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Type 1 diabetes leads to decline in lung function and restrictive pulmonary defects

Type 1 diabetes (T1D) is a metabolic disease characterized by hyperglycemia, resulting from decreased insulin secretion. In the long-term, T1D can affect the vascular system and various organs, leading to life-threatening complications. The effects of T1D on the lungs are not well understood. Recent studies suggest increased prevalence of pulmonary abnormalities and respiratory diseases in T1D patients. Therefore, this study aimed to investigate the impact of T1D on lung function. Additionally, we examined the effect of cigarette smoke (CS) exposure, a risk factor for various respiratory diseases, in a T1D animal model. Our central hypothesis is that T1D contributes to lung function changes and CS exposure worsens this phenotype.

To test our hypothesis, we utilized the streptozotocin (STZ)-induced T1D mouse model and citrate-injected controls. Animals were exposed to CS or room air (RA) daily for 6 months. Blood glucose and glycated hemoglobin (HbA1c) levels were measured throughout the exposures. After 6 months, pulmonary function test (PFT) was performed before euthanizing the animals.

As expected, blood glucose and HbA1c levels were higher in the STZ mice compared to the control mice. PFT results demonstrated that the pressure-volume loop shifted downwards and to the right in STZ mice regardless of CS exposure, suggestive of pulmonary fibrosis. In line with this, decreases in inspiratory capacity and compliance were observed in STZ mice, further confirming the presence of fibrosis. Additionally, decreased forced expiratory volume and forced vital capacity were observed in STZ mice. These changes occurred in parallel with increase in the expression of collagens (COL1A1, COL1A2, COL3A1) in the lungs of STZ RA mice, which was diminished with CS exposure. Altogether, our data suggest T1D alone leads to restrictive ventilatory defects, independent of CS exposure. Further research is required to determine the mechanisms underlying the observed phenotype.