

Management of wounds of various aetiologies with Technology Lipido-Colloid Mesh with Silver Sulphate (TLC-Ag) dressing

Prompt and appropriate management of wound infection is key to promoting wound healing and avoiding further complications. While systemic antibiotics are not typically indicated to manage local wound infection and may contribute to the ever-growing problem of microbial resistance, the use of local antimicrobials can be beneficial in controlling local signs and symptoms and kick starting the wound healing process. This article describes eight cases of wounds of different aetiologies, presenting with local signs and symptoms of infection or being at risk of infection, where a Technology Lipido-Colloid Mesh with Silver Sulphate (TLC-Ag) dressing was used as part of the standard of care. In all cases, the dressing under evaluation demonstrated positive results with early resolution, and positive wound and patient outcomes.

The skin is the largest organ in the body and serves numerous functions, including acting as a physical, chemical and microbiological barrier to protect the host as the first line of defence against external pathogens (Nguyen and Soulika, 2019; Chambers and Vukmanovic; Stejic, 2020). Any break in this protective barrier allows the invasion of a wound by proliferating microorganisms to a level that may invoke a response in the host and cause sustained inflammation, thereby delaying healing (Tom et al, 2019; Yang et al, 2024). The World Health Organization (WHO, 2013) suggests that open injuries have the potential for serious bacterial wound infections, which may lead to long-term disabilities, chronic wounds or bone infections and death.

Wound infection

A wound can be considered infected when the presence and subsequent proliferation of microorganisms leads to a local response in an individual (Sandoz, 2022). It is the result of a multiplication of pathogenic microorganisms that evoke a prolonged and excessive inflammatory response, leading to delayed healing, an increased risk of hospital admission, and implications for patients, including increased pain and reduced quality of life, as well as a significant burden on healthcare systems (Rondas, 2016; Falcone et al, 2021; Sandoz, 2022).

The risk of wound infection increases

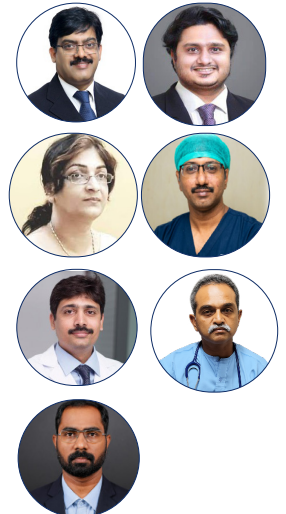
with the degree of contamination, immunosuppressive status and exposure to a dirty environment, and it has been estimated that about 50% of wounds contaminated with bacteria become clinically infected (Tom et al, 2019; International Wound Infection Institute (IWII), 2022). Wounds can be colonised by a wide range of organisms, many of which have natural resistance to various antibiotics (Matsuura et al, 2013; Tom et al, 2019).

Skin microbiota includes diverse microorganisms, i.e. bacteria, fungi, viruses, and yeasts, and plays a significant role in the protection of skin tissue and the maintenance of haemostasis. However, while commensal and pathogenic bacteria are in equilibrium in normal skin, their imbalance in the wound area can cause delayed or impaired cutaneous wound healing (Ersanli et al, 2023).

Anaerobic bacteria have been reported to propagate wound chronicity and biofilm production and have been identified as a major contributor to wound bioburden (Ersanli et al, 2023). As aerobic bacteria create biofilms on the exterior of deep wounds, anaerobic bacteria invade the interior (Hussain et al, 2016).

The classic signs and symptoms of local infection include:

- Redness or erythema
- Warmth
- Swelling or induration
- Pain or tenderness
- Pus or purulent secretions.



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These signs and symptoms are the first indications for the diagnosis of local wound infection (Lipsky et al, 2016; Ward and Holloway, 2019). Other signs may include friable or discoloured granulation tissue, pocketing, undermining of the ulcer rim, foul odour, delayed healing or deterioration of wound progression (deepening or extending), while systemic signs or symptoms such as fever, chills and elevated inflammatory markers, are often associated with spreading wound infection (Lipsky et al, 2016).

Moreover, microbiological investigations based on biopsies performed at the level of the depth of the infection diagnosed (e.g. bone, abscess, soft tissue) provide information on the identification of the organisms and their sensitivities to antibiotics (IWII, 2022).

Antimicrobials in wound care

Antimicrobials are therapeutic substances used to prevent or treat infections; these include antimicrobial dressings, which play an important role in the management of soft tissue infections (Roberts, 2016; Di Martino, 2022).

The use of antiseptics to prevent and treat wound infection is increasingly being studied, mainly because of the rapid spread of antimicrobial resistance and the rising emergence of multidrug-resistant microorganisms (Nair et al, 2023). While the most commonly used topical agents in wounds are targeted against planktonic cells, some have been adopted for use in managing chronic wounds complicated by biofilm (Schwarzer et al, 2019).

Clinicians must evaluate various factors concerning the wound when selecting an appropriate antimicrobial dressing, with crucial considerations, including wound size, depth, presence of necrotic tissue, foreign material, the level and type of exudate, and the risk and signs and symptoms of local infection (Yousefian et al, 2023).

Silver dressings in wound management

Silver has been used as an antimicrobial since ancient times, as early as 1850 BCE Egypt, where it was directly applied to wounds to improve healing (Dissemond et al, 2017). Silver, in its elemental form, is inert and only becomes bactericidal in the wound when it is ionised upon contact with an aqueous solution such as wound exudate (Fletcher et al, 2021). Silver ions are bactericidal by binding to the bacterial cell wall, thus preventing nutrients and oxygen from entering the cell. The silver ions are then transported through the cell membrane and into the cell, where they prevent the cell from producing further energy

and alter the sequence of the DNA (Percival and McCarty, 2015).

While the efficacy of silver dressings has been challenged by the Vulcan Trial (Michaels et al, 2009), the study's findings were considered potentially misleading, as the silver dressings were not used in line with clinical recommendations and, therefore, could not be expected to provide clinically relevant information on efficacy (Fletcher et al, 2021). Conversely, other clinical trials concluded that the use of silver dressings improves healing time and can lead to overall cost savings (Lazareth, 2008; Jemec et al, 2014). Moreover, a meta-analysis published in 2017 (Dissemond et al) shows that "the evidence base for silver in wound management is significantly better than perceived in the current scientific debate. Thus, if used selectively and for a limited period of time, silver not only has antimicrobial effects but is also characterised by an improvement in quality of life and good cost-effectiveness".

Technology Lipido-Colloid Mesh with Silver Sulphate (TLC-Ag)

Non-adherent and non-occlusive mesh dressings with Technology Lipido-Colloid with Silver (TLC-Ag, UrgoTul Ag® – Laboratoires Urgo, France) are indicated for wounds that are presenting with signs and symptoms of local infection or are at risk of infection (White et al, 2011). In vitro analyses showed that, from day one and throughout the duration of the study (seven days), a reduction in the number of colony-forming units for all the bacterial strains studied (including methicillin-resistant *S. aureus*, *P. aeruginosa*, *S. pyogenes* and *C. albicans*) was noted, making it possible to conclude that the TLC-Ag dressing demonstrates antibacterial efficacy on the microorganisms tested (White et al, 2011).

TLC-Ag has been demonstrated to promote wound healing through its support of a moist wound healing environment, which also allows for atraumatic removal, providing antimicrobial efficacy (Meaume et al, 2004; Lazareth et al, 2008). A sequential randomised control trial was conducted by Lazareth et al (2008) with patients with venous leg ulcers presenting with at least three out of five clinical signs. Patients were randomly treated either with the TLC-Ag dressing or with a neutral TLC dressing for 4 weeks. Then, subjects in both groups were managed for an additional 4 weeks with TLC dressings (without silver), totalling 8 weeks. The intention to treat population included 99 subjects. This randomised control trial demonstrated that a 4-week treatment with the TLC-Ag dressing resulted in both a reduction of clinical signs of infection and a

Key words

- Case study
- Infection
- Silver Sulphate
- Technology Lipido-Colloid Mesh

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sustained increase in the closure rate of venous leg ulcers presenting inflammatory signs suggesting a high bacterial load, compared to a neutral dressing.

In a prospective, multicentre, observational study, 728 patients with wounds of various aetiologies and wound infection statuses were treated with the TLC-Ag dressings in 39 centres for a mean duration of 26±19 day (Lützkendorf et al, 2022). At the initial visit, it was established that the majority of patients (60.4%) had a wound infection, while the remaining cohort presented with first clinical signs of a local wound infection (25.1%) or were at risk of wound infection (13.2%). Throughout the study period, all the parameters of wound infection continuously decreased, resulting at the final visit in a reduction of 78.9% in the prevalence of local wound infections and 72.0% in the clinical signs of wound infection. Concurrently, in terms of the healing process, 92.1% of the wounds healed or improved, 3.2% remained unchanged

and 1.7% worsened (data missing for 3.0%), and an improvement of the periwound skin was reported in 65.7% of the patients.

The TLC-Ag dressing was also previously evaluated in India, but mainly on burn wounds (Shanker, 2019; Uppal et al, 2020). The authors of this case series wanted to document the TLC-Ag dressing more widely across different aetiologies to increase the evidence base for the dressing's performance in the management of patients with wounds in India.

Conclusion

Wound infection is one of the most common and potentially devastating complications of the wound healing process (Celik et al, 2024). When inadequately managed, wound infection hinders wound healing, prolongs the inflammatory process, and may lead to secondary complications. In some cases, amputation, resulting in a cycle of pain, anxiety, and reduced quality of life for the patient, as

Case 1. Dr Rijju R Menon, Dr Anoop Vasudevan Pillai.

A 56-year-old male with peripheral artery disease was referred for recurrent ulceration with gangrene of the lower one-third of the left lower limb. The patient underwent bilateral iliac artery kissing balloon angioplasty and stenting, as well as left superficial femoral artery to popliteal artery subintimal angioplasty. Post-angioplasty, he developed a long segment occlusion of the superficial femoral artery, and despite regular saline gauze dressing, the ulcer began to increase in size, particularly in the lower aspect, and was associated with greenish discharge and blackish discolouration of the surrounding skin. The wound was surgically debrided [Figure 1A], antibiotics were initiated and negative pressure wound therapy (NPWT) at -125mmHg was applied with the TLC-Ag dressing used as an interface layer. After five days (first dressing change), healthy granulation tissue was noted in more than 70% of the wound, except at the ankle area, where there was an exposed joint with visible peroneal and Achilles tendons [Figure 1B]. By day 15, the wound presented with healthy granulation tissue, apart from the area with the exposed peroneal and Achilles tendons [Figure 1C]. At that point, NPWT was stopped, and the primary dressing was switched to a polyabsorbent fibre dressing with TLC-Ag (UrgoClean Ag, Laboratoires Urgo). Unfortunately, the patient passed away due to a myocardial infarction.

Figure 1A. Wound appearance immediately following debridement.



Figure 1B. Wound on day 5, during the first dressing change.



Figure 1C. Wound on day 15, following 3 dressing changes.



Case 2. Dr Riju R Menon, Dr Anoop Vasudevan Pillai.

A 56-year-old female with long-standing type 2 diabetes presented to the emergency department with blistering and necrosis of the heel and lateral aspect of the sole (left foot), accompanied by foul smelling pus discharge [Figure 2A]. X-ray showed osteomyelitis of the calcaneum. An initial surgical debridement was performed and all tissue on the lateral aspect of the foot and on the sole, extending from the metatarsophalangeal joint area of T5 up to the heel, was excised. The osteolytic part of the calcaneum was also removed [Figure 2B]. The patient was started on antibiotics. NPWT at -125mmHg was applied, with the TLC-Ag dressing used as an interface layer. After five days, healthy granulation tissue was noted in more than 70% of the wound, with good granulation cover over the calcaneal stump and very little slough [Figure 2C]. Following this, the dressing was changed to a polyabsorbent fibre dressing with TLC-Ag. By week 10, the wound appeared healthier, and the treatment was changed to TLC-NOSF (UrgoStart, Laboratories Urgo), with wound closure achieved by week 13 [Figure 2D]. In both cases, the TLC-Ag interface layer provided an antimicrobial effect as well as acted as an interface layer to prevent adherence of the reticulated NPWT foam.

Figure 2A. Wound appearance on presentation.



Figure 2B. Wound following post-surgical debridement.



Figure 2C. Wound at the first dressing change, 5 days post-debridement.



Figure 2D. Wound at week 13, after 3 weeks of treatment with TLC-NOSF.



Case 3. Dr Manisha Singh.

A 45-year-old-male with type 2 diabetes for 15 years and hypertension for 8 years, regularly taking anti-hypertensive medication. The patient experienced generalised pruritus, following which scratch marks became infected, leading to the development of an abscess above the left ankle in the lower one-third of the leg. The patient self-referred two days after the abscess formation. The abscess was drained, followed by sharp debridement [Figure 3A], cleansed with sterile water, and a TLC-Ag contact layer was applied, with dressing changes initially on alternate days. The frequency of dressing changes was increased to every four days after day 13 [Figure 3B]. The wound was closed by day 49 [Figure 3C]. Antibiotics were administered through a parenteral route for the first 5 days, followed by oral antibiotic therapy for another 7 days, due to patient and environmental factors that put the wound at further risk of infection.

As in the previous cases, the clinician noted the added benefit of the antimicrobial cover, as well as the patient reporting no pain during dressing changes.

Figure 3A. Wound appearance immediately after debridement.



Figure 3B. Wound on day 13, following 6 dressing changes.



Figure 3C. Wound on day 49.



Case 4. Dr Manisha Singh.

A 37-year-old female patient with a history of type 2 diabetes and anaemia, undergoing homeopathic treatment for recurrent eczema in the extremities, presented with a four-to-five-day history of high grade fever with chills, multiple blisters on the right lower limb surrounded by redness, mild swelling and severe pain, along with increased nodularity along the inner thigh [Figure 4A]. Clinical evaluation suggested spontaneous saphenous vein thrombophlebitis, potentially triggered by minor skin trauma due to itching. There was also a suspected underlying abscess in mid-leg secondary to phlebitis. The patient was managed with symptomatic and supportive treatment (antibiotics and analgesics) and showed some improvement in fever and swelling. However, the blisters enlarged in size, as observed during alternate day follow-up visits. Blister progression from day five to day seven worsened, and the patient gave consent for deroofting, which involves carefully removing the top layer of the blister to allow for better treatment of the underlying area.

Under local anaesthesia, the blisters were deroofted and soft necrotic tissue was removed [Figure 4B]. TLC-Ag dressings were applied as the primary dressing, with gauze as the secondary dressing, and dressing changes were done on alternate days. The wounds healed after two dressing changes [Figure 4C].

Figure 4A. Wound appearance on presentation.



Figure 4B. Wound following deroofting.



Figure 4C. Wound on day 7, following two dressing changes.

**Case 5. Dr Muralidhasan M.**

A 38-year-old male, post skin graft, presented with infection at the donor site on the anterior part of the thigh, diagnosed based on the presence of slough and malodour [Figure 5A]. The wound was debrided and cleansed with sterile water, and a TLC-Ag contact layer was applied as the primary dressing, with a cotton pad as the secondary dressing, changed approximately every 4 days. After one dressing change, the wound appeared healthier [Figure 5B], and within two dressing changes, the infection was completely resolved [Figure 5C]. The patient was instructed to use medical grade moisturisers thereafter.

The application of the TLC-Ag dressing provided an atraumatic cover that resolved the wound infection in just two dressing changes.

Figure 5A. Wound appearance on presentation.



Figure 5B. Wound on day 4 following the first dressing change.



Figure 5C. Wound on day 8, following the second dressing change.



Case 6. Dr Muralidhasan M.

A 34-year-old female presented with a superficial skin infection, which was initially managed by a local physician using cotton and gauze dressings. Due to the lack of resolution, the patient was referred to the hospital. On examination, a superficial skin infection was evident below the calf muscle in the right leg [Figure 6A]. The wound was cleansed with normal saline, and the TLC-Ag dressing was applied, with dressing changes every five days. The idiopathic wound healed within 10 days (two dressing changes) [Figure 6B]. Antibiotics were administered during the treatment. The clinician noted that, apart from the atraumatic and pain-free dressing changes, the dressing provided antimicrobial cover and, through the action of the TLC, allowed the wound to close within 10 days.

Figure 6A. Wound appearance on presentation.



Figure 6B. Wound fully healed after 2 dressing changes following 10 days.



Case 7. Dr Ravichander Rao A.

A 58-year-old male with a history of post-coronary artery bypass grafting was referred with a surgical site infection at the vein graft donor site, infected with *Klebsiella*, 3 weeks post-procedure. The wound was surgically debrided [Figure 7A], and the TLC-Ag dressing applied, with dressing changes on alternate days. The wound infection resolved within eight days, allowing for re-suturing [Figure 7B].

Figure 7A. Wound appearance on presentation.



Figure 7B. Wound fully healed after 2 dressing changes following 10 days.



well as increased treatment costs (Kim, 2019; Celik et al, 2024). Moreover, Indian studies on the epidemiology of chronic wounds estimate the prevalence at a rate of 4.5 per 1,000 population, and it is suggested that untreated or inadequately treated acute traumatic wounds are a frequent cause of these hard to heal wounds (Monika et al, 2022). Implementation of effective strategies to prevent, diagnose, and manage wound infection is important in reducing the burden of wounds, as well as mortality and morbidity rates (IWII, 2022).

It should be noted that climate and humidity in India play a significant role in wound healing and may require adapted approaches to wound care (Morgan-Jones et al, 2024).

The IWII 2022 guidelines recommend early recognition and management of factors that may predispose a wound to infection and, furthermore, emphasise that the

implementation of evidence-based care is fundamental for wound infection prevention and management. They advise that effective management should include optimising the individual host response, reducing local microbial burden, and promoting a positive environment for wound healing.

The TLC-Ag non-adherent wound dressing has been demonstrated as an effective antimicrobial that can restart the healing process in wounds presenting clinical signs of infection. The dressing's silver ions' ability to control a high bacterial load and provide anti-microbial properties appears to promote a favourable microenvironment and foster a sustained decrease in wound surface area in wounds presenting a high risk of infection (Lazareth et al, 2008).

Although the TLC-Ag dressing has been evaluated in India, this was primarily in burn

Case 8. Dr VasanthKumar Alva, Dr J Sam Christ Oliver.

A 54-year-old male was involved in a road traffic accident and sustained an injury on the right knee [Figure 8A]. His past medical history included type 2 diabetes for the past 10 years. The wound was cleansed with normal saline, debris was removed, and sutures were applied (removed on day 10) in the emergency department. Due to the contaminated nature of the wound, the TLC-Ag was applied as the primary dressing from day one to prevent risk of infection. The dressing was changed every 5 days [Figure 8B]. By day 20, the wound was almost completely closed, with healthy re-pigmentation, and was thereafter managed by the patient himself [Figure 8C]. The patient reported that there was no pain during any dressing removal.

Figure 8A. Wound appearance on presentation.



Figure 8B. Wound on day 5, following 1 dressing change.



Figure 8C. Wound on day 20, following 4 dressing changes.

**Case 9. Dr VasanthKumar Alva, Dr J Sam Christ Oliver.**

A 14-year-old male sustained an abrasion wound below the right elbow during a road traffic accident. The wound was cleansed with normal saline and debris removed in the emergency department [Figure 9A]. TLC-Ag was applied as the primary dressing to prevent infection due to the dirty nature of the wound and was then changed every five days [Figure 9B]. The wound was almost completely closed by day 15, with good re-pigmentation, and was thereafter managed by the patient himself [Figure 9C]. Again, the patient reported no pain during dressing removal.

Figure 9A. Wound appearance on presentation.



Figure 9B. Wound on day 5, following 1 dressing change.



Figure 9C. Wound on day 15, following 2 dressing changes.



wounds (Shankar, 2019; Uppal, 2020). The clinician authors saw a need to evaluate the dressing in different aetiologies. The patients noted and appreciated the pain-free dressing changes, and one could observe the positive healing outcomes with good aesthetic and re-pigmentation in most of the wounds.

These cases represent only a small cohort of patients, but the results are in line with those of other published trials and provide a positive platform to substantiate the inclusion of the TLC-Ag dressing as part of their standard of care for wounds presenting with signs and symptoms of local infection or at risk of infection. ●

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