

# Colloidal silver-based nanogel as nonocclusive dressing for multiple superficial pellet wounds

Ganesh Singh Dharmshaktu<sup>1</sup>, Aanshu Singhal<sup>1</sup>, Tanuja Pangtey<sup>2</sup>

Departments of <sup>1</sup>Orthopaedics and <sup>2</sup>Pathology, Government Medical College, Haldwani, Uttarakhand, India

## ABSTRACT

A good dressing is mandatory to an uncomplicated wound healing, especially when foreign particles contaminate the wound. Various forms of dressing preparations are available for use and differ in chemical composition and efficacy. Silver has been a known agent with good antimicrobial and healing properties and recent times has seen an upsurge in various silver-based dressing supplements. We describe our report of use and efficacy of a silver nanoparticle- based gel dressing in the healing of multiple superficial firearm pellet wounds.

**Keywords:** Colloidal silver, dressing, firearm injury, management, silver nanoparticle, superficial wound, treatment, wound

## Introduction

Silver has been an effective agent with documented efficacy against wide spectrum of bacterial, viral, and fungal infections.<sup>[1]</sup> Recently, many silver-based preparations are available for effective management of wounds. Various wound dressing materials or implants coated with silver have been advocated for preventive or therapeutic measure against biofilm formation.<sup>[2]</sup> Biologically, active ions released by silver bind and act over various bacterial cells structures and execute its potential effects by various mechanisms.<sup>[3]</sup> Various actions on the cell wall, sulfhydryl (SH) group and nucleic acid are some important sites of action.<sup>[3-5]</sup> Apart from this, the bacterial resistance to silver preparations has been documented to be slower and less as compared to antibiotics.<sup>[6]</sup> Silver-based products are a viable option for chronic or infected wound management as well as fresh wounds with potential to become infected. Besides it broad area of superficial wounds heals well with nonocclusive dressing and silver-based gel preparations may supplement it with appropriate antimicrobial coverage. Various superficial wounds are seen in primary care

settings and all require early healing to decrease the burden of complicated wounds requiring substantial financial and man-hour lost in the treatment.

## Case Report

A 35-year-old male patient presented to us with accidentally struck by a shotgun at close range leading to multiple pellet wound over his left thigh region. There were no major other injuries and he could bear weight on the affected limb suggestive of intact underlying bone. There was minimal bleeding as the pellets did not seem to penetrate deeper. However, the pain restricted full use of the limb and he was carried by his friends with supported walking into the emergency department. The clinical evaluation was done and revealed no significant musculoskeletal injury and intact distal neurovascular status. A diagnosis of uncomplicated superficial multiple pellet wounds was made [Figure 1]. The patient was admitted for supportive, symptomatic treatment as well as dressing of the wound. The radiological confirmation of intact femur was established and a shot of broad spectrum intravenous antibiotic was administered after anti-tetanus therapy. The wounds were washed with saline to remove external dirt and contaminant.

**Address for correspondence:** Dr. Ganesh Singh Dharmshaktu, Department of Orthopaedics, Government Medical College, Haldwani - 263 139, Uttarakhand, India.  
E-mail: drganeshortho@gmail.com

### Access this article online

#### Quick Response Code:



**Website:**  
www.jfmpc.com

**DOI:**  
10.4103/2249-4863.184659

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

**For reprints contact:** reprints@medknow.com

**How to cite this article:** Dharmshaktu GS, Singhal A, Pangtey T. Colloidal silver-based nanogel as nonocclusive dressing for multiple superficial pellet wounds. J Family Med Prim Care 2016;5:175-7.

The wound management was planned with a nonocclusive dressing with colloidal silver-based amorphous hydrogel (Megaheal; Aristo Pharmaceuticals Pvt. Ltd., Mumbai, Maharashtra, India) application to the wide area until it absorbs. The aforementioned gel has silver based nanoparticles manufactured through sol-gel technology. Dressings were performed initially by trained nursing staff thrice daily and then was explained and tutored to the patient and his attendant to continue as advocated. The patient was discharged on the 3<sup>rd</sup> day, and no antibiotics were used except a single shot at admission. The patient was reviewed as an outpatient every 5<sup>th</sup> day. His wounds showed gradual healing [Figure 2] and there was painless shedding of pellet remnants as scab [Figure 3]. His wound healed completely in 2 weeks following injury. Young age, healthy body, lack of comorbidity, or addiction might be other important factor in good healing. There was no complication related to the wound was seen in long follow-up, as the patient resumed his activities of daily living and vocation.

## Discussion

The particle size of silver used in the preparation has been found to be a good predictor of antibacterial activity as compared to the concentration and comparative studies between various silver preparations against nano forms also confirm that.<sup>[5,7]</sup> Smaller particles (<10 nm) have better efficacy due to the larger surface area to elute ions. Apart from it, the presence of silver has been found to positive and synergistic effects on concomitant antibiotic use.<sup>[8]</sup> Silver-based dressings are reportedly more effective. However, their long-term potential harmful effects are not well described or studied. Caution may be warranted for prolonged or excessive use and due to patient selection. The precise safe exposure limits are not well-defined, and workers in the area advocate study *in vitro* models with physiological relevance in view of better understanding of overall effects of the chemical on humans.<sup>[9]</sup> Further research is required to assess the short or long-term complications of silver nanoparticles in the body. The development of techniques to better control the release of nanoparticles from the preparations will not only make silver-based formulations bioactive but biocompatible with the host.<sup>[10]</sup> Our short course and superficial site were a positive factor in minimal harmful effects as there was no immediate or remote skin or systemic untoward complication noted in the follow-up of 18 months.

Although a controlled randomized study is required to fully assess the efficacy of silver-based ointments for wound management but examples of good results as in our case affirms their role in variety of superficial wounds as dressing adjunct in primary care settings.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.



Figure 1: The clinical picture of multiple pellet wounds



Figure 2: Healed wound with re-epithelialization



Figure 3: The healing wounds with scab formation and ready to shed

## References

1. Nair LS, Laurencin CT. Nanofibers and nanoparticles for orthopaedic surgery applications. *J Bone Joint Surg Am* 2008;90 Suppl 1:128-31.
2. Phillips PL, Yang Q, Davis S, Sampson EM, Azeke JJ, Hamad A, *et al.* Antimicrobial dressing efficacy against mature *Pseudomonas aeruginosa* biofilm on porcine skin explants. *Int Wound J* 2015;12:469-83.

3. Chaloupka K, Malam Y, Seifalian AM. Nanosilver as a new generation of nanoparticle in biomedical applications. *Trends Biotechnol* 2010;28:580-8.
4. Yamanaka M, Hara K, Kudo J. Bactericidal actions of a silver ion solution on *Escherichia coli*, studied by energy-filtering transmission electron microscopy and proteomic analysis. *Appl Environ Microbiol* 2005;71:7589-93.
5. Alt V, Bechert T, Steinrücke P, Wagener M, Seidel P, Dingeldein E, *et al.* An *in vitro* assessment of the antibacterial properties and cytotoxicity of nanoparticulate silver bone cement. *Biomaterials* 2004;25:4383-91.
6. Percival SL, Bowler PG, Russell D. Bacterial resistance to silver in wound care. *J Hosp Infect* 2005;60:1-7.
7. Choi O, Deng KK, Kim NJ, Ross L Jr., Surampalli RY, Hu Z. The inhibitory effects of silver nanoparticles, silver ions, and silver chloride colloids on microbial growth. *Water Res* 2008;42:3066-74.
8. Fayaz AM, Balaji K, Girilal M, Yadav R, Kalaichelvan PT, Venkatesan R. Biogenic synthesis of silver nanoparticles and their synergistic effect with antibiotics: A study against gram-positive and gram-negative bacteria. *Nanomedicine* 2010;6:103-9.
9. Ucciferri N, Collnot EM, Gaiser BK, Tirella A, Stone V, Domenici C, *et al.* *In vitro* toxicological screening of nanoparticles on primary human endothelial cells and the role of flow in modulating cell response. *Nanotoxicology* 2014;8:697-708.
10. Brennan SA, Ní Fhoghlú C, Devitt BM, O'Mahony FJ, Brabazon D, Walsh A. Silver nanoparticles and their orthopaedic applications. *Bone Joint J* 2015;97-B: 582-9.