Wound Care Management: Optimizing the D in DIME

BY
PATRICIA COUTTS RN IIWC
KEVIN Y. WOO PHD RN ACNP GNC(C) FAPWCA
DAVID H. KEAST MSC MD FCFP
R. GARY SIBBALD BSC MD FRCPC (MED DERM) MACP FAAD MAPWCA

Introduction

The healing of acute wounds follows a fairly predictable sequence of overlapping stages, including inflammation, proliferation, re-epithelialization and remodelling.[1] Unlike acute wounds, however, chronic wounds such as pressure ulcers, venous leg ulcers and diabetic foot ulcers do not always follow this predictable pattern because of disruption to 1 or more elements of the healing process.

The treatment of chronic wounds requires a systematic approach under the fundamentals of wound bed preparation (preparation and optimization of the wound bed for functional healing).[1] Within this framework, it is important to treat the cause and address patient-centred concerns before addressing local wound care.

Local wound management consists of the mnemonic DIME[2]:

- **D**ebridement;
- **I**nfection (reduction of bacterial bioburden) or abnormal prolonged inflammation;
- **M**oisture balance; and
- **E**dge effect of the stalled chronic wound.

This article focuses on the D: Debridement.

Patricia Coutts is Wound Care and Clinical Trials Co-ordinator, Dr. R. Gary Sibbald Dermatology Practice, Mississauga, Ontario

Kevin Woo is a Clinical Researcher and Nurse Practitioner, Wound Care Program, Women's College Hospital, Toronto, Ontario

David Keast is a Clinical Adjunct Professor of Family Medicine, University of Western Ontario, London, Ontario

R. Gary Sibbald is Professor, Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario

Role of debridement

Debridement is integral to wound bed preparation by removing devitalized tissue, foreign material, phenotypically abnormal or dysfunctional cells (cellular burden) and bacteria sequestrum. Providing the wound has the potential to progress toward healing, debridement has been demonstrated to stimulate the healing cascade, advancing wounds that are trapped in the inflammatory phase[3] through to the granulation phase and then on to epithelialization and healing. Optimizing the debridement process will promote effective and rapid healing of chronic wounds and can affect the cost of treatment.

Debridement of necrotic tissues in chronic wounds can be achieved with a number of methods, described as surgical (conservative sharp [forceps, curette to pick or scrape off necrotic tissue] and surgical sharp [scalpel cut to viable tissue]), autolytic (patient's endogenous collagenase), biologic (maggots), mechanical (wet-to-dry dressings, other devices) and enzymatic (collagenase).[4]

Methods of debridement can be deployed as a single therapeutic modality or serially combined to optimize the debridement process. Indeed, the different inherent conditions and nature of each patient's wound will require individualization of therapy. A variety of factors should be considered when choosing a debridement method or a combination of treatment modalities in order to achieve optimal clinical outcomes, including the patient's condition, goals of care, ulcer/peri-ulcer status, type of wound, quantity and location of necrotic tissue, presence of infection, the healthcare setting and professional accessibility or capability.

Costs

A recent analysis determined the costs associated with each type of debridement method,[5] with the aim of informing clinicians and policymakers not only of the direct and indirect costs associated with these therapies, but also the impact they can have on the healthcare system. The study determined the direct and indirect costs associated with the various debridement methods available to achieve a clean wound base for healing in Canada. It was based on a hypothetical patient in need of debridement of a chronic, stalled wound. The size of the wound was assumed to suit a 10×10 cm dressing and the time of therapy was defined as the time to a clean wound bed. The average time taken to achieve a clean wound bed was determined by the experiences of various wound care clinics and published literature.

Direct and indirect costs associated with wound management included healthcare personnel time (e.g. physicians, nurses, support workers), supplies (e.g. dressing, equipment, medical-grade maggots, collagenase), complications associated with the treatment (e.g. pain, infection, management of complications), operating room costs, transportation (e.g. transfers for care) and out-of-pocket expenses (e.g. parking). These were estimated based on existing data from federal, provincial and regional sources. In addition, all resources were stratified into 1 of 3 categories: namely daily resources, regularly scheduled resources and one-time resources.

The costs associated with the various debridement methods with the base case time to a clean wound bed are shown in Table 1. Surgical sharp and conservative sharp debridement were found to be the least costly methods, while biologic and mechanical debridement methods were the most costly. Of the remaining 2 approaches, autolytic treatment was more expensive than enzymatic treatment, with the cost differential driven primarily by the time needed to achieve a clean wound bed. A sensitivity analysis demonstrated that reducing or increasing the time to a clean wound bed by 1 week yielded similar cost rankings (Table 1).

Optimizing debridement

Optimizing the effects of debridement involves choosing the most clinically appropriate and cost-effective method for each situation. Patient status, wound condition and accessibility to trained healthcare personnel should all factor heavily in the decision process. Surgical debridement (sharp and conservative sharp) is the fastest and least expensive methodology, but must be performed by specially trained, competent, qualified and licensed healthcare professionals in an appropriate setting.

Surgical debridement is recommended in the presence of advancing cellulitis, crepitus, fluctuance and sepsis secondary to ulcer-related infection. However, sharp debridement is not appropriate for all patients and should be used with caution in the presence of immune incompetence, a compromised vascular supply to the limb or lack of antibacterial coverage in systemic sepsis. Relative contraindications include anticoagulant therapy and bleeding disorders. Individuals with stage III or IV pressure ulcers with undermining, tunnelling, sinus tracts or extensive necrotic tissue that cannot be easily removed by other debridement methods should be recommended for surgical evaluation.

Non-healable or maintenance wounds (where the cause of the wound has not been corrected because of patient or healthcare system factors) may benefit from conservative debridement of slough, but should not undergo active surgical debridement where there are patient contraindications or access to skilled professionals is lacking.

Until recently, debridement between surgical procedures was achieved with the use of moist dressings or autolysis, which allows the body's own collagenase to break down denatured strands of collagen. The introduction into the Canadian market of a collagenase ointment has the potential to speed the process of debridement following surgical intervention and further reduce the costs of therapy. Collagenase ointment can be used as an adjuvant therapy to sharp debridement or as a first-line therapy where sharp debridement is not appropriate. It is important to perform continuous debridement on a chronic pressure ulcer until the wound bed is covered with granulation tissue and free of necrotic tissue.

The first-line use of mechanical, autolytic, enzymatic or biologic methods of debridement is appropriate where there is less urgent clinical need for drainage or removal of necrotic tissue. In this instance, enzymatic therapy is associated with lower costs than the other methods of debridement. Daily assessment of the wound for signs of erythema, tenderness, edema, purulence, fluctuance and malodour (i.e. signs of infection) is important to ensure appropriate management. Careful consideration of patient parameters is required to tailor the debridement method to individual patient needs and ensure optimal clinical as well as economic outcomes.

References

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TABLE 1

Debridement methods and costs

Method	Base case		Cost	
	Time to a clean wound bed (model prediction, weeks)	Cost ($)	Time to a clean wound bed ↓ by 1 week ($)	Time to a clean wound bed ↑ by 1 week ($)
Surgical sharp	3	1,039	949	1,129
Conservative sharp	6	1,120	1,014	1,225
Enzymatic	4	1,265	1,152	1,378
Autolytic	10	1,505	1,379	1,630
Mechanical	6	1,841	1,604	2,078
Biologic	3	2,151	1,517	2,785