Immunomodulatory affects and functional role of bioaerosols in pulmonary - respiratory disorders and develop new mitigation strategies using genetically modified T cells and antibiofilm peptides

Pongali B Raghavendra and Mohana Sundaram

School of Regenerative Medicine - Manipal Academy of Higher Education, India

Abstract

Bengaluru city has been experiencing a rise in air pollution, particularly with high levels of particulate matter 10 (PM10), which is attributed as a prominent cause for various respiratory ailments in humans. The etiology of bioaerosol-related pulmonary diseases remains poorly understood. Recently, urban particulate matter (UPMs) derived bioaerosols emerged as prominent airborne components of environments, but the consequences of airway exposure to different human pulmonary and respiratory disorders remain unknown. Since the components of isolates can be immunogenic, we initiated a case study model to evaluate the pulmonary immune responses to these isolates found in urban environment. We evaluated air samples collected from urban areas of Bengaluru and test them directly on primary cell lines to explore their biological effects. Apart from employing improved microbial screening and detection methods, we also investigated key biological regulators and immune modulators, for a possible immune competence dysfunction. Biofilms play an important role in the pathogenesis of numerous bacterial species because of their ability to persist on medical devices and in the host. Biofilms are associated with 65% of all bacterial infections in humans, and no drugs are licensed to target them. We hypothesize antibiofilm peptides might have the potential to be used in novel adjuvant therapies. We tested biochemical methods for the key regulators such as platelet membrane-bound enzymes, membrane fluidity, Na+/K+-ATPase and caspase levels comparing treated ambient viable particle samples to healthy controls. We investigated the physiologic changes in monocytes and CD4 (+) T cell activity in patients. Specifically, we have set up in-vitro autologous or heterologous co-culture experiments between monocytes and CD4 (+) T cells, and used flow cytometry and ELISA to analyze the expression of surface molecules on monocytes and the release of cytokines by CD4 (+) T cells. Overall, our study may represent new insights into mechanisms underlying distribution of ambient air borne viable particles, its biological effects and immune properties of various distinct subsets of human T cells.

Thus these findings support to further evaluate or underlying mechanisms for human pulmonary and allergic diseases. We therefore propose further investigation with the antibiofilm peptides for biofilm-related drug resistance in combination with genetically modified T cells, targeting host-directed adjunctive therapy might be significant treatment modality for human pulmonary or immune related disorders.