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Foam Dressings in the Topical Management of Diabetic Foot

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***Abstract*:**
Introduction*: Diabetic foot is one of the major complications of diabetes mellitus. In India,the prevalence of diabetic foot ulcers was estimated to be 3.6%.Topical treatment is an important aspect of diabetic foot ulcers although secondary to surgical and systemic care. this study is about the outcome of using polyurethane foam dressings in topical management of diabetic foot ulcers.*
Objectives*To evaluate the outcome of using polyurethane foam dressing in topicalmanagement of diabetic foot ulcers secondary to systemic therapy.*
Methodology*30 patients who presented to Department of general surgery with complaints of diabetic foot ulcers, based on the inclusion and exclusion criteria were taken up for the study. Poly-urethane foam dressings were used and wounds were evaluated periodically based on Visual scoring system[9] on Necrotic tissue, granulation tissueand assessment of wound surface area.*
Results*In our study 63% of patients were males and the rest were females. 66.7% of patients had a history of trauma preceding the ulcer onset and the rest of the patients had a spontaneous ulcer formation. 70% of the patients had 100% granulation at the end of 7th dressing. Healing was achieved in all wounds. The mean percentagereduction in wound size at the end of 7th dressing compared to base line dressing was 34.5% which is comparable to previous similar studies.*
Conclusion*:In summary our study shows polyurethane foam dressing is effective in treating diabetic foot ulcers secondary to systemic therapy. It promotes reduction of wound surface area and better wound bed granulation. Polyurethane foam dressing is not only convenient for the patient but also reduces the wastage of resources. With this significant reduction in wound surface area, patients can be planned for appropriate surgical interventions if necessary.*
***Key Words*:** *Diabetic foot, foam dressing, granulation tissue, polyurethane, ulcer*

I. Introduction

Diabetes mellitus in characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both[5]. Diabetes is accompanied by a progressive tissue damage secondary to micro and macrovascular complications. It is the leading cause of end stage renal disease, a major cause of non traumatic amputations, responsible for 30% of the preventable blindness and a leading cause of cardiovascular mortality[5].

The prevalence of diabetes is rapidly rising all over the globe at an alarming rate. According to the world health organization, at least 171 million people worldwide have diabetes. The figure is likely to double by 2030. The WHO predicts that developing countries will bear the brunt of this epidemic in 21st century[5].

WHO reports show that 32 million people had diabetes in India in the year 2000 and this number is likely to be 71.4 million in 2030. Diabetic patients suffering from chronic foot ulcers may eventually have to undergo Amputation[6].Diabetes mellitus is recognized to be common in Indians in the Asian subcontinent. The projection indicates that India will have largest number of diabetic patients by the year 2025[7].

Diabetic foot is one of the major complications of diabetes mellitus. One in every six people with diabetes will have a foot ulcer during his /her life time. In order to estimate accurately the occurrence of diabetic foot ulcers and risk factors associated with this diabetic complication, the international consensus on the diabetic foot currently defines a diabetic foot ulcer as a full-thickness wound below the ankle in a patient with diabetes irrespective of duration[8].

In India, the prevalence of diabetic foot ulcers in clinical population was estimated to be 3.6%.3 Socio-cultural practices such as bare-foot walking, use of improper foot wear and lack of knowledge regarding foot care contributes towards increase in prevalence of foot complications in India[4].

Foot infection is the most common reason for hospitalization accounting to upto 25% of admissions. 15% of the patients develop foot ulcers during their lifetimes. If untreated they end in lower extremity amputation[6].

Diabetic foot ulcers should be treated aggressively to improve the quality of life, control infections, maintain patient's health, prevent amputations and to reduce health care costs. Topical treatment is an important

aspect of diabetic foot ulcers although secondary to surgical and systemic care. No hard evidence exists to place any one approach above another.

In ancient Greek and Roman medicine, sea sponges were used to absorb fluid from wounds. These were also soaked in wine and used as an antibacterial wound dressing. In 1880s the foam was made from gauze, cotton and coconut fiber, and had a center capsule containing an antiseptic. Later these sea sponges, small pieces of which were impregnated with extracts of opium and lettuce seeds and inserted into nostrils of patients as a anesthetic device to induce sleep prior to surgery. Foams were one of the first 'modern' dressings to be used in wound management and became widely available in the mid-1970s. The first foam to be used in general wound management was silastic foam and were mostly used in pilonidal sinus cavity wounds. It comprises a two-component product presented as two separate liquids, a polymer and a catalyst. When mixed together and poured into a cavity wound, they react, releasing heat and expanding to form a more solid structure that conforms to the shape of the cavity. Silastic foam is able to expand to about four times its original volume. The dressings are able to absorb exudate into the air spaces within the structure in a similar manner to other foam dressings. Modern foam dressings are mostly polyurethane sheets which are soft and contain a hydrophilic and hydrophobic end. The hydrophilic end absorbs the exudates by capillary action and it is held within the structure thereby removing the exudates and edema fluid and enhancing epithelialization. Our aim was to study the outcome of polyurethane foam dressings in the care of diabetic foot.

II. Materials And Methods

Patient Selection

From february 2014 to august 2015, 30 patients admitted to SRM Medical college hospital and Research Institute, SRM Nagar, Kattankulathur, Kanchipuram Dist, Tamil Nadu with and undergoing care for diabetic foot were selected for the study. We included patients of all ages and with a minimum ulcer size of 5cm. patients with vascular compromise, renal impairment, osteomyelitic changes, with a suspicion of malignancy, pressure sores and those on immunosuppressive and chemotherapy agents were excluded out of the study.

A simple randomization was done and the selected patients underwent foam dressings. All patients gave written informed consent before inclusion in the study.

Procedure

After getting Ethics committee clearance and obtaining consent, patients were taken up for the study. The patients were assessed with blood parameters - Complete blood counts, blood sugar values, Renal function tests, x ray of ulcer area involved, wound swab/pus culture sensitivity from the ulcers and Doppler study. Size of the ulcer was measured and visual scoring was done based on the necrotic and granulation tissue. Bed side mechanical wound debridement was done and wound was washed with normal saline. Polyurethane foam dressings were applied and antibiotics were started empirically. After 3 days, dressings were opened and wound was reassessed in regard to size and visual score. Debridement and saline wash were done if required and new foam dressings were applied. Antibiotics were changed in concordance to culture sensitivity reports. The same was continued until a total of eight dressings or the wounds attaining a maximum visual score of 6 and 4. The wounds which had achieved the maximum visual score before the completion of eight dressings, were still assessed in regard to the size of the ulcer but no new foam dressings were applied.

III. Results

In our study, 63% of the patients were males, and 30 % of the patients were in the age group of 51-60 years.46.7% of the patients had an ulcer of <10cm on the time of admission and 67% of the patients had a history of trauma preceding the ulcer onset. Base line mean surface area of the ulcer when compared to the 1st, 2nd and 3rd dressing had a negative co-relation and in-significant P value. This can be attributed to the aggressive wound debridement which was done initially to remove the necrotic tissue thereby increasing the ulcer surface area.

There was 9.8% of reduction in wound size on completion of 4th dressing compared to the base line surface area of ulcer and there was 25.9% reduction in wound surface area at the end of 6th dressing compared to base line surface area of the ulcer with the above reduction in size of the ulcer having a highly significant P value of <0.001 as calculated by Chi-Square / Fischer Exact test.

In our study, two patients had a completely healed ulcer. The mean percentage of reduction of wound size comparing base line ulcer surface area and at the end of the study was 34.5% with a highly significant P value of <0.001 calculated by Chi-Square / Fischer Exact test. This is comparable to previous similar studies conducted by Nather et al [1], where the study, which was a prospective case series study was conducted on 11 patients and had 24.9% of mean wound area reduction. A randomised control trial conducted by Eginton et al showed 59% of reduction in wound surface area[2].

IV. Figures & Tables

Distribution According To Age

Age in years	Sex		Total
	Male	Female	
30-40	4(21.1%)	0 (0%)	4 (13.3%)
41-50	4(21.1%)	1(9.1%)	5(16.7%)
51-60	3(15.8%)	6(54.5%)	9(30.0%)
61-70	4(21.1%)	2(18.2%)	6(20.0%)
Above 70	4(21.1%)	2(18.2%)	6(20.0%)
Total	**19**	**11(100.0%)**	**30(100.0%)**

Table Showing Presence Of Granulation Tissue

Study period	1	2	3	4
Base Line	21 (70.0%)	9 (30.0%)		
1st Dressing	21 (70.0%)	8 (26.67%)	1 (3.33%)	
2nd Dressing	8 (26.67%)	16 (53.33%)	6 (20.0%)	
3rd Dressing	2 (6.67%)	19 (63.33%)	8 (26.67%)	1 (3.33%)
4th Dressing		11 (36.67%)	14 (46.67%)	5 (16.67%)
5th Dressing			22 (73.33%)	8 (26.67%)
6th Dressing			16 (53.33%)	14 (46.67%)
7th Dressing			9 (30.0%)	21 (70.0%)

Table Showing Surface Area Of Ulcer In Cm

Period of study	0-5	6-10	11-15	16-20	> 20
Base line	2 (6.67%)	12 (40.0%)	8 (26.67%)	5 (16.67%)	3 (10.0%)
1st Dressing	2 (6.67%)	11 (36.67%)	8 (26.67%)	5 (16.67%)	4 (13.33%)
2nd Dressing	4 (13.33%)	10 (33.33%)	7 (23.33%)	5 (16.67%)	4 (13.33%)
3rd Dressing	6 (20.0%)	8 (26.67%)	8 (26.67%)	4 (13.33%)	4 (13.33%)
4th Dressing	7 (23.33%)	9 (30.0%)	8 (26.67%)	3 (10.0%)	3 (10.0%)
5th Dressing	7 (23.33%)	13 (43.33%)	4 (13.33%)	4 (13.33%)	2 (6.67%)
6th Dressing	10 (33.33%)	10 (33.33%)	6 (20.0%)	2 (6.67%)	2 (6.67%)
7th Dressing	11 (36.67%)	10 (33.33%)	5 (16.67%)	3 (10.0%)	1 (3.33%)

Table Showing Comparison Of Surface Area Of Ulcer And Period Of Dressing

Surface area (S.A) VS Dressing	Mean	N	Std. Deviation	Std. Error Mean	P value
S.A –base line	12.03	30	5.974	1.091	
S.A -1st Dressing	12.60	30	6.234	1.138	0.006
S.A –base line	12.03	30	5.974	1.091	
S.A -2nd Dressing	12.50	30	6.485	1.184	0.065
S.A –base line	12.03	30	5.974	1.091	
S.A -3rd Dressing	11.71	30	6.359	1.161	0.232
S.A –base line	12.03	30	5.974	1.091	
S.A -4th Dressing	10.84	30	6.192	1.130	0.000
S.A –base line	12.03	30	5.974	1.091	.
S.A -5th Dressing	9.83	30	6.023	1.100	0.000
S.A –base line	12.03	30	5.974	1.091	.
S.A -6th Dressing	8.91	30	6.001	1.096	0.000
S.A –base line	12.03	30	5.974	1.091	
S.A -7th Dressing	7.87	30	5.935	1.084	0.000

Figure 5: Method of Application of Foam Dressing

V. Conclusion

In summary polyurethane foam dressing is effective in treating diabetic foot ulcers secondary to systemic therapy. It promotes reduction in wound surface area and wound bed granulation. As the dressings are changed once in 3 days and once the patients diabetic status is stable, patients can be reviewed once in 3 days and thereby the need of prolonged hospital stay can be reduced.

Polyurethane foam dressing is not only convenient for the patient but also reduces the wastage of resources. Thus large diabetic foot ulcers were made more manageable. With this significant amount of reduction in wound surface area, patients can be planned for appropriate surgical intervention if necessary.

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