



Bariatric Surgery in Patients With Obesity and Latent Autoimmune Diabetes in Adults (LADA)

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Bariatric surgery induces weight loss and restores glucose metabolism in patients with obesity and type 2 diabetes (T2D) (1). In patients with autoimmune diabetes that eventually results in β -cell failure, the glycemic effects of bariatric surgery are limited (2). Adult patients with latent autoimmune diabetes in adults (LADA) have a slower decline in β -cell function and lower requirement for insulin therapy than patients with classical young-onset type 1 diabetes (T1D) (3). They are often misdiagnosed as having T2D and might have unrealistic expectations of diabetes remission after bariatric surgery with additional risk for development of postoperative diabetic ketoacidosis (DKA) (4). The safety and efficacy of bariatric surgery in patients with obesity and LADA have not been characterized.

We retrospectively analyzed medical records of patients with obesity and LADA who underwent bariatric surgery at the Cleveland Clinic Health System in the U.S. LADA status was defined as adult-onset diabetes with presence of GAD antibodies. We compared pre- and postsurgery BMI, glycemic control (HbA_{1c}), daily insulin dose, and blood pressure and lipid profile using a paired Student *t* test, with a *P* value of 0.05 considered significant.

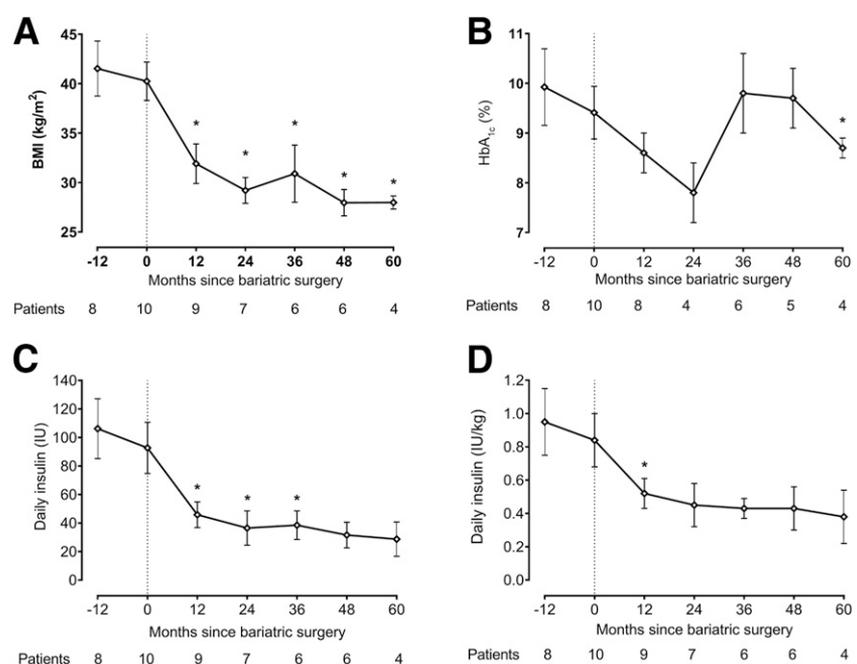


Figure 1—Changes in BMI (kg/m^2) (A), HbA_{1c} (%) (B), and daily insulin requirement (C and D) before and after bariatric surgery in patients with obesity and LADA. Data are presented as mean \pm SEM. Number of patients with data at each time point is shown beneath x-axis. **P* < 0.05.

Between October 2006 and March 2018, nine female patients underwent laparoscopic bariatric surgery (five Roux-en-Y gastric bypass and four sleeve gastrectomy) and one male patient underwent sleeve gastrectomy. The median age at time of

surgery was 52 years (range 40–66), with a median diabetes duration of 12 years (range 4–31). All 10 patients had elevated GAD antibodies, and only 2 patients had a detectable C-peptide at the time of surgery.

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Preoperatively, the median BMI was 38.6 kg/m² (range 34.8–53.7), the mean \pm SD HbA_{1c} was 9.4 \pm 1.7% (79 \pm 18.6 mmol/mol), and average insulin use was 0.84 \pm 0.50 IU/kg/day. Figure 1 shows the evolution of BMI, HbA_{1c}, and daily insulin requirement before and after surgery. One year postoperatively, BMI decreased to 30.3 \pm 3.8 kg/m² ($P = 0.004$) and daily insulin lowered to 0.52 \pm 0.27 IU/kg ($P = 0.019$), but the HbA_{1c} did not change significantly (8.6 \pm 1.2% [70 \pm 14 mmol/mol], $P = 0.24$). At the last follow-up (median 62 months, range 8–138), the weight loss persisted (BMI 33.1 \pm 6.6 kg/m², $P = 0.01$) and the HbA_{1c} remained unchanged compared with baseline (9.0 \pm 1.5% [75 \pm 16.4 mmol/mol], $P = 0.48$). All patients had HbA_{1c} >7% at the last follow-up. There were no significant changes in LDL (10 \pm 45 mg/dL), HDL (6 \pm 12 mg/dL), triglycerides (-13 ± 72 mg/dL), systolic blood pressure (2 \pm 31 mmHg), or diastolic blood pressure (-6 ± 20 mmHg) following surgery. Two patients with pre-existing albuminuria showed regression after surgery: urinary albumin-to-creatinine ratio decreased from 329 to 66 mg/g and from 183 to 27 mg/g. Four patients developed DKA (postoperative day [POD] 0, 8, 9, and 16). One patient was diagnosed with deep venous thrombosis on POD 9 and one patient with an anastomotic ulcer on POD 30.

This is the first case series describing the metabolic outcomes associated with bariatric surgery in patients with LADA. As expected, bariatric surgery induced major weight loss, accompanied by reduction in daily insulin requirement per kilogram body weight, presumably as a marker for reduced postoperative insulin resistance. There was no statistically significant improvement in glycemic control after surgery in this cohort of 10 patients with LADA, which is in contrast to the large reduction in HbA_{1c} that is seen after bariatric surgery in the majority of

patients with T2D (1). A numerical HbA_{1c} reduction of 0.9% in the 1st year after surgery might be clinically relevant, but thorough assessment of diabetes subtype before considering bariatric surgery is warranted. Recently, the importance of identifying subgroups of diabetes to tailor treatment was highlighted (5). Our data suggest that the reduced residual β -cell capacity before surgery limits the improvement of glycemic control after bariatric surgery in patients with LADA, similar to observation in many patients with T1D (2). Moreover, patients with LADA have an elevated risk associated with surgery, as shown by development of DKA in the 1st postoperative month in 4 out of 10 patients in the current series. In insulin-deficient patients, surgical stress, abrupt discontinuation of insulin or inadequate management in the perioperative period, postoperative infection, and prolonged poor oral intake and dehydration would be the potential causes for postbariatric surgery DKA (6).

Furthermore, we could not detect beneficial changes in cardiovascular risk markers in this patient cohort, which is contrary to findings in the general bariatric population (1) and might be due to the small cohort size and lack of power. Although LADA status was defined as adult-onset diabetes with presence of GAD antibodies, this retrospective series might have included patients with T1D and T2D.

In conclusion, bariatric surgery induces weight loss and reduces daily insulin requirement in patients with LADA, but the current study did not show improvement in glycemic control. Recognizing different subtypes of diabetes is warranted when considering bariatric surgery for treatment of diabetes, including awareness for specific postoperative complications such as DKA. The main reason for considering bariatric surgery in patients with LADA should be

treatment of severe obesity and potentially its multitude of comorbid conditions, not primarily for better glycemic control.

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