ABSTRACT

THESIS: Effects of subinhibitory carvacrol levels on *Bacillus cereus* virulence during endophthalmitis *in vivo*

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Bacillus cereus is a Gram-positive, pathogenic bacterium capable of causing an ocular infection known as endophthalmitis. The virulence of *B. cereus* during endophthalmitis is largely attributed to the presence of toxins such as Hbl and Nhe. Although broad-spectrum antibiotics such as vancomycin are able to control *B. cereus* in the eye during infection, these antibiotics can be toxic to sensitive retinal cells, and they do not control the damaging inflammatory response mounted by the host. Carvacrol is an extract from oregano oil with both antimicrobial and anti-inflammatory qualities that may serve as a possible alternative treatment for *B. cereus* endophthalmitis. However, at subinhibitory levels, carvacrol increases the virulence of *B. cereus*. We hypothesize that *B. cereus* exposed to subinhibitory carvacrol concentrations will cause more damage to the eye than the bacteria alone without progressing into a systemic infection in an *in vivo* mouse model. Systemic pro-inflammatory cytokines (TNF-α and IL-6) and anti-*B. cereus* IgG levels were measured by enzyme-linked immunosorbent assays. We found that mice infected with *B. cereus* and the subinhibitory concentration (SIC) of carvacrol had higher systemic levels of TNF-α, IL-6, and anti-*B. cereus* IgG. Ocular damage caused by infection

with *B. cereus* was quantified by histological analysis. We found that eyes infected with *B. cereus* stressed with the SIC of carvacrol had more damage than eyes infected with the bacteria alone. However, ocular damage was not significantly different in mice treated with *B. cereus* stressed with the SIC of carvacrol and mice treated with the SIC of carvacrol alone. We determined that endophthalmitis caused by *B. cereus* stressed with the SIC of carvacrol results in an increased systemic immune response and increased ocular damage, but we are unable to confirm if these increases are due to bacterial virulence or irritation caused by carvacrol. Future studies will investigate the effects of carvacrol on retinal pigment epithelial (RPE) cells found in the blood-retinal barrier.