WHASA consensus document on the management of lower limb ulcers

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INTRODUCTION

This consensus document of the Wound Healing Association of southern Africa addresses ulcers of the lower limb, focussing on arterial, venous and mixed ulcers. The diabetic foot ulcer and malignant ulcers have been addressed in other documents and readers are referred to these documents.

Key message of this document:
The first priority is to assess the arterial supply and then to correct critical lower limb ischemia

METHOD

An expert collaboration group from all walks of clinical care assembled for two days in Gauteng, South Africa to discuss and formulate a consensus document on the Management of Lower Limb ulcers. Teams were selected for clinical expertise and background in Vascular surgery, Vascular assessment & management, Orthopaedic management, Wound management, Reconstructive Surgery, Product application and Managed Health Care. Societies who brought their expertise to this endeavour to create collaboration and unified approach are WHASA, Case Manager Association of South Africa, South African Stomaltherapy Association, Pan African Diabetic Foot Working-Study Group and the Society of Private Nurse Practitioners of South Africa.

The Lower Limb team consisted of members of whom 67.6% had more than 15 years of experience and 50% of them specialists (medicine, nursing and hyperbaric oxygen therapy). They have reviewed the current literature pertaining to their area of expertise and present their findings during the meeting in a structure based on the Wound Bed Preparation Paradigm.[1] The purpose was not to reinvent the wheel but rather to put forward the South African voice and experience by means of recommendations. On day 2 to the full audience took part in a Modified Delphi method to generate an eighty percent immediate consensus for each recommendation.

As verification of this, an online-based modified Delphi method was used where each team member voted independently to verify the initially reached recommendation strength. Thereafter it was verified by an independent second panel consisting of national and international experts who were not part of the panel. A 4-point Likert scale (strongly agree, partially agree, partially disagree, strongly disagree) was used with space for individual comments. Each item to be included in this document has achieved eighty percent agreement (either strongly agree or partially agree) by all panels. This process took 24 months to complete.

CONTRIBUTORS

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RESULTS

1. Assess patient ability to heal and treat the cause

1A. How would you determine if there were adequate blood supply to the wound?

The ability of a wound to heal is directly proportional to its arterial supply.[2-6] The arterial blood contains oxygen and other essential nutrients. Various risk factors, patient symptoms, clinical signs, bedside tests and special investigations can be used to determine adequate blood supply or the lack thereof.

Risk factors for peripheral arterial disease[6,7] include family history, diabetes, hypertension, hypercholesterolemia, smoking, chronic renal disease and HIV/AIDS. Atherosclerosis is accelerated by the chronic use of corticosteroids. Peripheral arterial disease is often found in patients with atherosclerosis of other vascular beds including coronary artery disease and cerebro-vascular disease.[7] The patient history might include claudication (pain in lower limb when walking) or rest pain (pain in forefoot at rest) indicating arterial insufficiency. Rest pain is often exacerbated by elevation of the limb and decreased by placing the limb in a dependent position.[6]

The pulse status should be assessed and compared with all the other limbs. The AHA[8] has suggested a numeric grading system to standardise documentation. See Recommendation 2. The clinician should be aware of the fact that 9-10% of normal patients could have absent dorsal pedal pulses.[9]

Other clinical signs suggestive of peripheral arterial disease (PAD) include dependent rubor (hyperaemia), reduced capillary refill (> 5 seconds), elevation pallor (Buerger's test), poikilothermia (cool) and pain.[6]

Various consensus guidelines[6,8,10] advise that all patients with clinical evidence of peripheral arterial disease must be subjected to further investigations to objectively confirm the diagnosis. Ankle-brachial pressure indices have been demonstrated **to be an accurate diagnostic modality in non-diabetic patients**[11] (see addendum 1). On the other hand Toe-brachial pressure indices are accurate in diabetic patients,[11] due to the fact that the digital arteries tend not to be circumferentially calcified. All clinicians involved in the management of patients with lower limb ulcers should have direct access to an 8 MHz handheld Doppler.[6,11] The cost of this equipment should be weighed against the socio-economic impact of amputations that can be avoided with the appropriate use thereof.

Transcutaneous oximetry (TcPO2) is used as an objective assessment of the wound's ability to heal spontaneously. A TcP02 of greater than 30 mmHg in non-diabetics and greater than 40 mmHg for diabetics would indicate sufficient transcutaneous oxygen levels for a wound to heal.[12,13]

Special investigations, including arterial duplex-Doppler, digital subtraction arteriography, CT-arteriography and MR-arteriography, should only be done at the specific request of a specialist as part of the planning or execution of definitive treatment, e.g. revascularisation procedures.[6,8]

A history of limb trauma, varicose veins or deep vein thrombosis should alert the clinician to the possibility of venous insufficiency. Heaviness, pain or discomfort of a limb with venous insufficiency is often exacerbated when the limb is placed in a dependent position and relieved by elevation of the limb. Signs of chronic venous insufficiency include oedema, hyperpigmentation, lipodermatosclerosis, venous eczema and ulceration.[14]

Recommendation 1	**Agreement: 92.5%**
The presence of adequate blood supply to a wound of an extremity should be based on: • Patient history • Clinical examination • Ankle-brachial pressure indices in non-diabetics • Toe-brachial pressure indices in diabetics • $Tcpo_2$ • Selected and appropriate radiological investigations	

Recommendation 2	**Agreement: 97%**
During clinical examination pulses should be graded as:	
0 Absent	significant peripheral arterial disease
1 Faint	mild peripheral arterial disease
2 Normal	
3 Bounding	hyperdynamic circulation or heart valve disease

Recommendation 3	**Agreement: 100%**
All patients with clinical evidence of peripheral arterial disease must be subjected to further investigations to objectively confirm the diagnosis, including ankle brachial doppler indices.	

All patients with clinical evidence of peripheral arterial disease must be subjected to further investigations to objectively confirm the diagnosis, including ankle brachial doppler indices.

1B. Identify the causes as specifically as possible and identify referral:

Lower limb ulcers are caused by peripheral arterial disease, chronic venous disease, peripheral neuropathy or a combination of these disease processes. The causes are identified by means of the clinical parameters and investigations just discussed in 1A. Neuropathy should be assessed according to the guidelines recommended by the Consensus Document on the management of Diabetic Foot Ulcers.

All patients with severe peripheral arterial disease (critical limb ischaemia) should be referred to a vascular surgeon as a matter of urgency.[6,8,10] Not only is the patient's limb at risk but his life as well. Severe co-morbidities should be addressed and the patient referred if and when required. The clinician should refer a patient whenever the management of such a patient is considered to be beyond the clinician's scope of practice.

In cases where patients require compression bandages as compression therapy, the patient should be in the care of a clinician that is both competent in the assessment of lower limb perfusion status and different techniques to achieve optimal compression for the patient, depending on individual patient need and respective patient centred concerns.[1]

Table 1: Indications for referral

Referral is indicated for the following:	
Criteria	**Specialist**
ABPI < 0.5[6] Toe Pressure < 50 mmHg[6] $TcPO_2$ < 30 mm Hg in non-diabetics[13] $TcPO_2$ < 40 mm Hg in diabetics[13] Devitalised tissue and suspected PAD[6]	Vascular Surgeon: Urgent
ABPI < 0.9 > 0.5[6] Non-healing Venous Ulcer Mixed Ulcer[6,15]	Vascular Surgeon
Severe Uncontrolled Co-Morbidities	Appropriate specialist physician
Devitalised Tissue without PAD[6]	Surgical specialist or adequately trained physician for sharp surgical debridement
Wound related deep tissue infection[1] (Three or more STONEES criteria present – see section 8)	Referral to appropriate clinician for antibiotics

Recommendation 4	**Agreement: 99%**
A patient with a lower limb ulcer with any of the following criteria, requires urgent referral to a vascular surgeon: • Ankle-brachial pressure index < 0.5 • Toe pressure < 50 mmHg • Tcpo2 < 30 mmHg in non-diabetics • Tcpo2 < 40 mmHg in diabetics • Devitalised tissue in a patient with suspected peripheral arterial disease	

1C. Review co-factors / co-morbidities (systemic disease, nutrition, medications) that may delay or inhibit healing:[1-6,8]

- Peripheral arterial disease:
  - Diabetes
  - Smoking
  - Hypertension
  - Hypercholesterolemia
  - Chronic renal disease
  - HIV
  - Connective tissue disease
  - Calciphylaxis
- Previous surgery
- Previous trauma
- Co-morbidities such as coronary artery disease and cerebrovascular disease
- Malignancy
- Deep vein thrombosis
- Limited mobility
- Reduced activity

Environment, Occupation, Oedema, Nutrition or obesity issues, Medication, Anaemia

Other aggravating factors

1D. Determine when the wound will be categorised as healable, maintenance and non-healable

Healable:[1]

All patients with arterial ulcers should be referred for a vascular assessment and possible intervention. Curative, conservative, non-surgical management in high-risk patients with severe comorbidities could be considered if the following parameters[6] are met:

- $TcPO_2$ > 40 mm hg
- Abpi > 0.5
- Toe pressures > 50 mmHg

In spite of the fact that these parameters would suggest that the wound should heal with intensive wound care, the rate of healing will be reduced in the presence of ischaemia and hypoxia. The priority is to facilitate the healing cascade by protection of cellular processes and advantaging the host by creating an optimum wound environment.

Cause can be corrected

Maintenance:[1]

A maintenance wound is defined as a wound that is potentially healable, but patient or system factors prevent intervention. Advanced wound care modalities would not be appropriate in this setting. Some wounds in this category would eventually heal but the time to healing may be prolonged and adverse events if it occurs, have a detrimental effect on wound status. The priorities are to keep the patient and wound well controlled, prevent local infection and protect the wound from trauma and outside facors.

Cause can be corrected, but system or patient factors prevent intervention

Non-healable:[1]

A wound is considered non-healable when the patient and or system factors that prevent healing, cannot be corrected. A qualified, registered vascular surgeon should make the final decision regarding the ability or inability to reconstruct the vascular supply to a limb.[6] The main priorities are to preserve the tissue that is present, prevent infection by aggressive control of bacterial burden with wound bed dry to create a protective scab.

Cause cannot be corrected

2. Develop an individualised plan of care

Treatment of the lower limb ulcer should be done according to the Wound Bed Preparation guidelines.[1] Treatment should be modified according to the patient's individual circumstances. The treatment plan should be reassessed at every patient contact and adapted if the wound is not following the healing continuum. The MEASURE[17] tool should be used to assess wound progress.

Table 2: Pathways for care and referral depending on aetiology[1,16]

Arterial	Venous	Mixed
Identify and Treat the Cause		
1. Obtain a careful history to determine the arterial characteristics and to rule out other diagnoses; assess pain and identify the other systemic and local factors that may impair wound healing.	1. Obtain a careful history to determine the venous characteristics and to rule out other diagnoses; assess pain and identify the other systemic and local factors that may impair wound healing.	1. Obtain a careful history to determine the arterial and venous characteristics and to rule out other diagnoses; assess pain and identify the other systemic and local factors that may impair wound healing.
2. Perform a physical assessment. This will include a bilateral lower limb assessment as well as an ankle-brachial pressure index (ABPI) test on all patients with arterial ulcers to determine the severity of arterial disease.	2. Perform a physical assessment. This will include a bilateral lower limb assessment as well as an ankle-brachial pressure index (ABPI) test on all patients with venous ulcers to help rule out the presence of arterial disease.	2. Perform a physical assessment. This will include a bilateral lower limb assessment as well as an ankle-brachial pressure index (ABPI) test on all patients with mixed ulcers to determine the severity of arterial disease.
3. Determine the cause(s) of the arterial insufficiency based on aetiology: hypercholesterolemia, smoking, hypertension, diabetes, renal disease, etc.	3. Determine the cause(s) of chronic venous insufficiency based on aetiology: abnormal valves (reflux), obstruction, or calf-muscle-pump failure.	3. Determine the cause(s) of chronic venous insufficiency and arterial insufficiency based on aetiology.
4. Avoid compression therapy.	4. Implement appropriate compression therapy (ABPI > 0.8).	4. Implement appropriate modified compression therapy only after objective assessment confirms adequate arterial supply (ABPI > 0.6).
5. Implement optimal medical therapy: anti-platelet therapy, statin therapy, anti-hypertensive therapy, smoking cessation and glycaemic control.	5. Implement medical therapy if indicated for chronic venous insufficiency (superficial and deep thrombosis, lipodermatosclerosis). Smoking cessation.	5. Implement optimal medical therapy for arterial disease and selective therapy for venous disease. Smoking cessation.
6. Consider surgical and / or endovascular management if significant ischemia is present. Selected individuals could be considered for conservative management.	6. Consider selective surgical management if significant superficial or perforator vein disease exists, in the absence of extensive deep disease.	6. Consider surgical and / or endovascular management if significant ischemia is present. Venous procedures should only be considered after arterial repair.
Address Patient-Centred Concerns		
7. Communicate with the patients, the family and the caregivers to establish realistic expectations for healing and provide information for care and management of arterial disease. The presence or absence of a social support system is important for treatment and prevention of arterial leg ulcers.	7. Communicate with the patients, the family and the caregivers to establish realistic expectations for healing and provide information for care and management of venous disease. The presence or absence of a social support system is important for treatment and prevention of venous leg ulcers.	7. Communicate with the patients, the family and the caregivers to establish realistic expectations for healing and provide information for care and management of arterial and venous disease. The presence or absence of a social support system is important for treatment and prevention of mixed leg ulcers.
Provide Local Wound Care		
8. Assess the wound.		
9. Provide local wound care. Optimise the local wound-healing environment through bacterial balance and moisture balance. Consider debridement and / or appropriate adjunctive therapies after the arterial insufficiency has been corrected. The surrounding skin should be assessed and protected.	9. Provide local wound care. Optimise the local wound-healing environment through debridement, bacterial balance and moisture balance. Consider appropriate adjunctive therapies. The surrounding skin should be assessed and protected.*	9. Provide local wound care. Optimise the local wound-healing environment through bacterial balance and moisture balance. Consider debridement and / or appropriate adjunctive therapies after the arterial insufficiency has been corrected. The surrounding skin should be assessed and protected.*
Provide Organizational Support		
10. Consult appropriate disciplines to maximise and individualise the treatment plan to address factors and co-factors that may affect healing (e.g., mobility and nutrition).		

Compression bandages are contra-indicated in acute deep vein thrombosis, cellulitis and suppurative thrombophlebitis[1]

Venous eczema and / or dermatitis and / or pruritus could interfere with the wound management. Systemic antihistamines and local corticosteroids could improve patient adherence to compression bandages. Ensure that all bony prominences and / or calf fibrosis are well protected to prevent pressure ulcers. Modified compression (lower pressure with fewer layers) should be considered in all patients with abnormal sensation (peripheral neuropathy) and in patients with mixed ulcers where objective evidence has been obtained that the arterial supply is adequate. Patients should be requested to return immediately in the event of increase in pain, paraesthesia or strike through.[18,19]

Non-adherent dressings should be used to improve patient comfort and to avoid inadvertent debridement of an ischaemic wound.[1] The skin surrounding lower limb ulcers should always be protected appropriately. Circumferential taping must be avoided on all limbs due to the potential of a tourniquet effect. Optimal moisture balance is essential. Infection control should aim at reducing the bio-burden at the first visit to reduce the risk of critical colonisation converting to deeper infection.[1,20]

Recommendation 5	Agreement: 82%
All patients with arterial insufficiency must be placed on anti-platelet therapy, anti-hypertensive therapy and statin therapy,[6,8,10] unless a specific contra-indication exists. **This is dependent on patient clinical status, clear clinical assessment and clinical investigations.**	

Recommendation 6	Agreement: 97%
Smoking cessation is essential in all patients with chronic wounds but especially in those with arterial insufficiency.[6,8,10]	

Recommendation 7	Agreement: 100%
Patients with chronic venous insufficiency and venous ulceration, require elevation of limbs at rest, exercise to strengthen calf muscles, weight control, smoking cessation and external compression.[18]	

3. Assess and support individualized patient centred concerns

3A. Pain

The cause of the patient's pain should be identified and treated accordingly.[1,19] During the pain assessment consider location, duration and intensity (numeric or Visual Analogue Scale) of the wound pain.[1,19] It is also important to describe whether the pain is predominantly nociceptive or neuropathic in origin, in order to select an appropriate pharmacologic treatment. Nociceptive pain (throbbing, gnawing, and aching)[1] is caused by stimulation of peripheral or visceral pain receptors (nociceptors) by noxious stimuli. Neuropathic pain (burning, stabbing, shooting, and stinging)[1] is initiated or caused by a primary lesion or dysfunction in the nervous system.

Determine if the pain is procedure-related for example during dressing changes or debridement. In addition, the impact of the wound pain on the patient's quality of life (QoL) and activities of daily living (ADLs) needs to be taken into account.[1,19]

Pain can also be associated with infection and deep compartment infection should be ruled out. (Three or more STONEES criteria - see section 8)[1]

Recommendation 8	Agreement: 94.1%
Increasing pain after application of a compression dressing is enough justification for the patient to return immediately or for the dressing to be removed.	

3B. Activities of daily living:

The clinician should assess activities of daily living in every patient and manage the individual accordingly. One should distinguish between basic activities of daily living (personal hygiene and household tasks) and advanced activities of daily living (work, community social tasks).[1]

During the assessment the clinician should document what the patient is able to do and compare that with what the patient should have been able to do, had the ulcer not been present. This could be used as a guideline to post-surgical expectations. These parameters should not only be documented, but attempts should be made to improve on these parameters and patients should be reassessed on regular intervals, including a period of time after the wound has healed. Activities of daily living are limited in patients with leg ulcers.[1,18-20] Factors that affect this include pain, odour, impaired mobility, decreased activity, time lost during dressing changes and social isolation.

Patient education is essential. Adherence to a treatment plan by a patient (and their circle of care) is much more likely if they understand the various components of the treatment plan.[21] Patients with venous stasis ulcers should be encouraged to increase their physical activity: walking, swimming and cycling improves venous return to the heart and reduced venous congestion in the limbs.[22] The same applies to patients with corrected arterial insufficiency, where exercise improves arterial flow and the development of collateral circulation.[6,8,10] In patients with uncorrected critical ischaemia, ischaemia might be aggravated and a patient will not be able to continue with an exercise programme. The importance of limb elevation and weight control should be emphasised in patients with venous insufficiency.[18,22] All patients should be educated regarding nutrition, skin care, foot care and the prevention of injuries.[1]

Other techniques to improve the patient's activities of daily living include hosiery application devices, orthotic devices, specific exercises and intermittent pneumatic compression.

3C. Psycho-social well-being

The clinician should be aware of the psycho-social concerns that the patient might have, including clinical or reactive depression, anxiety regarding the risk of amputation, financial concerns, social isolation due to odour, etc. These aspects impact directly on the patient's adherence to the treatment plan.[1,21] The clinician should attempt to tailor the treatment plan accordingly, e.g. utilising charcoal for odour absorption.

A multi-disciplinary team approach with inter-professional collaboration[1,6] gives the patient access to appropriate professional advice. Support groups can help to fill the social void that the patient might perceive himself to be in. As always, communication is key and patient education essential.[21]

3D. Smoking

Recommendation 9	Agreement: 100%
Clinicians must actively encourage patients to stop smoking at every patient encounter.	

3E. Access to care, financial limitations

The team should be aware of the patient's access to care and economic challenges.[1,21] The treatment plan should always be based on individual requirements. Cheap does not necessarily imply cost-effective.

Arterial insufficiency with ulceration (ICD - I70.2) is a prescribed minimum benefit condition in South Africa and the appropriate care, including wound care, has to be funded by medical schemes.[23,24]

If a wound is deemed a maintenance wound or a non-healable wound,[1] the use of advanced or adjuvant therapies, would not only be clinically inappropriate, but wasteful to available resources.

4. Education and support to persons and their circle of care (including referral) to increase adherence (coherence) to the treatment plan.

The patient and the patient's circle of care must be educated[1,21] regarding the aetiology, the basic pathophysiology and the rationale behind the proposed treatment plan. After a thorough discussion, literature should be provided and a question and answer session scheduled. The patient and his support team should be allowed to openly interact with the clinical team during every patient encounter. The education can further be reinforced at follow-up visits by individual team members, including the nurse educators.

The patient must thoroughly understand the nature of the disease process responsible for the lower limb ulcer.[1,21] The patient must be made aware of the progressive and recurrent nature of the underlying disease process, its long-term prognosis[6,7] and potential recurrence rate.[6,7] Emphasis should be placed on the importance of skin and foot care, life style modification, exercise, nutrition, optimal medical therapy to address risk factors, disease control and the prevention of complications.[1,6,8,10,20,22]

5. Assessment and elements of the wound history and physical examinations that should receive additional attention

As already recommended in this document, all patients with clinical evidence of peripheral arterial disease must be subjected to further investigations to objectively confirm the diagnosis, including ankle brachial Doppler indices and/or toe brachial pressure indices.[6,8,10]

All clinicians involved in the management of patients with lower limb ulcers must have access to a handheld Doppler apparatus to determine ankle brachial pressure indices,[1,6,20] before a definite treatment plan commences.

The initial patient and wound assessment must be documented.[1,17,20] Photo documentation has become wide spread practice. In government hospitals this is difficult to store due to lack of computer equipment. Accountability of the images need to be well established between patient and carer to prevent breach of confidence issues and should include informed consent.[1,17,21] This could be used in addition to the MEASURE-tool.[17]

6. Wound cleansing

Arterial, venous and mixed lower limb ulcers should be cleaned with non-toxic solutions,[1,10,20] including sterile water, potable water, 0.9% NaCl or PHMB (polyhexamethylbiguanide). Ideally the whole limb should be cleaned. The surrounding skin should be cleaned before the wound itself is cleaned. Antiseptic solutions should only be used for a short period of time in selected individuals in an attempt to reduce the bio-burden (cf. NERDS & STONEES).[1] These solutions are cytotoxic and will impair wound healing. These solutions are applied for a short period of time before the wound is cleaned with a less toxic substance, such as 0.9% NaCl.

The use of footbaths and the practice of soaking a wound have fallen into disrepute, due to insufficient scientific evidence.

7. How should debridement be approached?

Although the wound bed paradigm recommends debridement as the initial step in local wound care, the lack of adequate arterial supply is an absolute contra-indication. **An ankle-brachial pressure index of less than 0.5 is an absolute contra-indication against debridement. An ankle-brachial pressure index of less than 0.8 is considered a relative contra-indication against debridement. This includes all forms of debridement, not only sharp surgical debridement.**[1,6,8,10,20,25]

In the absence of significant arterial insufficiency, in other words in patients with venous and mixed ulcers, debridement could be considered if there is objective evidence of adequate arterial supply.

In the South African context, Registered Nurses are allowed to do sharp debridement of devitalised tissue BUT not until bleeding occurs. Always function within the parameters of your scope of practice. Sharp debridement must be done in a surgically clean environment. Critical colonisation or infection could have occurred below the devitalised tissue, and NERDS and STONEES[1] should be considered during the wound assessment to determine whether a

Table 3: Venous, mixed and arterial ulcers[25] (Modified from: ABC of wound healing: Venous and arterial leg ulcers BMJ : British Medical Journal. 2006 February 11; 332(7537)347)[25]

	Venous	Mixed	Arterial Ulcer
History	History of varicose veins, deep vein thrombosis, venous insufficiency or venous incompetence	←→	History suggestive of peripheral arterial disease, intermittent claudication, and/or rest pain
Classic site	Over the medial gaiter region of the leg	←→	Usually over the toes, foot, and ankle
Edges	Sloping	←→	Punched out
Wound bed	Often covered with slough	←→	Often covered with varying degrees of slough and necrotic tissue
Exudate level	Usually high	←→	Usually low
Pain	Pain not severe unless associated with excessive oedema or infection	←→	Pain, even without infection
Oedema	Usually associated with limb oedema	←→	Oedema not common
Associated features	Venous eczema, lipodermatosclerosis, atrophy blanche, haemosiderosis (hyperpigmentation)	←→	Trophic changes (Thickened toe nails, absence of leg and foot hair, and shiny skin); gangrene may be present
Treatment	Compression is mainstay	←→	Appropriate surgery for arterial insufficiency; drugs for risk factor reduction

topical antimicrobial or systemic antibiotic is required. The wound should be reassessed within 3 days after a surgical debridement.

Recommendation 10	Agreement: 91.1%
Debridement is contra-indicated in critical arterial insufficiency as it will create a bigger skin breach without adequate blood supply to support healing and therefore increase the risk of subsequent infection.	

Debridement is an absolute contra-indication in presence of arterial insufficiency

Recommendation 11	Agreement: 100%
Clinicians should always function within the parameters of allowed scope of practice.	

Sharp debridement should be carried out by a suitably trained clinician with competence.

8. Assess and treat the wound for superficial critical colonisation / deep infection /abnormal persistent inflammation or persistent inflammation

Superficial infection/Critical colonization (NERDS)[1]
Non healing wound
Exudative wound
Red friable granulation tissue
Debris on wound surface
Smell or odor

Deep infection (STONEES)[1]
Size increased
Temperature of surrounding skin increased
Os – open exposed tendon or bone
New areas of breakdown
Erythema
Exudate/Oedema
Smell or odour

The presence of superficial critical colonisation can be determined by using the NERDS acronym as described in the Wound Bed Preparation Paradigm.[1] Superficial critical colonisation does not require systemic antibiotics, but does require local antimicrobial dressings, e.g. silver dressings, honey dressings, iodine based dressings or those impregnated with PHMB.[1]

The presence of deep tissue infection can be determined by using the STONEES acronym as described in the Wound Bed Preparation Paradigm. Deep tissue infection requires systemic antibiotics with local antimicrobial dressings.

Topical antibiotics should be avoided due to the risk of sensitisation of the patient and bacterial resistance.[1,21] Topical antiseptics should only be used to clean wounds, **and this is only appropriate for a short period of time** to reduce the bio-burden.[1,20,26] Long-term use of these cytotoxic chemicals can impair wound healing.[26]

In individuals who do not respond to the interventions described above, the following could be considered:

- Bedside Diagnostic Tools to assess protease activity
- Wound swab for MC&S
- Punch biopsy for MC&S
- Laboratory investigations (CRP, ESR, WCC)

The choice of antibiotic should be tailored to the individual patient. Generally lower limb ulcers require broad-spectrum gram-positive cover. In diabetic patients, gram-negative and anaerobic bacteria should also be covered. Initial broad-spectrum antibiotic treatment should be de-escalated to more directed antibiotic treatment when tissue biopsy MC&S results become available.

9. Select a dressing to match the appropriate wound and individual person characteristics

To date, none of the Cochrane database reviews of arterial or venous ulcer management have demonstrated a significant advantage of one dressing over another.[28] **However, the use of gauze dressings is considered inappropriate due to the significant pain associated with removing these dressing.**[1,19,20,27] In the context of arterial ulcers, this could also lead to the inadvertent removal of devitalised tissue (debridement) in a patient with critical limb ischaemia, further compromising the surrounding skin. The ideal dressing for a lower limb ulcer is non-adherent and non-occlusive.[20,28]

For venous leg ulcers, peri-wound protection is important since the wound is usually highly exuding and protection against maceration should be considered. A non-alcohol barrier film could be applied to the peri-wound skin to protect the wound edges from moisture, friction and adhesive trauma.

In the absence of arterial compromise, compression is essential in the management of venous ulcers.[18,22] A Cochrane review concluded that multi-layered systems are more effective than single layered systems,[18] and that high compression is more effective than low compression.[18] The efficacy of compression systems depends on clinician skill, how well they hold in place to provide continued adequate compression and on patient acceptance.[18,19] Products that are easier to apply consistently and more comfortable are needed for increased patient adherence. The choice between short-stretch (active patients) and long-stretch (inactive or bedridden patients) bandage systems or therapeutic garment (hosiery) should be tailored to the individual patient requirements.[19] Local expert opinion suggests that compression bandages should continue for at least 2 weeks after the venous ulcer has fully epithelialized. Maintenance and prevention should continue indefinitely with compression hosiery.[18,22]

In critical arterial insufficiency with ulceration, no compression should be applied until the arterial reconstruction has been performed and objective evidence has been obtained that indicate that it would be safe to continue with modified compression.[1,6,20]

Recommendation 12	Agreement: 97%
In arterial, venous and mixed lower limb ulcers, the use primary non-adherent, non-occlusive dressings is recommended.	

Recommendation 13	Agreement: 97%
In the absence of arterial compromise, compression therapy is the mainstay of the management of venous ulcers.	

10. Predictive of healing

As per the international guidelines and local research, a venous ulcer is expected to reduce by 30% in surface area within a 4-week period.[1,20,29] The majority of venous ulcers are expected to heal with the appropriate compression therapy in a patient who adheres to treatment.

The rate at which an arterial ulcer is expected to heal depends on the degree of ischaemia and hypoxia. Even when the Doppler-pressure and transcutaneous oxygen measurements indicate adequate oxygen levels for healing to occur, the rate of healing will be reduced.[13,20]

11. Adjunctive or active therapies when other factors have been corrected and healing does not progress

If a wound does not progress according to the projected trajectory the underlying aetiology should be reassessed:

- Consider the status of the original disease (recurrence, deterioration, complication)
- Exclude infection with clinical and / or laboratory investigations
- Check for elevated matrix metalloprotease activity
- Aggravating factors: anaemia, diabetes, poor nutrition
- Consider debridement of devitalised tissue if the arterial supply is adequate
- Consider malignancy (Rolled wound edges and nodular appearance of wound bed)

Additional treatment modalities, including advanced modalities such as hyperbaric oxygen therapy, negative pressure wound therapy, skin substitution or skin grafts, should only be considered in healable wounds.[1,20] In some instances, objective measurements can be made in individual patients in order to predict their response to these modalities, e.g. $TcPO_2$ > 200 mmHg following a hyperbaric oxygen challenge.[13]

Recommendation 14	Agreement: 86.2%-94%
Advanced treatment modalities should only be considered in healable wounds: • Hyperbaric oxygen therapy (94% agreement) • Negative pressure wound therapy (86.2% agreement), • Skin substitution (88.2% agreement) • Skin grafts (91.1% agreement)	

12. Members of an interprofessional team who could or should be part of the management of this condition for improving cost effective patient care outcomes with the cooperation of healthcare systems

Recommendation 15	Agreement: 100%
An all-inclusive interprofessional team is required to address the needs of these complex patients.	

The team, including the patient,[1,21] should formulate a formal wound care plan. This plan should then be documented, distributed to all team members and submitted for funding. The treatment plan should be referred to and updated at every patient interaction. Specific areas of attention are:

- Communication (e.g. written documentation) between team members is crucial
- Arterial ulcers (critical limb ischaemia) requires an aggressive, expeditious team approach to reduce costs and to prevent loss of limb and life[6,8,10,20]
- Venous ulcers (chronic venous insufficiency) requires objective exclusion of concomitant arterial disease[18,22] and a formal ambulatory treatment plan to reduce cost and expedite healing
- When determining the cost of treating a patient with a lower limb ulcer, the economic hours lost should be included. Expeditious resolution of problems leads to return to independence and reduced on-going health risk.[21]

CONCLUSION

Recommendation 16	Agreement: 97%-100%
Re-assessment in frequent intervals is important. If a wound does not progress according to the projected trajectory the underlying aetiology should be reassessed for: • Status of the original disease (recurrence, deterioration, complication) • Infection with clinical and / or laboratory investigations • Matrix metalloprotease activity • Aggravating factors: anaemia, diabetes, poor nutrition • Debridement of devitalised tissue if the arterial supply is adequate • Malignancy (rolled wound edges and nodular appearance of wound bed)	

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ADDENDUM 1

CIRCULATION

- AHA Scientific Statement

Measurement and Interpretation of the Ankle-Brachial Index

A Scientific Statement From the American Heart Association

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Key Words:
- AHA Scientific Statements
- Ankle brachial index

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