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Original Research Article

Comparison of the Nanocrystalline Silver (NCS) Dressing Over Paraffin Gauze Dressing on Split-Thickness Skin Graft Donor Site

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ABSTRACT

Background: Different dressing methods are used in split thickness skin grafting donor sites; none has a superior effect than other. The time tested paraffin gauze dressing is still preferred by many surgeons because it is easy available, cheaper and maintains moist environment; however the wound may get macerated, is prone for infection, is painful and takes longer time to heal. Nanocrystalline silver (NCS) method is one of the upcoming wound dressing technique with antimicrobial, pro-healing, and anti-inflammatory properties.
Methods: 76 patients planned for SSG were randomized into 2 similar groups to compare the healing time, pain and infection outcome of the conventional paraffin dressing to the newer NCS dressing. Diabetic patients or patients under analgesics or immunosuppressant, harvest for malignant ulcers and reharvests from previously used donor sites or defaulters were excluded from the study.
Results: 94.29 % cases healed by day 13 in NCS group whereas only 16.67 % cases in Paraffin group healed by day 13. However, 97.14 % cases healed by day 18 in NCS group whereas 88.9% cases in Paraffin group healed by day 18. Mean healing time in NCS group was 13.14 days (± 1.70) and 15.78 days (± 2.24) in Paraffin group which was highly significant ($p < 0.0000$).

Although the mean pain score were consistently low on all assessment days in NCS group as compared to Paraffin group, it did not reach the level for statistical significance on any day of assessment. There was no infection in both the groups.
Discussion: Healing time of paraffin gauze dressing in our study is within the range (4 – 20 days) as described by previous authors. Quicker re epithelizaion rate with various silver and polyurethane dressing preparations as shown by various authors is consistent with our result. We used semi occlusive nano crystalline silver dressing to incorporate both their advantages.

Despite the plethora of new materials on the market, we are still using paraffin gauze dressings for donor site wounds. Even though the anti-inflammatory and antibacterial properties of nanocrystalline silver has been established since many decades, the fear of the yet unproved toxic effect of silver on healing wounds, cost factor and lack of direct comparing studies and recommendations has been the major factor for its infrequent use. We conclude that NCS dressing is a preferred dressing for split-thickness donor site areas over conventional paraffin gauze dressing. Our study may provide impetus for better future structured studies to formulate recommendations for donor site wound healing.

Key words: Donor Site, Paraffin gauze, Silver dressing, Nanocrystalline silver, Skin grafting, Re-epithelialization.

INTRODUCTION

Nanocrystalline silver dressing (NCS) has antimicrobial and anti-inflammatory effects due to its Ag+ ion that inhibits the growth of bacteria, particularly in burns and chronic wounds. However, they are cytotoxic and may delay healing in acute wound. [1] On the contrary, paraffin gauze dressing is non-adherent, soothing, non allergenic and allows easy wound drainage. Both methods can be used on split thickness skin graft donor site. However, the conventional paraffin dressing needs frequent changing causing discomfort to the patient and have a longer healing time. [2]

This study compares NCS dressing with Paraffin gauze dressing on small split thickness skin graft donor site on days of healing, rate of infection and pain.

MATERIALS AND METHODS

A prospective observational study was conducted by recruiting 71 subjects over 14 years of age with raw area smaller than 20 X 20 cm2 who were admitted for intermediate thickness skin grafting and not inflicted by malignant ulcer, previously under immunosuppressant or regular analgesics, reharvests from previously used donor sites or defaulters at the Department of Surgery, Tribhuwan University Teaching Hospital, Kathmandu, Nepal over a period of 12 months (April 2012 to April 2013).

The 71 patients were randomly (computer generated) divided into 2 groups – Group 1 and Group 2. All group 1 patients were dressed with NCS over the SSG donor site and Group 2 with the traditional Paraffin gauze. Mupirocin ointment was applied locally to both at the end of the procedure. Intermediate thickness split skin grafting was harvested with the same Watson modification of Humby's knife handle with Down's Blade set at 1.5 mark (one third of a millimeter thickness) in both the groups. The grafts were harvested from either the thigh or the calf on the discretion of the operating surgeon based on the size, ease of harvest and availability. Hemostasis was meticulously achieved with local adrenaline (1 in 300000) soaked gauze for about 10 minutes in all cases. Both the Groups were dressed similarly on the outside with two layers of saline soaked gauze and a rolled Cotton bandage and finally Crepe bandage was applied.

All donor areas were routinely opened on day 13 and assessed (2 non blinded observers) subsequently on alternate days till >95% re-epithelizaion (dry, opalescent, pink, external confluent surface with easy peeling off of the overlying dressing; no pain on exposure to air; no residual exudates) or infection (excess soakage, unexplained fever or excessive pain).

Pain scores (0-10) at rest were calculated on days 3, 5, 8, 10, 13 and then-after on alternate days till end of study (infection or >95% re-epithelizaion).

Statistical Analysis

Statistical analysis was performed with SPSS 17.0 and SAS 9.4 version. Results were expressed as mean ± standard deviation. Wilcoxon Two-Sample non parametric test was applied for the continuous variable. Chi-square test was applied for the categorical variables. 5 percent level of significant was used for the analysis.

RESULTS

A total of 71 patients were enrolled in the study. 35 patients comprised NCS Group and 36 patients comprised paraffin group. The 2 groups were not statistically significant in terms of mean age, Male: Female ratio and donor site area as shown in Table 1 below.

Table1. Comparison of study groups

	Group 1	Group 2	p value *
Mean age	39.05	35.83	0.24
Male: Female ratio	5:2	25:11	0.75
Donor site area	98.40	98.77	0.99

*** p value > 0.05 not significant**

Outcome – Healing

94.29 % cases healed by day 13 in NCS group whereas only 16.67 % cases in paraffin group healed by day 13. Similarly, 97.14 % cases healed by day 18 in NCS

group whereas 88.9% cases in paraffin group healed by day 18. Mean healing time in NCS group was 13.14 days (± 1.70) and 15.78 days (± 2.24) in paraffin group which was highly significant (p <0.0000).

Outcome - Pain

Table2. Mean Pain Score

Mean Pain Score	Group 1	Group 2	P value *
Day 3	3.43	3.52	0.23
Day 5	3.57	4.29	0.06
Day 8	3.14	3.55	0.09
Day 10	2.40	2.84	0.56

*** p value > 0.05 not significant**

Although the mean pain score were consistently low on all assessment days in NCS group as compared to paraffin group (Table 2), it was not statistically significant on any assessment day. In general, mean pain score was similar across groups, saying that there was no difference in the pain score.

There was no infection in both the groups.

DISCUSSION

Although Innes et al [3] has described different methods to access donor site healing, we have used direct vision for donor site healing estimation. Though it has its own inherent disadvantages of biasness, our own practical problem of implementation has made us to choose this method.

Our current study has shown that re-epithelizaion under NCS occurred on average at 13.14 ± 1.70 days, as compared to 15.78 ± 2.24 days with paraffin gauze dressing. This is within the range quoted by various studies as depicted in the Table 3 and 4.

Table3. Comparison of Paraffin gauze dressing for healing time

Study	Sample size	Year of study	Days for reepithelization
Weber et al [4]	68	1995	19.3 ± 5.1
Barnea et al [5]	23	2004	10 – 14
Lohsiriwat et al [6]	20	2009	11.20±3.52 (range 4–19)
Demirtas et al [7]	24	2010	10.5 ± 2.4 (range: 8–16)
Our Study	35	2012	15.78 ± 2.24 (range 13 to 20)

The study by Innes et al [3] showed that Polyurethane dressing is better than Silver hydrocolloid dressing for faster wound healing. Similarly, studies by Lohsiriwat et al [6] and Dermirtas et al [7] also have favored the silver group from paraffin group healing. Our study, though using a different form of silver dressing, has also favored the NCS healing over Paraffin gauze similar to the aforementioned studies. The NCS dressing releases metallic silver (Ag^0) for the initial few days only; the later wound healing effect may be due to the semi occlusive nature of its polyurethane component. Innes et al [3] has confirmed this by showing earlier re-epithelizaion rate of non-polyurethane silver dressing over polyurethane dressing.

Table4. Comparison of Silver dressing* healing time

Study	Sample size	Year of study	Days for re-epithelizaion
Innes et al [3]	17	2001	14.5 ± 6.7
Lohsiriwat et al [6]	20	2009	7.90 ±2.47 (range 4–13)
Demirtas et al [7]	20	2010	8.± 0.9 (range: 7–10)
Our Study	35	2012	13.14 ±1.70 (range 11- 21)

*** various silver preparations used**

A meta-analysis of 75 relevant articles including 3 review articles by Voineskos et al [2] in 2009 did not show superiority of any single donor site dressing over others. They concluded that there is a weak evidence supporting moist dressing other than pain reduction and that more methodologically sound randomized controlled trials are needed.

Pain is different when assessed at rest, on dressing change or on ambulation. For uniformity, we have taken pain score at least 6 hours prior to getting an analgesic and after at least an hour of bed rest.

Pain is significantly less in wounds dressed with semi occlusive dressing as compared to non-occlusive dressing. We have used similar secondary dressing for both wounds to decrease this confounding factor.

Dermirtus et al [7] states that Paraffin gauze is the most painful dressing among hydrocolloid, hydro fiber, polyurethane and silver dressing.

Although the average pain scores were consistently low on all days in NCS dressing group, it did not reach the level for statistical significance on any day of assessment. This is in contrast to many similar studies which showed consistently less pain as shown in Table 5. Different patient population and comparison of a different material may be one of the reasons for the same.

Table5. Comparison of Pain Scores in different studies

Study	Total patients	Dressing Material in Group 1	Dressing Material in Group 2	Significance for pain (Group 1 compared with 2)
Weber et al, [4] 1995	68	Polyurethane	Paraffin	Yes, initially
Akita et al, [8] 2006	35	Polyurethane	Hydrogel	Yes
Lohsiriwat et al, [6] 2009	18	Hydrofiber silver	Paraffin	Yes
Dermirtus et al, [7] 2010	20	Silver	Paraffin	Yes
Our Study	71	NCS	Paraffin	No

We have had no infection in any cases. Similarly, Lohsiriwat et al [6] and Honari et al [9] had reported no infection rate for Silver dressing group. Dermirtus et al [7] had higher infection rates with paraffin gauze dressing as compared to Silver group; some patients from both the groups had infection in his study.

Although opening the donor earlier at 7 days would allow better wound assessment and easier dressing change as the wound dries up by day 10, we change the dressing on 13 POD to compare the 2 dressings.

Limitations of our study are as follows:

1. Objective criteria for donor site healing and wound infection were lacking.
2. Since NAC/Paraffin gauze sites were distinct and easily distinguishable in appearance, it was impossible for the 2 direct observers to be completely blinded and unbiased.
3. Silver dressings are relatively expensive, although costs are mitigated by sustained-release products that may be effective for up to 7 days.
4. NCS dressing should have been compared with another semi occlusive dressing for better comparison and advisable result.
5. The healed wounds were not photographed for verification and long term follow up was not available.

SUMMARY

Despite the plethora of new materials on the market, we are still using paraffin gauze dressings for donor site wounds. Even though the anti-Inflammatory and antibacterial properties of nanocrystalline silver has been established since many decades, the fear of the yet unproved toxic effect of silver on healing wounds, cost factor and lack of direct comparing studies and recommendations has been the major factor for its infrequent use.

Average day of re-epithelizaion in NCS dressing was significantly faster than paraffin gauze dressing. This finding may be useful for cases (eg, large burns) needing repeated harvests from the same site. Although the average pain scores were consistently low on all days in NCS dressing group, it did not reach the level for statistical significance on any day of assessment. NCS dressing, as compared to the traditional paraffin gauze dressing, increased the healing time without any benefit in pain management for donor site healing. Based on the findings of the current study, we conclude that the NCS dressing is a preferred dressing for split-thickness donor site areas. Our study may provide impetus for better future structured studies to formulate recommendations for donor site wound healing.

Conflict of interest – none declared
Informed consent – taken from all patients
Approval from Ethical Board of Tribhuwan University Teaching Hospital (Maharajgunj, Nepal) – taken

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