autonomic activation, and emotional salience of stressful stimuli. Impaired HA resulted in activation or a lack of deactivation in areas of the brain involved in interoception, executive function, and reward and hedonic perception and in the resting state network. After recovery from hypoglycemia, there was persistent activation or lack of deactivation in reward networks in patients with impaired HA compared to those with intact HA. The investigators concluded that emotional and motivational responses to hypoglycemia, including the emotional memory of each event, are likely barriers to hypoglycemia avoidance and are potential targets for restoring HA.

Lifestyle Intervention Beneficial for Overweight and Obese Type 2 Diabetics

Written by Brian Hoyle

The multicenter Look AHEAD study [Action for Health in Diabetes; NCT0017953] is a randomized controlled clinical trial that showed that overweight and clinically obese people with type 2 diabetes mellitus who received an intensive lifestyle intervention (ILI) had statistically significant better health-related quality of life compared with controls. The findings of the present analysis were presented by Ping Zhang, PhD, Centers for Disease Control and Prevention, Atlanta, Georgia, USA.

The 5145 participants were randomly assigned to ILI (n=2570) or diabetes support and education (DSE; n=2575). The intervention included a calorie goal of 1200 to 1800 kcal/day, with <30% from fat and >15% from protein, with use of meal-replacement products, and with at least 175 minutes of moderate-intensity physical activity per week. DSE was a more traditional approach, involving support and education. The primary objective of the main trial was to compare the long-term effects on cardiovascular morbidity and mortality, while this analysis assessed the impact on quality of life as measured by health utility scores (HUSs). Effects were measured directly with a feeling thermometer (FT) and indirectly with the Health Utility Index 2 and 3 (HUI-2 and HUI-3) and the SF-6D. The FT is an established measurement based on an imaginary scale of 0 to 100, with 0 being the worst health imaginable and 100 the best with respect to the respondent's view of his or her health on that day. The SF-6D is a classification for describing health as derived from 11 items of the SF-36 questionnaire. These instruments allowed the assessment of a variety of physical, cognitive, emotional, and social well-being. The study enrolled participants from 2001 to 2004. The median follow-up was 9.67 years, and the intervention was stopped in September 2012. HUI-2, HUI-3, and SF-6D data were collected every 6 months for the first 4 years and annually thereafter, with FT data collected every 6 months throughout follow-up. Analyses of the HUSs were on an intention-to-treat basis and included differences in the mean scores overall and at the time of each data collection. Covariates included clinic site, baseline HUS, and year. Significance was indicated by $p<.05$.

The participants were well matched at baseline for sex, age, body mass index, duration of diabetes, prevalence of insulin use, A1C (glucose) level, and history of cardiovascular disease (CVD; $p>.06$ for each parameter). The completion rate for the assessments was good, ranging from ~78% to 93% depending on the assessment tool (Table 1).

Table 1. Average Completion Rates of Study Assessments, %

	DSE	ILI
HUI-3	78.3	79.4
HUI-2	82.2	82.9
SF-6D	91.7	92.2
FT	92.3	92.7

DSE=diabetes support and education; FT=feeling thermometer; HUI=Health Utility Index; ILI=intensive lifestyle intervention.

The HUI-2 and HUI-3 tools did not indicate a difference between the ILI and DSE arms, but a significant difference was found for ILI with the SF-6D and FT tools (Table 2). Significant differences favoring ILI were based on the mean SF-6D scores (overall difference, –0.010; 95% CI, –0.014 to –0.006; $p<.001$) and the mean FT scores (overall difference, –0.021; 95% CI, –0.026 to –0.016; $p<.001$).

Table 2. Mean Differences in Mean Health Utility Score Over the Study Period Between DSE and ILI by Measurement Tool

	DSE	ILI	Change From Baseline	p Value
HUI-3	0.779	0.782	0.004	0.349
HUI-2	0.789	0.792	0.004	0.249
SF-6D	0.763	0.773	0.010	< .001
FT	0.766	0.787	0.021	< .001

DSE=diabetes support and education; FT=feeling thermometer; HUI=Health Utility Index; ILI=intensive lifestyle intervention.

Subgroup analyses according to age, body mass index, sex, race and ethnicity, and presence or absence of CVD at baseline revealed no significant differences in mean HUSs across subgroups between the ILI and DSE approaches based on any measurement tool. Comparison of data

obtained at each time point during the follow-up revealed a higher HUS for the ILI group only at Months 12 and 18 for HUI-2 scores and Months 6 and 12 for HUI-3 scores. However, SF-6D scores were always higher for the ILI group and were nearly always significantly different (ie, not at 0 and 5 years; $p < .05$ for all). FT scores were always significantly higher for the ILI group ($p < .05$ for all). HUI-2, HUI-3, and SF-6D values for all study participants tended to diminish with time, while FT values plateaued in the latter two thirds of follow-up.

Limitations included missing data not included in the analysis, potential reporting biases, and preferential weighting of HUSs that may not have been representative of the US population. The researchers concluded that an ILI is effective in improving quality of life. This estimated improvement will be used to assess the cost-effectiveness of this strategy.

Bariatric Surgery Confers Long-Term Protection for Patients With and Without Diabetes

Written by Brian Hoyle

Gastric banding surgery confers long-term (up to 17 years) protection from death and the development of cardiovascular diseases (CVD) and type 2 diabetes mellitus (T2DM) in patients with and without diabetes, according to the results of a study conducted by Antonio E. Pontiroli, MD, and colleagues, University of Milan, Milan, Italy.

Studies to date on the protection afforded by bariatric surgery have varied in their length of follow-up and number of patients and enrolled only a small number of patients with DM [Pontiroli AE, Morabito A. *Ann Surg* 2011] or have suffered from a lack of details or a high drop-out rate [Christou NV et al. *Ann Surg* 2004; Sjostrom L et al. *N Engl J Med* 2007; Busetto L et al. *Surg Obes Relat Dis* 2007; Adams TD et al. *N Engl J Med* 2007; Sowemimo OA et al. *Surg Obes Relat Dis* 2007]. The prolonged retention of patients in trials and the associated longer-term outcomes remain unclear. Furthermore, although bariatric surgery can apparently help prevent DM and lessen CVD risk [Pontiroli AE et al. *Diabetes Care* 2005; Heneghan HM et al. *Am J Cardiol* 2011; Johnson BL et al. *J Am Coll Surg* 2013; Busetto L et al. *Surg Obes Relat Dis* 2014], differences in outcomes between patients with and without diabetes remain unclear.

The present prospective, cohort record-linked study involved obese (body mass index [BMI] >35 kg/m^2) patients aged 18 to 65 years who underwent the same gastric banding procedure or received medical treatment from 1995 through 2001 at four centers in Milan. Medical records were examined for sex, age, clinical evidence of coronary heart disease (CHD) and retinopathy, anthropometric data (height, weight, BMI, systolic and diastolic blood pressures), and metabolic data (fasting blood glucose, HBA1C, total cholesterol, high- and low-density cholesterol, triglycerides, aspartate transaminase, alanine transaminase, creatinine, and estimated glomerular filtration rate). The limit date for deaths, patient exceptions, and hospital admissions was September 30, 2012. The analyses were on an intention-to-treat principle. Identification codes of all patients were entered into the Lumbardy Regional Database to ascertain patients alive, patients dead and cause of mortality, patients migrated elsewhere, and the development of new diseases.

The baseline characteristics differed between the patients who did and did not have gastric banding surgery, and therefore group matching was applied (Tables 1 and 2).

Table 1. Baseline Characteristics of Surgery and Non-Surgery Patients

Intervention	Surgery	No Surgery	p Value
Patients (M/W)	527	963	0.0001*
Age (years)	39.6	44.9	0.0001
BMI (kg/m^2)	43.0	39.8	0.0001
Systolic BP (mm Hg)	130.3	142.7	0.0001
Diastolic BP (mm Hg)	109.3	120.1	0.0021
On hypertension treatment	28	150	0.0001*
Blood glucose (mg/dL)	109.3	120.1	0.0021
On DM treatment	73	221	0.0001*
IFG	23	78	0.0001*
HbA1C (%)	6.0	7.8	0.0001*
Triglycerides (mg/dL)	133.8	158.2	0.0035
CHD	5	49	0.0001*
Died	17	92	0.0001*
% Died	3.2	9.6	0.0001*
Total Exemptions	133	402	0.0001*

BMI=body mass index; BG=blood glucose; BP=blood pressure; CHD=coronary heart disease; DM=diabetes mellitus; IFG=impaired fasting glucose; M=men; W=women.
*Chi-squared test.

Gastric banding was associated with significantly increased survival in both the entire patient cohort and among matched patients.

The survival advantage with surgery was evident for all patients with diabetes (OR, 0.37; 95% CI, 0.14 to 0.93; p=.035), matched patients with diabetes (OR, 0.33; 95% CI, 0.13 to 0.84; p=.020), and all patients without diabetes (OR, 0.39; 95% CI, 0.20 to 0.75; p=.005), and almost