Artificial Pancreas May Help in Meeting Targets

BY BRUCE JANCIN

EXPERT OPINION FROM A CONFERENCE ON MANAGEMENT OF DIABETES IN YOUTH

KEYSTONE, COLO. – Why are the Juvenile Diabetes Research Foundation and many of the nation's foremost diabetes researchers pressing full speed ahead to develop an artificial pancreas?

Quite simply, because multiple real-world studies show that current usual therapy of type 1 diabetes fails to achieve target hemoglobin A_{1c} levels in more than half of patients.

And while more intensified management using insulin pumps and frequent daily or continuous glucose monitoring (CGM) effectively lowers HbA_{1c} values for some patients outside the artificial world of clinical trials, it does not work for everybody – especially teenagers, many of whom do not want to have to deal with diabetes continuously, Dr. Georgeanna J. Klingensmith said at the conference, sponsored by the Children's Diabetes Foundation at Denver.

"An artificial pancreas may remove enough of the human error and hassle factor to allow more patients to achieve success, we hope. A cure for adolescence would also help," quipped Dr. Klingensmith, chief of the pediatric clinic at the Barbara Davis Center for Childhood Diabetes and professor of pediatrics at the University of Colorado, Denver.

A JDRF-sponsored study of CGM as it is used in routine clinical care underscores the adolescent adherence problem. Patients were instructed in the use of the device and were in frequent contact with their health care provider for the first month, then told to call as needed. By 6 months, 64% of the patients who were aged 25 years or older were using their CGM sensor at least 6 days a week, as instructed. So were 25% of 8- to 14-year-olds, but only 19% of 15- to 24-year-olds. Moreover, 21% of all 15- to 24-year-olds were not wearing the device at all in month 6 (Diabetes Care 2010;33:17-22).

Predictors of successful use of CGM at month 6 included age 25 years or greater, more frequent self-testing of blood glucose prior to going on CGM, wearing the device 6 days or more a week during the first month, and success in keeping blood glucose readings in the 70- to 180-mg/dL range during month 1.

Dr. Klingensmith cited among several examples of the state of real-world diabetes care the Hvidøre Study Group. In this 21-center study of roughly 2,000 pediatric type 1 diabetes patients, mostly in Europe, only a single center met the 2009 International Society for Pediatric and Adolescent Diabetes (ISPAD) consensus guideline that all children should have an HbA_{1c} below 7.5%. The mean HbA_{1c} was 8.2% (Diabetes Care 2007;30:2245-50).

Similarly, in 2,999 type 1 diabetes patients at six U.S. centers participating in the SEARCH for Diabetes in Youth Study, in which Dr. Klingensmith was a co-investigator, mean HbA_{1c} was 8.3%, with only 44% of type 1 patients meeting American Diabetes Association HbA_{1c} age-based targets (J. Pediatr. 2009;155:668-72).

Most of the factors associated with HbA_{1c} in a multivariate analysis of SEARCH were nonmodifiable: age, diabetes duration, race, parental education, insurance status, household income. The only two independent modifiable factors were insulin regimen – patients on pump therapy had a mean HbA_{1c} of 8.0%, significantly lower than any other regimen – and frequency of blood glucose testing.

In 2009, at the Barbara Davis Center for Childhood Diabetes in Denver, of 2,437 patients diagnosed with type 1 diabetes more than 3 months earlier, the median HbA_{1c} was 8.2% in children younger than 6 years old, 8.2% in 6- to 12-year-olds, and 8.7% in those aged 13-18 years. Plus, teens accounted for 75% of all patients with a median HbA_{1c} greater than 10%, Dr. Klingensmith continued.

An artificial pancreas, or "closed loop" system, would entail reliable automated guidance of insulin pump dosing based on input from CGM coupled with predictive algorithms for avoidance of severe hypoglycemia, she said. ■

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