Gastric Bypass Surgery in Severely Obese Women With Type 1 Diabetes: Anthropometric and Cardiometabolic Effects at 1 and 5 Years Postsurgery

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While the benefits of gastric bypass (GB) surgery in type 2 diabetes are well established, few studies have evaluated the long-term effects of GB in patients with type 1 diabetes (1,2), and these studies demonstrate conflicting effects on glycemic control. This is clinically important given the increasing prevalence of obesity in patients with type 1 diabetes (3). We studied 10 severely obese women with confirmed type 1 diabetes, as previously described (4), and evaluated outcomes prior to GB and at 1 and 5 years following surgery. Mean age at GB was 39.6 ± 8.4 years, mean duration of type 1 diabetes 24.6 ± 10.1 years, and mean age at diagnosis 16.0 ± 8.3 years. Six subjects used continuous subcutaneous insulin infusion.

BMI decreased by 33% from baseline at 1 year postoperatively (from 43.5 ± 7.5 to 29.3 ± 5.4 kg/m^2, $P < 0.0001$) but increased by a mean of 15% (to 33.8 ± 7.5 kg/m^2, $P < 0.01$) from 1 to 5 years (Table 1). Compared with baseline, HbA_{1c} was unchanged at 1 year (baseline 8.1 ± 1.3% [65 ± 14.2 mmol/mol] to 1 year 8.3 ± 1.4% [67 ± 15.3 mmol/mol], $P = 0.47$). Interestingly, HbA_{1c} trended upward at 5 years postoperatively to 9.8 ± 1.9% (84 ± 20.8 mmol/mol, $P = 0.15$). Basal insulin requirements decreased from 53.0 ± 29.7 to 23.0 ± 15.6 units/day ($P = 0.0005$) at 1 year postoperatively but trended up from 1 to 5 years to 31.1 ± 22.8 units/day ($P = 0.17$). The trend held even when accounting for body weight. There was a robust correlation between change in insulin dose and weight ($r = 0.66$; $P = 0.04$).

Cardiometabolic risk factor assessment showed decreases in plasma triglycerides (28% decrease, $P = 0.004$) and systolic blood pressure (mean decrease of 11 ± 8.3 mmHg, $P = 0.003$) at 1 year; however, these decreases were not sustained at 5 years. There was no significant change in diastolic blood pressure, total cholesterol, or LDL. Interestingly, HDL increased by 22% from 1 to 5 years following GB surgery ($P = 0.004$). Despite limited data on diabetes-related complications, microalbuminuria tended to improve, though this was largely driven by one subject. One subject had severe nonproliferative diabetic retinopathy (NPDR) at baseline, which improved to moderate NPDR at 1-year follow-up; moderate NPDR was unchanged in two subjects 1 year postoperatively.

We conclude that GB does not improve long-term glycemic control in severely obese women with type 1 diabetes. However, GB reduced body weight and improved several cardiometabolic risk factors for up to 5 years following surgery. The lack of sustained effect of GB on glycemic control in individuals with type 1 diabetes is likely a consequence of their persistent absolute insulin requirement, resulting in periods of fasting hyperglycemia and increased variability of postprandial glucose excursions, as previously demonstrated in subjects with type 2 diabetes after GB (5). GB markedly alters patterns of early postprandial glycemia, contributing to a potential mismatch between nutrient absorption and prandial insulin timing.

Our study was limited by small sample size and single-sex cohort. Nevertheless, our evaluation of anthropometric, glycemic, and cardiometabolic outcomes at multiple time points following GB surgery in severely obese women with type 1 diabetes suggests that GB induces weight loss and improvement of some cardiovascular risk factors but does not improve long-term glycemic control in women with type 1 diabetes.

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Table 1—Anthropometric and cardiometabolic risk factors and glycemic control at baseline (n = 10) and at 1 (n = 10) and 5 (n = 7) years following GB surgery

	Baseline	1 year	*P* value†	5 years	*P* value‡	*P* value§
Weight (kg)	121.9 ± 22.1	81.9 ± 15.8	<0.0001**	93.6 ± 21.0	<0.0001**	<0.01*
BMI (kg/m^2)	43.5 ± 7.5	29.3 ± 5.4	<0.0001**	33.8 ± 7.5	<0.0001**	<0.01*
HbA_{1c} (%)	8.1 ± 1.3	8.3 ± 1.4	0.47	9.8 ± 1.9	0.15	0.26
HbA_{1c} (mmol/mol)	65 ± 14.2	67 ± 15.3	0.47	84 ± 20.8	0.15	0.26
Basal insulin (units/day)	53.0 ± 29.7	23.0 ± 15.6	0.0005**	31.1 ± 22.8	0.02*	0.17
Basal insulin (units/kg/day)	0.42 ± 0.19	0.27 ± 0.13	0.0005**	0.37 ± 0.17	0.0021*	0.174
Insulin pump, *n* (%)	6 (60)	6 (60)		5 (71)		
Multiple daily injections, *n* (%)	4 (40)	4 (40)		2 (29)		
Systolic blood pressure (mmHg)	123.6 ± 8.3	112.6 ± 11.3	0.003*	118.7 ± 14.1	0.45	0.19
Diastolic blood pressure (mmHg)	72.8 ± 8.3	69.7 ± 4.2	0.32	72.4 ± 7.2	0.97	0.57
HDL (g/dL)	61.5 ± 18.4	63.0 ± 11.8	0.8	80.5 ± 16.7	0.04*	0.004*
LDL (g/dL)	102.3 ± 20.4	92.8 ± 20.5	0.41	91.5 ± 26.3	0.44	0.95
Total cholesterol (g/dL)	185.4 ± 30.9	172.7 ± 24.2	0.59	195.3 ± 27.5	0.72	0.07
Triglycerides (g/dL)	112.8 ± 55.1	80.6 ± 43.6	0.004*	111.2 ± 109.5	0.12	0.29
Microalbumin (mg/L)	62.2 ± 142	21.5 ± 26.7	0.34	14.2 ± 16.3	0.29	0.07

Data are presented as mean ± SD, unless otherwise noted. †1 year compared with baseline. ‡5 years compared with baseline. §5 years compared with 1 year. *Significant at $P < 0.05$. **Significant at $P < 0.001$.

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