007). Therefore, a non-soap cleanser or low pH soap is recommended. There are several non-soap cleansers available on the Drug Tariff. Proshield® Foam & Spray (H&R Healthcare) is a non-soap cleanser, which has the added benefit of breaking down dried stools (Flynn and Williams, 2011).

Following cleansing, the skin should be patted dry and then a suitable barrier product applied. The clinician must always make sure that the barrier product selected is appropriate for use with continence products. It should also be noted that not all barrier creams are suitable for use on broken skin (Voegeli, 2007; Beldon, 2008).

It should also be noted that skin damage caused by exposure to incontinence (moisture lesions) is often mistaken for superficial pressure damage, and vice versa. Differentiating between the two is important as the treatment regimen differs for both (Jones, 2010; Yates, 2012).

Conclusion

Good skin care is an integral part of nursing care. To ensure this takes place, the clinician must familiarise themselves with relelvant techniques and skin care products. It must be remembered that emollients hydrate the skin, while barrier products protect it, and one should not be used as a substitute for the other. We

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Table 1. Examples of traditional barrier products, dimethicone-based barrier products, and emollients (Voegeli, 2010; Journal of Wound Care, 2011).

Traditional barrier products	Dimethicone-based products	Emollients
Zinc cream	Cavilon® (3M) barrier cream and film	Emollin® (CD Medical) spray
Zinc Ointment	LBF® (CliniMed) sterile no-sting barrier wipes	Epaderm® (Mölnlycke Health Care) ointment and cream
Zinc and castor oil ointment	Medihoney® (Derma Science) barrier cream	Hydromol® (Alliance Pharmaceuticals) ointment
Drapolene® (Chefaro UK)	Proshield® Plus (H&R Healthcare)	Zerocream® (T&R Derma) emollient cream

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Avoiding allergic contact dermatitis in wound management

Dermatitis is inflammation of the skin, is not infectious, and is characterised by intense itching. It is a common condition that can be divided into two types: irritant and allergic. The steps that should be taken to avoid allergic contact dermatitis are outlined here.

As the skin ages, it becomes more sensitive to external irritants and, therefore, the possibility of dermatitis increases. The incidence of contact dermatitis is unknown, probably because not all individuals who suffer an episode report to their GP or are referred to a dermatologist. Anecdotally, it is likely that some individuals decide for themselves the root cause of the dermatitis and then stop using that product on their skin. However, for those who experience an episode of intense dermatitis, especially where there is a pre-existing wound or ulcer, it can be painful.

What is contact dermatitis?

Dermatitis is inflammation of the skin, is not infectious, and is characterised by intense itching. The skin can become inflamed and swollen with broken and exuding skin (*Figure 1*). The individual may complain of itching, burning, stinging, and generalised pain (Bianchi, 2011).

Contact dermatitis can be divided into two types; irritant and allergic. Allergic contact dermatitis (ACD) occurs in individuals whose skin has previously been exposed to, and sensitised by, an allergen. Subsequent contact with the allergen causes a cell-mediated response within the immune system and an inflammatory response (*Figure 2*).

Irritant dermatitis results from contact with an external agent (i.e. detergents, soaps, solvents, chemicals).

The most common areas affected by contact dermatitis are the face, hands, and legs, as these areas of the body are the most exposed and, therefore, most likely to come into contact with irritants. If the skin in those areas is already broken, due to a minor injury or ulceration, the individual becomes more prone to developing a sensitivity or allergic reaction to a skin cream, lotion, ointment, or wound dressing (Barron et al, 2007).

Older people and ACD

The older person is most at risk of an ACD as their skin is less supple and robust and may have already developed asteatotic eczema (itchy dry skin that, if aggravated, can appear as superficial fissures). It is more commonly seen in men and usually occurs on the lower leg (Van Onselen and Cox, 2011).

Older people are advised to care for their skin by using a soap substitute and applying emollient to their skin (Wounds UK, 2012), which can reduce pruritus (intense itching). However, many products contain preservatives and these can act as a sensitiser to the skin, causing ACD (Tavadia et al, 2003).

"The most common areas affected by contact dermatitis are the face, hands, and legs, as these areas of the body are the most exposed and, therefore, most likely to come into contact with irritants."

PAULINE BELDON
Tissue Viability Nurse Consultant, Epsom and St Helier University Hospitals NHS Trust, Carshalton

Figure 1. ***In dermatitis the skin is itchy, painful, and weeping.***

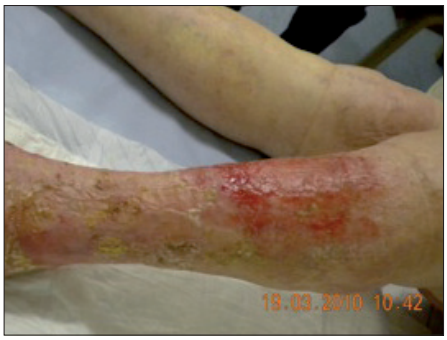
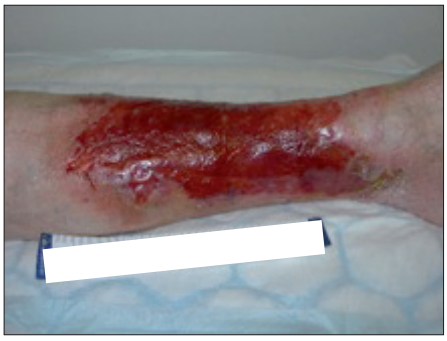


Figure 2. ***The patient has had a hydrocolloid dressing applied to a leg injury. Repeated applications of the hydrocolloid dressing have led to an increasing inflammation in the skin, which is painful and moist.***



Causes of ACD

There are numerous causes of ACD and some may surprise both clinician and patient. Preservatives are contained in all creams and lotions, and can trigger an allergic reaction in an individual who has used the same cream for many years, but has recently developed another wound or skin problem, which has rendered them hypersensitive. This is most common in patients with venous leg ulcers (Lim et al, 2007).

A list of potential irritants/allergens in emollients, lotions, and creams that can act as an irritant or allergen is illustrated in *Table 1*. In addition, an adhesive wound dressing that a clinician may have used on many patients without complaint, could trigger ACD in some individuals. It is not the dressing itself that has caused the ACD, but the adhesive used on the dressing border. The patient must be made aware of this information or they may remain under the false impression that an entire group of a particular dressing can cause a similar effect.

Differentiating between infection and ACD

The signs of infection are erythema, inflammation, local oedema, pain, discomfort, and pyrexia (European Wound Management Association [EWMA], 2005). It is vital that the clinician draws on their clinical knowledge to differentiate between infection and dermatitis. If the wound/ulcer is infected, the patient would be expected to have a pyrexia, while if the cause is dermatitis, this would not be the case.

However, there are some instances when the patient might not exhibit a pyrexia or other symptoms of infection as might be expected (i.e. if the patient has diabetes or is receiving chemotherapy or long-term steroid therapy, all of which mask infection). Therefore, the clinician must familiarise themselves with the patient's medical history.

Prevention of ACD

Good practice dictates that, prior to treating any wound or ulcer, the clinician should question the patient regarding any previous instances of ACD or whether they are aware of any product that triggers a reaction in their skin. If the patient discloses any previous allergy, then dressings containing said allergens should be avoided.

In those patients that declare one allergy, it can be assumed they have the potential to develop further allergies. Consequently, the clinician should avoid all products containing potential sensitisers to the individual's skin. It is a common misconception that individuals cannot be sensitive/allergic to products without preservatives that are bland (i.e. liquid paraffin in white soft paraffin 50:50). There are many similar preparations that have added preservatives to increase the product's shelf life (i.e. Epaderm® Ointment [Mölnlycke Health Care] contains liquid/white soft paraffin, but also includes cetostearyl alcohol).

Clinicians should ask patients various questions to identify those at risk of ACD. These should include whether the person's skin has ever reacted to the following:

- Sticking plaster or any adhesive wound dressing.
- Any metals (i.e. earrings, rings, or watch straps).
- Wool or lanolin.
- Over-the-counter skin soaps, lotions, or creams.
- Dyes.
- Perfumes.
- Rubber (e.g. washing-up gloves).
- Any cream or ointment prescribed by a doctor (Beldon, 2009).

Treatment of ACD

Primary treatment must focus on the removal of any wound management product, cream, or bandage that could be the cause of ACD. This should be replaced with a product that does not contain any known irritants or allergens.

If an allergic reaction has been severe or recurrent, the patient should be referred to a dermatology department for patch testing. This will aid identification of the allergen/irritant and the dermatologist must also provide the patient with vital information regarding which commonly-used products may contain the same irritants/allergens, enabling them to identify other potential sources, perhaps around the home, that may trigger another bout of ACD.

The use of a soap substitute to clean the skin, such as an emollient wash cream (i.e. Hydromol® Ointment [Alliance Pharmaceuticals], aqueous cream, Doublebase® cream [Dermal Laboratories]) will help to soothe the skin, although care should be taken that the offending irritant/allergen is not present in the cleanser (*Table 1*).

Following cleansing, the application of an emollient (the medical term for moisturiser) will help to soothe the inflammation.

In minor to moderate cases of ACD, the skin may calm once the offending irritant is removed and the skin has been moisturised. However, in severe cases, the application of a steroid ointment may be necessary, which should be applied regularly and on the direction of a clinician (adapted from Bourke et al, 2009).

Good practice

It could be argued that good practice would involve the avoidance of all potential allergens for all patients. Consequently, while it is vital for infection control purposes that clinicians wear gloves when changing dressings, these should be vinyl, non-powdered gloves to reduce the risk of ACD, since rubber (latex) allergies are fairly common (Wilkinson and Bird, 1998).

When dressings or bandages are removed, the clinician should inspect the patient's skin for signs of inflammation and take note if the patient complains of irritation or itching skin. If there is any doubt, the clinician should check the patient's treatment regimen for possible allergens and substitute for another product where relevant.

The patient's wound/ulcer should be cleansed with either water or saline and, in some cases, an emollient should be applied to care for the surrounding skin (i.e. patients with leg ulceration, where the skin has become dry and irritable). If the skin is not appropriately cared for, other problems may develop, such as fungal infection (Newton, 2013).

If the patient has described a previous condition that could have been ACD, then the use of a bordered, adhesive product should be eliminated as a potential treatment tool. Only non-adhesive or non-bordered wound dressings will reduce the risk of adhesives sensitising the skin (*Figure 3*).

Furthermore, some people are allergic to rubber (*Figure 4*). In these cases, the clinician should ensure that only bandages without rubber or elastane are used, which can prove difficult since many tubular bandages rely on elastane to ensure conformability to the patient's limb (i.e. Tubifast® [Mölnlycke Health Care] and Comfifast® [Synergy Health]). These should be replaced by a non-elasticated tubular bandage, such as Stockinette® or Tubinette® (both Mölnlycke Health Care), which are 100% cotton.

Some compression bandages will contain rubber, thus, the clinician must check and either seek an alternative for patients with a history of ACD or ensure there is always a layer of 100% cotton tubular bandage between the patient's skin and the bandage (Bourke et al, 2001).

Table 1. Irritants and allergens in commonly used emollients, lotions, and creams.

Potential allergen/irritant	Emollient, lotion, or cream
Benzalkonium chloride	Dermol® 500 (Dermal Laboratories Ltd), Dermol cream (Dermal Laboratories Ltd), Oilatum Plus (Stiefel).
Benzyl alcohol	Aveeno® cream and lotion (Johnson & Johnson), Balneum Plus® cream (Almirall Ltd), E45 Itch Relief cream (Forum Health Products Ltd), E45 lotion (Forum Health Products Ltd), Oilatum cream (Stiefel), Eucerin Dry Skin (Beiersdorf).
Cetyl/cetostearyl/cetearyl/ stearyl alcohol	Aqueous cream, Aveeno cream and lotion, Balneum Plus cream, Cetraben® emollient cream (Genus Pharmaceuticals), Dermol 500 lotion and cream, Diprobase® cream (Schering-Plough), Doublebase® bath additive (Dermal Laboratories Ltd), E45 cream, Hydromol® ointment (Alliance Pharmaceuticals), generic emulsifying ointment.
Chlorhexidine	Dermol 500 cream and lotion.
Lanolin and derivatives	E45 cream and lotion, Oilatum emollient, Oilatum Plus, Oilatum Junior bath.
Lauromacrogol	Balneum Plus cream. E45 Itch Relief cream.
Parabens	Balneum bath oil, Cetraben emollient cream, E45 cream and lotion, Hydromol cream.
Perfumes	Aveeno bath oil, Oilatum emollient.
Phenoxyethanol	Aqueous cream, Cetraben emollient cream, Dermol 500 lotion and cream, Doublebase emollient bath, Hydromol cream.

Ten top tips

Ten top tips to avoid allergic contact dermatitis are to:

1. Always question the patient regarding any previous allergic reaction to skin lotions, creams, emollients, or anything that has previously caused a skin reaction, including wool, metals, dyes, rubbers, and perfumes as these are the most common irritants.
2. Examine the patient's skin for signs of asteatotic eczema. If this is present then products with potential irritants/allergens should be avoided.
3. Avoid the use of adhesive, bordered wound dressings in any patients reporting symptoms of skin irritation in previous treatments.
4. Always wear vinyl, non-powdered gloves, for both the patient and your own skin protection.

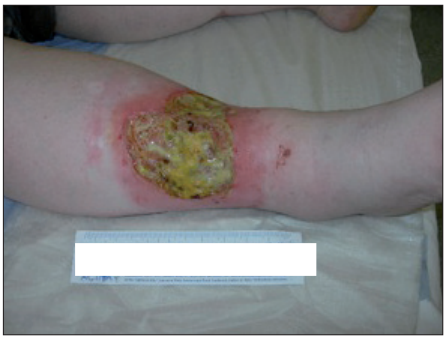


Figure 3. ***The patient has a clear outline of a wound dressing, where the adhesive border has caused a skin sensitivity. Continued use has led to allergic contact dermatitis.***

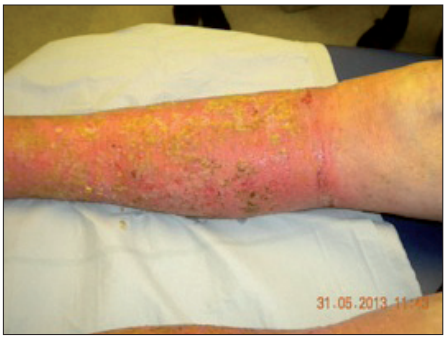


Figure 4. ***The patient has developed allergic contact dermatitis due to rubber in an elasticated tubular bandage.***

5. If the patient is an older person, question them regarding their skin cleansing routine. Use of soaps is inadvisable in the older person, due to the excessive drying effect. Suggest a soap substitute.
6. If the patient shows signs of mild skin dryness/irritation, this may be calmed by using an emollient.
7. On removal of wound dressings, always inspect the periwound skin for signs of irritation.
8. If the patient requires lower-limb bandaging, using 100% cotton, tubular bandages will protect from possible irritation.
9. If the patient develops symptoms of possible ACD, review all products used on the patient's skin. Replace any that may be irritants.
10. If a patient has recurrent or intractable ACD, refer immediately to the dermatology department for treatment and/or patch testing.

Conclusion

Wound management, especially for the older person, can be complicated, involving care of both the wound and patient's skin. An understanding of the potential problem of ACD, together with a thorough assessment of the patient and their skin is required prior to wound treatment. Clinicians must be aware of the frailties of the older person's skin and that gentle care is a must. WE

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Maintaining healthy skin: Key messages for older people

As the UK population ages, increasing numbers of people are at risk of age-related skin problems. Ageing leads to structural and physiological changes that increase the risk of skin problems, such as infection, pressure ulcers, dermatitis, and skin tears. This article emphasises that prevention is better than cure and clinicians can work with older people and carers to maintain healthy skin, and reduce the risk of skin damage.

The UK population is ageing. In 1961, 592 people celebrated their 100th birthday. By 2012, this figure had risen to 14 500, and by 2035 an estimated 110 000 people in the UK will be 100 years of age (Office for National Statistics [ONS], 2012).

Ageing affects every aspect of the body, including the skin. Ageing leads to progressive structural and physiological skin changes that increase the risk of skin problems (e.g. venous eczema) which, in turn, increase patients' vulnerability to skin damage, such as pressure ulcers, leg ulcers, and skin tears, as well as decrease healing ability (Fowkes, 2006; Farage et al, 2009; Stojadinovic et al, 2013).

This article aims to enable nurses to understand how age-related changes affect the skin and what they can do to aid older people in maintaining healthy skin.

The functions of the skin

The skin has five main functions: protection, sensation, heat regulation, storage, and absorption. It acts as a barrier to the external environment, preventing harmful bacteria from entering the body and protecting internal organs from damage. It also prevents the loss of vital body fluids. As the skin ages, its barrier function deteriorates. This deterioration affects immune function and increases the risk of the older person developing skin problems.

Age-related skin changes

The skin consists of three layers of cells: the epidermis, dermis, and subcutaneous tissue (Herlihy and Maebius, 2000). Ageing and lifestyle factors affect each layer of the skin. *Figure 1* illustrates the differences between old and young skin.

The epidermis

The epidermis – the skin's outermost layer – contains no blood vessels and thins as people age. For example, the epidermis of an 80 year old is 50% thinner than that of a 30 year old (Makrantonaki and Zouboulis, 2007).

The epidermis is divided into five layers. The stratum corneum is the outermost of the five layers and is primarily composed of a layer of keratinised cells. The cells of the epidermis are dead, are constantly being shed, and are replaced by cells from the deep layers. This process

"Ageing affects every aspect of the body, including the skin. Ageing leads to progressive structural and physiological skin changes that increase the risk of skin problems."

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Glossary

Collagen: A protein that are found in the human body. It gives strength and structure to the skin.

Dermis: The layer below the epidermis, containing blood vessels, nerves, hair follicles, sweat glands, and sebaceous glands.

Epidermis: The outer layer of the skin.

Elastin: A protein in connective tissue that is elastic and allows many tissues in the body to resume their shape after stretching or contracting. Elastin helps skin to return to its original position following distortion.

Melanocytes: Cells that produce the pigment called melanin, which gives colour to the skin, hair, and parts of the eye. They protect the skin from sun damage. Melanocytes are located in the lower part of the epidermis, just above the dermis.

Stratum corneum: Layer of keratinised cells that forms a barrier to protect underlying tissue from infection, dehydration, and chemical and mechanical stress.

takes approximately 28 days in young, healthy people. Cell replacement slows with ageing and the skin becomes thinner and more easily damaged.

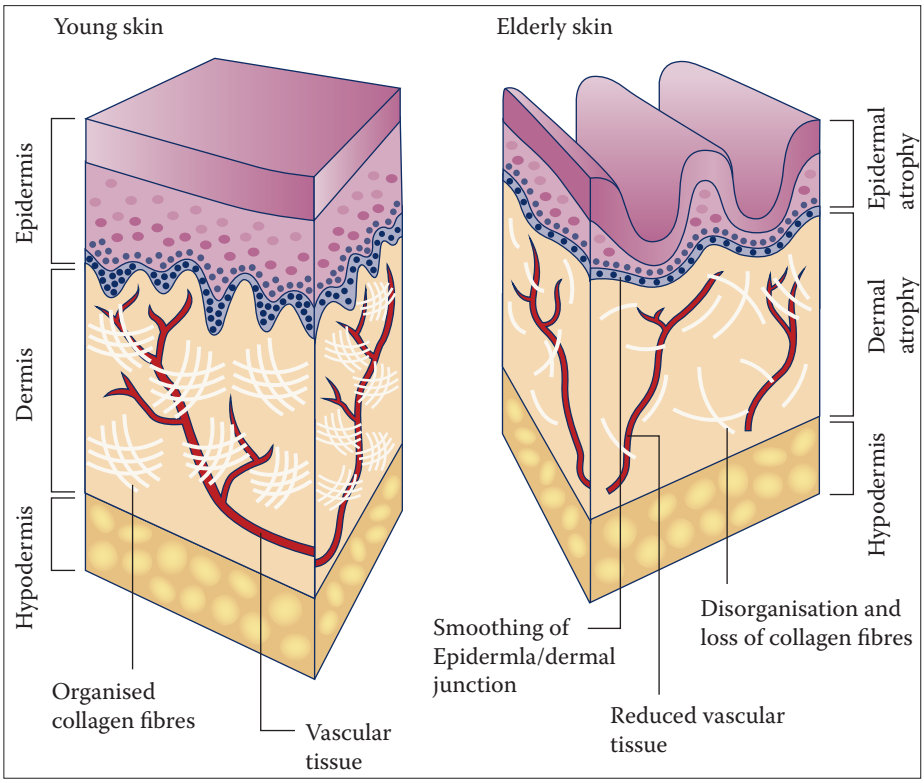
The epidermis contains melanocytes, which produce melanin to protect the skin from sun damage. As people age, less melanin is produced, resulting in older people of all races being more susceptible to sun damage (Gilhar et al, 2004; Minaker, 2011).

The dermis

The dermis supports, and attaches firmly to, the epidermis; this connection between the two becomes less secure as people age. Complex dermal protein fibres (known as collagen) provide strength and elasticity. Collagen contains thin strands of elastin and this elastin gives skin its flexibility and allows it to return to its normal shape after it has been distorted. Ageing reduces the amount of collagen produced, as well as the strength of collagen and elastin, which leads to skin sagging and wrinkling, and increases the risk of skin tears and bruising (Nazarko, 2009; Calleja-Agius et al, 2013).

The skin's blood vessels, nerve endings, hair follicles, sweat glands, and lymphatic drainage vessels are located in the dermis. The blood vessels carry blood and nutrients to the skin and aid temperature regulation by dilating and constricting. Ageing causes arteries to thicken, and capillaries thin, thus reducing the blood supply to the skin.

Figure 1. ***How ageing affects the skin***



The subcutaneous layer (hypodermis)

The subcutaneous or fatty layer carries the larger blood vessels that supply the skin. It acts as a thermal barrier and energy store for fats and water in the body. It also disperses localised pressure, protecting the superficial skin from the effects of internal bony prominences.

As people age, subcutaneous fat is lost and veins are more prominent and easily damaged. The skin may appear more transparent. The lipid and water content decreases, meaning that the skin becomes dryer, increasing the risk of cracked skin and infection (Fore, 2006).

Impact of lifestyle factors and illness on the skin

Certain factors accelerate skin ageing. The skin is easily damaged by ultraviolet light and excessive sun exposure can cause dryness, irregular pigmentation, loss of collagen, and deep wrinkling. Areas of the body

that are most often exposed to sun, such as the hands and forearms, age more rapidly than areas normally covered by clothing, such as the abdomen and buttocks.

Smoking deprives the skin of oxygen and accelerates the ageing process (Okada et al, 2013). Poor general health, poor nutrition, and inadequate fluid intake can also accelerate skin ageing (Posthauer et al, 2013).

Protecting skin from damage

Older skin is more vulnerable to damage than younger skin so it is important that clinicians do their utmost to protect the skin of the older person from damage. One of the most important steps that the clinician can take is to educate the older person, and those who support and care for them.

The principles of caring for the older person's skin are to prevent dryness, replace lost moisture, maintain the skin's barrier function, protect from chemical and mechanical damage, and be alert to changes that may require treatment.

Kottner et al (2013) recently reviewed of the evidence in relation to skin care for older people. They examined 187 published articles and concluded that "the evidence base for basic skin care in the elderly is weak". They found there was little evidence to recommend one skin cleansing regimen over another. Therefore, it can be assumed that the provision of effective skin care in older people is based not on evidence, but on the clinician's experience.

Preventing dryness

There is a protective, oily layer on the skin's surface made up of lactic acid and amino acids secreted from sweat glands, free fatty acids from sebum and amino acids, and carboxylic acid produced by the skin. This layer is known as the "acid mantle". It activates enzymes responsible for synthesising lipids, helps form lipids, and restores the epidermis if it is damaged by mechanical or chemical damage (Schmid-Wendtner and Korting, 2006).

Normal skin has a pH of 5.5, thus is it is slightly acidic. By contrast, soap is alkaline with a pH of approximately 9. Washing with soap strips the skin of its acid mantle and reduces its ability to form lipids and restore the epidermis when it is damaged (Kirsner and Froelich, 1998).When the skin's pH is altered, the skin can become colonised by bacteria, including virulent strains of *Staphylococcus aureus* (Rippke et al, 2004). Changes to pH also increase the risk of skin diseases, such as irritant contact dermatitis, atopic dermatitis, and *Candida albicans* infection (Schmid-Wendtner and Korting, 2006).

The older person may have used soap all their lives and, therefore, may not feel clean without it. If the older person wishes to continue using soap, the clinician can advise them to use a mild, non-perfumed soap, such as Simple® (Unilever), which maintains pH balance. Dove® (Unilever) soap is a superfatted emulsion that has been recommended for older skin (Hardy, 1996).

Robertson and Brown (2011) report the care of cancer patients and explain that people undergoing radiotherapy are advised to use "mild" soap. They asked patients to identify soaps that they consider to be mild and then tested these soaps. Patients identified Johnson's® (Johnson and Johnson) baby soap, E45® (Forum Health Products), Dove, Pears® (Unilever), Simple, and Imperial Leather® (Cussons). Robertson and Brown tested these soaps and found that only the Simple and Johnson's soaps had a pH of around 5.5. All were fragranced, except Simple and E45. Those that were most perfumed were Pears, Imperial Leather and Dove.

If the skin is very dry, emulsifying ointments should be used as this does not dry the skin. If the skin is sore, plain water is recommended until soreness subsides.

Many older people like to use bubble baths when bathing and shower gels when showering. It should be explained by the clinician that supermarket value ranges are often harsh on older skin. If the skin is not too dry or sensitive, a cream bubble bath or a pH-balanced shower gel can be used.

Maintaining the barrier function of skin

Emollients aim to restore the barrier lipid function and enable the skin to regain its ability to resist damage. These are available as lotions, creams, and ointments. The grease, shine, stickiness, and thickness of an emollient is a good guide to lipid content. Lotions have the lowest lipid content – these are light and easily absorbed. Creams have higher lipid content, while ointments have the highest lipid content, but some people consider them greasy (The British Dermatological Nursing Group, 2012).

NICE's (2013) guidance recommends that clinicians are guided by patients when determining which preparation is most appropriate for that person's dry skin. *Table 1* summarises this guidance. The amount and application of the emollient is a matter of clinical judgment as it depends on the emollient being used, the dryness of the person's skin, and the individual's response to the emollient.

Protecting against chemical and mechanical damage

In younger people, the layers of the skin are bonded together by fat and collagen, whereas the older person's skin is less cohesive, which means that skin is easily torn. Skin on the forearms and shins is especially vulnerable to skin tears. Skin tears can take a long time to heal and can occur when the older person is dressed or undressed carelessly, or too vigorously, by a caregiver. They can also occur when the older person or caregiver tries to force a limb into a garment that is too tight. Advising the older person to choose clothing that is easy to get on and off, as well as advising caregivers to take great care not to damage skin, reduces the risk of such damage. Caregivers should keep their nails short and avoid wearing rings with stones.

Skin tears can also occur when the older person uses a wheelchair without footplates. When footplates are not used, the metal prongs used to place the footplate on are exposed. These can easily damage vulnerable skin. Therefore, it is essential that all caregivers use footplates using wheelchairs for older people.

Preventing incontinence-associated dermatitis

Ageing increases the risks of continence problems, which may lead to incontinence-associated dermatitis (IAD). IAD is "a clinical manifestation of moisture-associated skin damage" (Gray et al, 2007). Between 3.4%–50% of people with urinary or faecal incontinence develop IAD (Gray et al 2007; Beeckman et al, 2010). The principles of prevention include rapid assessment and treatment of incontinence, and ongoing, high-quality continence and skin care. Beldon (2012) recommends that a barrier cream be used in cases of IAD, and the formulation should contain dimethicone as this provides an effective, almost invisible, barrier and does not reduce the absorbency of body-worn incontinence pads.

Several factors are thought to contribute to the development of incontinence-associated dermatitis. These include changes in skin pH, wet soggy skin, skin damage caused by mixing urine and faeces, and damage caused by faecal enzymes (Nazarko, 2007).

There are three steps in preventing IAD. These are: cleanse, moisturise, and protect. Skin should be cleansed with a mild soap or cleanser that is balanced to skin pH and contains surfactants that lift stool and urine from the skin. Skin should be cleansed routinely and after any episode of incontinence. Warm water should be used and excess force and friction should be avoided to prevent further skin damage.

The skin should be moisturised daily and as needed. Moisturisers may be applied alone or incorporated into a cleanser. Normally, moisturisers contain an emollient to replace lost lipids in the stratum corneum.

To protect the skin, a barrier cream or spray should be applied. The barrier may be zinc-based, petrolatum-based, dimethicone-based, an acrylic polymer, or another type. Individual organisations will have guidance on which products to use, specifically.

Being alert to changes in the skin

The older person is at risk of developing eczema, oedema and other skin changes that can affect the health of the skin

Table 1. Summary of NICE (2013) guidance on emollient use.

Change	Consequence
Dryness of skin	Mild to moderately dry – use creams. Moderate to severely dry – use ointments.
Weeping dermatitis	Use creams as ointments will tend to slide off, becoming messy for the individual.
Frequency of application	Creams are better tolerated, but need to be applied more frequently and generously to have the same effect as a single application of ointment.
Choice and acceptability	Take account of the individual's preference, determined by the product's tolerability and convenience of use.
Efficacy and acceptance	Only a trial of treatment can determine if the individual finds a produce tolerable and convenient.
One size does not fit all	More than one kind of product may be required. The intensity of treatment required and the area to be treated should guide treatment choice.
Balancing acceptability and effectiveness	The individual (and the prescriber) need to balance the effectiveness, tolerability and convenience of a product.

(Nazarko, 2009; Van Onselen, 2011). Clinicians should be alert to any changes in the skin and ensure that older people and their caregivers regularly check the skin and seek advice if they note any changes. Prompt treatment can prevent further skin problems.

Conclusion

Older people are as individual as any group. Some older people will have fragile, easily damaged skin, while others will not. However, increasing age places the skin at risk, and it is vulnerable to damage if it is not cared for. The clinician can support the older person in maintaining healthy skin by cooperating with the older person and their caregivers and so reduce the risk of skin problems. WE

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Back to basics: Is the wound infected?

Wound infection is a cause for concern as it signals a significant setback in the wound healing process and the patient's wellbeing. This article examines the reasons why wounds become infected, the various stages of infection, and the treatment regimens that should be put in place by the clinician when infection is present.

The human body is covered in micro-organisms (commensal flora) and these form part of the body's defence against other pathogenic microbes, which the human body encounters on a daily basis and that usually cause no harm. The number of microbes present on the mucosal and skin surfaces exceeds the number of cells in the human body (Tlaskalová-Hogenová et al, 2004).

It should not be assumed that the skin is only a passive barrier to the entry of bacteria; the skin is an active participant in defending the body against infection. Within the dermis of the skin lie specific cells associated with the immune response of the body: Langerhans cells, mast cells, macrophages, and dendritic cells, all of which help to activate the immune response, attack pathogenic bacteria, and minimise the risk of infection (Cooper, 2005).

All open wounds quickly become contaminated with a variety of micro-organisms – the majority of which will heal successfully. However, in some patients, wound contamination will lead to colonisation, critical colonisation, or infection (Cutting, 1998; *Table 1*). Certain groups within the population are more at risk of infection than others.

Protecting the patient from infection in the clinical setting

Wound contamination occurs when the wound comes into contact with a contamination source: equipment, poorly decontaminated hands, micro-organisms from the surrounding air, or self-contamination (Collier, 2004).

Standard infection control precautions exist to protect the patient against infection and clinicians must keep their hands clean by washing them with water and/or alcohol gel. Inadequate hand hygiene has been shown to be the biggest contributor to healthcare-acquired infections (HCAI; Pratt et al, 2007).

Additional protection for the patient is provided by aseptic technique, which involves:

- Ensuring the area in and around the wound is as clean as possible; an emphasis should be placed on hand hygiene.
- Ensuring as little disturbance as possible occurs in the wound area,
- Using sterile equipment.
- Reducing possible contamination of the wound site by using sterile wound dressing pack, gloves, and other equipment.
- Ensuring that wound dressing changes are only undertaken by a clinician deemed competent to do so (Royal College of Nursing, 2012).

"Any open wound provides an opportunity for bacteria to enter, however, the bacteria may not necessarily cause an infection and may simply colonise the wound."

PAULINE BELDON
Tissue Viability Nurse Consultant, Epsom and St Helier University Hospitals NHS Trust, Carshalton

However, the patient should be made aware that infection may occur despite best practice being implemented by the clinician and that they too have a role to play in minimising the risk of infection by ensuring good personal hygiene, keeping their home clean, and following the clinician's advice on wound management.

Managing infection risk

In order to reduce the risk of infection the clinician should also consider the wound dressing to be used, whether it is capable of containing the exudate of a moist wound, and how often the dressing will require renewal. If the clinician leaves the dressing in place for too long and exudate is not contained, this will increase the risk of infection (World Union of Wound Healing Societies [WUWHS], 2007).

Consequently, the clinician should change the dressing at appropriate intervals. Blaming the wound dressing for not coping with the exudate when it has been left *in situ* for a week is not good practice and will not inspire the confidence of the patient in the author's experience. Similarly compression bandaging needs to be changed more frequently in the heavily exuding leg ulcer, but less frequently as the exudate levels fall, in other words how frequently a dressing or bandaging is changed should be dictated by the patients wound and not the expectations of the clinician.

Every individual has a responsibility to aid their wound healing; poor lifestyle choices can play a role in decreasing the body's natural immunity and increasing the risk of infection. It is the responsibility of the clinician to inform the patient about how they can best assist in progressing their wound towards healing. Beyond adhering to specific prescribed drug and wound care regimens, dietary imbalance – causing either emaciation or obesity – reduces the body's natural immunity (RCN, 2012), as does excess alcohol, smoking, stress, lack of sleep, or excessive exercise (Cooper, 2005).

Difficulties in identifying local infection

It is important to remember that the periwound area may be red and appear inflamed for a number of reasons. These include:

- The aetiology of the wound/ulcer. A pressure ulcer may have secondary pressure damage around the main area of ulceration (*Figure 1*). This erythema (redness) will dissipate and does not signify the presence of infection.
- Inflammation is a natural stage of wound healing, especially if necrotic tissue is present. The inflammatory response may last some days as the body brings in white cells to the wound area to destroy the necrotic, nonviable tissue (*Figure 2*).
- Inflammation due to dermatitis; an irritant or allergic dermatitis will cause inflammation of the skin and may mislead the clinician into a presumption of infection (Beldon, 2001), the application of a dressing with an adhesive border is a common cause of dermatitis (*Figure 3*).
- Varicose eczema, which the clinician may mistake for inflammation due to infection (*Figure 4*).

Signs of infection

The clinician should examine the wound for signs of infection and while doing so they should bear in mind the wound aetiology (its cause) and how the body heals.

The first record of the symptoms of infection were identified by Celsus in the first century; heat, redness, tenderness and swelling. Back to the present day and Cutting and Harding (1994) expanded on these classical symptoms, offering the following traditional criteria for identifying wound infection:

- Abscess.
- Cellulitis.
- Discharge; including serous exudate with inflammation, haemopurulent or seroupurulent exudate, and pus.

Further, Cutting and Harding (1994) offered the following additional criteria for identifying wound infection:

- Delayed healing.
- Discolouration
- Friable granulation tissue that bleeds easily.

Table 1. Stages of infection (adapted from World Union of Wound Healing Societies, 2008).

Level of micro-organism presence	Definition
Contamination	The presence of micro-organisms without any signs of infection.
Colonisation	Micro-organisms have multiplied within the wound, there is no damage to the tissue, and no immune response generated.
Critical colonisation	The patient's immune defences are no longer able to prevent the amount of micro-organisms rising within the wound. Characterised by a delay in wound healing, but without signs of infection.
Infection	The patient's immune defences are overwhelmed by the micro-organism/s, which cause symptoms of infection and damage the wound bed.

- Unexpected pain or tenderness.
- Pocketing at the base of the wound.
- Bridging of skin or soft tissue.
- Abnormal smell.

Patients with chronic wounds require further consideration (European Wound Management Association [EWMA], 2005):

- Has the wound bed become more friable (delicate), and bleeds easily?
- Is the wound bed undermined?
- Have previously viable tissues become more sloughy?
- Has the wound stopped healing, despite appropriate treatment being in place?
- Is the wound enlarging unexpectedly?
- Has the level of exudate increased?
- Has there been an increase in pain or its severity?
- Has the wound odour become apparent or foul?

It is important to listen to the patient; if the patient reports increased discomfort or pain, increased exudate, acute inflammation, or malodour, the wound may be locally infected. The clinician should undertake assessment to establish whether the patient is experiencing symptoms of systemic infection, an easily detected and strongly suggestive one being elevated temperature (pyrexia; EWMA, 2005).

However, it is important to remember that certain population groups may not exhibit the classical signs of infection and need to be assessed and monitored with care. For instance, older people will not exhibit the same prompt immunological response of inflammation as a younger person (Ashcroft et al, 1998).

People with diabetes often have an impaired immune response and are at risk of infection (Edmonds, 2005). In addition, patients receiving chemotherapy or long-term steroid therapy will have a reduced immune response (Collier, 2005).

Microbiology and sampling

To appropriately manage an established wound infection, microbiological investigations are often undertaken. The nature of the sampling and investigations will vary according to local protocol. The most common methods for sampling wounds for microbiological investigations is the wound swab. The technique for taking a wound swab has been covered previously in *Wound Essentials* (see Patten, 2010).

Infection management

A full review of the management of infection is outside the scope of this article. Suffice to say, once wound infection has been established an appropriate management plan to resolve the infection must be rapidly implemented. Depending on the nature and extent of the infection, systemic (e.g. oral or intravenous antibiotics) or local (e.g. normal debridement, topical antimicrobials) infection control interventions must be undertaken.

A wound swab result only informs the clinician of the bacteria that has been collected; it will not determine whether the bacteria detected is actually causing the infection or, hence the unreliability of wound swab results (Gilchrist, 2000). Thus, a false positive swab, may identify bacteria, but not those causing the infection, while a false negative will fail to identify any bacteria from the wound (Miller, 2001). That said, wound swab results detailing micro-organism antibiotic sensitivity are used to guide antibiotic choice, so the clinician has a responsibility to ensure the wound swab is taken correctly (Patten, 2010).

Case report

Mr B presented with venous leg ulceration (*Figure 5*). Post assessment, he had been treated with appropriate wound dressings and compression therapy bandaging, and had been progressing well. He then presented at clinic complaining of increased pain and malodour from his bandaging, 6 weeks after first presentation. On inspecting the ulcer bed, slough was found and the ulcers had increased in size, and erythema in periulcer area was discovered. On taking Mr B's temperature, it was discovered he had a mild pyrexia; infection was diagnosed (*Figure 6*).

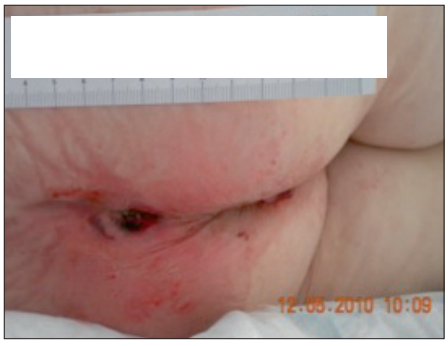

Figure 1. Secondary pressure damage presenting as erythema around the obvious pressure ulcer, can be misleading, the patient exhibited no signs of infection.

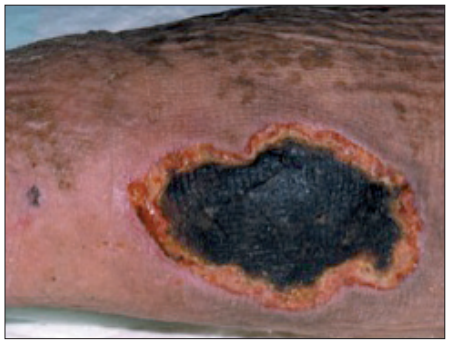

Figure 2. Necrotic tissue on a leg wound, the inflammatory response will last some days as the body works to remove the necrotic tissue.

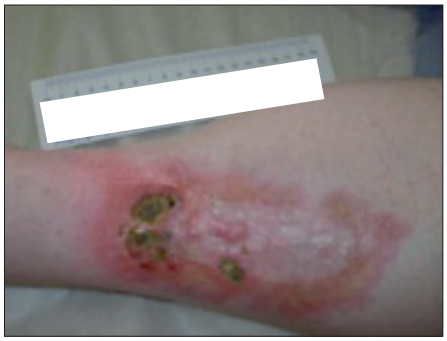

Figure 3. A rectangular adhesive border dressing has been applied, to which the patient has developed allergic contact dermatitis.

Mr B was advised to take regular analgesia and was prescribed antibiotics. An antimicrobial dressing was selected and dressing change frequency increased until the infection and Mr B's symptoms resolved.

Conclusion

It is vital that the clinician is knowledgable about the symptoms of infection, and also the stages of healing, or other factors, that could be mistaken for infection. The patient relies on the clinician's knowledge and understanding of infection, and their ability to listen to their symptoms when the patient voices concerns.

When infection is suspected, the clinician must assess the wound, consider whether the symptoms could have been caused by something other than infection (i.e. varicose eczema, autolytic debridement, allergic contact dermatitis, or secondary pressure damage), and always take the patient's temperature. Only once all these criteria have been met should antibiotic therapy be considered. WE

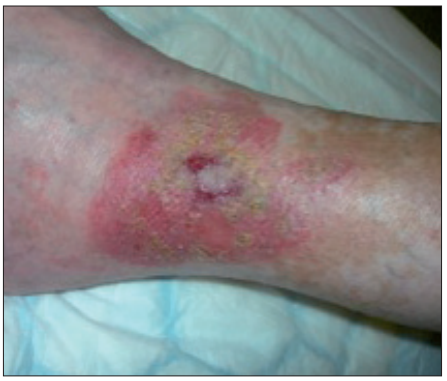

Figure 4. ***Venous leg ulcer with varicose eczema.***

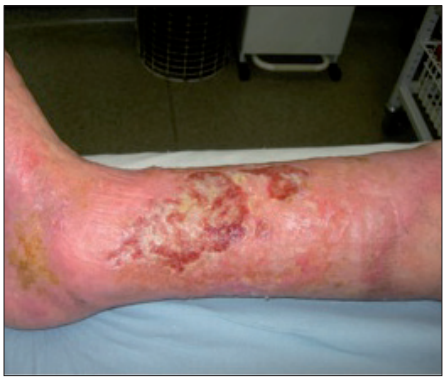

Figure 5. ***Mr B's venous leg ulcer, pre-infection.***

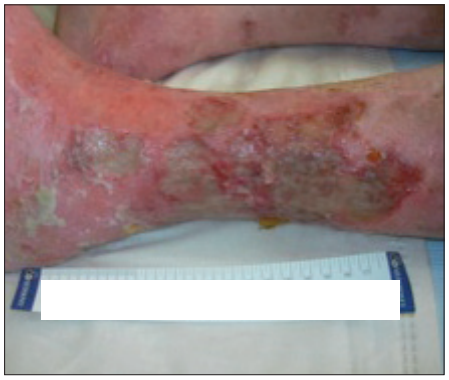

Figure 6. ***Mr B's infected venous leg ulcer.***

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Understanding compliance and concordance among people with leg ulcers

Frequently cited by clinicians as barriers to wound healing, "noncompliance" and "nonconcordance" must be fully understood in order to aid the development of effective therapeutic strategies. This article examines patient reports of their experience of ulceration, and provides ten top tips to aid clinicians in promoting concordance.

Leg ulceration is a long-term condition that has a significant impact on the people living with it. Inevitably, some people will not wish to take control of their treatment, or will be unable to do so due to dementia or a lack of mental capacity to make such decisions (Ebbeskog and Emami, 2005). Others will be proactive and positive about their treatment.

This article defines "compliance" and "concordance" and considers recent reports of patients' experience of ulceration, as well as programmes to help engage patients in leg ulcer care. Ten top tips to consider when forming partnerships with patients are also provided.

Compliance

In the healthcare setting, compliance is defined as: "The extent to which the patient's behaviour (in terms of taking medications, following diets, or executing other lifestyle changes) coincides with medical advice" (Sackett and Haynes, 1976). In 1997, The Royal Pharmaceutical Society (RPS) advocated a shift from "compliance" to "concordance" in an attempt to promote openness and empathy in patient–clinician relationships. Issues such as long waiting times, long periods of treatment, and complexity of treatment can lead to noncompliance.

Concordance

Clinicians are now encouraged to embrace patient–clinician partnerships and negotiate with patients who have long-term conditions. They are also encouraged to embrace concordance in all aspects of healthcare, including leg ulcer management (Moffatt, 2004a). The RPS (1997) defines concordance as: "A negotiation between equals ... a therapeutic alliance ... this alliance may, in the end, include an agreement to differ. Its strength lies in a new assumption of respect for the patient's agenda and the creation of openness in the relationship."

The experience of ulceration

Pain is, in most cases, near the top of the patient's list of concerns. It can be related to the ulcer,

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treatment, or both. Therefore, pain management must be a priority.

Green et al (2013) interviewed nine people with venous leg ulcers. Patients spoke of their experience of slow healing and multiple recurrences, and the effects this had on their lives. Pain featured heavily in all the interviews and participants expressed reluctance to take analgesia unless their symptoms were severe. Even with analgesia, the pain was not effectively controlled. Pain was also accompanied by chronic lack of sleep. A positive observation made by some participants was the perception of quality care when there was consistency in terms of dressings, compression, and feedback on the state of the wound.

The key lessons from this study, and others before it (Ebbeskog and Ekman, 2001), are that, unless the clinician understands the effects of ulceration on patients' lives and demonstrates empathy and skill in alleviating such symptoms as far as possible, then partnership and concordance are less unattainable.

An American study (Shannon et al, 2013) used a questionnaire across seven outpatient clinics to investigate patients' post-healing experiences of ulcer recurrence, wearing hosiery, and education related to leg care. Results indicated that 73% of patients wore their hosiery daily and 90% felt they had received enough information about caring for their legs post-discharge from the leg ulcer service.

Reasons for not wearing hosiery related to difficulties in application and removal, with a small number reporting pain when wearing hosiery. The researchers found that a quarter of participants gained weight during treatment. In terms of future research, it would be interesting to consider any correlation between weight gain and practical difficulties in applying and removing hosiery, as well as incidence of ulcer recurrence.

Promoting self-care strategies

van de Glind et al (2012) report the "Lively Legs" project in the Netherlands. The project was concerned with encouraging exercise and the wearing of compression garments. Twelve nurses were trained to deliver a structured programme of counselling, lifestyle advice, health education, and leg exercises, complemented by written information. The programme involved 3–6 sessions over a 6-month period. Fifty-three patients were recruited, and 49 completed it. The clinicians involved were asked about the experience through questionnaires, focus groups, and interviews.

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Potential barriers to patient recruitment into such programmes were investigated. One barrier was the difficulty identifying patients from digital patient record systems due to variances in how patient diagnoses were recorded (i.e. the fact they had a leg ulcer was not clear on the system). Another factor was the organisation of services where there might be competing organisations and, therefore, little incentive to refer patients to an external programme. The amount of time a nurse had spare to undertake the programme, the influence of changing managerial personnel in clinical areas, and lack of familiarity with the programme by potential referrers, such as GPs, were also identified as barriers to patient recruitment.

Patient recruitment was also found to be a problem in areas where nurses were less motivated and engaged in the programme. Inevitably, only the most motivated patients joined the programme, but the hardest-to-reach patients may also be people who could benefit from the programme.

Miller et al (2012) report a leg ulcer prevention programme in Australia. Participants (n=155) had six sessions in a blend of e-learning, face-to-face activities, and written resources. Health behaviours were measured pre- and immediately post-intervention. An increase in healthy behaviours following the programme in those participants who had exhibited few prior to the intervention was shown but this was the only change that was statistically significant in the behaviour changes (P=0.000).

Further research is needed to assess the sustainability of such outcomes and their impact on ulcer healing and recurrence. The researchers highlighted that helping patients to identify their own health goals was important in achieving positive health behaviours.

Brown (2012) reviewed the evidence on lifestyle advice and self-care strategies, and concluded that increasing mobility and ankle mobility reduced ulcer recurrence. The review highlighted how confused patients can become by advice they perceive as conflicting. For example, being told to exercise, and also to rest with their feet elevated. This illustrates the need to give clear instructions and advice to patients, ensuring that they, and their carers, have the opportunity to ask questions.

Ten top tips

Here are ten top tips designed to provide the clinician with practical advice on how to improve patient concordance:

1 Treat pain

The clinician must recognise the patient's pain and ensure adequate pain relief is provided. Patients should be encouraged not to be afraid of medication and to take it pre-emptively when necessary, rather than waiting until pain becomes unbearable.

2 Consider patient capacity and experience

Most patients adhere to treatment most of the time and clinicians must provide encouragement and support, backed by written information for the patient. It should not be assumed that more education is the answer to concordance. Patients should be given choices appropriate to their decision-making capacity and the clinician should be prepared to listen and compromise.

3 Be skilled

The clinician's lack of knowledge, and possibly lack of confidence, in explaining disease processes and the physiological effects of therapy, may contribute to a lack of patient understanding. Clinicians should ask themselves the following questions: "Have you had your bandaging skills appraised recently?" "How up to date are you in terms of techniques and bandage/hosiery types?" "How good are you at explaining complex information in lay terms?"

4 Recognise social isolation

Recognise social isolation: Social isolation is a common problem for people living with leg ulcers and impacts negatively on patient outcomes (Brown, 2005a; 2005b). Family, friends, and carers should be involved in care if they are available and if the patient wishes them to be. Wound malodour should be managed effectively as this can damage relationships. Where appropriate, social service and voluntary sector resources for community support should be suggested to the patient.

5 Be realistic

The reasons why patients do not feel able to comply or adhere and adapt treatment plans to their environment should be explored. There is little point telling a patient to elevate their legs if their job involves periods of standing, but prompts could be devised that would remind them to put their feet up at break times or when they get home. A higher class of hosiery to wear during work hours could be suggested. Patients may feel unable to tolerate full compression initially so beginning with reduced compression may be a good compromise. Team working and clear documentation are important factors in reducing the risk of professional conflicts when compromises are made with patients (Brown, 2005b).

6 Consider travel difficulties

Rich and McLachlan (2003) found that cost, lack of transport, and lack of confidence all impacted on patient engagement. Clinics may be in areas where people feel unsafe, especially if it is unfamiliar to them. Late afternoon or early appointments may mean travelling in the dark, at rush hour, or expensive travel times. Permission to introduce patients to each other should be sought as they may be able to travel together. Clinicians should also explore whether there is a voluntary car service for vulnerable patients. The clinic experience should be made both sociable and clinically effective to keep patients motivated to return.

7 Show compassion and empathy

Patients have reported that that a gentle manner and friendly demeanour make them feel secure and cared for (Ebbeskog and Emami, 2005). Clinicians should try wearing bandages and hosiery themselves and attempt to imagine what it might be like to have pain, oedema, leakage, and itchy skin for 24 hours, every day. Praise and encouragement are important too; we all respond to this if it is realistic and nonpatronising.

8 Do not try to do everything at once

The clinician should ensure bandages and hosiery are as comfortable as possible; constriction and slippage will be uncomfortable and potentially harmful. Ankle movement should not be restricted for mobilising and exercise, and footwear advice should be given before the patient commences compression therapy. When a wound is heavily exuding, the clinician should be prepared to change bandages more often until it is under control. Itchy skin should be managed with an appropriate skin care regimen, as well as using lining material to keep wool padding away from the skin. Charts can be used as reminders for leg elevation and exercise. Additionally, patients should be involved in measuring and recording outcomes, such as oedema reduction.

9 See the patient with "fresh eyes"

The clinician should go back to the beginning of the patient's assessment in case something was overlooked. Factors to consider are comorbidities, skin conditions, social factors, anxiety, and depression (Moffatt, 2004b). The advice of an experienced colleague who does not normally see the patient should be sought. They may see subtle changes in the patient

that are less obvious to the clinician who sees the patient regularly.

10 Communicate effectively

Marks et al (2005) discuss the effect that certain phrases may have on the patient and difference between the terms "aggravated directives" and "mitigated directives". An example of an aggravated directive is "you need to" or "I want you to," which requires action rather than answers from the patient. The use of aggravated directives is less likely to result in adherence and is not in the spirit of concordance. Mitigated directives, such as "maybe you can" or "let me say" are more effective since they are presented as a joint action.

Conclusion

Concordance will be promoted if the clinician has a sound knowledge of the condition and treatment options, as well as good communication skills, compassion, empathy, and an understanding of the patient's need. Clinicians need to have strong clinical skills in leg ulcer management, which includes evidence-based, effective patient education and support programmes.

People change according to circumstances, so labelling should be avoided and people should be allowed to change their mind. To paraphrase Price (2008), clinicians should accept that patients have "a life, not just an ulcer". WE

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