



TYPE 2 DIABETES MELLITUS OUTCOME AFTER BARIATRIC SURGERY: SIMPLE REVIEW

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Abstract:

Background: The research article explores the well-established link between type 2 diabetes and obesity, with a focus on the Kingdom of Saudi Arabia (KSA) where both conditions are prevalent. The high rates of diabetes in Saudi Arabia, particularly among obese individuals, highlight the urgent need for effective interventions. Bariatric surgery has emerged as a promising approach for weight loss and diabetes management, with Laparoscopic Sleeve Gastrectomy (LSG) being a preferred procedure in the region due to its efficacy and safety profile.

Objective: The study aimed to investigate the impact of bariatric surgery on patients with type 2 diabetes mellitus, focusing on outcomes such as glycemic control, medication reduction, and risk of complications. It also aimed to assess the long-term effectiveness of bariatric surgery in improving diabetes management, compare different surgical procedures, and evaluate the benefits of surgery in reducing diabetes-related complications like cardiovascular and kidney diseases.

Conclusion: The research underscores the positive outcomes of bariatric surgery in improving glycemic control and reducing the burden of type 2 diabetes in obese patients. While not all individuals achieve diabetes remission post-surgery, the procedure has shown significant benefits in terms of reducing medication dependence and lowering the risk of complications. The findings highlight the importance of considering bariatric surgery as a viable option for managing type 2 diabetes in obese individuals, especially those with a BMI of 35 kg/m² and above, to enhance long-term health outcomes and quality of life in Saudi Arabia and beyond.

Keywords: Glycemic Control, Type 2 Diabetes Mellitus, Obesity, Bariatric Surgery, Laparoscopic Sleeve Gastrectomy

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Introduction:

The correlation between type 2 diabetes and obesity has been extensively documented [1], with weight loss through metabolic surgery being recognized as a potential remedy for diabetes. Obesity, a pervasive systemic ailment with profound implications for global quality of life, remains a pressing concern [2]. In the Kingdom of Saudi Arabia (KSA), the prevalence of obesity is escalating across age groups above 15 years, with a higher incidence among females. Various factors contribute to the development of obesity, with dietary habits playing a central role, followed by insufficient physical activity and marital status [3]. Obesity is linked to a range of comorbidities, including type 2 diabetes mellitus (T2DM). Saudi Arabia has been identified by the World Health Organization (WHO) as the seventh country globally and the second in the Middle East with high diabetes rates, encompassing over six million diabetic patients and more than two million individuals with pre-diabetes [4]. Notably, a substantial proportion of diabetic patients in Saudi Arabia also grapple with obesity [5].

To address the obesity burden, the Saudi government allocated 500 million riyals in 2018 for an obesity prevention and management initiative. Given that physical inactivity contributes to obesity, it has been observed that Saudi females exhibit high levels of sedentary behavior, influenced by cultural norms that discourage public exercise and sports engagement [6]. Advances in diabetes management have facilitated improved disease control, although some cases present challenges in achieving treatment goals [7]. Weight loss is recognized as an effective approach for managing and preventing diabetes. Various pharmacological and nonpharmacological interventions are employed in the treatment and prevention of obesity. However, existing literature indicates that sustaining long-term weight loss can be problematic for some individuals [8].

Bariatric surgery is widely acknowledged as an effective intervention for weight loss and the reduction of co-morbidities in individuals with obesity. Numerous international studies have highlighted the positive impact of bariatric surgery, underscoring significant decreases in hemoglobin A1c (HbA1c), serum glucose levels, and cardiovascular risk among diabetic patients [9,10]. Furthermore, some research has indicated that bariatric surgery, when combined with medical therapy and lifestyle modifications, can lead to diabetes remission in obese patients, surpassing the outcomes of medical therapy alone [11].

Various types of bariatric surgery exist, including malabsorptive procedures, restrictive procedures, or a combination of both, each facilitating weight loss through metabolic changes via distinct mechanisms. Laparoscopic Sleeve Gastrectomy (LSG) stands out as a globally recognized surgical approach for managing obesity, particularly in diabetic patients, showcasing favorable outcomes [12]. LSG, a restrictive surgery, operates by altering appetite physiology and gastric emptying to induce weight reduction. Additionally, studies have indicated that LSG boasts a short operative duration and a low risk of complications, further solidifying its efficacy [13].

It is recommended that bariatric surgery be integrated into a holistic weight reduction program, complete with long-term medical supervision and lifestyle support [14]. Despite the global recognition of bariatric surgery, there remains a scarcity of studies in Saudi Arabia documenting the impact of such surgeries on weight reduction and HbA1c levels. Ahmed et al. (2018) found a substantial decrease in HbA1c levels within 12 months post-operatively among obese patients who underwent LSG, attributing this reduction to the accompanying decrease in BMI. The effectiveness of LSG in promoting weight loss has made it the preferred procedure in Saudi Arabia [15].

Objectives:

1. To investigate the impact of bariatric surgery on the outcomes of patients with type 2 diabetes mellitus.
2. To assess the long-term effectiveness of bariatric surgery in improving glycemic control and reducing the need for medication in patients with type 2 diabetes mellitus.
3. To compare the outcomes of different types of bariatric surgery procedures in patients with type 2 diabetes mellitus.
4. To evaluate the potential benefits of bariatric surgery in reducing the risk of complications associated with type 2 diabetes mellitus, such as cardiovascular disease and kidney disease.

Relation between type 2 diabetes and obesity:

The correlation between obesity and type 2 diabetes has been well established in research. Studies have shown that the increase in diabetes cases has coincided with the rise in obesity rates [16]. While the majority of individuals with type 2 diabetes are obese, only a small percentage of obese individuals actually develop diabetes. Nevertheless, obesity is considered to be the primary risk factor for the development of type 2 diabetes. This can be attributed to the physiological

changes associated with obesity that lead to insulin resistance [17].

In individuals with a genetic predisposition for type 2 diabetes, exposure to obesogenic factors such as high fat/carbohydrate/caloric intake and sedentary lifestyle can trigger dysfunction in pancreatic beta cells, adipose tissue, and weight gain [18]. As a result, the body struggles to maintain normal blood glucose levels due to a combination of decreased insulin production and increased insulin resistance. This progression from impaired glucose tolerance to clinical diabetes is a result of the complex interplay between obesity and diabetes [19].

Given this connection, weight loss is often recommended as a primary treatment for individuals with both obesity and diabetes [20]. By addressing the underlying obesity, it is possible to improve insulin sensitivity and reduce the risk of developing or worsening type 2 diabetes.

Impact of bariatric surgery on type 2 diabetes:

The well-established correlation between type 2 diabetes and obesity led to the anticipation that glycemic control would ameliorate due to weight loss facilitated by surgery. However, the unexpected immediate enhancement in glycemic control post-surgery indicated the presence of short-term mechanisms of action that were separate from, yet worked in conjunction with, long-term mechanisms [21]. In 2009, the American Diabetes Association (ADA) released a consensus statement outlining complete diabetes remission as the demonstration of normal fasting blood glucose levels and/or HbA1c without the need for anti-diabetes medications for a minimum of 1 year. Partial remission was defined as HbA1c < 6.5% and fasting blood glucose below 126 mg/dL without medication for 1 year. Subsequent studies have adopted similar definitions [22]. It is worth noting that at the time of manuscript submission, the revised ADA consensus statement on diabetes remission was still in progress. Despite the specific definitions utilized, multiple clinical investigations have consistently shown the significant capacity of surgery to enhance glucose regulation and induce remission. Numerous extensive cohort studies comparing bariatric surgery with conventional obesity management have validated that patients undergoing bariatric surgery are more likely to achieve diabetes remission than those solely utilizing conventional obesity therapy [23].

As a plethora of clinical studies have accumulated results, various clinical and scientific inquiries have emerged. One of the central questions revolves around the reasons behind the improvement in diabetes post-surgery. As

expected, a certain degree of glycemic enhancement post-bariatric surgery is linked to weight loss. Notably, 75% of patients who did not attain diabetes remission experienced weight regain [24]. Insulin sensitivity, a pivotal factor in diabetes pathogenesis, enhances in patients post-bariatric surgery to a similar extent as in individuals who have shed an equivalent amount of weight through caloric restriction [25].

Glucagon-like peptide 1 (GLP-1) is a gastrointestinal hormone secreted by intestinal neuroendocrine L cells that triggers the "incretin effect," boosting insulin secretion and glucose clearance in response to oral glucose. Following bariatric surgery, postprandial GLP-1 levels rise, resulting in enhanced beta-cell glucose sensitivity and reduced postprandial blood glucose levels [26]. In mice lacking the GLP-1 receptor (GLP-1R KO mice), continued enhancements in glucose regulation post-sleeve gastrectomy (SG) and Roux-en-Y gastric bypass (RYGB) are observed, akin to patients treated with a GLP-1 receptor antagonist post-surgery. Additional gut hormones that may contribute to improved glucose regulation post-surgery include PYY and oxyntomodulin, both of which increase following bariatric surgery [27].

Failure to achieve diabetes remission and relapse of diabetes:

While bariatric surgery has shown significant effectiveness in inducing remission of type 2 diabetes, it is important to note that not all individuals achieve remission. Identifying the factors that can predict the glycemic response to surgery is crucial in determining which patients are most likely to experience diabetes remission. Several studies have investigated this issue, revealing that certain factors are closely associated with diabetes remission. These factors include a shorter duration of diabetes before surgery (less than 4 years), higher levels of C-peptide, younger age, and reliance on oral medications or dietary control for managing diabetes [28,29].

Although the data collectively demonstrate the short-term benefits of bariatric surgery in managing diabetes, the long-term sustainability of diabetes remission remains a significant clinical concern. While many individuals experience long-term improvements in diabetes indicators such as HbA1c levels below 7%, reduced reliance on anti-diabetes medications, and lower complication rates, sustained remission is achieved by only a minority. Long-term outcome studies have shown that nearly 50% of patients who initially achieve diabetes remission experience a relapse [30]. For instance, data from a 15-year follow-up of the SOS

study indicated that the rate of diabetes remission decreased from 72.4% at 2 years post-surgery to 38.1% at 10 years and further dropped to 30.4% at 15 years [30]. Similar trends have been observed in randomized controlled trials (RCTs). In a study by Mingrone et al. in 2015, where individuals were randomly assigned to medical therapy, Roux-en-Y gastric bypass (RYGB), or biliopancreatic diversion (BPD) groups, ADA partial remission rates at 2 years were 0%, 75%, and 95%, respectively. By 5 years, these rates changed to 0%, 37%, and 63%. Factors that predict remission also play a role in achieving sustained remission, with predictors of relapse including insulin usage and a longer duration of diabetes before surgery, with a hazard ratio of 1.13 for each additional year of diabetes diagnosis [31].

Indications for metabolic surgery for the patients of T2DM:

According to American Society for Metabolic and Bariatric Surgery ASMBS, bariatric surgery is indicated for the following category patients: 1. Patients with a body mass index (BMI) of 40 kg/m² and above. 2. Patients with a BMI \geq 35 kg/m² and the presence of one or more obesity-associated co-morbidities such as T2DM, dyslipidemia, cardiovascular diseases, hypertension, obstructive sleep apnea, osteoarthritis, and non-alcoholic fatty liver disease. 3. Those who were unable to achieve and sustain a healthy weight with the previous non-surgical weight loss management [32].

Considering the progressive nature of T2DM, with the deterioration of pancreatic β -cells, weight control management should be initiated at the early stages of the disease [33]. It is recommended that metabolic surgery choices should be offered to T2DM patients, especially those whose BMI is 35 kg/m² and above. This will help halt and/or slow the progression of micro and macrovascular complications of T2DM [34].

Impact of bariatric surgery on diabetes-related complications and prevention:

Several studies have highlighted the significance of diabetes remission rates as a key indicator of the impact of bariatric surgery on type 2 diabetes. However, it is important to note that the health benefits of bariatric surgery extend beyond just achieving remission. Various cohort studies and randomized controlled trials (RCTs) have revealed that individuals undergoing bariatric surgery witness a substantial decrease in the usage of oral anti-diabetic medications and insulin. For instance, in a particular study, there was an 87% decline in

the use of oral medications and a 79% decrease in patients still requiring insulin [35,36].

Furthermore, the positive effects of bariatric surgery are long-lasting, with implications for improved diabetes management over the subsequent decade. This is evidenced by a reduction in both diabetes-related microvascular and macrovascular complications, as well as decreased mortality rates associated with the procedure. In a 15-year follow-up of the Swedish Obese Subjects (SOS) study, it was observed that the incidence of microvascular complications was 20.6 per 1000 person-years in surgical patients compared to 41.8 per 1000 person-years in controls, with a hazard ratio (HR) of 0.44 for the surgical group. Similarly, macrovascular complications were lower in the surgical cohort (31.7 per 1000 person-years) compared to the control group (44.2 per 1000 person-years) with an HR of 0.68 for surgical patients. Notably, long-term mortality rates were also found to be reduced in individuals who underwent bariatric surgery [38].

Moreover, research has shown that bariatric surgery plays a crucial role in preventing the development of diabetes. In the SOS trial, it was demonstrated that bariatric surgery led to a 96% risk reduction in developing diabetes at 2 years post-intervention and a 78% risk reduction at 15 years [39]. These findings underscore the growing recognition of bariatric surgery as a valuable strategy for not only treating diabetes and its complications but also preventing the onset of the disease [40].

Conclusion:

The research article highlights the significant impact of bariatric surgery on patients with type 2 diabetes mellitus and obesity. The study emphasizes the positive outcomes of bariatric surgery in improving glycemic control, reducing the need for medication, and decreasing the risk of complications associated with type 2 diabetes. While bariatric surgery has shown great potential in inducing diabetes remission and improving glucose homeostasis, it is important to note that not all individuals achieve remission, and sustained remission rates vary. Factors such as duration of diabetes prior to surgery, C-peptide levels, age, and medication use play a role in predicting remission and relapse. Despite these challenges, bariatric surgery has been associated with a reduction in diabetes-related complications, decreased mortality, and even prevention of diabetes development. The findings underscore the importance of considering metabolic surgery as a

viable option for managing type 2 diabetes in patients with obesity, especially those with a BMI of 35 kg/m² and above, to improve long-term health outcomes and quality of life.

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