DIABETES IN CONTROL
News and Information for Medical Professionals

BMP7 – Creating Insulin-Producing Cells and Lowering Insulin Resistance

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Agent could make transplants more available in patients with type 1 diabetes, improve insulin resistance.

In type 1 diabetes, the insulin-producing islets cells of the pancreas are attacked and destroyed by the immune system. This requires patients to manage their blood glucose levels through daily use of insulin. The use of islet transplantation has allowed many patients to live without the need for insulin injections, with some being insulin independent for more than a decade. However, the procedure is limited to the most severe cases of type 1 diabetes due to limited supply of insulin-producing islet cells. Currently, transplanted islets come from organ donors.

Researchers from the Diabetes Research Institute (DRI) at the University of Miami – Miller School of Medicine have found a safe method to convert non-insulin producing cells of the pancreas into insulin-producing cells using a single agent, bone morphogenetic protein-7 (BMP7). BMP7 is a member of the TGFβ superfamily, and is involved in many physiological processes, including development, morphogenesis and acting as a trophic factor. BMP7 was originally found to induce the formation of bone and cartilage.

Researchers at DRI use BMP7 to target non-endocrine pancreatic tissue (NEPT), which comprises nearly 98% of the pancreas and is not a primary target of autoimmunity in type 1 diabetes. NEPT has high plasticity, which means it can be turned into other cell types or tissues. Exposure of human pancreatic exocrine cells to BMP7 alone resulted in conversion into insulin-producing clusters that respond to glucose in laboratory setting. The clusters of cells formed produced high amounts of insulin and secreted even more when exposed to glucose, just as you would see in normal healthy beta cells. The team then transplanted the cells into diabetic mice whose beta cells had been destroyed artificially; the transplanted cells acted like healthy beta cells.

Ultimately, the team hopes to be able to inject BMP7 directly into the pancreas to stimulate the production of new beta cells. An alternative method to direct injection is to convert the other 98% of donated pancreas into healthy beta cells, which can potentially be transplanted into seven people. The research team believes this new method is less risky than other treatments for type 1 diabetes that are currently being investigated, such as stem cell research or introducing new genes into the body.

BMP7 may play a bigger role in diabetes management than just converting NEPT into insulin-producing clusters. BMP7 also affects adipose tissue, which plays an active role in systemic energy metabolism. There are two different types of adipose tissue: white adipose tissue and brown adipose tissue. White adipose tissue specializes in the storage of excess energy in the form of triglycerides. Brown adipose tissue specializes in energy expenditure in response to cold or overfeeding. Adipose differentiation is regulated by a network of hormones with insulin playing a vital role in both white and brown adipogenesis. Insulin receptor substrates function as the docking proteins coordinating hormone binding to the receptor and downstream signaling. Research suggests that BMP7 specifically promotes brown adipogenesis, which provides a novel approach to the treatment of obesity and related metabolic complications. BMP7 upregulates several components of insulin signaling as well as downregulation of insulin signaling inhibitor suppressors. The results indicate that BMP7 may also have the potential to improve insulin resistance and restore brown adipogenesis in cells with impaired insulin signaling.

Further research into BMP7 could open the door to a wide variety of treatment options for patients. With the option to create insulin-producing cells, researchers could potentially address the limited supply of islet cells and treat millions with diabetes in the US and around the world. BMP7 could also reduce obesity and improve insulin resistance in patients by promoting the formation of brown adipose. BMP7 provide many novel techniques and uses for the treatment and management of diabetes.

Practice Pearls:

- Islet cell transplants are reserved for the most severe cases of type 1 diabetes.
- A non-invasive procedure using BMP7 to convert NEPT into insulin-producing cells is on the horizon.
- BMP7 can reduce obesity and improve insulin resistance in patients through brown adipogenesis.

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