# *In-vitro* activity of disinfectants and ciprofloxacin alone and in combination on *Pseudomonas aeruginosa* biofilms

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## BACKGROUND

*Pseudomonas aeruginosa* is a multi-drug resistant pathogen and one of the major virulence factors is the ability to form biofilms. *P. aeruginosa* are protected in the biofilm and gains resistance against antibiotics and disinfectants. The aim of this study was to investigate susceptibility to antimicrobials/disinfectants of epidemiologically unrelated *P. aeruginosa* strains and the effects of antimicrobials/disinfectants on biofilms when used alone and in combination.

## MATERIAL/METHODS

From the 181 strains that were isolated at the Ege University Hospital, 83 strains that were found to be causative agent were used. Epidemiological relation of the isolates were evaluated by ERIC-PCR and the susceptibility of epidemiologically unrelated isolates to ciprofloxacin (CIP) and disinfectants [Altecidal liquid (polyhexanide- PHMB), Opakjel 2-70 (chlorhexidine- CHX), Descosept AF- (Quaternary ammonium compounds-QAC), and Mooncid Endo (2 % gluteraldehyde- GA)] was assessed using microdilution method. The biofilm formation capacities of the strains were evaluated with crystal violet method by measuring them with a microplaque-reading spectrophotometer. Three repetitions were performed. By using the 2MIC, MIC, MIC/2 and MIC/4 dilutions of CHX, GA, PHMB and QAC,and CIP in the checkerboard method, their effect on the biofilm producing capacities of nine strains with a strong biofilm production capacity and of the control strain *P. aeruginosa* ATCC 15442 was assessed when used alone and in combination.

## RESULTS

From the 83 strains, epidemiologically unrelated 19 strains were chosen. Ten of these strains were found resistant to CIP and all strains were susceptive to disinfectants at concentrations recommended by the manufacturing companies. The disinfectant with the lowest MIC value was CHX, followed by PHMB, QAC and GA.

While one strain did not produce biofilm, three strains had weak, six strains had moderate and nine strains had strong biofilm formation capacities and those nine strains producing strong biofilms were chosen for the further studies. The biofilm-production reduction/induction rates at MICs of CIP and disinfectants are shown in the Table.

Table: The effects of CIP and disinfectants at MICs on biofilm formation by nine strong biofilm producer strains

| Biofilm formation | CIP | GA | CHX | PHMB | QAC |
|---|---|---|---|---|---|
| Number of reduced strains | 7 | 7 | 9 | 6 | 5 |
| Number of induced strains | 2 | 2 | 0 | 3 | 4 |

According to the results of the checkerboard method, the combination that inhibited biofilm production most was the CHX-CIP combination. The QAC-CIP and PHMB-CIP combinations inhibited biofilm production at equal levels and the GA-CIP combination at a lower level.

## CONCLUSİON

Resistant and strong biofilm producer *P. aeruginosa* strains have been isolated in our hospital. In this study we concluded that CHX-CIP was the most effective combination that was inhibiting biofilm formation. Further studies are needed to identify right disinfectants for the protection of patients in the risk group for nosocomial *Pseudomonas* infections, and the right antibiotics treatment.