

# Successful Topical Management of a Lower Left Extremity Carbuncle Using Hypochlorous Acid: A Case Report on Chronic Wound Care and its Applications in Rural Health

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## ABSTRACT

Carbuncles are painful, deep skin lesions that erupt when multiple pus-filled infected hair follicles, called furuncles, consolidate into a single larger lesion. These lesions are often found in regions of the body exposed to high levels of friction such as the back of the neck, back, axilla, buttock, and groin<sup>[1]</sup>. Nevertheless, carbuncles can form on any surface of the body that contains hair follicles and in rare instances, affect regions such as the leg. Management of these deep skin lesions usually includes debridement of the wound followed by the administration of antibiotics. In certain patient populations, pathologic factors such as increased bacterial biofilm and lifestyle factors such as chronic smoking can prolong the wound healing process and result in refractory infections<sup>[2]</sup>. In the case of a 34-year-old male patient with a sizeable carbuncle located on his distal lower left extremity, a topical hypochlorous acid spray therapy, Spectricept Skin and Wound Cleanser, was eventually initiated to sterilize the wound and facilitate adequate wound healing. Hypochlorous acid is naturally produced by immune cells in the human body and has been known to have broad-spectrum antimicrobial activity<sup>[4]</sup>. Following the application of the new therapy, the carbuncle demonstrated a remarkable wound healing process that was much more effective than the standard management protocol with antibiotics. This case demonstrated the successful management of a chronic lower extremity wound using a topical hypochlorous acid spray, which can be readily accessible to patients in rural communities and reduce the burden of multiple clinic visits to achieve wound closure.

## INTRODUCTION

- Chronic wounds affect approximately 6.5 million individuals in the United States and accumulate over \$22.5 billion dollars in healthcare expenditures annually<sup>[5]</sup>. Chronic wounds are often extremely debilitating to patients, as they are associated with persistent pain, psychological distress, reduced productivity, diminished overall quality of life, and increased healthcare costs<sup>[5],[6]</sup>. It is generally accepted that lesions are categorized as chronic wounds if they have not successfully healed or show improvement after 4 weeks.
- The process of wound healing itself involves complex biophysiological processes that can be divided into four stages: hemostasis, inflammation, proliferation, and remodeling<sup>[7]</sup>. In the setting of chronic wounds, factors such as pre-existing comorbidities, socioeconomic factors, and a patient's lifestyle can largely impact the ability to successfully transition through the stages of wound healing<sup>[2]</sup>.
- Cigarette smoking has long been associated with delayed wound healing due to the vasoconstrictive effects of nicotine found in cigarettes. Previous studies have indicated that vasoconstriction due to chronic cigarette smoking creates a hypoxic environment in the tissue, which can significantly impair the cellular functions necessary for proper wound healing<sup>[2],[3]</sup>.
- Hypochlorous acid (HOCl) is a compound naturally produced by neutrophils in the human body to fight off pathogens. Due to its uncharged nature, HOCl can permeate the cell walls of bacteria and induce lysis through the production of reactive oxygen species via a process called oxidative burst. As a result of its rapid broad-spectrum antimicrobial activity, stabilized HOCl has been a recent pharmaceutical therapy of interest that targets bacterial biofilm and reduces the bacterial burden in chronic wounds<sup>[4],[8],[9]</sup>.
- The goal of a stabilized topical HOCl therapy in chronic wounds is to sterilize the wound and allow the necessary inflammatory cytokines and metalloproteinases to properly function and repair damaged tissue. The treatment is painless, easy to adhere to, and can play a significant role in antimicrobial stewardship strategies<sup>[10]</sup>.

## REPORT OF THE CASE

- 34-year-old male presented to the wound care clinic with a carbuncle on his lower left leg. The lesion contained numerous pustules, crusted skin, bloody exudate, and maintained a purplish discoloration surrounded by an erythematous base (Figure 1 & Figure 2). Patient was initially treated with antibiotics but was referred to the wound clinic due to delayed wound healing.
- Upon initial arrival at the wound care clinic (Figure 3) the lesion was markedly improved but still contained pustules, crusted skin, moderate exudate, and an erythematous base. Excisional debridement of the pustules and topical vancomycin-soaked gauze were used to dress the lesion. Cultures of the exudate and biopsy of the lesion were obtained.
- One week later, there was significant improvement (Figure 4) and cultures were negative, but biopsy revealed multiple microabscesses throughout the wound. Topical HOCl therapy, using Spectricept Skin and Wound Cleanser, with cover dressings was initiated.
- One week following initiation of HOCl therapy, the lesion demonstrated remarkable improvement with complete resolution of pustules, minimal erythema, and minimal tenderness (Figure 5). Application of topical hypochlorous acid twice daily was continued.
- One month following initiation of HOCl therapy, the patient demonstrated a near complete resolution of the lesion (Figure 6). There was no longer any evidence of infection around the lesion and the patient no longer reported any pain. Triamcinolone cream was added to his treatment protocol to reduce inflammation and itchiness.
- Two months following initiation of HOCl therapy, the patient presented with no signs of active ongoing infection of the lesion. The lesion demonstrated a markedly improved appearance with no new areas of drainage (Figure 7). Patient denied symptoms of pain and itchiness.
- Three months following initiation of HOCl therapy, the patient's wound has essentially healed. The tissue surrounding and underlying the lesion was intact with only signs of erythema remaining. Concurrently, a new pustular formation secondary to an insect bite presented distal to the original lesion (Figure 8). Patient was instructed to continue his daily HOCl regimen and follow-up as needed for maintenance of his original carbuncle and management of his newly formed lesion.

## RESULTS OF TREATMENT



Figure 1. Carbuncle on the medial aspect of the distal lower left extremity several weeks prior to arrival at the wound clinic



Figure 2. Carbuncle on the medial aspect of the distal lower left extremity several weeks prior to arrival at the wound clinic



Figure 3. Carbuncle on initial evaluation at the wound clinic



Figure 4. Carbuncle following standard debridement of pustules and application of topical vancomycin



Figure 5. Carbuncle following one week of topical hypochlorous acid spray



Figure 6. Carbuncle one month following hypochlorous acid therapy



Figure 7. Carbuncle two months following hypochlorous acid therapy



Figure 8. Carbuncle three months following hypochlorous acid therapy, essentially healed. Note the development of a new pustule formation secondary to a possible insect bite.

## DISCUSSION

- Although carbuncles can develop anywhere hair follicles are present, they are more likely to form in areas exposed to increased sweat and friction such as the neck, back, and groin.
- In a relatively young patient that presents with a chronic infection, there is significant concern for comorbidities such as primary immunodeficiency or the invasion of deeper tissue with resistant strains of bacteria<sup>[11]</sup>. This patient's condition was further complicated by his history of cigarette smoking, which has been shown to significantly delay wound healing.
- When approaching the management of chronic wounds, it is important to take the individual patient's pathology and lifestyle factors into consideration. Due to the initial presence of pustules and exudate of the patient's carbuncle, the most appropriate first step in management was to debride the wound and obtain a culture of the tissue followed with a broad-spectrum antibiotic dressing.
- The use of a topical antimicrobial agent was favored over systemic oral antibiotics because the patient lacked constitutional symptoms such as fever, lymphadenopathy, and sepsis<sup>[12]</sup>. The hypochlorous acid itself is an antimicrobial spray that was applied twice daily, making it an easy treatment modality for the patient to remain adherent to.
- In the setting of a clinic that largely serves a rural patient population, a topical hypochlorous acid spray is a formulation that can be easily applied and dispensed in an outpatient setting. This allows patients to be self-sufficient and adhere to treatment while saving the time and costs associated with multiple visits to the clinic.
- The only complication that arose during the course of treatment was the development of a new pustule below the original lesion. It is believed this new pustule was secondary to an insect bite from being outdoors frequently, as the patient denied shaving the area or any activity that could have caused an impacted hair follicle. Nevertheless, the patient was instructed to continue the topical hypochlorous acid regimen on the pustule as it had shown to be successful in treating his carbuncle.

## CONCLUSIONS

- In the setting of a chronic wound complicated by increased bacterial burden and a history of chronic cigarette smoking, a topical hypochlorous acid spray demonstrated the ability to clear the wound of active infection and facilitate successful healing. This therapy modality can be especially beneficial in clinics that mainly serve rural populations, as it can be easily administered in an outpatient setting and eliminate the need for patients to travel long distances to receive care.

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- Spectricept Skin and Wound Cleanser is FDA-cleared and intended for OTC use for cleansing, irrigating, moistening, debridement and removal of foreign material including debris from skin abrasions, lacerations, minor irritations, cuts and intact skin.
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## REFERENCES

