A Prospective Randomized Study Evaluating the Time Efficiency of the VERSAJET◇ Hydrosurgery System and Traditional Wound Debridement

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Introduction

Adequate and efficient debridement is paramount in eliminating wound detritus which acts as a bacterial culture medium, predisposes patients to the potential development of infectious processes and inhibits re-epithelialization. The removal of decaying and necrotic dermal-epidermal elements halts the need for an extensive autolytic immune reaction. Therefore, through metabolic strain reduction, the immune effort within surrounding healthy tissues can shift towards healing. The formation of granular bleeding wound surfaces chemotacticly increase local and systemic factors, which synergistically stimulate the repair process. The process of wound healing is a complex orchestration of cell mediated growth factors and chemotactic signals, ultimately resulting in increased mitotic figures and re-epithelialization (1).

Traditional methods of surgical debridement, through use of sharp and blunt dissection, tend to be inadequate in establishing a border of tissue completely void of nonviable elements. Residual nonviable tissue may remain at the microscopic level and result in the stagnation of the healing process. Chemical debridement agents aid in this situation but work slowly requiring multiple applications and necessitating stringent patient compliance.

The VERSAJET◇ Hydrosurgery System (Smith & Nephew Wound Management) poses a viable alternative to more traditional methods. It rapidly addresses tissue bio-burden both grossly and at the cellular level via complete and total wound debridement.

The system is composed of a reusable power console with foot pedal activation, disposable hand piece and tubing assembly. The system uses a high velocity stream of sterile saline produced by forcing the highly pressurized liquid media through a tiny nozzle at the end of the operator hand piece (1).

The physical principle of the system is based upon the Venturi effect which creates a localized vacuum across the operating window. As the fluid speeds up at the point of constriction, a reduction in pressure occurs and produces a partial vacuum. Therefore, the device is capable of high pressure tissue debridement with concomitant removal of nonviable tissues (1).

Excision and aspiration are performed by orienting the operating window to the tissue plane in question. An oblique angle provides a gentle vacuuming while a more parallel angle provides for aggressive debridement. The effects can be controlled by adjusting the console power settings, hand piece orientation and hand piece pressure (1).

We propose that the VERSAJET Hydrosurgery System will decrease the time required to adequately and efficiently debride wounds as compared to traditional methods.

Materials and Methods

The complexity of surgical wound debridement is determined by the severity of necrosis, fibrosis, overall vascular compromise, wound surface area (SA) and infection. A prospective randomized study intended to evaluate the efficiency and speed of two wound debridement methods was carried out at the Mount Sinai Hospital of Queens (Astoria, N.Y.). Method one (M1) consisted of a traditional debridement technique via the sharp resection of nonviable tissue. Method two (M2) employed the VERSAJET Hydrosurgery System.

Patients were identified, enrolled and categorized based upon wound SA (SA = $\pi\ r_1 r_2$). Surgically indicated wounds underwent blinded randomized debridement via M1 or M2. The procedure length was timed from the initial contact of the instrument to the wound bed, ending when the surgeon had attained a completely granular wound base free of all nonviable tissue.

Wounds were measured and digitally photographed pre-operatively and immediately post-operatively. Wounds were categorized based upon SA into small, medium and large subdivisions for both M1 and M2 populations. The ratio of wound SA to time for complete debridement was evaluated and recorded.

Results

Twenty-seven patients were enrolled into the wound debridement study. The M1 group was composed of 11 patients who underwent traditional debridement via sharp and blunt surgical technique. The M2 group consisted of a total of 16 patients who underwent debridement via the VERSAJET Hydrosurgery System. Wounds ranged in surface area from 65.94 cm^2 to 3.14 cm^2. The location of the lesions were equally divided among the forefoot, midfoot and rearfoot. Common pathologies related to the formation of these wounds included neuropathic ulceration associated with diabetes mellitus, stasis ulcers secondary to peripheral vascular disease and the development of infectious processes. Wounds were deemed appropriate for the study if ≥50% of their SA consisted of fibrous or necrotic debris. Wounds with a SA < 22 cm^2 were defined as small for the purposes of this study. A SA between 22 and 44cm^2 was defined as medium and a SA between 44 and 66cm^2 was defined as large.

The time for complete debridement in the M1 small population averaged 4 minutes 3 seconds while the average of the M2 small population was 1 minute 22 seconds. The time for complete debridement in the M1 medium population averaged 11 minutes 57 seconds while the average of the M2 medium population was 5 minutes 4 seconds. The time for complete debridement in the M1 large population averaged 16 minutes 54 seconds while the average of the M2 large population was 7 minutes 51 seconds.

The overall average rate of debridement was calculated at 0.18cm^2/sec for M1 and 1.67cm^2/sec for M2.

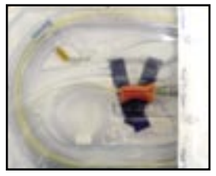
Patient Data

Traditional Debridement

Patient M1	Size (cm)	SA = $\pi\ r_1 r_2$	Time	Mean Time
SMALL				
1	1.00 x 1.25	3.925	5 min 32 sec	
2	2.00 x 1.00	06.28	3 min 25 sec	
3	1.75 x 2.25	12.36	4 min 07 sec	
4	2.50 x 2.00	15.70	3 min 12 sec	
				4 min 3 sec
MEDIUM				
5	2.50 x 3.50	27.48	9 min 24 sec	
6	5.00 x 2.00	31.40	12 min 26sec	
7	3.00 x 3.75	35.33	13 min 20sec	
8	3.25 x 4.50	40.80	12 min 41sec	
				11 min 57sec
LARGE				
9	4.00 x 4.00	50.24	15 min 37sec	
10	4.00 x 4.50	56.52	16 min 11sec	
11	7.00 x 3.00	65.94	18 min 56sec	
				16 min 54 sec

Debridement with VERSAJET

Patient M2	Size (cm)	SA = $\pi\ r_1 r_2$	Time	Mean Time
SMALL				
1	1.00 x 1.00	03.14	0 min 11 sec	
2	2.00 x 1.00	06.28	0 min 15 sec	
3	1.50 x 1.75	08.24	0 min 57 sec	
4	2.00 x 2.00	12.56	2 min 03 sec	
5	2.00 x 2.75	15.70	3 min 27 sec	
				1 min 22 sec
MEDIUM				
6	3.00 x 2.50	23.55	4 min 26 sec	
7	2.75 x 2.75	23.74	3 min 44 sec	
8	3.00 x 3.00	28.26	4 min 30 sec	
9	5.50 x 2.00	28.26	4 min 52 sec	
10	3.00 x 3.75	35.33	5 min 29 sec	
11	4.00 x 3.00	37.68	5 min 37 sec	
12	4.50 x 3.00	42.39	5 min 55 sec	
13	7.00 x 2.00	43.96	5 min 43 sec	
				5 min 04 sec
LARGE				
14	4.00 x 4.00	50.24	8 min 01 sec	
15	6.50 x 2.75	56.13	7 min 10 sec	
16	4.00 x 5.00	62.80	8 min 33 sec	
				7 min 51 sec



Discussion

The VERSAJET Hydrosurgery System is efficient and precisely targets necrotic areas while sparing viable tissue margins. It has multiple applications in traumatically induced injuries, soft tissue infections and wound debridements. Water jet dissection has been used for more than two decades in liver and kidney surgery and more recently, has been used in laparoscopic surgery (2). Surgical debridement through the use of this system provides the operator and patient the benefits of clean, viable and healthy wounds which reduces the need for repeat procedures (1). This benefit is of considerable importance when recognizing the cost of therapy for a foot ulcer has been estimated at $28,000 in the 2 years following diagnosis (3).

A significant difference in debridement time was observed when comparing the two methods. The overall average rate of debridement was 1.49cm2/sec faster than traditional surgical methods. Effective and competent use of the system imparts the benefits of limiting patient anesthesia exposure, decreases the time for blood loss to occur, limits the spread of contaminates in the OR and makes possible more rapid OR turnover rates via tapered procedure times.

In conclusion, the VERSAJET Hydrosurgery System provides a relatively facile method for excision of challenging aesthetic and functional areas (2).

Bibliography

1. Sharma S, McAleer JP. Debriding wounds with the versajet hydrosurgery system. Pod Magmt. 2005 Nov/Dec 24(9): 127-132.
2. Klein MB, Hunter S, Heimbach DM, Engrav LH, Honari S, Gallery E, Kiriluk DM, Gibran NS. The VERSAJET water dissector: a new tool for tangential excision. J Burn Care Rehabil. 2005 Nov-Dec;26(6):483-7.
3. Eldor R, Raz I, Ben YA, Boulton AJ. New and experimental approaches to treatment of diabetic foot ulcers: a comprehensive review of emerging treatment strategies. Diabet Med. 2004 Nov;21(11):1161-73.

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