Trichinella spiralis-derived extracellular vesicles induce regulatory T cells and reduce airway allergy in mice

Abstract

Introduction: Respiratory allergies are an increasing global health concern, with current treatments primarily targeting symptoms rather than underlying immune dysregulation. Trichinella spiralisderived extracellular vesicles (TsEVs) have been implicated in modulating immune responses, but their role in allergic airway inflammation remains unexplored. This study investigates the immunomodulatory potential of TsEVs in mitigating ovalbumin (OVA)-induced allergic airway inflammation in mice. Methods: TsEVs were isolated from T. spiralis muscle larvae excretory-secretory products and characterized using nanoparticle tracking analysis. BALB/c mice were sensitized and challenged intranasally with OVA to induce respiratory allergy. TsEVs were administered intranasally before and during OVA challenge. Bronchoalveolar lavage fluid (BALF), lung tissue, spleens, and sera were analyzed for immune cell infiltration, cytokine production, regulatory T cell (Treg) expansion, and OVA-specific antibodies using histology, flow cytometry, and ELISA. Results: Intranasal administration of TsEVs significantly reduced eosinophilic infiltration and airway inflammation in OVA-sensitized mice. TsEVs treatment suppressed Th2 cytokines (IL-4, IL-5, IL-13) and OVA-specific IgE while enhancing IL-10 production. Importantly, TsEVs promoted expansion of CD4+FoxP3+ and CD4+FoxP3-IL-10+ regulatory T cells in lungs and spleen, contributing to a systemic anti-inflammatory profile. Ex vivo studies confirmed TsEVs-mediated modulation of allergenstimulated immune responses. Discussion: Our findings highlight TsEVs as a promising therapeutic approach for allergic airway diseases by promoting immune tolerance and dampening inflammatory responses. These results pave the way for future translational applications of parasite-derived EVs in allergy treatment. KEY WORDS: Trichinella spiralis, extracellular vesicles, respiratory allergy, regulatory T cells, immune modulation, allergic inflammation.