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Original Article

Effect of Topical Insulin on Healing of Chronic Ulcers: A Randomized Controlled Study

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ABSTRACT

Background: Chronic ulcers, particularly diabetic foot ulcers, are associated with delayed healing, increased morbidity, and prolonged hospital stay. Insulin, beyond its metabolic role, has been shown to promote wound healing through angiogenesis, collagen synthesis, and cellular proliferation.
Aim: To evaluate the efficacy of topical insulin in enhancing healing of chronic ulcers compared to conventional normal saline dressing.
Methods: This randomized controlled study included 70 patients with chronic ulcers admitted to a tertiary care center. Patients were randomly allocated into two groups: Group A (topical insulin dressing) and Group B (normal saline dressing). Wound size was measured weekly, and outcomes including rate of healing, duration of hospital stay, and blood glucose levels were analyzed.
Results: The rate of wound healing was significantly higher in Group A compared to Group B (diabetic ulcers: 151.87 ± 34.16 vs 108.22 ± 23.90 mm²/week, p=0.01). Hospital stay was significantly reduced in Group A (36.7 ± 3.3 vs 48.0 ± 4.9 days, p=0.001). A statistically significant reduction in blood glucose levels was also observed (p=0.013). No hypoglycemic episodes were recorded.
Conclusion: Topical insulin significantly accelerates wound healing and reduces hospital stay in patients with chronic ulcers. It is a safe, cost-effective, and practical adjunct to conventional wound care.

Keywords: *Chronic ulcer, topical insulin, wound healing, diabetic.*

INTRODUCTION

Diabetic foot ulcers (DFU) are one of the most common and serious complications of diabetes mellitus(1).These are chronic non-healing wounds that may lead to infection, gangrene, and lower limb amputation if untreated(2). Approximately 15% of diabetic patients develop foot ulcers during their lifetime, and nearly 6% eventually require surgical amputation(3). DFUs are classified into neuropathic, ischemic, and neuroischemic ulcers based on the presence of peripheral neuropathy and peripheral arterial disease(4-5). Diabetic neuropathy contributes to nearly 90% of ulcers by causing loss of sensation, muscle weakness, reduced sweating, and impaired skin integrity, making the foot vulnerable to trauma and infection(6). Peripheral arterial disease further compromises blood supply and delays healing. Chronic ulcers are wounds persisting for more than six weeks without significant healing(7-8). Growth factors such as insulin-like growth factor and insulin promote angiogenesis, collagen synthesis, and granulation tissue formation(9). Therefore, this randomized study compared local insulin dressing with conventional saline dressing to evaluate the effectiveness of insulin therapy in diabetic foot ulcer healing.

MATERIALS AND METHODS

Study Design:
Randomized controlled trial

Study Setting:
Department of General Surgery, MGM Medical College, Indore

Study Duration:
12 Months From the approval from ethics committee

Sample Size:
70 patients

Inclusion Criteria
- Patients aged >18 years
- Chronic ulcers (diabetic, infective, traumatic)
- Patients willing to provide informed consent

Exclusion Criteria
- Immunocompromised patients
- Patients lost to follow-up

Methodology
Patients were randomly allocated into two groups:
- Group A (Intervention Group): Topical insulin dressing
- Group B (Control Group): Normal saline dressing

All ulcers were cleaned with normal saline and surgically debrided when required.

Intervention Protocol:
Topical insulin was prepared using 4 IU of regular human insulin diluted in 1 ml normal saline per 10 cm^2 of wound area. The solution was applied once daily and covered with sterile gauze.

Control Protocol:
Wounds were dressed daily with normal saline and sterile gauze without insulin.

Outcome Measures
- Rate of wound healing (mm^2/week)
- Duration of hospital stay (days)
- Random blood glucose levels (mg/dl)

Wound Measurement Technique
Wound size was measured using two largest perpendicular diameters and expressed in mm^2. Measurements were recorded weekly for up to 8 weeks or until complete epithelialization.

Statistical Analysis
Data were analyzed using Chi-square test and Student's t-test. A p-value <0.05 was considered statistically significant.

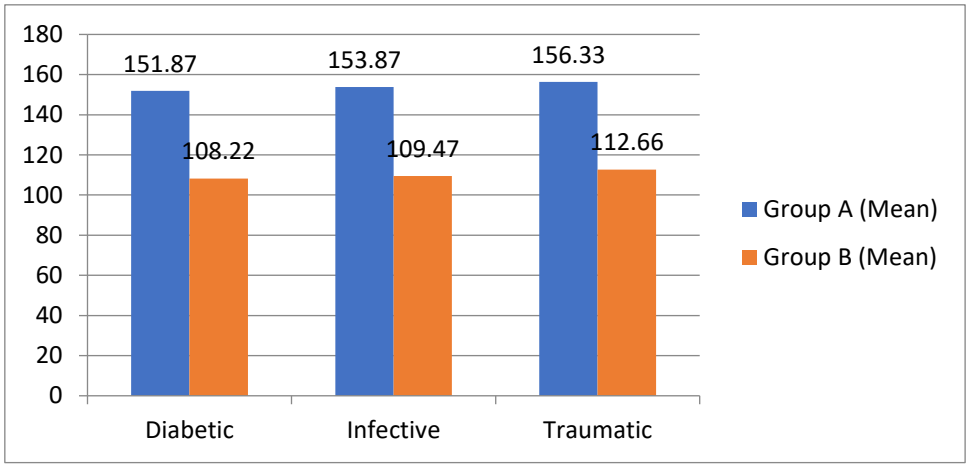
RESULTS
Baseline Characteristics
A total of 70 patients were included in the study:
- Diabetic ulcers: 41.4%
- Infective ulcers: 30%
- Traumatic ulcers: 28.6%

Both groups were comparable in terms of age, gender, and baseline ulcer size.

Rate of Wound Healing:

S. No.	Rate of healing	Group A (Mean ± SD)	Group B (Mean ± SD)	P Value	t Value
1	Diabetic	151.87 ± 34.16	108.22 ± 23.90	0.01*	df ≈ 27 p < 0.001 Highly significant
2	Infective	153.87 ± 88.79	109.47 ± 59.80	0.018	df ≈ 19

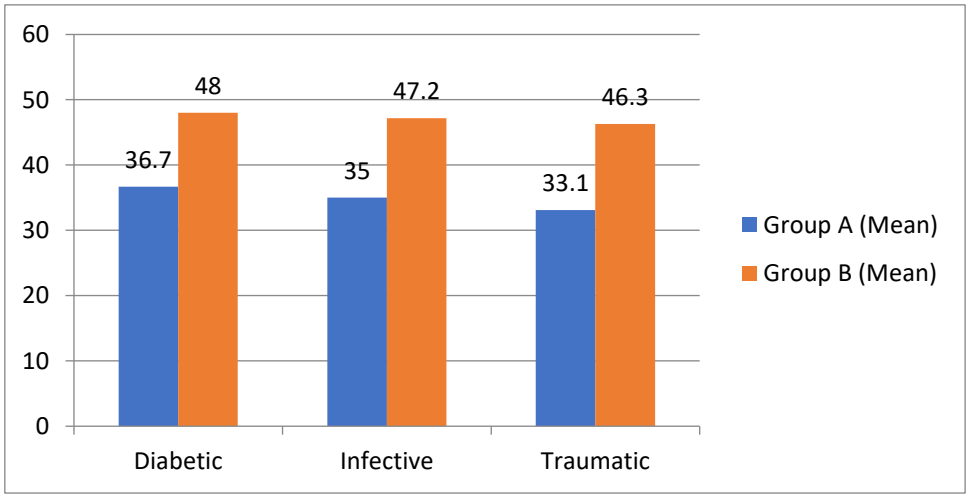
S. No.	Rate of healing	Group A (Mean ± SD)	Group B (Mean ± SD)	P Value	t Value
					p ≈ 0.20 Not significant
3	Traumatic	156.33 ± 11.63	112.66 ± 36.10	0.029	df ≈ 18 p < 0.01 Statistically significant



Significantly higher healing rate in insulin group

Hospital Stay:

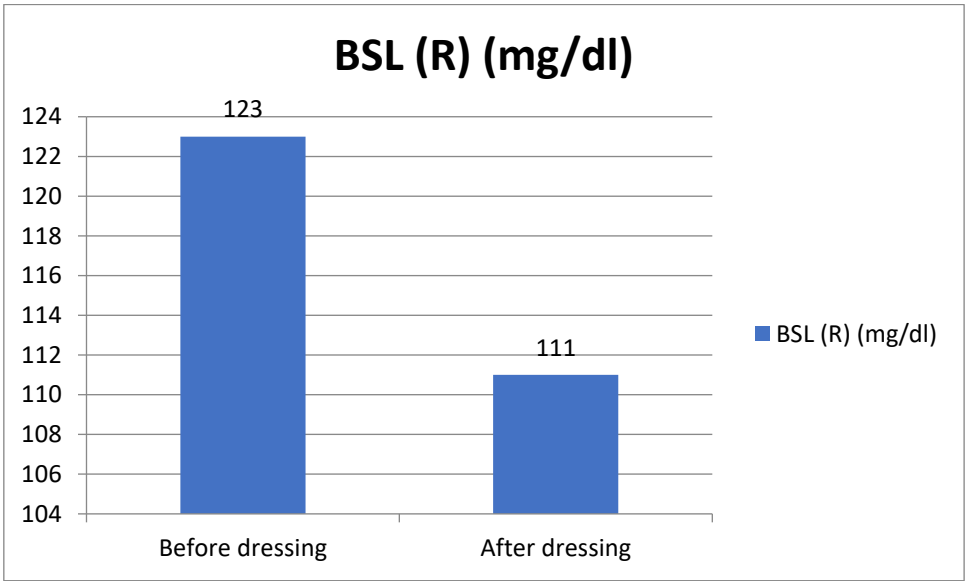
S. No.	Hospital Stay	Group A (Mean ± SD)	Group B (Mean ± SD)	P Value	t Value
1	Diabetic	36.7 ± 3.3	48.0 ± 4.9	0.001	df ≈ 27 p < 0.001 Highly significant
2	Infective	35.0 ± 5.2	47.2 ± 8.7	0.47	df ≈ 19 p < 0.001 Highly significant
3	Traumatic	33.1 ± 6.1	46.3 ± 0.7	0.003	df ≈ 18 p < 0.001 Highly significant



Hospital stay is significantly lower in Group A compared to Group B across all etiologies. The differences are highly statistically significant.

Blood Sugar levels:

Parameter	Before dressing	After dressing	P Value	
BSL (R) (mg/dl)	Mean ± SD (n= 35)	Mean ± SD (n= 35)	0.013*	t = 2.71, df = 34, p ≈ 0.01
	123±26.067	111±2.398		



There is a statistically significant reduction in BSL after dressing ($p < 0.05$)

Dressing appears to have reduced BSL in this group

DISCUSSION

Chronic ulcers continue to be an important problem in surgical practice because of delayed wound healing, prolonged treatment, and increased healthcare expenditure. The present study assessed the effectiveness of topical insulin dressing in comparison with conventional normal saline dressing in patients with chronic ulcers. A total of 70 patients were included, and both study groups were similar with respect to age, gender distribution, ulcer etiology, and baseline ulcer size, indicating good comparability between the groups. The mean age was 41.26 ± 9.84 years in Group A and 40.94 ± 10.07 years in Group B, with no statistically significant difference ($p = 0.90$). Male patients constituted the majority of cases, and diabetic ulcers were the most common ulcer type observed in the study population. The findings of the present study demonstrated that topical insulin dressing significantly improved the rate of wound healing when compared with normal saline dressing. In diabetic ulcers, the mean healing rate in the insulin group was 151.87 ± 34.16 mm²/week, whereas the saline group showed a healing rate of 108.22 ± 23.90 mm²/week ($p = 0.01$). Similar improvement was noted in traumatic ulcers, where the healing rate was 156.33 ± 11.63 mm²/week in Group A compared to 112.66 ± 36.10 mm²/week in Group B ($p = 0.029$). These observations suggest that topical insulin enhances tissue repair and accelerates wound contraction. The improved healing response associated with topical insulin may be related to its stimulatory effect on fibroblast activity, collagen formation, angiogenesis, and epithelial regeneration. Insulin is also known to enhance cellular glucose uptake and protein synthesis, thereby creating a favorable environment for wound repair. These mechanisms may explain the faster healing observed in the insulin-treated group. An additional important finding of the study was the reduction in hospital stay among patients receiving topical insulin dressing. In diabetic ulcers, the average duration of hospitalization was 36.7 ± 3.3 days in Group A compared with 48.0 ± 4.9 days in Group B ($p = 0.001$). Reduced hospitalization reflects earlier wound recovery and may help decrease the overall economic burden associated with chronic ulcer management. No major adverse effects or hypoglycemic episodes were observed following topical insulin application, indicating that the therapy is safe when used in controlled doses. The absence of significant complications, along with its low cost and easy availability, makes topical insulin a practical adjunct in chronic wound management, particularly in resource-limited settings. Although the results are encouraging, the study had certain limitations, including a relatively small sample size and shorter follow-up period. Further multicentric studies with larger patient populations and longer follow-up are required to validate these findings and to establish standardized treatment protocols. Overall, the present study supports the use of topical insulin dressing as an effective and safe adjunctive therapy for chronic ulcers, with benefits in terms of faster wound healing and reduced hospital stay (10).

CONCLUSION:
Topical insulin is an effective, safe, and economical adjunct in the management of chronic ulcers. It significantly improves wound healing and reduces hospital stay. Its use can be recommended in routine clinical practice, especially in low-resource settings. Further multicentric studies with larger sample sizes are recommended to validate these findings.

Declarations
Ethical consideration:
Institutional Ethics Committee approval, written informed consent was strictly obtained from all participants before enrollment

Informed Consent:
Written informed consent was obtained from all participants.

Funding:
None

Conflict of Interest:
None declared

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