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Caroline Caroe and Karsten Fogh report a case of pyoderma gangrenosum – a rare, neutrophilic dermatosis – associated with malignant melanoma.

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Wound digest Page 31 A summary of important papers on wound-related research.
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Adapting policies and guidelines makes good sense

It has been an absolute pleasure to work with the members of the International Wound Infection Institute (IWII) committee who have produced two of the articles included in this issue of Wounds International.

As is often the way with online publishing, the committee (headed by Terry Swanson) was asked to work to very tight deadlines. In addition to an innovations article, which describes the organisational structure of IWII and the innovative work they are doing (page 6), the IWII have written a succinct and clear update on the management of wound biofilm (page 20).

Key messages for the management of wound infection include, keep monitoring, keep assessing, keep evaluating treatment, but the IWII offer new information and some real gems that will generate debate and critical thinking around the difficult topic of wound biofilm management.

In practice, clinicians are often faced with having to make sense of complex clinical scenarios that may raise questions and concerns. A written case report provides an excellent way of sharing information and illustrating what interventions and management strategies have worked well and those that have been less successful. Caroline Carøe and Karsten Fogh (page 25) describe a patient who presented with pyoderma gangrenosum: they suggest that, in this case, there was an unusual association between pyoderma gangrenosum and malignant melanoma, which will no doubt stimulate thought and discussion.

One of the main objectives of Wounds International is the sharing of information and resources. At a recent Wounds UK event on eliminating avoidable pressure ulcers, held in Liverpool on 27 March 2014, one of the speakers – Juliet Price – used the phrase “pinch with pride”. Juliet asserts that this is an important part of the ethos for patient safety in her region. The point is that it is irrelevant where a good idea originates; if it can be of benefit to patients, improves care, and is appropriate, it should be adopted.

Where there are useful, reliable resources available, these can and should be shared with a wide audience. Materials can often be adapted for local needs, saving precious time and resources. Of course, it is always important to secure permission and to credit the materials to their original source appropriately and accurately.

In this issue of Wound International, Carol Tweed and Paula McKinnel from New Zealand describe their innovative campaign, “STOP Pressure Injury Day” (page 10). They explain how they adapted work that had been successful in other countries – in particular the content developed by NHS Midlands and East in 2012[1] – as part of the UK’s “Eliminating Avoidable Pressure Ulcer” campaign. They provide an honest and reflective account of their experience, identifying a number of lessons learned and objectives for the future. They maintain energy and enthusiasm, which is a vital component to keeping others motivated and involved.

I am very proud to announce that Wounds International will be partnering with MENA Conferences and Gulnaz Tariq (Wound Care Manager, SEHA Group of Hospitals, Abu Dhabi) to deliver our first conference in the Middle East on 5–6 June 2014 (see page 3, or visit http://bit.ly/1bLVyyu for more details).

The core speaker group for this event work and practice in the Middle East region and the programme has been developed with their support and input. These local key opinion leaders will be complemented by a small panel of internationally recognised practitioners who will share their wound care expertise and knowledge.

These are exciting times for Wounds International. There is so much to gain by collaborating with different organisations and individuals from different geographies. We are always delighted to welcome new authors and urge you to continue sharing your experiences and contributing to our online journal.

Suzie Calne
Editor, Wounds International

Wound infection is a source of morbidity and mortality the world over; be it in acute wounds, or the ever-growing number of chronic wounds. Much remains to be done by the clinicians in the field and researchers in the lab to better understand and manage wound infection. Though common, the nuances of many of the key issues in infection – biofilms, critical colonisation, and so on – are poorly understood.

In 2006, scientists, medical and nursing practitioners, allied healthcare professionals and academics met in Budapest to explore their shared interest in wound infection, and to discuss the possibility of forming an expert body able to participate in the expansion of understanding, prevention, and best-practice management of wound infections. The meeting was Chaired by Professor Keith Harding, and made possible by an unrestricted education grant from Smith & Nephew.

Off the back of the Budapest meeting, and 2 years later in Toronto, the newly formed International Wound Infection Institute (IWII; www.woundinfection-institute.com) held its first annual general meeting to establish a governance structure and agree a framework for future activities. Keith Harding was elected Chair and served until 2012, at which time Terry Swanson took on the Chairmanship at the annual general meeting held during the Australian Wound Management National Conference.

WHAT IS THE IWII?
The IWII is a multidisciplinary inclusive society, providing a global perspective on the latest developments in wound infection. We aim to inform and educate specialist and generalist practitioners in wound infection prevention and management, and create a positive impact on patient outcomes.

Membership of the IWII is free and available through the website (www.woundinfection-institute.com). The IWII currently has more than 1700 registered members from more than 20 countries. We aim to build our international membership and professional and commercial networks for those interested in the prevention and management of wound infection. We seek sustainable financial support, which will enable us to advance our research and education goals and the development of best practice documents for both the health professional and the wounded.

If you are interested in wound infection or more importantly preventing them then please consider becoming a member the IWII. Members have access to a wealth of material on the IWII website, with a focus on the latest evidence, research, and education in wound infection prevention and management. [Please note: the IWII website is currently being re-designed so we apologise for the lack of updates; our secretariat hopes that the website will be fully functional by mid-year.]

Available resources include a curriculum outline on wound infection, a comprehensive matrix of evidence, an international consensus paper on infection and several reviews and commentaries, including a monthly update on the latest publications in the field.

IWII OUTPUTS
The IWII has produced a number of widely recognised and endorsed documents. Importantly, the IWII reviewed, revised, and extended the 2004 TIME principles in the International Wound Journal.

A review was carried out of each of the core TIME concepts: tissue (nonviable); infection/inflammation; moisture balance; and edge/epithelial advancement, to determine whether any significant changes had occurred since the original publication. Where differences were identified, they were investigated and the findings included in the updated version of the framework. The most important differences were in four key areas:
Strong when wet\(^{1,2}\)

- Clean one-piece removal – high wet strength\(^{1,2}\)
- High absorbency – up to 7-day wear time\(^{1,2}\)
- Minimal dressing shrinkage – may help sustained coverage\(^{1,4}\)
- Minimal lateral wicking – may help to reduce the risk of peri-wound maceration\(^{2,5}\)

Gentle on the budget\(^3\)


For patients. For budgets. For today.\(^{3}\)
1. The role of biofilms
2. The use of negative pressure wound therapy (NPWT)
3. The use of topical antimicrobials
4. The increased understanding of molecular biological processes, particularly in relation to the use of specific diagnostic tools[3]

This publication – titled Extending the TIME concept: what have we learned in the past 10 years? – is now available for IWII members to download (http://bit.ly/1i64s5A). It has also gained significant exposure and has been internationally referenced in leading documents and journal articles since its publication.[4–7]

As well as the significant contributions to the TIME framework, the IWII has published work in the International Wound Journal, Journal of Wound Care, Wounds International and other relevant journals.[8–12]

The IWII have also been active at international congresses. Most recently, members of the committee have presented at the Wound Management Association of Ireland conference (Cork, Ireland), the Wounds International Asian Pacific Conference (Kuala Lumpur, Malaysia), and have been asked by the World Union of Wound Healing Societies to participate in their next meeting in Italy.

THE FUTURE

The current members of the IWII committee are listed in Box 1. The IWII will shortly have openings for at least four general committee positions and will be seeking nominations from the current committee for the positions of Vice Chair and Treasurer. If you are interested in becoming involved in the IWII, details on the 2014 annual general meeting are available from Terry Swanson (tswanson@swh.net.au) or Joyce Black (jblack@ummc.edu).

IWII annual general meetings are also educational events and take place as part of eminent international wound care congresses. The next IWII annual general meeting will take place on 9 May 2014 at the Australian Wound Management Association National Conference (http://www.awma.com.au/conferences). The focus for this year’s annual general meeting will be slough, with Terry Swanson to deliver a presentation titled “Unraveling slough: What is it, how do we differentiate it and how is it best managed?” Preliminary information regarding the latest IWII project will also be provided during this presentation. At the same meeting, IWII members Professor Keryln Carville and Associate Professor Geoff Sussman will deliver an update on wound infection with an overview of best practice documents, clinical research, and new products that became available in 2013, and an overview of best practice documents, clinical research, and new products that became available in 2013, and discuss the global concern regarding multi-resistant wound infections, respectively.

IWII committee members have also been invited to present at the Wounds International Middle East Conference in Abu Dhabi (5–6 June 2014; http://bit.ly/1bLYvyu).

AUTHOR DETAILS

Terry Swanson is Chair, International Wound Infection Institute, and Nurse Practitioner, South West Healthcare, Australia. Keryln Carville is Evidence Officer, International Wound Infection Institute, and Professor of Primary Health Care and Community Nursing, Silver Chain and Curtin University, Australia.

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- Clean one-piece removal – high wet strength\(^1\)–\(^3\)
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- Minimal dressing shrinkage – may help sustained coverage\(^1\)

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All references relate to in vitro testing excluding 2.
New Zealand’s 2013 STOP Pressure Injury Day Campaign: Successes of the New Zealand Wound Care Society

New Zealand faces many of the same issues as other countries around the world with an aging population, increasing numbers of chronically sick patients, and tight health care cost constraints. This is true of wound care, and here the authors report a campaign to address avoidable pressure injuries.

BACKGROUND
Most experts in tissue viability would agree that the majority of pressure injuries are the result of poor preventative strategies and can be avoided by early and simple interventions by frontline care staff alongside increased awareness involving healthcare professionals, patients, and their carers.\(^{1,2}\) Multifaceted programmes that involve and engage all levels of staff within healthcare organisations have been shown to reduce pressure injury incidence rates.\(^{2,3}\)

AVOIDABLE PRESSURE INJURIES: THE NEW ZEALAND EXPERIENCE
In recent years there has been an increase in both national and international awareness about quality health service provision and the associated burden of avoidable pressure injuries.\(^{4,5}\) Recent publication of the Pan Pacific Clinical Practice Guidelines for the Prevention and Management of Pressure Injuries\(^{6}\) has assisted also and provided an evidence-based framework. Despite these developments, no national strategic plan at Ministry level for understanding and preventing these injuries has been developed for New Zealand. Until very recently, pressure injuries were under the general umbrella of “patient safety”, rather than being specifically identified as important preventable adverse events. Medication safety, infection prevention and control, falls prevention and preventing perioperative harm all received higher priority.

The extent of avoidable pressure damage in New Zealand remains unknown and there is no current requirement to undertake pressure injury prevalence or incidence auditing. Some individual District Health Boards do undertake these activities, however, without standardisation of the data collection methods and reporting, the results are challenging to interpret and impossible to compare – either with other New Zealand District Health Boards or other countries.

MAKING PRESSURE INJURY PREVENTION A PRIORITY
The New Zealand Wound Care Society (NZWCS) is a voluntary organisation of healthcare professionals committed to improving outcomes and increasing quality of life for patients with wounds and skin integrity problems. One of the NZWCS’ key aims is raising awareness about pressure injuries at local, national and international levels. The Society strives to promote evidence-based practice within the New Zealand health services, and to inform policy making on wound care issues.

STOP PRESSURE INJURY DAY
For the past 2 years, the NZWCS has participated in the internationally led STOP Pressure Injury Day. This initiative was established in 2012 by the Spanish National Group for the Study of Pressure Ulcer Prevention and chronic wounds (GNEAUPP) and Ibero–Latin–American Society on Wounds (SILAHUE) following the Declaration of Rio De Janerio on Pressure Ulcer Prevention as a universal human right in October 2011. The purpose of this annual day is to increase awareness of pressure injuries to the public, professionals, and politicians, and to highlight how pressure injuries are a major healthcare problem, as well as how they can be almost completely avoided with appropriate interventions. The European Pressure Ulcer Advisory Panel, acknowledging and applauding this work, joined and encouraged countries internationally to participate (www.epuap.org/stop-pressure-ulcer-day).

The NZWCS’ 2013 STOP Pressure Injury Day campaign was in-line with the wider international programme objectives as above. Knowing that great work had already been done in other countries, and that we had limited time and finances, we set about making contact and building relationships with local and international key opinion leaders and organisations. These contacts included Jacqui Fletcher (UK) as the leader of the highly successful “Stop the Pressure” campaign that had been developed by NHS Midlands and East in 2012. The NHS Midlands and East kindly shared their concepts and resources for the campaign, all of which had been widely tested with users – saving the NZWCS time and giving us confidence that the message was appropriate.

Locally, we were grateful to receive the support of a range of organisations. Engaging with industry to assist in the distribution of resources gave a wider depth of health...
providers outside the main hospitals and easier access to the more remote geographical areas, of which there are many in New Zealand.

The Capital and Coast District Health Board (which covers the Wellington region) collaborated with us to provide images and design expertise to tailor the campaign for the New Zealand audience.

First, Do No Harm (FDNH; www.firstdonoharm.org.nz) is a clinically-led patient safety campaign group focused on promoting safer care across the top half of New Zealand’s North Island. FDNH assisted in the present campaign by providing expertise and feedback on the posters and the template for the patient information leaflet.

Achieving the NZWCS’ 2013 STOP Pressure Injury Day campaign goals was not going to be possible without funding for design and production of the resources. This was generously provided by four commercial device and dressings companies whose logos appeared on the posters, and whose representatives also assisted in distribution.

OUTPUTS AND OUTCOMES
Using simple key words and images associated with pressure injury prevention, we produced 4000 adult-[FIGURE 1A] and 150 child-specific posters [FIGURE 1B], 10000 stickers, and 4000 patient/carer information leaflets [FIGURE 2]. Amounts of each had to be estimated as the level of interest could not be predetermined. Electronic files of these resources were also made available for download from the NZWCS website, alongside other informative links, at http://bit.ly/1inYOQP

A number of challenges emerged in relation to the dissemination of the educational materials. FDNH distributed widely across their region, however there were some stumbling blocks with company distribution. This was especially problematic where access to healthcare professionals within certain hospitals was limited. Nonetheless, the participating companies managed to overcome many of the difficulties and even organised couriering of materials.

Unfortunately time ran short in the planning of engaging with local media but this is back on the agenda for the 2014 campaign.

The response of the resource materials was in the main positive. The adult poster was well received with its simple message, however there was some feedback that the photos were too graphic to have up in a public place and not all health areas recognised the concept of care bundle acronym “SKINS”. We underestimated the popularity of the child poster, which was well received by healthcare professionals. Unfortunately, we did not seek or receive any public feedback but, again, this is something else for the 2014 “to do” list.

Figure 1. Using simple key words and images associated with pressure injury prevention, the New Zealand Wound Care Society developed [A] adult- and [B] child-specific posters.
THE FUTURE
Having evaluated the 2013 campaign, we would very much like to continue the momentum in 2014. The time that goes into a voluntary campaign, alongside busy working and personal lives cannot be underestimated, so improving on the man power and planning will be required for 2014 proposed activities. The NZWCS hope to add to the existing resources with patient story videos, coverage in current affairs magazines, engaging with a wider range of healthcare professionals, and possibly a TV interview. We will need to work again with industry that hopefully will assist us financially and also gain wider health professional contacts and distribution to further raise the pressure injury prevention profile across New Zealand. The Director of Nursing group in New Zealand now has pressure injuries as a key performance indicator, this may be New Zealand’s first step towards a national strategic plan, so approaching this group in 2014 should also assist in further raising the profile.

CONCLUSION
The Stop Pressure Injury Day campaign in New Zealand was a great achievement for the NZWCS. Healthcare professionals in the society who are passionate about this subject – in both primary and secondary care settings – have taken the campaign resources and message to their local areas. The contacts that the companies have throughout New Zealand, made it possible to spread the message further than the previous year. With the national Director of Nursing group now tasked with improving standards of pressure injury prevention, the NZWCS now has a robust national body to approach in raising pressure injury awareness at local and national levels. The lasting resources and activities that this campaign has generated will become a platform on which to build and expand in future years as there is still much work to be done from grass roots right up to Ministry levels. Starting small and with a simple message, already researched and gratefully borrowed, was highly advantageous and meant we did not have to reinvent the wheel. This has enabled momentum and new direction, providing opportunities and audiences.

AUTHOR DETAILS
Carol Tweed is a Clinical Education Consultant, and a member of the New Zealand Wound Care Society. Paula McKinnel is a Clinical Nurse Specialist in Wound Care, Capital and Coast District Health Board, and is both a National Committee Member and the Wellington Coordinator of the New Zealand Wound Care Society.

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Skin Care Matters

What can you do to prevent pressure injuries?

If you are in bed
- Change your position every two to three hours, moving between your back and sides
- Use pillows to stop knees and ankles touching each other, particularly when you are lying on your side
- Try to avoid creases in the bed linen
- If sitting up in bed, be aware that sliding down the bed can cause a pressure injury to your bottom and heels
- Ask for assistance if required

If you are in a wheelchair
- Relieve pressure by leaning forward, or leaning side to side for a few minutes every half hour

What else can you do to help?
- Eat a healthy diet and drink plenty of fluids
- Keep your skin clean and dry
- Ask your nurse to help you with any incontinence
- Your Nurse, Occupational Therapist, Physiotherapist, Doctor or Dietitian can help you plan your care to prevent a pressure injury

Pressure injuries can sometimes occur even if everything is being done to prevent them. Please talk to your nurse if you require more information.

We are here to help you

Acknowledgement: Developed by Counties Manukau Health and adapted by Auckland District Health Board

Figure 2. The New Zealand Wound Care Society adapted an existing patient/carer information leaflet from Counties Manukau District Health Board.
Ten Top Tips...
Using negative pressure wound therapy effectively

Author: Peter Vowden

Negative pressure wound therapy (NPWT) has revolutionised the approach to complex wounds, enabling a breakthrough in wound management.1,2 Drawing on current research-based evidence and expert consensus opinion, the following tips can be used to aid appropriate use for optimal outcomes.

1 KNOW WHAT YOU WANT TO ACHIEVE

Select the right patient
NPWT can be used to treat full- and partial-thickness acute and chronic wounds, including pressure, diabetic foot and venous leg ulcers, traumatic, postoperative and dehisced surgical wounds, skin flaps and grafts, explored fistulae and partial-thickness burns. Large cavity wounds with high exudate levels are particularly suited to NPWT, although it can also be used on wounds with mild or moderate levels of exudate.

Treatment should only be commenced following a thorough assessment and patients for whom NPWT is contraindicated (e.g. those with untreated osteomyelitis or malignancy) have been excluded. Understand when precautions are needed (e.g. in patients with active bleeding or difficult wound haemostasis) and proceed accordingly. For example, this may include protecting vulnerable structures such as exposed blood vessels, anastomotic site, organs or nerves.

Define the treatment aims
When starting NPWT it is important to define what you want to achieve and establish both the timeline for care and the exit dressing or surgical strategy for individual patients. Review aims at every dressing change. If the initial treatment aims have not been met at 2 weeks, stop and re-evaluate the treatment plan.

2 PREPARE THE WOUND BEFORE STARTING THERAPY

Before starting therapy, ensure underlying and associated causes have been addressed.

Debride the wound to remove any devitalised and sloughy tissues, which impede delivery of negative pressure. NPWT may assist with ongoing wound bed preparation by removing body fluids, wound exudate, and infectious materials.3 However, NPWT can never replace debridement and is contraindicated in wounds containing dry, necrotic eschar.

Cleanse the wound thoroughly (including any tunnels or undermined areas) using saline or a suitable antiseptic irrigation solution (e.g. Prontosan [B Braun], Octenilin [Schülke and Mayr] and Dermacyn [Oculus])4 prior to NPWT application. This can help to reduce the bacterial load and remove any debris from the wound surface such as slough. It is important to dry the periwound area thoroughly after cleansing.

Consider using a light layer of a skin barrier product to protect the surrounding skin from repetitive removal of the NPWT dressing. This can also protect intact skin from contact with body fluids.5

Always read the manufacturer’s instructions for use, and relevant clinical guidelines, before commencing therapy.

3 FILL THE WOUND USING THE RIGHT AMOUNT OF FILLER

Fill the wound with sufficient material – this may be foam or gauze – contouring to fit the dimensions of the wound bed, which may be difficult in irregularly shaped wounds. A pre-cut (spiral) foam dressing can be useful in this situation and can make application easier to perform. Applying negative pressure will remove air from the dressing material and pull the wound edges together by reducing the volume of the cavity. If insufficient material is used, it can lead to sub-optimal delivery of negative pressure. Only fill explored tunnels or undermined areas and fill tunnels using the most appropriate
“Continuous negative pressure is the most commonly used setting ... However, intermittent or dynamic/variable mode may help to speed up granulation tissue formation and encourage blood flow at the wound edge.”

6. Take your time at dressing changes

Taking time to apply and remove NPWT dressings can reduce pain and increase patient comfort. Switch off the machine for half an hour before removing the dressing; this allows time for the pressure to equalise in the wound bed and for the dressing to separate from the tissues. Injecting saline solution under the dressing may also help to reduce pain at dressing changes and facilitate atraumatic removal.

7. Each time a dressing is changed, consider the pressure setting and mode

There are currently no detailed clinical guidelines regarding the choice of pressure setting for individual wounds; the level of suction is based on individual assessment of the wound. Higher levels of negative pressure (e.g. -125mmHg) have been shown to have a positive effect on wound contraction, regional blood flow and the formation of granulation tissue. However, these higher levels can sometimes cause pain and therefore a reduction in negative pressure could be an option (e.g. > -75mmHg). There is a risk of reduced negative pressure in the wound bed when the transportation of fluids has to go against gravity (e.g. when the wound is on the leg and the unit is placed on the trouser belt of the mobile patient).

Continuous negative pressure is the most commonly used setting and is recommended for use over unstable structures to provide a splinting effect. However, intermittent (suction pump switches on and off) or dynamic/variable mode (amount of suction rotates between the target pressure and a minimum low level of negative pressure) may help to speed up granulation tissue formation and encourage blood flow at the wound edge.

8. Take steps to avoid complications

Pain

Some patients may experience pain during treatment or dressing changes. Consider reducing the negative pressure to a lower level that is acceptable for the patient. Take your time applying and/or removing the dressing (see Top Tip #6). In addition, a non-adherent fenestrated wound contact layer placed below the wound filler may help reduce pain but it may also reduce the formation of granulation tissue. Do not stretch the drape and do not apply it to the skin under tension. Analgesia or anaesthesia should be considered prior to dressing change and time allowed for this to take effect. Pain will reduce as the wound heals.

Maceration

Do not use too many layers of drape as this can decrease the moisture transmission rate. Ensure there is sufficient wound filler in the wound and that there is a good overlap of drape material, ensuring that the wound filler does not extend onto intact periwound skin. Protect...
Clinical Update **TEN TOP TIPS** Using negative pressure wound therapy effectively

9 **CONSIDER INSTITUTION THERAPY TO REDUCE WOUND BIOBURDEN**

For wounds that are colonised or infected, NPWT can be combined with fluid instillation (V.A.C. VeraFlo™ Therapy [KCI]). This delivers a wound instillation solution to the wound bed, which is left to rest for a short period of time and then removed during a cycle of NPWT. This method has been shown to reduce the number of operating room visits for surgical debridement on patients with infected wounds and may decrease the time to closure, while increasing the number of wounds closed and the volume of granulation tissue produced. This therapy option may also have a potential role in biofilm removal in complex wounds.

10 **PROVIDE APPROPRIATE TRAINING ON DEVICE USE**

When applied correctly, NPWT is an effective option for managing complex wounds in a variety of healthcare settings. Appropriate training should be given to staff on how to apply the device as well as recognising and managing potential complications. When discharging patients home with NPWT *in situ*, all patients/carers should be given printed instructions and know who to contact in an emergency. Care arrangements need to be transferred effectively and treatment status, aims and goals clearly described. For complex patients, a face-to-face handover of care may be appropriate. It is also important to ensure that the patient’s home circumstances are appropriate for this form of care.

Remember, NPWT looks simple, but may not be simple. Always seek advice from the lead clinician when in doubt.

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Acknowledgement: This article has been supported by KCI.
Superficial wound blisters are an abnormal swelling (i.e. filling with fluid) in the epidermal layer of the skin in response to trauma [FIGURE 1]. Blistering in postoperative wounds may be caused by skin stripping from removal of medical tape removal, or prolonged exposure of the skin to adhesive contact layers of dressings and associated with the presence of sutures. Deeper dermal blisters are generally associated with burns or direct trauma and can take longer to heal than superficial blisters. Postsurgical blistering can cause pain, wound leakage, delay healing of the wound, and increase the risk of postoperative surgical site infection, which ultimately can result in prolonged and costly hospital stays. [1]

The incidence of postoperative orthopaedic wound blisters ranges from 6% to 24%, with blisters being second only to infection as a surgical incision-related adverse event following orthopaedic surgery. [2–4] Studies, mainly of evaluative or audit design, suggest a possible association between post-orthopaedic surgery blisters and the use of adhesive wound dressings[1] and adhesive tapes,[6] particularly following knee arthroplasty and hip surgery.[7] When blistering occurs, the patient may be at increased risk of longer term morbidity and mortality, reduced quality of life,[9] and subsequently increase the cost burden.[6]

Postoperative nursing teams – and nurses in primary care – are integral in preventing postoperative wound blistering. Given the range of wound dressings, and the lack of a standardised approach, it is important nurses implement strategies to prevent wound blisters developing, including careful patient assessment, and selection of the most appropriate dressing for each individual postoperative orthopaedic patient.[6,9]

Drawing on current research-based evidence and expert consensus opinion,[1,4] the following ten top tips outlines strategies for the prevention of orthopaedic surgery-related wound blisters.

1 PATIENT ASSESSMENT PRIOR TO SURGERY: THE FIRST STEP IN PREVENTION

A thorough patient assessment, taking into account age and type of surgery planned is important. The clinician should take and document a detailed medical and social history. Any pre-existing conditions or environmental issues that may adversely affect wound healing and skin integrity should be investigated. Patient assessment should encompass the condition of the skin. Attention should be paid to the periwound area; friability, previous skin damage or trauma, fragility, loss of elasticity, and dehydration place the patient at increased risk of blistering.[9]

The clinician should also be alert to certain drug therapies and drug combinations that increase the risk of wound blister development (e.g. steroids, non-steroidal anti-inflammatory drugs, antineoplastic chemotherapy).[16]

2 PREOPERATIVE PREPARATION: THE SKIN MUST BE READIED FOR SURGERY AND HEALING, AND PROTECTED DURING SURGERY

Hygiene and skin integrity must be maintained. It is important that the skin is clean, and that during the preoperative hygiene preparation...
Dressing-induced blistering around the post-surgical wound is painful and distressing. Worse, it can lead to infection – delaying healing and potentially compromising the procedure itself. Mepilex Border Post-Op is designed to minimize post-operative blistering. It manages exudate very well, which can reduce the number of dressing changes. Mepilex Border Post-Op is also designed to be very flexible, supporting patient mobility.

Don’t let blisters determine the outcome of surgery. Start the post-operative journey to healing with Mepilex Border Post-Op.

Learn out more about Mepilex Border Post-Op and preventing post-operative blistering at www.molnlycke.com

Ten Top Tips Preventing orthopaedic surgery-related wound blisters

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“Formulation of a patient care plan – based on the patients’ history and the condition of the perioperative wound area – is paramount in preventing wound blisters, particularly if the assessment reveals the patient is at increased risk.”

the skin remains intact. Presurgical procedures should be followed for the sterilisation of the skin surface, and sterilising agents used should be compatible with the intended postoperative dressing to be applied. Current guidelines indicate that the most appropriate skin preparation agents should be aqueous or alcohol-based antiseptic preparations (e.g. povidone iodine or chlorhexidine) and ideally the postoperative dressing should have any compatibility issues identifiable in product information.[11]

In order to minimise risk to skin integrity, policies for pressure relief and redistribution should be observed, particularly in older people who often have fragile, dry skin. These strategies should minimise friction and shear forces exerted on the skin.[12]

Formulation of a patient care plan – based on the patients’ history and the condition of the perioperative wound area – is paramount in preventing wound blisters, particularly if the assessment reveals the patient is at increased risk.

3 WOUND DRESSING CHOICE SHOULD BE MADE AHEAD OF SURGERY AND IMPLEMENTED IMMEDIATELY AND CONSISTENTLY IN THE POSTOPERATIVE PERIOD

Some local practice guidelines may suggest that theatre and ward nursing staff should know – prior to surgery – which postoperative dressing has been selected for each patient (as per their care plan), so that the agreed, ideal dressing to prevent blistering is applied as the first dressing.[1]

The surgical team and ward staff need to have up-to-date knowledge of wound dressing product types that have been proven to be effective in the prevention of blisters. Aide memoire’s to the most clinically appropriate choice of postoperative wound dressings should be available and visible in theatre and ward areas. Staff should be familiar with the wound care formulary.

4 THE DRESSINGS USED SHOULD BE FLEXIBLE

The wound dressing chosen should have optimum flexibility, however should be able to remain in situ for the optimum length of time. Flexibility can be enhanced by using a dressing that has maximum conformity to the wound, therefore clear and accurate assessment and documentation of the wound size, position and closure technique is important. Having components within the dressing, which are layered enables flexibility, for example, a soft-silicone dressing will enhance the dressings’ ability to conform to the wound shape and skin contours. A wound dressing that incorporates layers, however remains thin, will enhance conformity and flexibility. Other wound dressing types which are layered and have been shown to reduce blister formation include having a highly absorbent hydrofiber outer layer.[6]

5 MAKE SURE THE DRESSING SELECTED IS THE MOST APPROPRIATE FOR THE WOUND TYPE AND SIZE

An easy-to-apply dressing that is self-adhesive and does not require the use of additional medical tape to secure it will aid in the prevention of wound blisters. On removal, the dressing should come away easily, without causing trauma or pain. Mepilex® Border (Mölnlycke Health Care), for example, incorporates a Safetac® wound contact layer, allows non-traumatic removal by preventing the dressing from sticking to the wound and therefore reduces the risk of blister formation.[12]

6 LOW-FRiction DRESSINGS SHOULD BE USED TO ALLOW PATIENTS TO MOBILISE EARLY WITHOUT RISKING BlistERING

It is important that patients are mobilised early following orthopaedic surgery, to reduce risk of adverse postsurgical events (e.g. venous thromboembolism[13]) and promote healing, however adverse frictional forces at the wound site should be avoided. Although there is limited randomised controlled trial research in wound dressings, friction-lessening choices should be made where possible, whereby the dressing has been designed to reduce the effect of friction and shear forces on the wound.[14]

7 BALANCING PERMEABILITY AND ABSORBENCY OF THE SELECTED DRESSING

Considerable attention has been given to absorbent wound dressing research and development. To prevent blistering, a moist, foam-filled, absorbent dressing should be
used. The dressing should allow a small degree of evaporation while retaining a moist wound healing environment, yet be resistant to the entry of pathogens. The dressing should be able to allow for swelling of the wound and surrounding skin as the inflammatory stage of wound healing progresses, without affecting the permeability, conformity, or adhesion.

8 MINIMISE DRESSING CHANGES TO PREVENT BLISTERING

Studies into prevention of wound blistering show that the less frequently the dressing is changed, the lower the risk of blistering. For this reason, the wound dressing chosen for use postoperatively should have as long as possible in situ duration. Unless changing is required due to signs of excessive exudate and possible infection, keeping dressings in place should be favoured, however this will be determined on an individual patient basis, and as per local guidelines, which could be, for example, 24 hours or until the dressing begins to come away from the wound.

9 WHEN POSSIBLE, THE DRESSING SELECTED SHOULD ALLOW THE WOUND TO BE VISUALISED WITHOUT ITS REMOVAL

Postoperative wound inspection and evaluation is a mainstay of good wound care. The ability to inspect a wound without removing the dressing will aid in reducing the risk of wound blister formation by reducing the number of episodes of dressing removal / application, however the other required properties of the dressing should not be compromised. Examples of dressings that allow visualisation of the wound are OPSITE™ Post-Op (Smith & Nephew), OPSITE™ FLEXIGRID™ (Smith & Nephew), Tegaderm™ (3M), Mepore® Film (Mölnlycke Health Care).

10 SEEK EXPERT HELP WHEN NEEDED

The tissue viability team and nurse specialists are expert in providing support and guidance in complex wound care situations. These experts should be consulted when the choice of dressing is not clear for a particular patient with a complex wound or needs; the wound is showing signs of infection; wound blistering has occurred and needs treatment; or closer liaison with primary care services is required. Early signs of blistering include: pain in the periwound area; soft tissue swelling surrounding the wound; or redness.

The tissue viability team are a useful resource for policy, guidelines, training, education and knowledge of latest research and products, and can provide regular updates to all key staff.

CONCLUSION

Patient assessment preoperatively is extremely important, and of equal importance is the choice of dressing for a moving, orthopaedic surgical wound. Ideally, the dressings chosen in these circumstances should be thin, flexible, self-adherent without skin pulling, friction-reduced, absorbent, foam-filled, transparent, of soft-silicone manufacture, and anti-microbial. The patient care plan and dressing selected must be communicated to all key healthcare professionals providing care to the patient in question prior to surgery, and acted on by the pre-, peri- and post-operative surgical teams. Much of the responsibility for reducing wound blister risk rests with the nursing team in acute and primary care settings, and excellent communication between and within these teams is needed. Orthopaedic surgery-related wound blisters can be prevented, thereby reducing the budgetary burdens associated with adverse wound-related events and improving patient outcomes.

AUTHOR DETAILS

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REFERENCES

Understanding and managing wound biofilm

Ten Top Tips

Our understanding of the factors that delay wound healing continues to improve through advances in research into the microenvironment. There is now strong evidence that biofilm is present in the majority of chronic wounds.\(^1\)\(^-\)\(^4\) The pathogenesis of biofilms continues to be evaluated, but current knowledge suggests they are detrimental to wound healing and degrade the extracellular matrix. We acknowledge that there are gaps in the evidence and significant debate continues on how best to move the current understanding forward.

If we accept the premise that biofilm is present in the majority of chronic wounds – and that it has potential to delay healing – then the clinician requires knowledge on how to identify biofilm presence and how best to manage it. Here, the International Wound Infection Institute provides ten top tips on understanding and managing would biofilm.

1. Understand the terminology to get the most out of research articles and guidance documents

At the most basic level, a biofilm can be described as bacteria embedded in a thick, slimy barrier of sugars and proteins. The biofilm barrier protects the microorganisms from external threats.\(^5\) More detailed descriptions of biofilm recognise it to be a complex microbial community that is encapsulated in an extracellular polysaccharide matrix (glycocalyx). The glycocalyx is composed of proteins, polysaccharides and extracellular DNA. The matrix of sugar and protein shields the microbial contents against the effects of the individual’s immune system and many topical and systemic antimicrobial agents. The organisms within the biofilm cannot be detected using a normal wound culture method.

The following terms are key to understanding any discussion of biofilms. They are defined here specifically in the context of wound management.\(^6\)

**Planktonic bacteria** Free floating bacteria that are not attached to a wound surface. They are susceptible to systemic and topical antibiotics and can be detected using a normal wound culture swab.

**Quorum Sensing** The ability of bacteria to communicate with each other by releasing, sensing and responding to small signal molecules. This allows the bacteria to act like a multicellular organism with the ability to develop into biofilm and increase its defences and virulence.

**Persistor bacteria** Quiescent (i.e. metabolically inactive) bacteria that are less susceptible to antibiotic therapies.

2. Identification: recognising biofilm is a complex, specialist task

Specialised microscopic techniques used since 2008, have allowed several research groups to demonstrate that 60% to 90%\(^7\) of chronic wounds have biofilm formation.\(^1\)\(^-\)\(^3\)\(^,\)\(^8\)\(^-\)\(^9\)

Currently, the only definitive techniques available to detect biofilm involve advanced microscopy or specialised culture techniques. Microbiologists and researchers have used several microscopy methods to identify structures that are characteristic of biofilms such as epifluorescence microscopy, confocal laser scanning microscopy, scanning electron microscopy, and light microscopy [**Figure 1**].\(^10\)

As standard clinical microbiology culturing procedures only detect planktonic bacteria, special procedures must be used to culture bacteria that are present in biofilms. Typically, samples are initially treated for 24 hours in antiseptic solutions that rapidly kill all planktonic bacteria (such as brief exposure to dilute bleach) the neutralised biofilm communities are physically dispersed with ultrasonic energy and cultured on nutrient agar plates to quantitate levels of biofilm bacteria.\(^11\)

**References**

Prontosan®

For cleansing and moistening of skin wounds and burns. For the prevention of biofilm.

- Reduces healing time
- Prevents infections
- Absorbs wound odour
- Painless dressing changes
There is significant debate as to whether clinicians can rely on clinical indicators to determine the presence of biofilm in a wound. There is significant debate as to whether clinicians can rely on clinical indicators to determine the presence of biofilm in a wound.

**Table 1** summarises the key factors that may indicate the presence of biofilm. Broadly, the clinical indicators that should raise suspicion of biofilm include:

- Antibiotic failure
- Infection of >30 days’ duration
- Friable granulation tissue
- A gelatinous material easily removed from wound surface that quickly rebuilds.

**3 RISK FACTORS FOR BIOFILM FORMATION: BE ABLE TO RECOGNISE PATIENTS AND WOUNDS THAT ARE AT RISK**

Although there is limited information regarding specific risk factors for biofilm, it is felt that many of the same factors that delay wound healing also predispose to biofilm formation.

We now understand that many medical conditions are the result of biofilm formation, cystic fibrosis, periodontitis, endocarditis, kidney stones, tonsillitis, osteomyelitis, and persistent otitis media, to name a few. Biofilms are also associated with use of implants and prosthetics such as indwelling urinary catheters, heart valves, joint replacements and contact lenses.

Risk factors include: immuno-compromise; decreased perfusion; presence of foreign bodies; hyperglycaemia; white blood cell dysfunction; necrotic tissue; oedema; malnutrition; repeated trauma; high moisture levels. Malik et al also suggest that the following may contribute to the development of biofilm formation: diabetes, duration of ulcer >1 month, size of wound (>4 cm²), male sex, and previous antibiotic use.

**4 WOUND CLEANSING: THE FIRST STEP IN REMOVING NONViable DEBRIS FROM THE WOUND**

Rodeheaver and Ratliff define wound cleansing as the “removal of surface contaminants, bacteria and remnants of previous dressings from the wound surface and its surrounding skin”. This definition best reflects the importance of removing all dressing product, wound debris and care of the periwound. Benefits attributed to wound cleansing are well known, but the issue appears to be when, how and, with what.

An international consensus asserts that cleansing an infected chronic wound at each dressing change is warranted. Other indicators for cleansing a wound are obvious contamination with dirt, debris, foreign matter, excess exudate, slough and nonviable tissue.

As with any wound, a holistic assessment is completed and the wound and patient requirements are determined. Optimally solutions should be at body temperature to avoid cooling of the wound and risk of slowing mitotic activity.

Methods employed for wound cleansing may vary. Therapeutic irrigation with a force of 4–15 psi has been demonstrated as effective and safe. Whatever solution is chosen to clean the wound, it should be: nontoxic; hypoallergenic; readily available; cost-effective; easy to use.

Wound cleansing solutions commonly used in wound management include: sterile normal saline, sterile water, potable tap water, and liquid antiseptics. A Cochrane review in 2008 concluded that there was some evidence that using potable tap water to clean a wound may reduce planktonic bacteria; other studies suggest that normal saline and tap water are ineffective for biofilm management.

When wound infection is suspected then a solution with a surfactant, antiseptic, or antimicrobial agent is recommended. Further
investigation into the efficacy of antiseptics for anti-biofilm management is warranted, however, some commonly used antiseptic solutions are: polyhexanide (PHMB) with betaine (a surfactant); povidone-iodine; octenidine with ethylhexyl glycerine (a surfactant). As previously stated, each clinician should be aware of the cytotoxicity of each solution, appropriate concentrations and the individual wound requirements when choosing the most appropriate solution.

5 DEBRIDEMENT: MECHANICAL REMOVAL OF BIOFILM IS OFTEN REQUIRED

Debridement can be defined as the removal of nonviable tissue and foreign matter (including residual dressing product) from a wound. Wound bed preparation and TIME (management of Tissue, Infection and Inflammation, Moisture Balance and Edges of wound) have been considered the standard for appropriate wound management for over a decade[30] and biofilm-based wound care incorporates these same principles (FIGURE 2).

Sharp debridement is considered the most significant method in the prevention and control of biofilm. Wolcott and colleagues[22] have demonstrated that post-debridement biofilm is more susceptible to antimicrobial treatments for 24–48 hours. They suggest serial debridement to remove mature biofilm, followed by the application of a topical antimicrobial to address the remaining immature, more susceptible biofilm.

6 TOPICAL ANTIMICROBIALS

The action and bactericidal efficacy of topical antimicrobials against biofilm

Figure 2. Principles of wound biofilm management.[21]

Table 1. Clinical indicators of biofilm in chronic wounds and supporting evidence.

<table>
<thead>
<tr>
<th>Clinical Indicator</th>
<th>Supporting Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive moisture / exudate</td>
<td>Evidence that excessive moisture encourages biofilm development[12]</td>
</tr>
<tr>
<td>Poor-quality granulation tissue (e.g. friable, hypergranulation)</td>
<td>High bioburden may present as friable granulation tissue[18]</td>
</tr>
<tr>
<td>Signs and symptoms of local infection</td>
<td>Secondary signs of infection are more typical of biofilm infection[14]</td>
</tr>
<tr>
<td>Antibiotic failure or recurring infection following antibiotic cessation</td>
<td>Antibiotic failure is the hallmark of biofilm infection. The use of antibiotics is still controversial regarding biofilm management; it has been suggested that – without the use of concurrent strategies for biofilm management – efficacy may be as low as 25%–30%[6,14]</td>
</tr>
<tr>
<td>Negative wound culture</td>
<td>Routine cultures will only pick up the free-floating (i.e. planktonic) bacteria, not those within a biofilm[2,18]</td>
</tr>
<tr>
<td>Nonhealing wound in spite of optimal wound management and host support</td>
<td>Biofilm defences include resistance to: ultraviolet light, biocides, antibiotics and host defences. Biofilm can quickly reconstitute but strategically does not kill its host[16]</td>
</tr>
<tr>
<td>Infection lasting &gt;30 days</td>
<td>Infections of 30 days’ duration may also contain biofilm, planktonic infection would not persist &gt;30 days[15]</td>
</tr>
<tr>
<td>Responds to corticosteroids and TNF-α inhibitors</td>
<td>Inflammation is a by-product of biofilm, thus a good response to these treatments suggests presence of biofilm. Decreasing inflammation removes the primary source of nutrition[15]</td>
</tr>
<tr>
<td>Gelatinous material easily removed from the wound surface</td>
<td>Clinicians and researchers are trying to determine if the by-product of biofilm formation can be clinically seen. Case studies demonstrate differences in wound material that can be easily removed but quickly reform, either on the wound or under a dressing. Some authors believe that slough equals biofilm, but this has not been conclusively proven. A build-up of self-secreting polymers and host components is suggestive of biofilm[20,21]</td>
</tr>
<tr>
<td>Surface substance reform quickly</td>
<td>Research suggests that biofilm can reform within 24–72 hours[22]</td>
</tr>
</tbody>
</table>

REFERENCES


“Sharp debridement is considered the most significant method in the prevention and control of biofilm.”
bacteria have been studied in vitro and in a porcine skin model. In particular, both silver and iodine releasing dressings have been shown to kill biofilm bacteria.[31–35] One study demonstrated a reduction in colony forming units over time with several silver dressings, however, cadexomer iodine achieved complete kill rates of *Staphylococcus aureus* in mature biofilms.[36]

While antimicrobial dressings may have variable effects on bacteria in mature biofilms, they are known to be widely effective against planktonic bacteria. The best strategy for biofilm based wound care is the “clean and cover” approach, which relies on adequate debridement to disrupt biofilms and the use of antimicrobial dressings between debridements to reduce the ability of planktonic bacteria to re-establish a biofilm.

7 MOISTURE MANAGEMENT
Malik et al[36] identified excessive moisture as a risk factor for biofilm formation. The TIME framework[37] outlines the need to manage moisture levels with appropriate dressings or appliances. Excessive wound exudate may relate to underlying conditions including: inflammation/infection; venous insufficiency; poor compliance or concordance with compression therapy; development or deterioration of systemic causes of peripheral oedema (e.g. chronic heart failure, renal failure, liver failure); lymphoedema.

The underlying cause of excessive exudate must be determined and managed appropriately, with medical management or compression therapy should the cause be venous insufficiency or lymphoedema. Absorbent dressings should be used and the dressing change frequency adjusted to maintain a moisture balance and prevent maceration. If a biofilm is suspected, previously discussed strategies should be employed.

8 SWAB RESULTS ARE OFTEN INCONCLUSIVE; THE LEVINE METHOD IS RECOMMENDED IF SWABS ARE TAKEN
While some clinicians may infer the presence of a biofilm because of presenting clinical characteristics as previously discussed, others may choose to culture the wound. However, wound swab results may be misleading as clinical microbiology laboratories use methods that select for planktonic bacteria or are not always suitable for culture of anaerobic species, and the sampling technique may not capture bacteria protected within a biofilm. The result is often a negative or inconclusive culture report.[34] Methods to rapidly detect the presence of biofilm are required to assist the clinician in effective wound treatments.

Evidence suggests the best method for obtaining a wound culture of planktonic bacteria is the Levin method.[39–41]
Case report

Pyoderma gangrenosum associated with melanoma

Pyoderma gangrenosum (PG) is a rare, non-infectious, ulcerating, neutrophilic dermatosis, that most frequently affects the lower extremities of adults aged 25–54 years.[1,2]

There are four main clinical types of PG: (i) ulcerative; (ii) pustular; (iii) bullous; and (iv) vegetative (2). In addition, peristomal PG is known.[2,3] These variants of PG can be linked to specific associated conditions in approximately 50% of patients.[2] The most common associated diseases are inflammatory bowel disease (IBD), arthritis and haematologic disease.[1,4,5]

In the present case, we describe a female patient with PG associated with malignant melanoma as an unusual clinical presentation. We emphasize the importance of diagnosing the PG-associated diseases in time and initiating the necessary treatment.

CASE REPORT

In June 2010 a 59-year-old woman was referred to the authors’ institution with a 14-day history of spontaneously developed, large, exuding wounds on her legs. The patient reported a sore, slightly elevated bruising on the left lower leg as the initial area of concern. A couple of days later, she developed similar bruising over her right hip. During the days that followed, these two areas deteriorated into large, exuding wounds: a 10 cm x 10 cm ulcer, sharply defined with a red–purple edge on the left lower leg [FIGURE 1]; and a 12 cm x 10 cm ulcer on the right hip – similar in appearance to the one on the lower leg, but more necrotic.

On presentation to the authors’ institution, thorough physical examination of the patient revealed no pathological findings, beyond the described skin changes.

The ulcers were clinically suggestive of PG. After blood samples and a skin biopsy were taken, treatment with prednisolone (40 mg per day) and painkillers was commenced. Wound care with local steroids, foam dressings, and absorbent bandages (changed daily) was also undertaken.

Laboratory tests included complete differential blood count, electrolytes, liver enzymes, Wassermann reaction, antinuclear antibody, rheumatoid factor, antineutrophil cytoplasmic antibodies, immunoglobulines, and urine analysis. The aberrant blood samples showed elevated C-reactive protein (CRP) of 126 mg/L, and erythrocyte sedimentation rate of 68 mm/hour, thrombocytes of 622 x 10⁹/L, leukocytes of 22 x 10⁹/L with a predominance of neutrophils of 19 x 09/L, and microcytic anaemia with a haemoglobin level of 6.2 mmol/L.

Pyoderma gangrenosum associated with melanoma

Pyoderma gangrenosum – a rare, neutrophilic dermatosis – is associated with diseases including inflammatory bowel disease, arthritis and haematologic disease. This case story describes an unusual association between pyoderma gangrenosum and malignant melanoma. Clinicians should consider malignant melanoma in all patients with pyoderma gangrenosum.

Authors:
Caroline Carøe, Karsten Fogh

Figure 1. Pyoderma gangrenosum on the patient’s left lower leg (10 cm x 10 cm) at presentation. Note the sharply defined, red–purple wound edge.
A 6-mm punch biopsy taken from the edge of the lower-leg ulcer showed necrosis and inflammatory dermal infiltrates composed of mature neutrophils, compatible with PG. A computed tomography scan of the chest-abdomen-pelvic and bone marrow biopsy revealed no underlying disease.

Two days after presentation, the ulcer on the lower leg had increased in size to 13 cm x 10 cm. There were no signs of infection in either wound. CRP had decreased to 22 mg/L, erythrocyte sedimentation rate to 33 mm/hour, and leukocytes to 16.6 x 10^9/L. A week after commencement of treatment no further reduction in ulcer size had been achieved on either the lower leg or hip. Local treatment of the wound was betamethasone cream with chinoform cream with a nonadherent, absorbent dressing.

In July 2010, 5 weeks after the first presentation to the authors’ institution, treatment with azathioprine (dose escalation to 200 mg per day) was commenced, phasing out prednisolone and within a couple of months and the wounds showed marked improvement. The wounds were treated locally with a zinc ointment to the periwound area and a foam dressing. Granulation began and there was an initial epithelialization.

In March 2011, the patient presented to her GP with skin alteration on the back and swelling in the armpit. After excision, she was diagnosed with malignant melanoma. She was confused and magnetic resonance imaging revealed cerebral metastases. Treatment with azathioprine was discontinued and intravenous steroids commenced. The patient died in May 2011.

DISCUSSION

PG lesions are described as painful, sharply outlined, necrotic ulcers, creating haemorrhagic or purulent exudates, and with undermined, violaceous borders and a surrounding zone of erythema. PG is a clinical diagnosis; there is no specific histological or serological marker for the condition that can alone provide the diagnosis. However, histologically, PG is characterised by the presence of inflammatory dermal infiltrates with a predominance of mature neutrophils.

Local wound care of PG is important to improve conditions for healing and prevent secondary bacterial infection. The ulcers should be cleansed daily and application of potassium permanganate solution or silver sulphadiazine cream can be helpful. Topical potent corticosteroids are useful to reduce the irritation in the skin surrounding the ulcer. Nonadherent foam dressing are recommended.

The systemic diseases associated with PG are seen in approximately 50% of the overall cases of PG, but in patients with the ulcerative type of PG they occur in >70% of patients.

Ahronowitz et al report IBD to be the most common PG-associated disease, followed by arthritis, haematologic abnormalities, and haematologic malignancies. Other associations listed as rare or questionable include hidradenitis suppurativa, pyogenic arthritis–pyoderma gangrenosum–acne syndrome, pulmonary disease, systemic lupus erythematosus, thyroid disease, solid organ malignancy, autoimmune hepatitis, and sarcoidosis. The most common malignant disease associated with PG is haematologic malignancy, this is seen in up to 7% of PG cases – predominantly acute myeloid leukemia, which has a 1-year mortality rate as high as 75%.

In the present case, the authors describe PG in association with malignant melanoma. The global incidence of cutaneous melanoma is increasing. Melanoma, which commonly spreads via the central nervous system (CNS), is challenging to treat due to the lack of active systemic agents and the limited CNS penetration of available agents. Consequently, a poor prognosis is associated with CNS metastasis from malignant melanoma.

This patient with PG reported here subsequently developed cancer and died of metastatic disease. The presence of both these diseases concomitantly may be unrelated. However it could be postulated that there is a link and it may be worth thinking about malignancy, when a patient develops PG with no other related systemic disease. It is suggested that immunosuppressive treatment increases the risk of skin cancer, however this is usually related to non-melanoma skin cancer and the long-term administration of immunosuppressive treatment in transplant patients.

CONCLUSION

This case describes an unusual and worrying clinical scenario that suggests underlying malignancy should be considered in pyoderma gangrenosum cases.
Pyoderma gangrenosum is an ulcerative, cutaneous condition that usually occurs on the legs. Ulcers initially look like small insect bites or papules, progress to become larger wounds, and frequently become chronic. Patients of any age may be affected by the condition, but it predominantly occurs in the fourth and fifth decades of life. Though mortality is rare and the prognosis generally good, pyoderma gangrenosum causes pain, scarring, and often recurs.

Pyoderma gangrenosum does not have characteristic serologic or histologic features. Thus, all other potential causes of similar lesions must be excluded prior to making a diagnosis of pyoderma gangrenosum. Other causes of cutaneous ulceration that is similar in appearance to pyoderma gangrenosum include infection, malignancy, vasculitis, collagen vascular diseases, diabetes, and trauma.

The aetiology of pyoderma gangrenosum is still vague, but dysregulation of the immune system is suspected to be a major feature and the condition is associated with underlying systemic diseases in half of cases. Ascertaining the underlying systemic condition associated with a given case of pyoderma gangrenosum can be clinically challenging.

There is no consensus on the treatment of pyoderma gangrenosum, due in part to the rarity of the condition itself. Systemic medications that have been successfully used in treatment include corticosteroids, sulfasalazine, dapsone, thalidomide, minocycline, clofazamine, mycophenolate mofetil, cyclosporine, intravenous immunoglobulin, cyclophosphamide, and biologic medications. To date, only one controlled, clinical trial has been published that reports the safety and efficacy of infliximab – an antitumor necrosis factor monoclonal antibody – for the treatment of pyoderma gangrenosum.

Although there are some reports of successful flap coverage, sites of pyoderma gangrenosum-induced ulceration are not generally considered good candidates for skin grafts. Further skin breakdown at the harvest site is also a clue to diagnosis, and pathergy is often seen.

Given these limitations, the current treatment strategy for pyoderma gangrenosum is to:
1. Reduce inflammation by multiple modalities, and
2. Optimise wound healing by conservative methods.

The case report provided here by Carøe and Fogh demonstrates the difficulties of treating pyoderma gangrenosum. The diagnostic approach and treatment strategy used were in accordance with currently accepted strategies. Although it is difficult to determine whether the malignant melanoma played a role in the formation or aggravation of the ulcer in this case, malignancy should be evaluated as a possible underlying cause of pyoderma gangrenosum.

The authors should be congratulated for their efforts in treating this difficult condition, and for their vigorous search for the underlying cause.

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Technology and product review

Sciatic nerve block: A useful procedure for diabetic foot surgery

The range of comorbidities experienced by people who require lower-limb surgery to manage diabetic foot disease are many. These comorbidities make the undertaking of general anaesthesia both difficult and places them at high risk of complications during surgery or in the immediate postoperative period. In this article the authors present a description of a peripheral nerve block procedure as an alternative to general anaesthesia in patients undergoing lower-limb surgery. Two case reports are also presented.

People with diabetic foot disease regularly have severe comorbidities resulting in a high-risk profile for anaesthesia. General anaesthesia and neuroaxial blockade (e.g. spinal anaesthesia) may impair hemodynamic stability. In people with diabetes who require podiatric surgery, peripheral nerve blocks targeting at the sciatic nerve may be a useful alternative to general anaesthesia.

The authors provide a detailed description of the sciatic nerve block technique, and two case reports.

PRACTICAL PROCEDURE

While in supine position, the sciatic nerve is identified by electric nerve stimulation through a lateral approach with an insulated needle being inserted at the middle of the patients’ thigh [FIGURE 1]. The correct position of the needle (we use NanoLine 22 g × 80 mm; Pajunk®, Germany) is confirmed by electric nerve stimulation. The electrical nerve stimulator (we use Stimuplex HNS 11®; Braun, Germany) produces an electrical current that depolarises the nerve membrane and causes contraction of the effector muscles of the relevant area. This confirms the proximity of the needle to the nerve. Foot flexion at 0.1 ms and 0.4 mA indicates adequate motor response and 40 mL of local anaesthetic (e.g. ropivacaine 0.5% or lidocaine 1.5%) are injected. If technical equipment and expertise are present, the sciatic nerve may also be localised by ultrasound.

Some regions of the lower leg belong to the saphenous nerve, which is the terminal branch of the femoral nerve. In order to achieve complete anaesthesia of the lower leg, this nerve has to be blocked by additional 10 mL of local anaesthetic (e.g. ropivacaine 0.5% or lidocaine 1.5%). Because the saphenous nerve only consists of sensory fibres, electric nerve stimulation may result in painful paraesthesia and is counterproductive. It is sufficient to inject into the subcutaneous wall reaching from the tuberositas tibiae to the medial caput of the gastrocnemius muscle [FIGURE 2]. However, the saphenous nerve can also be identified by ultrasound. Sufficient surgical anaesthesia is achieved 10–15 minutes after completion of injection. Characteristics of

Figure 1. Patient position and needle insertion for a sciatic nerve block.
Technology update: Sciatric nerve block: A useful procedure for diabetic foot surgery

Figure 2. The saphenous nerve is block by injecting a subcutaneous wall from the tuberositas tibia [1] to the medial caput of the gastrocnemius muscle [2].

the block are related to the type of local anaesthetic used; lidocaine blocks have a fast onset and last from 2 to 3 hours, while ropivacaine blocks have a slower onset but regularly last >10 hours. It is therefore suggested that lidocaine and ropivacaine be combined to achieve both fast onset and a long duration. With a sufficient block, additional postoperative pain control can usually be dispensed with.

Using this block technique does not impair the patient’s protective reflexes (e.g. coughing, swallowing), meaning that there is no need for postoperative fastening and, for this reason, may make inpatient glycaemic control more manageable.

CASE STUDIES
As outlined before, diabetic patients regularly suffer from severe comorbidities, which contribute to a high risk profile according to American Society of Anesthesiologists patient classification status III (severe systemic disease – i.e. definite functional impairment [e.g. diabetes and angina with relatively stable disease, but requiring therapy]) or IV (severe systemic disease that is a constant threat to life [e.g. diabetes and angina and chronic heart failure; patient has dyspnea on mild exertion and chest pain]).

Hence, surgical procedures to manage diabetic foot disease should be undertaken with a careful consideration of the anaesthetic techniques available. Regrettably, there is a widely held belief – among both patients and healthcare professionals – that all surgical procedures require general anaesthesia. In the authors’ practice, the nerve block anaesthesia described above has proven a useful addition to the management of some patients requiring surgery to manage diabetic foot disease. The following case reports illustrate the benefits of peripheral nerve blocks in this patient group.

Case 1
A 72-year-old man was scheduled for below-knee amputation due to infected diabetic foot ulceration. The patient had long-standing insulin-dependent diabetes (IDDM), renal insufficiency and severe coronary artery disease. He had a history of myocardial infarction during a femoro–popliteal bypass surgery, which led to intraoperative cardiopulmonary resuscitation. Given the patient’s history general anaesthesia was not recommended. Due to absolute arrhythmia associated with atrial fibrillation, he was anticoagulated with high-dose enoxaparin and therefore spinal anaesthesia was contraindicated.

Following discussion, the patient consented to regional anaesthesia and the authors’ team blocked the sciatic and the saphenous nerve as described above. Beside light sedation with 0.5 mg of midazolame he received no other systemic substance.

The surgery was uneventful with a heart rate between 60 and 80 beats/min and a noninvasive blood pressure of 130/60 mmHg throughout. Postoperatively the patient was transferred to his normal ward to take lunch.

At 1-year follow-up the patient was doing well, with no major documented events.

Case 2
A 77-year-old man with a history of long-standing IDDM, renal insufficiency and arterial hypertension, was scheduled for forefoot amputation due to infected diabetic foot ulceration. The patient’s left ventricular ejection fraction was significantly reduced (15%). Spinal anaesthesia (with possibly deleterious preload reduction) and general anaesthesia (with possibly hazardous positive-pressure ventilation) seemed unfavourable interventions.

The patient consented to a regional anaesthesia and the authors’ team undertook the block described previously. Again, beside moderate intravenous sedation during the blocking procedure with midazolame and sufentanil (1 mg and 0.01 mg, respectively) no additional systemic medication was required. Surgery was uneventful, heart-rate ranged between 75 and 85 beats/min; blood pressure was stable at 130/80 mmHg.
Following the amputation, the patient was transferred to his normal ward. At 1-year follow-up the patient was doing well, with no major documented events.

**DISCUSSION**

The authors’ experience indicates that people with diabetes may benefit from peripheral nerve blocks for surgical procedures of the lower leg. The authors’ experience corresponds with previous investigations.[7,8] Avoiding general anaesthesia in this population may be a central concern, and improve short-term outcomes following lower-limb surgery.

As long-standing diabetes impairs various body systems, these patients have low reserves to preserve against additional straining factors during general anaesthesia.[9,10] This includes:

- Preserving cardiopulmonary integrity, which is negatively influenced by positive pressure ventilation during general anaesthesia.[11]
- Negating the need for anaesthetic agents that reduce vascular tone and increase the need for vasopressor substances, which may impair capillary blood flow.
- Insufficient metabolic and excretory capacities may cause extended effects of muscle relaxants, inhalants and opioids, thereby impairing the early postoperative recovery period.[12] The latter two additionally reduce the integrity of the immune system.[13] Combinations of these factors are suspected to be responsible for increased pulmonary complications in people with diabetes.[14]

With the use of peripheral blocks, the drawbacks of general anaesthesia are not only avoided, but additional benefits added:

- By contrast to signal transduction under general anaesthesia, blocking a peripheral nerve means thatafferent signals are stopped before they cause efferent endocrine stress responses.[15]
- Patients do not require postoperative fasting, so that continued oral medication and nutrition may help in preserving blood glucose homeostasis during this vulnerable period.[16]

**CONCLUSION**

Healthcare professionals who are involved in surgical procedures of the lower limbs in vulnerable patients with diabetes may consider the use of peripheral nerve block in stead of general anaesthesia, in those in whom it is appropriate.

**REFERENCES**

## Wound digest

This digest summarises some of the key papers published on issues related to wound management.

### SELECTED PAPERS OF INTEREST

1. **Effectiveness of percutaneous tenotomy for diabetic toe ulcers**
   - Readability: ✓ ✓ ✓ ✓
   - Relevance to daily practice: ✓ ✓ ✓ ✓
   - Novelty factor: ✓ ✓ ✓ ✓

   The authors evaluated the effectiveness of percutaneous flexor and/or extensor tenotomy procedures for the treatment of diabetic, neuropathic toe ulcers.

   The medical files of 83 individuals were reviewed and, in total, percutaneous tenotomy procedures were carried out for 103 tip-of-toe ulcers; 26 cock-up/dorsal ulcers; 21 kissing ulcers; and 10 plantar metatarsal ulcers.

   A successful response to the procedure was a healing response at week 1 and wound closure at week 4 post-procedure.

   Percutaneous tenotomy procedures were successful for the treatment of tip-of-toe ulcers, kissing ulcer, and cock-up ulcers (P < 0.01). However, they were not successful for the treatment of plantar metatarsal ulcers.


2. **Oral treatment of pressure ulcers with polaprezinc (zinc L-carnosine complex): 8-week open-label trial**
   - Readability: ✓ ✓ ✓ ✓
   - Relevance to daily practice: ✓ ✓ ✓ ✓
   - Novelty factor: ✓ ✓ ✓ ✓

   The authors aimed to evaluate the efficacy and safety of polaprezinc (oral zinc L-carnosine complex; an agent commonly prescribed for gastric ulcers in Japan) over 8 weeks’ treatment for chronic pressure ulcers.

   Patients (n=14; nine men; 68.4 ± 11.8 years of age) with stage II–IV pressure ulcers (II, n=1; III, n=9; IV, n=4) of ≥8 weeks’ duration were recruited and received 150 mg/day of oral polaprezinc (116 mg L-carnosine; 34 mg zinc) for a maximum of 8 weeks; pressure ulcer severity was measured weekly using the Pressure Ulcer Scale for Healing (PUSH) score and blood biochemistry was monitored.

   Eleven patients healed within 8 weeks; none withdrew.

   From baseline to 8 weeks, the PUSH score improved significantly (8.1 [95% confidence interval (CI): 6.0–10.3] to $-1.4$ [95% CI: $-4.0$–$1.1$; $P<0.001$]); the difference from baseline became significant after 1 week ($P<0.05$) with a mean weekly improvement in PUSH score of 2.0.

   During the course of treatment, serum zinc levels increased significantly ($P<0.001$), while serum copper levels ($P=0.001$) and copper:zinc ratios ($P<0.001$) decreased significantly.

   Pre-existing copper deficiency deteriorated in one participant.

   Data from this small cohort suggest that 8 weeks of oral polaprezinc may be effective and well-tolerated in the treatment of pressure ulcers.


3. **Repositioning for pressure ulcer prevention in adults**
   - Readability: ✓ ✓ ✓ ✓
   - Relevance to daily practice: ✓ ✓ ✓ ✓
   - Novelty factor: ✓ ✓ ✓ ✓

   The authors undertook a literature review to assess the effects of repositioning on the prevention of pressure ulcers (PUs) in adults – regardless of risk or inpatient setting – to ascertain the most effective repositioning schedules for adult PU prevention, and also to ascertain the cost associated with implementing different repositioning regimens, compared with alternate schedules or standard practice.

   Randomised controlled trials (RCTs) that assessed the effects of any repositioning schedule or different patient positions and measured PU incidence in adults in any setting were collected from electronic databases and the reference sections of included studies.

   Three RCTs and one economic study were included in the review (representing a collective total of 502 participants).

   Two trials compared the 30º and 90º tilt positions using similar repositioning frequencies, the third RCT compared alternative repositioning frequencies. All three trials were underpowered and at high risk of bias.

   The risk ratio (RR) for PUs (any category) with 2-hourly repositioning compared with 3-hourly repositioning on a standard mattress was 0.90 (95% CI: 0.69–1.16), and was not significantly different for 4- and 6-hourly repositioning on viscoelastic foam mattresses (RR 0.73; 95% CI: 0.53–1.02).

   A cost-effectiveness analysis of nursing time revealed that...
3-hourly repositioning using 30° tilt overnight was cost saving (nurse time cost per patient £206.6 vs £253.1).

- The authors concluded that the lack of robust evaluations of repositioning frequency and position for PU prevention, while a source of uncertainty, do not mean that these interventions are ineffective because all comparisons are grossly underpowered.


4 Examining factors that influence the adoption of health-promoting behaviours among people with venous disease

- The authors investigated a multi-component educational programme, and conducted a secondary analysis of data, to examine relationships between health behaviours among people with a venous leg ulcer who participated in an e-learning programme.

- Relationships between various health behaviours following completion of an education programme were assessed; participants were receiving community nursing services, had a medically confirmed venous leg ulcer, and spoke English.

- The education package comprised six sessions that covered leg ulcer treatment and the role of compression therapy, being active and the conduct of leg exercises and leg elevation, healthy eating and hydration, skin care, and compression stocking and hosiery application aids.

- No significant differences were identified by participant gender, age or need for a carer. Participants performing few of the recommended health-promoting behaviours prior to the education achieved more behaviour change than those already engaged in the sought after activities (P=0.000).

- The authors concluded that, while people living with venous disease are encouraged to make multiple behaviour changes, there is limited association between the health behaviours recommended and those subsequently pursued.


5 A prospective, randomised comparative study of weekly versus biweekly application of dehydrated human amnion/chorion membrane allograft in the management of diabetic foot ulcers

- In this prospective, randomised, comparative, non-blinded, single-centre clinical trial, the authors aimed to determine whether weekly application of dehydrated human amnion/chorion membrane allograft for the treatment of diabetic foot ulcers reduced time to healing more effectively than biweekly application.

- Patients with non-infected ulcers (n=40) of ≥4 weeks’ duration were recruited and randomised to receive weekly or biweekly allograft application plus a non-adherent, moist dressing with compressive wrapping and offloading for the duration of the 12-week study period.

- Complete healing was achieved in 92.5% of ulcers during the study period; mean time to complete healing was 4.1±2.9 versus 2.4±1.8 weeks (P=0.039) in the biweekly versus weekly groups, respectively. By week 4, complete healing occurred in 50% of the biweekly group, and 90% of the weekly group (P=0.014). The total number of grafts applied was similar between the groups (2.4±1.5 vs 2.3±1.8 for biweekly vs weekly groups, respectively; P=0.841).

- The authors concluded that allograft is an effective treatment for diabetic ulcers and that weekly application heals wounds more rapidly than biweekly.


6 Comparative effectiveness of advanced wound dressings for patients with chronic venous leg ulcers: a systematic review

- The authors undertook a systematic review of the literature on the benefits and harms of advanced wound dressings on wound healing, mortality, quality of life, pain, condition of the wound bed, and adverse events among patients with chronic venous leg ulcers, as compared with treatment with compression alone.

- Primary studies from January 1980 through July 2012 listed in online databases were collected and evaluated by two independent reviewers.

- Thirty-seven studies met the search criteria and were included.

- Though most evidence was of low or insufficient quality, some suggested that cellular dressings, collagen, and some antimicrobial dressings may improve chronic venous leg ulcers healing rates when compared with compression alone or other dressing types.

- The authors highlighted the limited data available and concluded that, given the poor quality of the literature, well-conducted studies to evaluate the effectiveness of advanced wound dressings on chronic venous ulcer healing are needed in the future.

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