

Efficacy of Topical Insulin Dressings V/S Normal Saline Dressing On Diabetic Foot Ulcer - A Hospital Based Study

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I. Introduction

The prevalence of diabetes is increasing worldwide. India ranks second in the world with 165.1 million diabetic patients. The various lower limb complications in diabetic patients are peripheral neuropathy, Charcot's arthropathy, foot ulcers, infections and lower extremity amputations¹ which may lead to hospitalization and disability among the diabetics² Indolent, non healing foot ulcers constitute a major problem that plagues those with diabetes due to angiopathy and neuropathy. It is well known that the basic cellular and molecular mechanisms that result in wound healing involve cell adhesion, migration, proliferation, differentiation, and apoptosis³. Abnormalities of distinct factors contribute to defective wound healing in diabetes, including decreased growth factor production⁴, angiogenic response^{5,6}, macrophage function⁵, collagen accumulation, epidermal barrier function, and keratinocyte and fibroblast migration and proliferation³ Wound dressings represent a part of the management of diabetic foot ulceration. Conventional dressings were found ineffective in management of these ulcers as they respond poorly thereby increasing hospital stay of the patient. Previous data showed that topical insulin dressing accelerates wound healing in the skin of diabetic rats and humans^{7, 8, 9}. Insulin stimulates the growth and development of different cell types and affects proliferation, migration, and secretion by keratinocytes, endothelial cells, and fibroblasts^{10,11}. on diabetic foot ulcers and to compare topical insulin dressing with normal saline and betadine dressing.

II. Materials And Methods

A randomized, prospective study had been conducted in patients with diabetic foot infections admitted in Subharti Hospital, Meerut between the time period of August 2015- August 2017, after clearance from Institution Ethical Committee. The patients aged above 20 years of either sex with diabetic foot ulcers with Wagner grading of I-IV will be included in the study. Patients who will be excluded from study are as follows: - a) patients with diabetic foot ulcers of Wagner grade V. b) X-ray showing features of osteomyelitis. c) Doppler showing gross atherosclerotic changes and venous abnormalities like varicosities. d) Malnutrition and uncontrolled diabetes mellitus. e) Other clinically significant medical conditions that would impair wound healing like any hepatic, renal, immunological and neurological disease. f) Patients receiving corticosteroids, other immunosuppressive agents, radiation or chemotherapy one month prior to entry into the study. (g) Patients who had been previously operated for diabetic foot infections. Patients fulfilling the inclusion criteria were randomized in two groups. In Group A, topical insulin will be used for dressing. In Group B normal saline will be used for dressing. In Group A, ulcers will be cleaned with normal saline and then irrigated with 4 units (0.1 ml) of human soluble insulin (Actrapid) in 1 ml normal saline (0.9%) for each 10cm² of wound. The solution will be then sprayed on the ulcer surface with an insulin syringe and ulcer will be left to dry and then covered with sterile cotton gauzes. Dressing will be done twice daily. In Group B, ulcer cleaned with normal saline without insulin and covered with sterile gauzes. All patients will be given Cap. Ampicillin 250 mg, Cloxacillin 250 mg qid at the time of admission. Metronidazole 400mg tds was given to all patients as anaerobic culture had not done in our study. Later antibiotics will be changed according to pus culture and sensitivity reports. Ulcer size, its depth, reduction in discharge and slough and granulation tissue will be evaluated. This evaluation will be done till 12 days. Patients will be subjected to the statistical computation with appropriate statistical method using STAT GRAPHICS CENTURION for windows. The value of p<0.05 will be considered as significant and p< 0.01 as highly significant

III. RESULTS

At day 0

Group	Mean Size (In Cm ²)	Mean Depth (In Mm)	Slough Present	Granulation (Healthy)	Culture (Positive)
A	4.8±0.6	8.6±0.9	20(100%)	0(0%)	20(100%)
B	4.9±0.6	8.4±0.7	20(100%)	0(0%)	20(100%)

At day 6

Group	Mean Size (in cm ²)	Mean Depth (in mm)	Slough present	Granulation healthy	Culture positive
A	3.9±0.7	6.7±0.7	13(65%)	7(35%)	13(65%)
B	4.2±0.5	7.3±0.7	18(90%)	2(10%)	18(90%)

At day 12

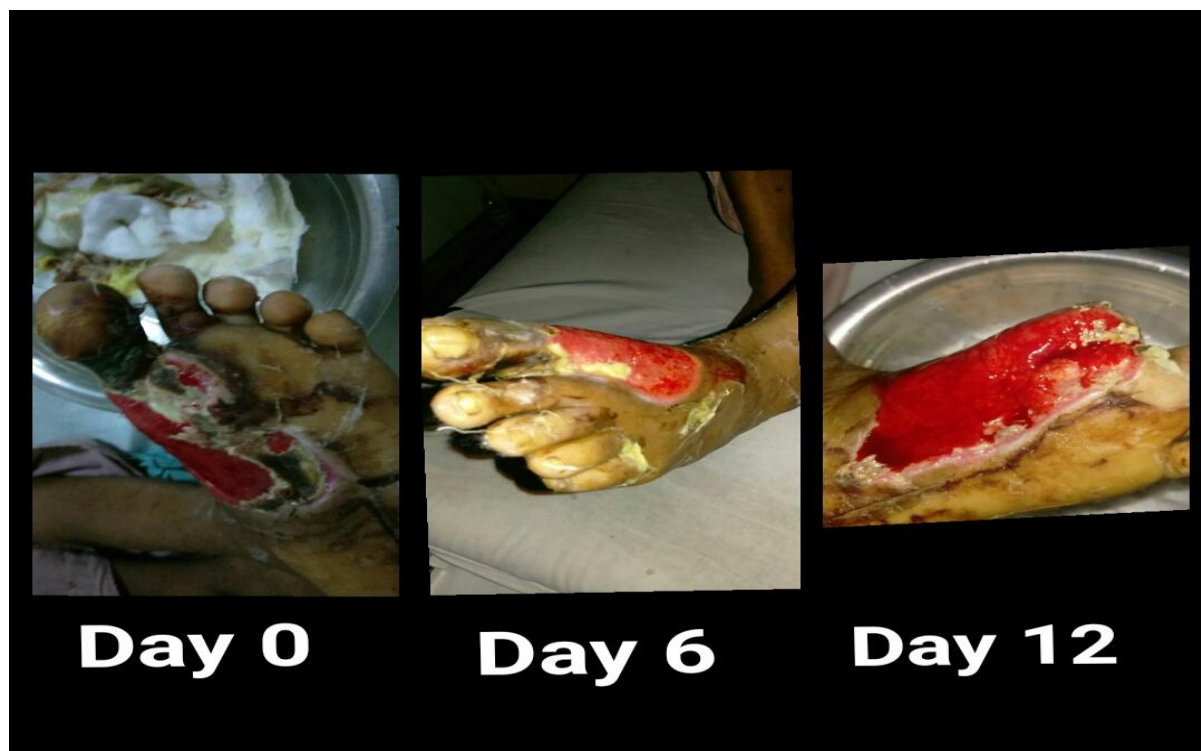
Group	Mean Size (in cm ²)	Mean Depth (in mm)	Slough present	Granulation healthy	Culture positive
A	1.5±0.3	4.1±0.7	6(30%)	14(70%)	6(30%)
B	1.9±0.5	5.8±0.8	15(75%)	5(25%)	15(75%)

Group	Grafting	Amputation	Mean duration of hospital stay(days)	debridement required	Mean HbA1C	Mean sugar level	Mean duration of diabetes mellitus (months)
A	12(60%)	0(0%)	21.0±4.4	8(40%)	6.1±0.6	241.4±32.0	70.8±7.0
B	16(80%)	2(10%)	25.9±4.3	18(90%)	6.5±0.4	244.6±36.7	75.8±12.7



Day 0

Day 12



IV. Discussion

In our study, 42 (70%) patients were in age range 41-60 years in all two groups..Majority 42 (70%) were males and 18 (30%) were females. The age range in our study was between 42 to 78 and mean age was found to be 60 years, which is comparable to study done by Jyothylekshmy V et al¹², who observed 200 (72.2%) males and 77 (27.7%) females. The age range was between 19 and 87 and the mean age was found to be 61 years. In our study mean duration of diabetes mellitus was found to be 70.8 ±7 months in group A 75.8±12.7 in group B .In a similar study performed by Madanchi et al¹³ who observed 873 patients of diabetic foot ulcer found mean duration of diabetes mellitus was 172.2 months .In our study mean HbA1C was 6.1±0.6% in group A, 6.5±0.4% in group B which is comparable to Madanchi et al¹³ in whom study 14.4% patients had HbA1C<7% and 85.6% patients had HbA1C>7%.The mean HbA1C level in his study was found to be 9.51%. In our study the mean sugar level in group A was 241.4 ±32mg/dl, 244.6±36.7 mg/dl in group B.The mean blood sugar in a study by Madanchi et al¹³ was 198.7mg/dl. In our study, at the time of admission all patients 40(100%) had slough and unhealthy granulation tissue in it. The mean ulcer area at the time of admission in group A was 4.8 ± 0.6 cm² , 5.35±0.6cm² in group B. The mean depth of ulcer at the time of admission was 8.6±0.9mm in group A, 8.4 ±0.7mm in group B. In a study Swaminathan et al¹⁴ the mean ulcer area in insulin group was 4.1 cm² and in saline group it was 3.1cm². In group A at day 6, the mean ulcer surface area was found to be 3.9±0.7cm² and mean depth of ulcer was 6.7±0.7mm. At day 12, mean surface area of ulcer was 1.51 ±0.3 cm² and depth was found to be 4.1±0.7mm. In group B at day 6, mean ulcer surface area was 4.24±0.5cm² and mean depth of the ulcer was 7.3±0.7mm. At day 12, the mean size of ulcer was found to be 1.9± 0.5 cm² and mean depth was found to be 5.8±0.8mm. The mean difference in surface area of ulcer after 12th day was 3.2±0.7cm² in group A, 2.9±0.8cm² in group B. The mean difference in depth of ulcer was 4.4±1.2mm in group A , 2.5±0.9mm in group B. So after day 12, reduction in surface area was more in group A than in group B. The statistical difference for difference in mean depth of ulcer after 12 was found to be significant between A and B (p= 0.001). In a study by Swaminathan et al¹⁴ the mean ulcer size was reduced to 1.6 cm² in insulin group and 2.9cm² in saline group after 4 weeks. In our study at day6 of admission, 13(65.0%) patients in group A, 18(90.0%) patients in group B. At day 12, 6(30%) patients of group A had slough, 15(75%) patients of group B had slough. At day 12, the statistical difference between the patients with Slough & those without Slough in group A & B was significant, P=0.004. At 6th day, granulation tissue was healthy in 7 (35.0%) patients in group A, 2(10%) patients in group B. At day 12, healthy granulation tissue was found in 14(70%) patients in group A, 5(25%) patients in group B. At day 12, the statistical variation between the patients of group A & B was significant P=0.004. At day 6, 13(65%) patients had positive culture (polymicrobial or monomicrobial) in group A as compared to 18(90%) patients in group B. at day 12, only 6(30%) patients had positive culture in group A as compared to 15(75%) patients in group B. In the study by Reddy CV et al¹⁵ wound culture after 14th day was found to be negative in 73.33% of patients in insulin group and 56.67% in

normal saline group. So topical insulin is effective in reducing microbial colonization of ulcer which in turn helps in wound healing. 8(40%) patients of group A required debridement after dressing while 2(90%) patients in group B required debridement after dressing. This reduction of requirement of surgical debridement in group A was very important as it not only reduces cost but also had the advantage of not exposing patients to trauma and morbidities associated with anesthesia. In Group A, 8 (40.0%) patients were such in whom no secondary intervention (grafting or amputation) were required. 12 (60.0%) patients were subjected to grafting of affected lower limb and none underwent Amputation. In group B, no secondary intervention required in 2 (10.0%) patients while 16 (80.0%) patients were subjected to grafting of affected limb and 2(10.0%) were subjected to Amputation (2 case of great toe amputation). In group A mean duration of hospital stay was 21.0±4.4 days while in group B the mean duration of stay was 25.9±4.3 days. The study was comparable with the study Goenka et al¹⁶ in whom the mean duration of hospital stay was 38±7.03 days in insulin group and 44.3±17.5 day in saline group.

V. Conclusion

In our study we conclude that the topical application of insulin in diabetic patients with ulcers has a significant improvement in healing of the ulcer with reduced hospital stay and cost of treatment.

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