

Bacterial endotoxin binding activity of a silver impregnated activated charcoal dressing and gauze



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OBJECTIVE

To evaluate the bacterial endotoxin binding capability of a proprietary silver-impregnated activated charcoal dressing (SIAC). The study assessed the binding capacity of SIAC vs gauze in an in-vitro test over 24-hours.

INTRODUCTION

Bacterial endotoxins are the lipopolysaccharide component of the cell wall membrane of Gram negative bacteria. Small quantities of endotoxin are released during cell replication but the majority of endotoxin is released into the environment upon cell lysis. Bacterial endotoxin release is one of many factors considered to cause delayed healing in infected and critically colonized wounds. Depending on mode of action antimicrobial treatment of infection may induce release of these endotoxins with subsequent detrimental effects¹.

Specific to wound healing endotoxins have been shown to cause decreased fibroblast proliferation *in vitro*², and *in vivo*, increased expression and release of proinflammatory cytokines^{3,4}, decreased production of collagen⁴ and decreased tensile strength in healing wounds⁵.

Activated charcoal has been used in the past to bind endotoxins found in plasma due to Gram-negative bacterial sepsis⁶. A wound dressing which is antimicrobial and also capable of binding toxins detrimental to wound healing may be beneficial in the treatment of infected wounds.

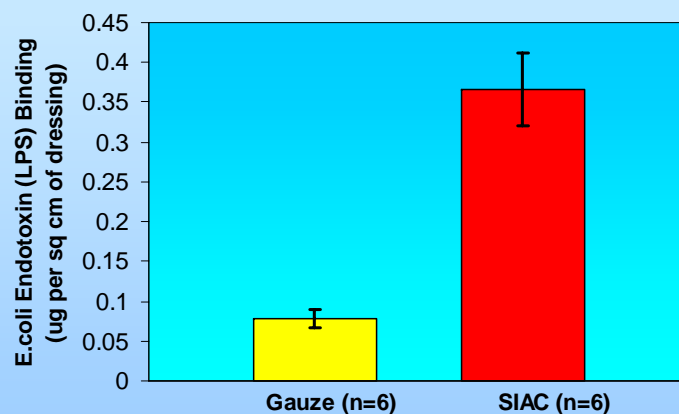
TEST DRESSINGS

The proprietary silver impregnated activated charcoal dressing used in this study was ACTISORB[®] Silver 220 Dressing, Johnson & Johnson Wound Management Worldwide, a division of ETHICON, INC.

The gauze used in this study was TOPPER[®] 8, (Johnson and Johnson Wound Management Worldwide, a division of ETHICON, INC.)

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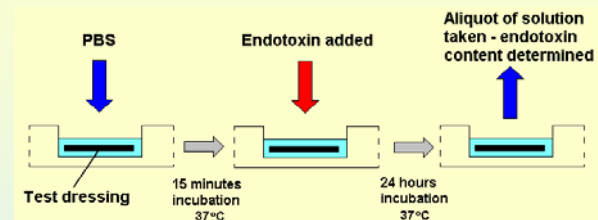
Figure 2. Bacterial Endotoxin binding capacity over 24-hours for SIAC vs Gauze



METHODOLOGY

Six samples (2.5cm x 2.5cm) of SIAC and gauze were pre-wet with phosphate buffered saline for 15 minutes at 37°C, while shaking. The wetted samples were then incubated in a known concentration of *E. coli* endotoxin O55:B5, for 24 hrs at 37°C, without shaking (Figure 1). *E. coli* endotoxin is a bacterial metabolite often found in chronic wounds.

Figure 1: Schematic of experiment design



Six control solutions were also prepared without test samples and containing only endotoxin at the same initial concentration as that used with the test samples. The same procedure was repeated with the control solutions as was used with the test samples.

The amount of endotoxin remaining in solution after incubation was determined using a quantitative gel-clot LAL assay. The amount of endotoxin bound to the dressings was then determined using the initial concentration minus amount remaining after incubation minus the amount bound to the incubation plates (determined from the control solutions). The amount bound to the incubation plates was determined from the initial concentration (control solution) minus concentration after incubation (control solution).

Gel-clot LAL assay - LAL (Limulus Amoebocyte Lysate) is used to estimate the concentration of endotoxin. LAL reacts with the endotoxin to form a gel and this reaction forms the basis of the assay. The sensitivity or gel-clot endpoint of the LAL used, where a firm solid gel is formed when in contact with a specific level of endotoxin, was determined. This sensitivity level or concentration of endotoxin was used to quantify the amount of endotoxin in solution.

REFERENCES

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CONCLUSIONS

An analysis of endotoxin levels indicated a significant difference between the binding ability of ACTISORB Silver 220 dressing and gauze ($p=0.001$), with the ACTISORB Silver 220 dressing adsorbing over 3 times more endotoxin per weight of dressing and over 4.5 times more endotoxin per surface area.

Based on these in-vitro results, ACTISORB Silver 220 dressing could offer an alternative approach to help in the management of infected and critically colonized chronic wounds.