

A STUDY OF SILVER NITRATE SOLUTION IN DRESSING OF DIABETIC FOOT ULCERBipin Kishore Bara¹, Siba Prashad Pattanayak², Tapan Kumar Malla³, Manoj Kumar Behera⁴, Binoy Kumar Maharana⁵¹Assistant Professor, Department of General Surgery, Berhampur University, Odisha.²Associate Professor, Department of General Surgery, Berhampur University, Odisha.³Junior Resident, Department of General Surgery, Berhampur University, Odisha.⁴Senior Resident, Department of General Surgery, Berhampur University, Odisha.⁵Junior Resident, Department of General Surgery, Berhampur University, Odisha.**ABSTRACT****BACKGROUND**

Diabetic foot ulcer is very common now a days. It ranges from 15% to 25%. Various methods and dressing agents have been tried for dressing. In this study, silver nitrate in solution form as a dressing agent has been tried.

MATERIALS AND METHODS

A prospective study was conducted at MKCG Medical College, Berhampur, Odisha. Here, a total of 100 number of patients having diabetic foot ulcer were studied and consent for various procedures were obtained from them. Data regarding granulation tissue formation, pus culture and sensitivity report, skin graft acceptance and hospital stay were analysed in tabular manner.

RESULTS

Among 100 study subjects, 50 were taken as control group and 50 as study group. The granulation tissue formation on 14th day was 95% in study group and 82% in control group. Successful skin graft uptake was 94% in study group and 80% in control group. Hospital stay in study group was 25.6 ± 3.4 days and 35.3 ± 7.2 days. Pus culture sensitivity test on day 14 was positive in 6 cases in study group and 12 cases in control group.

CONCLUSION

Foot ulcer is a common problem worldwide, among which diabetic foot ulcer is the commonest one. Various modalities of dressing methods and materials are available, but in my study silver nitrate in the form of solution form is a better option as compared to others.

KEYWORDS

Diabetic Foot Ulcer, Silver Nitrate, Granulation Tissue, Skin Graft.

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BACKGROUND

The lifetime incidence of foot ulcer within the diabetic community is around 15%. Diabetic foot ulcers precede almost 85% of amputations in India.¹ Chronic leg ulcers are generally associated with reduced quality of life, high morbidity and financial loss to the patient.²⁻¹¹ The dressing of wound is an old art varying from herbal dressing to modern dressing material like creams, ointments and solutions. The classes of wound dressing are occlusive dressing, non-occlusive dressing, absorptive dressing, skin substitutes and negative suction vacuum dressing. In spite of many modes of wound dressing, treating diabetic wound

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is a challenging task and this has led in search of better option for wound healing agent. Liquid Silver nitrate, a newer agent may be tried in treating of diabetic foot ulcer, as it has been claimed for faster granulation tissue formation in the wound. Hence, improves quality of graft bed and results in better graft uptake: a better wound management. The present study was conducted to assess the efficacy and effect of topical spray of silver nitrate solution in the diabetic wound versus conventional dressing material.

MATERIALS AND METHODS

The study included 100 patients of diabetic foot ulcer admitted in MKCG Medical College from June 2015 to June 2017.

Inclusion Criteria

1. Grade I and II foot ulcers as per Meggitt-Wagner classification.
2. Patients on oral hypoglycaemic agent or insulin for Diabetes mellitus.

Exclusion Criteria

1. Chronic ulcers due to other aetiology.
2. Grade III, IV, V foot ulcers as per Meggitt-Wagner classification.
3. Immunocompromised state like HIV.
4. Age less than 15 yrs.
5. Patients with varicose vein and decreased vascularity (ischaemia) of lower limb.
6. Patients with allergy to silver nitrate.

After satisfying inclusion and exclusion criteria, the selective patients were randomly assigned to study group and control group. Each patient participating in the clinical trial signed on informed consent form, though one had the right to withdraw without any prejudice at any point of time. In all cases, detailed history was taken. History of IHD (Ischaemic Heart Disease), other chronic systemic ailments, smoking and alcohol drinking was asked and recorded. The site, depth and duration of ulcer were recorded. In all patients haemoglobin, DC (Differential Count), TLC (Total Leucocyte Count), FBS (Fasting Blood Glucose), PPBS (Postprandial blood glucose), blood urea and creatinine were routinely done. Urine routine and microscopic examination was done. After slough removal the surface were measured, tracing the outline on transparent paper. This outline was transferred to graph paper and size was measured in both control and study group.

In study group, 2 mL of silver nitrate solution was taken in a syringe after cleaning the wound with distilled water, drying it with sterile gauze and then the silver nitrate solution was sprinkled over the wound surface. After this the wound was covered with gauze soaked with silver nitrate solution, whereas in control group dressing was done by 50% w/v povidone-iodine solution. Dressings were done and followed every alternate day for 14 days. Size of ulcers was measured weekly. Wound culture was done on day 1 and on day 14, observed side effect (local and systemic) were documented. The results obtained were statistically evaluated and compared on following points.

1. Effect of silver nitrate solution on bacterial load in the wound.
2. Rate of granulation tissue formation.
3. No. of days required for healing.
4. Skin graft uptake.
5. Side effect of topical silver nitrate dressing.

Variables were compared using the chi-square t-test and 'p' value was obtained and found to be significant.

RESULTS

Study included 100 patients and maximum no. of cases belonged to age group 40 to 60 years. In the above study, the number of males (68) were more in comparison to females (32). In control group, 8 patients (16%) had ulcer size < 5 cm; 12 patients (24%) had ulcer between 5 - 10 cm and 5 patients (10%) had ulcer size > 10 cm. In study

group, 10 patients (20%) had ulcer size < 5 cm; 8 patients (16%) had ulcer size 5 - 10 cm and 7 patients (14%) had ulcer size > 10 cm.

The rate of granulation tissue formation was assessed on 14th day and mean granulation tissue was 95% in study group and 82% in control group. The result was analysed using Yate's chi-square test and was found to be significant ($p < 0.001$) (Table 1).

Granulation Tissue	Control N=50	Study N=50	P-value (Yate's Chi-Square Test)
71% - 80%	19	4	25.42, $p < 0.001$
81% - 90%	24	14	
91% - 100%	7	32	
Total	50	50	

Table 1. Granulation Tissue Formation as on 14th Day

After granulation tissue formulation, the patients in both groups were subjected to split thickness skin grafting and graft uptake was again measured on the 7th post-operative day as the % of ulcer surface area mentioned in the table below. In study group, 94% successful graft taken was observed and in control group it was found to be 80%. The result was analysed using Yate's chi-square test, which showed to be highly significant ($p = 0.001$) (Table 2).

Graft Uptake	Control n=50	Study n=50	P-value (Yate's Chi-Square)
< 70%	13	5	24.46, $P < 0.001$
71% - 80%	7	8	
81% - 90%	28	13	
91% - 100%	2	24	
Total	50	50	

Table 2. Graft Uptake

Hospital stay for both groups were calculated and compared. Hospital stay for study group was 25.32 ± 3.13 days and in control group was 35.00 ± 2.57 days. The results were obtained using Independent sample t-test, which was found to be highly significant ($p = 0.001$) (Table 3).

Duration of Hospital Stay	Control N=50	Study N=50	P-value (Independent sample T test)
Mean \pm SD	35.00 ± 2.57 SEM=0.36	25.32 ± 3.13 SEM=0.44	$P < 0.001$

Table 3. Hospital Stay

Difference in mean duration of hospital stay between the control and study group is 9.68 days (95% CI 8.54 - 10.82)

Patients of both groups were subjected to culture and sensitivity test and antibiotics were adjusted accordingly. After 14 days again, culture and sensitivity test was done and a significant result was obtained in study group who

were subjected to silver nitrate solution ($p= 0.118$) (Table 5).

Result	Control N=50	Study N=50	P-value (Chi-Square Test)
Positive	24	16	2.66, $p= 0.102$
Negative	26	34	
Total	50	50	

Table 4. Bacterial Culture Report on Day 1

Result	Control N=50	Study N=50	P-value (Chi-Square Test)
Positive	12	6	2.43, $p= 0.118$
Negative	38	44	
Total	50	50	

Table 5. Bacterial Culture Report on Day 14

DISCUSSION

Management of diabetic foot ulcer is a challenge to every treating surgeon. As newer dressing materials have come, it is necessary to identify the cheapest and effective one for dressing the diabetic ulcer.

In this study the dressing material is silver nitrate in liquid form, though in ointment base form its efficacy has already been proved. But it is better in liquid form and its response has been tried in my study.

This study is similar to Muthu Kumar Swamy MG et al,¹² who tried with phenytoin and Pukar I et al who studied with newer dressing material (oxum, opsite, collagen, oxoferin).

In my study, mean age group in study group were 48 and 50 years in control group. Graft uptake was 93% and 76% respectively. Hospital stay was 25 days and 35 days respectively. My study was also compared with other studies like Pendse et al, Lodha et al and Bansal et al.^{13,14}

Limitation of the Study- A small sample size is itself a major limitation in the above study. A randomised control trial study with a larger population may have help to further strengthen the findings or may reveal variations. The factors which also may affect wound healing like alcohol intake, smoking, time duration and glycaemic control in diabetes mellitus were not compared and analysed in this study.

CONCLUSION

Silver nitrate in liquid form is newer concept in management of wound healing. It enhances granulation tissue formation and reduces bacterial load in the wound. Hence, better management after skin grafting, which also shortens the hospital stay for diabetic foot ulcer patients.

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