Imaging autoimmune diabetes

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Researchers at Lund University have managed to develop a technique whereby they can study the inflammatory process that takes place in the pancreas during the natural development of type 1 diabetes, allowing for real time and repeated non-invasive imaging of individual islets of Langerhans. The technique enables the visualisation of a human autoimmune disease in animal models that gives us a way to watch the body´s response to new therapeutic strategies that attempt to save islets from this deadly immune system attack.

Anja Schmidt-Christensen and Dan Holmberg are two of the researchers behind the study.

"The main breakthrough with this technique we have developed is that inflammatory processes from now on can be studied in the actual autoimmune disease situation that takes place in the pancreas during the natural development of type 1 diabetes," said Dan Holmberg, Professor of Immunology.

By transplanting individual islets of Langerhans, to the anterior chamber of the eye in the mouse model for type 1 diabetes, the researchers have been able to follow the inflammatory process in real time through a sophisticated microscope in a way that was not previously possible.

In type 1 diabetes, the Islets of Langerhans in the pancreas are partly made up of insulin-producing beta cells, and do not produce sufficient quantities of the hormone insulin mainly due to the autoimmune destruction and killing of beta-cells by the body's own immune system.

Initially, the researchers had certain misgivings about the model, because immune defense mechanisms are believed to be suppressed in the eye to protect vision, the so called immune privileged status of the eye. However, in the light of all previous knowledge of the inflammatory process in the pancreas in type 1 diabetes, the researchers have been able to demonstrate that the process in the transplanted islets in the eye recapitulates the autoimmune insulitis in the pancreas. This is fundamental to the model and research findings that have now been presented.

"It is also clear that the images we produce are high quality. The major advantage of this technique is unlike with any other existing non-invasive techniques like MRI and PET – the high cellular resolution making it possible to see individual cells and monitor how they move and interact with each other.

"But the uniqueness of this model is that the imaging can be performed on the very same islet(s) of individual animals multiple times during a follow-up period, whereas other techniques with similar resolution require invasive surgery and only allow single snapshot images," said Anja Schmidt-Christensen, who is joint first author of the study with Lisbeth Hansen.

Researchers can now study how the process progresses from day to day and over the course of months, how the invading inflammatory cells enter the Islets of Langerhans, how they move and interact, multiply and finally destroy the insulin-producing beta cells.

"This gives us new opportunities to see the body's reaction to different treatment strategies to save the islets from the immune system's deadly attacks. It opens up the way to many new areas. One thing we really want to do, and have the technology to do in the future, is to create a model of the human immune system and transplant cell islets from humans," said

Dan Holmberg.

More information: "Imaging dynamics of CD11c+ cells and Foxp3+ cells in progressive autoimmune insulitis in the NOD mouse model of type 1 diabetes." A. Schmidt-Christensen, L. Hansen, E. Ilegems, N. Fransén-Pettersson, U. Dahl, S. Gupta, Å. Larefalk, T. Dahlbaek Hannibal, A. Schulz, P.-O. Berggren, D. Holmberg. *Diabetologia*. link.springer.com/article/10.1 … 07/s00125-013-3024-8

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