Beta cell-seeded implant restores insulin production in type 1 diabetes mouse model

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Researchers have successfully created a novel biomaterial that can be seeded with insulin-producing beta cells. Implantation of the beta cell-seeded biomaterial reversed diabetes in a mouse model by effectively normalizing glucose levels and significantly increasing survival. The research results will be presented Monday, March 19, at ENDO 2018, the annual 100th meeting of the Endocrine Society in Chicago, Ill.

"Implications for our studies present a viable and sustainable treatment to restore normal glucose levels without having to ever depend on external insulin administration," said lead author Diana Elizondo, a graduate student at Howard University in Washington, D.C.

Beta cells of the pancreas produce, store and release the hormone insulin, which is responsible for regulating levels of glucose in the blood. When blood glucose levels start to rise during digestion, beta cells quickly respond by secreting some of their stored insulin while at the same time increasing production of the hormone. As blood glucose falls, the amount of insulin secreted by the pancreas goes down.

In people with type 1 diabetes, beta cells are attacked and destroyed by the immune system. In type 2 diabetes, glucose responsiveness becomes impaired, diminishing the ability to adequately produce insulin to control blood glucose levels.

In this new study, researchers implanted beta cells using a novel copolymer microcarrier derived from polysaccharide, or biomaterial. Isolated beta cells from healthy donor mice were seeded in the biomaterial and implanted into diabetic mice. This normalized glucose levels and increased survival in the treated mice compared to non-treated groups.

As glucose levels normalized, levels of insulin were also lowered, the study found. Implanting the beta cells using the biomaterial did not trigger an immune response. The implanted beta cells prompted the formation of new blood vessels, which supported long-term retention of the transferred beta cells and sustainable monitoring of blood glucose levels.

While transplanting donor beta cells is one promising approach to combat type 1 diabetes in the future, the immune system response that destroys a person's own cells in the first place can happen again and attack the transplanted cells. "Future studies aim to engineer donor-compatible beta cells to seed in our biomaterial as a means to avoid transplant rejection and provide long-term restorative insulin therapies," Elizondo said.

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