SIGNIFICANT AND RAPID REDUCTION OF FREE ENDOTOXIN CONCENTRATION BY DIALKYLCARBAMOYL CHLORIDE (DACC)-COATED WOUND DRESSING

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Introduction

Endotoxin or Lipopolysaccharide (LPS) is a component of the outer cell membrane of the gram-negative bacteria, and is mainly released when the bacteria grow, die or damaged. The lipid-A domain of endotoxin is responsible for its toxicity.

Endotoxin is a known potent trigger for inflammation. Several in vitro studies suggest that endotoxin also contributes to a delay in wound healing [1-4]. Therefore, reduction of endotoxin in the wound may lead to less inflammation and better wound healing process.

Dialkylcarbamoyl chloride (DACC)-coated wound dressing reduces bio-burden in the wound by hydrophobic binding of microorganisms. It is hypothesized that the hydrophobic interaction also occurs between the DACC-coated wound dressing and the hydrophobic Lipid-A part of endotoxin.

Aims

1) To explore the ability of DACC-coated wound dressing to bind endotoxin from Pseudomonas aeruginosa in vitro.

2) To investigate its effect on the level of endotoxin released from gram-negative bacteria.

Materials & Methods

For endotoxin binding experiment, two punched circular (14 mm Ø) DACC-coated wound dressing (Sorbact® Compress) were incubated with 50 μl of 107 CFU/ml P. aeruginosa for 1 hour. After incubation, intact bacteria were separated by centrifugation and filtration. The supernatants were analyzed for endotoxin.

To investigate the effect of DACC-coated wound dressings on the level of endotoxin released from gram-negative bacteria, another two punched circular pieces (14 mm Ø) of DACC-coated dressing (Sorbact® Compress) were incubated with 50 μl of 108 CFU/ml P. aeruginosa for 1 hour at 37°C. After incubation, intact bacteria were separated by centrifugation and filtration. The supernatants were analyzed for endotoxin.

Endotoxin analyses were performed using Limulus assay.

Results & Discussions

In this in vitro study, DACC-coated dressing was able to consistently reduce endotoxin concentration by 93-99% (P < 0.0001) after 24 h. Even at a very high endotoxin concentration of 11000 EU/ml, 99% reduction can be seen after 24 h incubation (Fig. 1). A significant endotoxin reduction of 39% (P < 0.001) was observed already at 5 minutes, and continued over time to 48 h (Fig. 2). Moreover, endotoxin that bound to the dressing adhered strongly, given that it was not released by the extensive vortexing for 1 minute.

After a one-hour incubation of clinically relevant P. aeruginosa strain with DACC-coated dressings, no increase of free endotoxin concentration was observed. Instead, free-endotoxin concentration was reduced to below detection limit (from 420 EU/ml to <0.2 EU/ml, >99.95% reduction).

Conclusion

This is the first study to show that DACC-coated wound dressing is able to significantly and rapidly bind purified and shed endotoxin from P. aeruginosa. This ability to remove both endotoxin and bacterial cells may lead to less inflammation in the wound and better wound healing process.

References