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Dual-hormone artificial pancreas is a step closer for patients with Type 1 diabetes

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For patients with type 1 diabetes, a dual-hormone artificial pancreas system (also known as a closed-loop delivery system) improved the control of glucose levels and reduced the risk of hypoglycemia compared with conventional pump treatment in a trial published in *CMAJ* (*Canadian Medical Association Journal*).

It is challenging for patients with type 1 diabetes to control their glucose levels because tight glucose control increases the incidence of hypoglycemia (dangerously low glucose levels). Insulin pump treatment, which provides a continuous predetermined subcutaneous supply of insulin, is available, but hypoglycemia still occurs.

"Hypoglycemia is feared by most patients and remains the most common adverse effect of insulin therapy," writes Ahmad Haidar, Institut de Recherches Cliniques de Montréal and McGill University, with coauthors.

The dual-hormone artificial pancreas delivers insulin and glucagon using infusion pumps based on continuous glucose sensor readings as guided by an intelligent dosing algorithm. The infusion pumps and the glucose sensors are already on the market, but the intelligent algorithm was developed by the researchers in Montreal.

Researchers sought to assess the ability of the artificial pancreas to improve glucose control and reduce the possibility of hypoglycemia in adults with type 1 diabetes. They conducted a trial with 15 adult patients

who had been using an insulin pump for at least 3 months. Patients were admitted to a clinical research facility for 2 15-hour experiments, and their glucose levels were controlled in 1 visit using the artificial pancreas system and the other visit using conventional pump treatment. On each visit, the patients exercised on a stationary bike, received an evening meal and a bedtime snack, and stayed in the facility until the next morning.

With the artificial pancreas system, participants' glucose levels were in the target zone 71% of the time compared to 57% with the conventional pump treatment. The artificial pancreas resulted in a 20-fold reduction in the number of night-time glucose measurements in the low glucose level range.

"[The dual-hormone artificial pancreas] improved glucose control and reduced the risk of hypoglycemia in our 15 participants, as compared with continuous subcutaneous insulin infusion," write the authors. "Rates of hypoglycemia were reduced, with no increased risk of hyperglycemia."

"Closed-loop delivery systems have the potential to substantially improve the management of diabetes and the safety of patients. These systems will probably be introduced gradually to clinical practice, with early generations focusing on overnight glucose control and using insulin alone," conclude the authors.

In a related commentary, Drs. David Nathan and Steven Russell, Massachusetts General Hospital, Harvard Medical School, write "Although [this] study is neither the first nor the longest investigation using a dual-hormone artificial pancreas, it is the first to compare such an apparatus to conventional intensive therapy in a randomized design. Treatment with the artificial pancreas increased the amount of time patients spent in the target range of blood glucose levels and decreased

hypoglycemia. Thus, Haidar and colleagues show that low doses of glucagon administered under the control of a computer algorithm can act as a counter-regulatory hormone, preventing glucose levels from falling too low."

More information: Research paper: www.cmaj.ca/lookup/doi/10.1503/cmaj.121265
Commentary: www.cmaj.ca/lookup/doi/10.1503/cmaj.130011

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