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Et al.

IMAGING PROBES FOR DETECTING INFLAMMATION IN THE MOUSE MODEL OF TYPE 1 DIABETES

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Non-invasive imaging of early signs of inflammation of endocrine pancreas is of importance due to a generally late clinical diagnosis of type 1 diabetes (T1D). Seventy-80% of insulin producing beta-cells could be already lost prior to the onset of clinical symptoms. Therefore, monitoring these early changes including increased vascular permeability of pancreas and activation of pro-inflammatory signaling pathways will aid in early diagnosis and timing of therapy. We have developed and tested superparamagnetic nanoparticles (NPs) with strong photoacoustic signal for detecting potential permeability changes in the pancreas of streptozotocin (STZ)- induced mouse model of T1D. These biocompatible gold/iron-oxide NPs enable application of multi-modality photoacoustic (PA) and magnetic resonance (MR) imaging to investigate the extent of NP accumulation in the pancreas. In addition, we have investigated the spatial distribution of nanoparticles in the endocrine and exocrine of pancreas using electron microscopy techniques. Our initial time-dependent histology results demonstrate the influx of macrophages and neutrophils as the first responders to pancreatic damage as well as activation of the NF-κB signaling pathway, which plays a central role in the inflammation of the islets. We recorded a significantly stronger PA signal in the pancreas of STZ-treated mice compared to control mice, which indicate higher accumulation of the NPs in mice with chemically induced diabetes. The potential use of a combination of clinically available imaging modality (MRI) and emerging high-resolution/high sensitivity PA makes this approach feasible for clinical translation. Furthermore, the safety of these imaging modalities makes them ideal for both initial diagnosis of diabetes in individuals at risk of T1D and for longer term noninvasive monitoring of the response to therapy.

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