



EFFICACY OF CONVENTIONAL DRESSINGS VERSUS NANOCRYSTALLINE SILVER DRESSINGS IN DIABETIC FOOT ULCERS: A CLINICAL STUDY

General Surgery

Dr. B. Sandeep	Associate Professor, Department of General surgery, Alluri Sitarama Raju Academy of Medical Sciences, Eluru-534005, West Godavari district, Andhra Pradesh, India.
Dr. M. Vanaja	Associate Professor, Department of General surgery, Alluri Sitarama Raju Academy of Medical Sciences, Eluru-534005, West Godavari district, Andhra Pradesh, India.
Dr. Madala Samba Siva Rao*	Associate Professor, Department of General Surgery, Alluri Sitarama Raju Academy of Medical Sciences, Eluru 534005, West Godavari district, Andhra Pradesh, India. *Corresponding Author
Dr. Venkata Durga Prasad	Postgraduate, Department of General Surgery, Alluri Sitarama Raju Academy of Medical Sciences, Eluru 534005, West Godavari district, Andhra Pradesh, India.

ABSTRACT

Introduction: Diabetic foot is an extensive term for inflammation, ulceration, and foot gangrene. Proper wound treatment and an active multidisciplinary approach will decrease the risk of limb amputation. In the management of diabetic foot care, wound dressings play a significant part. A newer modality for the treatment of diabetic ulcer is nanocrystalline silver ion dressing.

Materials And Methods: A comprehensive history, including the history of onset mode, duration, the progress of ulcers, and details on diabetes status, has been obtained in the form of the duration of DM and treatment. The Ulcer examination was carried out. All patients underwent the following investigations: Hb, blood sugar, serum creatinine, urine ketone bodies, X-ray foot, Doppler (both arterial and venous).

Results: Male predominance was observed in both groups. In the Nanocrystalline silver dressings group, the males were 72%, and females were 28%. In the conventional dressing group, males were 74%, and females were 26%. The Male: Female ratio was 3:1. In the nanocrystalline silver dressings group, the onset was Spontaneous in 66% of the cases and traumatic in 34% of the cases. In Conventional dressings group, the onset was Traumatic in 64% of the cases and spontaneous in 36% of the cases. The Staphylococcus aureus was the most common organism in the Culture, with 44 % in the NCS and 58% in CD groups. In the NCS group, Slough and discharge were seen in only 14% of the cases compared to the CD group, where it was seen in 40% of the cases. The duration of a 4-weeks hospital stay was seen in 28% of the cases in the NCS group and 44% of the cases in the CD group. The duration of a 5-weeks hospital stay was seen in 18% of the cases in the CD group.

Conclusion: In this research, we have been able to explore the multifaceted advantages of nanocrystalline silver dressings. By removing toxic complexes, eliminates discomfort and reduces the bacterial load and systemic inflammation. It, therefore, decreases the formation of exudates and thereby reduces the frequency of discomfort induced by the dressing. Overall, it has a rather beneficial impact on wound healing and end outcome, further verified by histopathological research.

KEYWORDS

Nanocrystal line, Silver, Iodine, Saline, Betadine

INTRODUCTION:

Diabetes Mellitus is characterized by persistent hyperglycemia of carbohydrate, protein, and fat metabolism deficiencies attributable to fructose, Insulin, or all anomalies.

The result of Diabetes Mellitus involves long-term dysfunction, an deterioration of different organs, notably of the eyes, kidneys, hearts, and blood vessels. Chronic complications are responsible for high morbidity and mortality and cause increased hospital stays.

Foot ulcers are most often observed in diabetic people and are treated typically in various ways. Many internal and external aspects affect the advancement towards chronicity or full recovery.

A debilitating complication of diabetes mellitus is a diabetic foot ulcer. In elderly patients, this condition is more frequent. Many diabetic foot ulcers can cure while a smaller proportion continues to remain active and eventually leads to limb amputation.

With the long duration of the ulcer and the elderly patient, there is also an elevated risk of amputation. Early prevention plays an important part in improving the patient's quality of care and decreases the financial burden.

One of the most complicated and daunting problems is diabetic foot ulcers, which require multidisciplinary management. Wound dressings are a massive component of diabetic foot ulceration treatment. An optimal dressing must reduce the symptoms and have sufficient wound protection and effective healing.

The Silver topical anti-microbial agent has been used for wound treatment for hundreds of years. Since then, a wide variety of wound dressings containing elemental silver or silver-releasing compounds have been developed that are simpler to apply, ensure the continued

supply of silver, and require fewer routine dressing changes, and have resolved many of the problems associated with the first silver preparations. Silver dressings ensure a moist wound atmosphere and help promote self debridement of wound and thus increased healing and decreased hospital stay.

Silver ions are highly reactive and influence several sites in bacterial cells, responsible for the destruction of bacterial cells by disrupting cell walls.

AIMS AND OBJECTIVES:

- 1) To research the efficacy of Nanocrystalline silver in the treatment of diabetic foot ulcers.
- 2) To Estimate the time needed to treat diabetic foot ulcers with Nanocrystalline Silver versus conventional dressing
- 3) A number of Nanocrystalline silver dressing required in comparison with conventional dressing.

Inclusion Criteria And Methods:

The patients who were admitted with a diabetic foot ulcer in Alluri Sitarama Raju Academy of Medical Sciences from November 2019 to April 2021 were included. The number of patients included in our study will be 100. Patients will be allocated to either of the dressings by simple randomization.

Study Type: A random prospective and observational study

Inclusion Criteria:

T2DM Patients with diabetic foot ulcers.

Ulcers of size less than 10x10 cm.

Exclusion Criteria:

- Clinical signs of infection, cellulitis; X-ray showing Osteomyelitis.

- Doppler showing gross atherosclerotic arterial changes and venous abnormalities like varicosities.
- Malnutrition, uncontrolled diabetes.
- Other clinically significant medical conditions that would impair wound healing like renal, hepatic, haematological, neurological, and immunological diseases.
- Patients receiving corticosteroids, immunosuppressive agents, radiation, or chemotherapy within one month prior to entry into the study were also excluded.

RESULTS:

1 Area of reduction with NCD and CD

2 Duration of hospital stay

3 Number of Dressings required are as follows :-

Table 1: Area Of Reduction With Nanocrystalline Silver Dressings And Conventional Dressings.

Area of Reduction (%)	Nanocrystalline silver dressing		Conventional Dressing	
	Number	Percentage	Number	Percentage
1-10	-	-	1	2%
11-20	-	-	34	68%
21-30	-	-	7	14%
31-40	15	30%	2	4%
41-50	27	54%	2	4%
51-60	6	12%	2	4%
61-70	1	2%	2	4%
71-80	1	2%	-	-
Total	50	100%	50	100%
Chi-Square	2.0597			
P-Value	0.151			

While in the CD group, 4% each had a reduction in the range of 31 - 40, 4 - 50, 51 - 60, and 61 - 70%.

In the CD group, 14% had a reduction in the range of 21 - 30%.

In the CD group, 68% had a reduction in the range of 11 - 20%. In the CD group, 2% had a reduction in the range of 1-10%.

The chi-square statistic is 2.0597.

The p-value is 0.151241.

Table 2: Duration Of Hospital Stay

Duration of hospital stay	Nanocrystalline silver dressings		Conventional Dressings	
	Number	Percentage	Number	Percentage
1 - weeks	4	4%	-	-
2 - weeks	12	24%	8	16%
3-weeks	20	40%	11	22%
4 - weeks	14	28%	22	44%
5-weeks	-	-	9	18%
Total	50	100%	13	100%
Chi-Square	14.6476			
P-Value	0.005			

Distribution based on hospital stay duration with various dressings with nanocrystalline silver dressings and Conventional dressings

The maximum duration of hospital stay was seen in the conventional dressing group in comparison to the nanocrystalline silver dressings group.

The duration of a 2-weeks hospital stay was seen in 24% of the cases in the NCS group and 16% of the cases in the CD group.

The duration of a 3-weeks hospital stay was seen in 40% of the cases in the NCS group and 22% of the cases in the CD group.

The duration of a 4-weeks hospital stay was seen in 28% of the cases in the NCS group and 44% of the cases in the CD group.

The duration of a 5-weeks hospital stay was seen in 18% of the cases in the CD group.

The chi-square statistic is 14.6476.

The p-value is 0.005491.

The result is significant at $p < 0.01$.



Distribution based on hospital stay duration with various dressings with nanocrystalline silver dressings and Conventional dressings

Table 3: Number Of Dressings Required

No. of Dressings	Nanocrystalline silver dressings		Conventional Dressings	
	Number	Percentage	Number	Percentage
1-5	4	8%	2	4%
6-10	21	42%	6	12%
11-15	21	42%	6	12%
16-20	4	8%	15	30%
21-25	-	-	15	30%
26-30	-	-	6	12%
Total	50	100%	50	100%
Chi-Square	0.04			
P-Value	0.841			

Distribution based on the number of dressings with nanocrystalline silver dressings and Conventional dressings

The dressings required were higher for the conventional dressing in comparison to the nanocrystalline group.

In the CD group, the 26 - 30 dressings were done for 12% of the cases.

In the CD group, the 16 - 20 and 21 - 25 dressings were done for 30% of the cases each.

In the NCS group, the 16 - 20 dressings were done for only 8% of the cases.

In the NCS group, 6 to 10 and 11 to 15 dressings were done for 42% of the cases each, while in the CD group, they were done for 12% of the cases each. In the CD group, the 1 - 5 dressings were done for 4% of the cases, while in the NCS group, it was done in 8% of the cases.

The chi-square statistic is 0.04. The p-value is 0.841449.

Slough & Discharge	Nanocrystalline silver dressings		Conventional Dressings	
	Number	Percentage	Number	Percentage
Present	7	14%	20	40%
Absent	43	86%	30	60%
Total	50	100%	50	100%
Chi-Square	8.5743			
P-Value	0.003			

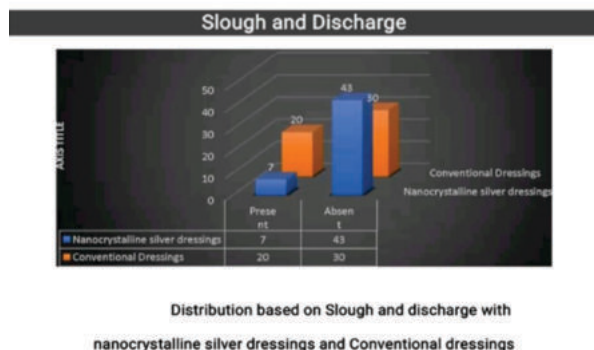
Distribution based on Slough and discharge with nanocrystalline silver dressings and Conventional dressings

In the NCS group, Slough and discharge was seen in only 14% of the cases compared to the CD group, where it was seen in 40% of the cases.

The chi-square statistic is 8.5743.

The p-value is 0.003409.

The result is significant at $p < 0.01$.



DISCUSSION:

Area Of Reduction:

NCS: In the NCS group, 2% each had a reduction in the range of 61 - 70% and 71 - 80%. 12% had a reduction in the range of 51 - 60%.

54% had a reduction in the range of 41 - 50%. 30% had a reduction in the range of 31 - 40%. 4% each had a reduction in the range of 21 - 30%, 11 - 20%, and 1 - 10%. While in the CD group, 4% each had a reduction in the range of 31 - 40%, 41 - 50%, 51 - 60%, and 61 - 70%. While 14% had a reduction in the range of 21 - 30%. 68% had a reduction in the range of 11 - 20%. 2% had a reduction in the range of 1 - 10%.

Our results were not consistent with other studies since no wounds were completely healed in our study in both the groups as opposed to another study by Ramanaih et al.

Number of Dressings:

The dressings required were higher for the conventional dressing in comparison to the nanocrystalline group. In the CD group, the 1 - 5 dressings were done for 4% of the cases, while in the NCS group, it was done in 8% of the cases.

In the NCS group, the 16 - 20 dressings were done for only 8% of the cases. 6 to 10 and 11 to 15 dressings were done for 4.2% of the cases each, while in the CD group, they were done for 12% of the cases each.

Hospital Stay Duration:

The maximum duration of hospital stay was as seen in the conventional dressing group in comparison to the nanocrystalline silver dressings group. The duration of a 1-week hospital stay was seen in 4% of the cases of the NCS group. The duration of a 2-weeks hospital stay was seen in 24% of the cases in the NCS group and 16% of the cases in the CD group. The duration of a 3-weeks hospital stay was seen in 40% of the cases in the NCS group and 22% of the cases in the CD group. The duration of a 4-weeks hospital stay was seen in 28% of the cases in the NCS group and 44% of the cases in the CD group. The duration of a 5-weeks hospital stay was seen in 18% of the cases in the CD group. In Ramanaih et al. study, the duration of stay of Case group was three weeks while we had patients being discharged in the 4th week. In the control group, we had earlier discharges in 2nd week and 3rd week while the other study didn't have any discharge till the 4th and 5th week.

CONCLUSION:

In this research, we have been able to explore the multifaceted advantages of nanocrystalline silver dressings. By removing toxic complexes, eliminates discomfort and reduces the bacterial load and systemic inflammation. It, therefore, decreases the formation of exudates and thereby reduces the frequency of discomfort induced by the dressing. Overall, it has a rather beneficial impact on wound healing and end outcome, further verified by histopathological research.

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