Outpatient Glycaemic Control with a Bionic Pancreas in Type 1 Diabetes


BACKGROUND

The safety and effectiveness of automated glycaemic management have not been tested in multiday studies under unrestricted outpatient conditions.

METHODS

In two random-order, crossover studies with similar but distinct designs, we compared glycaemic control with a wearable, bihormonal, automated, “bionic” pancreas (bionic-pancreas period) with glycaemic control with an insulin pump (control period) for 5 days in 20 adults and 32 adolescents with type 1 diabetes mellitus. The automatically adaptive algorithm of the bionic pancreas received data from a continuous glucose monitor to control subcutaneous delivery of insulin and glucagon.

RESULTS

Among the adults, the mean plasma glucose level over the 5-day bionic-pancreas period was 7.7 mmol per litre, and the mean percentage of time with a low glucose level (<3.9 mmol per litre] was 4.8%. After 1 day of automatic adaptation by the bionic pancreas, the mean (±SD) glucose level on continuous monitoring was lower than the mean level during the control period (7.4±0.7 vs. 8.8±1.7 mmol per litre], P<0.001) and the percentage of time with a low glucose reading was lower (4.1% vs. 7.3%, P=0.01). Among the adolescents, the mean plasma glucose level was also lower during the bionic-pancreas period than during the control period (7.7±1.0 vs. 8.7±1.5 mmol per litre, P=0.004), but the percentage of time with a low plasma glucose reading was similar during the two periods (6.1% and 7.6%, respectively; P=0.23). The mean frequency of interventions for hypoglycaemia among the adolescents was lower during the bionic-pancreas period than during the control period (one per 1.6 days vs. one per 0.8 days, P<0.001).

CONCLUSIONS

As compared with an insulin pump, a wearable, automated, bihormonal, bionic pancreas improved mean glycaemic levels, with less frequent hypoglycaemic episodes, among both adults and adolescents with type 1 diabetes mellitus. (Funded by the National Institute of Diabetes and Digestive and Kidney Diseases and others; ClinicalTrials.gov numbers, NCT01762059 and NCT01833988.)

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### SA is failing to escape global trend to obesity

The proportion of people who are overweight or obese has soared in the past three decades and not a single country has been able to reverse the trend, according to a global study to be published in the leading medical journal *The Lancet*.

South Africa is no exception and also holds the dubious distinction of having the highest proportion of people who are overweight or obese in sub-Saharan Africa. Director of the non-communicable diseases unit at the Medical Research Council and study co-author Andre Kengne said obesity posed risks for both individuals and society at large, as it raised the potential for a host of health problems including diabetes, cardiovascular disease, cancer and osteoarthritis. He said the health system was going to be under increasing pressure to provide care for obesity-related problems.

The proportion of women who are overweight or obese in SA increased from 58.7% in 1980 to 69.3% last year, while for men the figure increased from 36.1% to 38.8% over the same period. The figures for children were particularly worrying, said Kengne, as obese children were likely to grow into obese adults, and were increasingly experiencing diseases usually considered to be the problems of middle age.

In SA, the proportion of girls and young women under the age of 20 who were overweight or obese soared from 19.5% in 1980 to 26.3% last year, while the figures for boys and young men rose from 13.7% to 18.8%. The world has experienced a startling increase in rates of obesity and overweight in adults (28% rise) and children (up 47%) in the past 33 years, according to the study.

*Source: Tamar Kahn: Business Day*

### Mortality in overweight diabetes patients lower

The body mass index affects mortality differently in adults without diabetes than in those with diabetes, according to a US study published in the *Journal of General Internal Medicine*.

Chandra Jackson and colleagues from the Harvard School of Public Health analyzed data from 74,710 US adults between 35 and 75 years old, 5 percent of whom were diagnosed with diabetes. The participants were followed over a six-year period.

Death rates throughout were substantially higher among those with diabetes than those without diabetes. However, compared to individuals with normal weight, death rates among people with higher body weight dipped considerably for those with diabetes, but rose sharply in people who did not suffer from the condition.

"This finding was surprising, but it may be due to a commonly observed phenomenon in chronic disease epidemiology called 'reverse causation' where a person's weight at the time of the survey can be affected by their disease if it leads to weight loss and muscle wasting during advanced stages. This apparent obesity paradox has been observed in the past among individuals with diabetes," explained Jackson.

Jackson and her colleagues believe that Type 2 diabetes status should be taken into account in future BMI-mortality studies, much as is done with heart disease, smoking and cancer, to ensure valid population estimates.
Insulin prolongs life of cardiac patients suffering from diabetes

Intensive treatment with insulin following a heart attack can effectively prolong life for patients with type 2 diabetes. This is the result of a follow-up study of the Swedish DIGAMI-1 trial (Diabetes Mellitus Insulin Glucose Infusion in Acute Myocardial Infarction) that was published in "The Lancet Diabetes & Endocrinology". On average, those affected lived two years longer than those in the control group did.

The DIGAMI-1 study involved 620 people with type 2 diabetes in Sweden and started in 1990. It showed that a 24-hour insulin treatment following a heart attack and a subsequent regular insulin treatment for at least three months decreased the all-cause mortality of patients compared to glucose-lowering treatment.

Almost all study participants died during the 20 years follow-up investigation. It showed that those who had received intensive insulin treatment lived on average 2 to 3 years longer than those persons who received glucose-lowering treatment. The effect was measurable up to approximately eight years following the cardiac incident. According to the results, patients who were less than 70 years old and who were at low cardiovascular risk benefited most.

However, the authors from the Karolinska Institute (Stockholm) under the leadership of Viveca Ritsinger said that the effect on the length of survival would probably be less today due to the advances in treatment methods.

Not only a Mediterranean diet protects against diabetes

An Italian-Greek study shows that a Mediterranean diet as well as nutrition low in available carbohydrates can protect against type 2 diabetes. The results of the study were published in "Diabetologia".

The scientists from the Mario Negri Institute of Pharmacological Research in Milan examined patients from Greece who were part of the ongoing "European Prospective Investigation into Cancer and Nutrition" (EPIC) led by the University of Athens.

To date, 22,295 participants were observed over the course of 11 years. Type 2 diabetes appeared in 2,330 subjects. To establish the eating habits, the study participants completed a questionnaire. The researchers developed a Mediterranean Diet Score (MDS) from 1 to 10 and a similar scale to measure the amount of available carbohydrate (glycaemic load - GL) of the diet.

Results showed that subjects with an MDS of over 6 had a 12 percent lower risk of developing diabetes than patients with an MDS of 3 or less. Persons with the highest GL had a 21 percent higher risk than those with the lowest amount of available carbohydrates in their diet. If a higher MDS was combined with a low GL, the probability of developing type 2 diabetes declined by 20 percent as opposed to a diet with low MDS and high GL.

The researchers conclude that, "A low GL diet that also adequately adheres to the principles of the traditional Mediterranean diet may reduce the incidence of type 2 diabetes."
STENO-2 study: Multifactorial intervention gain does remain after a 19-year follow-up

The Steno type 2 diabetes study is a multifactorial intervention study aiming at correcting the main modifiable factors responsible for micro- and macrovascular complications and premature death in type 2 diabetes mellitus (T2DM). Results concerning microangiopathy (3.8-year follow-up) were published in 1999,\textsuperscript{1} micro-, macroangiopathy, and mortality results (8 years) in 2003,\textsuperscript{2} and first post-study follow-up (13 years) in 2008.\textsuperscript{3} At the 49\textsuperscript{th} Annual Meeting of the EASD, held in Barcelona (24-27 September 2013), the 19-year follow-up results were presented.\textsuperscript{4}

Briefly, 160 T2DM patients with microalbuminuria (55.1 ± 7.2 years), were randomized to conventional or intensified multifactorial lifestyle and pharmacological intervention for an average period of 7.8 years. Intensified treatment, performed by a multidisciplinary team, associated lifestyle changes with in-depth and stepwise pharmacological therapy targeting hyperglycaemia, hypertension, lipid abnormalities, microalbuminuria, smoking, and secondary prevention with aspirin.

Intensified treatment included gliclazide and/or metformin (according to body weight), bedtime insulin if HbA1c remained above 7 % despite maximal oral agent dosage, then standard or intensified insulin therapy. All patients received an ACE inhibitor, irrespective of blood pressure. Hypertension was treated with all available drug classes, alone or in combination, and lipid abnormalities with a statin and/or a fibrate. In the intensive group compared with the conventional one, a significant decrease in progression of nephropathy, retinopathy, and autonomic neuropathy was observed after a 3.8-year follow-up, and a reduction by 50 % of major CV events and death (24 vs. 44 %, \(P=0.007\)), as well as of progression in retinopathy, nephropathy, and neuropathy after a 7.8-year follow-up.

After this prospective intervention study, all patients received intensified intervention in an open follow-up.

At the 19-year analysis, 33 patients from the intervention group vs. 54 from the conventional one (HR 0.51 IC 95 \% 0.33-0.79; \(P=0.001\)) reached the composite of dialysis treatment and all-cause death, dialysis being 6.6 years earlier in the conventional than in the intervention group (\(P=0.093\)). A 50 \% reduction in GFR or eGFR, or doubling of creatinine was observed in 33 patients from the intervention group vs. 30 in the conventional one (HR 0.55, IC 0.55-0.83; \(P=0.31\)). Progression to macroalbuminuria (\(\geq300 \text{mg/24 h}\)) was reduced by 58 \% in the intervention group (HR 0.42, IC 0.25-0.70; \(P=0.004\)). Mortality risk was increased in patients from the conventional group progressing to macroalbuminuria and/or with GFR <60mL/min/1.73m\(^2\) compared with not-progressing patients (\(P=0.006\)).

This 19-year follow-up analysis of the Steno 2 results confirms that intensified multifactorial treatment decreases mortality and need for dialysis in T2DM patients with microalbuminuria.

These results are along the same lines as those of ADVANCE, a large multicentre prospective randomized study. A decrease by 65 \% in risk of ESRF,\textsuperscript{5} and a 12 \% trend for a decrease in cardiovascular mortality were observed in the intensive glucose control group based on Diamicron-MR\textsuperscript{6} after only a 5-year follow-up. The open post-study follow-up of ADVANCE (ADVANCE-ON) is still in progress, with the first results expected in 2014.

Source: PJ Guillausseau, Paris – France