



**Dra. Núria Vilarrasa García.**

Specialist in Endocrinology and Nutrition.  
Hospital Universitario de Bellvitge-IDIBELL (Barcelona, Spain).



# Obesity in Type 1 Diabetes

## Does Bariatric Surgery Have a Role?

**O**besity is a chronic disease with a pandemic dimension in the Western world, both in developed and developing countries, and is currently one of the most challenging public health issues. In Spain, the estimated prevalence of overweight in the adult population is 39.3%, and obesity (body mass index [BMI] >30 kg/m<sup>2</sup>) is 21.6% (22.8% in men and 20.5% in women), and it increases with age.<sup>1</sup> The prevalence of obesity in people with type 1

diabetes mellitus (T1DM) has increased over the past decades. Large population-based registries, such as SEARCH, T1DM Exchange, the European Diabetes Patienten Verlaufsdocumentation registry, and the SWEET registry, have estimated the prevalence of overweight and obesity to be between 15.3–36%. A recent study conducted in Catalonia (SIDIAP database) estimated the prevalence of obesity in people with T1DM at 18%.<sup>2</sup>

## CONSEQUENCES OF EXCESS WEIGHT IN T1DM

Excessive weight gain in individuals with T1DM is associated with the development of central adiposity, insulin resistance, inflammation, and the risk of hypertension, dyslipidemia, or elevated cholesterol levels, all of which are key components of metabolic syndrome and established risk factors for cardiovascular disease (CVD)<sup>3</sup>. In individuals with T1DM and obesity, the coexistence of these characteristics shared with type 2 diabetes mellitus (insulin resistance, inflammation, etc.) has been termed “double diabetes.” In these patients with obesity and T1DM, other comorbidities associated with obesity, such as metabolic liver disease, sleep apnea syndrome, polycystic ovary syndrome, etc., are also more frequently present. Additionally, obesity appears to be associated with a higher risk of complications related to diabetes, such as retinopathy and nephropathy.

## TREATMENT OF OBESITY IN T1DM

The foundation of obesity treatment, which should be offered to every patient, is to follow a healthy diet, with the best results being observed in a structured

program along with physical activity. Recently, pharmacological treatments for obesity have become available. However, although not contraindicated in T1DM, these patients have not been included in clinical trials for these new molecules<sup>4</sup>.

In individuals with severe obesity, when diet and exercise have failed to improve weight, bariatric surgery may be considered as a therapeutic option. Bariatric surgery is indicated in individuals with T1DM and a BMI of 35 kg/m<sup>2</sup> or greater with associated comorbidities, or a BMI of > 40 kg/m<sup>2</sup>. Since 2016, this treatment has been supported by the International Federation for the Surgery of Obesity and Metabolic Diseases (IFSO). However, the American Diabetes Association states that, although these surgical procedures improve metabolic profile and cardiovascular risk, larger and longer studies are needed to establish their true role in T1DM<sup>5</sup>.

## TYPES OF BARIATRIC SURGERY

Bariatric surgical procedures are traditionally divided into restrictive (vertical or sleeve gastrectomy), mixed (gastric bypass), or hypoabsorptive techniques (biliopancreatic diversion/duode-

nal switch). The most widely used are vertical gastrectomy (VG) and gastric bypass (GB) surgery<sup>6,7</sup> (Figure 1).

## HOW DOES BARIATRIC SURGERY WORK IN PATIENTS WITH T1DM?

Patients with T1DM have reduced insulin secretion from their pancreas, which will not improve with the weight loss caused by surgery, but insulin resistance in the liver and peripheral tissues will decrease, thus reducing the insulin needs.

## RESULTS OF BARIATRIC SURGERY IN T1DM

The results of obesity surgery in T1DM have been described until recently in small patient series, most of which had short-term follow-up. In general, these studies have shown a significant reduction in body weight and insulin requirements, as well as improvements in other cardiovascular risk factors (mainly hypertension, dyslipidemia, and obstructive sleep apnea). However, only modest and transient benefits have been reported in blood glucose control, which mainly occur within the first year after bariatric surgery. >>

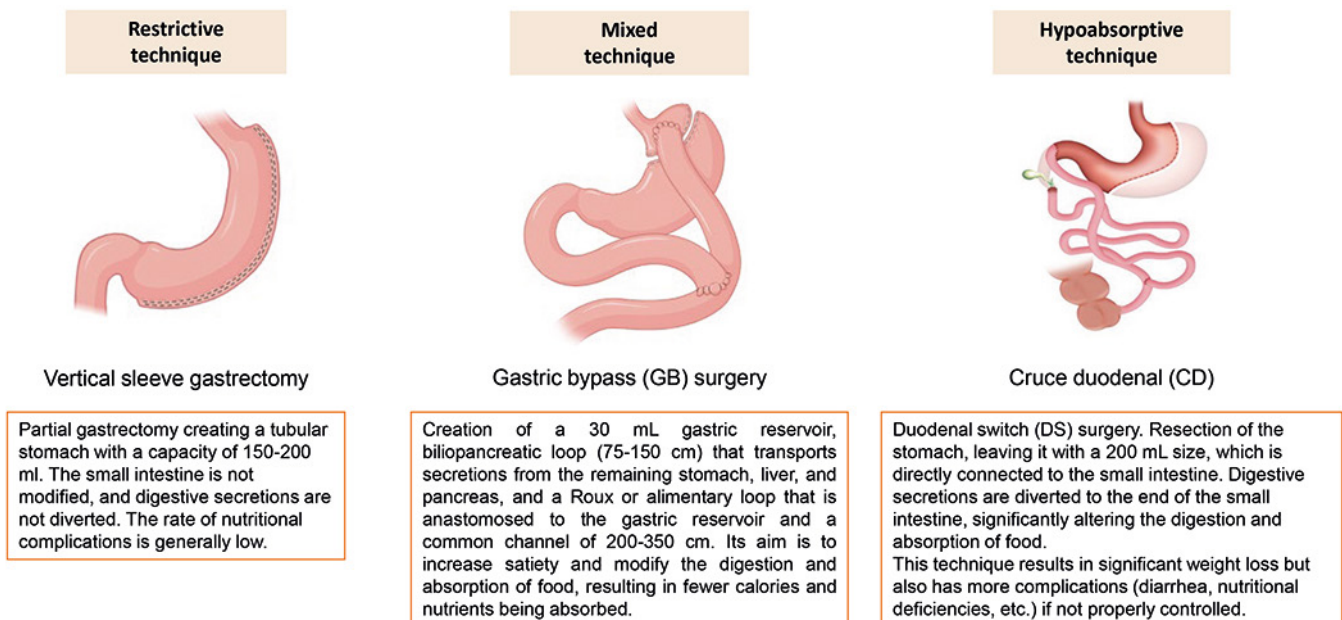


FIGURE 1. Types of bariatric surgery

## PATIENTS WHO UNDERWENT GASTRIC BYPASS SURGERY SHOWED A REDUCED RISK OF DEVELOPING CARDIOVASCULAR OR HEART DISEASE (57% REDUCTION IN RISK) AND A REDUCTION IN CARDIOVASCULAR DEATH



» The Obesity Knowledge Area of the Spanish Society of Endocrinology and Nutrition (SEEN) published the results of a cohort of 32 patients with T1DM who underwent bariatric surgery, with a mean follow-up of 4.6 years. They observed a reduction of 0.6% in HbA1c within the first year, which, however, returned to baseline values in the long term. A sustained reduction of 51% in the total daily insulin dose and a decrease in approximately 50% of patients with hypertension, dyslipidemia, and obstructive sleep apnea were also observed<sup>8</sup>.

### SAFETY OF BARIATRIC SURGERY IN T1DM PATIENTS

Bariatric surgery in experienced centers is considered a safe procedure, with a perioperative mortality rate < 0.3%, comparable to appendectomy or cholecystectomy. However, a higher risk of hypoglycemia after bariatric surgery has been reported in individuals with T1DM. Food intolerance and vomiting after surgery may contribute to this. Additionally, there is a mismatch between the insulin peak after subcutaneous administration and the earlier, more significant postprandial glucose excursion caused by the rapid arrival of carbohydrates to the jejunum, which could increase the risk of hypoglycemia, along with the improvement in insulin sensitivity. Therefore, this risk would likely be lower after techniques such as VG. However, it is still unknown whether the type of surgical technique has a real impact on hypoglycemic events and which surgery would be most appropriate in this context. In our non-randomized retrospective series, 9.3% of patients experienced a severe hypoglycemic event, but its frequency did not differ between surgical procedures that bypass the duodenum (GB surgery, duodenal switch) and VG.

The largest cohort to date is the Swedish cohort based on registries, which included 387 individuals with T1DM who had undergone »



» GB surgery and were compared to 387 patients of similar age/BMI/sex and diabetes duration<sup>9</sup>. In this study, patients who underwent surgery showed a numerical difference in hypoglycemic events that led to coma, but this difference was not statistically significant.

Diabetic ketoacidosis (DKA) is a potentially life-threatening and highly feared complication. In the Swedish national cohort, a risk up to 1.9 times higher for serious hyperglycemic events after GB surgery vs non-operated patients was found. Poor perioperative glucose control, along with omission or non-compliance with prescribed insulin doses, was also associated with this risk of DKA.

It is noteworthy that in the Swedish study, a higher risk of alcohol and substance abuse after surgery was observed, as has been reported in other bariatric surgery series.

## EFFECTS OF BARIATRIC SURGERY ON DIABETES COMPLICATIONS

In some cases of patients who underwent bariatric surgery, improvement in microalbuminuria with regression to normoalbuminuria has been reported, although the results regarding retinopathy remain inconsistent<sup>10</sup>. In the Swedish cohort study, no differences were found regarding the risk of renal disease or amputation risk after gastric bypass surgery vs controls. However, patients who underwent gastric bypass surgery showed a reduced risk of developing cardiovascular or heart disease (a 57% reduction in risk) and a reduction in cardiovascular mortality. The differences were more pronounced for stroke and heart failure. **D**

RISKS	BENEFITS
↑ Risk of hypoglycemia	↓ Weight
↑ Risk of diabetic ketoacidosis	↓ Insulin dose
↑ Risk of alcohol intake/substance abuse	↓ Insulin resistance
↑ Risk of nutritional deficiencies	Transient improvement in HbA1c
↑ Surgical risks (bleeding, infection, pulmonary thromboembolism, etc.)	Improvement in cardiovascular risk factors (hypertension, dyslipidemia, sleep apnea, etc.)
↑ Technique-related surgical risks (nausea, vomiting, diarrhea, gastroesophageal reflux, internal hernia, etc.)	↓ Cardiovascular risk and mortality

**TABLE 1.** Risks and benefits of bariatric surgery in patients with T1DM

## CONCLUSIONS

Bariatric surgery in patients with T1DM and severe obesity has proven effective in reducing weight, insulin dose, and improving associated comorbidities. Recent studies show a significant reduction in CVD and cardiac death. These benefits outweigh the adverse events observed, such as a higher risk of hypoglycemia and DKA. To avoid these adverse effects, close follow-up by a multidisciplinary team is essential to provide a personalized and modifiable insulin and dietary regimen throughout all phases of treatment, with particular attention to diabetes education. In this situation, new technologies such as continuous glucose monitoring (CGM) can be especially useful. **Table 1**

## REFERENCES:

- 1.- Aranceta-Bartrina J, Pérez-Rodrigo C, Alberdi-Aresti G, Ramos-Carrera N, Lázaro-Masedo S. Prevalence of General Obesity and Abdominal Obesity in the Spanish Adult Population (Aged 25-64 Years) 2014-2015: The ENPE Study. *Rev Esp Cardiol (Engl Ed)*. 2016 Jun;69(6):579-87.
- 2.- Genua I, Franch-Nadal J, Navas E, Mata-Cases M, Giménez-Pérez G, Vlachos B, Mauricio D, Goday A. Obesity and related comorbidities in a large population-based cohort of subjects with type 1 diabetes in Catalonia. *Front Endocrinol (Lausanne)*. 2022 Dec 2;13:1015614.
- 3.- Purnell JQ, Zinman B, Brunzell JD. The effect of excess weight gain with intensive diabetes mellitus treatment on cardiovascular disease risk factors and atherosclerosis in type 1 diabetes mellitus: results from the Diabetes Control and Complications Trial/ Epidemiology of Diabetes Interventions and Complications Study (DCCT/EDIC) study. *Circulation*. 2013;127(2):180-187.
- 4.- Kueh MTW, Chew NWS, Al-Ozairi E, le Roux CW. The emergence of obesity in type 1 diabetes. *Int J Obes (Lond)*. 2024 Mar;48(3):289-301.
- 5.- American Diabetes Association Professional Practice Committee. *Diabetes Care*. 2024 Jan 1;47(Suppl 1):S179-S218.
- 6.- [https://www.seen.es/ModulGEX/workspace/publico/modulos/web/docs/apartados/993/110620\\_083626\\_7246364497.pdf](https://www.seen.es/ModulGEX/workspace/publico/modulos/web/docs/apartados/993/110620_083626_7246364497.pdf)
- 7.- <https://www.seen.es/portal/aula-virtual/aula-diabetes/diabetes-obesidad/aprende-obesidad-diabetes>
- 8.- Vilarrasa N, Rubio MA, Miñambres I, Flores L, Caixàs A, Ciudin A, Bueno M, García-Luna PP, Ballesteros-Pomar MD, Ruiz-Adana M, Lecube A. Long-Term Outcomes in Patients with Morbid Obesity and Type 1 Diabetes Undergoing Bariatric Surgery. *Obes Surg*. 2017 Apr;27(4):856-863.
- 9.- Höskuldsdóttir G, Ekelund J, Miftaraj M, Wallenius V, Ottosson J, Näslund I, Gudbjörnsdóttir S, Sattar N, Svensson AM, Eliasson B. Potential Benefits and Harms of Gastric Bypass Surgery in Obese Individuals With Type 1 Diabetes: A Nationwide, Matched, Observational Cohort Study. *Diabetes Care*. 2020 Dec;43(12):3079-3085.
- 10.- Middelbeek RJ, James-Todd T, Cavallerano JD, Schlossman DK, Patti ME, Brown FM. Gastric bypass surgery in severely obese women with type 1 diabetes: anthropometric and cardiometabolic effects at 1 and 5 years postsurgery. *Diabetes Care*. 2015;38(7): e104-5. doi:10.2337/dc15-0396