Pros and cons of surgical intervention for the management of obesity in the context of diabetes

Corinne Owers and Roger Ackroyd

Citation: Owers C, Ackroyd R (2013) Pros and cons of surgical intervention in the management of obesity in the context of diabetes. *Diabesity in Practice* **2**: 102–6

Article points

1. Many authorities have recommended bariatric surgery as a viable treatment in the battle against diabetes.
2. There are a number of bariatric operations, and these work in different ways to reduce calorific intake and assist people with losing weight.
3. Bariatric operations, although still in their relative infancy, can provide an effective and worthwhile treatment, or at least adjunct, to the management of diabesity.

Key words

- Bariatric surgery
- Obesity
- Type 2 diabetes

Authors

Corinne Owers is Specialist Registrar in General Surgery and Roger Ackroyd is Consultant Upper Gastrointestinal and Bariatric Surgeon, Sheffield Teaching Hospitals NHS Foundation Trust, Sheffield.

The authors review the different types of bariatric surgery that are available and the associated benefits and risks. They argue that with a combination of bariatric surgery, primary and secondary care of diabetes, and simple lifestyle interventions to maintain weight loss following surgery, bariatric operations, although still in their relative infancy, can provide an effective and worthwhile treatment, or at least adjunct, to the management of diabesity.

Diabetes has been shown to be one of the most costly drains on the health service in the UK. Approximately 8.4% of the annual NHS budget was spent on diabetes medications according to a 2011 report, *Prescribing for Diabetes in England* (NHS Information Services, 2011). Of this, only 15.3% of the budget was spent on insulin and related items, with the rest on oral medication, suggesting that the majority of patients were treated for type 2 diabetes. This figure is supported by a report which shows that 90% of people in the UK with diabetes have the type 2 form (Diabetes UK, 2012). In 2010, 2 338 813 people in England alone were registered as having diabetes, accounting for 4.3% of the population.

Arguably the most significant risk factor for type 2 diabetes in the UK population is obesity, defined as a BMI of above 35 kg/m^2. It is thought that worldwide over 60% of people with type 2 diabetes are obese (Dixon et al, 2012) and obesity accounts for 80–85% of the overall risk of developing type 2 diabetes (Diabetes UK, 2012). As the number of people diagnosed with obesity increases, the number of people diagnosed with diabetes is expected to increase accordingly. Type 2 diabetes has no universally accepted definition, although the 2008 NICE clinical guideline refers to glucose levels sufficiently high as to put the person at risk of the microvascular complications of diabetes (nephropathy, retinopathy and neuropathy; NICE, 2008). This type of diabetes also predisposes an individual to high risks of macrovascular complications, such as hypertension and cardiac and peripheral vascular disease.

Treatment for type 2 diabetes has traditionally been with a combination of diet control and lifestyle, oral medications and insulin, progressing in a stepwise manner as the glucose control deteriorates. Once the progression to insulin occurs, weight loss becomes even more of a challenge given that insulin has a tendency to induce weight gain.

Owing to these complications of diabetes, it is important to reduce the individual's blood glucose to a level as near normal as possible (4–6 mmol/L). Given the predisposition of people with obesity towards type 2 diabetes, we feel that a reasonable method of improving and, in many cases, curing type 2 diabetes is with bariatric surgery. Surgery works by increasing the efficiency of insulin secretion from the pancreas and decreasing insulin resistance (Dixon et al, 2012).

Bariatric surgery often has a dramatic effect upon glucose control. Surgery has previously been seen as a last resort or a dramatic solution to the problem of type 2 diabetes, but when placed into the context of people with diabesity, its efficacy can be clearly seen. Many authorities have recommended bariatric surgery as a viable treatment in the battle against diabetes. A congregation of experts on diabetes met in Rome, Italy, in 2007 (at the Diabetes Surgery Summit) to discuss the issue and validated surgery as a treatment option (Rubino et al, 2010), and

the International Diabetes Federation had written a position statement on the inclusion of bariatric surgery in the treatment of diabetes (Dixon et al, 2011). The NICE (2008) clincial guideline on type 2 diabetes (updated in 2009) recommends bariatric surgery for people in whom primary lifestyle interventions have been unsuccessful in achieving weight loss, and as a primary intervention for diabetes in people with a BMI of over 50 kg/m^2. Surgery has been included as a viable treatment for people with type 2 diabetes by the American Diabetes Association (2009).

The largest study of people undergoing bariatric surgery to date is the Swedish Obese Subjects trial. Here, the usefulness of bariatric surgery in the management of type 2 diabetes was seen by a 72% remission rate at 2 years and 36% at 10 years (Sjöström, 2013).

A study from the Cleveland clinic in the US showed superior glycaemic improvement in patients undergoing surgical intervention, compared with the control group, who underwent intense medical management. Of the 140 patients who completed all assessments, 42% in the surgery group achieved the target HbA_{1c} level of 42 mmol/mol (6.0%), compared with only 12% in the medical group. The number of medications used in the medical group increased, but decreased in the surgical group (P<0.001). The authors concluded that at 12 months, bariatric surgery significantly improved diabetes, although they noted this was a short-term study (Schauer et al, 2012). A further randomised controlled trial comparing medical with surgical treatment (bypass and biliopancreatic diversion) showed that in 60 patients, there was no diabetes remission in the medical group, compared with 75% following bypass and 95% following biliopancreatic diversion (P<0.001; Mingrone et al, 2012).

Types of bariatric surgery

There are a number of bariatric operations, and these work in different ways to reduce calorific intake and assist people with losing weight. Although they can be broadly split into restrictive and malabsorptive operations, the majority of the common procedures in use within the UK today contain elements of both. Among people undergoing surgery through the NHS, the most common operations include the laparoscopic sleeve gastrectomy and the Roux-en-Y gastric bypass (RYGB), both of which have been shown to significantly reduce the need for antidiabetes medication almost immediately post-surgery.

Upon reviewing an individual in the bariatric clinic and counselling him or her about surgery, one of the most important factors in the decision as to which operation to perform is whether or not the person has diabetes. The type of surgical intervention is usually a joint decision between the surgeon and the patient, according to patient choice and surgeon's recommendation. It is especially important in people with type 2 diabetes for them to lose weight quickly in order to maximise the chance of achieving normoglycaemia, or at least reducing any medication requirements. Therefore, the most effective operations in these cases are usually the sleeve and the bypass. Although the biliopancreatic diversion and duodenal switch operations are the most successful at achieving significant weight loss, and have been shown to resolve type 2 diabetes in up to 100% of cases, these operations are more likely to lead to malabsorption and ill health related to malnourishment. Indeed many individuals have such severe malnutrition that they need their operation reversing – in a study of 701 patients undergoing biliopancreatic diversion and duodenal switch, 4.7% required revisional surgery (Cossu et al, 2004).

The gastric band is still a popular operation in many centres. The average weight loss, however, is less than with the gastric sleeve or bypass and, therefore, individuals should carefully consider whether or not this operation is the right one for them in the context of their diabetes. Despite this, the first randomised controlled trial on bariatric surgery versus best medical treatment for type 2 diabetes was with gastric banding as the surgical intervention and this clearly showed its effectiveness against type 2 diabetes; gastric banding surgery was five times more likely to reverse type 2 diabetes than simple lifestyle modifications (Dixon et al, 2008).

The gastric sleeve is primarily a restrictive operation, whereby the majority of the stomach is removed, leaving a thin sleeve. This effectively restricts the volume of food that can be consumed in a single sitting. Expected weight loss is slightly less than with the bypass; however, resolution of type 2 diabetes occurs in 69–87% of people at 3 years (Abbatini et al, 2010; Jiménez et al, 2012; Pirolla et

Page points

1. There are a number of bariatric operations, and these work in different ways to reduce calorific intake and assist people with losing weight.
2. Although they can be broadly split into restrictive and malabsorptive operations, the majority of the common procedures in use within the UK today contain elements of both.
3. Among people undergoing surgery through the NHS, the most common operations include the laparoscopic sleeve gastrectomy and the Roux-en-Y gastric bypass, both of which have been shown to significantly reduce the need for antidiabetes medication almost immediately post-surgery.

Page points

1. There are many studies demonstrating diabetes remission following gastric bypass surgery.
2. Some studies have shown that there is often distaste for sweets following the gastric bypass. Given that control of blood glucose in diabetes is often made easier by avoiding highly sugary foods, this distaste could in fact be seen as a positive by some individuals.

al, 2012). Many individuals prefer the sleeve owing to its relative simplicity, although complications, such as bleeds and strictures, can occur.

The gastric bypass has both a malabsorptive and restrictive component. The stomach is stapled leaving only an egg-cup-sized pouch below the oesophagus, and a loop of small bowel disconnected downstream and brought up to form an anastomosis with the pouch. The remaining bowel and stomach is reconnected a variable distance downstream from the anastomosis. This has the effect of bypassing a proportion of small bowel where absorption of foodstuffs does not occur, but maintaining some normal physiological function as the digestive juices secreted by the stomach, liver and pancreas still join with foodstuffs at this distal anastomosis, allowing "normal digestion" to occur. The amount of absorption given this shorter common channel is limited and, therefore, the individual needs to have regular blood tests and take multivitamins in order to avoid nutritional deficiencies. Although over-the-counter multivitamins contain vitamin B_{12}, which is sufficient following gastric banding surgery, both gastric sleeve and bypass patients need a 3-monthly vitamin B_{12} injection, as the absorption of this vitamin is severely limited given the removal or disconnection of the majority of the stomach, which is where intrinsic factor, the protein that allows absorption of vitamin B_{12}, is secreted.

The most common vitamin deficiencies include: vitamin B_{12}, iron, folate, calcium, selenium, zinc, magnesium and the fat-soluble vitamins (A, D, E and K). People who have undergone surgery are strongly advised to take comprehensive multivitamins (A–Z) lifelong, as well as maintaining a healthy balanced diet in order to minimise nutritional abnormalities. Zinc and selenium deficiencies can cause alopecia and hair loss, which, particularly in females, can cause significant distress. Although no formal consensus exists, it is advisable that individuals have their nutritional markers checked each year lifelong. Given the 2-year follow-up regimen for most patients in the NHS, this responsibility often falls to the GP, although dietary advice is always available from the bariatric dietitian (Bloomberg et al, 2005).

There are many studies demonstrating diabetes remission following gastric bypass surgery, such as that of Jiménez et al (2010), who showed an 80% remission rate at 36 months. The largest multicentred study, included over 4300 patients in the US and demonstrated a 68.2% remission rate at 5 years, with 35% redeveloping diabetes after another 5 years (Arterburn et al, 2013). Remission was found to be associated with previous insulin use and length of time with diabetes. It is unclear whether or not the length of the common channel makes any difference with regard to further weight loss, but some studies have shown a trend towards this being the case. Up to 82–83% of patients with diabetes find that they achieve normoglycaemia following this type of operation at 6 years (Obeid, 2012).

Some studies have shown that there is often distaste for sweets following the gastric bypass. Sugerman (1992) described a number of people following the bypass who found that they no longer had a preference for these foods. It is unclear whether this taste change is due to the desire to avoid dumping syndrome, or if there is some mechanism where the taste of sweets is simply no longer enjoyed. Given that control of blood glucose in diabetes is often made easier by avoiding highly sugary foods, this distaste could in fact be seen as a positive by some individuals. "Early" dumping syndrome is caused by the rapid emptying of food contents, particularly carbohydrates and sugars, into the small intestine and is most often experienced by patients with a limited (or no) gastric capacity. The intestine expands quickly and fluid enters the lumen owing to the hyperosmolar effects of the food. Hypovolaemia can occur, as well as hypoglycaemia due to the release of excessive insulin from the pancreas. Symptoms commonly include abdominal cramps, nausea and vomiting, dizziness, fatigue and diarrhoea. These unpleasant side effects can deter the affected person from ingestion of these foodstuffs. Management is usually by changing the post-operative diet to avoid triggering factors, eating small meals frequently throughout the day, and avoiding ingestion of water for 30 minutes postprandially. Occasionally, lying supine after eating can alleviate symptoms by preventing hypovolaemia.

"Late" dumping is due to the effects of hypoglycaemia, caused by the release of excessive insulin from the pancreas. Symptoms commonly mimic those of typical hypoglycaemia – sweating, tremor, aggression, drowsiness and palpitations. Avoidance of triggering factors, and the exchange of simple carbohydrates (simple sugars and bread)

for complex carbohydrates, is the mainstay of management.

Associated risks

Bariatric surgery is not without risks. The morbidly obese individual typically has a number of other significant health issues that can affect them both during and after anaesthesia, and, therefore, it is important to adequately optimise the person before surgery. The inflammatory effects of obesity not only contribute to insulin resistance but also increase the risks of developing deep vein thrombosis (DVT). It is essential, therefore, to ensure that all patients undergoing the surgery receive adequate prophylaxis against venous thromboembolism to minimise the rates of DVT and pulmonary embolism (PE), which carry a 20–30% mortality risk (Lakhani and Fein, 2011). Although PE and DVT post-bariatric surgery are rare in the UK, four PEs and three DVTs were recorded in the UK's National Bariatric Service Registry 2010 report (NBSR, 2011). Patients may be sent home from hospital with thromboprophylaxis, but this complication is still seen. The anaesthetic can be difficult, owing in part to the increased prevalence of obstructive sleep apnoea in obese people (Sareli et al, 2011), but also the positioning of the patient during the operation, which is often a steep head-up position. This is necessary for the surgeon to visualise the anatomy inside the abdomen and perform the surgery, but can contribute to the already higher risk of DVT, and also make ventilation more difficult. Furthermore, the higher pressures used within the abdomen during laparoscopic surgery, and the sheer weight of the patient's own abdominal wall, can cause numerous problems for both the anaesthetised patient and the anaesthetist (Owers et al, 2012). In many centres around the UK, patients undergoing RYGB or gastric sleeve are routinely admitted to the high-dependency unit post-operatively so that they can be closely monitored, given the increased risk of hypertension, sleep apnoea and diabetes in this population (Owers et al, 2012).

Numerous studies have examined and discussed the physical effects and complications of bariatric surgery. Only over the most recent decade have professionals begun to understand the numerous psychological and sociological changes that occur as a result of surgery. A significant number of people with obesity experience mental health conditions, such as depression, anxiety, and have a history of sexual abuse (van Hout and van Heck, 2009; Lier et al, 2011), and these, hypothetically at least, could affect their ability to deal with the lifestyle changes afforded to them through surgery. The clinician needs to be aware of individuals' understanding about the cause of their obesity as, anecdotally, many people claim, for example, that their weight is secondary to insulin or "in their genes" (da Silva and da Costa Maia, 2012). By working with the individual to educate him or her about the causative factors, the bariatric team will be better served to help the person adjust to the necessary lifestyle changes and, therefore, adjust to a potentially new routine with regard to diabetes management.

Psychological support can be imperative during the peri- and post-operative periods; weight loss can often negatively affect individuals, causing a resurgence or deterioration in psychological health. In the context of people with diabetes, it is important to ensure they are adequately supported so that their need for medications is closely monitored, and they continue to self-care. Psychological comorbidities have also been shown to be predictive of weight regain; therefore, in order to avoid deterioration in diabetes control in the long term following surgery, further support may be needed (Odom et al, 2010). Most bariatric teams include a bariatric psychologist, and any individual with a history of, or current, psychological problems should at least be discussed with the multidisciplinary team, or referred pre- or post-operatively for psychological support.

Other post-surgery considerations

People are often non-compliant to behavioural and lifestyle modifications following surgery (Elkins et al, 2005), and it is, therefore, important for individuals, particularly those with diabetes, to have regular follow-up both from the bariatric multidisciplinary team and a diabetes consultant or GP. It is imperative that the modification of diabetes treatment is done in a controlled manner and that people continue to monitor their glucose levels, rather than simply stopping their medications following surgery. Given that the gastric bypass, gastric band and gastric sleeve do not show a 100% resolution in diabetes control, it must be impressed upon the individual that their condition may significantly improve, but that it

Page points

1. Bariatric surgery is not without risks. The morbidly obese individual typically has a number of other significant health issues that can affect them both during and after anaesthesia, and, therefore, it is important to adequately optimise the person before surgery.
2. Only over the most recent decade have professionals begun to understand the numerous psychological and sociological changes that occur as a result of surgery.
3. People are often non-compliant to behavioural and lifestyle modifications following surgery.

may still be necessary for antidiabetes medications to be taken. Following surgery, people still need to follow a strict diet and be careful about their food intake, or their weight can be regained. If this were to occur, it is likely that diabetes would also return. Although bariatric surgery is a successful treatment for type 2 diabetes, it is not a 100% effective cure and people need to understand that the responsibility for their weight, and consequently their glycaemic control, is still down in part to their own self-control. Weight regain, although normal following surgery in a limited capacity, is usually due to a relapse into previous eating habits or "cheating" (such as eating high-calorie foods such as cream, chocolate and crisps, which pass easily through any pouch or sleeve). Regular follow up with the dietitian is imperative in the first few years; after this, individuals are usually discharged to the GP.

However, weight loss following surgery can be rapid and, in the case of people with diabetes, this is usually a desirable outcome. It is believed by some that bariatric surgery for severely obese people with diabetes should be offered as an initial treatment, rather than making such individuals attend a community weight management programme; however, given the funding climate in the NHS, and the desire to ensure people are committed to a new lifestyle, this will be unlikely in most centres (Van Nieuwenhove et al, 2011). Although it is not always possible to cease taking all antidiabetes medications following surgery, it is often the case that medications can be reduced almost immediately. One study showed that improved glycaemic control can be seen in fewer than 6 days, with some improvement noted in beta-cell function (James, 2001). Although poorly understood, the improvement in diabetes following surgery has been attributed to many factors, including limited calorific intake, decreases in simple carbohydrates, delayed gastric emptying, bypass of the duodenum and proximal jejunum, and gut hormonal changes.

During the recovery phase, food intake is limited and individuals are first able to eat only small volumes of liquid, before progressing to mushy food and then resuming a somewhat normal diet after a few weeks. Because of this, glycaemic control is different in the initial recovery period and people often do not need to take their medications, although they should still maintain a close watch on their blood glucose and seek advice about their condition if necessary. Once the weight loss begins to occur, an individual can often rapidly find that their glucose sensitivity and insulin resistance improves, often while they are still eating a post-operative diet. A significant number of people, therefore, are able to stop their medications immediately.

The absorption of numerous medications, including antidiabetes drugs, can be affected by bariatric surgery. Individuals should be advised to consult their dietitian, bariatric surgeon or GP pre-operatively about which medications may need to be changed to a chewable, crushable or liquid format, and those that may need to be changed owing to the decrease in absorptive capability. Although some centres employ a bariatric pharmacist, this resource is limited and it often falls to the GP to ensure that absorption of medications is not adversely affected by surgery. There is limited evidence about the affect of bariatric surgery on most medications, and in many cases clinical assessment of comorbidities must suffice.

Conclusion

The overall benefits of bariatric surgery in the context of diabetes make this type of surgery a viable option for those in whom primary weight-loss interventions have been unsuccessful and medication does not sufficiently control blood glucose. It may be that, in some people, the need for rapid weight loss in order to assist with diabetes control will make this a more routine method of treatment in the future. Although, as discussed, studies show that glycaemic control is not always maintained in the long term, this may be partly due to the number of people who regain weight after surgery, further limiting the body's capability to control blood glucose. However, any time spent without a diagnosis of diabetes, or with a reduction in medications owing to better overall glycaemic control, will have a substantial benefit, and may serve to reduce the number of long-term complications seen.

Therefore, with a combination of bariatric surgery, primary and secondary care of diabetes, and simple lifestyle interventions to maintain weight loss following surgery, bariatric operations, although still in their relative infancy, can provide an effective and worthwhile treatment, or at least adjunct, to the management of diabesity. ■

Abbatini F, Rizzello M, Casella G et al (2010) *Surg Endosc* **24**: 1005–10

American Diabetes Association (2009) *Diabetes Care* **32**: S13–S61

Arterburn DE, Bogart A, Sherwood NE et al (2013) *Obes Surg* **23**: 93–102

Bloomberg RD, Fleishman A, Nalle JE et al (2005) *Obes Surg* **15**: 145–54

Cossu ML, Fais E, Meloni GB et al (2004) *Obes Surg* **14**: 1182–6

da Silva SS, da Costa Maia A (2012) *Obes Surg* **22**: 1714–22

Diabetes UK (2012) *Diabetes in the UK 2012: Key Statistics on Diabetes*, pp. 1–22. Available at: http://bit.ly/MoJ1Nv (accessed 15.09.13)

Dixon JB, O'Brien PE, Playfair J et al (2008) *JAMA* **299**: 316–23

Dixon JB, le Roux CW, Rubino F, Zimmet P (2012) *Lancet* **379**: 2300–11

Dixon JB, Zimmet P, Alberti KG et al (2011) *Arq Bras Endocrinol Metabol* **55**: 367–82

Elkins G, Whitfield P, Marcus J et al (2005) *Obes Surg* **15**: 546–51

James PT, Leach R, Kalamara E, Shayeghi M (2001) *Obes Res* **9**: 228S–33S

Jiménez A, Casamitjana R, Flores L et al (2012) *Ann Surg* **256**: 1023–9

Lakhani M, Fein S (2011) *Cardiol Rev* **19**: 1–4

Lier HO, Biringer E, Hove O et al (2011) *Health Qual Life Outcomes* **9**: 79

Mingrone G, Panunzi S, De Gaetano A et al (2012) *N Engl J Med* **366**: 1577–85

National Bariatric Surgery Registry (NBSR) (2011) *First Registry Report to March 2010*. Dendrite Clinical Systems, Henley-on-Thames, Oxfordshire

NHS Information Centre (2011) *Prescribing for Diabetes in England: 2005/6 to 2010/11*. The Health and Social Care Information Centre, London. Available at: http://bit.ly/1aL5dUo (accessed 15.09.13)

NICE (2008) *Type 2 Diabetes: The management of Type 2 Diabetes*. NICE Clinical Guideline 66. NICE, London. Available at: http://tiny.cc/CG66 (accessed 16.09.13)

Obeid A, Long J, Kakade M et al (2012) *Surg Endosc* **26**: 3515–20

Odom J, Zalesin KC, Washington TL et al (2010) *Obes Surg* **20**: 349–56

Owers CE, Abbas Y, Ackroyd R et al (2012) *J Obes* **2012**: 781546

Pirolla EH, Jureidini R, Barbosa ML et al (2012) *Am J Surg* **203**: 785–92

Rubino F, Kaplan LM, Schauer PR (2010) *Ann Surg* **251**: 399–405

Sareli AE, Cantor CR, Williams NN et al. (2011) *Obes Surg* **21**: 316–27

Schauer PR, Kashyap SR, Wolski K et al (2012) *N Engl J Med* **366**: 1567–76

Sjöström L (2013) *J Intern Med* **273**: 219–34

Sugerman HJ, Kellum JM, Engle KM et al (1992) *Am J Clin Nutr* **55**: 560S–6S

van Hout G, van Heck G (2009) *Obesity Facts* **2**: 10–5

Van Nieuwenhove Y, Ceelen W, Stockman A et al (2011) *Obes Surg* **21**: 582–7