BIO_18 - Evaluation of the neutralization potential of methicillin-resistant *Staphylococcus aureus* < /i>(MRSA) using Silver Nanoparticles associated with anti-PBP2a Monoclonal Antibody

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Introduction: The rise of bacterial resistance, especially methicillin-resistant *Staphylococcus aureus* (MRSA), represents a global health challenge. These bacteria strains are resistant to multiple antibiotics, resulting in high mortality rates. Considering this context, innovative strategies are essential to effectively combat infections. The combination of monoclonal antibodies (mAbs) which specifically target bacterial cells, with silver nanoparticles (AgNP), known for their antimicrobial properties, offers an innovative approach to combating resistant infections.

Objectives: Assess the neutralization potential of MRSA through the combination of AgNP with monoclonal antibody IgG anti-MRSA.

Methodology: Spherical 10 nm AgNP, stabilized with Boron and albumin (BSA), were synthesized in-house at the Serological Testing Laboratory (LASOR). A mAb that recognizes a MRSA specific protein was previously developed and characterized. Initially, approximately 107 colony-forming units (CFU) of Brazilian epidemic clone strain of MRSA were inoculated into 20 mL of Luria-Bertani broth (LB) in 50 mL Falcon tubes. The tubes were then incubated at 37°C for 24 hours and treated with AgNP in multiple concentrations (from 1.25 to 20 µg/mL), to determine the optimal concentration for exerting antimicrobial activity against MRSA. The effective concentration of AgNP, in combination with 100 and 200 µg of the mAb IgG anti-MRSA were tested. Sample collection at predetermined intervals to measure the optical density at 600 nm (OD_{600}) of the culture was conducted.

Results: In the initial assessment of the inhibitory potential of AgNP, it was determined that the most effective concentrations for inhibiting bacterial growth were 10 and 20 µg/mL. In the subsequent assay, AgNP at these concentrations, as well as mAb IgG individually, demonstrated the ability to reduce bacterial growth. It was observed that increasing the concentration of the mAb IgG did not significantly affect the inhibition of growth, while higher concentrations of AgNP showed greater inhibitory potential, both individually and in combination. Utilizing the mAb IgG in conjunction with AgNPs resulted in a modest decrease in bacterial load when compared to the separate use of each compound.

Conclusion: The results of the preliminary assays indicated that all the conditions evaluated apparently demonstrated the ability to inhibit bacterial growth. These findings suggest that the approach under study has the potential to become an effective strategy for MRSA neutralization. However, quantitative tests to confirm and robustly validate this neutralization potential will be conducted soon.

Keywords: Methicillin-resistant *Staphylococcus aureus*; Silver nanoparticles; Monoclonal antibody