

## Approach to Wound Bed Preparation in Superficial Soft Tissue Infections: A Comparative Study of Methods of Debridement

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### Abstract

**Introduction:** Venous ulcers (additionally called varicose or venous stasis ulcers) are a chronic, ordinary and debilitating situation that impacts up to at least one% of the populace. The science of wound bed preparation is evolving at a pace faster than ever as advances in molecular techniques are bringing out the pathophysiology of wound healing in a better light. Today's surgeons have an overwhelming choice of newer techniques to assist wound bed preparation from use of recombinant growth factors and genetically engineered tissues to hyperbaric oxygenation. Translating these new principles into everyday practice remains a long way off and one must not forget the importance of assessment of various local and systemic factors that may impair healing.

**Results:** This study involves selecting hundred suffering from acute or chronic wounds, randomly distributing them to the following groups irrespective of age, sex and etiology of wounds and then treating them with different methods of debridement as denoted by the group's name **Group I** Surgical debridement group, **Group II** Autolytic debridement group, **Group III** Mechanical debridement group, **Group IV** Enzymatic debridement group.

**Discussion:** The term debridement comes from the French *debrides*, meaning to unbridle. It was probably first used as a medical term by surgeons working several hundred years ago in war zones, who recognized that grossly contaminated soft tissue wounds had a better chance of healing (and the soldier surviving) if the affected tissue was surgically removed to reveal a healthy bleeding wound surface. When necrotic or foreign material is present in a wound, sharp or surgical debridement can reduce the risk of infection and sepsis and aid wound healing. Several studies have been conducted to compare sharp debridement with enzymatic/ autolytic/ mechanical debridement as by far it has been considered the gold standard of debridement.

**Conclusion:** Even though surgical debridement has by some distance been taken into consideration as the gold standard for casting off necrotic tissue, it could now not essentially be satisfactory. It does remove the supply of infection inside the quickest manner and promotes the levels of healing both proliferative and inflammatory and enables in accurate assessment of the wound however it also destroys the crucial new tissue. Also it can no longer be safe and has headaches like bleeding.

**Keywords:** Review, Debridement, Wound healing, Bacterial load, Hemorrhage.

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## Introduction

Venous ulcers (additionally called varicose or venous stasis ulcers) are a chronic, ordinary and debilitating situation that impacts up to at least one% of the populace. Best exercise documents and expert opinion indicates that the removal of devitalized tissue from venous ulcers (debridement) via any one of six techniques facilitates recovery. However, to date there was no evaluation of the proof from randomized managed trials (RCTs) to assist this. Hydro surgery, further to being a totally particular and selective device, lets in extensively faster debridement. Ultrasound remedy affords a tremendous reduction of exudation, and improves the wound recuperation time. The science of wound bed preparation is evolving at a pace faster than ever as advances in molecular techniques are bringing out the pathophysiology of wound healing in a better light. This remains central to approach to wounds e.g. one cannot expect satisfactory healing in presence of local edema or poor glycemic control in a diabetic or for that matter healing of vascular ulcers in patients with occlusive vessel disease. Experimental evidence suggests that a bacterial load of between  $10^5$  and  $10^6$  organisms per gram in a wound bed, irrespective of the organism, will adversely affect wound healing. With some more virulent organisms, however, a lower level may cause infection [3]. Therapy should reflect the clinical status of the wound and not be based on culture results alone. Over time, the bacterial status of the wound will vary and it is important to recognize the changes that indicate wound deterioration and respond to them quickly. These may include increasing exudate, pain, odour, and bleeding or tissue fragility. Of all the factors controlling infection, host resistance is probably the most important determinant of wound infection and will be influenced by a number of local and systemic factors that include: Vascular disease, Oedema, Diabetes mellitus.

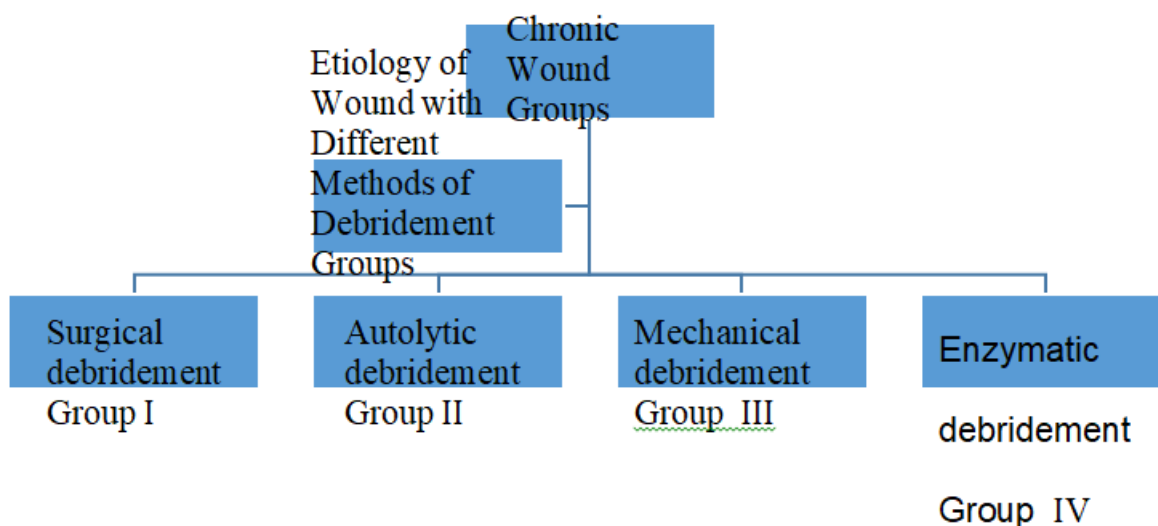
Alcohol abuse, Poor nutritional, status Smoking, Immunosuppression/use of steroid medications.

Correction of the bacterial balance may be inhibited by the presence of a biofilm that consists of attached microorganisms within a secreted glycocalyx. The presence of biofilm represents a focus for infection, which is protected from the effects of antimicrobials, including antibiotics. As seen in the over view above, the most obvious marker of a chronic wound is the presence of necrotic tissue, which can be both a focus for bacteria and a barrier to healing. Debridement occurs naturally within wounds and studies indicate that if this process is accelerated then healing will be more rapidly [4]. Falange [5] stresses the importance of initial and maintenance debridement. In a chronic wound, the pathological processes causing the wound frequently continue in the underlying tissues and may create a reservoir for the production of further exudate and necrotic tissue. However, it is not enough to sustain the healing. Debridement "introduces" the element of acute wound into the chronic wound which wakes up the process of healing in it. Also it repeatedly removes the accumulated necrotic burden without removing the new and healthier tissues [6]. The consequences of not debriding a wound have been defined by Baharestani like Increased risk of infection, Imposition of additional metabolic load, Psychological stress, Ongoing inflammation, Compromised restoration of skin function, Abscess formation, Inability to fully assess the wound depth, Nutritional loss through exudate, Delayed healing. Surgical debridement is critical in the face of necrotic wounds or wounds with eschar. Autolytic, enzymatic and mechanical methods offer various options for maintenance debridement. With the exception of surgical excision of a chronic wound, debridement is rarely completed in one treatment episode. Enzymatic,

chemical, mechanical and autolytic debridement are frequently regarded as safer options, although the risk to the patient of ongoing wound complications is greater [8], [9]. We propose to do a study to compare the various methods of debridement as described above and assess their efficacy in achieving optimized wound bed preparation in wounds of various etiologies eg necrotizing soft tissue infections, diabetic foots, venous ulcers, pressure sores, burn wounds, amputation wounds and so on. These factors are assessed periodically and compared finally to assess the relative efficacy of the four methods.

**Material and Methods**

In this prospective look at, one hundred patients from G.R.M.C Government Medical College Gwalior M.P and Two Hospital JAH and KRH with acute ulcers as well as continual non recovery ulcers along with diabetic ulcers, venous ulcers, decubitus ulcers, publish disturbing and submit -burn uncooked areas, necrotizing tender tissue infections and surgical web page infections who healthy the inclusion criteria have been selected. Thorough examination of wound turned into recorded and additionally a be aware of the grade of wound, swab way of life sensitivity and presence of systemic contamination changed into made at the outset. They were randomly Divided in four businesses every matched for age, intercourse and other comorbid situations.



**Table 1: Wound Assessment**

	0	1	2
Black eschar	>25%	1-25%	0%
Dermatitis	Severe	Moderate	None
Depth of wound	Severely Depressed	Moderately depressed	Raised
Scarring	Severe	Moderate	Minimal or none
% of granulation Tissue	<50%	50-75%	>75%
Edema/swelling	Severe	Moderate	Mild
% of regenerating Epithelium	<25%	25-75%	>75%
Exudate	Severe	Moderate	Mild
<b>Total</b>	<15%	15-75%	>75%

## Results

This study involves selecting hundred suffering from acute or chronic wounds, randomly distributing them to the following groups irrespective of age, sex and etiology of wounds and then treating them with different methods of debridement as denoted by the group's name **Group I** Surgical debridement group, **Group II** Autolytic debridement group, **Group III** Mechanical debridement group, **Group IV** Enzymatic debridement group.

**Etiology** The patients were allocated randomly to the four groups after taking due consent and the differential etiology of wounds in patients in four groups was comparable. The codes allotted to etiology for ease of tabulation were: NSTI Inc Fournier's gangrene, Post traumatic raw area, Post-cellulitis, SSI, Venous ulcer, Diabetic foot, Post burn raw area, Pressure sores. Necrotizing soft tissue infections and diabetic foot were two etiology responsible for maximum number of wounds. The etiology of wounds in patients in the groups was as follows:

### Group I Surgical debridement group

	Frequency	Percent
<b>1.00</b>	3	12.0
<b>2.00</b>	6	24.0
<b>3.00</b>	2	8.0
<b>4.00</b>	7	28.0
<b>5.00</b>	1	4.0
<b>6.00</b>	3	12.0
<b>7.00</b>	1	4.0
<b>8.00</b>	2	8.0
<b>Total</b>	25	100.0

### Group II Autolytic debridement group

	Frequency	Percent
<b>1.00</b>	10	40.0
<b>2.00</b>	1	4.0
<b>3.00</b>	3	12.0
<b>4.00</b>	2	8.0
<b>5.00</b>	2	24.0
<b>6.00</b>	6	4.0
<b>7.00</b>	1	4.0
<b>8.00</b>	2	8.0
<b>Total</b>	25	100.0

### Group III Mechanical debridement group

	Frequency	Percent
<b>1.00</b>	7	25.0
<b>2.00</b>	6	25.0
<b>3.00</b>	2	8.3
<b>4.00</b>	4	16.7
<b>5.00</b>	1	4.2
<b>6.00</b>	3	12.5
<b>7.00</b>	1	4.2

<b>8.00</b>	1	4.2
<b>Total</b>	24	100.0

#### Group IV Enzymatic debridement group

	Frequency	Percent
<b>1.00</b>	4	16.0
<b>2.00</b>	3	12.0
<b>5.00</b>	2	8.0
<b>6.00</b>	7	28.0
<b>7.00</b>	5	20.0
<b>8.00</b>	4	16.0
<b>Total</b>	25	100.0

For each of the subjective and objective criteria, the findings with respect to all the patients in the group were compared. The criteria i.e. discomfort, pain, exudates and time to heal were analyzed using ANOVA in SPS software. For all the criteria and all the patients, the levels of significance were calculated for all days of observation where  $p < 0.05$  was allotted a confidence value of 95% and  $p < 0.01$  was given a confidence level of 99%. The results of

comparison with appropriate statistical analytical technique for all the variables are elaborated in the following pages.

**Considerations in various methods of debridement Table 1:-** Let us assign a score of importance to each consideration from 4+ to 0 as per its relevance while undertaking a debridement procedure: 4+ Extremely important, 3+ Very important, 2+ Important, 1+ Has no bearing / affect, 0 May not be considered at all

	Surgical	Autolytic	Mechanical	Enzymatic
General condition	4+	2+	3+	2+
Comorbidities	4+	1+	2+	1+
Consent	4+	1+	2+	1+
Anesthesia	4+	0	0	0
Pain relief	4+	2+	3+	2+
Technical skill	4+	1+	2+	1+
Anatomical knowledge	4+	1+	2+	1+
Antibiotics	4+	4+	4+	4+
Bleeding	4+	1+	2+	1+
Anesthesia related complications	4+	0	0	0

#### Discomfort:

Discomfort at a scale of two-10 changed into recorded for each patient of all organizations. The sequential periodic records of Discomfort ratings of all of the patients had been as in keeping with Appendix III. These facts were in comparison the usage of the ANOVA method and tiers of importance for difference within the 4 corporations had been calculated. It became obvious that the

reduction in soreness tiers within the autolytic agencies and the mechanical institution was appreciably more than the patients in the other two groups. The least distinction in discomfort becomes cited in patients undergoing mechanical debridement. To similarly verify the remark and for statistical validation of this statistics, Fischer-check became accomplished and p-values calculated. The

results of statistical analysis are as given beforehand-

**Table 2: depicts the statistical comparison between groups with respect to the presenting symptoms**

ANOVA(Analysis of Variance)						
		Sum of Squares	df	Mean Square	F	Sig.
DAY1	Between Groups	3.981	3	1.327	2.420	.071
	Within Groups	52.100	95	.548		
	Total	56.081	98			
DAY3	Between Groups	7.826	3	2.609	2.475	.066
	Within Groups	100.133	95	1.054		
	Total	107.960	98			
DAY7	Between Groups	50.033	3	16.678	9.800	.004
	Within Groups	159.967	94	1.702		
	Total	210.000	97			
DAY14	Between Groups	64.931	3	21.644	9.816	.005
	Within Groups	207.273	94	2.205		
	Total	272.204	97			
DAY21	Between Groups	106.763	3	35.588	13.081	.002
	Within Groups	255.727	94	2.720		
	Total	362.490	97			
DAY28	Between Groups	55.446	3	18.482	9.914	.001
	Within Groups	171.512	92	1.864		
	Total	226.958	95			
DAY35	Between Groups	8.702	3	2.901	2.107	.105
	Within Groups	126.631	92	1.376		
	Total	135.333	95			

This suggests that there is not a significant difference in symptom level at presentation (p-value= 0.071). This further reveals that the difference in the improvement of the symptom (discomfort) is **statistically significant** on days 3, 7, 14, 21 and 28 with 95% confidence limits (p-value < 0.05). On day 35 the comparisons became biased as end points had been achieved in most wounds.

### Pain

Pain at a scale of one-10 was recorded for each affected person of the check group and control organization. The sequential periodic records of Pain scores of all the sufferers are as in step with Appendix III. The ANOVA approach and levels of significance for distinction inside the four corporations had been calculated. It became observed that the discount in ache degrees within the autolytic institution followed intently through the mechanical group became drastically extra than the patients in different companies. To further

verify the remark and for statistical validation of this information, F-check turned into achieved and p-values

calculated. The consequences of statistical analysis are as given beforehand-

**Table 3 depicts the statistical comparison between groups with respect to the presenting symptoms**

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
DAY1	Between Groups	9.401	3	3.134	2.429	.070
	Within Groups	122.558	95	1.290		
	Total	131.960	98			
DAY3	Between Groups	20.920	3	6.973	5.007	.003
	Within Groups	130.917	94	1.393		
	Total	151	97			
DAY7	Between Groups	34.439	3	11.480	5.531	.002
	Within Groups	195.112	94	2.076		
	Total	229.551	97			
DAY14	Between Groups	31.944	3	10.648	3.601	.016
	Within Groups	277.943	94	2.957		
	Total	309.888	97			
DAY21	Between Groups	30.936	3	10.312	4.279	.007
	Within Groups	226.543	94	2.410		
	Total	257.480	97			
DAY28	Between Groups	24.667	3	8.222	4.639	.005
	Within Groups	166.598	94	1.772		
	Total	191.265	97			
DAY35	Between Groups	15.465	3	5.155	4.082	.009
	Within Groups	116.191	92	1.263		
	Total	131.656	95			

This suggests that there is not a significant difference in symptom level at presentation (p-value=0.07).

### Discharge

Discharge at a scale of 1-5 becomes recorded for each affected person to take a look at the group and manipulate the

group. The sequential periodic statistics of discharge ratings of all of the patients are as in keeping with Appendix III. This

information had been in comparison using ANOVA approach and levels of importance for difference within the 4 organizations have been calculated. It turned out to be obtrusive that the reduction in discharge tiers within the autolytic and mechanical groups become extensively greater than the sufferers on top of things. To similarly verify the observation and for statistical validation of these statistics, F-test a look at was carried out and p-values calculated. The

consequences of statistical analysis are as given ahead.

**Table 4 depicts the statistical comparison between groups with respect to the presenting symptoms**

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
DAY1	Between Groups	1.520	3	.507	1.817	.149
	Within Groups	26.500	95	.279		
	Total	28.020	98			
DAY3	Between Groups	19.443	3	6.481	17.002	.000
	Within Groups	36.213	95	.381		
	Total	55.657	98			
DAY7	Between Groups	10.282	3	3.427	5.569	.001
	Within Groups	58.465	95	.615		
	Total	68.747	98			
DAY14	Between Groups	10.216	3	3.405	3.647	.015
	Within Groups	88.693	95	.934		
	Total	98.909	98			
DAY21	Between Groups	9.300	3	3.100	3.270	.025
	Within Groups	90.053	95	.948		
	Total	99.354	98			
DAY28	Between Groups	4.404	3	1.468	2.829	.043
	Within Groups	48.790	94	.519		
	Total	53.194	97			
DAY35	Between Groups	2.447	3	.816	3.288	.024
	Within Groups	23.318	94	.248		
	Total	25.765	97			

For day 35, the comparison could not be done as the discharge in both groups had fallen to a minimum level and the standard deviation from the mean was not significant for either group. This suggests that there is no significant difference in symptom level at presentation (p-

value=0.149). This further reveals that the difference in the improvement of the symptoms (discharge) is statistically significant on days 7, 14, 21 with 95% confidence limits (p value <0.05).

### Discussion

The term debridement comes from the French *debrides*, meaning to unbridle. It was probably first used as a medical term by surgeons working several hundred years ago in war zones, who recognized

that grossly contaminated soft tissue wounds had a better chance of healing (and the soldier surviving) if the affected tissue was surgically removed to reveal a healthy bleeding wound surface [7,8]. When necrotic or foreign material is present in a wound, sharp or surgical debridement can reduce the risk of infection and sepsis and aid wound healing. Several studies have been conducted to compare sharp debridement with enzymatic/ autolytic/ mechanical debridement as by far it has been considered the gold standard of debridement. Devitalized tissue is known to offer a surroundings wherein microorganisms can attach and form biofilms, ensuing in wound infection [9,10]. This may additionally result in a more serious deep tissue contamination



that can be life or limb-threatening. Therefore, a fundamental guideline of treating wounds is that all or any devitalized tissue should be removed and the wound prepared for recuperation, in step with the TIME (Tissue, Infection, Moisture, and Edge) control system [11]. The results of this take a look at show that over the course of the treatment, Hydro Clean plus reached its number one scientific goal of successfully and hastily putting off devitalized tissue and allowing true wound bed coaching in each case. [12] This rapid debridement promoted a healing reaction, leading to an effective recovery of final results for the patients. In addition, each affected person and clinician satisfaction became high in terms of the bodily handling attributes of Hydro Clean plus (eg, application, atraumatic elimination and exudate control) [13-16]. These consequences are supported by means of numerous different scientific research that have demonstrated a success, results with Hydro Clean plus in the debridement and cleaning of continual wounds. A hydro-responsive wound dressing such as Hydro Clean plus promotes autolytic debridement of devitalized tissue and slough and encourages new granulation tissue formation. Evidence for debridement although it is widely accepted that wound debridement is necessary for optimal wound healing, evidence for the effectiveness of different methods of debridement from randomized controlled trials is lacking and methods of measurement are poorly developed (17). If dressings or enzymatic agents are to be compared with surgical and sharp debridement, careful definitions will need to be agreed upon which are reproducible and measurable. Pain control Careful explanation of a debridement procedure together with an agreed place and time can reduce apprehension and promote confidence in the patient and the practitioner. If anesthesia is required it is important that this is given appropriately.

General anesthesia is preferable for extensive debridement, particularly if another procedure is being considered such as closure with a skin flap. It is important that the general fitness of the patient is considered and some patients may elect to have general anesthesia. Wide debridement may not require general anesthesia and spinal or epidural anesthesia can be considered [20].

All acute wounds such as NSTI s were subjected to a thorough surgical debridement. Comparisons were made amongst the four for purposes of maintenance debridement. Unfortunately we lost 2 patients. One was a patient received in a state of advanced sepsis, the source being bilateral diabetic foot. She succumbed to MODS four days after surgical debridement which included amputation. The second patient was a unique case of tropical myocarditis with NSTI. Despite aggressive management, we lost the patient to MODS after 24 days of his presentation to the hospital. Analyses of variables in this study show that the reduction in discomfort levels in the autolytic group and the mechanical group was appreciably more than the patients in the other three groups. Also the difference in the improvement of the symptom (discharge) is statistically significant on days 7, 14, 21 with 95% confidence limits [21-24].

According to Frade et al., the natural bio membrane of latex extracted from *Hevea brasiliensis* proved to be safe as a dressing, for it did not set off allergic reaction reactions the various volunteers who underwent the patch test or amongst customers of the natural bio membrane, because it become clinically and immunologically tested by IgE stages [25-28]. The vegetal bio membrane turned into important for the induction of the healing, specifically on the inflammatory level, confirmed with the aid of the considerable exudation and debridement of the ulcers in relation of the manipulate remedy of

persistent venous ulcers, which seems to be immediately related to the acute vascular formation accompanied by means of epithelialization. [29-31]

### Conclusion

Even though surgical debridement has by some distance been taken into consideration as the gold standard for casting off necrotic tissue, it could now not essentially be satisfactory. It does remove the supply of infection inside the quickest manner and promotes the levels of healing both proliferative and inflammatory and enables in accurate assessment of the wound however it also destroys the crucial new tissue. Also it can no longer be safe and has headaches like bleeding. It calls for an intensive set-up for anesthesia delivery and tracking and this will be cumbersome if the process needs to be repeated. Also an affected person's comorbid reputation might not permit this. Safer options which include autolytic, mechanical and enzymatic debridement optimize the wound surroundings and sell recuperation without a good deal of technical talent. Equivocal outcomes were visible in autolytic and mechanical debridement in reduction in soreness and ache. This observation proves that mechanical debridement may also hasten wound recuperation. The largest gain lies within the reality that these strategies of debridement may be repeated as frequently as the dressings themselves thoroughly and without causing the patient much soreness without compromising the charge of conversion into an appropriately prepared wound mattress.

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