

## Special Article

[ Simplified Wound Care/Management - Excerpts from 7th National Wound Care Workshop 2021 ]

### Management of Non-healing Wounds : A Simple Practical Approach

Paresh Pai<sup>1</sup>, Debabrata Kundu<sup>2</sup>, Prem Prakash<sup>3</sup>, Sessaiah Nimmala<sup>4</sup>, Pramod G<sup>5</sup>, Sivakumar A<sup>6</sup>, Sachin Gupta<sup>7</sup>, Anup Uttam Petare<sup>8</sup>

Non-healing ulcers do not heal or improve after 3-4 weeks of treatment. Ulcers may not heal on account of local, focal or systemic factors. Detailed assessment and record keeping with serial photographs is required to identify the cause of non-healing so that it can be corrected. Debridement, management of Biofilms using appropriate dressing material like anti-biofilm agents, nano-crystalline silver, and adjunctive techniques like negative pressure wound therapy, hyperbaric oxygen therapy application of topical growth factors help wound healing. Correction of arterial & / or venous insufficiency, offloading for neuropathic feet ensures faster healing with no relapses. Identification and correction of systemic factors such as anemia, uncontrolled sugars, poor nutrition, immune-suppressed state, cytotoxic drugs further ensures faster results.

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**Key words :** Non-healing ulcers, Biofilm, hyperbaric oxygen therapy, Negative pressure wound therapy, Nanocrystalline silver, Topical growth factors.

**N**on-healing wounds present with chronic pain, morbidity, stress, financial burden badly impacting the health and quality of life of patients<sup>1</sup>. These wounds take unusually more time to heal or fail to restore anatomic and functional results. The occurrence of non-healing wounds increases with age (Fig 1).

#### Identification of Non-healing Ulcers :

- Ulcers that do not heal after 3-4 weeks of treatment
- Ulcers that do not improve after treatment at three consecutive visits
- Ulcers in high-risk patients including patients with venous insufficiency, diabetes (with/without neuropathy and/or arterial insufficiency, peripheral vascular disease)
- Wound Healing Society classifies chronic

<sup>1</sup>MS, Vascular & Endovascular Surgeon, The Vascular Clinic, Mumbai 400007

<sup>2</sup>MS (General Surgery), Consultant Surgeon, Kolkata 700056, WB

<sup>3</sup>MBBS, MS, Additional Professor, Indira Gandhi Institute of Medical Sciences, Patna 800001, Bihar

<sup>4</sup>MS, Consultant Surgeon, Praja Vidhya Sala Multi Speciality Hospital, Guntur 522006, Andhra Pradesh

<sup>5</sup>MBBS, MS (Ortho), Consultant Government Hospital, Chikballapur 562105, Karnataka

<sup>6</sup>MS, MCh (Plastic), Consultant Plastic, Cosmetic & Reconstructive Surgeon, Desire aesthetics, Chennai 600101, Tamil Nadu

<sup>7</sup>MBBS, MS, Consultant Orthopedician, Jaipur, Rajasthan

<sup>8</sup>MBBS, MD, Medical Advisor, Dr Reddy's laboratories, Hyderabad 500034

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#### Editor's Comment :

- Most importantly, author suggested to first confirm diagnosis/ presence of malignancy, arterial insufficiency, venous insufficiency, vasculitis, immuno-compromised state before focusing on local treatment of ulcer, debridement, management of biofilm and choice of dressing.
- Treatment of systemic conditions and neuro-vascular deficiencies should not be dismissed, ignored or neglected.
- Debridement depends on the type of wound, comorbidities, patient's comfort and requirements.
- Systemic causes of non-healing ulcers should be corrected.
- Nanocrystalline silver dressings offer a barrier to MRSA and prevent cross contamination.
- Hyperbaric oxygen therapy, NPWT and topical growth factors help faster wound closure and healing.

wounds into four major categories: pressure ulcers, DFU, venous ulcers, and arterial insufficiency ulcers<sup>2</sup>

#### Examination of Non-healing Ulcers :

- Recording detailed history and local evaluation.
- Record of wound: site, size, features such as discharge, floor, edge, margins, surrounding skin and base.
  - Documentation with photographs helps to monitor the progress of wound healing.
  - While performing local examination it is important to look for presence of infection, underlying bone destruction or osteomyelitis, exposed cartilage, presence of malignancy.
    - Identification of focal problems comprises of evaluation of arterial supply, venous and lymphatic drainage and neurological assessment.
    - Evaluation of general conditions and factors also plays a major role.

Local causes	Focal Causes	Systemic causes
Late presentation Infection: Pyogenic, Mycobacterial, Fungal Bone Destruction Osteomyelitis Over joints - movement Joint involvement – exposed cartilage, synovium Underlying scar tissue Edema Malignancy	Arterial insufficiency Venous insufficiency Lymphatic blockage Neuropathic ulcers Combination of above	Anemia Poor nutrition low albumin Uncontrolled diabetes Hepatic dysfunction Chronic Renal failure Auto-immune- vasculitis Immuno-compromise Drugs – hydroxyurea, steroids, etc

Fig 1 — Causes of non-healing or recurrence of ulcers

### Management of Local Causes :

Detailed local examination can indicate the possibility of local causes and includes clinical evaluation to check for heavy discharge, gradual increase in pain and tenderness, unhealthy granulation or necrotic tissue or foreign body, malodor, directs towards the development of non-healing wound. Local rise of temperature, edema, inflammatory changes surrounding the wound or fever are other signs and symptoms. Other diagnostic modalities include X-ray of local part, wound swab, tissue culture and biopsy.

### Debridement :

This procedure helps to heal wound using multiple methods depending on the type of wound, comorbidities, patient's comfort and requirements<sup>3</sup>. It ensures vascularity, removes all dead and infected tissue, stimulates growth factors and angiogenesis<sup>4</sup> (Fig 2).

### Management of Biofilm :

Biofilm is present in 80-90% non-healing ulcers and cannot always be identified with naked eye. Since its thickness is only 100 $\mu$ , it is often confused with slough. There are visual and indirect indicators to suggest presence of biofilm<sup>5</sup> (Fig 3).

The panel recommended frequent and liberal debridement, determining host factors, presence of diabetes, venous ulcer or arterial diseases for effective management of biofilm. In presence of infections, systemic antibiotics are endorsed. After debridement, local antibiofilm agents like Betain and Polyhexamethylenebiguanide (PHMB), colloidal or nano-crystalline or ionic silver, cadexomeriodene combination available in market should be applied.

Furthermore, wound needs to be re-assessed frequently and compared with previous photos to monitor the improvement. After few days, therapy to be optimized according to the patient needs and depending on the culture, antibiotic should be prescribed. After granulation, wound closure with flap or skin graft should be carried out.

As per the consensus statement, debridement is one of the most important treatment strategies against biofilms but they can reform rapidly; hence repeated debridement and appropriate topical antiseptic therapies are required to suppress its reformation<sup>6</sup> (Fig 4).

### Choice of Dressing :

After wound improves, different dressing types can be used such as gauze dressing, impregnated gauze dressing, transparent films, foam dressings, hydrocolloid dressings, hydrogels, or topical antimicrobial agents.

An ideal dressing material should be bacteria proof, enable gaseous exchange, be non-adherent, fibre and toxin free, maintain tissue moisture and optimum temperature, be hypoallergenic, patient acceptable and cost-effective.

In recent times, nanocrystalline silver has been evaluated offering beneficial results in wound

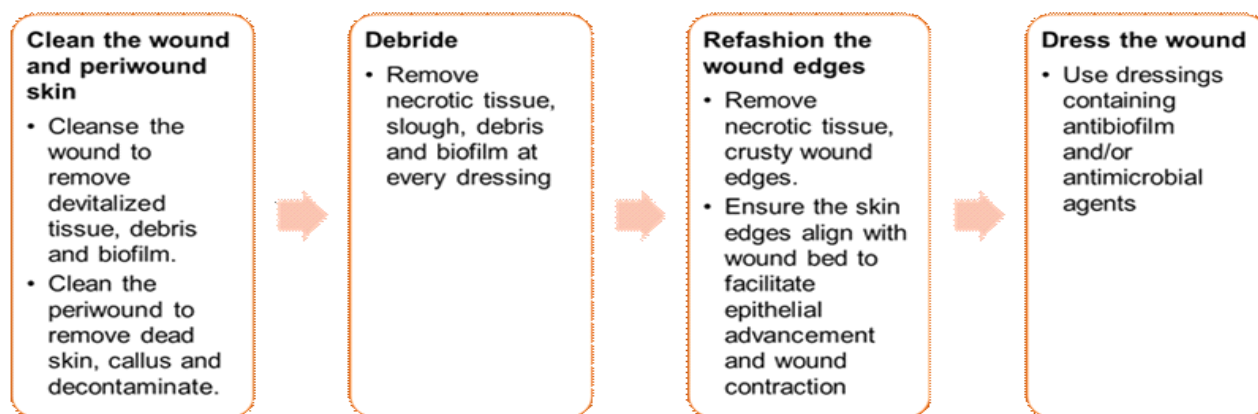


Fig 2 — Principles of debridement of ulcers

management. Nanocrystalline silver dressings offer a barrier to MRSA, prevent cross contamination and encourage optimal patterns of healing through apoptosis and reduced inflammation.

**Role of Adjunctive Therapies :**

Negative pressure wound therapy with/without infusion accelerates the development of granulation tissue, improves healing time in DFU and salvages synthetic grafts.<sup>7</sup>

Hyperbaric oxygen therapy improves endothelial progenitor cell mobilization leading to neovascularization that helps wound healing.

Topical growth factors include platelet derived growth factor (PDGF), fibroblast growth factor (FGF) and granulocyte-macrophages colony stimulating factor (GM-CSF). Platelet derived growth factor is the only pharmacologic agent approved for the treatment of DFU. Once granulation is achieved using PDGF, it certainly helps epithelialization and faster wound closure.

**Management of Focal Causes :**

**Principles of Treatment of Ischemic Ulcers :**

Patients with arterial insufficiency present with painful ulcers with nocturnal rest pain. This ulcer shows necrotic floor with pale surrounding tissue and absence of inflammation. Ischemic ulcers are diagnosed on the basis of location, rest pain, ischemic rugor with cool limb, absent pulsation and ischemic changes in nails. The panel suggested measuring the ankle-brachial index

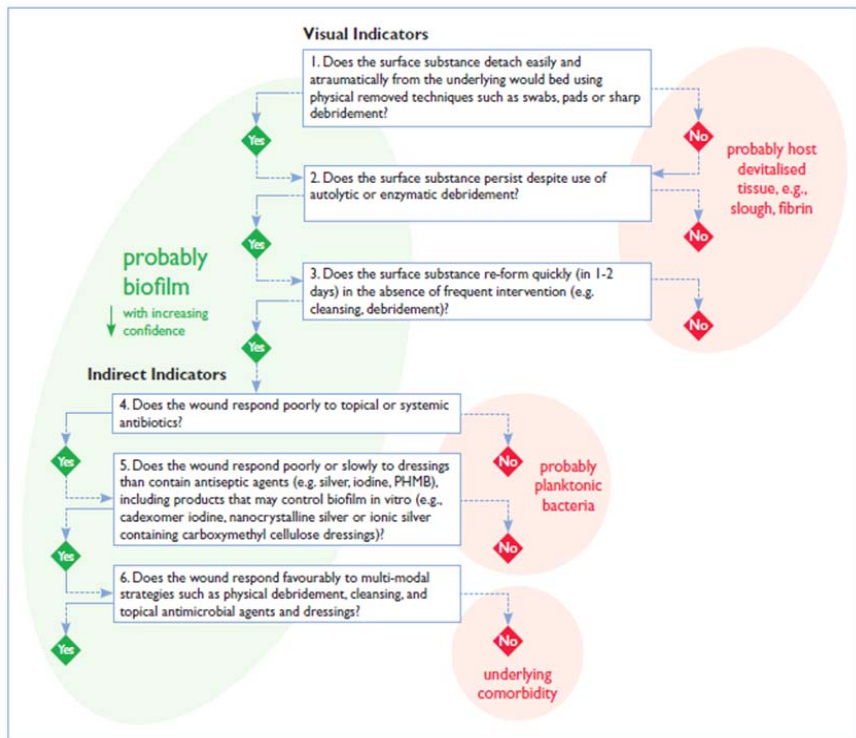


Fig 3 — Algorithm for detection of Biofilm<sup>5</sup>

(ABI), treadmill test to check for maximum walking distance and pain free walk when possible, duplex ultrasound, digital subtraction angiogram, CT-angiography (normal renal function and non-calcified

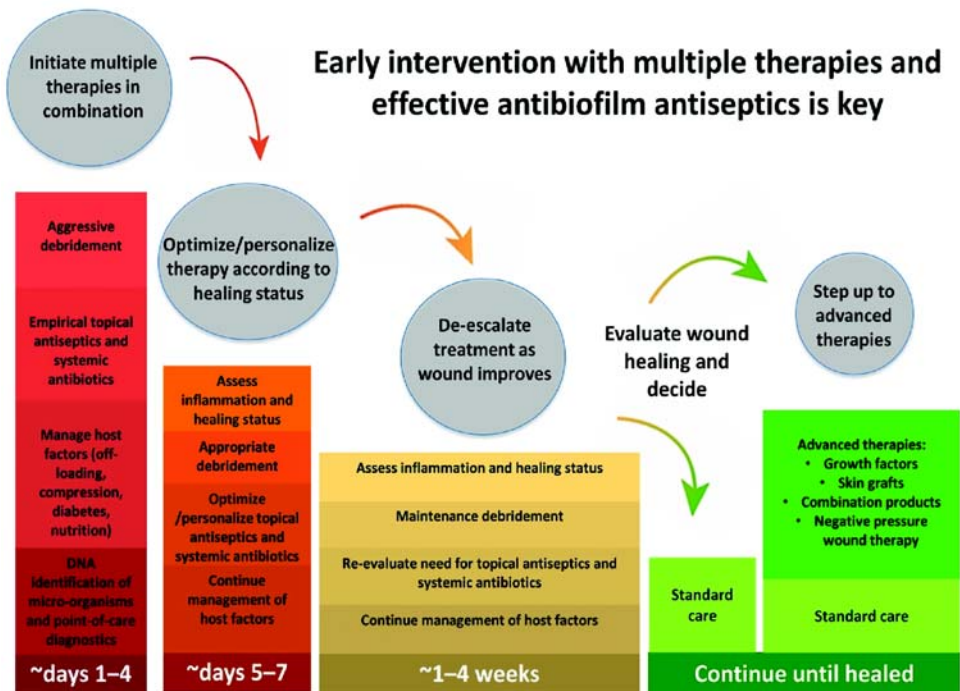


Fig 4 — Summary of step wise treatment of Biofilms<sup>6</sup>



arteries) or MR angiography (calcified arteries in diabetics) with or without contrast (if Creatinine is raised) as important tests to assess the extent of arterial disease.

#### **Improve Vascularity First :**

Once compromised vascularity is suspected, medications such as antiplatelet drugs, vasoactive drugs should be given to improve vascularity. Panel emphasized the need to immediately drain the abscess without performing debridement that may injure healthy ischemic tissue that should be done only after the vascularity is restored by using Endovascular and / or Open Surgical techniques. Medical management to sustain improved vascularity through control of risk factors such as smoking, cholesterol, hypertension along with lifestyle modification in the form of regular exercise, good pedal hygiene and use of appropriate footwear is also very important. The target BP is recommended as <150 mmHg and HbA1c <7 %. Surgical debridement and amputation may be used to manage arterial ulcer.

#### **Principles of Treatment of Venous Ulcers :**

Panel emphasized that if both arterial and venous insufficiency are present, arterial ischemia needs to be corrected first before tackling the Venous insufficiency since principles of treatment for both etiologies is diametrically opposite. Initial treatment of Venous insufficiency can worsen the arterial insufficiency compromising the ulcer and increasing the risk of limb loss (Fig 5).

#### **Heal the Ulcer First :**

Diagnosis of venous ulcer is based on the location, leg swelling, pigmentation, and presence of venous insufficiency. Both the legs need to be examined for difference in size and if present investigated further with MR venography and or IVUS (intra-vascular ultrasound) along with Venous Doppler to rule out presence of proximal venous obstruction with or without reflux.

When venous ulcers are present, it is difficult to do a proper Venous Doppler examination and an important culprit perforator located just above the site of the ulcer may be missed

and treatment if offered at this stage can become incomplete and ineffective in healing the ulcer. Additionally, Panel suggested that venous ulcers should be examined in standing position that is often not done due to inconvenience and therefore, early reflux may be invariably missed.

Medication is initiated to control infection, swelling and venous tonics to improve venous tone and function. Co-existing Arterial insufficiency must be ruled out first before offering multilayer compression bandages applied once a week to heal the ulcer.

#### **Multilayer Compression Bandaging :**

Wound healing is supported by multilayer bandaging system consisting of four layers. First layer is dressing with cover of cotton wool, then cotton bandage followed by elasticated crepe and short stretch cohesive bandage. Other options include using medical compression ulcer stocking kit with daily topical dressing. It is always advisable to perform dressing without an adhesive bandage as it can damage the skin at the time of removal. The inner layer of stockings that exerts a pressure of 18 mmHg is used for 24 hours and outer layer that exerts pressure of 20-30 mmHg is used only during the day.

It is vital to correct venous insufficiency after the ulcer heals to prevent recurrence of the ulcer.

The moderator discussed whether after using four-layer bandage in rural people would they come back to vascular surgeon for correction of venous insufficiency with either surgery or endovenous laser treatment (EVLT) or should correction be offered first (Fig 6). The panel recommended a comprehensive



Fig 5 — Venous ulcers with Kollagen and NPWT

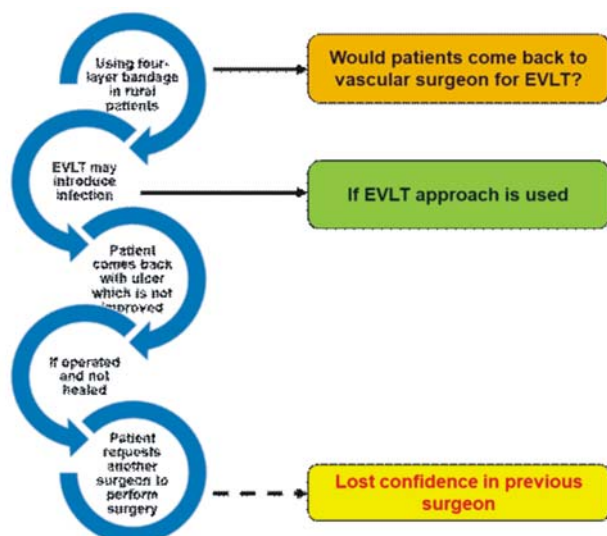


Fig 6 — Endovenous laser treatment (EVLT) in rural patients

treatment as bandages need more time to heal these chronic ulcers. Therefore, patients should be explained about this and make them wear stockings until ready to come for definitive treatment and follow-up.

#### Principles of Treatment of Lymphatic Obstruction :

Lymphatic obstruction should be suspected when the swelling is unilateral, more in the foot with skin folds and skin changes of peud'orange. It is confirmed by performing Lymphoscintigraphy and corrected by using Lymphapress therapy, Multilayer bandaging and prolonged use of antibiotics. Surgical correction with lymphatic drainage catheters, lymphnodal-venous bypass is reserved for recalcitrant cases and may offer long term relief or until fibrosis occurs and blocks the drainage.

#### Principles of Treatment of Neuropathic Ulcers:

Diagnosis, Detection of Neuropathy is important to get the ulcer to heal and prevent recurrence by focusing on offloading the site of the ulcer and protecting the area. Regular periodic care is important to get rid of callus, correction of any deformity if present, and prescribing 24 x 7 use of protective footwear.

#### Management of Systemic Causes :

Treating systemic causes of non-healing ulcers include the correction of anemia, poor nutrition, uncontrolled diabetes, compromised hepatic and renal function, immuno-suppressed state, and halting use of cytotoxic drug therapy for some time. Vasculitis can be diagnosed by measuring levels of ESR, C-reactive protein, antinuclear antibody, performing biopsy at appropriate site and doing a PET Scan. It can be treated using immuno-modulators or steroids.

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