A Comparison of the In Vitro Antimicrobial Activity of Iodoform Gauze and Silver-Containing Sodium Carboxymethyl Cellulose Wound Dressings

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Introduction

The risk of infection in acute and chronic cavity wounds such as abscesses, fistula's and late stage pressure ulcers is significant and needs to be controlled using topical antimicrobial therapies in addition to antibiotics when clinically appropriate.

Impregnated dressings such as iodoform gauze are widely used to facilitate drainage and provide antimicrobial protection in acute cavity spaces following incision and drainage, and they are also used to pack tracking wounds where infection is a risk. More recently, a sodium carboxymethyl cellulose dressing** containing ionic silver with superior fluid handling and antimicrobial properties to traditional iodoform gauze has been designed in strengthened ribbon form for the management of a wide variety of cavity wounds such as excised abscesses, fistula, pituitary sinus, post-surgical wounds and tunneling pressure ulcers. It is also available as an unreinforced 100% Hydrofiber® dressing for wounds that are at risk of infection.

In this study, a simulated cavity wound model was used to compare the antimicrobial effectiveness of iodoform gauze packing strip and a silver-containing “100% Sodium CMC ribbon dressing**” 100% silver-containing CMC ribbon dressing against pathogenic and antibiotic-resistant bacteria over a seven-day test period.

Materials & Methods

The antimicrobial activity of 100% silver-containing CMC ribbon dressing (ConvaTec Inc) and iodoform gauze packing strips (Dynarex) was evaluated against antibiotic resistant bacteria using a simulated wound fluid model. Overnight cultures of challenge organisms: Community-acquired methicillin-resistant Staphylococcus aureus (CA-MRSA, strain USA300) and multi-resistant (extended spectrum beta-lactamase) Pseudomonas aeruginosa (NCTC 13437) were separately prepared in MRS to obtain a working concentration of approx.1x10^6 cfu/ml. A 1.0 ml volume of each challenge suspension was then separately added to a 9.9ml volume of simulated fluid contained within a 30ml sterile universal container (such that each model contained approx. 1x10^7 cfu/ml of challenge organism) [see figures 1 & 2]. Samples of 100% silver-containing CMC ribbon dressing (1cm x 22cm) and iodoform gauze packing strip (0.635cm x 35cm) were then separately transferred to the inoculated containers (n=5 for each challenge organism); these dressing sizes were sufficient to fill a 10mm volume (figures 1 & 2). A negative control (100% CMC ribbon dressing) was also prepared and included within each challenge organism.

Following incubation of each test model at 35°C (±2°C), total viable counts were performed using a pour plate method. From each test model, a 100µl volume of each challenge suspension was then separately added to 9.9ml volumes of MRS containing 0.1% sodium thiosulphate (to neutralise residual antimicrobial activity). Serial 1:10-fold dilutions were then prepared using the same diluent and 1.0ml volumes of the most appropriate dilutions were separately inoculated into sterile petri-dishes. After TSA (poured to a depth of 4mm) was then added to each petri-dish, with each dish being sealed to mix the inoculum and agar. All agar plates were allowed to solidify and then incubated at 35°C (±2°C) for at least 72 hours prior to observation and counting. Duplicate total viable counts were performed on each test model at 4, 24, 48, 72, 96 hours and day 7 timepoints.

Results presented in figures 3 & 4 show that 100% silver-containing CMC ribbon dressing killed both CA-MRSA and a multi-resistant strain of P. aeruginosa over a 7-day test period. An approximate 100-fold reduction in P. aeruginosa was observed in the presence of 100% silver-containing CMC ribbon dressing within 72h (figure 3), and a greater than 100,000-fold reduction in P. aeruginosa was observed in the presence of the same dressing within 48h (figure 4).

Discussion

Despite the modern era of wound care, gauze dressings are still widely used today, often impregnated with antimicrobial agents to prevent wound infection. One of the oldest impregnated dressings is iodoform gauze which was first used in the early 20th Century as an antiseptic dressing. Prolonged use of iodoform gauze has been associated with toxicity.

Despite iodoform gauze having an extensive history as an antiseptic dressing, iodoform is not a potent antimicrobial agent and today many other agents exist that have greater antimicrobial potency. Ionic silver is one such agent and is now widely used in many forms of antimicrobial dressing.

Due to the continued extensive use of iodoform gauze in wound care, we undertook an in vitro study using a stringent simulated wound fluid model to compare the antimicrobial efficacy of an iodoform gauze packing strip against a modern, silver-containing hydrofiber ribbon dressing (100% silver-containing CMC ribbon dressing). The outcome of this study was that 100% silver-containing CMC ribbon dressing was more effective in this in vitro model than iodoform packing strips at killing the selected challenge organisms, which are emerging antibiotic-resistant pathogens. We believe this dressing combines superior infection and exudate control properties for the management of a wide variety of cavity wounds.

References


*Hydrofiber® (ConvaTec Inc.)
**AQUACEL® Ag with strengthening fibre

Figure 1. 100% silver-containing CMC ribbon dressing Packaged Within the Simulated Wound Fluid Model

Figure 2. Iodoform Gauze Packing Strip Packaged Within the Simulated Wound Fluid Model

Figure 3. Antimicrobial Efficacy of 100% silver-containing CMC ribbon dressing and iodoform gauze packing strip Against CA-MRSA (USA 300)

Figure 4. Antimicrobial Efficacy of 100% silver-containing CMC ribbon dressing and iodoform gauze packing strip Against Multi-resistant P. aeruginosa (NCTC 13437)