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Topical colloidal silver as an anti-biofilm agent in a Staphylococcus aureus chronic rhinosinusitis sheep model.

[Rajiv S¹](#), [Drilling A](#), [Bassiouni A](#), [James C](#), [Vreugde S](#), [Wormald PJ](#).

Author information

Abstract

BACKGROUND: Treatment of recalcitrant chronic rhinosinusitis (CRS) is a challenge with increasing antibiotic resistance, leading to re-emergence of topical therapies. The aim of this study was to assess safety and efficacy of topical colloidal silver solution for the treatment of Staphylococcus aureus biofilms in a sheep model.

METHODS: In the safety study, normal saline (control) and 30-ppm colloidal silver solution (test) was used to flush the frontal sinuses for 14 days in 8 sheep (4 sheep each). In the efficacy study, following frontal sinus infection with Staphylococcus aureus, sheep were treated with either control saline or topical silver solution of varying concentrations (30 ppm/20 ppm/10 ppm/5 ppm) for 5 days, with 4 sheep in each group. Blood silver level, full blood counts, and biochemical parameters were analyzed in both safety and efficacy studies. Sinus tissue was harvested for histological examination and ciliary structure analysis in safety and for biofilm biomass quantification by fluorescence in situ hybridization (FISH) technique and COMSTAT 2 software in the efficacy study. Results were analyzed using appropriate statistical tests.

RESULTS: Sheep treated with silver showed a significant decrease in biofilm biomass (0.004, 0.004, 0.004, and 0.007, in the 4 silver-treated groups, respectively) compared to saline control (0.175), $p < 0.001$. Although average blood silver levels were higher in the treated groups compared to controls ($p <$

0.05), blood counts and biochemical parameters were normal. Histology and ciliary structure analysis did not show any difference between control and treatment groups.

CONCLUSION: Topical colloidal silver solution has effective antibiofilm activity in Staphylococcus aureus CRS in a sheep model and appears safe.

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KEYWORDS: Staphylococcus aureus; biofilm; chronic rhinosinusitis; colloidal silver; sheep

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