

Can studies of inhibition of adhesion by sub-mic concentrations of antibiotics predict the outcome in biofilm formation inhibition?

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Abstract

The use of sub-inhibitory (sub-mic) concentrations of antibiotics has been suggested as a way of preventing biofilm formation by clinically relevant microorganisms. Many studies have demonstrated that low concentrations of antibiotics can inhibit initial microbial adherence to medical-device surfaces. However, since initial adherence and subsequent biofilm formation can be two distinct phenomena, conclusions withdrawn regarding initial adherence cannot be extrapolated to biofilm formation..

In this study, we evaluated the adherence of several clinical isolates of Coagulase negative staphylococci (CoNS) to acrylic and the effect of sub-mic concentrations of vancomycin, cefazolin, dicloxacillin and combinations of these antibiotics. Most of the antibiotic-strain combinations resulted in an effective reduction of bacterial adherence, in some cases reaching 77% inhibition of adherence. Some synergistic effects were observed when using combinations of antibiotics. To determine the effect of the above antibiotics in biofilm formation, the strains with a high biofilm formation capacity were grown in sub-mic concentrations of those antibiotics. While some antibiotic-strain combinations significantly inhibited biofilm formation, most of the combinations that inhibited adherence did not have a profound effect on overall biofilm formation. No synergistic effects on reducing biofilm formation were found when using sub-mic combinations of antibiotics. When comparing the results of the effect of sub-mic amounts of antibiotics on inhibition of adherence with their effect on inhibition of biofilm formation, significant differences ($p < 0.05$) were found, mainly when using combinations of antibiotics. In general, the effect on inhibition of adherence was greater than the effect of inhibition of biofilm formation.

Our results demonstrate that assays evaluating the inhibition of initial adherence to medical surfaces cannot predict the effect of inhibition of biofilm formation.