

METABOLIC SURGERY AS A TREATMENT FOR TYPE II DIABETES: LITERATURE REVIEW

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Abstract: **INTRODUCTION:** Metabolic surgery, also known as bariatric surgery, is an essential tool in the treatment of obesity and Type 2 Diabetes Mellitus (DM2). In addition to promoting weight loss, this intervention positively influences metabolic health, especially through changes in the gastrointestinal tract. Although its effectiveness in T2D remission is proven, the exact mechanisms underlying these benefits are not yet completely understood. Given the growing number of cases of obesity and DM2, it is essential to further investigate this relationship to improve the clinical management of these complex conditions. **OBJECTIVE:** Analyze the effectiveness and mechanisms of action of metabolic surgery in the treatment of DM2. **METHODOLOGY:** A literature review was carried out using the database *MEDLINE-PubMed*, covering studies published between 2014 and 2024. Of the 250 studies found, 20 were selected after critical analysis. The inclusion criteria were based on the descriptors “*Metabolic Surgery*” AND “*Bariatric Surgery*” AND “*Obesity*” AND “*type 2 diabetes*” excluding animal studies and narrative reviews. **RESULTS:** The benefits, such as rapid improvement in blood glucose and glycemic homeostasis, are observed immediately after the procedure, even without weight loss. Studies indicate high long-term DM2 remission rates, ranging between 59.3% and 91.2%, depending on the type of surgery. Metabolic surgery also reduces other comorbidities of obesity and improves quality of life. However, more research is needed to understand the long-term risks and benefits, as well as compare its effectiveness with conventional treatments for T2D. **DISCUSSION:** Metabolic surgery induces remission of DM2 through several mechanisms, such as mobilization of triglycerides in the liver and pancreas and hormonal changes that improve insulin

sensitivity. Furthermore, changes in the intestinal microbiota and bile acid signaling contribute to the reduction of insulin resistance. Bariatric surgery also improves glycemic control and reduces HbA1c. These procedures are promising for patients with obesity and DM2 resistant to conventional treatment, improving both metabolic parameters and quality of life. **CONCLUSION:** Metabolic and bariatric surgery is effective in treating DM2, in addition to weight loss. Bariatric therapy induces remission by influencing hormonal and metabolic systems, while metabolic therapy is an alternative for refractory patients to conventional treatment with a higher BMI. A personalized approach is crucial, integrated into general care. Recent advances, such as new eligibility criteria, represent progress. In summary, both are effective options for remission of DM2 and reduction of complications.

Keywords: Bariatric; Metabolic surgery; Type 2 Diabetes Mellitus.

INTRODUCTION

Metabolic surgery, a term coined approximately 35 years ago to more accurately describe bariatric surgery, has stood out not only for its ability to induce weight loss, but also for its influence on metabolic health, especially in the context of Type Diabetes Mellitus. 2 (DM2).

This chronic metabolic disease is of great global relevance, being directly associated with obesity, with studies indicating a substantial increase in the risk of DM2 in individuals with a high body mass index (BMI). The alarming prevalence of these conditions reflects a public health crisis, requiring innovative therapeutic approaches¹².

Metabolic surgery has emerged as an important tool in the fight against obesity and associated diseases, such as DM2. In addition to weight loss, metabolic surgery is linked to

improvement in DM2 due to rearrangements in the gastrointestinal tract that affect the incretin/anti-incretin system, bile acid composition and intestinal microbiota. However, the exact mechanisms underlying this improvement have not yet been fully elucidated, highlighting the need for further research.

With projections indicating a significant increase in the prevalence of obesity and DM2 by 2030, metabolic surgery emerges as a promising and effective intervention. Subsequent studies have consistently demonstrated its ability to induce T2D remission and improve glucose homeostasis, reducing the need for hypoglycemic medications and decreasing the micro- and macrovascular complications of T2D. However, it is essential to better understand the mechanisms underlying these benefits to further improve the treatment of T2DM and obesity^{3 4}.

In this context, it is necessary to critically analyze the available evidence on the effectiveness and mechanisms of action of metabolic surgery in the treatment of DM2. Better understanding this relationship between obesity, DM2 and metabolic surgery is crucial to offer promising perspectives in the management of these complex metabolic conditions and to advance clinical practice and research in this area.

OBJECTIVE

To analyze the effectiveness and mechanisms of action of metabolic surgery in the treatment of type 2 diabetes and summarize recent findings on its effects on the pathophysiology, glycemic control and complications of DM2

METHODOLOGY

A literature review was carried out through the selection of studies in the database *MEDLINE-PubMed* (National Library of Medicine, National Institutes of Health) published between the years 2014 and 2024. 225 studies were found, 20 of which were selected by a critical analysis. Articles published in English and/or Portuguese that addressed the relationship between metabolic surgery and the treatment of DM 2 and available in full were included in this review. The descriptors used were “*Metabolic Surgery*” AND “*Bariatric Surgery*” AND “*Obesity*” AND “*type 2 diabetes*”. Through analysis, articles that did not meet the inclusion criteria were excluded, such as animal studies and narrative reviews.

RESULTS

Metabolic surgery, also known as bariatric surgery, is a crucial intervention in the treatment of T2DM, especially in patients with high BMI. It is indicated in several situations, such as when the BMI is equal to or greater than 40 kg/m², when it is between 35 and 39 kg/m² and the target blood glucose values are not reached, or when it is between 30 and 34 kg/m². m² and other control methods are not effective⁸⁷.

Among the four most common surgical interventions - Roux-en-Y gastric bypass (RYGB), sleeve gastrectomy (SG), adjustable gastric banding, and biliopancreatic diversion (BPD) - excess weight loss varies considerably. For example, it is 47.5% with gastric banding, 61.6% with gastric bypass and 70.1% with BPD, with or without duodenal switch⁶⁸.

Positive results in improving blood glucose levels and glycemic homeostasis can be noticed quickly after the procedure, even before weight loss. The diabetes mellitus remission rate was 57% after gastric banding, 80% after gastric bypass and 95% with biliopancreatic diversion⁷⁸.

Excess weight loss after sleeve gastrectomy is greater than after gastric banding (58% versus 42% at 1 year and 66% versus 48% at 3 years) and is roughly comparable to that of gastric bypass (70 % versus 61% in 1 year).

Furthermore, DM2 remission after surgery is significant, with rates ranging from 59.3% to 91.2% after five years, depending on the type of procedure performed. Furthermore, the average weight loss in the first two years after surgery is substantial, exceeding values obtained with conservative treatments alone. This weight reduction is accompanied by hormonal changes that affect appetite and food reward, contributing to post-surgical metabolic success.

When comparing different surgical techniques, such as adjustable gastric banding and Roux-en-Y gastrojejunol bypass (RYGB), it is observed that the latter presents a significantly higher percentage of diabetes remission, even with similar weight loss. This difference suggests that the metabolic changes promoted by surgery play a crucial role in improving glycemic control^{1 2 3 5}.

In addition to the benefits in treating DM2, metabolic surgery has also demonstrated effectiveness in reducing other comorbidities associated with obesity, such as high blood pressure. Clinical studies highlight that patients undergoing bariatric surgery experience a significant improvement in quality of life and a reduction in mortality related to obesity and its complications. However, it is important to consider the potential risks associated with surgery, such as nutritional deficiencies and long-term complications.

DISCUSSION

T2DM remission after metabolic surgery is a complex and multifaceted phenomenon, with a variety of underlying mechanisms involved. One of the reasons is the rapid food shortage after the procedure, which leads to the mobilization of triglyceride reserves in the liver and pancreas, resulting in a reduction in liver and pancreatic fat. This reduction has been associated with the normalization of fasting insulin in patients undergoing gastric bypass, due to the exclusion of the foregut, which reduces the hyperinsulinemic signal.

Furthermore, metabolic surgery triggers significant hormonal and metabolic changes that contribute to improved glucose levels. The rapid arrival of nutrients to the distal intestine in patients who have undergone intestinal bypass results in an increase in the secretion of GLP-1 and other incretins, which contributes to improved glucose levels. These metabolic adaptations, combined with reduced secretion of hormones that exacerbate diabetes, play a crucial role in the disease remission seen in many patients undergoing metabolic surgery^{1 2 3 5}.

Furthermore, metabolic surgery has been associated with changes in gut microbiota and bile acid signaling, which play important roles in improving insulin sensitivity and glucose tolerance. Modifications in the composition of the intestinal microbiota and bile acid signaling contribute to the reduction of insulin resistance and the improvement of pancreatic beta cell function after surgical intervention^{7 8 9}.

Importantly, metabolic surgery not only restores hormonal function and insulin sensitivity, but also promotes metabolic and physiological changes that go beyond weight loss. Bariatric surgery, in turn, offers significant benefits in glycemic control and reduction of glycated hemoglobin (HbA1c) in patients with DM2, when compared to conventional clinical treatment. This approach also triggers

a series of physiological and hormonal changes that contribute to metabolic control, including improvements in insulin sensitivity and the secretion of glucose-regulating gut hormones^{8 9}.

Therefore, both metabolic and bariatric surgery offer significant benefits in the treatment of DM2, contributing to disease remission and improved glycemic control. These procedures represent promising strategies for patients with obesity and DM2 refractory to conventional treatment, providing improvements not only in metabolic parameters, but also in quality of life and reducing the risk of complications associated with the disease.

CONCLUSION

Given the evidence presented, it becomes clear that both metabolic and bariatric surgery play significant roles in the treatment of DM2, offering a variety of benefits that go beyond simple weight loss. Bariatric surgery, for example, demonstrates effectiveness in the remission of DM2, often even before significant weight loss, due to its influence on the incretin/antiincretin system, the composition of bile acids and changes in the intestinal microbiota.

These pathophysiological mechanisms are fundamental to understanding the observed results, which include not only diabetes remission, but also improved cardiovascular risk and reduced need for antidiabetic medications.

On the other hand, metabolic surgery offers a valuable alternative, especially for patients with T2DM refractory to conventional treatment and a higher BMI. This approach allows for earlier surgical intervention and a response adapted to the patient's individual needs, thus expanding the therapeutic options available.

However, it is important to recognize that

choosing the surgical technique and identifying ideal patients requires a personalized and judicious approach. Bariatric surgery is not a one-off solution to diabetes and obesity; it is just one part of a broader strategy that includes multidisciplinary approaches and healthy lifestyle changes. Therefore, it is critical to integrate metabolic surgery into a comprehensive care context to optimize long-term outcomes and improve patients' quality of life.

In this sense, recent advances, such as the DSS-II consensus, which expands the

eligibility criteria for metabolic surgery, represent a significant step in the recognition and acceptance of this approach as an integral part of T2DM treatment. These changes offer hope to millions of patients around the world by providing them with a new and effective therapeutic option.

Therefore, amid these considerations, we conclude that metabolic and bariatric surgery are promising strategies in the treatment of DM2, offering substantial benefits in disease remission, improving glycemic control and reducing the risk of associated complications.

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