

STUDY ON COMPARISON OF THE EFFECT OF TOPICAL INSULIN WITH NORMAL SALINE DRESSING IN HEALING OF DIABETIC FOOT ULCERS

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ABSTRACT

BACKGROUND

Numerous topical medication and gels are promoted for ulcer care and healing. Relatively, few have proved to be more efficacious than saline wet-to-dry dressings. The present study was aimed to compare the effect of topical insulin and normal saline dressing in healing of diabetic foot ulcers.

MATERIALS AND METHODS

The present two-year hospital-based randomised-controlled trial was conducted in the Department of General Surgery, Rangaraya Medical College, Kakinada, from April 2015 to March 2017. A total of 60 patients with diabetic foot ulcers were studied. Based on the envelop method, patients were divided into two groups of 30 patients each that is group A (topical insulin) and group B (normal saline).

RESULTS

In this males (66.67% in group A and 83.33% in group B) outnumbered females in both the groups with male-to-female ratio of 2:1 in group A and 4:1 in group B. The mean age in group A was 52.00 ± 11.00 years, and in group B, it was 57.00 ± 9.80 years (p=1.000). Among patients with group A, significant reduction of mean ulcer area was observed (307.23 ± 169.87 mm²) with higher mean percentage reduction (35.19 ± 19.00 percent), whereas in group B, the mean percentage reduction was significantly less (18.82 ± 4.06 percent) with less reduction of mean final ulcer area (149.90 ± 64.45 mm²) (p<0.001).

CONCLUSION

Overall, topical insulin dressing provided favourable outcome in patients with diabetic foot ulcer by significant reduction in wound area when compared to normal saline dressing and it had positive role in reducing the wound infection if present.

KEYWORDS

Diabetic Foot Ulcers, Normal Saline, Topical Insulin, Wound Healing.

HOW TO CITE THIS ARTICLE: Reddy CV, Reddy SV, Amala P, et al. Study on comparison of the effect of topical insulin with normal saline dressing in healing of diabetic foot ulcers. J. Evid. Based Med. Healthc. 2017; 4(39), 2371-2375. DOI: 10.18410/jebmh/2017/467

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Numerous topical medication and gels are promoted for ulcer care and healing. Relatively, few have proved to be more efficacious than saline wet-to-dry dressings. The present study was aimed to compare the effect of topical insulin and normal saline dressing in healing of diabetic foot ulcers.

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Financial or Other, Competing Interest: None.

Submission 17-04-2017, Peer Review 22-04-2017,

Acceptance 12-05-2017, Published 13-05-2017.

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DOI: 10.18410/jebmh/2017/467

were studied. Based on the envelop method, patients were divided into two groups of 30 patients each that is group A (topical insulin) and group B (normal saline).

Inclusion Criteria

- Diabetic patients between the age group of 40 to 70 years.
- Patients having ulcers measuring more than 2 cm in lower limbs.
- Patients with diabetic control with oral hypoglycaemics and insulin with blood glucose levels between 110 and 130 gm/dL.
- Patients with grade I and II ulcers of Wagner's classification.

Exclusion Criteria

- Patients with grade III, IV and V ulcers of Wagner's classification.
- Patients with absent peripheral pulses, dorsalis pedis artery, posterior tibial artery and anterior tibial artery.
- Patients who were not on regular followup.
- Patients not willing to enroll in the study.



Procedure

Wound discharge was sent for culture and sensitivity, if present. Empirical antibiotics namely ciprofloxacin and metronidazole were started and changed to sensitive antibiotics after sensitivity report. Debridement was done if necessary.

Dressing

Group A- In Group A, one cc normal saline with 10 IU insulin for each 10 cm² wound was used.

Group B- In group B, plain normal saline was used, which was one of the standard procedure for ulcer dressings.

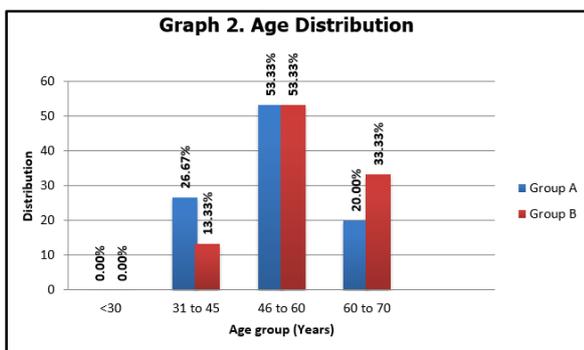
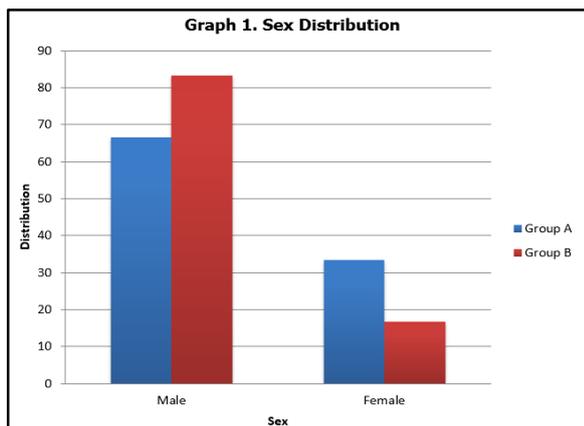
RESULTS

- Group A (n=30) - Patients in this group underwent dressing with topical insulin (purified human biosynthetic neutral plain insulin).
- Group B (n=30) - Patients in this group underwent dressing with normal saline.

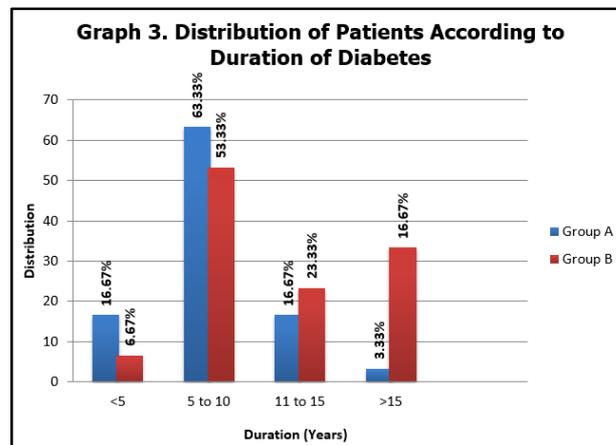
Data obtained was tabulated on Microsoft excel spreadsheet and analysis was done. The final results were tabulated as below.

Sex Distribution

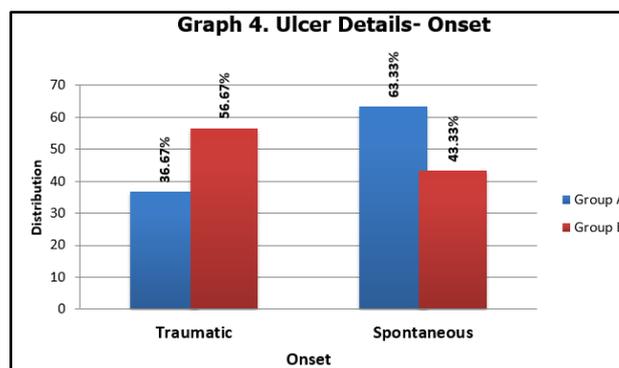
In this study, majority of the patients were males in both the groups (66.67% in group A and 83.33% in group B) with male-to-female ratio of 2:1 in group A and 4:1 in group B.



In this study, most of the patients (55.33%) were aged between 46 to 60 years in both the groups.

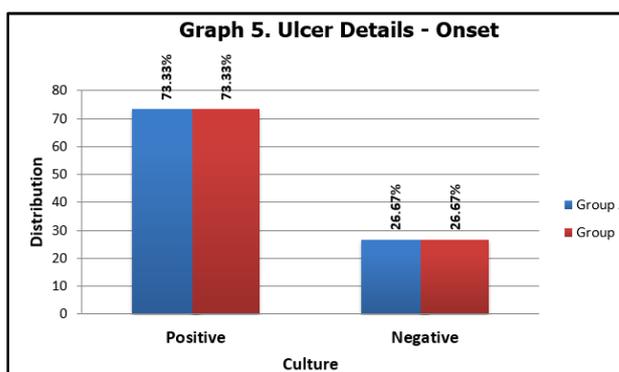


In this study, most of the patients in both the groups (63.33% in group A and 53.33% in group B) had duration of diabetes between 5 to 10 years. The duration of diabetes comparable in both the groups (p=0.208).

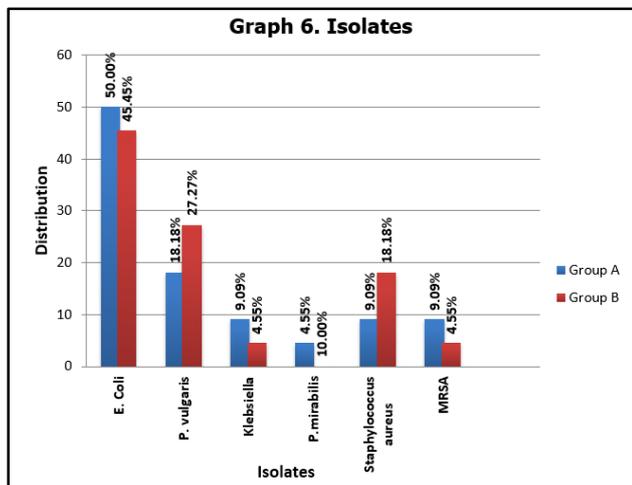


In the present study, 63.33% patients had spontaneous onset of ulcer in group A compared to 56.67% with traumatic onset in group B. However, the onset of ulcer was comparable in both the groups (p=0.121).

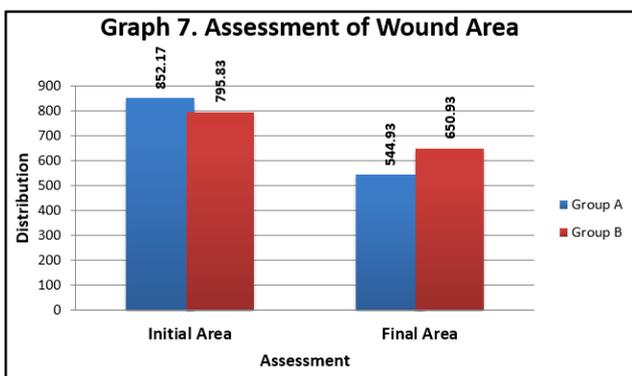
Wound Culture



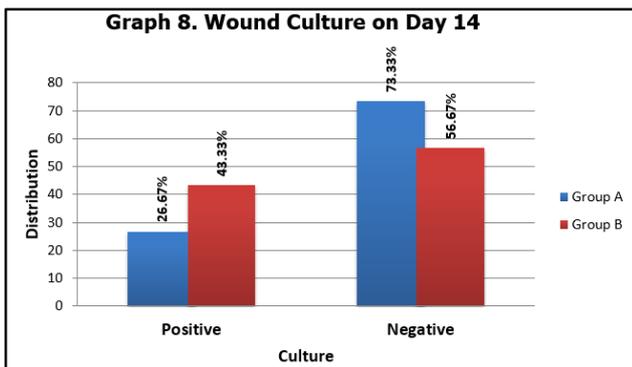
In the present study, wound culture was positive in 73.33% of patients each in both the groups.



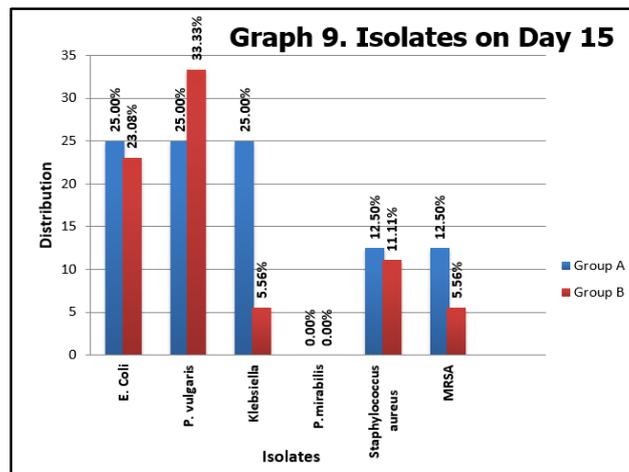
In this study, the most common organism was E. coli in both the groups (50% in group A and 45.45% in group B).



In the present study, the mean initial ulcer area in group A was 852.17 ± 412.93 mm² in group A, which reduced to 544.93 ± 255.44 mm². Similarly, in group B, the mean initial ulcer area in group B was 795.83 ± 360.28 mm², which reduced to 650.93 ± 306.99 mm².



In the present study, the wound culture on day 14 was negative in 73.33% patients in group A compared to 56.67% in group B. However, no statistically significant difference was observed between the two groups (p=0.176).



In the present study, the most common isolate on day 14 was P. vulgaris in group B (33.33%), and in group A, it was E. coli and P. vulgaris (25%).

DISCUSSION

Diabetic foot ulcers are common and estimated to affect 15% of all diabetic individual during their lifetime. Patient suffering from diabetic ulcer often require hospitalisation. One of the major causes of non-healing of ulcer in diabetes is infection. It is caused by a variety of microorganism. Most common are Staphylococcus aureus and Pseudomonas aeruginosa, which invade the wound and multiply producing harmful toxic substances causing destruction of tissue and disturbance in wound healing.^{1,2}

The management of diabetic foot ulcer requires offloading the wound by using appropriate therapeutic footwear,^{3,4} daily saline or similar dressings⁵ to provide a moist wound environment debridement when necessary, antibiotic therapy if osteomyelitis^{6,7} or cellulitis is present,^{8,9} optimal control of blood glucose and evaluation and correction of peripheral arterial insufficiency.

The present study was undertaken to compare the effect of topical insulin and normal saline dressing in healing of diabetic foot ulcers.

The present two-year hospital-based randomised-controlled trial was conducted in the Department of General Surgery, Government General Hospital, Kakinada, from April 2015 to March 2017. A total of 60 patients with diabetic foot ulcers were studied. Based on the envelop method, patients were divided into two groups of 30 patients each that is group A (patients in this group underwent dressing with topical insulin) and group B (patients in this group underwent dressing with normal saline).

In this, males (66.67% in group A and 83.33% in group B) outnumbered females in both the groups. The male-to-female ratio was 2:1 in group A and 4:1 in group B (p=0.121). Most of the patients (55.33%) were aged between 46 to 60 years in both the groups. The mean age in group A was 52.00 ± 11.00 years, and in group B, it was 57.00 ± 9.80 years (p=1.000) suggesting the demographic characteristics of the study population were comparable in both the groups.

In this study, most of the patients in both the groups (63.33% in group A and 53.33% in group B) had duration of diabetes between 5 to 10 years ($p=0.208$). The mean duration of diabetes in group A was 8.33 ± 3.44 years, and in group B, 10.66 ± 5.40 years ($p=0.051$). These findings suggest the characteristics of diabetic history was comparable in both the groups.

In the present study, 63.33% patients had spontaneous onset of ulcer in group A compared to 56.67% with traumatic onset in group B ($p=0.121$). The wound culture was positive in 73.33% of patients each in both the groups. The most common organism was *E. coli* in both the groups (50% in group A and 45.45% in group B) suggesting the equal distribution of patients with regard to ulcer characteristics.

In the present study, the mean initial ulcer area in group A was 852.17 ± 412.93 mm² in group A, which reduced to 544.93 ± 255.44 mm². Similarly, in group B, the mean initial ulcer area in group B was 795.83 ± 360.28 mm², which reduced to 650.93 ± 306.99 mm². However, the mean ulcer area at beginning in both the groups was comparable.

Among patients with group A, significant reduction of mean ulcer area was observed in group A (307.23 ± 169.87 mm²) with higher mean percentage reduction (35.19 ± 19.00 percent), whereas in group B, the mean percentage reduction was significantly less (18.82 ± 4.06 percent) with less reduction of mean final ulcer area (149.90 ± 64.45 mm²). The difference between the percentage reduction and reduction of final ulcer area was statistically significant ($p=0.001$) showing significantly favourable outcome in patients who underwent normal saline dressing.

In study conducted by Swamynathan et al (2014), the mean initial ulcer area in insulin group is 4.1 cm² and in saline group is 3.1 cm², which reduced to 1.6 cm² and 2.9 cm², respectively. There is scarcity of the literature showing the comparison of topical insulin and normal saline in diabetic foot ulcer.

In studies done by Pierre et al¹⁰ in 1998, healing time was reduced from 6.5 ± 1.0 days with placebo to 4.7 ± 1.2 days during insulin infusion ($P < 0.05$) and study by Rezvani et al in 2009¹¹ found a healing time of 41.85 ± 20.56 days in the insulin group and 43.50 ± 22.85 days in the normal saline dressing group. Lima et al¹² stated that the use of topical insulin cream, accelerated wound healing by activating some insulin signal pathways in rats with experimental diabetes in their double-blind placebo-controlled study.

It is known that insulin stimulates the growth and development of different cell types and affects proliferation, migration and secretion by keratinocytes, endothelial cells and fibroblasts.^{13,14} Previous data, although not well-controlled showed that topical insulin accelerates wound healing in the skin of diabetic rats and humans.¹⁵

In the present study, the wound culture on day 14 was negative in 73.33% patients in group A compared 56.67%

in group B. However, no statistically significant difference was observed between the two groups ($p=0.176$). The most common isolate on day 14 was *P. vulgaris* in group B (33.33%), and in group A, it was *E. coli* and *P. vulgaris* (25%).

CONCLUSION

Based on the results of the present study, it maybe concluded that topical insulin dressing provides favourable outcome in patients with diabetic foot ulcer by significant reduction in wound area when compared to normal saline dressing.

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