Mette Kolpen, J Microb Biochem Technol 2016, 8:4(Suppl)
http://dx.doi.org/10.4172/1948-5948.C1.019

Enhancement of the bactericidal activity of antibiotics in hypoxic biofilms as seen in patients with chronic pulmonary disease

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Pseudomonas aeruginosa lung infection is among the most severe complication in patients with chronic obstructive pulmonary disease (COPD) and cystic fibrosis (CF). CF related pulmonary infection is characterized by antibiotic-tolerant biofilms in the endobronchial mucus with zones of oxygen (O_2) depletion mainly due to polymorphonuclear leukocyte (PMN) activity. Despite anoxic conditions, the flexible metabolism of *P. aeruginosa* growing in biofilms allows this pathogen to obtain energy for growth by denitrification as demonstrated by production of nitrous oxide in CF sputum samples. While the exact mechanisms affecting antibiotic effectiveness on biofilms remain unclear, accumulating evidence suggests that the efficiency of several bactericidal antibiotics such as ciprofloxacin is enhanced by stimulation of the aerobic respiration of pathogens and that lack of O_2 increases their tolerance. Re-oxygenation of O_2- depleted biofilms may thus improve susceptibility to ciprofloxacin possibly by restoring aerobic respiration. Such strategy was then tested using re-oxygenation of O_2- depleted *P. aeruginosa* strain PAO1 agarose embedded biofilms by hyperbaric O_2 treatment (HBOT) enhancing the diffusive supply for aerobic respiration during ciprofloxacin treatment. The demonstration of enhanced bactericidal activity of ciprofloxacin in *P. aeruginosa* biofilm during re-oxygenation by hyperbaric O_2 treatment (HBOT) is indeed a proof-of-principle study that may translate into improved treatment of both CF and COPD patients.

Biography

Mette Kolpen has completed her PhD from University of Copenhagen and is currently a Postdoctoral Fellow at University of Copenhagen, Germany. She has published 13 scientific articles in peer-reviewed international journals and books. She has during the previous 6 years demonstrated O_2 depletion in the endobronchial mucus of cystic fibrosis (CF) patients.

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