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Nicotine in e-cigarettes dysregulates Interferon Beta, Tumor Necrosis Factor Alpha, and Matrix Metalloproteinase 12 expression, without effecting respiratory syncytial virus virulence in Mice

Introduction/rationale for the study: The safety of electronic cigarettes (e-cigarettes) is a major topic of discussion, especially with the recent vaping-associated pulmonary injury (EVALI) outbreak and growing evidence of potential harmful effects of vaping. The key goals of this study were to determine if components of e-cigarette vapor alter inflammatory responses against the respiratory syncytial virus (RSV) infection.
Methods: The murine alveolar macrophage cell line MH-S cells were exposed to nicotine, diacetyl, and e-cigarette vapor with and without nicotine. A/J mice were exposed to PBS, e-cigarette vapor with and without nicotine for 2 months before RSV infection. Pulmonary function maneuvers were performed on the animals with the Scireq Flexivent system. Cell media and BALF was further investigated with Luminex bead assays.
Results: In MH-S cells, both e-cigarette and nicotine significantly induced the expression of matrix metalloprotease (MMP) 12 and reduced expression of Interferon beta (IFNβ) and Tumor Necrosis Factor Alpha (TNFα). In mice, e-cigarette vapor, with and without nicotine, did not influence RSV infection-induced animal weight loss, RSV infectivity, airway hyperresponsiveness during methacholine challenge, or immune cell infiltration into the lungs. However, e-cigarette vapor containing nicotine enhanced obstruction, and induced expression of MMP12 and reduced expression of IFNβ and TNFα. Tissue inflammation scores were recorded on lung tissues and demonstrated similar inflammation in the lungs of all RSV infected animals, regardless of prior exposure or not to e-cigarette vapor, or nicotine content of the vapor.
Conclusions of the study: Therefore, nicotine in vaping products modulates immune responses to respiratory infections, such as RSV. Specifically, changes in MMP-12, IFNβ, and TNFα might play a role in these changes.

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