EFFECT OF DIFFERENT ANTIMICROBIAL AGENTS ON
STAPHYLOCOCCUS AUREUS ADHESIVENESS AND BIOFILM
FORMATION

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ABSTRACT

The effect of fluoroquinolones (ciprofloxacin, ofloxacin, and levofloxacin),
clindamycin, β-lactams (cefoperazone, cefotaxime, cefepime), streptomycin, and
vancomycin on the adherence and biofilm formation by Staphylococcus aureus (12
clinical isolates) was studied. In the presence of 1/2 MIC, 1/4 MIC and 1/8 MIC, the
optical density of the formed biofilms on plastic surfaces was reduced to 24-59.9%,
32.4-76.7% and 49.7-88.5% of the controls, respectively. Treatment of the preformed
biofilms with high concentrations (25-200 μg/ml) of the tested agents caused
reduction in the optical density of the adherent biofilms to a range from 52.3 to 87.7%
of the control. In an in-vitro model of vascular catheter colonization, the tested
subinhibitory concentrations reduced the percentage of the viable adherent cells to
32.1-71.6%, 42.5-85.6%, and 60.3-95.3% of the controls, respectively. The tested
fluoroquinolones and clindamycin are significantly more active than the other tested
agents, and levofloxacin was the most active one. The vascular catheter segments
precolonized with S. aureus for 24 hr and exposed to 50 μg/ml (4-31 times MIC) of
the tested fluoroquinolones and clindamycin for 2 hr showed few viable adherent cells
(7-13 CFU/segment), while no adherent viable cells were cultured in the presence of
100 μg/ml (8-62 times MIC). Also, the tested subinhibitory concentrations reduced the
percentage of the viable bacterial cells adherent to the surface of human lung
epithelial A549 cells to the range of 30.1-79.2%, 41.1-89.3%, and 60.9-96.2% of the
control, respectively. Treatment of the A549 cells, preattached with bacterial cells,
with the tested agents at concentrations of 5, 10, and 20 μg/ml (1/4-50 times MIC)
reduced the range of the percentage of the adherent cells to 53.2-88.3%, 33.8-79.2%,
and 27.2-68.1% of the control, respectively. The superior activity of the tested
fluoroquinolones and clindamycin was also observed. The obtained data show that
subinhibitory concentrations of ciprofloxacin, ofloxacin, levofloxacin, and
clindamycin efficiently reduced the biofilm formation and adherence of S. aureus to
the surfaces of plastics, vascular catheters, and human lung epithelial A549 cells.
Also, higher concentrations (≥ MIC) of fluoroquinolones and clindamycin were able
to eradicate the adherent S. aureus.