

Taking the fear out of wound infection: conquering everyday issues



Learning objectives

1. Identifying the cost which wound infection can have on both the patient and healthcare organisations
2. Understanding the development of wound infection and what signs and symptoms may present
3. The role of biofilm in delayed wound healing and infection and what you can do to manage it
4. Considerations when making treatment choices following holistic assessment of the patient's needs

Antibiotic resistance

Antibiotic resistance is an increasing problem on a global scale.

England's chief medical officer, Sally Davies, warned:

“The world is facing an antibiotic apocalypse. Unless action is taken to halt the practices that have allowed antimicrobial resistance to spread and ways are found to develop new types of antibiotics, we could return to the days when routine operations, simple wounds or straightforward infections could pose real threats to life.”

Antibiotic resistance

Antibiotics alone **should not be used routinely for the promotion of wound healing.**

Antibiotics must be used in combination with prudent wound management strategies, such as wound bed preparation (i.e. debridement and therapeutic cleansing) and use of dressings to optimise wound healing and reduce bioburden.



Antibiotic resistance

Remember

Systemic antibiotics should be reserved for use only when the degree of infection is unable to be controlled with local intervention alone (i.e. topical antiseptic and debridement at every dressing change).

Cost of infected wounds

Wound infection can affect:

- Hospital bed days (admissions/readmissions)
 - Mean additional length of stay of 11 days at a mean cost of €5,800 per case and with an attributable mortality rate of 5% (Posset et al, 2009)
 - Surgical site infection (SSI) affects 30–40 patients per 1,000 operations (Drew et al, 2007)
 - In 2013–14 there were 104,598 cases of cellulitis treated in secondary care, with a mean bed stay of 6.2 days (Lee and Levell, 2016)
- Costs of nursing visits, dressings, etc:
 - The majority of chronic wound infections are managed in the community
 - Chronic wounds are at an increased risk of infection, or may be unable to heal due to the presence of micro-organisms within the wound

Cost of infected wounds

- Cost of DFUs to the NHS is approximately £650 million (NICE, 2012), and account for more than 80% of amputations (NICE, 2015)
 - More than one-half of non-traumatic lower extremity amputations are related to diabetic foot infections
- Non-healing venous leg ulcers cost £13,500 per year versus £3,000 for a healed ulcer (Guest et al, 2015)

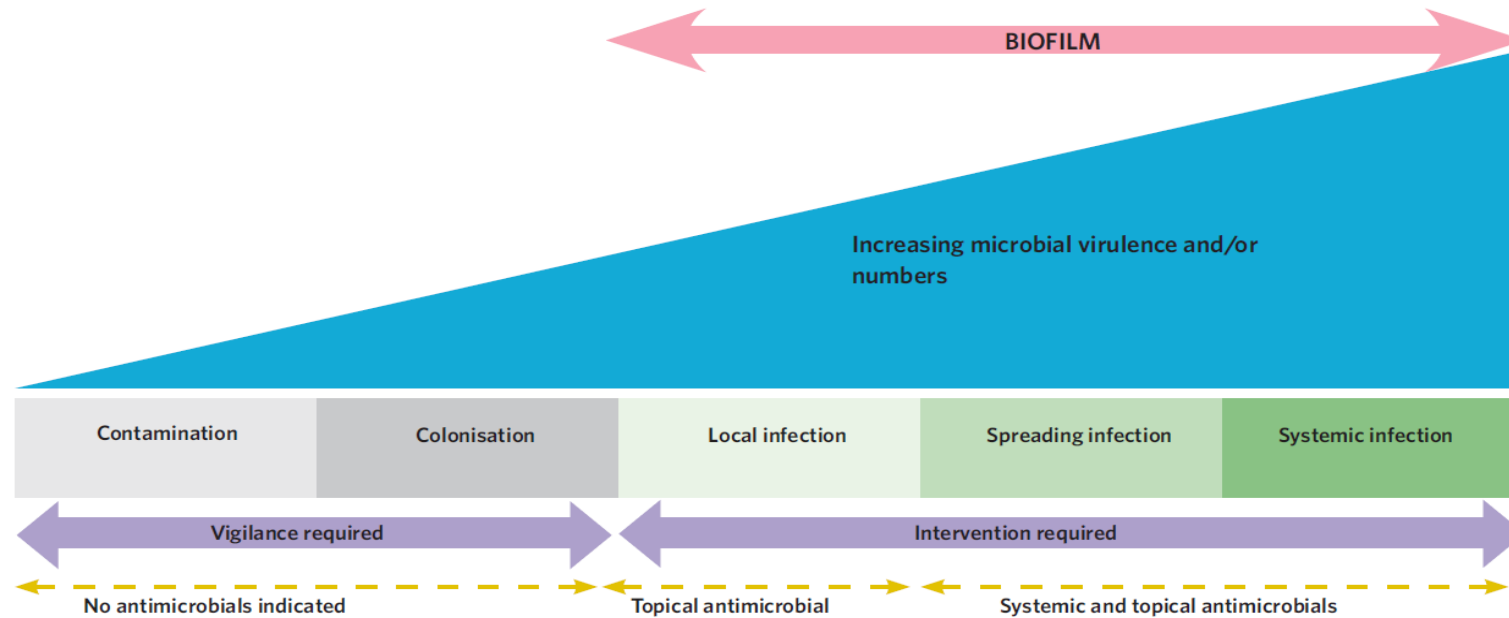
Patient cost of infected wounds

- Pain and suffering
- Increased exudate and malodour
- Anxiety and distress
- Impaired mobility
- Social isolation
- Delayed healing
- Increased patient morbidity/mortality — cellulitis, osteomyelitis, sepsis, death



Wound bioburden

All wounds contain micro-organisms, yet the majority are not infected.



Previously, critical colonisation was also included, but this was removed in 2016 due to a lack of clarity and evidence around the term.

Diagnosis of wound infection

- Diagnosis of wound infection is based on clinical assessment of the patient and their wound
- Healthcare professionals should understand the risk factors and signs and symptoms of wound infection
- It is important to know the signs of infection in the wound type(s) you treat the most, as there are some differences
- It is also important to consider patients in whom signs and symptoms are subtle or absent
- Consider presence of biofilm as a cause of chronicity

Signs and symptoms of wound infection

- Abnormal granulation tissue
- Bleeding from friable granulation tissue at the surface
- Wound breakdown and enlargement
- Increased inflammatory signs and abscess formation
- Increased pain
- Increased odour
- Increased exudate and maceration of surrounding skin



(Leaper et al, 2015)

Patient factors to consider

- Comorbidities
- Metabolic disorders
- Medication
- Age
- Psychological factors
- Life choices



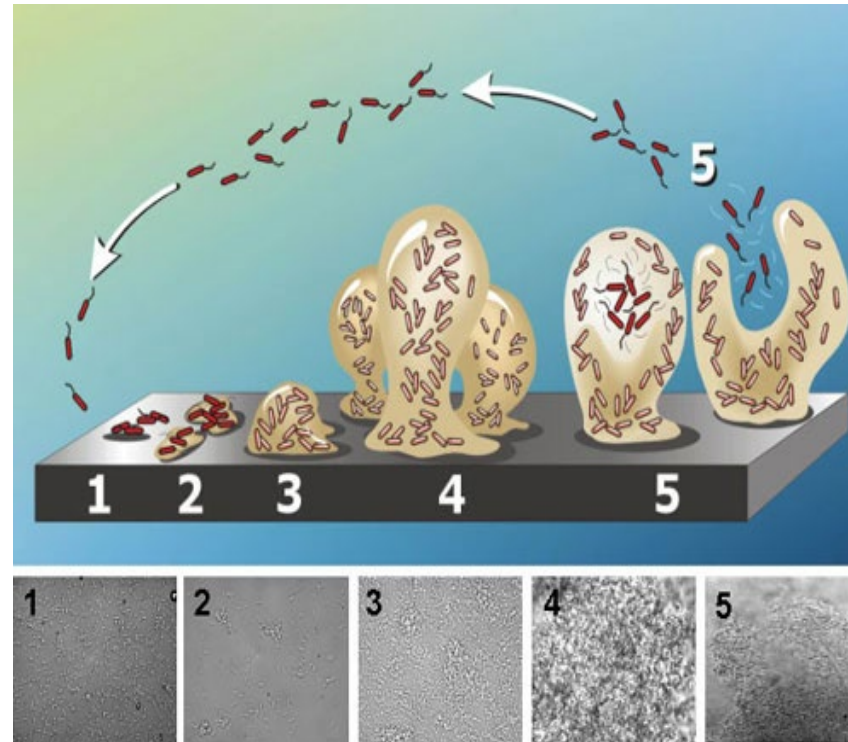
Other things to consider — is there a biofilm?

- It is thought that nearly all chronic wounds contain biofilm (Malone et al, 2017)
- A biofilm is defined as 'an aggregate of bacteria tolerant to treatment and the host defence' (Bjarnsholt et al, 2016)
- Slow growth due to metabolic inactivity makes biofilm less susceptible to the actions of antibiotics and other antimicrobial agents (Bjarnsholt et al, 2016; Wounds UK, 2017)
- Also protected from antimicrobial agents by an extrapolymeric substance (EPS) made up of polysaccharides, DNA and proteins
- Clinical consequences of biofilm include delayed healing, inflammation and increased exudate volume

Five stages of biofilm formation

How quickly do biofilms form?

1. Initial attachment
2. Irreversible attachment
3. Maturation, 1
4. Maturation, 2
5. Dispersal



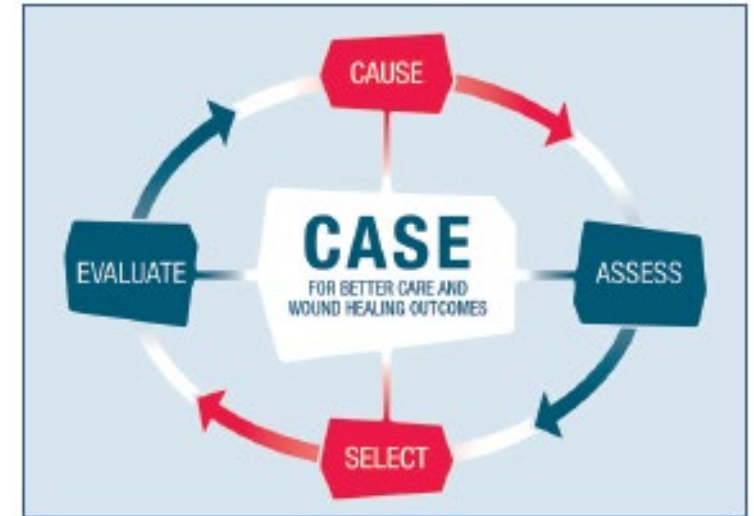
Planktonic bacteria typically:

- Attach within minutes
- Form attached microcolonies within 2–4 hours
- Develop initial extracellular polymeric substance tolerant to biocides within 6–12 hours
- Evolve into mature biofilm colonies within 2–4 days
- Rapidly recover from mechanical disruption and reform mature biofilm within 24 hours

Holistic management of wound infection

Holistic management of wound infection should aim to:

- Optimise host response
- Optimising the wound healing environment
- Reduce/manage wound bioburden levels



Implement local infection control policies and procedures.

Holistic management of wound infection

Optimise host response:

- Optimise management of comorbidities
- Minimise or eliminate risk factors that increase infection risk where feasible
- Optimise the patient's immune response
- Maximise nutritional status and hydration

Consider: Is your patient high risk and may require prophylactic management?

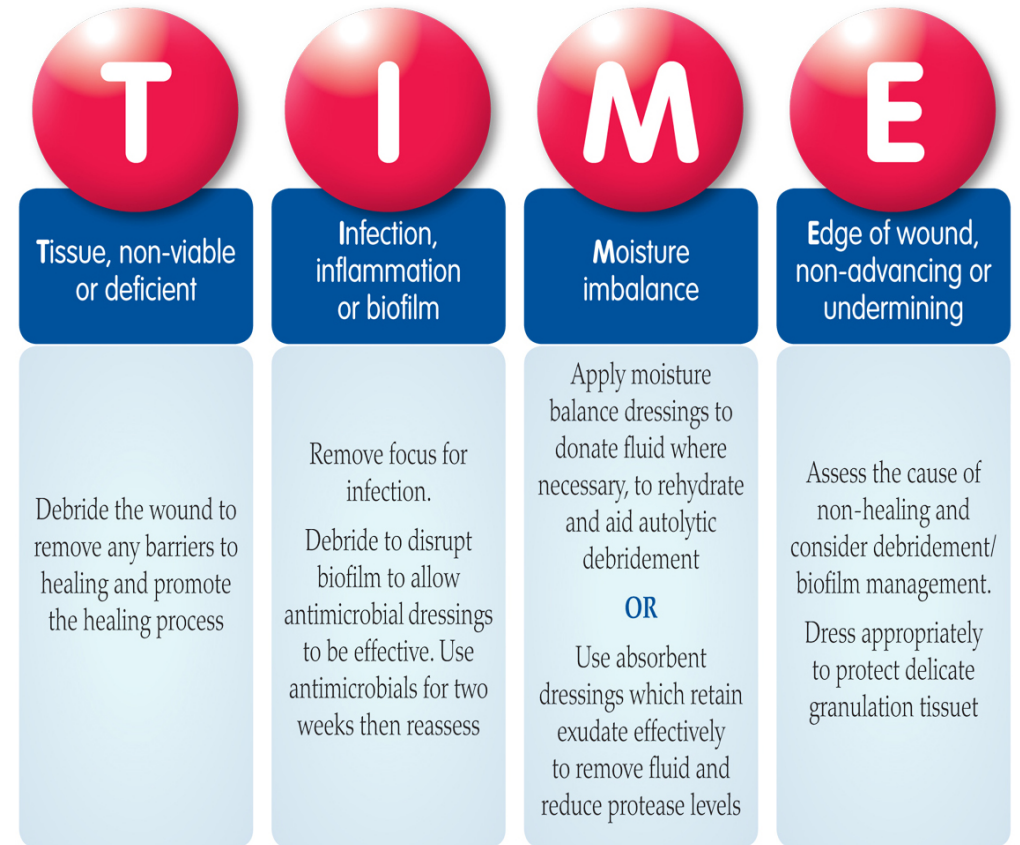


Holistic management of wound infection

Optimising the wound healing environment

The principles of wound bed preparation are entrenched concepts, based on the acronym TIME.

TIME also allows clinicians to examine key elements of wound healing through a structured approach.



Holistic management of wound infection

Reduce wound bioburden

- Prevent cross-infection
- Facilitate wound drainage
- Ensure periwound hygiene and protection
- Ensure effective wound bed preparation
- Use effective biofilm management and prevention
- Use appropriate dressings to manage exudate — a dressing containing an antimicrobial may be considered
- If considered necessary, consider an appropriate topical antimicrobial agent



Biofilm management

- Frequent wound bed debridement to break up the biofilm, disrupt the ECM and inhibit microbial cell-to-cell communication
- Suppress microbial growth. Effective antimicrobial dressing post-debridement to prevent biofilm re-formation
- Alternate topical treatments to prevent emergence of dominant bacteria
- Effective biofilm clinical pathway to manage/disrupt and maintain the disruption of biofilms

Treatment options: antimicrobial agents

Topical antimicrobial agents are compounds often contained within topical dressings. The majority of agents are described as broad spectrum, which means that they have the ability to either kill or control the growth of organisms commonly found within an open wound bed.

Selection of an antimicrobial dressing should be based upon comprehensive holistic assessment, with a primary objective of optimising the wound bed (Wounds UK, 2011).

Resistance to some topical agents has also been reported (Finley and Durnham, 2016), so this should be considered.

Antimicrobial agents *continued*

When selecting a topical antimicrobial agent to reduce or eradicate micro-organisms, consider:

- Its ability to inhibit or kill resistant bacterial strains
- The amount of antimicrobial agent available for release
- Any contraindications for using the agent
- Its cytotoxicity to human cells
- The ability of the carrier (dressing) product to conform to the wound effectively
- The duration of antimicrobial action
- How the agent is released into the wound bed

Antimicrobial agents *continued*

Duration of use should always be based on regular wound assessment.

Remember the **two-week challenge**, as this allows time for the agent to work. Decision of whether to continue or cease use of an antiseptic needs to be based on assessment findings, i.e. if there are still signs of continuing infection, antimicrobial treatment should be continued and reviewed again after two weeks.

In conjunction with therapeutic cleansing and debridement, alternate, or rotate topical wound therapies, as the suppression of a range of microbials is attained through the application of different topical antiseptics in a two- or four-week rotation period.

Regular and consistent reassessment

Evaluate interventions based on resolving signs and symptoms of wound infection and the patient's general condition.

Consider:

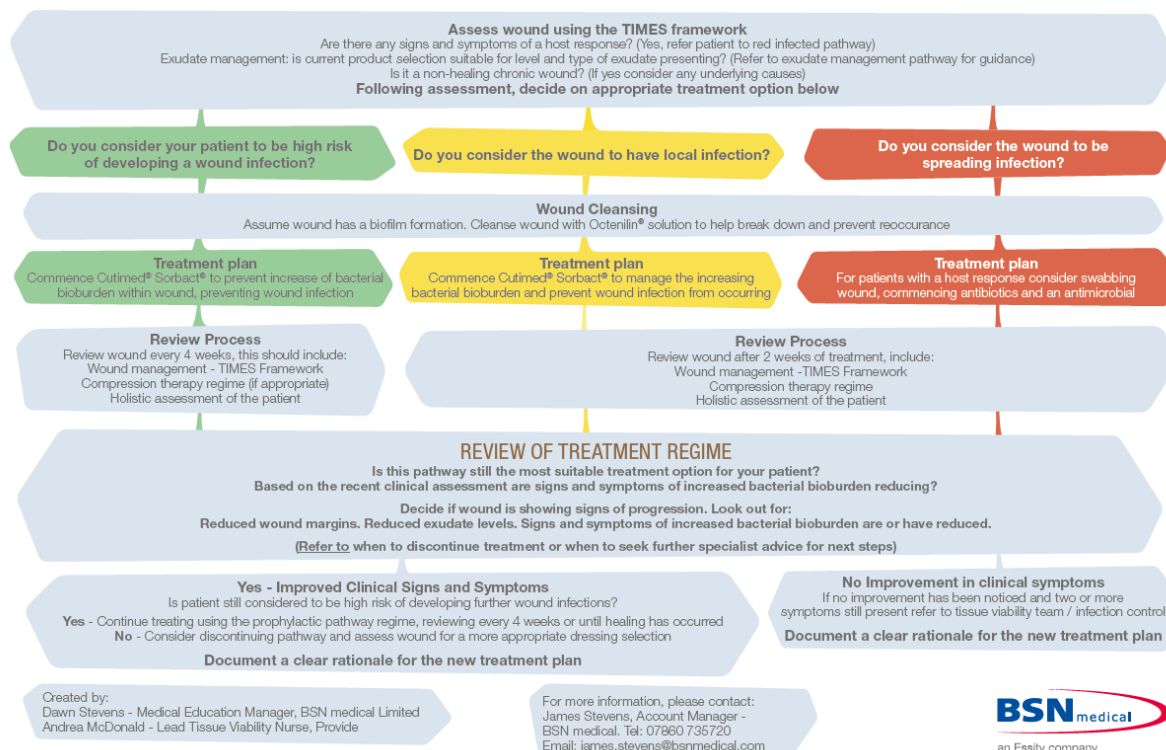
- Has the patient's pain decreased?
- Has exudate volume lessened?
- Has malodour resolved?
- Has erythema and oedema decreased?
- Is there a reduction in non-viable tissue?
- Is the wound reducing in size and/or depth?

Regular and consistent reassessment *continued*

- Document wound assessments (e.g. photography)
- Monitor condition of the periwound skin, particularly in heavily exuding wounds
- If there is limited or no improvement in signs and symptoms of wound infection, reassess the individual and their wound and adjust the management plan accordingly
- Consider if further investigations are required
- Consider referring the individual to specialised services (e.g. a wound clinic)

Treatment pathway for managing and preventing wound infection

PREVENTING AND MANAGING WOUND INFECTION



PREVENTING AND MANAGING WOUND INFECTION

SUPPORTING INFORMATION

What is a High Risk Patient?

- Co-morbidity that alters a patient's immune response
- Patient who has had 2 or more infections within the same wound previously within a 6 month period
- Medications that can alter a patient's immune response (Chemotherapy)

Holistic Assessment of the Patient

- Consider the following:
- Nutritional status including fluid intake
 - Co-morbidities - are they being managed effectively?
 - Medication regimes
 - Compliance with the treatment - is there anything that is preventing compliance?

Wound Assessment - TIMES Framework

- T - Tissue type - viable-continue as healthy granulation tissue present. Non-viable-consider debridement options before continuing
- I - Inflammation or Infection - review pathway if wound is infected
- M - Moisture levels - aim for a moist wound healing environment refer to Exudate Pathway for appropriate dressing selection
- E - Edge of the wound is epithelialisation present? If no progress observed please review the wound starting at T of TIME
- S - Surrounding skin - assess the cause and manage hyperkeratosis / eczema / dry skin / oedema / skin damage. Protect the skin for further damage

Signs and Symptoms of Local infection

- Increased exudate levels
- Wound progression slows down (static wound)
- Erythema not exceeding 2cm
- Alteration in pain levels

Signs and Symptoms of Spreading Infection

- Erythema extending 2cm
- Pain
- Heat
- Swelling
- Increased Exudate
- Malodour

Suspected biofilm in the chronic wound - are any of the following present?

- Absence of healing progression, even though all obvious comorbidities and wound management issues have been addressed
- Visible, slimy, gel-like and shiny material on the surface of the wound bed, which detaches easily and atraumatically from the wound bed
- Re-forming of slough quickly, despite debridement
- An increase in the production of exudate
- Poor quality granulation tissue - possibly fragile and/or hypergranulation
- Signs of local infection (as biofilm is a precursor to infection) e.g. heat, redness, swelling, pain, odour

Systemic Infection

All of the signs and symptoms of Spreading infection but including a host response (high temperature and generally unwell)

Cellulitis Guidelines

Diagnosis will include an assessment of the patient highlighting the following:

- Painful, hot, swollen, and tender skin, that spreads rapidly. Skin may have a glossy tight appearance, blisters may also be present
- Look for a skin break where the infecting organism may have entered
- Mark it with a pen to monitor for spreading infection
- GP to commence 7 days oral antibiotics
- Monitor for signs of sepsis - if suspected admit to acute hospital to follow sepsis pathway (the sepsis six)

Cellulitis can often be misdiagnosed and could be:

- Lipodermatosclerosis - hardened, tight, red or brown skin, typically affecting the inner aspect of the calf
- Venous eczema - red, scaly or flaky skin, which may have blisters and crusts on the surface
- Exclude DVT - refer to policy (Venous Thromboembolism in Adults available on intranet)

Signs of Sepsis

- Class I - there are no signs of systemic toxicity and the person has no uncontrolled co-morbidities
- Class II - the person is either systemically unwell or systemically well but with a co-morbidity (for example peripheral arterial disease, chronic venous insufficiency, or morbid obesity) which may complicate or delay resolution of infection
- Class III - the person has significant systemic upset such as acute confusion, tachycardia, tachypnoea, hypotension, or unstable co-morbidities that may interfere with a response to treatment, or a limb-threatening infection due to vascular compromise
- Class IV - the person has sepsis syndrome or a severe life-threatening infection such as necrotising fasciitis

BSN medical Limited

PO Box 258 • Willerby
Hull • HU10 6WT

www.bsnmedical.co.uk
Tel: 01482 670100 • Fax: 01482 670111
E-mail: advancedwoundcare.uk@bsnmedical.com

References:

- Antimicrobials made easy, Wounds International, (2011) Vol 2 (1) www.woundsinternational.com
- Antibiotic Resistance: we must act now Says WHO NHS Choices, (2012) Nursing times
- Best Practice Statement: The use of topical antiseptic / antimicrobial agents in wound management, 3rd edition, (2013), Wounds UK
- NICE (2015), Cellulitis - acute. Available: <http://cks.nice.org.uk/cellulitis-acute?topic=immunity> Last accessed 09/09/2016
- CREST (2005) Guidelines on the management of cellulitis in adults. Clinical Resource Efficiency Support Team. www.gahr-ni.org

BSN medical
an Essity company

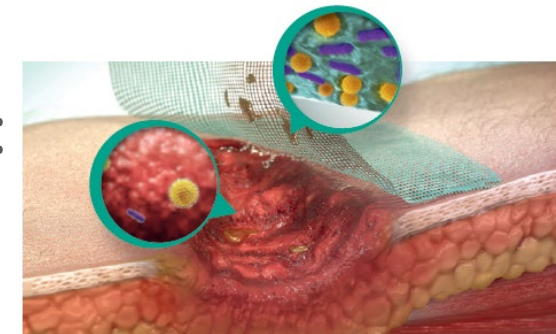
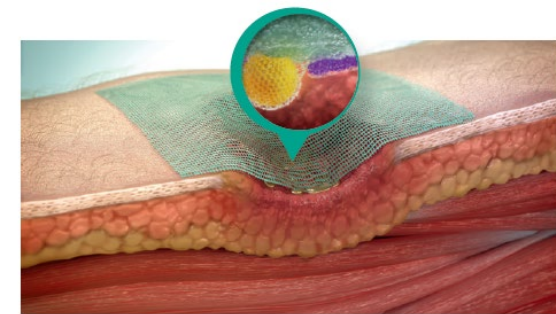
3687/718

BSN medical
an Essity company

Case reports — introducing Sorbact® technology

Cutimed® Sorbact® dressings (in a moist wound bed) attract and bind bacteria/fungi through hydrophobic interaction:

- Common microorganisms found in a wound bed environment are hydrophobic
- Cutimed Sorbact displays hydrophobic properties, allowing the dressings to irreversibly bind bacteria and fungi in a moist wound bed
- Once bound, pathogens are removed with each dressing change, effectively and safely reducing the microbial load:
 - Unlike other antimicrobials which use various chemical agents and can cause side-effects through release of endotoxins



Sorbact® Technology

- Cutimed Sorbact reduces bacterial burden in critically colonised wounds up to 73%, outperforming silver-based dressings (Mosti et al, 2015)



Mosti et al, (2015) Comparative study of two antimicrobial dressings in infected leg ulcers: a pilot study. *J Wound Care* **24(3)**: 121–2; 147–7

Case report one — post-operative wound infection following toe amputation

- This 66-year-old male patient presented with a discoloured great toe, which rapidly deteriorated to necrotic, devitalised tissue
- He had a history of *polyarteritis nodosa* — external, IE: only affecting skin can be referred to as 'cutaneous vasculitis' and diabetes



Case report one — post-operative wound infection following toe amputation

- He was an independent person and reinforced the importance of resuming his work and promoting self-care
- Goals of treatment were to implement effective wound bed preparation, treat wound infection and promote healing



Case report one *continued*

- On clinical examination, the toe was necrotic and there was evidence of infection and a high risk of systemic infection
- Vascular duplex showed no significant arterial disease
- It was agreed by the multidisciplinary team to admit him for amputation of the toe(s) under spinal anaesthesia
- Iloprost infusion was started for three days continuously to assist with healing due to poor small bore circulation, alongside intravenous (IV) antibiotic therapy



Case report one *continued*

- The surgical wound dehiscenced
- Following discharge home, it was agreed with the patient to cleanse the wound with an antimicrobial cleansing agent and then apply a dressing that would reduce the bacterial burden in and around the wound bed and effectively absorb exudate. This was Cutimed Sorbact swab and Cutimed Sorbact pad
- The patient attended the tissue viability clinic



Case report one *continued*

- At the first and second reassessments there was considerable improvement. This was not only visible, but also reported by the patient. Devitalised tissue was effectively resolved and granulation tissue was evident. The Sorbact technology was able to bind and remove bacteria and fungi via a simple physical principle



Case report one *continued*

- Malodour was no longer a problem and the patient's pain level was decreasing
- There was no need for antibiotic therapy
- Being able to self-care had a considerable impact on his quality of life
- The wound progressed in a timely manner and completely healed after 12 weeks



Case report two — post-operative wound infection following toe amputation

- This 62-year-old man with type II diabetes controlled on insulin had Charcot's foot disease and neuropathy
- Following injury to his foot, a small trauma wound became infected and rapidly deteriorated to a large, infected wound



Case report two — post-operative wound infection following toe amputation

- Although from appearance there did not appear to be signs of infection, the wound was increasing in size and tracking 4cm to the right of the wound edge
- There was a high volume of haemopurulent exudate, which was extremely malodorous
- Pain was not reported as an issue due to neuropathy, but this was a risk of the patient missing cardinal signs of infection



Case report two *continued*

- The patient and his wife (ex nurse) wanted to remain as independent as possible and not dependent on clinicians
- He attended the tissue viability clinic and there were signs of spreading infection. A joint decision was made to admit him for surgical debridement and IV antibiotic therapy
- Following four days in hospital, he was discharged under the care of the tissue viability service and district nursing team



Case report two *continued*

- On examination, there was a deep tracking wound with the additional associated high risk of recurrent infection
- The patient was extremely anxious and fearful, as the consultant on discharge had discussed the possibility of amputation if any further deterioration occurred
- The aim was to reduce and maintain a low level of bacterial burden, thereby reducing the risk of local or systemic infection



Case report two *continued*

- It was agreed to implement Cutimed Sorbact swab and Cutimed Sorbact pad to reduce micro-organism burden, absorb exudate, and maintain an effective moisture balance
- Within five days of starting treatment, exudate volume was decreasing and was now serous in colour
- Malodour had also resolved to the relief of the patient and his wife
- Between weeks 2 and 4, the wound was moving along the healing trajectory, showing reduction in size and depth and visual granulation tissue

Case report two *continued*

- By week 14, the wound had completely healed with no recurrence of infection or need for antibiotic therapy
- The patient's quality of life had improved considerably, and he was no longer stressed and anxious about the fear of losing his limb
- He could resume his important role as a husband, father and grandfather
- He was also able to resume normal activities of daily living, which are taken for granted, such as walking, wearing normal footwear/clothing, social activities



Summary

- Wound infection is costly to organisations and patients
- The rise of bacterial resistance presents a problem on a global scale
- Wound infection presents a number of challenges in clinical practice
- It is difficult to identify infection in patients where signs and symptoms are subtle or absent
- Identifying when chronicity is due to the presence of biofilm can also be overlooked
- Holistic wound assessment should consider these factors
- Management should be based around antimicrobial agents unless antibiotics are indicated
- Selecting an antimicrobial agent should consider toxicity to human cells
- Cutimed Sorbact is a suitable, safe and proven dressing to actively prevent and manage wound infection

BSN Medical Education Academies

- Free education and training is available via BSN medical's educational academies.
- Modules available include:
 - Anatomy and physiology of skin
 - Factors affecting wound healing
 - Infection management
 - Litigation and the law and the NHS
 - Improving the assessment of wounds