A retrospective cost analysis of NPWT and HF-dressing

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Introduction

Exudate management is necessary to mitigate the detrimental effects it has on the wound healing process[1-5]. Among the options for exudate management are the many varieties of negative pressure wound therapy (NPWT). The vacuum, created with NPWT systems is stated to promote local perfusion[6] and to assist in the removal of exudate, thus decreasing the inhibitory factors in that exudate[7].

Hydrokinetic Fiber Dressing®[Δ] (HF dressing) consists of a core of modified cellulose fibers and specific gelling agents, encased in a polypropylene enveloping layer. NPWT and HF dressing were shown to have a significant number of similarities with regard to wound bed preparation, including exudate management[8, 9]. A retrospective chart review was used to perform a cost evaluation of the two treatment modalities, analyzing the cost-performance ratio between the HF dressing and a specific NPWT system (VAC♠) and assessing whether or not such cost difference was related to a superiority of the clinical performance of one modality over the other. Non-contact Low Frequency Ultrasound (NLFU)♥ was used as an adjunct treatment in subjects with a significant amount (>25% of the total surface of the wound) of slough and/or necrosis.

Methods

The study was performed with subjects in a long term acute care facility (LTAC). A chart review was used for collecting the data. All subjects who were admitted between March 2012 and April 2013 with orders for NPWT were entered into the study. However, if contraindications for the use of NPWT existed HF Dressing was used instead. Both treatment modalities were used in accordance with the manufacturers' instructions and were combined with standard wound management.

Demographic and wound data were analyzed, including wound surface and volume. Cost of materials was calculated using the real life cost for the facility. For NWPT this included the daily cost of renting the device and, for each dressing change, the cost of dressing materials and canister. For HF dressing the cost of an adhesive foam fixation material♠, used for coverage, was added to the cost of the primary dressing. For both treatment modalities the average cost of NLFU was added for those subjects for whom this option was used.

Demographics

23 subjects (15 males) with 26 lesions (average age: 61.3 years) were treated with HF dressing and 15 subjects (8 males) with 16 lesions (average age 68.3 years) with NPWT.

The types of lesions and their location are presented in Table I. All subjects suffered from one or more co-morbidities (HF dressing average: 3.4, NPWT average: 2.1), ranging from obesity and COPD to terminal illness and kidney or liver failure. NLFU was used as an adjunct in 21 lesions (80%) treated primarily with HF dressing and in two wounds treated with NPWT (12.5%).

Table I

Type of lesion and location, complete data set

Hydrokinetic Fiber Dressing			NPWT		
Type of lesions	Number of lesions	% of total	Type of lesions	Number of lesions	% of total
Venous leg ulcer	3	11.5	Diabetic foot ulcer	3	18.8
Press. ulcer, total	13	50	Pressure ulcer, total	3	18.8
of which unstageable	(1)		of which stage IV	(3)	
of which stage IV	(12)				
Surgical	10	38.5	Surgical	10	62.5
Total	26			16	

Location	Number of lesions		Location	Number of lesions
Lower leg	3		Lower leg	1
Foot	1		Foot	3
Abdomen	5		Abdomen	3
Chest	1		Groin	1
Buttocks	2		Hip	1
Sacrum/Coccyx	10		Sacrum/Coccyx	3
Hip	2		Sternum	2
Iliac crest	1		Shoulder	1
Heel	1		Unknown	1

Table II

Complete data set

Quantity of exudate / Percentage granulation / Percentage epithelium

	Hydrokinetic Fiber Dressing		NPWT	
	Upon study start	Study end	Upon study start	Study end
Exudate amount				
Moderate to large	20	4	4	2
Small or scant		25		14
Granulation				
Beefy Red 75-100%	1	20	4	11
Beefy Red 25-75%	2	6	4	2
Pink, Dull < 25%	16	0	6	2
None	7	0	2	0
Unknown	0	0	0	1
Epithelium				
50-75%	0	4	0	3
25-50%	0	15	0	5
< 25%	26	7	16	8
Pain (visual analogue scale: 0=no pain, 10=excruciating pain)				
Percentage difference	3.7	0.6 (84%)	0.7	0.2 (75%)

Table III

Average Cost of Materials, Entire Treatment period

Both treatment groups, all subjects

	Hydrokinetic Fiber Dressing	NPWT	Difference (in $$)	Difference (in %)
	N=26	N=16		
Total avg. cost of materials / wound	$661.46	$2,301.55	$1,640	348%
Cost per % surface reduction	$22.20	$66.33	$44	299%
Cost per % volume reduction	$13.87	$34.66	$21	250%
Cost per day	$22.66	$84.27	$62	372%
Avg. # of dressing changes	13	12		

Both treatment groups, only subjects without Non-contact Low Frequency Ultrasound adjunct

	Hydrokinetic Fiber Dressing	NPWT	Difference (in $$)	Difference (in %)
	N=5	N=14		
Total avg. cost of materials / wound	$132.38	$2,374.6	$2,242	1794%
Cost per % surface reduction	$4.98	$67.65	$63	1359%
Cost per % volume reduction	$2.04	$34.46	$32	1690%
Cost per day	$5.52	$81.48	$76	1477%
Avg. # of dressing changes	10	12		

Both treatment groups, only subjects with Non-contact Low Frequency Ultrasound adjunct

	Hydrokinetic Fiber Dressing	NPWT	Difference (in $$)	Difference (in %)
	N=21	N=2		
Total avg. cost of materials / wound	$799.62	$1,504.62	$705	188%
Cost per % surface reduction	$26.13	$47.46	$21	182%
Cost per % volume reduction	$18.34	$30.46	$12	166%
Cost per day	$27.80	$103.77	$76	373%
Avg. # of dressing changes	13	6		

Figure I
Wound surface (cm^2): change from study start to study end

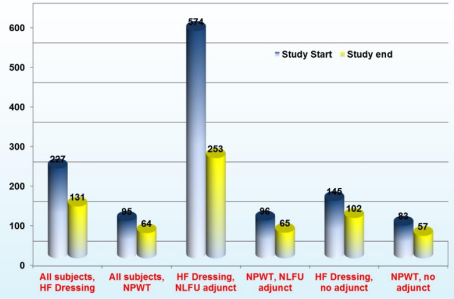


Figure II
Wound surface (cm^3): change from study start to study end

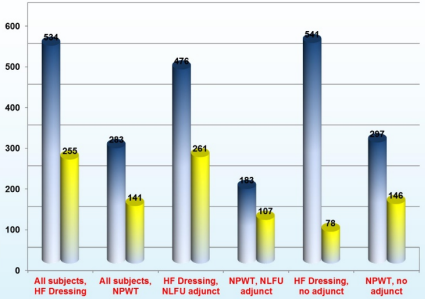
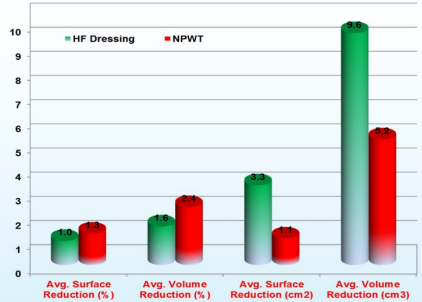


Figure III
Average reduction per day per treatment type



Results

On average, subject's lesions were in the study for 29.2 (HF dressing) and 27.3 (NPWT) days with dressing changes taking place three times per week. For all lesions combined the average number of dressing changes in the HF dressing group was 13 and 12 in the NPWT group.

The entire population, as well as two subsets populations were analyzed on healing results and cost of materials. One of these subsets included only lesions in both study populations treated with NLFU (HF dressing: N=21, NPWT: N=2) and the second included only lesions in both study groups treated without NLFU (HF dressing: N=5, NPWT: N=14).

General trends with regard to aspects of healing were very similar amongst the complete data set and the subsets. Thus, for the amount of exudate, the percentage of granulation tissue and epithelium, as well as pain levels, only the results for the complete data set are reported (Table II).

The size of the wound surfaces and volumes (study start, study end) in the complete patient population as well as in the two subsets are presented in Figures I and II while Figure III shows the average reduction per treatment group per day, expressed as percentages and absolute quantities (cm^2 and cm^3). At study end, the average surface reduction of the entire HF dressing population was 42% and the average volume reduction was 52%. For the NPWT treated wound these percentages were 33 and 50 respectively.

Significant cost differences were observed in the all-subjects-combined data sets as well as in the two subsets with regard to the total average cost of materials per lesion, the cost per percentage surface and volume reduction, as well as the cost per day (Table III). For example, when comparing cost of materials for the two datasets containing all wounds the total cost per wound was $ 661.46 for HF dressing and $ 2301.55 for NPWT, a cost difference of $ 1640 (348%).

Limitations

A retrospective study has inherent limitations such as the lack of randomization. In this review most subjects in both groups suffered from pressure ulcers and surgical lesions left to heal by secondary intention. Most of the lesions were large with the lesions in the HF dressing group being substantially larger than those in the NPWT group. All subjects were also suffering from co-morbidities, many of them serious.

Discussion

Negative Pressure Wound Therapy has been used quite successfully for exudate management[8,7] but the therapy has a number of recognized side effects and risks[10]. In addition, NPWT often is prescribed for wounds that, in fact, have (relative) contraindications for the use of NPWT according to the manufacturers of the different devices. Since HF Dressing was shown to provide a proper alternative to NPWT in an expert panel and Delphi panel review[9] the cost of these two treatment options was assessed.

Length of stay (and, thus, subject participation in this study) in an LTAC facility is limited and given the seriousness and size of the lesions it was not expected that any of the subjects would reach complete reepithelialization. Still, within the study period 17 lesions in the HF dressing group and eight in the NPWT group showed a level of reepithelialization between 25 and 75% of the original wound surface. In fact, virtually all lesions in both treatment groups showed progress over the treatment period with regard to healing *per se* (change of necrosis to granulation, reepithelialization). Depending on the actual healing parameter results were equivalent to substantially superior for the HF dressing treated wounds (Figures I-II).

Cost of materials showed very consistent trends, with absolute cost, cost per day, and cost per percentage of surface and volume healing being substantially lower for HF Dressing (Table III), for the entire study population as well as for the subpopulations. Calculating total cost of care was not the purpose of this evaluation and, for example, nursing time during dressing changes was not measured. However, given the complexity of NPWT removal and application it is safe to assume that, for the same number of dressing changes, the cost of nursing would have been much higher for NPWT than for the HF dressing.

Conclusion

Optimally preparing a patient for discharge is amongst the most important goals of treatment in an LTAC facility. To be able to do this properly different treatment protocols need to be available to attain such a goal and these include NPWT, as well as treatment with Hydrokinetic Fiber Dressing, with or without Non-contact Low Frequency Ultrasound.

In a retrospective chart evaluation serious wounds in subjects with serious co-morbidities were treated with one of these two treatment protocols. When evaluating all subjects in the two groups healing trends were more positive for the HF dressing while the cost of materials was significantly lower for this modality. Similar results were observed in two subset populations.

This evaluation indicates a strong trend towards the Hydrokinetic Fiber Dressing protocol being at least equal to NPWT with regard to healing while offering a substantial reduction in cost of materials.

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