Colistin-loaded silk membranes against wound infection with Pseudomonas aeruginosa.

Abstract:
Wound infections caused by multidrug-resistant bacteria are a major issue in wound care. An occlusive dressing delivering an antimicrobial agent to the wound may be advantageous. The objective of this study was to evaluate an occlusive silk membrane loaded with colistin to establish an effective antimicrobial wound dressing against Gram-negative bacteria in vitro and in vivo. ST-silk protein membranes (thickness, 100 μm; pore size, <100 nm) were loaded with log-scale colistin dilutions (0.027 to 270 mg/ml) and tested in a modified microbroth dilution assay against Pseudomonas aeruginosa (American Type Culture Collection 27853). A rat burn infection model was used to demonstrate the antimicrobial activity of ST-silk membranes loaded with 270 mg/ml colistin. Finally, a porcine wound infection model was used to study dose response (2.7, 27, and 270 mg/ml colistin loading concentration) in a time-dependent manner (0, 2, 4, and 6 days). The in vitro study demonstrated a concentration-dependent antimicrobial effect against P. aeruginosa, with complete elimination at the highest loading concentrations (2.7, 27, and 270 mg/ml). All colistin membranes demonstrated lower colony-forming unit counts compared with the corresponding phosphate-buffered saline or carrier controls. The rat burn infection model demonstrated a colony-forming unit reduction of...
greater than 3 log-scales for the colistin-loaded ST-silk membranes after 3 days. On average, the wounds' colony-forming unit quantity remained at greater than 1000 during the entire follow-up of 6 days, apart from three wounds where complete bacterial clearance was observed. This study demonstrates that occlusive ST-silk membranes loaded with an antimicrobial agent may be an effective dressing for infected wounds.