



Review Article

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## *An Overview on the Effect of Bariatric Surgery on Type 2 Diabetes Mellitus Patients: Literature Review*

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### ABSTRACT

*The advent of bariatric surgery and its popularity comes because of the obesity epidemic. Following a progression from normal to overweight, only when a person's body mass index is increased  $\geq$  by 30 kg/m<sup>2</sup> the diagnosis of obesity is made. This is a problem of many Western countries and westernized countries, as fast-food chains have already deepened their roots in everyday meals. Another cause of obesity is genetic inheritance, which is not uncommon as, for example, patients of Prader-Willi syndrome are known to develop excessive weight gain due to hormonal imbalances out of their conscious control and due to its many associated risks and diseases, such as metabolic syndrome, management of severe refractory cases is of utmost importance. In these cases, bariatric surgery became the mainstay in modern medicine with many techniques and breakthroughs.*

*We aimed to review the literature on bariatric surgery, along with the indications, techniques, complications, and management. PubMed database was used for article selection, papers were obtained and reviewed. While obesity prevalence and its related complications rate are increasing, the surgical treated patients' rate is growing as well. As a result, complications related to these surgeries can arise in these patients and be fatal in some scenarios. Fortunately, with the implementation of new techniques and breakthroughs in overall operational care, the satisfaction and success rates are increasing. Nevertheless, patients shall be aware that this operation is considered usually the last line of management and they shall exhaust all conservative management options first.*

**Key words:** *Bariatric surgery, Metabolic surgery, Obesity management, Body mass index*

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### INTRODUCTION

The advent of bariatric surgery comes as a consequence of the obesity epidemic. Following a progression from normal to overweight, it is only when a person's body mass index is increased  $\geq$ 30 kg/m<sup>2</sup>, the diagnosis of obesity is made [1, 2]. This is a problem of many Western countries and westernized countries, as fast-food chains have already deepened their roots in everyday meals. Another cause is genetic inheritance, which is not uncommon as, for example, patients of Prader-Willi syndrome are known to develop excessive weight gain due to hormonal imbalances out of their conscious control.

The multitude of conditions associated with the condition includes other major chronic diseases such as type 2 diabetes, hypertension, and dyslipidemia [3]. The obese person would suffer from functional impairment in daily function and during sleep, some developing obstructive sleep apnoea. The extra weight is also a heavy burden on a person's joints, as eventually, they would develop arthritis. Women with obesity are often found to have the

polycystic ovarian syndrome, resulting in secondary infertility in women of childbearing age. The many conditions associated with obesity could inevitably lead to clinical depression of the patient and a continued cycle of eating excessively.

## MATERIALS AND METHODS

As mentioned in the introduction, obesity appears when a person's body mass index is increased  $\geq 30$  kg/m<sup>2</sup> (Table 1).

**Table 1.** Body Mass Index

Categorization	Body Mass Index
Normal	18.5–24.9
Overweight	25–29.9
Obesity Class 1	30–34.9
Obesity Class 2	35–39.9
Obesity Class 3	$\geq 40$

Body Mass Index = weight divided by height

PubMed database was used for article selection, and the following keys were used in the mesh (Bariatric [MeSH Terms]) AND (Metabolic Surgery [MeSH Terms]). Concerning the inclusion criteria, the articles were selected based on the inclusion of one of the following topics; bariatric complications, obesity management. Exclusion criteria were all other articles that did not have one or more of these topics as their primary endpoint.

## RESULTS AND DISCUSSION

Surgeons are careful in not offering surgical interventions before conservative and physiotherapeutic measures are sought first and fail. This is because of an increased risk of complications in this category of illness, as many would present with underlying co-morbidities. Another valuable reason is that many patients could lose acceptable body weight with lifestyle modification and exercise. This is important as patients with less pre-operative weight have been shown to benefit further from bariatric surgery in terms of excess weight reduction percentage relative to those with higher pre-operative weight [4].

In bariatric surgery, the advantage is a quicker and larger excess weight reduction when compared to conservative methods. The bariatric intervention also offers sustainability of this lost weight, unlike dietary regimes that a patient could relapse from. The physiological mechanism behind this phenomenon is the basal metabolic rate that decrements when the patient is adhering to the diet, with time the patient returns to their original weight. With bariatric surgery, the basal metabolic rate does not decrease but is shifted rapidly to a different baseline, hence the sustainability of weight loss after surgery. Other benefits of bariatric surgery are seen in better outcomes of co-morbid conditions such as type 2 diabetes, and clinical depression as it improves the quality of life. The cost of each procedure also differs, gastric bypass is often cost-effective relative to other types, with a higher quality of life scores [5]. Different procedures may offer better hospital stay than others, for instance, gastric bypass discharge has a hospital stay of 2 days while gastrectomy takes a day more [6]. Furthermore, mortality is decreased in patients who undergo bariatric surgery by 30% at 15 years [7].

The decision to perform bariatric surgery requires the inclusion of a multidisciplinary team. A physician is required to monitor the diabetic and metabolic abnormalities and offers medical consultation. A dietician is important in the perioperative period as candidates should begin with lifestyle modifications and dietary advice, as well as monitoring for excess weight loss. The surgical team would need the inclusion of radiology and anesthesiology personnel with the lead of a bariatric surgeon. Other specialties may need to be consulted in the postoperative period including physiotherapists, respiratory and sleep specialists.

The improvement in the outcome of type 2 diabetes patients is linked to weight loss and is apparent before significant weight loss occurs in the post-bariatric surgery period. While bariatric surgery does not cure diabetes, it offers a solution for glycaemic control. Many patients enter a grace period of remission, as the literal load on pancreatic beta cells is lifted [8, 9]. It is for this reason that guidelines now recommend a lower body mass index indication for bariatric surgery if the patient also suffers from type 2 diabetes mellitus. While diabetes subsides, years later there is a risk of recurrence which is not completely understood as not all patients have weight regain

years after the surgery [10]. Recent evidence has also shown a positive role of bariatric surgery in the treatment of non-alcoholic steatohepatitis [11]. Certain patients, including those with both diabetes mellitus and obesity, are eligible for bariatric surgery. These include obesity class 3, and patients who had tried other non-surgical weight-reducing interventions that were not fruitful.

There are different types of bariatric surgery, however, around three types are commonly done in practice. These have their specific advantages and disadvantages relating to how the procedure is made. Excess weight loss differs slightly between each type of procedure. Gastric bypass surgeries have considerable excess weight losses at 50–60%, this holds for Roux-en-Y gastric bypass surgery [12-14]. On the other hand, the rates of excess weight loss are higher in silastic ring gastric bypass at 60-80% [15-17]. Excess weight loss varies widely across the different types, reaching as low as 30% weight loss in gastric bypass surgeries and up to 95% weight loss in duodenal switch procedures. As with any operation, there is a risk of failure, and reoperation of bariatric surgeries occurs at a varying range depending on the type of surgery done [15].

A confounding factor in the excess weight loss that should be considered is the expertise of the operating surgeon, even when it comes to complications of bariatric surgery [18]. Bariatric surgery types are similar in their low rate of thromboembolic events such as deep vein thrombosis and pulmonary embolism but differ in other areas where the leak could occur in bypass or gastrectomy types while a port infection would occur in gastric banding procedure. In bilopancreatic diversion and its variant of a duodenal switch, there is always protein malabsorption. Therefore, in the latter procedure, the surgeon should prescribe a high protein diet with other dietary supplements to negate the effects of malabsorption. Mineral deficiency also occurs with other types of bariatric surgery, for example, iron deficiency is high in both gastric bypass and sleeve gastrectomy patients [19]. Other important supplements of vitamin D and calcium might be needed in post-Roux-en-Y surgeries [20].

There are certain types of bariatric surgery that are more common in practice including gastric banding, gastric bypass, sleeve gastrectomy, and bilopancreatic diversion. Across all types of bariatric surgery, if a patient develops abdominal pain with tachycardia in the postoperative period then a diagnosis of peritonitis should be suspected [21]. In gastric banding, a band is placed around the cardia of the gastrum and is fixed. The band is thereafter attached to a port, which is liable to infection or leakage. The band itself is susceptible to slippage if not placed securely intra-operatively.

In gastric bypass, the operating surgeon attempts to decrease the available gastric space to the size of an egg, a gastric pouch. The gastric pouch limits the amount of food intake as satiety and expansion of this limited part of the stomach is faster. The surgeon completes this pouch to the rest of the gastrointestinal tract by attaching the gastric pouch to the Roux of the intestines. The complications of this procedure include internal herniation of the gastrum which could result in abdominal pain. The limited space for food inevitably leads to malnutrition, and gastric ulceration could result from the acids flowing into the intestines before the digestive juices of the pancreas are reached.

Sleeve gastrectomy is yet another bariatric procedure, where the stomach is stapled so that only 15% of the gastrum remains for food intake. In this restrictive procedure, all the food is actively absorbed as in the normal human body, however, gastroesophageal reflux may result in the postoperative period. The surgeon should offer many options to mitigate this complication either through limiting the procedure intraoperatively or strengthening these structures with plication or gastroplasty [22]. Bilopancreatic diversion and duodenal switch are often used after a gastric sleeve, where the majority of the intestinal tract is bypassed. These surgeries are reserved for morbidly class 3 obesity patients who did not respond well to other surgical and non-surgical measures. The problem with this bypass is protein and caloric malabsorption, combined with vitamin and mineral deficiency.

## CONCLUSION

While obesity prevalence and its related complications rate are increasing, the surgical treated patients' rate is growing as well. This option while it can be life-changing in many cases, has a significant effect on the overall health care system. Moreover, complications can arise in these patients and can be fatal in some scenarios. Fortunately, with the implementation of new techniques and breakthroughs in overall operational care, the satisfaction and success rates are increasing. Nevertheless, patients shall be aware that this operation is considered usually the last line of management and they shall exhaust all conservative management options first.

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## REFERENCES

1. Haghghi-Morad M, Shakoori A, Salevatipour B. Evaluation of abdominal obesity using ultrasound and its correlation with intima-media thickness in carotid arteries. *Int J Pharm Phytopharmacol Res.* 2019;9(5):43-7.
2. Aziz N, Wal A, Wal P, Pal RS. Preparation and evaluation of the polyherbal powder: the nature's pharmacy for the treatment of diabetes mellitus and its complications. *Pharmacophore.* 2019;10(1):60-70.
3. Ruban A, Stoenchev K, Ashrafian H, Teare J. Current treatments for obesity. *Clin Med.* 2019;19(3):205-12.
4. Nickel F, Javier R, Werthmann FS, Benner L, Tapking C, Karadza E, et al. Predictors of risk and success of obesity surgery. *Obes Facts.* 2019;12(4):427-39.
5. Alsumali A, Eguale T, Bairdain S, Samnaliev M. Cost-effectiveness analysis of bariatric surgery for morbid obesity. *Obes Surg.* 2018;28(8):2203-14.
6. Welbourn R, Hollyman M, Kinsman R, Dixon J, Liem R, Ottosson J, et al. Bariatric surgery worldwide: baseline demographic description and one-year outcomes from the fourth IFSO global registry report 2018. *Obes Surg.* 2019;29(3):782-95.
7. Genser L, Barrat C. Long term outcomes after bariatric and metabolic surgery. *Presse Med.* 2018;47(5):471-9.
8. Affinati AH, Esfandiari NH, Oral EA, Kraftson AT. Bariatric surgery in the treatment of type 2 diabetes. *Curr Diab Rep.* 2019;19(12):156.
9. Tsilingiris D, Koliaki C, Kokkinos A. Remission of type 2 diabetes mellitus after bariatric surgery: fact or fiction?. *Int J Environ Res Public Health.* 2019;16(17):3171.
10. Shah A, Laferrère B. Diabetes after bariatric surgery. *Can J Diabetes.* 2017;41(4):401-6.
11. Jirapinyo P, Thompson CC. Treatment of NASH with gastric bypass. *Current gastroenterology reports.* 2018;20(10):49.
12. Chen Y, Corsino L, Shantavasinkul PC, Grant J, Portenier D, Ding L, et al. Gastric bypass surgery leads to long-term remission or improvement of type 2 diabetes and significant decrease of microvascular and macrovascular complications. *Ann Surg.* 2016;263(6):1138-42.
13. Obeid NR, Malick W, Concors SJ, Fielding GA, Kurian MS, Ren-Fielding CJ. Long-term outcomes after Roux-en-Y gastric bypass: 10-to 13-year data. *Surg Obes Relat Dis.* 2016;12(1):11-20.
14. Maciejewski ML, Arterburn DE, Van Scoyoc L, Smith VA, Yancy WS, Weidenbacher HJ, et al. Bariatric surgery and long-term durability of weight loss. *JAMA Surg.* 2016;151(11):1046-55.
15. O'Brien PE, Hindle A, Brennan L, Skinner S, Burton P, Smith A, et al. Long-term outcomes after bariatric surgery: a systematic review and meta-analysis of weight loss at 10 or more years for all bariatric procedures and a single-centre review of 20-year outcomes after adjustable gastric banding. *Obes Surg.* 2019;29(1):3-14.
16. Sheikh L, Pearlless LA, Booth MW. Laparoscopic silastic ring mini-gastric bypass (SR-MGBP): up to 11-year results from a single centre. *Obes Surg.* 2017;27(9):2229-34.
17. Carbajo MA, Luque-de-León E, Jiménez JM, Ortiz-de-Solórzano J, Pérez-Miranda M, Castro-Alija MJ. Laparoscopic one-anastomosis gastric bypass: technique, results, and long-term follow-up in 1200 patients. *Obes Surg.* 2017;27(5):1153-67.
18. Gagner M, Hutchinson C, Rosenthal R. Fifth International Consensus Conference: current status of sleeve gastrectomy. *Surg Obes Relat Dis.* 2016;12(4):750-6.
19. Steenackers N, Van der Schueren B, Mertens A, Lannoo M, Grauwet T, Augustijns P, et al. Iron deficiency after bariatric surgery: what is the real problem? *Proc Nutr Soc.* 2018;77(4):445-55.
20. Schafer AL. Vitamin D and intestinal calcium transport after bariatric surgery. *J Steroid Biochem Mol Biol.* 2017;173:202-10.
21. Kassir R, Debs T, Blanc P, Gugenheim J, Amor IB, Boutet C, et al. Complications of bariatric surgery: presentation and emergency management. *Int J Surg.* 2016;27:77-81.
22. Crawford C, Gibbens K, Lomelin D, Krause C, Simorov A, Oleynikov D. Sleeve gastrectomy and anti-reflux procedures. *Surg Endosc.* 2017;31(3):1012-21.