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Bacteriophage-antibiotic synergism to control planktonic and biofilm producing clinical isolates of *Pseudomonas aeruginosa*

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Introduction: Pseudomonas aeruginosa is a highly resistant opportunistic pathogen and is capable of forming biofilms on medical devices. Bacterial biofilms, which are micro-colonies encased in extracellular polysaccharide material are so difficult to be treated by conventional antibiotics. During the last decade, *P. aeruginosa* phages have been extensively examined as an alternative to antimicrobial agents.

Aim: The aim of the study was to assess bacteriophage-antibiotic combination on planktonic and biofilm states of *P. aeruginosa* isolates.

Materials: In this study, we isolated 6 lytic phages from hospital effluents; they were tested against 50 *P. aeruginosa* strains, isolated from different clinical specimens delivered to the Diagnostic Microbiology Laboratories, Faculty of Medicine, Alexandria University.

Results: Out of the 50 isolates, 15 were susceptible to these phages. So the biofilm forming capacity of these 15 isolates was investigated. The results showed that 14 isolates (93.33%) produced detectable biofilm. The minimum inhibitory concentration (MIC) and minimum biofilm eradication concentration (MBEC) assays were used to evaluate the antibiotic sensitivity patterns of these *P. aeruginosa* isolates in their planktonic and biofilm phases to amikacin and meropenem. Also, the effects of phage on the planktonic and biofilm states of isolates at different multiplicities of infections (MOI) were tested. On the planktonic state, Amikacin-phage combination showed synergistic effect (P=0.001) and Meropenem-phage combination showed synergistic effect (P=0.003). On the biofilm state, Amikacin-phage combination showed biofilm eradication in 50% of the isolates (P=0.003). On the other hand, Meropenem-phage combination showed biofilm eradication in only 14.3% of the strains.

Conclusion: The combination of phage and antibiotics could have potentially more benefits on *P. aeruginosa* planktonic and biofilm states than just using phages or antibiotics alone.

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The art of mathematical biology

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Mathematical biology is a fast-growing, well-recognized subject and one of the most exciting modern applications of mathematics. The increasing use of mathematics in biology is inevitable as biology becomes more quantitative. The complexity of the biological sciences promoted interdisciplinary involvement. For the mathematician, biology opens up new and exciting branches, while for the biologist, mathematical modeling offers another research tool commensurate with a new powerful laboratory technique but only if used appropriately and its limitations recognized. Currently, it seems that theoretical/mathematical biology offers lots of promising perspectives and possibilities for mathematicians and theoretically interested biologists. Mathematical biology has been successfully applied in many fields as for example; cancer detection, antiretroviral therapy including the integrase inhibitor Raltegravir in HIV-1 patients and molecular dynamics.

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