Novel Use of Antimicrobial Hand Sanitizer in Treatment of Nosocomial Acinetobacter Infection

By Meghan Donahue, MS; Luke R. Watson, MD; Alfonso Torress-Cook, DrPH; Paul A. Watson, MD
ORTHOPEDICS 2009; 32:58

January 2009

Abstract

Colonization of wounds with multidrug-resistant organisms is a difficult orthopedic problem. Acinetobacter infections are especially difficult because they are resistant to all currently available antibiotics. We present the use of a novel skin sanitizer, Stay Byotrol Clean (Byotrol Inc, Spartanburg, South Carolina), to treat a multidrug-resistant wound infection.

A 31-year-old T10 paraplegic man presented with chronic bilateral stage IV decubitus trochanteric ulcers. Cultures grew methicillin-resistant Staphylococcus aureus and vancomycin-resistant Enterococcus. The ulcers were initially treated with irrigation and debridement and vancomycin, levaquin, and cefepime. After 4 months of aggressive treatment, the cultures continued to be positive for Escherichia coli and Acinetobacter baumannii. The patient was started on amikacin and tigecycline. Despite 1 additional month of aggressive wound care, debridements, and intravenous antibiotics, the cultures continued to grow A baumannii and Pseudomonas aerug. The A baumannii was resistant to all available antibiotics tested. The ulcers were then treated with daily application of Stay Byotrol Clean hand and skin sanitizer. Four days later, cultures were negative for any bacterial growth, with no A baumannii. After 1 week, the ulcers showed new granulation tissue with no visible necrotic tissue. After 3 months of treatment, the ulcers had healed.

Stay Byotrol Clean is nonirritating and contains no iodine or alcohol. It is currently being used for decolonization of patients on admission to the hospital, however, there is great potential for its use in wound treatment, preoperative surgical sterilization, and orthopedic devices.

Case Report

A 31-year-old T10 paraplegic man presented with chronic bilateral stage IV decubitus trochanteric ulcers with exposed necrotic greater trochanteric bone bilaterally (Figure 1). The patient’s right hip wound measured 11×12 cm and left hip wound measured 10×14 cm. Cultures grew methicillin-resistant Staphylococcus aureus and vancomycin-resistant Enterococcus. Initial treatment included irrigation and debridement; vancomycin, levaquin and cefepime; aggressive nutrition; and local wound care with wound wax and silver nitrate paste. After 4 months of wound care and gaining 45 lbs, the patient was discharged home with continued home wound care.
Figure 1: Left (A) and right (B) hips before Stay Byotrol Clean application (Staytrol Inc, Spartanburg, South Carolina); minimal granulation tissue present. Figure 2: Left (A) and right (B) hips after eight daily applications of Stay Byotrol Clean; wound granulation was present and skin was free of bacteria.

Three days later, the patient returned with fevers and foul-smelling discharge from the bilateral decubitus ulcers. Levaquin and aggressive wound care with wet-to-dry dressings were started. The patient underwent a repeat irrigation and debridement of the wounds. Wounds cultures were positive for *Escherichia coli* and *Acinetobacter baumannii*. Blood cultures were negative. The patient was put on amikacin and tigecycline. Despite 1 additional month of aggressive wound care, the bilateral hip cultures continued to grow *Acinetobacter baumannii* and *Pseudomonas aerug*. The *Acinetobacter baumannii* was resistant to all available antibiotics tested.

Following the second culture positive for *Acinetobacter baumannii*, the decubitus ulcers were treated with daily application of Stay Byotrol Clean skin-sanitizing foam and received daily dressing changes and wound care. Four days later, cultures were negative for all bacterial growth with no *Acinetobacter baumannii*. Eight days later, the ulcers showed new granulation tissue with no visible necrotic tissue (Figure 2). The right hip ulcer measured 3.5×4 cm and the left hip ulcer measured 10×10 cm. The wounds remained negative for growth and healed after 3 months of treatment.

**Discussion**

Multidrug-resistant organisms are a major problem for surgeons. *Acinetobacter*, a pleomorphic aerobic Gram-negative bacillus, is commonly found in the hospital environment. *Acinetobacter* colonization is found among the general public, but because of low virulence, infection is rare and usually only found in very ill patients. There are at least 32 species of *Acinetobacter*, but *Acinetobacter baumannii* is responsible for the majority of infections. Studies of *Acinetobacter baumannii* infections show that up to 90% are hospital acquired. This organism rapidly acquires antimicrobial-resistant genes and survives antimicrobial environments. Since its discovery, *Acinetobacter baumannii* has developed resistance to almost all commercially available antibiotic drugs, including carbapenem, cephalosporins, aztreonam, aminoglycosides, and ciprofloxacin.

Risk factors for resistant *Acinetobacter baumannii* infection include previous antibiotic use, hospitalization, nursing home residency, Foley catheterization, intensive care unit stay, and invasive procedures. Due to limited treatment
options for resistant *Acinetobacter baumannii*, patients infected with this pathogen have increased severity of illness and mortality rates when compared to nonresistant *Acinetobacter baumannii*. As the number of multidrug-resistant organisms increases, so does the need for antimicrobial products to treat patients infected with these pathogens.

Stay Byotrol Clean (benzalkonium chloride 0.1%) skin sanitizer is a commercially available product widely used in the United Kingdom and only recently available in the United States. Laboratory analysis has shown that Stay Byotrol Clean has antimicrobial properties against multidrug-resistant organisms, including drug-resistant *Acinetobacter spp*, methicillin-resistant *Staphylococcus aureus*, *Clostridium difficile*, and vancomycin-resistant *Enterococcus*. In addition to the biocide benzalkonium chloride, the Byotrol technology (a polymer layer) is thought to have a physical effect that rapidly disrupts the microbe's ability to reproduce and maintain colonies, preventing biofilm formation. Because it is alcohol- and iodine-free, it is less irritating than many antibacterial and surgical scrubs used in health-care facilities. Stay Byotrol Clean also appears to prevent recolonization. Stay Byotrol Clean is currently being used for decolonization of patients upon admission to the hospital, but there is great potential for Stay Byotrol Clean to be used in wound treatment, preoperative surgical sterilization, and orthopedic devices.

Patient safety is imperative for all medical treatment options, and our patient was counseled carefully prior to consenting to treatment. Stay Byotrol Clean is not FDA compliant as a wound sanitizer, only as a skin sanitizer. The active ingredient in Stay Byotrol Clean is benzalkonium chloride, which is used in mouthwash and as a preservative in eye drops and nasal sprays.

Marple et al. reviewed 18 studies on the safety of benzalkonium chloride in nasal solutions and concluded that benzalkonium chloride appears “safe and well tolerated for both long- and short-term clinical use.” Benzalkonium chloride has also been tested in vitro as a wound irrigant. Gainer et al. compared benzalkonium chloride to normal saline irrigation in beef muscle strips inoculated with bacteria and found that benzalkonium chloride was an effective wound disinfection agent. Tarbox et al. evaluated the efficacy and toxicity of benzalkonium chloride as an irrigant in rats and found that benzalkonium chloride was more effective than normal saline at eradicating *Staphylococcus aureus* with no toxicity noted on histological examination. As well, Conroy et al. studied in vitro rat wound irrigation with benzalkonium chloride vs normal saline, castile soap, and antibiotics. Benzalkonium chloride was the only irrigation that significantly lowered the rate of *Staphylococcus aureus*.

Although benzalkonium chloride appears to have a good safety profile for use on mucus membranes, is an effective in vitro irrigant, and caused no adverse reactions clinically in our patient, further study is needed to verify Stay Byotrol Clean’s safety as a wound decolonization agent.

**Conclusion**

Nosocomial *Acinetobacter* wound infections are a major problem for surgeons due to their antibiotic-resistant properties. This case report documents the use of a new product that may be used to treat such infections. Because Stay Byotrol Clean foam is nonirritating and contains no iodine or alcohol, it is an ideal candidate for wound treatment. The foam not only kills multidrug-resistant bacteria on contact, but also creates a barrier that prevents recolonization and the formation of bacterial biofilm. Stay Byotrol Clean is currently being used for decolonization of patients upon admission to the hospital, but there is great potential for Stay Byotrol Clean to be used in wound treatment, preoperative surgical sterilization, and orthopedic devices.

**References**


Authors

Ms Donahue is from Creighton University Medical School, and Dr Watson (Paul) is from Lakeside Orthopaedics, Omaha, Nebraska; and Drs Watson (Luke) and Torres-Cook are from Pacific Hospital Long Beach, Long Beach, California.

Ms Donahue has no relevant financial relationships to disclose, and Drs Watson (Luke), Torres-Cook, and Watson (Paul) own Bioblockade LLC, a company that distributes Byotrol products.

Correspondence should be addressed to: Paul A. Watson, MD, Lakeside Orthopaedics, 16909 Lakeside Hills Ct, #208, Omaha, NE 68122.

Visit us regularly for daily orthopedic news.

Copyright © 2009 SLACK Incorporated. All rights reserved.