

Comparative study between use of silver colloid and conventional dressing for diabetic foot ulcer

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Abstract

Objective: To compare the effect of silver colloid over wound healing in comparison to conventional dressing in diabetic foot ulcer, and find a cost-effective alternative management for diabetic foot.

Methods: Two groups with 24 individuals each were taken. Group A includes conventional dressing to ulcer. Group B includes silver colloid dressing. Daily dressing is done. Mean area of ulcer is noted before dressing. After 14 days of silver colloid dressing, areas of ulcers are taken in cm square measurements using calipers, compared with conservative dressing ulcers

Results: A total of 40 patients were included in the study, out of which 1 was lost to follow up. A total of 39 (n=39) eligible patients were studied, silver colloid group included 19 patients and conventional dressing included 20 patients. After 2 weeks, healing was seen in

14(73.7%) patients in silver colloidal dressing group and 8 (40%) patients in conventional dressing group (p value < 0.05).

Complete healing was seen in 5 patients in silver colloid and 2 patients in conventional dressing group.

Conclusion: comparison to conventional dressing in the management of diabetic foot both in form ulcer healing and reduction in ulcer size.

Keywords: silver colloid, diabetic foot ulcer, wound healing, conventional dressing.

Introduction

Perhaps the most deceptively simple of all therapeutic procedures is the treatment of cutaneous infection with topical medication. Despite the unique accessibility of the skin to scientific investigation, it has for too long been the playground of crude empiricism”—Professor Sydney Selwyn. [1]

Wounds are either acute or chronic and can result from venous or arterial insufficiency, diabetes, burns, trauma, chronic pressure or surgery.[2] Antiseptic agents also may control bacterial load and prevent the development of infection but may also be toxic to fibroblasts and other viable cells. [6]

However, Silver has only a very weak toxic potential and only rarely induces microbial resistance in vitro studies have demonstrated the effectiveness of silver-based dressings against pathogenic bacteria.[7] Thus, use of silver-releasing dressings in conjunction with debridement on wounds at risk of developing infection is beneficial.[4] Nanotechnology has facilitated the production of very small size silver particles with increasingly large surface area to volume ratios. Which imparts greater anti-microbial efficacy and most importantly lowers their toxicity to human tissue cell.[5] The percent change in foot ulcer area after 4 weeks of observation is a predictor of healing at 12 weeks. This simple tool may serve as an important clinical decision point in the care of diabetic foot ulcers for early identification of patients who may not respond to standard care and may need additional treatment.[3]

It is reported that colloidal (nano) silver particles promote wound healing and reduce scar appearance and that cytokines play an important role in these processes by their capacity to decrease wound inflammation and modulate fibrogenic cytokines. Nano silver induces apoptosis primarily in inflammatory cells in the dermis and clearly resolve inflammation by removing the inflammatory cells safely. It increases the rate of wound closure, which occurs through promotion of proliferation and migration of keratinocytes and helping differentiation of fibroblasts in to my of Ibroblasts, thereby promoting wound contraction.[8]

In a study done by Sharma R et al. Int Surg J. 2017 Aug;4(8):2627-2631 After 12 weeks, complete healing was seen in 11 (84.62%) patients in silver colloidal dressing group and 5 (41.67) patients in conventional dressing group (p value < 0.05). The percentage decrease in wound area after 12 weeks of dressing in silver and conventional group was 85.63% and 68.63% respectively [9]

The purpose of this single center randomized control study was to compare the efficacy of silver colloidal dressings versus conventional dressings in management of diabetic foot ulcers.

Methods

- Study Design: Hospital based Comparative prospective Observational study.
- Ethical committee: A.J. Institute of Medical Sciences and Research Centre, Mangalore.
- Period of study: August 2020 to May 2021 (10 months)
- Place of study: A. J. Institute of Medical Science and research Centre, Mangalore
- Sampling Technique: Purposive sampling technique was adopted to allocate individuals to the group who meet the inclusion criteria for the study.

Diabetic patients of age 18 years and above were included after getting an informed consent. ulcers classified under WAGNER Grade 1-3 ulcers and Patients compliant with diabetic medication were included.

Patients suffering from a condition that interfered with wound healing e.g., carcinoma, vasculitis, connective tissue disease, an immune system disorder, treatment with corticosteroids, immunosuppressive agents, radiation therapy, chemotherapy and patient with known hyper sensitivity to colloidal silver gel were excluded.

Patients not giving consent for the dressing or not complaint with dressing were not included in the study.

Methodology

Two groups with 24 individuals each were taken. Group A includes conventional dressing to ulcer. Group B includes silver colloid dressing. Mean area of ulcer is noted before dressing using calipers. Us culture for aerobic and anaerobic microorganism on first day. Debridement as and when required. Amoxicillin clavulanic acid was started empirically for all patients and thereafter switched over to other culture sensitivity guided antibiotics. Daily dressing was done with betadine and normal saline for patients under conventional dressing group and for group B normal saline and silver colloid was used for dressing. After 14 days of silver colloid dressing, areas of ulcers are taken in centimeter square measurements using calipers, and compared with conservative dressing ulcers.

Statistical analysis

Data was collected in Microsoft excel worksheet 2019. The collected data was analyzed by SPSS (version 23) to find descriptive statistics, mean +/- standard deviation, frequency, percentage. Chi square test to test the difference in rate (percentage) between the two modalities.

Results

A total of 40 patients were included in the study, out of which 1 was lost to follow up.

A total of 39 (n=39) eligible patients were studied, silver colloid group included 19 patients and conventional dressing included 20 patients, of which 27(69.2%) were males and 12(30.8%) were females. Majority of the patients belonged to grade 2 and 3 Wagner’s classification., i.e., grade 2 included 20(51.3%) of patients and grade 3 included 16(41%). Most of the

patients were on insulin and constituted 84.6 % (n=33) of the sample size. Mean age of participants=57.79 years (SD=+/-12.105).

Table 1: Socio-demographic character of participants (n=39)

Variable	Frequency	Percentage (%)
Gender		
Male	27	69.2
Female	12	30.8
X-ray findings		
Normal	35	89.7
Osteomyelitis	4	10.3
Wagener s grading		
Grade 1	3	7.7
Grade 2	20	51.3
Grade 3	16	41
Type of medication		
Insulin	33	84.6
Oha	6	15.4

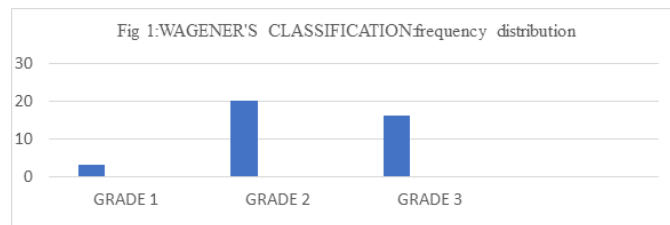


Fig 1: Wagener’s classification: frequency distribution
 After 2 weeks, healing was seen in 14(73.7%) patients in silver colloidal dressing group and 8 (40%) patients in conventional dressing group. With a p value of 0.033 Complete healing was seen in 5 patients in silver colloid and 2 patients in conventional dressing group.

Table 2: Healing response of silver colloid and conventional dressing group

Dressing type	Healing /Healed	Non-healing/ Amputated	Total	X ²	P value
Silver	14(73.7)	5(26.3)	19		

colloid					
Conventional	8(40)	12(60)	20	4.496	0.033
Total	22	17	39		

**p value < 0.05 is statistically significant).

Discussion

The use of silver as a prophylactic and treatment for infection and other diseases dates back to about 1000 BC, when the ancient Greeks and the Romans used it as a disinfectant. [13,14]

Silver dressings contain silver atoms that are slowly released as positively-charged silver cations (Ag+), which have a strong antimicrobial effect: they bind to bacterial cell wall, causing disruption of the wall and the death of the bacteria.[10] Ag+ ions also bind to bacterial enzymes thereby preventing them from performing their function as well as to bacterial cell DNA, thus interfering with cell division and replication.[10]

Reduction in the use of antimicrobial medicine has been seen in diabetic ulcer cases with the use and application of topical NS. On the other hand, use of iodine preparations has been criticized because povidone iodine, unless highly diluted, is toxic to most cell types and implicates in healing process.[4]. Therefore, the need of finding new topical applicants which are cost effective and furthermore effective in infection control in treatment of diabetic foot ulcers becomes a major concern in modern times.

It is reported that colloidal (nano) silver particles promote wound healing and reduce scar appearance and that cytokines play an important role in these processes by their capacity to decrease wound inflammation and modulate fibrogenic cytokines. Nano silver induces apoptosis primarily in inflammatory cells in the dermis and clearly resolve inflammation by

removing the inflammatory cells safely. It increases the rate of wound closure, which occurs through promotion of proliferation and migration of keratinocytes and helping differentiation of fibroblasts into myofibroblasts, thereby promoting wound contraction.[11]

In the trial of Münter, patients treated with silver-containing foam experienced less pain, showed a quicker reduction of odor, and required less frequent dressing changes due to leakage. These secondary advantages of silver can be used in balancing the pros and cons for the use of silver.[4]

The Contop trial evaluated 352 chronic non-healing ulcers in which venous leg ulcers were present in 43-48%, mixed venous/arterial in 20-24%, pressure ulcers in 10% and diabetic foot ulcers in 5-9%. The primary dressing type consisted of a foam or alginate in 45%, hydrocolloid or film in 15%, gauze in 4%, antimicrobial in 30% (silver foam in 48% of these) and a range of other dressings in the remaining 6%. There was a 50% reduction in wound size by Week 4 in those treated with the silver foam, compared to a 30% reduction in the (combined) standard care groups, with p=0.002 for the difference.[4] In a study done by Sharma R et al. *Int Surg J.* 2017 Aug;4(8):2627-2631 After 12 weeks, complete healing was seen in 11 (84.62%) patients in silver colloidal dressing group and 5 (41.67) patients in conventional dressing group (p value < 0.05). The percentage decrease in wound area after 12 weeks of dressing in silver and conventional group was 85.63% and 68.63% respectively [9]. The results of which are similar to our study.

However, multi centric studies with a larger population and variable socio demographic characteristics must be

undertaken to establish the efficacy of silver colloid over other conservative dressings.

Conclusion

Based on the study silver colloidal based dressing had better results in comparison to conventional dressing in the management of diabetic foot both in form ulcer healing and reduction in ulcer size.

Further, considering the cost of hospitalization and reduced burden on health care system the silver colloidal dressing is a cost-effective option in chronic non-healing diabetic ulcers as compared to conventional dressing.

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