Bacteriophage Addition to Systemic Antibiotic Therapy Does Not Eradicate Peri-Implant Biofilm-Formed Infection in Fracture-Related Infection: A Preclinical Study

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INTRODUCTION:

Fracture related infection (FRI) is complex complication in orthopedic trauma with significant patients morbidity. With growing resistant bacteria, alternative antimicrobial such as bacteriophages have gained popularity to be used as an adjunct to antibiotics. The purpose of this study is to investigate the efficacy of combining bacteriophage therapy to systemic antibiotic treatment for eradicating peri-implant biofilm infections in a preclinical model of FRI.

METHODS:

A mouse model of FRI was employed, wherein peri-implant biofilm infections were established using a methicillin-resistant *Staphylococcus aureus* (MRSA) strain. Mice were divided into two groups: the treatment group received a combination of bacteriophage and systemic antibiotics, while the control group received systemic antibiotics alone. The primary outcome measure was bacterial burden at the site of infection, evaluated through quantitative cultures from liquid samples (from irrigation), soft tissue, implant, and bone. Secondary outcomes included biofilm penetration efficacy and the development of bacteriophage resistance.

RESULTS:

There was no statistically significant difference in bacterial burden between the treatment and control groups across all sample types ($P > 0.05$). The addition of bacteriophage therapy to systemic antibiotics did not show enhanced efficacy in reducing the bacterial load or eradicating the biofilm-formed infections. Variance analysis showed no significant differences between groups, suggesting consistent treatment effects across the study population.

DISCUSSION AND CONCLUSION:

The addition of bacteriophage therapy to systemic antibiotic treatment did not significantly reduce peri-implant biofilm infections in a preclinical mouse model of FRI. These findings highlight the challenges of biofilm penetration and suggest that further optimization of bacteriophage therapy, including phage selection, dosing, and delivery methods, is necessary for enhancing its therapeutic potential in complex infections such as FRI.