Bariatric surgery: a cutting-edge cure for Type 2 diabetes?

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Abstract

Type 2 diabetes is rapidly becoming a global health crisis. It is associated with multiple comorbidities and is placing an ever increasing financial burden on society. There is now a need to explore new methods of tackling this problem. A growing pool of evidence suggests that bariatric surgery has the potential to cure Type 2 diabetes in a select population and provide additional benefits for many of its associated comorbidities. Whilst there are various proposals that explain these phenomena, current research suggests the cause is mainly due to increased post surgical release of insulin promoting gut hormones. The aim of this paper is to introduce some of the complex issues surrounding the use of bariatric surgery in Type 2 diabetes and highlight the controversial aspects encompassing this topic.

Type 2 diabetes is reaching epidemic proportions. As the next generation of frontline doctors, it will be our responsibility to manage this problem using the most effective methods available.

The prevalence of Type 2 diabetes in the UK and globally is approximately 3.5% and this is expected to reach 4.4% by 2030. Of these patients, 80% are clinically obese [body mass index (BMI) >30 (kg/m^2)] and 20% of all patients with diabetes will develop microvascular and/or macrovascular complications. This problem currently places a huge financial burden on the UK’s National Health Service (NHS), with provision of healthcare for Type 2 diabetics costing £1.3 billion per year. The cost to society in benefit payments and revenue is much greater at an estimated £6.5 billion per year.

Bariatric surgery is a rapidly developing field that has the potential to cure Type 2 diabetes in the majority of individuals with a BMI >35 and reduce the burden of diabetic complications, comorbidities and cost to society.

What is bariatric surgery?

Bariatric surgery is used in the management of the morbidly obese (BMI >40 or >35 with comorbidities such as Type 2 diabetes or hypertension) but it is not widely available in the UK. It involves surgically restricting food intake and/or inducing a malabsorptive state. Whilst there are many different types of surgery, the majority performed are either the laparoscopic Roux-En-Y gastric bypass or laparoscopic gastric band surgery.

Roux-En-Y gastric bypass is a mixed restrictive and malabsorptive procedure that bypasses the stomach, duodenum and proximal jejunum. This surgery is associated with an immediate resolution of Type 2 diabetes.
Laparoscopic gastric banding is a restrictive procedure where an adjustable band is placed around the upper region of the stomach. Here, the beneficial effects occur over a longer period and are associated with gradual weight loss.

**What is the proposed mechanism of action?**

Type 2 diabetes is associated with insulin resistance and insulin insufficiency. The exact mechanisms are unclear, but obesity and lack of physical activity contribute to insulin resistance. Recent studies have focused on the insulin-mediating action of hormones released from the gastrointestinal tract. Broadly there are two proposals; the distal hypothesis and the proximal hypothesis.

The distal hypothesis proposes that incretin hormones, for example glucagon-like peptide (GLP-1), are secreted by cells within the distal jejunum and ileum in response to intestinal nutrients, improving the efficacy of insulin. This is due to a combination of increasing the secretion of insulin by enhanced proliferation of $\beta$ cells in the pancreas and decreasing insulin resistance.$^{5,6}$

In the proximal hypothesis it is thought that a counter-regulatory signal, an anti-incretin hormone, is triggered by the passage of nutrients through the foregut and released from the duodenum and proximal jejunum. Its action is to increase insulin resistance by interfering with the incretin mechanism.$^{5,6}$ However, recent evidence suggests that this mechanism plays a lesser role relative to the distal hypothesis.$^6$

In health there appears to be a correct balance between incretin and anti-incretin hormone secretion. In Type 2 diabetes, the incretin and anti-incretin hormone ratio is skewed, resulting in an imbalance favouring increased insulin resistance.

With gastric bypass surgery the delivery of nutrients is diverted from the foregut to the distal intestine. This increases the secretion of incretin hormones, decreases the release of anti-incretins, and shifts the ratio back to normal glucose homeostasis.

**Research outcomes**

There is growing evidence that bariatric surgery may effectively cure Type 2 diabetes. In a 2009 meta-analysis of 621 studies, there was an immediate, complete resolution of Type 2 diabetes in 78.1% of patients$^7$ and improvement or resolution of Type 2 diabetes in 86.6% of patients following the surgery.$^7$

For all patients undergoing bariatric surgery there are additional benefits that include resolution of hypertension in 61.7%, resolution of sleep apnoea in 85.7% and an improvement of hypercholesterolaemia in 70% of patients.$^3$ In the severely obese, bariatric surgery has also been shown to have better outcomes for weight loss over 15 years compared to non-surgical controls (average loss of weight; gastric bypass 27%, controls <2%).$^8$ It has also been shown that there is a decreased overall mortality in these surgical patients compared to controls over a 16-year period.$^8$

**Complications**

A major issue related to bariatric surgery is whether it is safe. As with any operation there are associated risks, but these should be assessed in light of the perceived benefits.
There are both general and specific complications associated with the surgery. The general complications include: risk of infection, venous thromboembolism and anaesthetic problems. In 4.3% of patients there will be at least one major adverse outcome within 30 days of the procedure. Nevertheless, the current overall mortality from bariatric surgery is <1% and the laparoscopic approach has the potential to reduce the perioperative risk even further.

The specific complications of bariatric surgery include leaks of gastrointestinal contents, nutritional deficiencies such as iron, folate and calcium deficiency associated with the Roux-en-Y bypass procedure and dumping syndrome associated with gastric banding surgery.

**Conclusions**

We acknowledge that this is a controversial topic and lifestyle modifications should be the cornerstone of management in all patients with Type 2 diabetes.

Whilst bariatric surgery is recognised as an invasive, expensive procedure requiring rigorous assessment, it has the potential to cure the majority of patients with Type 2 diabetes. It is cost-effective and significantly reduces the risk of diabetic complications and comorbidities. Whilst surgical treatment for Type 2 diabetes is still in its infancy, there are huge implications for future research with the potential of solving a growing epidemic.

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