Photoinactivation as an effective tool for sensitization of multidrug resistant ESKAPE pathogens to antimicrobials

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89 years after accidental discovering of penicillin by Alexander Fleming the world is facing with the problem of rapidly growing microbial resistance to antibiotics. This phenomenon occurs naturally in time through genetic modifications but abuse and misuse of antimicrobial agents or feeding animals with forage containing antibiotics speeds up the emergence of bacterial resistance. Microorganisms belonging to ESKAPE group are particularly involved in this problem as they can easily "escape" from antimicrobial treatment. This group consist of the following pathogens: *Enterococcus* spp., *Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa* and *Enterobacter* species. An alternative method to fight against these resistant bacteria can be photoinactivation with visible light. Studies conducted by our team demonstrated that irradiation of pathogens which represent different antibiotic resistance profile can sensitize them to chemotherapeutical agents or eradicate completely.

Photoinactivation uses non-toxic photosensitive compound, oxygen and visible light. Exposure of photosensitizer to light leads to transition of this compound from ground to excited state. This can undergo to triplet state which can be separated into two types of action. First type involves electron transfer which leads to formation of reactive radicals. Second type includes transfer of energy which leads to formation of singlet oxygen. Formed in these two types of reaction components promote oxidative stress which results in DNA or cell envelope damage and also destruction of lipids, proteins and other cell components. These changes lead finally to cell death.

12 ESKAPE pathogens exhibiting extensively drug resistance profile (XDR) will be exposed to different sources of light and photosensitizers. Efficacy of light therapy manifested in changes of sensitivity to chemotherapeutical agents and bacterial cell viable counts will be verified using various experimental *in vitro* methods. Culmination of research will be conducting *in vivo* experiments with the use of model organism.

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