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Type 1 Diabetes Leads to Decline in Lung Function and Restrictive Pulmonary Defects

Several recent studies suggest type I diabetes (T1D) is associated with an increased prevalence of pulmonary abnormalities and respiratory diseases. However, the effects of T1D on the lungs remains to be elucidated. This study aimed to investigate the impact of T1D on lung function. Our central hypothesis is that T1D contributes to lung injury associated with a decline in lung function.
To test our hypothesis, we utilized the streptozotocin (STZ)-induced T1D mouse model and citrate buffer-injected controls. Animals were IP injected with STZ or citrate buffer daily for 5 consecutive days. Blood glucose and glycated hemoglobin (HbA1c) levels were measured throughout the study period (3 and 6 months). At the end of the study period, a pulmonary function test (PFT) was performed. Lungs from the study animals were collected and evaluated for gene expression and histological changes.
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, characteristic of restrictive pulmonary defects. In line with this, decreases in inspiratory capacity and compliance were observed in STZ mice, further confirming restrictive changes in the lung. 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 genes associated with tissue remodeling and fibrosis, Acta2, Fn1 and Ccn2, in the lungs of STZ mice. The presence of pulmonary fibrosis was further confirmed by quantifying trichrome staining of lung tissue, which demonstrated significantly increased collagen staining in both the upper and lower lobes of STZ mice compared to the control mice. Altogether, our data suggest T1D leads to restrictive ventilatory defects. Further research is required to determine the mechanisms underlying the observed phenotype.