



International Alliance for Global Health Dermatology

## GLODERM – empowering skin health: an initiative for education, capacity building and advocacy in global dermatology

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**Conflict of interests:** Editorial board member of Community Skin Health; member of GLODERM Trainee Committee (GTC).

### Introduction

Skin diseases are widespread and carry significant public health implications worldwide. The Global Disease of Burden (GDB) Study 2019 reported that there were approximately 4.86 billion new cases of skin and subcutaneous diseases worldwide.<sup>1</sup> Skin diseases are the fourth leading cause of non-fatal disease burden. It is widely recognized that these conditions can have a profound impact on individuals both physically and psychologically, affecting their overall quality of life as evidenced in the GDB Study 2019, especially in resource-poor regions.<sup>2</sup>

GLODERM, the International Alliance for Global Health Dermatology, established in 2018, reflects a legacy of dedication, innovation and collaboration in advancing global skin health.

Founded by a small group of passionate dermatologists, it has now grown to an international community of more than 1000 members from over 54 countries. In 2020, GLODERM was joined by the GLODERM Trainee Committee (GTC), which has since initiated several educational initiatives to promote knowledge equity, create opportunities for building networks and fostering collaboration. GLODERM has evolved into a global leader in dermatological education, advocacy and collaboration.<sup>3</sup>

### Education

GLODERM's educational initiatives, led

by the GTC, include the Educational Webinar Series, which provides a platform for knowledge exchange and professional development in dermatology. Launched in 2020, more than 30 sessions have been conducted. These webinars offer trainees and healthcare professionals worldwide free access to expert insights and cutting-edge research in dermatology, ranging from clinical case studies to discussions on research techniques, serving as a valuable resource library for anyone interested in advancing skin health. A highlight for the 2024 webinar series was the Albinism Awareness Week webinars, which covered a broad range of topics including genetics, dermatology, ophthalmology and social impact. Additionally, the GTC launched a podcast titled 'Stories of Our Skin' in late 2024, further contributing to global dermatological education and awareness.

### Mentorship programme

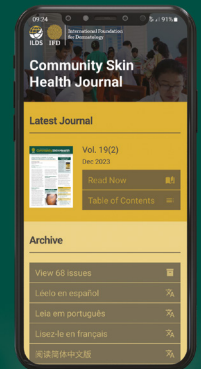
Mentor or research opportunities are not always available. In 2022, the GLODERM Mentorship Programme started as a first-of-its-kind international mentorship programme that not only provides guidance and support for professional development but also fosters a culture of engagement and collaboration within the dermatological community. The programme has welcomed 17 mentees from 14 countries, who subsequently established outreach initiatives in

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the community, started residency programmes, raised awareness of disability and fought stigma associated with skin diseases in their respective countries. Through mentorship, GLODERM aims to build a diverse and resilient workforce equipped to address the complex challenges of global dermatology.

### Conclusion

Skin health is not a privilege but a fundamental right for all individuals. Through education, advocacy and

*Continued overleaf...*

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capacity building, GLODERM is dedicated to driving meaningful change in dermatology, addressing systemic barriers and empowering future generations of health professionals to meet the diverse challenges in skin health.

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**Diagnostic clues of skin ulcers. Part I: general concepts and ulcers of non-infectious aetiology**

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**Conflict of interests:** None.

**Key words:** Skin ulcer; non-infectious skin ulcer; skin ulcer diagnosis; skin ulcer treatment.

**Abstract**

Skin ulcers have varying aetiologies, both infectious and non-infectious. The clinician caring for patients with skin ulcers faces multiple difficulties in establishing the correct diagnosis as the clinical signs of different ulcers can be very similar, regardless of their pathophysiological cause. Also the lack of the defence barrier of intact skin leads to contamination or actual infection by multiple micro-organisms. Recognizing the clinical and epidemiological clues of different ulcers is the first step in trying to diagnose the cause and decide on the most appropriate confirmatory tests. Venous, arterial, neuropathic and sickle cell anaemia-associated ulcers are of non-infectious aetiology, whereas tropical ulcer, melioidosis, cutaneous diphtheria, Buruli ulcer, yaws and leishmaniasis are caused by infectious agents. This paper is one of a series of two articles. In this first part, general concepts of ulcer care and the main characteristics or clinical clues of ulcers of non-infectious origin that may indicate the underlying aetiology, appropriate diagnostic tests and management and treatment are discussed. Part II, for later publication, will address the features of ulcers caused by an infection.

**Table 1. Difficulties for the clinician in ulcer diagnosis**

Difficulty
1. Ulcers caused by varying aetiologies can have similar appearances
2. Lack of access to diagnostic services in many areas
3. Presence of multiple different micro-organisms that can make elementary culture techniques unhelpful
4. Establishing whether it is bacterial contamination or actual infection is not easy

in the skin triggered by an infectious or non-infectious cause. Ulcers with different pathophysiological causes can share very similar clinical signs, and the lack of the defence barrier of the intact skin leads to contamination by multiple micro-organisms. Bacteria present in the ulcer may be the primary aetiological cause. On the other hand bacteria may be present as a result of subsequent contamination, colonization or as an actual infection whereby bacterial tissue invasion induces physiological consequences that lead to delayed healing and ulceration.<sup>1</sup> Non-infectious causes of ulcers include trauma, burns, bites, stings, systemic diseases and drugs. The most common causes of chronic leg ulcers are chronic venous insufficiency, peripheral arterial disease and diabetic neuropathy. In ulcers caused by infections, the agents may include multiple bacteria, mycobacteria, fungi, protozoa, parasites and viruses.

The prevalence of systemic pathology and the distribution of infectious agents varies depending on geographical and sociocultural settings. In Part I and Part II, we will analyse non-genital skin ulcers that are more characteristic or prevalent in different areas. We will focus on the clinical clues to help determine the cause of the ulcer, appropriate diagnostic tests, and subsequent control and treatment strategies.

Clinicians face multiple difficulties in establishing the cause of skin ulcers (Table 1). Careful assessment of the clinical clues is an essential first step in determining the underlying cause and deciding on the most appropriate tests (Table 2).

**Key learning points**

- A skin ulcer (lack of continuity of skin) is a clinical sign caused by many different aetiologies.
- Clinical examination of the ulcer, as well as other clinical and epidemiological clues, are essential for determining the cause and for guiding subsequent diagnostic tests and treatment.
- Ulcers tend to contain numerous micro-organisms, even those where the primary cause is non-infectious.

**Introduction**

Ulcers are the result of the breakdown of the surface of previously normal skin or following an inflammatory process



**Fig 1.** Non-infectious ulcers. **(a)** Venous ulcer above medial malleolus showing irregular borders and hyperpigmentation and dermal fibrosis of surrounding skin and 'inverted champagne bottle' appearance of lower leg. **(b)** Arterial ulcer with well-demarcated edges, minimal exudate and located distally over bony prominence. **(c)** Neuropathic ulcer and dry skin in a patient with diabetes.

Photos: courtesy of Dr. Cecilia Horcajada y. Dr. Jesús Borbujo, Hospital de Fuenlabrada, Madrid, Spain

**Table 2. What do I need to know about the patient? Eight essentials**

The eight essentials	
1. Geographical area where the patient lives or has visited	
2. Comprehensive medical history, including previous and current systemic diseases and drugs	
3. Analysis of the community situation	Current, prior or usual, similar lesions among cohabitants
4. Clinical course of the ulcer(s)	<p>Have you previously had similar ulcers?</p> <ul style="list-style-type: none"> <li>• On the same area? Anywhere else?</li> </ul> <p>How long have you had this ulcer?</p> <p>How has it evolved?</p> <ul style="list-style-type: none"> <li>• Rapid and progressive growth</li> <li>• Slow and progressive growth</li> <li>• Stable</li> <li>• Improvement and worsening episodes</li> <li>• Eccentric growth</li> <li>• Development of confluent or non-confluent satellite lesions</li> <li>• Development of distant new lesions</li> </ul>
5. Prior circumstances that patients can associate with the ulcer	<p>Insect/animal bite</p> <p>Trauma</p> <p>Topical applications</p> <p>Concomitant fever or systemic symptoms</p>
6. Symptoms	<p>Exudate and its characteristics</p> <ul style="list-style-type: none"> <li>• Serous</li> <li>• Haemorrhagic</li> <li>• Purulent</li> <li>• Mixed</li> </ul> <p>Itching</p> <p>Pain and its characteristics</p> <ul style="list-style-type: none"> <li>• Intensity</li> <li>• Permanent or episodic</li> <li>• Any factor changing intensity</li> </ul>
7. Treatments since ulcer onset	<p>Type/s of treatment/s</p> <p>Tolerability</p> <p>Response</p>
8. Clinical examination and tests	<p>Peripheral pulses</p> <p>Sensory testing of the affected and contralateral limb</p> <p>Signs of venous insufficiency</p> <p>Lab tests depending on medical history and clinical examination</p> <p>Doppler examination of peripheral pulses, if available</p>

Regardless of the cause of skin ulcers, their clinical care is broadly similar (Table 3). In addition to these general care measures, the clinician should minimize avoidable harmful stimuli,<sup>2</sup> control the underlying pathology that hinders healing and implement specific treatment depending on the aetiology of the ulcer, as detailed in the sections below.

## Venous ulcer

Venous leg ulcers, caused by venous insufficiency, are one of the most common lower limb ulcers. With a worldwide distribution, the estimated prevalence in the general population is 2%, rising to 5% among those > 65 years of age. These ulcers cause an important socioeconomic burden and a great psychological and physical impact on those affected.<sup>3</sup> They are related to older age and are associated with a sedentary lifestyle and a genetic predisposition. Incompetence of the valves of the perforating veins connecting superficial and deep venous systems generates persistent high venous pressure. Clinical signs of venous insufficiency are purpura, hyperpigmentation, eczematization of surrounding skin, dermal fibrosis, an 'inverted champagne bottle' appearance of the leg and varicose veins. Venous ulcers follow an indolent clinical course, are frequently recurrent and are often related to external injury.

They are usually located on the medial lower leg, above the malleolus. Ulcers tend to be irregular in shape with well-defined borders (Fig. 1a). The ulcer bed has granulation and fibrinous tissue and may be covered by yellow-white exudate. Besides the previously described signs of venous insufficiency, the surrounding skin may show inflammatory signs. Associated pain may be absent, mild or extreme (Table 4). Specific treatment of venous ulcers is aimed at reducing venous pressure and gravitational reflux<sup>4</sup> and includes the following.

- Exclude any associated arterial compromise, in which case compressive bandages cannot be used.
- If arterial compromise has been excluded, use compressive bandages. For lower leg ulcers, compression must be applied from the base of the toes to just below the knee joint.
- Elevate legs above the level of the heart while lying down.
- Surgical treatment, if correctable incompetent valves are detected.

## Arterial ulcer

Diseases causing occlusion of arterial blood supply lead to necrosis, skin ulcers and delayed wound healing. The prevalence of peripheral arterial disease in the general population is around 3%, increasing up to 20% in individuals > 70 years. The underlying causes include atherosclerosis, hypertension, hyperlipidaemia and vasculitis. Diabetes, family history of atherosclerosis and, chronic kidney disease

*Continued overleaf...*



# Diagnostic clues of skin ulcers. Part I: general concepts and ulcers of non-infectious aetiology...continued

**Table 3. General principles for ulcer treatment. Ten essentials.**

The 10 essentials	
1. Promote a clean environment	Keep ulcer clean. Use soft soap and warm clean water or saline. Cover with bandages to avoid external contamination when needed
2. Eliminate anoxic and devitalized tissue	Remove necrotic areas, secretions and crusts
3. Avoid chemical irritation	Use soft soap/cleansers, avoid alkaline soap. Avoid aggressive use of antiseptics. In case of suspected infection, cleaning with isotonic purified solution of sodium hypochlorite 0.05% is recommended. <sup>2</sup> Minimize potentially allergenic or irritant topical treatments
4. Avoid physical trauma	Protect areas from rubbing, blows and rough cleaning practices. Only change dressings when necessary, so not to hinder the healing process. Dressing change can vary from daily to weekly, depending on exudate and infection
5. Care of skin surrounding ulcer	Use emollients if dry skin. Avoid adhesive dressings. Short course of topical steroids if eczema
6. Alert to complications (unexpectedly poor ulcer progress)	Watch for signs of infection: erythema, increased local heat, pain, foul-smelling drainage, pus, oedema, fever. Antibiotic treatment when necessary. Avoid antibiotic treatment in the absence of infection. If possible, guide treatment by Gram stain and culture, Giemsa stain or molecular diagnostics. Biopsies may be necessary to rule out associated diagnoses such as neoplasia or vasculitis
7. Address systemic issues/ deficiencies	Correct malnourishment, mineral or vitamin deficiencies, anaemia, obesity, sedentary lifestyle, hypoxia
8. Adjust topical applications and dressing to the clinical situation	Use drying solutions and absorbent dressings if abundant exudate. Use greasy or enzymatic applications, and hydrocolloid and non-adhesive dressings on excessive necrotic tissue. A wide range of dressings, healing factors and tissue equivalents are available, although none of them have demonstrated higher efficacy
9. Pain control	Analgesics may be necessary when local care is not sufficient
10. Check progress	To monitor ulcer progress, outline the ulcer contour on a transparent paper or glove, or check with a syringe the amount of saline that the defect can contain

are recognized risk factors, as is also being a person of skin of colour.<sup>5</sup> Arterial ulcers are mainly located distally and over bony prominences, such as toes or the pretibial area. They are usually punched-out in appearance with well-demarcated borders, a necrotic ulcer bed and lack exudate or bleeding<sup>6</sup> (Fig 1b). Other signs and symptoms of arterial impairment may be present and include changes in the surrounding skin (thin, shiny, hairless, dry, cold skin), toenails (hypertrophic, slow growing, brittle toenails), weak or absent peripheral pulses and exercise-induced calf pain alleviated by rest (intermittent claudication) (Table 4).

Venous and arterial insufficiency may coexist giving rise to a mixture of clinical features. Arterial ulcers cause severe pain that may worsen with limb elevation and in bed at night. Clinical suspicion is confirmed by determination of the ankle-brachial index and vascular imaging studies. Arterial ulcer treatment requires prevention and treatment of the underlying problems that compromise arterial flow (atherosclerosis, hypertension, hyperlipidaemia) and may also include referral for microvascular surgery.<sup>7</sup>

### Diabetic neuropathic ulcer

Diabetes is considered a silent pandemic with increasing prevalence worldwide. Low- and middle-income countries account for the highest percentage of adults affected.<sup>8</sup> Diabetic foot ulcer is a highly morbid complication affecting approximately 25% of those with diabetes. The incidence increases with age and poor control of diabetes. This figure is rising, especially among populations of people of skin of colour.<sup>9</sup> Complex mechanisms of microvascular dysfunction and impaired wound healing play a role, but neuropathy and infection are the main contributing factors. Ulcers occur after unnoticed trauma because of impaired sensitivity.

On clinical examination, light touch sensation and proprioception (position sense) may be decreased or absent. On the other hand, autonomic neuropathy causes dryness and

fissuring of skin leading to erosions, ulcers and subsequent infection. The clinical course and healing process are very slow. Diabetic ulcers are most common on the pressure points and soles of the feet and over bony prominences (Table 4 and Fig. 1c). They are usually surrounded by a callus and the borders are undermined. The ulcer bed is necrotic and may expose underlying structures. These ulcers tend to be covered by a haemorrhagic crust.

Wound infection is very common but the external signs of this complication (pain, exudation, local increase of temperature, oedema) can be subtle in these patients leading to difficulties in prompt detection. Untreated infection hinders the healing process and may spread to deeper tissues leading to bone infection necessitating amputation in some cases. Frequently, because of sensory impairment, diabetic ulcers are painless. Ulcers associated with other neuropathic conditions, like leprosy, share similar characteristics.

As a specific measure, prevention is the key objective. Affected individuals and their caregivers must be trained in specialized and thorough self-care of the feet. Good hygienic measures, gentle cleansing with a mild soap and gentle drying, the frequent use of emollients to keep the skin well moisturized and periodic check-ups to detect the presence of small skin breaks, calluses or toenail deformities early, are very important to control the condition before further progression. The use of appropriate footwear that correctly accommodates the structural deformities of the foot is essential to avoid foot injuries over pressure points from friction or trauma. From a general point of view, careful and close monitoring of diabetes is the most effective preventive measure. Surveillance for infection is important, using clinical observation and serum biomarkers for local or systemic signs of inflammation. If osteomyelitis is suspected, imaging techniques are necessary.

### Sickle cell anaemia-related ulcers

Sickle cell anaemia is a group of autosomal recessive diseases

**Table 4. Clinical clues for various ulcer types**

Ulcer type	Five clinical clues
Venous ulcer	Irregular shape Above medial malleoli Skin changes in distal lower leg Chronic and recurrent Older adults
Arterial ulcer	Well-demarcated, regular shape Absent or minimal exudate Distal locations or over bony prominences Severe pain Clinical signs of arterial insufficiency
Diabetic ulcer	Dry and cracked skin, and other signs of neuropathy Located over bony prominences and on soles of feet Indolent clinical course Minimal pain Frequent bacterial infection
Sickle cell ulcer	Sickle cell disease. Genetics and geographical distribution Severe pain Lower legs, mainly on medial and lateral malleoli Indolent clinical course From $\geq 10$ years, more frequent with ageing

characterized by the presence of a mutated haemoglobin (HbS), prevalent in people with skin of colour. There is morphological, sickle-shaped, distortion of erythrocytes that causes an increase in blood viscosity, slow flow in small vessels and tendency to trigger the coagulation cascade, subsequently leading to distal tissue ischaemia and ulceration. The clinical consequences are veno-occlusive crises and ulcers, both more frequent in homozygous individuals and in certain geographical areas, like Jamaica.

Leg ulcers are common and generate significant morbidity. Other types of anaemias (spherocytosis, thalassemia, iron deficiency etc), when severe, can lead to the same complication. Ulcers are related to the severity of haemolysis and other signs of advanced vasculopathy, such as pulmonary hypertension and priapism. Besides venous insufficiency, trauma, infections and anaemia are major facilitating factors. Hydroxyurea (used to treat sickle cell anaemia) is known to also cause skin ulcers.

Sickle cell ulcers are extremely painful. They usually appear after the age of 10 years, increase with age and are more frequent in

males. The clinical course follows an indolent pattern. The ulcers are located in areas with little adipose tissue, thin skin and venous compromise, such as the medial malleolus (Table 4). Less frequently, they appear on the lateral malleolus, pretibial region, dorsum of the foot and Achilles region. The clinical characteristics of the ulcers are similar to those of venous ulcers.

The specific treatment measures include correction of anaemia to a level of unaltered Hb  $> 8$  g/dL. Sometimes, red blood cell transfusion is needed. The eventual pathogenic role of hydroxyurea and its withdrawal from the patients' treatment regime may have to be considered. It is important to control excessive venous pressure and to prevent trauma as described in the sections for venous and neuropathic ulcers. Pain management can be difficult and requires appropriate analgesics. Surgical treatment may be necessary and may include skin grafting.<sup>10</sup>

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## CASE ONE FOR DIAGNOSIS

### Deepani Munidasa

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This 9-year-old schoolgirl lives in the village with her grandmother and two kittens. She presented with a non-painful, non-itchy elongated nodule on her right upper cheek for 2 weeks. In the following couple of weeks, she developed malaise, fever and a painful swelling under the chin consistent with submental regional lymph node enlargement.

A lymph node was biopsied and she was treated with a course of antibiotics resulting in complete resolution of the skin nodule and lymph nodes.

**Question 1 – What is the diagnosis?**

**Question 2 – What is the preferred treatment?**

Answer on page 31.



# Cutaneous genital schistosomiasis in a 6-year-old female child: case report and review

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**Conflict of interests:** None.

**Key words:** Cutaneous schistosomiasis; vulva; female child.

## Abstract

Schistosomiasis affects millions of individuals worldwide. There are at least six species that can cause human schistosomiasis – *Schistosoma haematobium*, *S. mansoni*, *S. intercalatum*, *S. guineensis*, *S. japonicum* and *S. mekongi*. This disease more commonly leads to morbidity rather than mortality. We describe a 6-year-old girl with a multinodular plaque and swelling of the vulva. The lesion was asymptomatic but had increased in size and the patient reported no systemic symptoms. *Schistosoma* infection was confirmed via histopathological examination. Cutaneous schistosomiasis should be considered in the differential diagnosis of nodular lesions of the external genitalia.

## Introduction

Globally, more than 200 million people are affected by schistosomiasis, making it a common parasitic infection.<sup>1</sup> The disease is more prevalent in South America, Asia, Africa and the Arabian Peninsula, but has also been reported in Europe<sup>2,3</sup> and in travellers to the tropics.<sup>4</sup> Certain pathogenic species can be found in specific geographic locations, e.g. *Schistosoma mansoni* in South America vs. *S. japonicum* and *S. mekongi* primarily in Asia.<sup>5</sup>

Human schistosomiasis represents a helminthic infection by trematodes, with freshwater snails serving as the intermediate hosts. The snails release larvae (cercariae) that mature into adults within the vasculature after penetrating the skin. Individuals can also be infected by ingestion of water contaminated by larvae.<sup>5</sup>

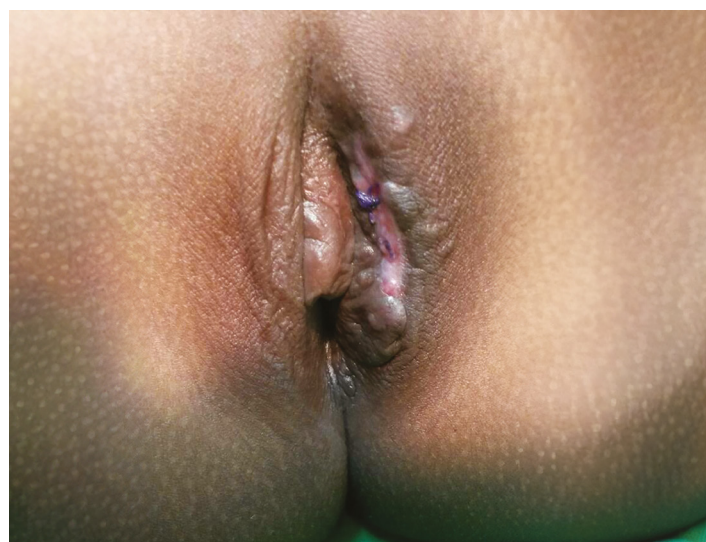
In humans, colonization may persist for years with secretion of eggs. An immune response to the trematodes, consisting of granuloma formation, can occur in both local and systemic schistosomiasis.<sup>6</sup> In addition to *S. haematobium*, *S. mansoni*, *S. intercalatum*, *S. guineensis*, *S. japonicum* and *S. mekongi*, cutaneous involvement can also result from non-human species of *Trichobilharzia* and *S. bovis* (causing cercarial dermatitis).<sup>3,7</sup> *Trichobilharzia* and *S. bovis* are hybrid between zoonotic and human species and are endemic in temperate regions of the world.<sup>3</sup>

## Case report

A six-year-old female child was referred to our dermatology clinic with a 'growth' involving her vulva that had been noted 8 weeks prior. Her mother stated it had gradually increased in size but had not bled and was not painful or pruritic. There were no additional symptoms such as fever, lower abdominal pain, dysuria, haematuria or vaginal discharge. She was from

an area with freshwater bodies close to her home and as a child she often swam in them. Blood chemistries and blood count were within normal limits, no ova were detected in her urine or stool, and human immunodeficiency virus (HIV) status was negative.

On clinical examination, she had firm, non-tender, skin-coloured swelling of the left labia minora as well as a multinodular hyper- and hypopigmented plaque of the left labia majora with scarring (Figure 1). The latter was fixed to the underlying tissue. A few satellite papules were also present. There was no discharge or ulceration. Bilateral, mobile, non-tender inguinal lymphadenopathy was detected.



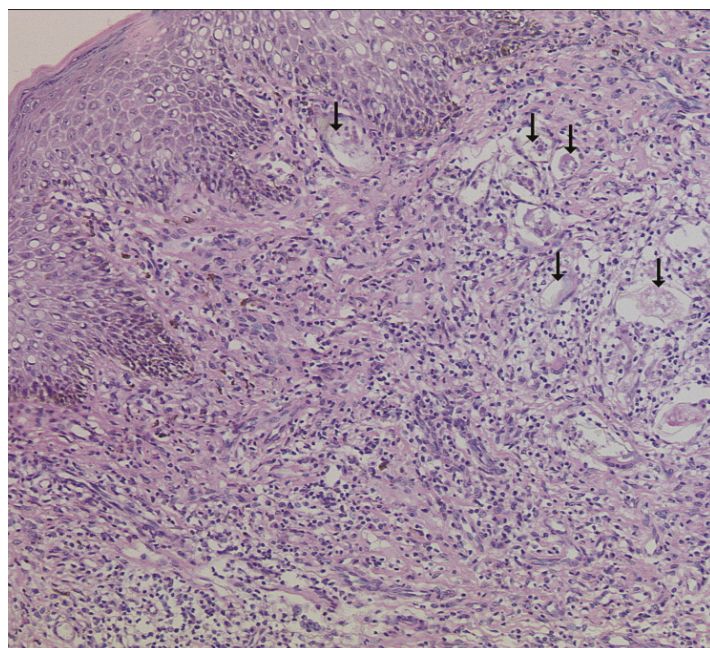
**Fig 1.** Firm, non-tender, skin-coloured swelling of the left labia minora as well as a multinodular hyper- and hypopigmented plaque of the left labia majora with scarring. It was fixed to the underlying tissue. A few satellite papules were also present. Note the purple stitch indicates where the biopsy was taken.

Histopathological examination of an incisional biopsy demonstrated multiple schistosomes within the dermis. There were also multiple epithelioid cell granulomas, Langhans giant cells, lymphocytes, plasma cells and scattered eosinophils within the dermis (Figure 2). Based on the clinical and histological findings, a diagnosis of cutaneous schistosomiasis was reached.

## Discussion

In schistosomiasis, three stages of cutaneous manifestations have been described: pruritic cercarial dermatitis; Katayama syndrome with urticarial lesions; and in late disease, granulomatous lesions. The first two stages occur early on within 6 months of exposure.<sup>8</sup>





**Fig 2.** Photomicrograph of haematoxylin and eosin stain of vulvar biopsy. Multiple schistosomes are located in the dermis (black arrows). Multiple epithelioid cell granulomas, Langhans giant cells, lymphocytes, plasma cells and scattered eosinophils are also seen in the dermis.

Cercarial dermatitis (swimmer's itch) can occur as early as 30–60 min following exposure to larvae-infested freshwater. It follows the entry of *Schistosoma* larvae into the skin and can be seen in those who have not been previously exposed, including travellers.<sup>9</sup> This presentation is not seen in children who grow up in endemic areas, in theory because they acquire maternal protective antibodies during their early months of life. In addition to a zosteriform papular pattern on the trunk, patients can develop recurrent flares, fever, peripheral blood eosinophilia and internal organ involvement (e.g. central nervous system, gastrointestinal tract) during the early stages.<sup>10</sup>

Late cutaneous schistosomiasis, defined as infection that occurs 6 months post-exposure tends to be rare. In most reported cases, the lesions are found in the perineal or genital region and they follow disease in other organs.<sup>9</sup> Less commonly, the trunk is involved. Rarely, isolated cutaneous disease has been observed in the absence of constitutional symptoms or preceding urological disease.<sup>8</sup>

Classically, single or multiple nodules or papillomatous lesions are seen. Additional findings in women include ulceration of the vulva and vaginal discharge or bleeding as well as lower abdominal pain.<sup>11</sup> Of note, cutaneous schistosomiasis has been described predominantly in females in their second and third decades of life.<sup>9</sup> Confirmation of the diagnosis is routinely based on detection of eggs in faeces or urine or serological assays, but in the case of cutaneous involvement, histological substantiation is possible. Characteristics of the spines can assist in species identification – a terminal, lateral or minute spine represents *S. haematobium*, *S. mansoni* and *S. japonicum*, respectively.<sup>12</sup>

Although topical corticosteroids and/or antihistamines are often prescribed for cercarial dermatitis, antihistamines with

or without systemic corticosteroids can be used for acute schistosomiasis; sometimes praziquantel is started at this stage, taking into account the risk of an allergic reaction. In chronic disease, dosages and frequencies vary, e.g. in African and South American schistosomiasis, the single dose is 40 mg/kg whereas for *S. japonicum* and *S. mekongi* it is 60 mg/kg. If an allergic reaction is suspected, the dose is divided. The cure rate can be increased from 80% to 100% if the single dose regimen is repeated for 2 consecutive days after 6–12 weeks.<sup>13</sup>

Repeat examination of stool and urine should be performed 6 weeks after completion of systemic therapy. Although cutaneous lesions can resolve within 6 months, calcification of ova may lead to persistence. Additional evidence of cure includes resolution of peripheral eosinophilia. Genital schistosomiasis can lead to an increased risk of transmission of other diseases such as HIV and is associated with a risk of ectopic pregnancies and infertility owing to fallopian tube blockage. To avoid stigmatization and alleviate anxiety, the non-sexual transmission of genital schistosomiasis should be explained.<sup>13</sup>

## Conclusion

Our case is thought to be unique in that the patient was a young female child with no history of preceding systemic or constitutional symptoms based on her clinical history. She was diagnosed as having isolated cutaneous disease, based on the histological findings of her skin biopsy plus negative urine and stool examination for schistosomiasis (we were unable to perform a serological test). To the best of our knowledge, this is the first reported case of cutaneous female genital schistosomiasis in a child from Tanzania. Unfortunately, our patient was lost to follow-up before commencement of therapy and therefore we are unable to report on her treatment and clinical outcome.

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# The Available Technology Dressing (ATD) technique for wound management

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**Key words:** Wound care, ulcers; village health workers; traditional health practitioners; available technology dressings; polymeric membrane dressings; sickle cell leg ulcers.

## Abstract

Wounds present a particular challenge in remote areas of the tropics, where infection rates are high and healthcare professionals and basic wound care supplies are both scarce. The need for an effective, safe, sustainable, evidence-based, wound-dressing solution for this setting led the authors to develop and clinically evaluate the Available Technology Dressing technique.

## Introduction

The number of lives seriously impacted by wounds worldwide is underestimated.<sup>1,2</sup> In rural tropical settings, many people with wounds care for themselves or seek care from a family member or friend initially.<sup>1</sup> Some seek care from a village health worker or traditional health practitioner.<sup>1</sup> Wound care outcomes are often poor and costs are surprisingly high.<sup>1</sup> Acute wounds often become disabling chronic wounds due to poor management.<sup>3</sup> Almost 25 years ago, while working over a 5-year period in a small rural clinic in northern Ghana, the magnitude of this problem became painfully evident.<sup>4</sup> This awareness motivated us to develop the Available Technology Dressing (ATD) technique.<sup>5</sup>

## Limitations of available dressings

Working at the clinic provided us with the opportunity to systematically trial a wide variety of donated advanced wound dressings.<sup>4</sup> Unfortunately almost all of them performed very poorly in the harsh environment of the tropics.<sup>4,5</sup> Mixed bacterial and fungal infections developed overnight under foams, hydrocolloids and hydrogels.<sup>4,5</sup> Many of the dressings either cracked in the dry season or melted in the hot or rainy seasons. The only type that performed well was polymeric membrane dressings (PMDs), which consistently balanced moisture, kept wounds clean, decreased pain and promoted brisk wound healing despite extremes of temperature and humidity.<sup>4,5</sup> However, importing PMDs is not a sustainable solution for patients and caregivers, particularly in villages.<sup>1,5</sup>

A review of the literature found that commonly recommended natural wound management approaches often have serious drawbacks.<sup>3</sup> Papaya, the natural source of papain, is widely available in much of the tropics.<sup>3,5</sup> The flesh, directly applied to a wound, will act as a debriding agent. However, papain concentrations vary and after papaya debrides necrotic tissue it must be removed promptly to avoid destroying healthy tissue.<sup>3</sup> In a village outpatient setting, it can be difficult to monitor patients carefully enough to avoid disaster<sup>5</sup> (Fig. 1). Similarly, while medical maggots may only eat necrotic tissue,



Photo: Linda Benskin.

**Fig 1.** Full-thickness burn from papaya.

the wild maggots found in villages will invade healthy tissue and can be painful.<sup>1,5</sup> Unlike honey produced in temperate climates, honey produced in the tropics is often so watery that it ferments; such honey does not have strong antimicrobial properties.<sup>3,5,6</sup> Honey in commercial dressings drips out in warm climates.<sup>5</sup> Banana leaf dressings help keep wounds moist, but they carry such a high bioburden that autoclaving is required, which is not an option in remote settings.<sup>7</sup>

## Existing practices

Following the principle that one should always assess before diagnosing or prescribing, we conducted a usual wound practice study with village health workers, traditional health practitioners and villagers performing self-care in villages throughout Ghana, Cambodia and Zambia.<sup>1,5,8</sup> In order to obtain reliable results, we used the unique story completion survey method.<sup>1,5,8</sup> The principal investigator related the

*Continued overleaf...*



## Sickle Cell Leg Ulcer Research Study participants found ATDs led to:

- Dramatically decreased pain at dressing changes
- No bleeding at dressing changes (ATDs do not stick)
- A cleaner wound bed without painful scrubbing
- Decrease ulcer pain throughout the day (and night)
- Fewer problems with excess wound drainage
- Fewer problems with wound odor
- No wound infections when instructions were followed
- Ability to return to usual activities (work, school)
- A slow, but steady, decrease in wound size
- Dramatic wound-related cost savings

## The most common challenges with using ATDs were:

- Taking the time to change the ATD every day
- Avoiding scrubbing the wound bed
- Rinsing at an angle to wash the dirt out of the ulcer
- Applying the skin protectant at the edge of the ulcer
- Learning to cut slits, not holes, in the plastic
- Positioning the slits so that the fluid would drain well
- Fluffing the absorbent so that it would absorb better
- Choosing a convenient wrap to hold the ATD on
- Locating a good skin protectant (ask a pharmacist)

## For more information about ATDs, contact/view:

- Sponsor:
- Educational conference poster about ATDs – click on “View full-text” to see, or to download, the poster <https://www.researchgate.net/publication/374083790>
- 

# A Step-By-Step Guide to Available Technology Dressings for Wound Management



The Available Technology Dressing (ATD) is a method of dressing wounds. It is specially designed for the challenges of warm areas without a lot of resources. ATDs are safe, effective, and affordable.

**The ATD must be applied correctly to work well.**

It is easier to remember the best way to dress your ulcer with the ATD method if you know the reason for each step in the process. This booklet should help you with that.

## Wounds heal best when they are clean, moist, and calm.

- If a wound is dirty, the body will spend energy trying to clean it instead of healing it, and it can get infected.
- If a wound is too wet or too dry, the new cells will have a difficult time covering the opening, and the infection-fighting cells will have a difficult time capturing the germs. When the wound is moist, the body makes enzymes that dissolve damaged tissue and clean the wound. This is called autolytic debridement.
- A wound needs to be calm to grow new tissue. If it is irritated by scrubbing, dressings that stick, being bumped, or harsh cleaners, it is more likely to get bigger instead of getting smaller. Pain slows healing.
- Snug, but not too tight, compression helps the body remove wastes and bring fresh supplies to the wound area.

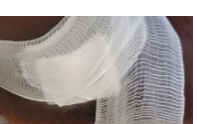
*When the ATD method is used correctly, it helps the wound heal more quickly by keeping it clean, moist, and calm.*

### You will need (numbers correspond to each step):

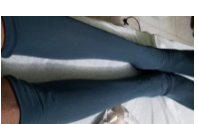
- 1) **Irrigation materials:** a clean clear soda bottle (about 500ml), and table salt  
Make a hole in the bottle lid with a hot bicycle spoke or similar object. Fill the bottle with germ-free water. Add one capful of table salt, if desired.
- 2) **Surrounding skin moisture protection:** An inexpensive ointment used to protect babies' bottoms from diaper rash is a good choice. Plain zinc oxide paste or plain shea butter works well. The ointment should be affordable, not melt in the heat, and should not be toxic (it should not sting if a bit of it gets in the ulcer).  
A semi-permeable **membrane to protect the wound**, such as thin clear food-grade plastic bags. Cut a plastic bag slightly larger than the ulcer. It should cover the edges about a finger's width all around with the plastic gently pushed down into the cavity. Cut a slit in the plastic with scissors or a blade to allow excess fluid to escape into the absorbent material near the part of the ulcer closest to the floor when you walk. If the ulcer is large, cut other slits spaced apart. Do not cut holes! The slit edges should meet up.
- 4) An inexpensive **absorbent material**, like what is used to absorb menstrual flow, fluffed gauze, or fluffed pieces of old cotton cloth (wash and reuse).
- 5) **A snug wrap to hold the dressing in place** (a long sock or long sleeve from a child's T-shirt, stretch gauze, elastic bandage, or strips of cotton sheets).



Step 1                      2



Step 3



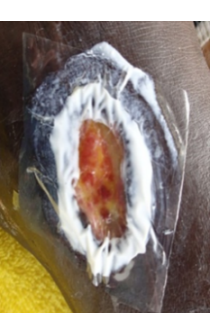
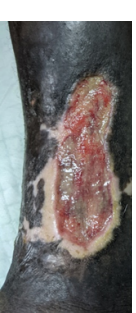
Step 4



Step 5

### Dressing your Ulcer:

1. Irrigate: Squeeze **hard** on the bottle with it pointed at an angle so that the water pushes any dirt out of the ulcer, **away from you**. Do not scrub!
2. Dry the skin around the ulcer, but leave the ulcer itself damp. Apply the moisture protection in a thick rim **right up to the edge** of the ulcer. This will become neater with practice.
3. Place the cut clear plastic onto the wet ulcer, gently **pushing any air out** through the slit(s). The slit(s)' edges should meet so there is **no gap**.
4. Place the fluffed absorbent material over the slit(s) in the plastic to absorb the fluid that "burps" out of the slit(s).
5. Secure the bandage, including the absorbent material, with a clean dry wrap or other material to hold it in place **snugly** without hurting. Use tape if needed.



*Every day, remove the old dressing (it will not stick!), irrigate, dry the edge (not the wound), and then apply the moisture protection, the cut clear plastic with the slits, the absorbent, and the wrap. If you wash & reuse the absorbent or wrap, put them out in direct sunlight for a few hours to dry and disinfect them.*



# The Available Technology Dressing (ATD) technique for wound management...continued

beginning of the story of a patient coming to receive care while showing the participant their wound photo. Then, the participant related how they would complete the story – how they would manage that wound – without any prompting. This process was repeated for a total of seven wound types per participant. The study found that, just as in wealthy countries, non-experts often try to dry wounds, which delays healing and increases infection rates.<sup>1</sup> In contrast, village health workers and traditional health practitioners who are recognized for their expertise in wound care agreed with expert wound healthcare professionals worldwide that the goal is to keep wounds appropriately moist.<sup>1</sup> These expert village lay healthcare providers expressed frustration because their crushed leaves and poultices could not keep wounds ideally moist, which led to disappointing results.<sup>1</sup>

## Developing the ATD technique

Knowledge of the basic science of wound care guided the development of the proposed ATD technique.<sup>1,9</sup> We sought an approach that:

- keeps wounds clean and appropriately moist;
- uses only materials from the natural environment or local village market;
- is acceptable to patients and caregivers;
- can be taught to lay health providers, patients and families.

We discovered that plastic food wrap has been used effectively for wounds in Japan, but patients found the wrapping technique used there intolerable in a hot tropical environment.<sup>3,5</sup> In India, plastic surgical drapes were effective primary dressings for burns because they do not stick to the wound bed.<sup>9</sup> Food wrap and surgical drapes are not available in most village markets,<sup>5</sup> but thin, strong, clear, food-grade plastic bags, which are also semipermeable membranes, are widely available across Africa, South America and Southeast Asia.<sup>5,9</sup> Because they are routinely used to carry water, rice, soup and other prepared foods, these clear bags are not affected by bag bans.<sup>9</sup> Given the great success of thin plastic improvised dressings in Japan and India, and the reliable availability of food-grade plastic bags in tropical village markets, we developed a dressing technique to meet the above goals using these bags as the wound contact layer.<sup>5,9</sup>

## Assessment of the ATD technique in a tropical setting

**Methods:** After refining the ATD technique through informal case studies, a 12-week, staggered start and stop, outcomes-blinded, randomized controlled trial was conducted at the University Hospital of West Indies in Mona, Jamaica in patients with chronic sickle cell leg ulcers (which are often regarded as the most challenging of all wound types).<sup>5,9</sup> The ATD technique consists of: (1) thoroughly irrigating the wound with a strong squeeze on a homemade device filled with homemade saline (a ~500 mL soda bottle with a hole in the cap from a hot bicycle spoke or similar sized wire); (2) drying the skin next to the wound, then protecting it with a thick layer of a non-toxic moisture barrier (e.g. zinc oxide paste or shea butter); (3) gently conforming a cut-to-fit piece of food-grade clear plastic bag (a clean semipermeable membrane) to the wound bed and to the moisture barrier (cut slits – not holes – in the plastic to allow excess fluid from autolytic debridement to escape); (4) placing fluffed clean absorbent material over the slits to absorb the

excess fluid; (5) holding all of this in place (and, when tolerated, applying compression) with a snug wrap.<sup>5</sup> Daily, remove the ATD, irrigate the wounds thoroughly, dry the periwound and apply more moisture barrier, plastic with slits, absorbent and wrap. Exact dressing components can vary based upon availability<sup>5</sup> (See tear out leaflet).

Patients were randomized to trial one of the following three dressing types: wet-to-moist (WTM) gauze, ATDs and the gold-standard advanced dressing type, polymeric membrane dressings (PMDs).<sup>5,9</sup> Dressings were changed daily by the patients themselves. Participants submitted wound photos and returned questionnaires to the investigators weekly. Nurses telephoned to complete forms verbally for patients who could not read well. In-person follow-up visits took place at weeks 1, 4, 8, 12 and whenever the researchers, blinded observers or patients had any concerns about possible complications.<sup>5</sup> Data were collected on change in wound area, measured electronically from photos and tracings, dressing change and persistent wound pain, various other quality-of-life parameters, complications (infection or healing-impairing maceration), time spent on dressing changes, cost of supplies and dressing method acceptability.<sup>9</sup> Because the wounds were chronic sickle cell leg ulcers, there was no expectation of closure in only 12 weeks, but it was hoped that the severe pain might be reduced and that some ulcers would decrease in size.<sup>5,9</sup>

**Results:** Forty patients completed the study (WTM n=16; ADT n=13; PMD n=11).<sup>5</sup> The ATD technique, which is more available than WTM gauze dressings, was also far safer (zero complications vs. 4/16 (25%) mild pseudomonas infections), and more effective (12/13 (92%) of participants experienced a net wound closure, compared with 8/16 (50%) in the WTM gauze group and the group percentage mean change in wound area at 12 weeks was 27% smaller vs. only 7% smaller in the WTM gauze group).<sup>5</sup> Weekly ATD total supply costs were USD \$3.23 vs. USD \$6.35 with WTM gauze.<sup>5</sup> In addition, the ATDs reduced dressing change pain and overall pain better than WTM gauze.<sup>5,9</sup> As expected, the gold-standard advanced wound dressings, PMDs, provided superior outcomes in every aspect tested except cost (median cost for PMDs was USD \$28.87 per week).<sup>5,9</sup> Within the PMD group, 2/11 (18%) of the sickle cell leg ulcers closed completely.<sup>9</sup> However, PMDs and other advanced dressings are simply not available in rural areas of developing countries.<sup>5</sup>

Although the ATD technique proved suitable for teaching self-care to patients, the specifics are critical to success. Our experience revealed that patients often did not intuitively understand the purpose of each step of the dressing process, and so they tended to make mistakes.<sup>5</sup> Teaching the reasons for each step, with appropriate analogies when possible, and coaching during return demonstration of the technique quickly enabled patients to learn how to complete their dressing changes correctly.<sup>5</sup>

**Conclusion:** This small study revealed that the ATD technique was safer, more effective, associated with less pain and cheaper than WTM gauze dressings. Patients were able to change the dressings themselves, especially when taught the basic reasons for each step involved. In settings where gold-standard PMDs are too expensive or unavailable, it is beneficial to teach patients and lay healthcare providers the ATD technique.

*Continued on page 31...*

# Optimizing nutrition intervention to enhance wound healing in low-resource settings

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**Conflict of interests:** None.

**Key words:** Wound healing; nutrition; low-resource areas.

Billions of people live in parts of the world where resources for adequate medical and nutritional care are unavailable. In these low-resource settings, management of chronic wounds is particularly challenging. Demographic patterns of chronic wounds in low-resource settings across the world show diverse wound aetiologies, including diabetic foot wounds, pressure injuries, vascular lower extremity wounds, burns and complications of acute bacterial soft tissue infections and wounds caused by chronic skin infections and neglected tropical diseases.

The medical and nutritional treatments of these wounds are often hindered because of the lack of wound-care-certified staff, food deserts, scarcity of supplies and lack of knowledge regarding the link between nutrition and wound healing. In certain parts of the world, nutritional optimization sometimes is complicated further by poverty, famine and even violence.

Delayed wound healing and poor wound outcomes are almost guaranteed in the presence of poor nutritional intake and malnutrition. It is imperative that patients with wounds consume an adequate amount of both macronutrients and micronutrients daily to fuel the wound-healing process and build new tissue. In clinical practice, providers must determine the nutritional status of their patients by conducting an initial nutrition screening to identify those at risk and those with pre-existing malnutrition. A comprehensive nutrition assessment should follow the screening to develop a realistic intervention plan appropriate for the available resources.

## Overview of the wound-healing process

Normal wound healing has four overlapping stages – haemostasis, inflammation, proliferation and maturation. The initial stage of wound healing involves the action of platelets and fibrin meshwork to achieve haemostasis around the injury. The subsequent inflammatory phase involves neutrophils, lymphocytes and macrophages, which mount an immune response in the wounded area. During the proliferative phase, fibroblasts enter and proliferate in the wound site where they secrete collagen molecules. This newly formed matrix is host to angiogenesis and in its final step, the wound edges are drawn together. The final phase includes remodelling and contraction to create tissue maturation.

These phases and their biophysiological functions must occur in the proper sequence at a specific time and continue for a specific duration at an optimal intensity. Many factors can affect wound healing and interfere with one or more phases in this process, thus causing improper or impaired tissue repair.<sup>1</sup> Table 1 summarizes the cellular and biophysiological events of each stage.

**Table 1. Normal wound-healing process<sup>1</sup>**

Phase	Cellular and Biophysiological Events
Haemostasis	<ul style="list-style-type: none"><li>• Vascular constriction</li><li>• Platelet aggregation, degranulation and fibrin formation (thrombus)</li></ul>
Inflammation	<ul style="list-style-type: none"><li>• Neutrophil infiltration</li><li>• Monocyte infiltration and differentiation to macrophage</li><li>• Lymphocyte infiltration</li></ul>
Proliferation	<ul style="list-style-type: none"><li>• Re-epithelialization</li><li>• Angiogenesis</li><li>• Collagen synthesis</li><li>• Extracellular formation</li></ul>
Remodelling	<ul style="list-style-type: none"><li>• Collagen remodelling</li><li>• Vascular maturation and regression</li></ul>

## Nutrition screening and assessment

Nutrition screening is the process of identifying patients who may have a nutrition diagnosis and benefit from nutrition assessment and intervention by a registered dietitian nutritionist (RDN), if one is available.<sup>2</sup> Nutrition screening is critical in all patients with wounds at the first encounter, whether in an inpatient or long-term care facility setting, an outpatient wound centre or community health clinic. A variety of validated nutrition screening tools are available free of charge, making this first step of the nutrition care process easily achievable, even in low-resource settings. Some common screening tools include the Malnutrition Screening Tool (MST), the Malnutrition Universal Screening Tool (MUST), the Mini Nutrition Assessment – Short Form (MNA-SF) and the Short Nutritional Assessment Questionnaire (SNAQ).<sup>3</sup> Any member of the healthcare team can perform these screenings. Most tools take just a few minutes to complete and include a series of questions focusing on weight status, food intake, medical conditions and related topics.

Following the screening, a referral to an RDN is made if indicated and the resource is available. The RDN will then conduct a complete nutrition assessment, which includes assessment of anthropometric, biochemical and diet history data, as well as relevant socioeconomic information that may affect food intake. In low-resource settings, laboratory tests sometimes are not available, so a combination of nutritional intake history and careful assessment of anthropometric parameters, including a nutrition-focused physical examination, is preferred. Laboratory testing for hepatic proteins, such as albumin and prealbumin, is shown to reflect the inflammatory process more than nutritional status, so these laboratory tests are no longer recommended as part of



the nutrition assessment.<sup>4</sup> After the assessment is completed, an appropriate plan of care is started in coordination with the multidisciplinary team.

## Oral nutritional supplements

Oral nutritional supplements (ONSs) are nutrient-dense products used to fill in gaps in a patient's diet. High-calorie, high-protein ONSs can also serve as a meal replacement. These products are commercially available in a variety of forms, including beverages, puddings, jellied products, bars and powders for adding to water or other liquids, and come in a variety of flavours. It is imperative to find a product that the patient will consume in its entirety to avoid waste, particularly in low-resource settings.

Wound healing-specific formulas contain nutritional components that are important in the wound-healing process, such as arginine, vitamin C, zinc and specific collagen dipeptides, including prolyl-hydroxyproline (PO) and hydroxyprolyl-glycine (OG).<sup>5</sup> Some products contain citrulline as a precursor to arginine. Approximately 80% of citrulline is converted to arginine in the kidneys.<sup>6</sup> Current research suggests that these products can improve healing, and a recommendation for such is included in the current version of the *Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline*, issued jointly by the European Pressure Ulcer Advisory Panel, the National Pressure Injury Advisory Panel and the Pan Pacific Pressure Injury Alliance. The guideline recommends provision of a high-calorie, high-protein, arginine, zinc and antioxidant ONS or enteral formula for adults with a stage 2 or greater pressure injury who are malnourished or at risk of malnutrition.<sup>7</sup>

In low-resource settings these commercial products are sometimes not available or may simply cost too much, making it necessary to employ strategies that use local or homemade products. It is possible to make similar high-calorie, high-protein milkshakes from whole milk and ice cream.

## Adapting nutrition wound care guidance in a low-resource setting

**Protein:** Protein is the macronutrient most closely tied to wound healing for many reasons. Protein, a complex nitrogenous compound made up of amino acids in peptide linkages, is essential for life. Proteins carry out the work of the cell by serving as enzymes, receptors, transporters, hormones, antibodies or communicators that build, maintain and repair body tissues.<sup>8</sup>

The typical protein recommendation for patients who have wounds with malnutrition or at risk of malnutrition ranges from 1.25 to 1.5 g/kg of bodyweight daily.<sup>7</sup> In simple terms, this equates to about 280 – 340g for a 57–66 Kg patient (or approx. 10 – 12 oz for a 125 – 145 lb patient). To meet this goal in low-resource settings, the recommendation is to suggest lower cost protein foods, such as tinned fish (e.g. sardines, tuna fish), peanut butter, lentils, beans, chicken drumsticks, ground beef and amaranth.

**Vitamin C:** Citrus fruits, including oranges, lemons, limes and tangerines, are abundant in many geographic areas,

even those with low resources. The high vitamin C content of citrus fruits makes them ideal to provide vitamin C, which is a necessary daily cofactor for wound healing (Figs. 1 and 2).

### L-citrulline and arginine:

Food sources of citrulline are not abundant, with watermelon having the highest content of L-citrulline.<sup>9</sup> L-citrulline is a precursor of arginine and currently is used extensively in commercial preparations of amino acid supplements because it provides higher levels of bioavailable arginine. Watermelon is an alternative where available.

**Zinc:** Zinc is a cofactor for many metalloenzymes required for cell membrane repair, cell proliferation, growth and immune system function. As a cofactor for RNA and DNA polymerase, it is also involved in DNA synthesis, protein synthesis and cellular proliferation.<sup>10</sup> Zinc-rich foods are strongly encouraged. Food sources high in zinc include oysters, chicken legs, lean pork chops, lentils, oatmeal, beef (chuck), firm tofu, hemp seeds, wheat germ and mushrooms.<sup>11</sup> It is possible to replace a commercial zinc supplement with a

diet containing adequate zinc foods throughout the week.

### Antioxidants:

Rather than relying on commercial supplements, many people in low-resource areas can rely on local plants and spices, including turmeric (Fig. 3), oregano and moringa (Fig. 4).

Curcumin, the active ingredient in turmeric, has significant



Fig 1. Fruits high in vitamin C.



Fig 2. Vegetables high in vitamin C.



Fig 3. Turmeric.



Fig 4. Moringa.

Continued overleaf...

# Optimizing nutrition intervention to enhance wound healing in low-resource settings...continued

antioxidant and anti-inflammatory properties. Turmeric has a long history of therapeutic application in traditional Asian medicine. Turmeric is often called the golden spice because of its brilliant yellow colour. Others refer to it as Indian saffron. In wound healing, turmeric intake may enhance granulation tissue formation, collagen deposition, tissue remodelling and wound contraction.<sup>12</sup> This spice is readily available in many areas.

Oregano (*Origanum vulgare* L.) is a common flowering plant cultivated all over the world, including several geographical areas in low-resource settings. Oregano extract has cytotoxic, antioxidant and antibacterial activities mostly attributed to carvacrol and thymol.<sup>13</sup> Studies show that oregano improves wound healing through its anti-inflammatory, antioxidant and antimicrobial activity, as well as anti-collagenase and anti-elastase effects and the promotion of tissue remodelling and re-epithelialization.<sup>14</sup>

Moringa *oleifera* is a plant native to northern India that also grows in other tropical and subtropical places, such as Asia and Africa. Folk medicine has used the leaves, flowers, seeds and roots of this plant for centuries.<sup>15</sup> Moringa is reported as an important element in controlling diabetes. Moringa leaves are noted as a significant agent in reducing the blood glucose level immediately after it is taken.<sup>16</sup> The extracts (aqueous) from moringa show significant pro-healing actions, which may have a role in treating diabetic foot ulcers.<sup>17</sup>

**Hydration:** Safe, potable water is difficult to obtain in some low-resource areas, but proper hydration is necessary for wound healing. If water or other fluids are not available, the best advice is to consume foods with a high-water content, such as cucumbers, cantaloupe watermelon, lettuce, tomatoes, cabbage, celery, spinach and summer squash/zucchini.

## Nutrition education and implementation

Low-resource environments tend to lack adequate specialized staffing teams and hence are unlikely to have RDNs to manage and monitor nutritional interventions in patients with wounds. The use of trained local health educators is of immense value in patient nutrition education helping to improve wound-healing outcomes. No matter how low resource the setting is in terms of infrastructure and materials, concerned and compassionate human beings always can do something of value. The most precious resource available in these circumstances is other people.<sup>18</sup>

The development of simple nutritional protocols based on the current recommendations but using available food items should become part of the treatment plan for patients. Table 2 summarizes the recommendations. Rather than high-cost supplements, homemade foods can often provide the necessary nutrients at a lower cost. The key to a successful nutrition programme is learning the basic principles of nutrition and wound healing and then developing a plan to meet nutritional needs with what is available in the local area.

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Table 2. Summary of nutrition recommendations

Recommendations
• Patients presenting with chronic wounds and open skin lesions in low-resource settings should undergo a comprehensive nutritional screening at first contact with the healthcare provider and if necessary, have a complete nutrition assessment
• In the absence of registered dietitian nutritionists, local health educators can serve in this role after receiving training on nutrition principles and learning to use simplified protocols
• Patients should follow a high-calorie, high-protein diet based on available food items in the geographic location
• The daily food plan should include citrus fruits if available in the location
• Watermelon is suggested for daily consumption if available in the area
• Zinc-rich foods are an important part of the diet
• Depending on availability in the geographic area, use of turmeric, oregano and moringa is encouraged
• Patients should understand the importance of proper hydration

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## DIAGNOSIS ANSWERS

### 1. Cat scratch disease.

Cat scratch disease is an infectious bacterial disease that results most often from the scratch, lick or bite of a cat. The causative bacteria is *Bartonella henselae* found in the cat's saliva. Inoculation at the bite site typically causes an asymptomatic nodule or pustule and painful lymph node enlargement may develop within a few weeks. Fever and malaise may be experienced.

The skin lesions often resolve completely. However, dissemination and serious neurological and cardiac sequelae may occur in immunocompromised patients.

- Most healthy individuals clear the infection without treatment. However, some with significant symptoms may require a short course of antibiotics such as azithromycin.



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