

Introduction

Infection is an important and common complication in wound care and can develop in any wound type. Clinicians involved in wound care need to be able to accurately assess and identify symptoms of wound infection. Early intervention should be carried out according to evidence-based best practice within a structured framework to standardise care (Wounds UK, 2021). This Made Easy will introduce the Therapeutic Index for Local Infections (TILI) score, a diagnostic tool designed to facilitate identification and decision-making around infection for staff of all levels (Dissemond et al, 2020a).

Authors: Val Edwards-Jones, Jeanette Milne and Andrew Sharpe (details on page 4)

Overview of wound infection

Wound infection is the result of microbial invasion of soft tissue and can manifest in acute wounds (such as surgical, traumatic and burns) and chronic wounds of all types, but predominantly of venous, arterial, diabetic and pressure aetiologies (International Wound Infection Institute [IWII], 2016). Infection can cause increased patient morbidity, anxiety and distress, and is associated with delayed healing and increased healthcare costs (Cutting, 2016).

Real-world evidence has shown that an estimated 3.8 million patients with a wound were managed by the NHS in 2017/2018, of which 89% of acute wounds and 49% of chronic wounds healed in the study year (Guest et al, 2020). The healing rate of chronic wounds was also estimated: 59% healed if there was no evidence of infection, compared with 45% if there was a definite or suspected infection (Guest et al, 2020). This evidence highlights the substantial burden of wounds, but also the importance of preventing wound infection.

Historically, wound swabs are taken to aid diagnosis of local wound infection, and antibiotics, are frequently prescribed. Whereas in acute wounds, this is the correct approach, in chronic wounds, where a biofilm can exist in up to 80% of wounds (Malone et al, 2017), a wound swab often does not identify any clear pathogen and antibiotics are not beneficial. A different approach to diagnosis and treatment may be needed with the threat of antimicrobial resistance (AMR) looming. Accurate clinical diagnosis of local wound infection at the point of care is essential, so that use of antibiotics can be reduced and appropriate topical treatment administered.

Importance of an AMS-informed approach

AMR is a global health issue that threatens the effective prevention and treatment of infection and occurs when bacteria, viruses, fungi, and parasites evolve over time and no longer respond to specific antimicrobials, groups of antimicrobials or even to any antimicrobial therapy (Fletcher et al, 2020; WHO, 2020). 'Antimicrobial' is an umbrella term that includes antibiotics, antiseptics, disinfectants, and other agents, such as antiviral, antifungal, antibacterial and antiparasitic medicines (Wounds UK, 2021).

All infection treatment should therefore take an approach informed by antimicrobial stewardship (AMS), which includes infection prevention and avoiding the misuse or overuse of antimicrobials. Adopting such an approach requires a systemic change in behaviour through increased public awareness and education (Wounds UK, 2021).

Early intervention and judicious use of antimicrobial dressings can help to form part of an AMS-informed approach, by managing infection locally and using antiseptic agents over systemic antibiotics wherever possible (Wounds UK, 2021).

Risk factors and signs and symptoms of wound infection

In dealing with wound infection, it is important for clinicians to understand the risk factors, and the signs and symptoms, as this can assist with identifying infection and early intervention. Characteristics of both the individual, their wound and the wound environment can contribute to the development of infection (IWII, 2016) and, in most cases, infection occurs when cumulative risk factors overwhelm the host's defence system (Korol et al, 2013).

For healthy individuals with an acute wound, an experienced clinician will often identify overt signs of infection easily, such as purulent discharge, erythema and swelling, local warmth, increasing malodour and new or increasing pain (IWII, 2016). However, in immunocompromised individuals and those with chronic wounds, subtle or covert signs of infection may exist and must be identified to detect infection (IWII, 2016). **Box 1** lists the covert signs of wound infection to consider.

Box 1. Covert signs of infection (adapted from IWII, 2016)

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

Understanding the key drivers of infection and recognising early warning signs can help to identify a deteriorating patient, such as comorbidities, poor nutrition and personal hygiene, dehydration, or prolonged, repeated contact with the healthcare system. Essentially, all the factors that can directly increase the risk of infection should be considered and not just the wound alone.

Selecting therapeutic treatments must be based on the individual patient, their wound and the severity of infection; treating infection appropriately (and as early as possible) improves patient quality of life and overall outcomes, as well as reducing resource use and costs to healthcare systems (Wounds UK, 2021).

The stages of wound infection

The wound infection continuum provides a framework that describes the gradual increase in the number and virulence of microorganisms, together with the response they invoke within the host (Figure 1).

Signs and symptoms commonly exhibited by the individual and the wound as infection emerges and proliferates that are associated with stages of the wound infection continuum include (IWII, 2016; Wounds UK, 2021):

Contamination – wounds of all types can develop microorganisms. Unless compromised, the host defences respond swiftly to destroy bacteria.

Colonisation – refers to the presence within the wound of microbial organisms. Microbial growth occurs at a non-critical level, and wound healing is not impeded or delayed.

Local infection – occurs when bacteria or other microbes move deeper into the wound tissue and proliferate at a rate that invokes a response in the host. Local signs of infection may be covert (subtle) or overt (classic).

Spreading infection – describes the invasion of the surrounding tissue by infective organisms that have spread from a wound and may involve deep tissue, muscle, fascia, organs, or body cavities.

Systemic infection – affects the whole body as microorganisms spread and can lead to severe sepsis, septic shock, organ failure or death.

Accurate diagnosis of local wound infection and early intervention

It can be difficult to diagnose local wound infection accurately, particularly as signs and symptoms may be subtle. Assessment of the presence of wound infection should be carried out according to evidence-based best practice within a structured framework to standardise care (Wounds UK, 2021).

Monitoring and early intervention should be considered a priority in all patients with wounds where potential infection or increased bioburden is an issue (Wounds UK, 2021).

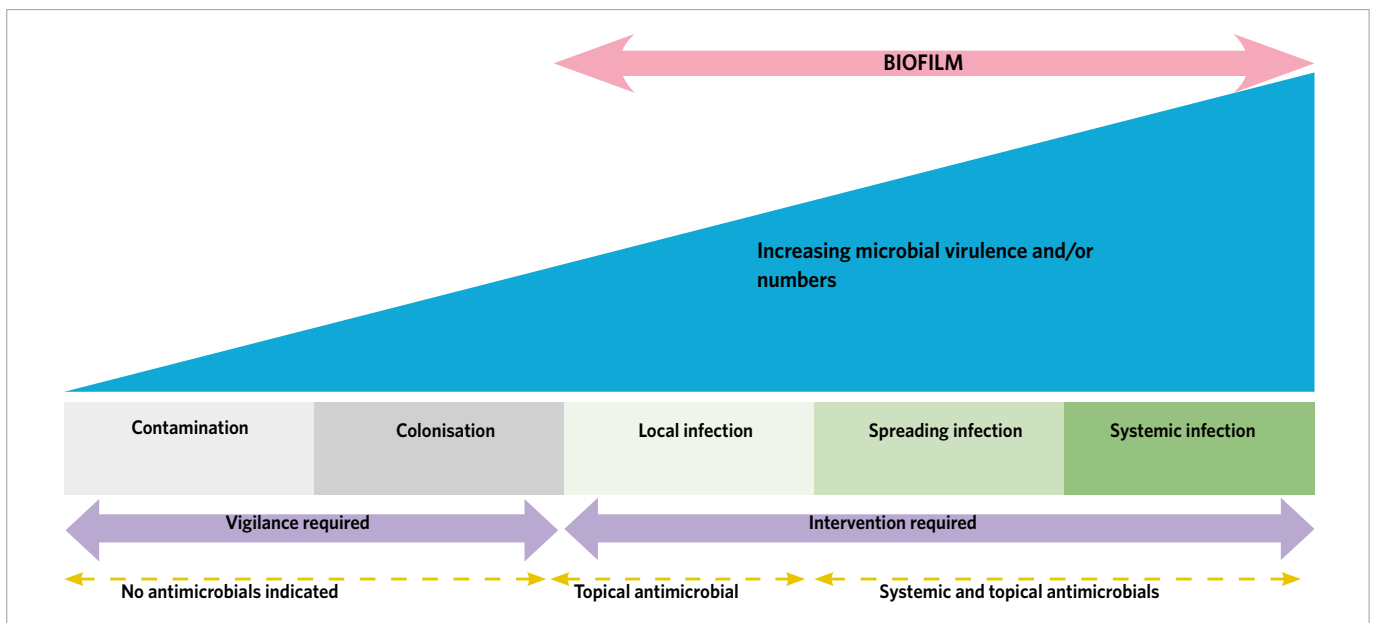


Figure 1. The infection continuum (IWII, 2016)

To accurately diagnose local wound infection, it is necessary for clinicians to use their judgement to interpret signs and symptoms, and familiarity with secondary signs of infection is key (Swanson et al, 2014).

Accurate assessment can be facilitated by using structured frameworks and diagnostic tools to assist in the identification of infection. A diagnostic tool can provide a consistent approach to identifying localised wound infection and support clinical decision-making.

Introducing the TILI score

The Therapeutic Index for Local Infections (TILI) score is a diagnostic tool that was developed to facilitate identification and decision-making around infection for staff of all levels, including those not specialised in wound care (Dissemond et al, 2020a).

The TILI score has been validated and found to be suitable for use in practice when diagnosing local infections in acute and hard-to-heal wounds. The TILI score focuses on nine clinical criteria for local wound infection. Six of the criteria are non-direct indicators and three are direct indicators (see [Table 1](#)).

If at least five of these six non-direct indicator criteria, or at least one direct indicator criteria, is met, this indicates that antiseptic wound therapy could be initiated.

Table 1. Non-direct and direct indication for antiseptic wound therapy

Non-direct indication

Erythema to surrounding skin
Heat
Oedema, induration or swelling
Spontaneous pain or pressure pain
Stalled wound healing
Increased and/or change of colour or smell of exudate

Direct indication

Presence of wound pathogens
Surgical septic wound
Presence of free pus

It should be noted that there are also specific health conditions for the individual clinical situation, which are a direct indication for antimicrobial wound therapy.

These include the presence of wound pathogens, such as methicillin-resistant *Staphylococcus aureus*, septic surgical wound or the presence of free pus, or cases of post-surgical



Figure 2. Wound infection in a dark skin tone

Photograph kindly supplied by Louise Morris, Prevention of Harms Practitioner – Pressure Ulcers, Birmingham Community Health Care NHS Foundation Trust

wound infection. See [Table 1](#) for full information on the criteria (non-direct or direct indication) for antiseptic wound therapy.

When considering the criteria for the TILI system, erythema (generally defined as redness) of the surrounding skin should be observed, as this may present differently depending on the patient's skin tone. Visual cues for changes in skin appearance may be easily observed in light-coloured skin, but in patients with dark skin tones, it may be harder to spot visual signs of early changes; therefore, clinicians need to use their observation skills and holistic assessment to ensure that any signs and symptoms are detected and managed quickly (Clark, 2010). [Figure 2](#) illustrates how infection may present in a patient with a dark skin tone.

Duration of antiseptic wound therapy has been noted in various expert recommendations and guidelines and should be time-limited to a maximum of 10–21 days with regular reassessment (Dissemond et al, 2020a). Essentially, the potential complications of infection do not justify the non-specific long-term use of antiseptic wound therapies, so treatment goals need to be set and treatment targeted accordingly (Dissemond et al, 2020a; Wounds UK, 2021).

Multiple strategies are required to manage wound infection. These include wound cleansing, debridement and use of topical antimicrobial agents for local wound infection, as well as antibiotics for systemic infection (e.g. when the patient [host] becomes unwell and/or when erythema of greater than 2cm is observed at the wound edge).

It is important to differentiate between local and systemic infection based on clinical signs and symptoms, as the interventions required will be based on the presenting patient and comorbidities. Choice of antiseptic agent and understanding

Author details:

Val Edwards-Jones, Professor Emeritus of Medical Microbiology, Manchester Metropolitan University, and Institute of Skin Integrity and Infection Prevention, University of Huddersfield

Jeanette Milne, Chief Matron Community, Northumbria Healthcare NHS Foundation Trust

Andrew Sharpe, Advanced Podiatrist, Salford Care Organisation

To cite this document:
Edwards-Jones V, Milne J, Sharpe A (2021) *TILI Score Made Easy*. Wounds UK, London. Available from: www.wounds-uk.com/made-easy

This document has been supported by:



both its limitations and strengths is key. Treatment should be fast and effective and resolve signs and symptoms of infection.

The TILI score in practice

In clinical practice, assessment for the presence of wound infection should be made according to a structured, evidence-based framework such as the TILI score.

The pathway (Figure 3) also incorporates the National Early Warning Score (NHSE Patient Safety Alert, 2018), highlighting the importance of early recognition of, and response to, 'soft signs' indicating physical deterioration of the patient and enabling early intervention.

The TILI score has been validated and found to be suitable for use: the criterion validity, which measures the validity of the TILI score compared with the current gold standard, was analysed to confirm that the score correctly classified local infection and confirmed the need for antimicrobial therapy (Dissemond et al, 2020b).

Regular wound assessment and ongoing care is also recommended, enabling the clinician to follow a step-down approach to treatment or make a referral to specialist services if current treatment is not progressing the wound to healing (Wounds UK, 2021).

Importantly, the score focuses on early intervention with a selective and time-limited use of local antiseptic wound therapy in patients with infected wounds and, therefore, supports an approach informed by AMS.

Decision-making pathways, such as the TILI score, should be incorporated into everyday practice alongside other existing appropriate treatment pathways.

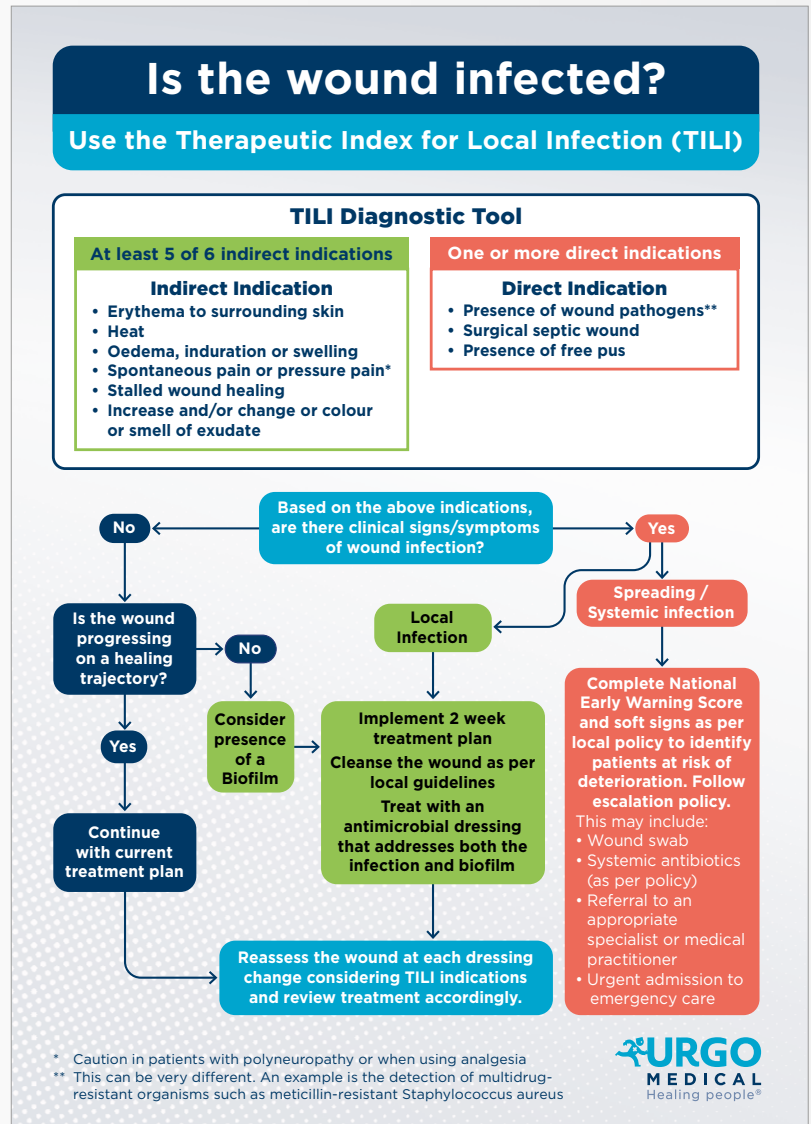


Figure 3. Pathway for use of the TILI score in practice

References

- Clark M (2010) Skin assessment in dark pigmented skin: a challenge in pressure ulcer prevention. *Nursing Times* 106: 30
- Cutting K (2016) The current burden of infected wounds. *Br J Health Care Manag* 22(9): 436-8
- Dissemond J, Gerber V, Lobmann R et al (2020a) Therapeutic index for local infections score (TILI): a new diagnostic tool. *J Wound Care* 29(12): 720-5
- Dissemond J, Strohal R, Mastronicola D et al (2020b) Therapeutic Index for Local Infections score validity: a retrospective European analysis. *J Wound Care* 29(12): 726
- Fletcher J, Edwards-Jones V, Fumarola S et al (2020) *Best Practice Statement: Antimicrobial stewardship strategies for wound management*. Wounds UK, London. Available at: www.wounds-uk.com
- Guest JF, Fuller GW, Vowden P (2020) Cohort study evaluating the burden of wounds to the UK's National Health Service in 2017/2018: update from 2012/2013. *BMJ Open* 10: e045253
- International Wound Infection Institute (2016) *Wound Infection in Clinical Practice: Principles of Best Practice*. Wounds International, London. Available at: www.woundsinternational.com
- Korol E, Johnston K, Waser N et al (2013) A systematic review of risk factors associated with surgical site infections among surgical patients. *PLoS One*. <http://dx.doi.org/10.1371/journal.pone.0083743>
- Malone M, Bjarnsholt T, McBain AJ et al (2017) The prevalence of biofilms in chronic wounds: a systematic review and meta-analysis of published data. *J Wound Care* 26(1): 20-25
- NHSE Patient Safety Alert (2018) Resources to support the safe adoption of the revised National Early Warning Score (NEWS2). Available at: <https://www.england.nhs.uk/publication/patient-safety-alert-safe-adoption-of-news2/> (accessed 26.10.2021)
- Swanson T, Grothier L, Schultz G (2014) *Wound Infection Made Easy*. Wounds International, London. Available at: www.woundsinternational.com
- Wounds UK (2021) *Best Practice Statement: Use of silver in practice*. Wounds UK, London. Available at: www.wounds-uk.com
- World Health Organization (2020) Antimicrobial resistance. Available at: <https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance> (accessed 26.10.2021)