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Toward a Practical Framework for Debridement in Chronic Wounds: Findings From a United States-Based Multidisciplinary Consensus Panel

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Acknowledgments
Manuscript preparation and assistance were provided by HMP Collective and Jaime Dickerson, PhD.

Disclosure
All panelists received honoraria for their role in the development of this installment of the *Wounds* Clinical Guidance series. This series was financially supported by DEBx Medical, MediWound, Smith+Nephew, Solventum Corporation, URGO Medical, and XSONX.

Ethical Considerations
This article does not involve human or animal subjects; institutional review board or ethical approval was not required.

Supporters
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Recommended Citation
Lantis JC, Dove C, McFee K, et al. Toward a practical framework for debridement in chronic wounds: findings from a united states-based multidisciplinary consensus panel. *Wounds*. 2026;38(Suppl 3):S1-S20. doi.10.25270/wnds/25155

Manuscript Accepted: February 4, 2026

Wounds 2026 Vol. 38 No. 3 Suppl

Toward a Practical Framework for Debridement in Chronic Wounds: Findings From a United States-Based Multidisciplinary Consensus Panel

Abstract

Background. Effective debridement is a cornerstone of wound bed preparation and healing. Despite widespread recognition of its importance, practical guidance for selecting and sequencing debridement methods across diverse care settings remains limited. **Objective.** To provide United States (US)-based, patient-centered recommendations incorporating debridement into the continuum of wound management. **Methods.** A 9-member panel composed of experts in vascular surgery, podiatric surgery, plastic and reconstructive surgery, general surgery, nursing, physical therapy, and basic science convened in Grapevine, Texas, in April 2025. Using nominal focus group methodology, these experts developed 20 draft statements from discussion transcripts and refined them through 2 survey rounds using a 5-point Likert scale. Interpanelist agreement was assessed using Kendall's *W* and Spearman rank correlation coefficient analysis. **Results.** Seventeen consensus statements were finalized, reflecting high agreement (Kendall's $W = 0.566$). Core themes included matching debridement to wound goals and patient factors, adopting a dynamic escalation/de-escalation ("chutes and ladders") approach, and emphasizing communication, pain control, and diagnostic adjuncts. The panel stressed flexibility, clinician judgment, and patient-centered care when integrating debridement strategies across settings. **Conclusion.** This US-based multidisciplinary consensus provides practical, patient-centered guidance for selecting and sequencing debridement methods across wound types and care settings, supporting clinicians to apply flexible, evidence-informed strategies to optimize wound bed preparation and healing outcomes.

Keywords: chronic wounds, clinical guidance, consensus statement, debridement, Nominal Focus Group

Background

Effective debridement is an essential part of successful wound healing and a key component of both infection control and wound bed preparation.[1-3] The importance of debridement in the treatment of healable chronic wounds of various etiologies, including pressure, venous, and diabetic ulcers, is universally acknowledged.[4-6] The goals of debridement may vary depending on the type of wound, the phase of healing, and the treatment setting. Such goals include removal of nonviable material and metabolic waste, reduction of bacterial load, disruption of biofilm, removal (or reactivation) of senescent cells, and modulation of the wound bed environment—including shifting a stagnant, ineffective inflammatory response to a more normal physiological inflammatory response.[7-10]

Active methods of debridement include surgical, sharp, mechanical, biological, chemical, and enzymatic, whereas the passive maintenance of a moist wound environment is thought to promote debridement by endogenous proteases.[11-18]

Although there is universal agreement that debridement is an essential component of chronic wound management and healing, there is a need for practical guidance on selecting the appropriate debridement method that considers patient characteristics and comorbidities, treatment setting, wound etiology, scope of practice, and timing. Moreover, the use of multiple methods of debridement, recently termed integral debridement by an international committee, should be considered over the course of a wound's healing trajectory.[19]

The purpose of this clinical consensus guidance is to provide wound surgery and medicine professionals, along with other health care practitioners who care for wounds, a practical, actionable, patient-centric framework that integrates debridement within the broader care continuum. Although recent guidance has been published, including Mayer et al,[19] this panel aims to provide practical algorithms that better reflect United States (US)–based practice, reimbursement, and licensing. The panel also recognizes the variability among patients, wounds, care settings, and provider skill sets, and the need for multiple approaches to achieve effective debridement.

Methods

CONSENSUS PANEL AND MEETINGS

The expert multidisciplinary panel was purposely selected by the senior author and moderator (J.L.) to include a diversity of backgrounds and clinical settings, including vascular surgery (n = 1), podiatric surgery (n = 1), physical therapy (n = 1), nursing or nurse practitioner (n = 3), plastic and reconstructive surgery (n = 1), general surgery (n = 1), and basic science (n = 1). All 9 panelists are recognized experts in wound care and together, the panelists have over 200 years of wound care experience (range, 8 years-38 years) and more than 300 peer-reviewed publications. The moderator is a vascular and general surgeon. The panelists are from diverse practice backgrounds and come from all regions of the United States, including urban and rural settings, academic centers, community hospitals, mobile wound services, standalone wound clinics, and private practice.

The panel was convened in person on April 30, 2025, in Grapevine, Texas, and a follow-up virtual meeting was held on May 28, 2025. The initial meeting focused on creating a framework for discussion, establishing the panel's goals, and developing a consensus understanding of the following topics: why debridement matters, wound bed preparation with debridement, the goals of debridement, debridement tools and types, and integral debridement. The meeting lasted 5 hours, with 7 of 9 panelists present. The 2 panelists who did not attend the meeting in person were later provided the meeting audio transcript and then briefed in a separate meeting with the moderator.

NOMINAL FOCUS GROUP METHODOLOGY

Nominal focus group (NFG) methodology was used to develop this consensus document. NFG is a 2-stage process that combines a focus group exploration (stage 1) with the nominal group technique (stage 2).[20] The strength of this approach is that it allows for the in-depth discussion characteristic of a focus group, with the prioritization of the results characteristic of the nominal group technique.

SURVEY QUESTIONS

Twenty statements were drafted after the first panel meeting. The moderator used these statements to generate outputs from the discussion transcript and then shared the statements with the panelists. Panelists were asked to express their agreement or disagreement with each statement using a 5-point Likert scale ranging from 1 (strongly disagree) through 5 (strongly agree). The results of this vote provided the basis for further group discussion, refinement of the statements, consolidation, and modification during the second-round survey, which led to the final 17 consensus statements (**Table**).

STATISTICAL ANALYSIS

Interpanelist agreement was assessed across both rounds of voting using Kendall's coefficient of concordance (*W*) test. The Kendall's *W* statistic ranges from 0 (no agreement) to 1 (perfect agreement). Specific questions were asked again after voting rounds 1 and 2 based on the intervening discussion. Agreement on these subsets of questions that were asked again was also assessed using the Kendall's *W* test. For questions that were asked again, the Spearman rank correlation coefficient was used to evaluate the stability of the panelists' opinions. A high correlation and statistical significance indicate consistency in rankings, while a low correlation or nonsignificant results suggest changes in a panelist's perceptions. Since this is a non-parametric test (does not assume normal distribution), a *P* value less than .05 indicates significant agreement among the panelists.

PRACTICAL TOOL DEVELOPMENT

The panel agreed that wounds may start at many different levels and move through the escalate/de-escalate, or "chutes and ladders," process for multiple starting points. The practical tool development is based on where wounds start and allows for mobilization across a variety of end points, skill sets, and locations. The entire panel agreed on the practical tool.

Results

AGREEMENT AMONG PANELISTS

The 17 consensus statements that resulted from the panelists' meetings, discussions, and voting demonstrate a high level of agreement (**Table**). Agreement was moderate across all statements in round 1 voting ($W = 0.446$), but, as expected, it was stronger after round 2 voting ($W = 0.566$). In round 2, there was unanimous, strong agreement for 3 of the 17 statements (**statements 4, 5, and 11**) and agreement or strong agreement for 14 of the 17 statements, with just 3 statements receiving a single vote of either "neutral" (**statements 15 and 16**) or "disagree" (**statement 13**). Most contentious questions were asked again; after round 1, these showed weak agreement ($W = 0.20$), while questions asked again after round 2 showed moderate agreement ($W = 0.40$).

STABILITY OF VOTES

Most statements that were asked again showed nonsignificant correlations, indicating that views on them shifted from round 1 voting to round 2 voting, as noted in the respective *P* values in the next sentence. These included statement 1, "In general, after assessment of a chronic wound, some form of debridement should be considered" ($P = .60$, $P = .09$); statement 8, "Sharp debridement should be used judiciously and when clinically

Table. Debridement consensus statements[a]

	Consensus Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	In general, after assessment of a chronic wound, some form of debridement should be considered.				1	8
2	Debridement has multiple functions, but fundamentally, it is to initiate a less chronic and more acute inflammatory wound environment.				3	6
3	The primary goals of debridement extend beyond the removal of necrotic tissue and slough to include modulating the wound microenvironment, disrupting biofilm, and reactivating the stalled healing processes.				1	8
4	The ultimate goal of wound management may dictate the form of debridement.					9
5	Debridement must be matched to the wound type, size, and etiology; care setting; patient comorbidities and pain level; and the skill and comfort levels of the treating individual.					9
6	Debridement may have to follow a "chutes and ladders" (ie, an escalation/de-escalation) pathway to maximize wound bed preparation.				2	7
7	Debridement should be considered a dynamic process rather than a static, one-time event.				2	7
8	Sharp debridement should be used judiciously and when clinically indicated.				1	8
9	Cleansing—especially mechanical cleansing with antiseptics—sets the stage for effective debridement when used before and after debridement.				3	6
10	Pain management and patient preparation are essential components of any debridement procedure and must be prioritized.				1	8
11	Clear communication with patients and caregivers about debridement goals, potential pain, changes in wound appearance, and procedural steps is essential for shared decision-making and compliance.					9
12	Adjunctive imaging technologies (eg, bacterial fluorescence imaging, near-infrared spectroscopy, thermography) may support debridement decisions but should not replace clinical judgment.				1	8
13	Practical tools such as checklists, classification tables, and algorithmic graphics are beneficial as a wound care resource to support clinician decision-making and patient safety.		1		1	7
14	There is a critical need for more research on debridement pain management protocols, optimal frequency of debridement, and real-world effectiveness of newer technologies and modalities in diverse care settings.				5	4
15	Debridement end points must be clearly defined and reassessed regularly to ensure interventions remain beneficial and aligned with patient healing trajectories.			1		8
16	Diagnostic and imaging technologies (eg, fluorescence imaging, near-infrared spectroscopy, thermography) can be used to support clinical end points for debridement.			1	1	7
17	Ownership of the wound care plan should follow the patient and their evolving needs, with responsibility transitioning to the most appropriate provider or setting as the wound stalls or progresses.				2	7

[a]The 9 panelists were asked to vote on each of the 20 consensus statements using a 5-point Likert scale (1 = strongly disagree, and 5 = strongly agree). Subsequent discussion and refinement of the statements resulted in 17 consensus statements, all with at least 89% of panelists indicating they "agree" or "strongly agree" with them.

indicated" (P = .35, P = .35); statement 9, "Cleansing—especially mechanical cleansing with antiseptics—sets the stage for effective debridement when used before and after debridement" (P = .20, P = .60); statement 13, "Practical tools such as checklists, classification tables, and algorithmic graphics are beneficial as a wound care resource to support clinician decision-making and patient safety" (P = .47, P = .20); and statement 16, "Diagnostic and imaging technologies (eg, fluorescence imaging, near-infrared spectroscopy, thermography) can be used to support clinical end points for debridement" (P = .05, P = .90). It needs to be noted that currently these technologies have received US Food and Drug Administration (FDA) approval for use in conjunction with primary methods, but not as standalone tests per the Code of Federal Regulations. The shifts in voting for these statements could be interpreted to mean that these questions were initially misunderstood or differently interpreted in round 1 voting, and that the opportunity to revisit these items helped clarify intent and improve alignment; however, in all cases, the statement wording was modified due to discussion between voting rounds.

CONSENSUS STATEMENTS

Consensus 1

In general, after assessment of a chronic wound, some form of debridement should be considered.

All panelists agreed with this statement, with 8 (89%) strongly agreeing; the total score was 44. Several panelists noted that in many care settings (eg, mobile wound care, rural wound clinics), accurate diagnosis may not be possible in an acceptable time frame. This could be for various reasons, including unavailability or limited coverage for testing, or scope of practice limitations for the wound care provider. Nevertheless, wound bed preparation, including some form of debridement, should be performed following wound assessment. One panelist noted that, for example, when perfusion cannot be confirmed, a "step down" (**see consensus statement 6**) or less aggressive form of debridement would be appropriate.

Consensus 2

Debridement has multiple functions, but fundamentally, it is to initiate a less chronic and more acute inflammatory wound environment.

All panelists agreed with this statement, with 6 (67%) strongly agreeing; the total score was 42. One panelist stated, "Patients have been told for many years that their chronic wound is stuck in the inflammatory phase." Another panelist pointed out that "ineffective inflammation" is a more accurate term, because the inflammatory response differs in acute wounds. Chronic wounds lack an adequate influx of inflammatory cells, and the debridement margin should extend beyond the stalled cells to include the wound edge.[7,10,21-23] Other panelists noted that this process is usually described as the chronic wound adopting the traits of, or becoming, an acute wound.

Consensus 3

The primary goals of debridement extend beyond the removal of necrotic tissue and slough to include modulating the wound microenvironment, disrupting biofilm, and reactivating the stalled healing processes.

All panelists agreed with this statement, with 8 (89%) strongly agreeing; the total score was 44. This statement aligns with statement 2 and for decades has been a generally accepted tenet in the understanding and practice of healing chronic wounds.[24-27] The idea that debridement—particularly aggressive, sharp debridement—can alter the environment of a chronic wound to more closely resemble that of an acute wound has been recognized and promoted for many years.[24,28-31] Cells grown from tissue obtained post-debridement indicate faster migration and growth as well as a better response to wound healing stimuli compared with wound tissue obtained prior to debridement.[32] In addition, genomic profiling has confirmed that debridement induces significant pro-healing biological changes in wound tissue.[10,33,34] There is some anecdotal evidence that chemical debridement may have some of these properties as well.

Consensus 4

The ultimate goal of wound management may dictate the form of debridement.

All panelists strongly agreed with this statement; the total score was 45. There was a recognition that, while debridement is a fundamental component of wound bed preparation, the means of debridement must be governed by a number of factors intrinsic and extrinsic to the wound. The health care practitioner must determine whether the wound is healable. If it is not, then comfort care is

appropriate, including debridement methods that may result in slower healing (compared with sharp debridement) but minimize pain. It is also important to account for the patient's characteristics. Wound management goals will likely differ depending on the patient's age, mobility, pain tolerance, and comorbidities.

Consensus 5

Debridement must be matched to the wound type, size, and etiology; care setting; patient comorbidities and pain level; and the skill and comfort levels of the treating individual.

All panelists strongly agreed with this statement; the total score was 45. Of course, there may be limitations on treatment options based on the provider's scope of practice. Surgical sharp debridement (ie, debridement performed in the operating room) is not within the purview of skilled wound care nurses or advanced practice providers; thus, using less aggressive treatment modalities is a logical first option rather than progressing directly to a surgical referral. What is adequate for the situation? Is the wound complex and deep? Has there been a diagnosis of osteomyelitis? Depending on the circumstances, a more aggressive approach might be appropriate. The patient's capacity to tolerate pain and discomfort must also be balanced with the chosen debridement modality and the goals of the treatment plan. The practitioner must determine whether the plan is to keep patient comfort foremost and minimize intervention, or whether it calls for preparing the wound for plastic and reconstructive surgery (eg, a flap or graft), preparing for negative pressure wound therapy (NPWT), or managing infected tissue. Each of these factors guides the choice and frequency of debridement. These factors and the resulting outcomes also need to be matched with the patient's expectations and goals. The panel recommends that tools and techniques be selected based on their effect on the wound bed, the skill required for safe and effective use, and appropriateness for the setting (eg, operating room or home). The panel agrees that all modalities, including hydrosurgery, sharp excisional techniques, enzymatic agents, and mechanical methods, have a role, dependent on wound type, setting, and patient factors.

Consensus 6

Debridement may have to a follow a "chutes and ladders" (ie, an escalation/de-esclation) pathway to maximize wound bed preparation.

One panelist (plastic surgery) characterized the wound care journey as beginning with 1 practitioner in a particular care setting and moving to a different practitioner in a different care setting. The panel quickly adopted this notion. Along this journey, there may be intermittent (episodic) sharp or mechanical debridement, with less aggressive maintenance (enzymatic or autolytic) debridement (**see consensus statement 7**).

Consensus 7

Debridement should be considered a dynamic process rather than a static, one-time event.

The panel discussed the overlap between statements 6 and 7, but ultimately felt that each statement underscores 2 distinct, albeit related, ideas. Statement 6 highlights the need for flexibility in the debridement strategy, adaptable to changing conditions, whereas statement 7 underlines that debridement is not a 1-time ("one and done") event for the majority of wounds. All panelists agreed with statements 6 and 7, with 7 (78%) strongly agreeing with both; the total score was 43.

The notion that a single modality of debridement, appropriate at 1 stage in the healing journey, would continue to be the best option at subsequent time points was rejected. Panelists embraced the idea that different methods can and should be used. That is, as wound healing progresses, technique de-escalation may be possible; conversely, when the healing process stagnates, escalation may be required. Changes in the care setting might also drive a chutes and ladders approach, emphasizing a dynamic, flexible strategy that can adapt to the current medical needs of the wound and patient. This philosophy is akin to the integral (or *integrated*) debridement concept, which supports a holistic, patient-centered approach and recognizes that, for many patients, wound care that draws on multiple debridement methods and leverages interdisciplinary collaboration can be beneficial.[19] Several panelists cautioned that the term integral could be misunderstood because, in American English, it is defined as "essential" or "necessary for completeness"; while the panel noted multiple methods of debridement would be used sequentially, when warranted, or concomitantly. An example of this dynamic process is intermittent sharp debridement weekly, with daily enzymatic debridement.

Consensus 8

Sharp debridement should be used judiciously and when clinically indicated.

All panelists agreed with this statement, with 8 (89%) strongly agreeing; the total score was 44. Many clinicians (especially nonsurgeons) are reluctant to perform sharp debridement due to fear of causing harm. The panel emphasized that encouragement, proper education, and a permission-based culture ("It is OK to try") are critical in overcoming this belief. The panel also agreed that sharp debridement should be done only when clinically indicated; performing it too frequently can delay healing. The decision to use sharp debridement should never be based on reimbursement or billing considerations. Serial sharp debridement may be medically necessary where there is a continued build-up of necrotic material; however, the underlying reason or reasons should also be investigated. As outlined in consensus statements 4, 5, and 6, debridement must always be tailored to the specific goals of wound management, wound and patient characteristics, and the clinician's training and scope of practice. Wound care professionals should consider alternative methodologies when appropriate and use a chutes and ladders approach, knowing when to switch between or combine sharp, enzymatic, and autolytic debridement; in essence, wound care professionals should follow a tiered debridement strategy that best supports healing and minimizes trauma.

The goal of debridement should be to remove senescent and quiescent cells from the periphery of the wound, while removing biofilm, reducing bioburden, and culling nonproliferative material from the base of the wound. Mandatory debridement protocols should never be used unless they are based on the direct treatment of recognized or diagnosed pathophysiology.

The role of surgical debridement was noted to be mandatory in wounds with extensive necrosis and/or a need for significant hemostatic and pain control. In addition, the stress on the patient, support staff, facility, and practitioner must be considered when planning to perform extensive sharp debridement in the outpatient setting.

Consensus 9

Cleansing—especially mechanical cleansing with antiseptics—sets the stage for effective debridement when used before and after debridement.

All panelists agreed with this statement, with 6 (67%) strongly agreeing; the total score was 42. The panel emphasized that cleansing is inseparable from debridement, serving both to prepare the wound for debridement and to maintain a clean wound environment afterward. The panel concurs with recent consensus publications that emphasize the importance of wound cleansing before and after debridement as an effective tool to combat biofilm.[35,36] Mechanical cleansing (eg, use of gauze scrubs, cloths, finger cots) of the wound and periwound area, combined with antiseptic, antimicrobial, or surfactant agents, is advocated as basic practice, particularly in home and low-resource settings; saline alone will not remove biofilm.[36] The need for wound cleansing choice based on wound characteristics is well described in a recent International Wound Infection Institute (IWII) publication.[37]

Consensus 10

Pain management and patient preparation are essential components of any debridement procedure and must be prioritized.

All panelists agreed with this statement, with 8 (89%) strongly agreeing; the total score was 44. Pain management was recognized as both a barrier and a decision-making point in debridement choice and frequency. The panel highlighted the need for pre-procedure pain assessment and counseling, use of topical agents and local anesthesia where feasible, and selection of less painful methods to manage patient apprehension and anxiety. Ongoing patient engagement concerning pain expectations and wound progression was emphasized as key to adherence and successful wound management.

Consensus 11

Clear communication with patients and caregivers about debridement goals, potential pain, changes in wound appearance, and procedural steps is essential for shared decision-making and compliance.

All panelists strongly agreed with this statement; the total score was 45. Panelists recognized that the wound healing process is a journey, and that the patient is central to it. Open communication is paramount to success. Patients and their caregivers are not spectators but are active participants. Routine discussions that set and help manage expectations, that underscore the progress that has been achieved, and that highlight next steps in treatment lead to the best outcomes. Patient and caregiver understanding of treatment goals is of particular importance for debridement procedures that may cause pain or bleeding.

Consensus 12

Adjunctive imaging technologies (eg, bacterial fluorescence imaging, near-infrared spectroscopy, thermography) may support debridement decisions but should not replace clinical judgment.

All panelists agreed with this statement, with 8 (89%) strongly agreeing; the total score was 44. The panel was clear that good outcomes may be achieved without the use of diagnostic and imaging technologies, but there was strong consensus that these technologies can be quite useful adjuncts in the decision-making process. All panelists recognized that these technologies have not achieved widespread adoption or availability and cannot currently be required. One panelist noted that the subtleties in wound care may not be fully appreciated by all wound care providers, using a "stable vs unstable eschar" trope (the stable eschar should not be removed; the unstable eschar may be concealing infection and necrotic tissue). Notably, near-infrared spectroscopy (NIRS) is a valuable adjunctive tool that can detect clinical conditions that impair oxygenation.[38] NIRS can determine viable vs nonviable tissue beyond what the naked eye can see.[39] Bacterial fluorescence imaging (BFI) is a useful means of assessing the extent of bacterial colonization in wounds and can more precisely guide when and where to debride.[40-42] Thermography can detect elevated wound temperature, a sign of an inflammatory response or infection.[43,44] Additional study is needed in this area.

Consensus 13

Practical tools such as checklists, classification tables, and algorithmic graphics are beneficial as a wound care resource to support clinician decision-making and patient safety.

Eight panelists agreed with this statement, with 7 (78%) strongly agreeing; 1 panelist disagreed. The total score was 41. Most panelists felt that checklists, classification tables, algorithmic graphics, and other such tools provide clinicians—particularly those with less wound care experience—with useful information that may supplement, but is not a substitute for, their own medical judgment and clinical decision-making. There was an appreciation of the utility of these tools, particularly graphics, in patient education. The dissenting panelist was not against the use of such references but felt it important to underscore that, while these are available options, they should not be considered mandatory.

Consensus 14

There is a critical need for more research on debridement pain management protocols, optimal frequency of debridement, and real-world effectiveness of newer technologies and modalities in diverse care settings.

All panelists agreed with this statement, with 4 (44%) strongly agreeing; the total score was 40. The panel identified several current gaps in the knowledge base where additional research is needed, including (1) pain management protocols specific to debridement in outpatient and home settings, (2) optimal frequency and extent of debridement in various wound types, (3) validation of biomarkers and diagnostic tools to guide debridement timing and method selection, and (4) more real-world data on outcomes of different debridement approaches in rural, underserved, and lower-resource settings. The panel strongly recommends that these research gaps be prioritized. Panelists noted that this is an "ongoing need" and "it's really important we get this done," and that "more basic science research is needed on all of these." The panel agreed that the need for more research in these areas should not be misconstrued to mean that there is no existing supportive data[45,46]; instead, more research will facilitate more stringent validation and better patient care algorithms.

Consensus 15

Debridement end points must be clearly defined and reassessed regularly to ensure interventions remain beneficial and aligned with patient healing trajectories.

Eight panelists (89%) strongly agreed with this statement and 1 panelist was neutral, for a total score of 43. There was acknowledgment of the lack of clear, evidence-based definitions for when a wound is adequately debrided. The overriding goal of debridement is to prepare the wound bed for granulation and ultimately reepithelialization. This entails the removal of all devitalized tissue, biofilm, slough, and bioburden, including senescent cells that are unable to respond appropriately to molecular signals. The panelists proposed the following markers as debridement end points: a clean, bleeding wound base with healthy granulation tissue; absence of slough and necrosis; and stable or closing wound margins. The panel acknowledged that infection and biofilm may be difficult to detect visually and that diagnostic tools, including NIRS and BFI, have demonstrated utility for detection.[38,41,47] The panel agreed with the importance of continual reassessment and recognition of diminishing returns when debridement is no longer productive. One panelist stated, "If the debridement is not meeting those end points and trajectories, then you need to reevaluate the wound, the patient ... what has changed? Reassess, perfusion, bacterial burden, possibly more aggressive operative debridement."

Consensus 16

Diagnostic and imaging technologies (eg, fluorescence imaging, near-infrared spectroscopy, thermography) can be used to support clinical end points for debridement.

Eight panelists (89%) agreed with this statement, with 7 (78%) strongly agreeing, and 1 panelist was neutral; the total score was 42. This statement relates to consensus statement 12, but whereas the focus of statement 12 is the utility of diagnostics in guiding debridement decision-making, statement 16 supports using these same technologies to help determine when debridement treatment goals have been met. In other words, the technologies not only are valuable for determining the need for and the degree of debridement at the outset but can also provide the clinician with valuable information about when debridement goals have been met.[48] One panelist also pointed out the relationship to statement 14, which discusses the need for additional validation research supporting the adoption of new diagnostic technologies. Another panelist underscored that these tools are not a substitute for a "well-trained physician's clinical judgment" but rather are supportive. The panel affirmed that basic clinical assessment skills remain the cornerstone of decision-making, particularly in settings in which these technologies are unavailable, cost-prohibitive, or user-dependent.

Consensus 17

Ownership of the wound care plan should follow the patient and their evolving needs, with responsibility transitioning to the most appropriate provider or setting as the wound stalls or progresses.

All panelists agreed with this statement, with 7 (78%) strongly agreeing; the total score was 43. Development of a comprehensive wound care plan is complex and often involves contributions and expertise from a diverse team, which may start with the primary care provider and grow to include health care providers from general surgery, vascular surgery, foot and ankle surgery, plastic and reconstructive surgery, rheumatology, dermatology, infectious diseases, nursing, nutrition, and physical therapy, among others. The team approach is critical and must be led by the responsible clinician to maintain consistency and, ultimately, achieve successful outcomes.[49,50] Treatment plans must be patient-focused, incorporating the patient and their family in the decision-making process to maximize effectiveness.[49] Flexibility should be "baked in" so that as the wound changes, either stalling or progressing, treatment modalities can be adjusted (ie, chutes and ladders approach) or the ownership of the plan can be transitioned to the best possible provider and care setting.

Practical Debridement Tools

The panelists noted the multiple methods of debridement that may be used in the chutes and ladders approach to wound care (**Figure 1**). The range of products allows for this overlap in therapies (**Figure 2**). The clinician should choose the therapeutic intervention based on the patient's care goals, and clinical care, availability, and pain tolerance, and the practitioner's ability.

AUTOLYTIC DEBRIDEMENT

Moist wound care, which allows for autolytic debridement, is available to all health care practitioners. This approach relies on the patient's own enzymes and the neutrophils provided by a moist wound environment, allowing for autolytic debridement. In this setting, the patient's own wound perfusion delivers inflammatory cells and enzymes to the microenvironment that break down the surrounding tissue. Products in this category include but are not limited to hydrogels, foams, hydrocolloids, hydrofibers, and alginates.

Dressings in this category create a more active healing environment, such as those that support the continuous debridement of slough (UrgoClean Ag; Urgo Medical North America). These dressings are made of fibers that, as they hydrate, attract the positively charged zones of wound slough, eliminating this material via physical adhesion more actively than in a purely autolytic environment.[51] This product also contains silver to act as an antimicrobial barrier and possibly decrease pain upon removal.[52] In support of this dressing, a 2020 published observational study of more than 2000 patients showed that at 2 weeks, 90.6% of patients demonstrated improvement in the healing process, and exudate levels were reduced by 70%.[53] In this large observational study, there was a 79% increase in healthy granulation tissue and a reduction in slough noted at 3 weeks of therapy.[51] These types of dressings are ideal for a patient who may have already undergone some form of more active debridement, such as enzymatic or sharp debridement, but who needs ongoing maintenance debridement with a longer wear time and fewer dressing changes.

TOPICAL CHEMICAL DEBRIDEMENT

A potential adjunct and a novel therapy in the topical chemical debridement category is a single-use product that may act as a bridge between the multiapplication enzymatic

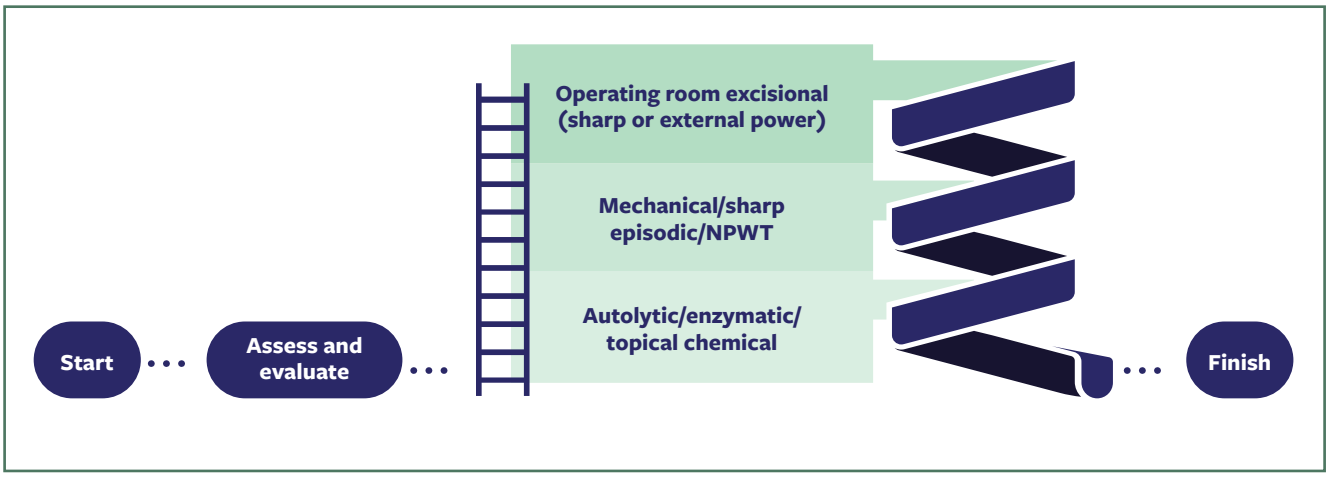

Figure 1. Diagram of the escalation and de-escalation (ie, chutes and ladders) approach for debridement methods. Abbreviation: NPWT, negative pressure wound therapy.

pathway and the single, episodic sharp or excisional pathway. This novel topical desiccating agent (TDA) (Debrichem; DEBx Medical) has not yet received FDA clearance in the United States. This product is applied directly to the wound in any treatment setting. Commercially available anesthetic creams and tumescents should be applied approximately 30 minutes beforehand, and a pain management strategy should be formulated.[54] The local anesthetic is then removed, and the active agent is applied and left in place for up to 60 seconds, after which it is removed with normal saline. Currently, this product is intended as a nonsurgical debriding agent for application by health care professionals, but it could have further applications. It works as a TDA, reacting with water in the wound bed. Bacteria and biofilms contain large amounts of water. As a result, the TDA kills bacteria and destroys biofilm.[55] The natural lipid content of intact skin, along with the lower water content, protects the periwound environment.

The TDA manufacturer is currently undertaking a study titled "A Pilot Study to Investigate the Relative Effectiveness and Safety of Chemical Wound Debridement and Curettage in the Treatment of Venous and Mixed Aetiology Leg Ulcers" (ClinicalTrials.gov identifier: NCT06652360).[56] The study compares desiccating gel vs mechanical debridement, a standard approach that involves manually scraping away dead tissue from the wound bed. In addition, the company has initiated an aggressive diabetic foot ulcer (DFU) study, "CHEMfoot: Debrichem in Chronic Diabetic Foot Wounds (CHEMfoot)" (ClinicalTrials.gov identifier: NCT07206862),[57] an open-label, multicenter study primarily conducted in France.

Researchers at a single center in the United Kingdom published a noncomparative evaluation of the clinical results of the desiccating gel.[58] The sample comprised 21 patients with complex, nonhealing wounds (venous leg ulcers [VLUs] and posttraumatic wounds). During a 4-week follow-up period, the mean percentage of devitalized tissue in the wounds declined from 69% at baseline, to 49% at week 4. The mean percentage of granulation tissue increased from 31% at baseline to 51% at week 4.[58] Neither of these outcomes was statistically significant. It will be interesting to see the clinical impact on patients when this product enters the US market. The safety profile of this product has been well described in the literature.[54,59]

NONPOWERED MECHANICAL DEBRIDEMENT

In the extended care setting, there are numerous products that allow for gentle mechanical debridement within various licensing situations. Most of these are straight mechanical which in most cases allow for a rough surface further to remove slough and other debris from the wound. From a basic science standpoint, the health care provider should consider what these products are doing to the edge migration of keratinocytes, their ability to remove senescent and quiescent cells, and how they are affecting callus and circumferential hyperkeratotic enrolled skin edges.[60] However, these products for gentle mechanical debridement can be quite useful at reducing wound bacterial burden, especially when augmented by other cleansing agents.

One preclinical study using an infected porcine skin wound model showed that monofilament devices outperformed standard gauze, with the devices achieving up to a 100-fold reduction in bacterial counts.[61] Histological and morphological analyses suggest that monofilament devices not only removed bacteria but also disrupted the bacterially derived extracellular polymeric substance.[61]

Some of these products utilize knitted monofilament polyester fibers; the goal of these products is to loosen and remove slough and debris while preserving newly formed granulation tissue (Debrisoft; Lohmann & Rauscher USA,

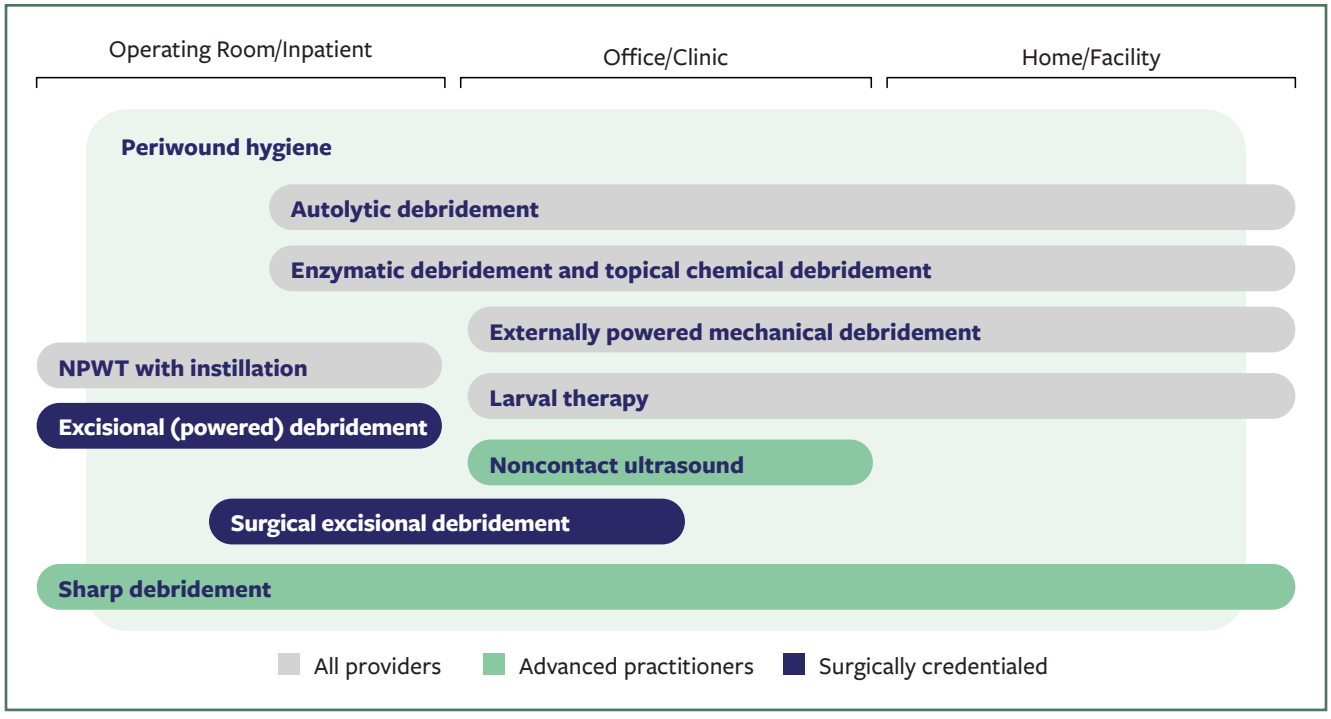

Figure 2. Diagram of location of care and therapy provided by practitioner skill set.
Abbreviation: NPWT, negative pressure wound therapy.

Inc). Some are worn on the finger (over the glove the health care provider normally wears) and incorporate a fabric with small hooks (Kylon; Histologics, LLC)—similar in construction to hook-and-loop fastener—that is used either to clean wounds and provide wound hygiene or for tissue sampling. These easy-to-use devices can also collect tissue for biopsy testing (eg, anatomic pathology, microbiology, molecular testing) (Soft K-Rette curette, Soft K-Cot, and SoftBiopsy; Histologics, LLC).

The EZDebride (MDM Wound Ventures) is a manual mechanical device that incorporates numerous cutting flutes into an ergonomically created head. Technically, this is a controlled-depth sharp debridement tool. A prospective study of patients with 28 chronic wounds noted a 69% decrease in bacterial fluorescence after debridement with this tool and complete resolution of bacterial biofluorescence in 19% of wounds.[62]

All of these products can be quite helpful in care provided by practitioners in sites of care where instrument debridement is not available. Additionally, evidence-based consensus exists that specially formulated solutions, such as those containing pure hypochlorous acid, can amplify and augment nonpowered (or powered) mechanical debridement.[19]

ENZYMATIC DEBRIDEMENT

Enzymatic debridement is widely used and has very little downside. In the United States, the only FDA-cleared product available in this setting is collagenase clostridium histolyticum (CCH) (Collagenase Santyl Ointment; Smith and Nephew). The primary active ingredient in this topical prescription drug is collagenase, which is similar to the naturally occurring human matrix metalloproteinase.[63] The difference is that CCH is able to cleave the devitalized collagen supporting necrotic tissue more efficiently and more rapidly into more fragments, while not harming protected healthy collagen or intact skin. The goal with CCH is selective debridement—digesting only denatured collagen while leaving healthy tissue and potentially new epithelial growth intact. Ira Herman, PhD, and colleagues have also identified that the multiple collagen fragments, along with collagen-associated peptides derived from thrombospondin-1, multimerin-1, fibronectin, transforming growth factor β–induced protein ig-h3, and tenascin-C, generated from collagenase-digested human dermal collagen, affected capillary endothelial and fibroblastic matrices, which increase cell proliferation and angiogenic remodeling in vitro by 50% to 100% over controls.[63] These novel mechanisms of action appear to improve wound closure by, in part, modulating the M1 macrophage to the M2 macrophage.[64,65] Investigators have found through single-cell RNA sequencing that when blood-derived macrophages were subjected to the active pharmaceutical ingredient (API) from CCH, there was an upregulation of collagen genes and genes supporting extracellular matrix (ECM) function. The macrophages were transformed into a fibroblast-type phenotype. While this process should

happen normally in wounds, it is impaired in diabetic wounds, leading to compromised ECM and tensile strength. Thus, the CCH API seems to facilitate the formation of new granulation tissue and may have a role in reducing long-term dehiscence or readmissions.[65]

CCH has been available clinically for almost 60 years, and it has a strong safety profile. Likewise, it has had a strong research profile, including studies on burns that have shown reduced pain, increased debridement, and reduced rates of infection.[66] As summarized by Lantis and Gordon,[17] 4 prospective randomized trials of DFU treatment have all shown improved closure rates, freedom from infection, and ease of use compared with a variety of standard of care treatments. Of note, those studies also support the fact that CCH was even more effective when used with sharp debridement.[17] Milne et al[67] showed that CCH debrided 85% of chronic unstageable pressure injuries after 6 weeks of treatment vs less than 30% for standard of care in a prospectively assessed cohort. Overall, this therapy has been well tolerated and widely used with favorable clinical outcomes. While some health care providers and patients feel the product works too slowly, the question is, "Compared to what?" It is incredibly difficult to surpass the product's safety profile. This therapy is currently available and used across all spectrums of debridement by both health care providers and patients themselves. Multiple publications have shown its clinical effectiveness and economic value in both inpatient and outpatient settings.[68-70]

A newer addition to the field of enzymatic debridement is bromelain. This biologic drug is available in Europe and the United States as a debriding agent for burns (NexoBrid; MediWound) and is used for eschar removal in patients with deep partial- or full-thickness thermal burns. A related product containing the same active ingredient, developed specifically for chronic wounds (EscharEx; MediWound), is currently being widely studied, including in 2 prospective randomized controlled trials (RCTs). The BBD is currently being studied in a phase 3 prospective RCT to evaluate its use in VLUs (A Double Blind Study Performed to Evaluate the Efficacy and the Safety of EscharEx in Debridement of VLU [VALUE]; ClinicalTrials.gov identifier: NCT06568627).[71] An RCT on DFUs is also planned.

The mechanisms of action of BBD therapy are many. The drug is a mixture of proteolytic enzymes derived from the stems of pineapple plants. The combination of enzymes selectively targets devitalized tissue, while inhibiting bacterial biofilm formation and promoting granulation tissue formation.[72] This latter mechanism has allowed the aforementioned company that manufactures the proprietary BBD to receive FDA guidance to seek a second claim beyond simply debridement—the facilitation of wound closure.

The BBD product has been studied in numerous settings in the chronic wound environment. In the largest study, which evaluated BBD vs a standard of care that included collagenase and hydrogels, full debridement was achieved in 63% of patients after 8 daily treatments vs in 30% in the placebo group and 13% in the standard of care group.[73] In an earlier study of 73 patients with DFUs, VLUs, and postoperative wounds, complete debridement was achieved in 55% vs 29% of patients treated with BBD.[74] In an open-label proof-of-concept study of 12 patients with DFU or VLU, biofilm and bacterial load were assessed with both quantitative culture and fluorescence imaging.[75] Among the 6 patients with baseline biofilm, microorganisms were reduced to single or undetectable levels by the end of treatment; median BBD applications to complete debridement was 2.[75]

Based on the strong literature and clinical study outcomes, one may speculate that BBD therapy seems poised to take an active role in the realm of enzymatic debridement, when it becomes available in the United States for nonburn wounds (eg, pressure injuries, postoperative wounds, VLUs, DFUs), in both the inpatient and outpatient setting.

EXTERNALLY POWERED MECHANICAL AND SHARP DEBRIDEMENT TOOLS

Externally powered mechanical and sharp debridement tools are used by practitioners with excisional and/or sharp debridement credentialing. Interestingly, the first product in this category discussed here may be used by practitioners with lower-level credentials. It can be used as both a debridement and a wound hygiene tool. This device has sonic frequency microvibrational technology that stimulates micro bleeding (XSONX Wound Hygiene System; XSONX, LLC). Although this tool is described as a wound hygiene product, it can be used with 5 different heads that have varying wound interfaces, ranging from not very aggressive to quite aggressive. Although there are no publications in the literature about this device, multiple abstracts have been presented—all of which generally show reduced pain, decreased procedural time during debridement, and some evidence of reduced bacterial burden compared with traditional sharp debridement.[76] Additionally, ultrasound debridement augmented with a pure hypochlorous acid-based solution has shown success in wounds destined for surgical primary closure.[77]

It is important to note that other less portable powered devices exist; however, the panel specifically discussed the product named in the previous paragraph. Other externally powered devices include various lavage systems, such as Jetox ND (DeRoyal Industries, Inc) and Microjet Wound Therapy (Medaxis AG), as well as pulsatile lavage systems, such as Pulsavac Plus (Zimmer Biomet), palaJet AC (Heraeus Medical), and InterPulse (Stryker). Pulsatile lavage systems are used to clean both chronic and acute wounds. They may offer some debridement, and their positive features include reduction of bacterial burden and removal of foreign particles. However, these benefits must be weighed against negative aspects, such as bacterial seeding in deeper tissue layers and damage to various

tissues.[78] Generally, pulsatile lavage systems work well when they maintain pressures from 5 psi to 15 psi.

MAGGOT DEBRIDEMENT THERAPY

Maggot debridement therapy (MDT), or larval therapy, is a biological method of debridement that uses sterile, laboratory fly larvae (eg, *Lucilia sericata* [green bottle fly]) to clean necrotic wounds and can be coupled with sharp or mechanical debridement methods. Although underutilized in wound management, MDT received FDA clearance in 2004 and has gained more attention in recent years for hard-to-heal wounds for which conventional care has been unsuccessful.[79]

In an RCT, Dumville et al[80] demonstrated faster and more effective debridement with MDT vs hydrogels in venous or mixed ulcers, but did not show an improvement in healing rates. While some studies have shown an increase in pain for the patient, patients who do not report pain may experience and describe the movement of the maggots below the dressing, which may be bothersome.[80,81] However, in a systematic review and meta-analysis of RCTs comparing MDT with conventional therapy, Lam et al[82] reported no significant differences in pain, healing rate, or antimicrobial effects. Pain was the most reported adverse effect in their findings.

Though there is limited evidence available for the treatment of MDT on burn injuries, a 2023 RCT by Gaffari et al[83] evaluated 31 full-thickness burn injuries and randomized the cases to receive either MDT or conventional silver dressings. The MDT-treated participants showed decreases in necrosis, time to debridement, and time to healing, but no significant changes were noted for bacterial contaminants between the 2 groups.[83]

MDT has demonstrated consistent efficacy for faster debridement and may be incorporated into wound care algorithms as a biologic adjunct to support wound bed preparation. It can be recommended as a selective, biologically active debridement modality with proven ability to clear devitalized tissue and optimize the wound bed for healing.

HYDROMECHANICAL REMOVAL WITH NPWT

Since the inception of NPWT in 1995, it has been paramount to perform good debridement prior to placing NPWT. A comprehensive review of NPWT is beyond the scope of this article; however, it is important to note that it is often used immediately after wide excisional debridement in the operating room.[84] Moreover, the use of NPWT with a variety of foams, especially if augmented with instillation of fluid, has been shown to prepare the wound bed for skin grafting or other closure techniques (Veraflo Cleanse Choice Complete Dressing [CCC] and Veraflo Cleanse Choice Dressing [CC]; Solventum). Hydromechanical removal of infectious materials, nonviable tissue, and wound debris supports debridement and wound bed preparation at the same time.[85-87] Overall, NPWT with instillation and dwell (NPWTi-d CC and CCC) provides active removal of nonviable tissue while promoting rapid granulation tissue formation; a recent consensus document describes the role that pure hypochlorous acid-preserved solutions can play in amplifying the debridement associated with NPWTi-d.[85] Notably, the authors of a systematic review and meta-analysis reported 27% fewer surgical debridements with the use of NPWTi-d compared with control therapy (2.23 and 3.07, respectively; $P = .01$).[88]

NONCONTACT ULTRASOUND DEBRIDEMENT

Noncontact ultrasound debridement is performed with a specific, low-frequency, noncontact ultrasound device indicated for the cleansing and debridement of chronic wounds (UltraMIST; Sanuwave Health, Inc). No studies have assessed its specific debriding functions. At least 1 prospective study was initiated, but it was withdrawn and not completed.[89] Studies have looked primarily at the increased healing rates.[90] A systematic review recognizes that there is insufficient evidence to state that this therapy really debrides necrotic tissue, but it does suggest that it promotes wound healing.[91]

SHARP DEBRIDEMENT

As discussed in the "Background" section, all debridement encourages healing by converting a chronic, nonhealing wound environment into a more responsive healing environment. While the conversion from chronic to a more acute or balanced inflammatory environment rationale seems logical, the evidence supporting its use in enhancing healing is less robust than one might think.[8,92] There is more evidence in the literature for the debridement of DFUs than of VLUs and pressure injuries.[93] However, the studies on which clinicians have based their rationale for debridement of DFUs have methodologic flaws, in many cases actually showing an association rather than causation between healing and debridement.[30]

POWERED EXCISIONAL DEBRIDEMENT

Complete excisional debridement or extirpation of a wound is not widely done, but it can dramatically improve a wound. Multiple tools are available in the operating room, including curettes and scalpels. However, there are 2 externally powered devices that can potentially improve the operating room experience.

The tangential hydrosurgery device (Versajet; Smith and Nephew) has been associated with reduced times in the operating room (and thus, reduced costs), fewer returns to the operating room, lower hospital readmission rates, and reduced bacterial load in the wound after debridement.[94,95] This device works by the Venturi effect, effectively utilizing a a cutting blade of water that can be

aimed at different angles, depending on the handpiece used. This device can also be used for complete excision of the wound followed by immediate skin grafting.[96]

Another operating room device is a handset with interchangeable tips that is augmented by ultrasonography (SonicOne; LifeNet Health [formerly Misonix]). This device generates ultrasonic vibrations that create cavitations, or "bubbles," in the necrotic tissue, which then implode, disrupting the tissue and making it easier to remove. This device is coupled with a suction feature that removes debris from the wound. In clinical practice, this device has been noted to reduce biofilm and unhealthy tissue while minimizing bleeding.[97,98] This particular device can also be used bedside or in the clinic setting.

Discussion

The overriding objective of this multidisciplinary panel was to codify current processes in chronic wound debridement as practiced in the United States. The panel makeup of experts representing multiple clinical specialties, including basic science, and encompassing all geographic regions of the United States, including urban, rural, and suburban settings, ensured that a diversity of opinion would inform the discussion and provide validity to the resultant consensus statements.

Comparative analysis of voting by the panel between rounds 1 and 2 demonstrated that the level of agreement within the panel increased significantly, particularly on the most contentious statements, for which consensus was initially lacking. The Kendall's *W* value increased from 0.20 to 0.40 on these statements, indicating a shift from weak to moderate agreement. For 14 of the 17 statements, 100% of the panelists either agreed or strongly agreed with the statement. Spearman correlation analysis showed that, although many panelists' views remained stable, others changed, supporting the robustness and validity of the iterative process.

A key takeaway from the consensus panel is the importance of flexibility—matching the debridement method to the clinical context, patient comorbidities, wound characteristics, and available resources. A chutes and ladders approach was discussed to escalate or de-escalate the aggressiveness and debridement methodology in response to changing wound or patient dynamics. A continuum of debridement intensity is available, ranging from passive agents such as autolytic debridement, to active agents such as collagenase or bromelain, to aggressive surgical excision or hydrosurgery. New methods are now available (eg, mechanical debridement using NPWTi-d) or will be available in the future (eg, enzymatic debridement with thermolysin)[18,87] (**Figure 2**). Currently, NPWTi-d works best in conjunction with initial surgical excisional debridement; however, future therapies may reduce the need for surgical debridement.

The importance of proper wound cleansing is emphasized in the present guidance, not simply before debridement or only of the wound bed, but after debridement and including the periwound area. Mechanical cleansing with gauze, combined with appropriate antiseptics, is advocated to ensure biofilm disruption and reduce bacterial burden.

Available diagnostic technologies, such as NIRS, BFI, and thermography, do not replace the clinical judgment of experienced clinicians, but they can provide clinicians with valuable data to inform decision-making. The panel recognized that these technologies are not available in all settings and that although they can help in the decision-making process, they are not essential to reaching good outcomes. The panel also recognized the rapid development of novel diagnostic tools and urges all stakeholders to remain up to date with new validated tools as they become available.

The panel noted that the goals of chronic wound debridement differ from those of acute wound debridement. The goal of chronic wound debridement is to reduce biofilm, remove senescent and quiescent cells, and potentially stimulate dermal and epidermal growth. Acute wound debridement is primarily focused on eliminating the acute bacterial load as well as dead and devitalized tissue to facilitate progression to delayed primary closure rather than secondary closure.

Finally, the panel agreed that the best care involves a robust plan that keeps the patient at the center. There should be clear, frequent communication between the clinician managing the wound care plan, the multidisciplinary team involved, and the patient and their caregiver or caregivers. The patient should be informed of what is planned; what to expect in terms of pain, wound appearance, and likely outcomes; and what comes next. The best outcomes are achieved when patients are actively engaged in and adherent to the prescribed treatment regimen.

Limitations

The recommendations made by this expert panel, as presented in the 17 consensus statements, represent the opinions of the panelists based on their collective, extensive clinical experience and scientific investigation in the treatment and study of chronic wounds. These statements are not the outcomes of an RCT; nevertheless, they are data-driven and evidence-based through decades of professional experience and a deep knowledge of the published literature. Each panelist has a unique background, with different kinds of training and a

variety of professional experiences. While these unique circumstances may also introduce personal biases, the diversity of the panel ensures that the whole is greater than the sum of the parts. The overall agreement on these statements solidifies their generalizability and usefulness to many. All panelists are US-based, and the intent of this consensus panel from the outset was to provide a patient-centric, practical document for a US-based audience.

Conclusion

This multidisciplinary, broad-based consensus panel developed 17 consensus statements to guide wound debridement applicable across diverse wound care settings in the United States. This flexible, context-driven framework will support expert clinicians working in state-of-the-art facilities and wound care practitioners in more resource-limited environments.

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