CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

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Project Number

S1511

Project Title

Do Beta Lactam Antibiotics Stimulate Non-typeable Haemophilus influenzae Biofilm Formation?

Abstract

Objectives/Goals

The purpose of this study was to analyze the effects of beta- lactam antibiotics on NTHi biofilm formation. Although beta lactam antibiotics are known be bactericidal, it was hypothesized that specific sub-lethal concentrations may enhance biofilm growth.

Methods/Materials

Different NTHi bacterial strains were incubated for 24 hours in 96 well plates in the presence of increasing concentrations of amoxicillin, cefuroxime and ampicillin. Norfloxacin, a non-beta lactam antibiotic, was also tested and was used for comparison. Biofilm formation was assessed using a crystal violet assay. A CLSM and a SEM were used to analyze the effects at the microscopic level.

Results

At specific sub-lethal concentrations of antibiotic the majority of NTHi strains exhibited increased biofilm formation. These antibiotic concentrations were deemed maximum stimulatory concentrations (MSC). At these MSCs, biofilm formation increased while bacterial count decreased. When the antibiotic concentration was increased beyond this point, biofilm mass decreased. CLSM and SEM pictures backed these findings and changes in the biofilm profile and bacteria morphology coincided with a large stress response at the MSC.

Conclusions/Discussion

The antibiotic concentration in the middle ear after systemic or oral administration of an antibiotic is currently unknown. It is conceivable that middle ear antibiotic concentrations fall within the MSC range. Systemic administration, which doesn#t specifically target the middle ear, may encourage biofilm formation in bacterial pathogens. By looking at the local concentration in the ear and the process by which antibiotics are administered, future research can help with the effectiveness of antibiotics for patients with otitis media.

Summary Statement

This is a study of the effects of antibiotics on NTHi biofilm formation.

Help Received

Used lab equipment at House Ear Institute under the supervision of Dr. Paul Webster and Christoph Schaudinn