

Pancreas in type 1 diabetes has both exocrine and endocrine alterations

AUTHORS

Jordan J. Wright¹, Diane C. Saunders¹, Chunhua Dai¹, Greg Poffenberger¹, Brynn Cairns², David V. Serreze², David M. Harlan³, Rita Bottino⁴, Marcela Brissova¹, Alvin C. Powers^{1,5,6}

¹*Division of Diabetes, Endocrinology, and Metabolism, Department of Medicine, Vanderbilt University Medical Center, Nashville, TN, USA.*

²*The Jackson Laboratory, Bar Harbor, ME, USA*

³*Division of Diabetes, Department of Medicine, Diabetes Center of Excellence, University of Massachusetts Medical School, Worcester, MA, USA.*

⁴*Institute of Cellular Therapeutics, Allegheny-Singer Research Institute Department of Biological Sciences, Carnegie Mellon University, Pittsburgh, PA, USA.*

⁵*Department of Molecular Physiology and Biophysics, Vanderbilt University, Nashville, TN, USA.*

⁶*Veterans Affairs Tennessee Valley Healthcare System, Nashville, TN, USA.*

PURPOSE

Individuals with longstanding and recent-onset type 1 diabetes (T1D) have a smaller pancreas. Since beta cells represent a very minor portion of the pancreas, the loss of pancreas volume in T1D is primarily due to the loss of pancreatic exocrine mass. However, the structural changes in the T1D exocrine pancreas are not well understood.

METHODS

To characterize the pancreatic endocrine and exocrine compartments in T1D, we studied pancreata from adult donors with T1D duration greater than 6 years compared to age-matched normal donor (ND) pancreata. Islet cell mass, islet morphometry and number, exocrine mass, acinar cell size and number, and pancreas fibrosis were assayed by immunohistochemical staining.

SUMMARY OF RESULTS

T1D pancreata were approximately 45% smaller than ND pancreata (47.4 vs 85.7 g, 95% CI 42.0 – 52.7 and 78.1 – 93.2, n=31 and 36), independent of T1D duration or age of T1D onset. T1D pancreata had decreased beta cell mass (0.061 vs 0.93 g, 95% CI 0.00 – 0.12 and 0.50 – 1.4, n=6 and 9), fewer total islets (0.7 vs 1.9 x 10⁶ islets/pancreas, 95% CI 0.52 – 0.87 and 1.3 – 2.5, n= 6 and 7), and 45% reduction in total exocrine mass (42.0 vs 96.1 g, 95% CI 29.4 – 54.7 and 80.3 – 112, n=6 and 7). T1D acinar cells were similar in size but fewer in number (63.6 vs 111.5 x 10⁹ cells/pancreas, 95% CI 45.3 – 82.1 and 78.3 – 144.7, n=10 and 12), likely accounting for the change in pancreas size. Within the T1D exocrine tissue, there was a greater degree of fibrosis.

CONCLUSIONS

T1D pancreata are smaller than ND pancreata because there are fewer exocrine cells; the cause, mechanisms and implications of the exocrine cell loss are unknown.

