BIOFILMS FORMATION BY STAPHYLOCOCCUS EPIDERMIDIS: MODULATION BY FLUOROQUINOLONES

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ABSTRACT

The interaction between pefloxacin, ciprofloxacin, norfloxacin, ofloxacin, and levofloxacin and biofilms formed by Staphylococcus epidermidis (20 clinical isolates) was studied. In the presence of 1/2 MIC, 1/4 MIC and 1/8 MIC, the optical density of the biofilms was reduced to 22-24%, 44-52% and 65-74% of the controls, respectively. Treatment of preformed biofilms with fluoroquinolones in concentrations ranging from 12.5 µg/ml to 400 µg/ml, caused reduction in the optical density of the adherent biofilms to 45-77% of the control. In an in vitro model of vascular catheter colonization, subinhibitory concentrations (1/2, 1/4, or 1/8 MIC) of fluoroquinolones reduced the number of adherent bacteria to 24-28%, 48-55% and 58-76% of the controls, respectively. The vascular catheter segments precolonized with Staphylococcus epidermidis for 24 hours and exposed to the fluoroquinolones in 4-8 times MIC (50 µg/ml) for 2 hours showed less than 8% growth of adherent cells compared to the controls. No adherent organisms were cultured in the presence of 8-16 times MIC (100 µg/ml). The activity of pefloxacin in reducing the bacterial adherence and eradicating the preformed biofilms was demonstrated by scanning electron microscope. The effect of the fluoroquinolones on the adherence of Staphylococcus epidermidis to the surface of human epithelial (Hep-2) cells was also studied. In the presence of subinhibitory concentration (1/2, 1/4, and 1/8 MIC), the range of the number of the adherent viable cells was reduced to 39-48%, 46-61%, and 62-75 % of the control, respectively. Treatment of Hep-2 cells, preattached with bacterial cells, with the tested fluoroquinolones at concentrations of 5, 10, and 20 µg/ml decreased the number of the adherent cells to 64-71%, 53-61%, and 29-37% of the control, respectively. These data show that subinhibitory concentrations of pefloxacin, ciprofloxacin, norfloxacin, ofloxacin, and levofloxacin inhibit the adherence of Staphylococcus epidermidis to the surfaces of plastics, vascular catheters, and human epithelial (Hep-2) cells. In addition, higher concentrations of fluoroquinolones were able to eradicate the preformed biofilms of Staphylococcus epidermidis.