Debridement: Technical Considerations and Treatment Options for the Interprofessional Team

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GENERAL PURPOSE: To enhance the learner's chronic wound debridement competence as an interprofessional team member.
TARGET AUDIENCE: This continuing education activity is intended for physicians, physician assistants, nurse practitioners, and nurses with an interest in skin and wound care.
LEARNING OBJECTIVES/OUTCOMES: After participating in this educational activity, the participant will:
1. Differentiate healable, maintenance, and nonhealable wounds to create a holistic debridement treatment plan using the Wound Bed Preparation paradigm.
2. Evaluate active debridement options including the potential need for an interprofessional referral or specialized investigations.
3. Assess chronic wound debridement options.
4. Analyze case studies for appropriate clinical application of debridement modalities.

ABSTRACT
Debridement is a critical component in the management of both acute and chronic wounds. Six reviewed methods of debridement exist, and specific techniques are more appropriate to match patient needs with available clinical resources. Accurate differentiation between healable, maintenance, and nonhealable wounds is paramount when determining whether a wound would benefit from debridement.

Clinical assessment includes review of the patient's underlying medical conditions/ previous surgeries along with the history and progression of the wound. Awareness of the physiologic wound bed preparation components that contribute to the current wound status will direct treatment of the abnormal components. Optimal wound status includes complete healing or reduced abnormal wound-related symptoms or signs.

Debridement competency requires an awareness of the six types of debridement, their clinical utility, and appropriate patient selection. Providers need to assess patients' wounds, triage them, and refer them as necessary to an interprofessional setting. For stalled but healable wounds, specialized testing may be necessary when managing patients who would benefit from more invasive or advanced forms of wound care. This article informs providers on the training and experience required for specific debridement techniques depending on the wound etiology.
KEYWORDS: autolytic, biological, debridement, interprofessional, enzymatic, mechanical, scope of practice, sharp, wound care

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INTRODUCTION

Although debridement is as old as medicine/healthcare itself, the decision to debride a wound is an evolving concept. Our assessment of the biochemical and cellular abnormalities and physiologic processes in wound healing has expanded in the past two decades. The approaches available to debride a wound have broadened and increased. As available options are explored, it must first be recognized that not all wounds are healable. Active debridement is not a suitable intervention for most maintenance and nonhealable wounds. In addition, not all debridement techniques are within the scope of practice of each healthcare professional (HCP).

This continuing education article is aimed at HCPs working independently with access to or as part of an interprofessional wound care team. It integrates the authors' review of how debridement has recently evolved as part of the Wound Bed Preparation (WBP) paradigm. The authors also connect many facets of the patient care plan to emphasize that debridement cannot be undertaken in isolation. Cochrane-level comparative evidence of one debridement modality versus another is scant (Supplemental Table 1; http://links.lww.com/NSW/A132).

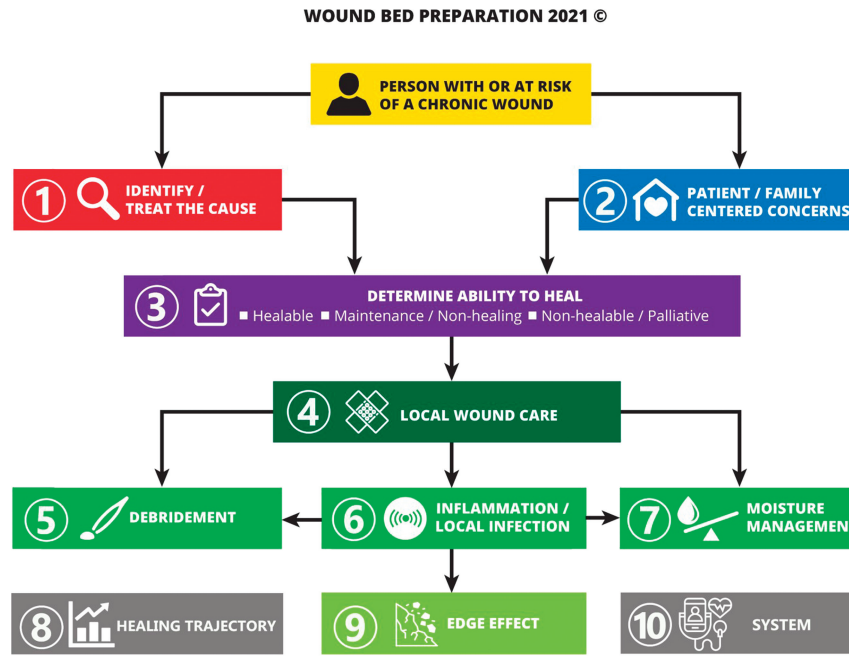
The appropriate debridement method choice is constrained by the practice setting, resource limitations, professional scope of practice, healing potential of the person's wound, and patient consent. The 2021 Nurses Specialized in Wound Ostomy and Continence Canada debridement best practice recommendations note that many terms are used inconsistently or ambiguously.[1] The *Wound, Ostomy, and Continence Nurses Society Core Curriculum: Wound Management* summarizes recent evidence[2] and complements prior wound-type-specific guidelines and debridement recommendations for lower leg ulcers,[3] lower-extremity venous disease,[4] and pressure injuries.[5]

The WBP paradigm provides a systematic approach to managing chronic wounds.[6,7] Many wound care experts have evolved the paradigm to its current version presented in Figure 1, modified in 2022.[8] The present-day paradigm facilitates HCPs through a 10-step patient-centered systematic approach. This article does not seek to examine each of the 10 components of WBP, but rather focuses on potential debridement practice considerations when managing a patient with wounds.

In determining whether a wound has the ability to heal, a comprehensive patient and wound assessment must first be conducted. It is critical to classify whether a wound is healable, maintenance, or nonhealable/palliative (Table).

Several factors determine if debridement is warranted. They include the individual patient circumstances (care setting, available resources, finances) and patient goals of care. These patient aspects guide which method of

Figure 1. WOUND BED PREPARATION 2021 WITH PARADIGM UPDATE



Wound Bed Preparation 2021[8] with updated and numbered paradigm version (2022) reproduced with permission from WoundPedia.

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Table. SUMMARY OF WOUND CLASSIFICATIONS

Status	Definition	Treatment
Healable	The patient has the physiologic capacity to heal and is adherent to the plan of care - Adequate blood supply - The cause of the wound has been corrected	- Provide moist wound healing - Treat infection/inflammation - Promote granulation
Maintenance	The patient has the physiologic capacity to heal, but external factors (patient or healthcare system) are present that impede healing	- Decrease moisture - Bacterial reduction - Prevent deterioration - Improve patient quality of life including pain, exudate, and odor control
Nonhealable/palliative	The patient does not have the physiologic capacity to heal: - Inadequate blood supply that cannot be treated - The cause cannot be corrected	- Decrease moisture - Bacterial reduction - Prevent deterioration - Optimize comfort

debridement would be best. The acronym VIPS (vascular, infection, pressure, sharp surgical) is an excellent approach to guide the assessment of a person with a foot or lower leg wound:

- **V**ascular - confirm vascular supply is adequate;
- **I**nfection - control superficial infection (treat topically) and deep-surrounding infection (treat systemically);
- **P**ressure - redistribute plantar/dorsal foot pressure; and
- **S**harp Surgical - consider conservative surgical or sharp surgical debridement (SSD)-healable wounds once the cause has been treated.

INTERPROFESSIONAL REFERRAL AND SPECIALIST INVESTIGATIONS

Healthcare professionals must adhere to legislation and organizational policy when considering debridement, whether it be assessing, initiating, or performing the act. All debridement modalities come with some level of risk, so HCPs must ensure appropriate resources are immediately available should the patient need medical attention because of complications. These may include, but are not limited to, pain, bleeding, or adverse reactions.

The makeup of an interprofessional team will vary depending on the country or region. There are differences in the availability of specialists (physicians, nurses, and other allied HCPs), and the clinical roles, titles, and scope of practice differ across jurisdictions. Interprofessional team coordination and communication are critical for optimal patient outcomes. All care providers are responsible for regularly evaluating both acute and chronic wounds and assessing when intervention is appropriate. Therefore, it is particularly important for providers to have a functional comprehension of the indications, contraindications, risks, and benefits of each method of debridement, especially conservative sharp wound debridement (CSWD) and SSD. Advanced practice assessment facilitates timely referral to specialists and appropriate care for patients eligible for debridement.

Active debridement should not be performed on nonhealable wounds or wounds with insufficient perfusion. Referral to a physician or surgeon is necessary if a patient has insufficient, nonpalpable pulses or monophasic/absent pulse sounds. This is in keeping with the WBP paradigm that highlights the importance of treating the cause. Palpating for pedal pulses and confirming a multiphasic waveform or a healable ankle-brachial pressure index using handheld Doppler can be the first step. More advanced assessments may include a Duplex sequential lower leg arterial Doppler in a vascular laboratory. Angiography may be required for more complex assessments. Once an adequate blood supply is confirmed and adequate tissue perfusion is established, then moist wound healing can be initiated.

Should HCPs determine that a patient has a diminished or absent blood supply, a vascular surgeon or appropriate care team should assess the patient to correct the blood supply problem (graft, bypass, dilation), plan for how to manage a nonhealable wound, or possibly consider lower limb amputation. Similarly, patients with persistently high blood glucose (measured by the hemoglobin A_{1c} [HbA_{1c}], average blood sugar over 90 days) need further evaluation by an endocrinologist or other appropriately educated diabetes specialist. Hemoglobin A_{1c} levels of 7 or lower are ideal; however, patients who are older or subject to hypoglycemic episodes may have a target HbA_{1c} of 8 to 9. Values greater than 9 are suboptimal, and patients with HbA_{1c} values greater than 12 may not respond to infection with the usual inflammatory responses. Persons with diabetes who have poorly controlled HbA_{1c} levels should be referred to prescribing HCPs with expertise in diabetes management; often this may be a diabetes care team (eg, doctor, NP, educator, chiropodist/podiatrist or foot specialist, endocrinologist).

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Some chronic wounds do not fit a routine clinical pathway and require a systematic approach. A patient navigation team and process may be necessary tools to improve patient outcomes and maximize healthcare resources. According to a home care study by Arputhanathan and colleagues,[9] 64% of nonhealing wounds were not diagnosed accurately, resulting in ineffective care and resource utilization. In Canada, the Project ECHO (Extension Community Healthcare Outcomes) Ontario Skin and Wound Care has been seeking to drive system change through a hub-and-spoke interprofessional approach. Maintaining flexibility by providing virtual follow-up consultations is one solution but comes with limitations including expense and privacy concerns. During COVID-19, virtual or blended-care models, patient navigation, and access to specialists have become feasible for community wound-care patients.[9]

CHOICE OF DEBRIDEMENT MODALITY

There are risks with all methods of debridement, in part because debridement is not appropriate for some wounds. Active debridement is contraindicated in nonhealable wounds, but these wounds can have conservative debridement of slough. Patient consent is also a critical component of care: HCPs should always obtain consent for debridement. In addition, resources to manage complications must be in place and easily accessible. These complications may include local pain, contact irritant or allergic dermatitis, bleeding, and infection.[10] Some methods of debridement may be used in combination. The indications, contraindications, and consideration for the different debridement modalities are described in Supplemental Table 2 (http://links.lww.com/NSW/A133).

All patients described in the following case reports provided written informed consent for their images and case details to be published.

Autolytic

Autolytic debridement further facilitates the body's natural debridement processes by moisture-donating or moisture-retentive dressings that activate enzymes present in wound exudate to promote the destruction of nonviable tissue.[11] Moisture-retentive occlusive dressings (eg, hydrocolloid; foams, especially open cell polyvinyl alcohol foam; occlusive films) and amorphous dressings (calcium alginates, hydrogels) facilitate autolytic debridement.

Case report. *E.M. is a 75-year-old cisgender woman who ruptured her Achilles tendon 2 years ago. The condition had a delayed diagnosis by a physiotherapist. E.M. immediately saw a surgeon for tendon repair, but the surgical wound dehisced and remained open for 2 months with exposed tendon before a full-thickness skin graft was performed. Most of the graft took, and approximately 5% remained open. Admission to the wound service assessment included an ankle-brachial pressure index of 0.9 in the affected leg with palpable, multiphasic pedal pulses. X-ray was negative for bone changes, and there were no signs of deep/surrounding infection. Autolytic debridement was selected as most appropriate because the setting (patient's home) lacked access to necessary supplies and equipment to control a bleed. Moist wound healing (autolytic debridement) was initiated by applying a silicone-bordered foam. Within days, exudate increased significantly, causing a new wound. Although it is important to correctly assess wounds for the application of autolytic debridement, it is just as important to know when to discontinue it.*

Mechanical

Mechanical debridement involves the removal of nonviable tissue through the application of external force (eg, saline wet to dry, high-pressure jet stream of liquid). Whereas outdated forms of mechanical debridement such as wet-to-dry dressings have declined in use because of their nonselective nature, other more advanced technologies for mechanical debridement have been developed. A recent systematic review and meta-analysis by Flores-Escobar and colleagues[12] investigated ultrasound-assisted wound debridement in comparison with a placebo. Eight randomized controlled trials (RCTs) met their inclusion criteria in patients with diabetic foot ulcers (DFUs).[12] Ultrasound-assisted wound debridement showed higher healing rates than placebo.

Enzymatic

With enzymatic debridement, proteolytic enzymes are introduced to the wound to dissolve nonviable tissue. Jimenez and colleagues[13] conducted an RCT examining the enzymatic debridement using clostridial collagenase in 215 patients with nonischemic DFU. The results demonstrated positive outcomes with collagenase as a debriding agent over 6 weeks of treatment in comparison with a hydrogel control group; this finding is consistent with other studies. Patients in the two groups whose wounds had not decreased in size after 4 weeks were switched to the other arm of the study; those who changed to collagenase were four times more likely to achieve closure over the following 12 weeks.

Case report. *A 68-year-old woman presented with a bilateral dorsal pressure injury to the foot with fibrinous dry slough present on both wounds. Her right fifth toe had been amputated for osteomyelitis in the past. There was mild periwound erythema. The wound measurements were as follows: left, 5 × 3 × 0.1 cm; and right, 3.5 × 2.5 × 0.1 cm* (Figure 2A). *After careful assessment, it was determined that the wound was capable of healing. The patient's diabetes and other cardiovascular comorbidities were controlled. Following initial sharp debridement, silver dressings were discontinued prior to application of collagenase. An enzymatic agent was chosen because of its selectivity. Daily collagenase applications were covered with*

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Figure 2. ENZYMATIC DEBRIDEMENT OF BILATERAL DORSAL FEET

Bilateral dorsal foot wounds at (A) baseline and (B) 12 weeks.

Photographs credited to Travis Motley, supplied courtesy of Smith+Nephew.

a nonadherent moist gauze dressing. Concurrent silver dressings were avoided to reduce infection because the metal ions would inactivate the collagenase. The collagenase helped remove the fibrous slough, and the ointment was discontinued once granulation tissue became well established. By week 12, the left foot wound was closed, and the right measured 0.5 × 0.2 × 0.1 cm (Figure 2B).

Biological

Biological debridement is the application of sterile, medical-grade larvae into the wound to digest softened and liquefied nonviable tissue and bacteria to promote wound healing. Syam and colleagues[14] conducted a critical analysis of RCTs comparing maggot debridement therapy to conventional treatments for lower-limb wounds. The authors note that the small number of studies and short follow-up make robust conclusions difficult to draw. Nevertheless, DFU healing improved with quick, early debridement results; the reappearance of slough may require repeated debridement.

Steenvoorde and colleagues[15] compared the effectiveness of free-range maggots (not contained in a sac or net) versus contained maggots. The authors reported that 66.6% of wounds fully closed with free-range maggots versus 33.3% with contained maggots.[15] Successful wound healing with free-range maggots required fewer treatments than contained maggots (4.3 vs 2.4 treatments; $P = .028$). A cycle of treatment was defined as an application for 24 to 72 hours.

Conservative Sharp Wound Debridement

With CSWD, clearly identifiable, nonviable tissue is removed using sharp sterile instruments including scalpels, curettes, or scissors and forceps. It can also remove clinically viable tissue including senescent cells and bacteria that may cause a healable wound to be stalled.[16] It does not extend to bleeding tissue.

Case report. *C.V. is a 72-year-old cisgender woman who has experienced peripheral neuropathy in both limbs since age 30 years. Her medical history includes rheumatoid arthritis, hypertension, and dyslipidemia. She is currently awaiting heart surgery to replace a valve; C.V. uses a cane when ambulating as her mobility is impaired. C.V. is an American citizen residing in Mexico where she receives management of her wounds. C.V. presented to the wound clinic with wounds on the first metatarsal head bilaterally. Wound and nail care had not been provided for some time, resulting in periwound callus* (Figure 3A).

C.V. attended a specialized wound clinic where HCPs determined CSWD was the most appropriate method of debridement. Considerations included type of setting (ie, because this was a specialized clinic, appropriately educated and trained HCPs and the necessary supplies and equipment were in place), the speed with which the callus could be removed, the patient having complete loss of sensation bilaterally, and pedal pulses being palpable with multiphasic waveform bilaterally (Figure 3B).

Sharp Surgical Debridement

Sharp surgical debridement is a mainstay for the removal of nonviable tissue as part of local wound care described by the WBP paradigm. It may include the removal of both viable and nonviable tissue down to healthy bleeding tissue to promote healing and create a clean wound bed that facilitates healthy tissue granulation. Indications for SSD include acute infection, gross contamination, suspicion of extensive tissue involvement further than is apparent on initial examination, and situations in which urgent debridement is necessary because of limb- or life-threatening infection. Generally, it is indicated only for healable wounds, yet there are relative and absolute contraindications. A chronic, nonhealing wound may be a relative contraindication to SSD; however, the risks may outweigh the benefits in the setting of an acute infection and would thus be indicated. An absolute contraindication to sharp debridement would be severe coagulopathy.

This type of debridement is typically performed by a provider with formal surgical training or other qualified HCP, such as physician, physician assistant, nurse practitioner, or chiropodist/podiatrist either in the sterile OR or bedside location. It can involve the use of multiple tools including scalpels, scissors, electrocautery, hydrosurgery, or curettes. It requires adequate pain control and can be performed using local anesthetic, regional block, sedation, or general anesthesia, depending on patient suitability, preference, and extent of contamination and expected debridement. The presence of neuropathy may facilitate this procedure without any anesthesia or the use of local anesthesia to the periwound skin.

In performing this technique, wound beds are typically probed, explored, and washed using sterile solutions to ensure adequate local or deep/surrounding infection control. Thus, SSD enables the surgeon or other HCP to explore wounds for pockets of tissue that harbor

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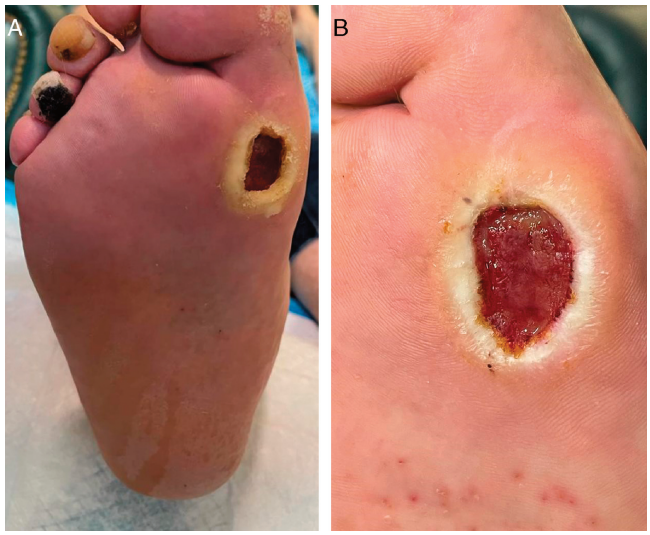
Figure 3. CONSERVATIVE SHARP WOUND DEBRIDEMENT (CSWD) OF BILATERAL METATARSAL HEAD

Right metatarsal head (A) at initial visit and (B) after CSWD.



Photographs courtesy of Erin Rajhathy.

infection or purulent fluid. The problem can then immediately be addressed with drainage and copious irrigation using sterile solutions to reduce contamination and ensure adequate infectious source control. Providers should consider sending debrided tissue for bacterial culture where appropriate.

Because SSD enables extensive removal of nonviable and viable tissue, this procedure transitions the wound back to an acute state enabling stimulation of initial wound healing phases including the production of granulation tissue. In addition, SSD often enables complete visualization of soft tissue defects and offers critical information regarding potential additional reconstructive options. Newly created surgical wounds are then inspected for adequate hemostasis and dressed appropriately for subsequent postoperative care. Wounds requiring SSD are generally allowed to close via secondary intention or with adjunctive techniques. This may include the application of negative-pressure wound therapy, especially for post-DFU surgery or split-thickness skin grafts. Other types of wounds may require adjunctive therapies, including skin grafts, skin substitutes, electrical stimulation, or peroneal nerve stimulators where appropriate and with healthcare system availability.

Case report. *A single, 40- to 49-year-old woman with obesity postoperatively developed an abscess and subsequent wound dehiscence after revised bariatric surgery. Comorbidities included asthma, mediastinal gauge on neuroma, sleep apnea, and abdominal hernia. Positive nutrition screen required referral to a dietitian. She is supported by a family. She presented with a wound open for 16 months. Negative-pressure wound therapy was in place with 0.9- to 1.5-cm undermining. Assessment did not support superficial or deep/surrounding infection. An interprofessional team considered known and unknown factors to address in her care management plan. A dermatologist performed SSD under local anesthetic in a wound clinic setting using a scalpel and surgical scissors to eliminate undermining of the scar tissue. A swab was taken from a part of the wound equal to or deeper than 3 cm to send for culture. A larger clean wound base of 2 cm is achieved to help stimulate new cell migration from the edge. After debridement, the wound was painted with povidone-iodine (Betadine) to address possible antibacterial burden, packed with a calcium alginate, and covered with a secondary silicone foam dressing.*

Case report. *An 84-year-old male smoker with multiple medical problems including multiple lower extremity endovascular interventions was evaluated in an outpatient setting for extensive ischemic ulceration of the right lower extremity* (Figure 4A). *The patient recently underwent revascularization of the right lower extremity with a patch angioplasty and right common femoral to distal posterior tibial polytetrafluoroethylene bypass and wishes to undergo wound management rather than definitive amputation. A general surgeon who specializes in wound care performed excisional debridement using scalpel and forceps to excise the eschar from the mid pretibial area to the lateral right ankle. Portions of necrotic extensor tendon were also excised with the eschar. Avascular and necrotic tissue were subsequently removed to the depth of subcutaneous tissue and underlying tendon, which was tolerated well* (Figure 4B) *The wound was then dressed with gauze soaked in Dakin solution, covered with gauze, and expectantly managed.*

DEBRIDEMENT TECHNIQUES AND THEIR INDICATIONS

An expert group of wound care clinicians developed Supplemental Table 3 (http://links.lww.com/NSW/A134), contrasting the different debridement methods in relation to selectivity, speed, pain, exudate, and infection with scores for each category ranging from 1 (most desirable)

Figure 4. SHARP SURGICAL DEBRIDEMENT (SSD): EXCISION OF LATERAL RIGHT ANKLE

Ischemic ulceration of the right lower extremity (A) on admission and (B) following SSD.

Photographs courtesy of David Tran.

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to 6 (least desirable).[1,11] Costs are not included in the comparison because they vary by jurisdiction.

Callus reduction is an important consideration for persons with diabetes or other causes of neuropathy; these patients will often produce callous around the wound edges because of local pressure that needs to be redistributed. This callus is often firm or hard to touch and can inadvertently increase pressure on the wound, leading to delayed healing. Some individuals form more callus than others and require more frequent or regular conservative sharp debridement of the callus (serial debridement).

The authors recommend that HCPs view the debridement skills video of the International Interprofessional Wound Care Course provided by WoundPedia (https://youtu.be/XUp8hqgejY4). The video explores CSWD and SSD techniques and also provides good insights into different tissue types and which other debridement methods can be considered. For further education, there are advanced wound debridement courses specific to nursing competencies in Canada and the US.

Despite the increased spectrum of debridement techniques, there continues to be a lack of high-quality evidence. Only five Cochrane Database Systematic Reviews examining wound debridement and the effectiveness of the modality were published between 2010 and 2020 (Supplemental Table 1).[17–21] Note, however, that the Cochrane reviews require a very high level of evidence, and there are many more systemic and scoping review articles that mention debridement.

DEBRIDEMENT IN RESOURCE-LIMITED SITUATIONS

The availability of different debridement modalities varies significantly, as does the availability of an interprofessional team. Regular follow-up appointments can be a challenge for patients receiving wound care interventions, especially those in rural or remote communities. For individual patients, access to suitable products may also be dependent on healthcare system and insurance coverage. Out-of-pocket costs can include uninsured services, medications, or dressings that many patients cannot afford. Enzymatic debriding agents are pharmaceuticals with coverage varying by state, province, or territory. Healthcare practitioners often have access to different treatment options across healthcare sectors (eg, home care setting versus hospital). The cost of healthcare and wound care products can also inhibit quality wound care for patients who may have financial limitations. Cost considerations may influence the decisions and choices of interventions for patients in accessing nursing services or home health services for wound management.

CONCLUSIONS

Debridement remains a mainstay of WBP in chronic wound management. Its ability to remove biofilm and material from the wound bed remains essential for preventing and controlling infection and inflammation. Debridement also often facilitates proper visualization of the wound bed base, enabling HCPs to make appropriate and wound-specific treatment decisions. The most suitable debridement modality depends on a spectrum of factors, including the healing potential of the wound and obtaining informed consent from the patient. Not all wounds should be debrided. A patient navigation model applied by an interprofessional team can optimize care and resource management to ensure patient safety, improve wound care outcomes, and reduce the risk of litigation for HCPs.

PRACTICE PEARLS

- The WBP paradigm[8] provides a valuable model/process for managing patients with a chronic wound requiring debridement.
- High-level evidence on wound debridement for everyday practice is limited, but the procedure is often valuable for individual patient care. It may create an acute wound in a chronic wound stimulating healing.
- Consider the comparative criteria across the six debridement options to identify potential debridement methods for each patient with a wound.
- The most appropriate debridement modalities should be matched to patient characteristics including goals of care, wound classification (healable, maintenance, or nonhealable), available resources, clinician scope of practice, and healthcare system limitations.
- Interprofessional team collaboration can optimize debridement choices and frequency for improved patient outcomes. ●

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