The pH of a Hypochlorous Acid-Based Wound Solution is Not Significantly Altered to Become Alkaline After Application to Cutaneous Wounds

Cameron S. D'Orio BS[1], Eriks E. Ziedins BS[1], Shane Mathew MD[1,4], Bonnie C. Carney PhD[1,2], Lauren T. Moffatt PhD[1,2], Jeffrey W. Shupp MD[1,2,3,4]

[1]Firefighters' Burn and Surgical Research Laboratory, MedStar Health Research Institute, [2]Department of Surgery and Biochemistry, Georgetown University School of Medicine, [3]Department of Plastic and Reconstructive Surgery, Georgetown University School of Medicine, [4]The Burn Center, Department of Surgery

Introduction

Cutaneous wounds often require cleansing with topicals to reduce wound debris and maintain a wound pH conducive to healing. Hypochlorous acid (HOCl) is used in a wound cleansing solution that is formulated to have a pH comparable to normal human skin. Other available products are also used as topical cleansers but some are highly alkaline and therefore may be less conducive to re-epithelialization. Here, we investigated an HOCl-based wound solution (HOCL WS) to determine whether application to a burn or other wound would alter the pH of the solution to become more alkaline or retain acidity.

Methods

Female Yorkshire swine (n=4) were anesthetized, sedated, and subjected to a full thickness cutaneous contact burn. After 24 hours of post-injury monitoring, crystalloid resuscitation, and a 1% silver sulfadiazine dressing to uninjured and burned skin, wounds were debrided and HOCl WS (0.033% HOCl)-soaked gauze was applied to debrided burns or adjacent uninjured skin for 20 minutes. The pH of the HOCl WS was measured prior to gauze soaking and wound exposure and after extraction from the gauze **(Figure 1)**.

This collection technique was replicated in cutaneous wounds in patients (n=16) to compare the pH of the same HOCl WS after wound application.

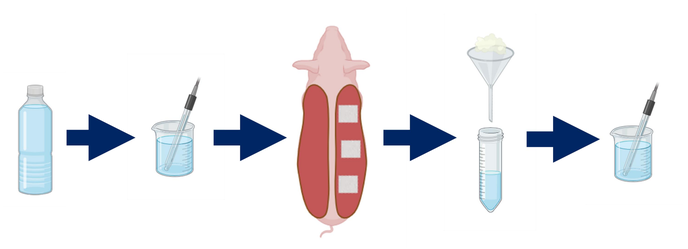

Figure 1. Extraction of HOCl WS-soaked gauze post exposure to acute burn wounds in a swine contact burn model.

Results

In an acute swine burn model, the pH of HOCl WS alone did not change when combined with sterile gauze (5.22±0.02 vs 5.34±0.06; p=0.83) in the absence of wound exposure. After application to both uninjured skin and burn wounds, the pH of solution decreased, indicating a shift towards higher acidity (4.26±0.28 and 4.16±0.30, respectively; p<0.0001). There was no difference in pH of HOCl WS exposed to uninjured skin- and burned skin-soaked sites (p=0.89) **(Figure 2)**.

The pH of HOCl WS increased after application to cutaneous wounds in patients (5.17±0.11 vs 5.99±0.23) **(Figures 3 and 4)**. The average pH of HOCl WS prior to wound application was less than the reported maximum pH from the manufacturer.

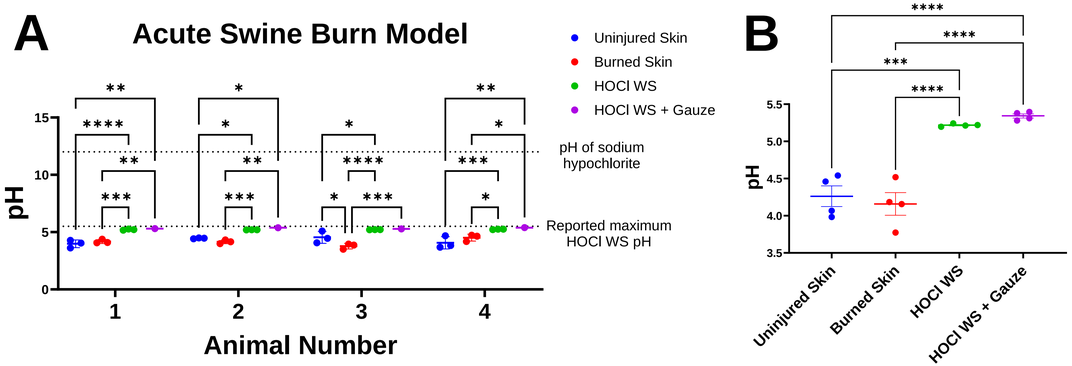

Figure 2. pH changes in HOCl WS after application to normal skin and burned skin in an acute swine burn model. Individual animal data (A) and grouped data (B). *:p≤0.05; **:p≤0.01; ***:p≤0.001; ****: p≤0.0001.

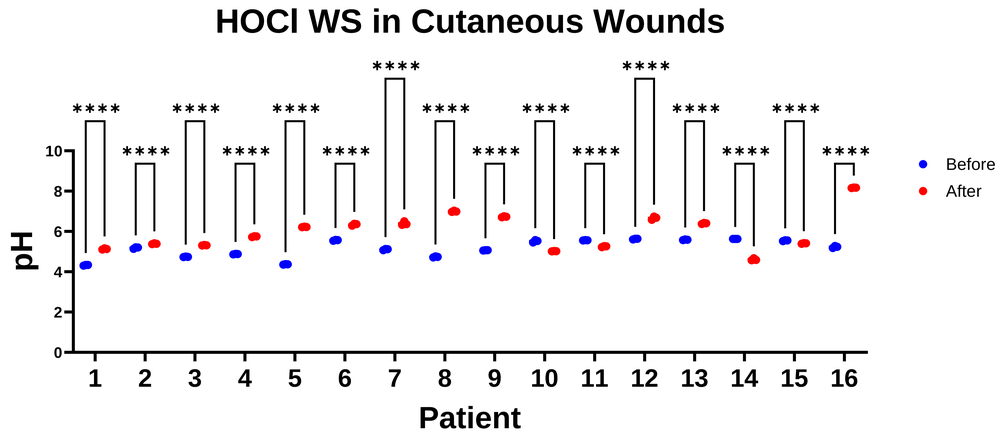

Figure 3. pH changes in HOCl WS after application to cutaneous wounds in patients. ****:p≤0.0001.

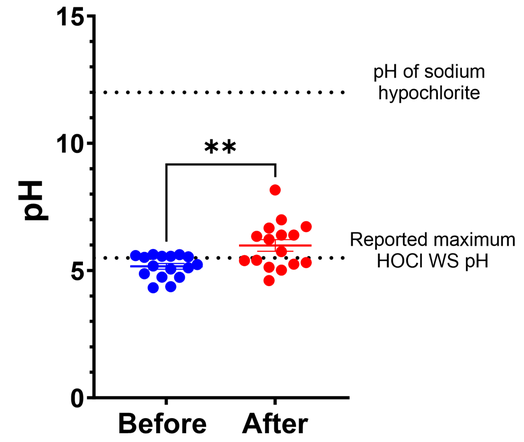

Figure 4. pH changes in HOCl WS after application to cutaneous wounds in comparison to the pH of sodium hypochlorite. **:p≤0.01.

Discussion

This HOCl WS did not become alkaline after application in an acute swine burn model and in cutaneous wounds in patients. Given that chronic wounds are typically alkaline and that acidic pHs may aid in wound healing, this on-the-market HOCl WS may be an effective agent for cleansing chronic wounds. The use of HOCl-based wound solutions needs to be further studied in burn wounds to elucidate optimal pH environments for sufficient wound healing.