

The surgical management of obesity

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ABSTRACT

Obesity has reached pandemic levels globally. Surgical management of obesity aims to establish metabolic control, weight loss and resolution of multiple health conditions and to improve quality of life. Here, we examine the role of surgery in the management of obesity within the context of a multidisciplinary team involving a variety of healthcare professionals. We highlight the importance of patient selection, perioperative care, the various types of bariatric surgery currently available as well as emerging procedures. In addition to clarifying the different types of procedure, we also examine the potential complications and issues of weight regain and failure to lose weight. Ultimately, bariatric surgery remains comparatively safe and with generally excellent results in terms of control of existing obesity-related conditions; with the ever-increasing number of patients living with obesity, the scope of bariatric surgery is thus likely to increase.

KEYWORDS: obesity, obesity-related disease, bariatric surgery

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Introduction

Obesity is a chronic medical condition that affects many individuals worldwide. It is characterised by excess body fat that increases the risk of various health complications, such as diabetes, hypertension, heart disease, stroke and some forms of cancer. Although non-surgical methods, such as diet, exercise and medication, can help individuals lose weight, these methods might not always be successful in achieving the desired weight loss and metabolic control goals. In such cases, bariatric surgery can be a highly effective treatment option. Bariatric surgery was perhaps first described as early as the tenth century in Spain, with King Sancho of Leon reported to have undergone 'suturing of the lips' resulting in him losing half of his body weight so that he could once again ride his horse. Given that, for a large proportion of human history, starvation rather than obesity has been the main issue for the population, bariatric surgery had no real reason to develop further. However, during the 20th century, with the increase in urbanisation and automation of

manual labour, increasingly sedentary lifestyles and the ability to mass produce highly calorific foods cheaply, obesity became a disease of pandemic proportions. As a result, a variety of surgical approaches have evolved over the course of the past 75 years to meet the challenges posed by obesity. Here, we discuss the various surgical options available for the management of obesity, their advantages and limitations as well as potential complications.

Indications for surgery

The indications and qualification for bariatric surgery differ across healthcare systems. Currently in the UK, the national guidelines for the offering of bariatric surgery as stipulated by National Institute for Health and Care Excellence (NICE) are for patients with a body mass index (BMI) greater than 40 kg/m² or for those with a BMI greater than 35 kg/m² and with one or more obesity-related health condition, such as type 2 diabetes mellitus (T2DM), hypertension or sleep apnoea. Importantly, surgery is not a cure for obesity, but rather a tool to help patients achieve sustained weight loss and improve their overall health.

Measuring success

The success of any of the procedures for obesity is usually measured in terms of the excess weight loss (EWL) that the procedure offers, resolution of obesity-related medical conditions, such as T2DM, hypertension, obstructive sleep apnoea (OSA), dyslipidaemia, its safety profile and the postoperative quality of life (QoL) it affords the patient.

Preoperative evaluation

Bariatric services require a dedicated multidisciplinary team (MDT) comprising surgeons, metabolic/obesity physicians, bariatric anaesthetists, clinical nurse specialists, clinical psychologists, pharmacists and dietitians. In the UK, before surgery, the patient is required to go through a tiered obesity program, which involves all the above healthcare professionals. Medical evaluation might be required, including laboratory tests and imaging studies, to assess the overall health of the patient and to identify any potential risks or complications. Patient optimisation preoperatively is essential and can involve careful control of blood glucose in patients with T2DM, input from specialists in endocrinology, cardiology, renal and respiratory medicine, and so on. Careful control of existing healthcare conditions, particularly T2DM, OSA, cardiorespiratory and renal diseases, is vital to ensure a positive outcome for the patient.

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The psychological and dietetic aspects of this preparation are crucial. Irrespective of the procedure undertaken, it is likely to be as successful as it could be if the patient has a better understanding or an inability to tolerate the lifestyle and dietary restrictions that these procedures demand. Good social support of the patient is vital to ensure positive outcomes.

Types of bariatric procedure

There are several types of bariatric surgery, including Roux en-Y gastric bypass (RYGB), sleeve gastrectomy (SG), adjustable gastric banding (AGB) and biliopancreatic diversion with a duodenal switch (DS). The selection of the appropriate surgery depends on various factors, such as patient choice, the patient's BMI, medical history and overall health. Broadly, the procedures can be either restrictive (ie limit the volume of the digestive tract, usually the stomach), malabsorptive (reduce the number of calories that the digestive tract can absorb) or a combination thereof. Some procedures have disappeared or drastically reduced in their popularity over the past three decades, being surpassed by other more novel or less complication-prone procedures.

The evolution of bariatric procedures

Techniques have evolved since the advent of modern bariatric surgery following the first gastric bypass performed in 1954. Over the years, surgeons have developed new techniques and procedures that are increasingly more effective and associated with fewer complications. During the 1960s and 1970s, gastric bypass surgery became more popular; however, given that the procedures were performed as open surgery, the perioperative morbidity was significant. With the development of laparoscopic surgery during the 1980s, further developments have enabled increasingly complex surgeries to be undertaken with lower morbidity and mortality rates as well as reduced pain and faster recovery.

During the 1990s, the adjustable gastric band was introduced, adding another dimension to bariatric surgery. Following this, sleeve gastrectomy became popular during the early 2000s and, more recently, the one anastomosis gastric bypass (OAGB) has become a treatment mainstay. Irrespective of the procedure undertaken, the aim of bariatric surgery is to establish metabolic control, resolution or arrest of progression of existing medical conditions, and weight loss, while maintaining muscle mass and improvement of QoL.

Roux en-Y gastric bypass

Many procedures in bariatric surgery have come and gone, but few have remained as versatile as RYGB (Fig 1), which remains one of the most common bariatric procedures worldwide. It involves creating a small stomach pouch by stapling the upper portion of the stomach and connecting it directly to the jejunum and, as such, can be termed both restrictive (small gastric pouch of 30–40 ml) and malabsorptive (bypassing of a significant proportion of the small bowel, hence reducing absorption). It is highly effective in achieving significant weight loss as well as controlling diabetes, hypertension and other obesity-related conditions. It also remains a good option for patients who have significant gastro-oesophageal reflux disease (GORD). The amount

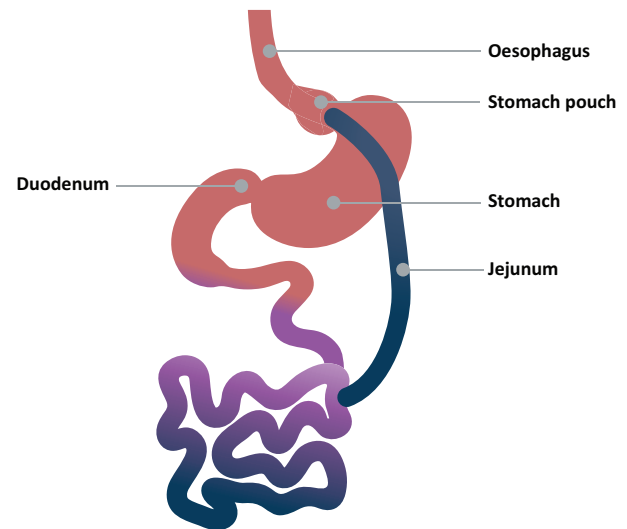


Fig 1. Roux en-Y gastric bypass.

of small bowel bypassed has been a matter of much debate within surgery and, traditionally, a greater amount of bowel was bypassed. The greater the length of the small bowel bypassed, the greater the weight loss; however, with this comes the danger of micronutrient malabsorption, vitamin deficiency, loose stools and sarcopenia. As a result, current global practice is that the combined lengths of the two limbs (biliary-pancreatic and the alimentary) should not exceed more than 200 cm, with most surgeons opting to have a combined limb length of 150 cm.¹

Sleeve gastrectomy

SG, also called the gastric sleeve or just 'sleeve', involves the resection of the lateral portion of the stomach (up to 85%) to leave behind a small, banana-shaped stomach (Fig 2). The diameter of the 'sleeve' depends on the size of the Bougie tube that is used to resect, but typically measures <2 cm in diameter. The surgery is highly effective in achieving significant weight loss and helps to control T2DM, hypertension and other obesity-related conditions; however, in patients with existing GORD, reflux symptoms can worsen owing to the higher intraluminal pressure in the sleeve compared with the stomach before the procedure.

Adjustable gastric banding

The adjustable gastric banding involves placing a silicone band around the upper part of the stomach, creating a small stomach pouch (Fig 3). The band is connected to a filling port located underneath the skin. Through this port, fluid can be injected that will adjust the amount of restriction the band produces on the stomach, thereby restricting the amount of food that can be consumed. The band is a purely restrictive procedure, it is less invasive than gastric bypass or SG and can be removed if necessary. However, it is less effective in achieving significant weight loss and can require frequent adjustments to maintain weight loss; as a result, it is no longer available on the NHS.

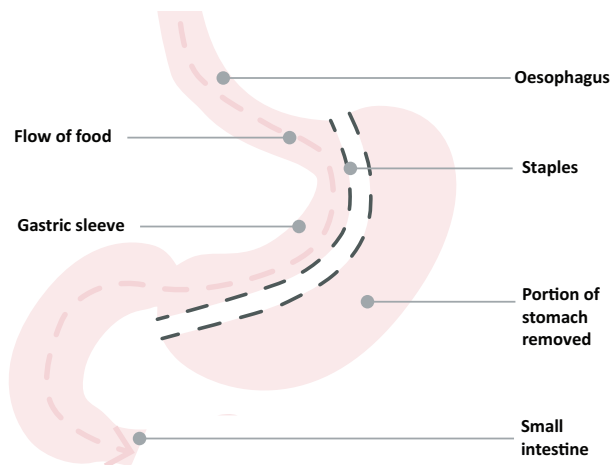


Fig 2. Sleeve gastrectomy.

One anastomosis gastric bypass

OAGB, also perhaps unhelpfully called the ‘mini’ bypass, is a similar technique to the RYGB in that a gastric pouch is formed (although, in this case, the pouch is significantly longer) and then attached to a loop of jejunum. Given that the flow of bile and pancreatic enzymes from the duodenum is not interrupted, there is only one anastomosis compared with the two anastomoses in an RYGB. This is a newer technique compared with SG or RYGB and has shown auspicious early results in producing substantial weight loss. As with any bypass, the length of small bowel bypassed significantly influences the degree of weight loss (and malabsorption). The total length of the small bowel bypassed has varied over time and across different institutions; however, anything from 60 cm to 250 cm of the small bowel has been bypassed.¹ Concerns have been raised regarding the potential for patients to develop significant bile reflux (much greater than with RYGB),² which could in turn cause oesophagitis and Barrett’s oesophagus, and could lead to oesophageal or gastric malignancy.

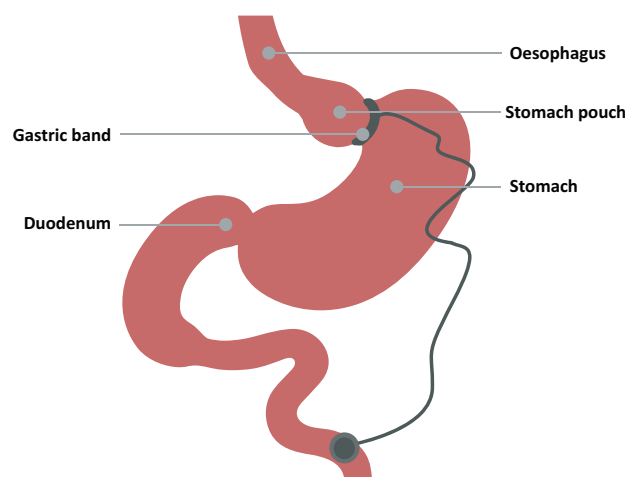


Fig 3. Adjustable gastric banding.

Insufficient time has elapsed to know whether this concern is substantiated and, if so, what exactly the risk of developing oesophagogastric cancer is.

Duodenal switch

Biliopancreatic diversion with DS is a complex surgical procedure that involves removing a significant portion of the stomach and rerouting the small intestine to reduce the number of calories absorbed by the body. The surgery is primarily malabsorptive and often results in massive weight loss,³ but also carries a higher risk of complications, such as malnutrition and vitamin deficiencies.

Single anastomosis duodeno-ileal with sleeve (SADI-S)

Single anastomosis duodeno-ileal with sleeve (SADI-S) is a variation of the DS, whereby only one anastomosis is performed (duodenum is attached to ileum) rather than having two anastomoses, as is the case with DS. Given that it is a significantly malabsorptive procedure, there is substantial weight loss, almost comparable to that achieved with DS; however, it tends to result in lower vitamin and micronutrient deficiencies.⁴

Laparoscopic gastric plication

Laparoscopic gastric plication involves the folding of the stomach onto itself and suturing it in place to reduce the intragastric volume and, therefore, is purely a restrictive procedure. Although it has been reported to produce reasonable weight loss (although modest), it has also been reported to have a higher rate of complications compared with most other bariatric procedures.⁵ Given its variable weight loss potential and concerns around its durability, it is currently not funded by the NHS.

Endoscopic procedures

A variety of novel endoscopic procedures have been developed, although their long-term efficacy is as yet uncertain. They are all restrictive procedures and have the added advantage of having low morbidity and, in some instances, not requiring a general anaesthetic.

Gastric balloon

A gastric balloon involves the insertion of a silicone or rubber balloon that is inflated with 500–750 ml of water depending on the balloon brand (Fig 4). A small amount of blue dye (usually methylene blue) is injected into the balloon so that, if the balloon were to burst, the patient’s urine would turn green, alerting them to seek medical help immediately and have it removed. The danger with a deflated balloon is that it will migrate into the duodenum and small bowel, causing obstruction, and necessitating urgent surgical intervention, invariably in the form of a laparotomy to rescue the situation. The balloon is purely restrictive (by reducing the intraluminal volume of the stomach) but has limited efficacy in maintaining weight loss. In the NHS, it is only funded in patients who require a modest degree of weight loss but are not medically fit enough to undergo a more definitive surgical procedure.

Endoscopic sleeve gastroplasty

Endoscopic sleeve gastroplasty (ESG) is the endoscopic version of gastric plication. Endoscopically, the inside of the stomach is sutured

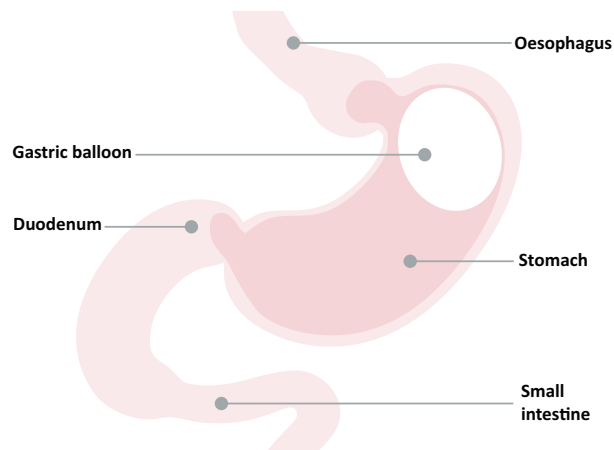


Fig 4. Gastric balloon.

to reduce the intragastric volume by up to 70% (almost comparable to that achieved with SG). Initial results are encouraging, suggesting an EWL of up to 60%, which is again equivalent to SG.⁶ However, other studies have reported the EWL to be lower after ESG compared with SG.⁷ It is not currently funded by the NHS.

Obsolete procedures

Several bariatric operations performed historically have now largely been abandoned, namely the vertical band gastroplasty (VBG), which was a restrictive procedure that involved the stapling of the stomach vertically to create a small pouch on the inner aspect (lesser curve) of the stomach. A band is then placed around the outlet of the gastric pouch to further restrict the functional aspect of the pouch. The procedure had a reasonable EWL of ~50–55%, but the high complication rate and need for revisional surgery have largely made this procedure obsolete.⁸

Which procedure?

The type of procedure undertaken is ultimately the choice of the patient, although there are certain medical contra-indications that need to be borne in mind. For example, in a patient who has Crohn's disease, it is probably inadvisable to undertake any sort of procedure that involves anastomosis of the small bowel (RYGB, OAGB, DS or SADI-S). Similarly, patients with significant GORD symptoms are likely to have worsening of this reflux after SG and, therefore, RYGB might be a better option because it gives both significant weight loss and good control of reflux. The grossly malabsorptive procedures, such as DS and SADI-S, are uncommon and are rarely used as a first-step procedure, but rather as a 'rescue' operation, when patients start experiencing weight regain or as part of a pre-planned two-stage procedure in those who have a very high BMI (>60 kg/m²). Although such patients tend to give the highest possible weight loss (often close to or even above 100% EWL), there is considerable concern regarding malabsorption, nutrient deficiency and potential sarcopenia. The other factor that potentially limits the choice of procedure is the healthcare system the patient finds themselves in. In the

NHS, procedures such as GB are no longer funded because they are thought to have limited efficacy in maintaining long-term weight loss compared with SG or RYGB. Other more malabsorptive procedures as a second stage require special funding.

Postoperative care

After surgery, individuals are required to follow a strict diet and exercise regimen to promote healing and weight loss. They might also require nutritional supplements to prevent malnutrition and vitamin deficiencies. Enhanced recovery and even day-case programs are in place across most units in the UK and typically involve an MDT approach to manage symptoms of pain and nausea, as well as early mobilisation of the patient and nutritional advice and support during the postoperative period.

Risks, complications and side effects

All surgical procedures have risks and complications, and bariatric surgery is no exception, although compared with many other forms of major surgery, it fares well in terms of perioperative morbidity and mortality. The most common complications associated with bariatric surgery include bleeding, infection and venous thromboembolism in the form of deep venous thrombosis (DVT) and pulmonary embolism. Risk of cardiorespiratory complications, such as myocardial infarction (MI) and lower respiratory tract infection (LRTI), are other potential complications, although uncommon. Complications specific to the procedures include staple line leaks and bleeds, strictures and, in the case of bypasses, internal hernias. Long-term complications can include nutritional deficiencies (more common in severely malabsorptive procedures), bowel obstruction, failure to lose weight and weight regain. In patients undergoing gastric bypass (RYGB or OAGB) and in a smaller number of patients undergoing GS, reactive hypoglycaemia and Dumping syndrome can be problematic. These phenomena often occur in patients who have undergone a gastric bypass, because the relatively small/short gastric pouch permits the rapid transition of food into the small bowel, causing a sudden hyperglycaemic state. In turn, this prompts a haemostatic response by the body, causing a rapid release of insulin resulting in a dramatic drop in the patient's blood glucose, causing nausea, lethargy, a feeling of light-headedness, sweating and a general feeling of being unwell. The symptoms can range from mild to debilitating. Patient counselling is important to mitigate these symptoms by eating foodstuffs low in simple carbohydrates, eating slowly and consuming foods with high nutritional and fibre content. Medications, such as acarbose, which is a complex oligosaccharide that acts as a competitive, reversible inhibitor of pancreatic alpha-amylase, have been used; however, the results have been disappointing. Novel endoscopic techniques, such as trans-oral outlet reduction endoscopy (TORe), have gained traction. This procedure aims to limit the size/aperture of the anastomosis between the gastric pouch and the small bowel to slow down the sudden transition of food into the small bowel.

Outcomes following bariatric surgery

Bariatric surgery has been demonstrated to be a highly effective strategy in treating obesity and its related diseases. The extent

Table 1. Types of bariatric procedure, their respective excess weight loss and average percentage of resolution of existing obesity-related disease

Bariatric surgery type	Average excess weight loss	Resolution of diabetes	Resolution of obstructive sleep apnoea	Resolution of hypertension	Resolution of dyslipidaemia	Restrictive or malabsorptive	Relative contraindications
RYGB	60–70 %	80 %	85 %	75 %	70 %	Restrictive and malabsorptive	Severe oesophageal reflux, gastroparesis, IBD
Sleeve gastrectomy	50–60 %	60 %	70 %	60 %	55 %	Restrictive	Barrett's oesophagus, severe oesophageal reflux, gastroparesis, IBD
OAGB	60–70 %	80 %	85 %	75 %	70 %	Restrictive and malabsorptive	Barrett's oesophagus, severe oesophageal reflux, gastroparesis, IBD
Duodenal switch	70–80 %	90 %	95 %	80 %	85 %	Restrictive and malabsorptive	Barrett's oesophagus, severe oesophageal reflux, gastroparesis, IBD
SADI-S	60–70 %	85 %	90 %	75 %	70 %	Restrictive and malabsorptive	Barrett's oesophagus, severe oesophageal reflux, gastroparesis, IBD
Gastric band	40–50 %	50 %	60 %	50 %	45 %	Restrictive	Previous upper abdominal surgery, high BMI, eating disorders
Gastric plication	50–60 %	60 %	70 %	60 %	55 %	Restrictive	Barrett's oesophagus, severe oesophageal reflux, gastroparesis, IBD
ESG	25–30 %	30 %	40 %	25 %	20 %	Restrictive	Previous upper abdominal surgery, active peptic ulcer disease, large hiatal hernia
Gastric balloon	10–15 %	15 %	20 %	10 %	10 %	Restrictive	Previous upper abdominal surgery, active peptic ulcer disease, oesophageal stricture

BMI = body mass index; ESG = endoscopic sleeve gastroplication; endo-sleeve; IBD = inflammatory bowel disease; OAGB = one anastomosis gastric bypass; mini bypass; RYGB = Roux en-Y gastric bypass; SADI-S = single anastomosis duodeno-ileal bypass with sleeve.

of weight loss, QoL and resolution of these related healthcare conditions varies from one procedure to another. In broad terms however, bariatric surgery in appropriately selected patients substantially reduces weight, improves overall health and QoL.

Weight loss

The extent of weight loss as measured by EWL varies across different procedures (Table 1). However, on average, patients undergoing bariatric surgery can experience 50–60% EWL after SG, 60–70% after RYGB, 70–80% following OAGB and up to 100% EWL after the more malabsorptive procedures, such as DS and SADI-S. A gastric band can provide up to 30–40% EWL and the gastric balloon up to 30%. However, all these figures are population estimates and the actual EWL in each individual patient can vary dramatically depending on patient habits, motivation, diet, lifestyle choices such as exercise, as well as the operative technique.

Resolution of obesity-related diseases

Several obesity-related diseases respond well to bariatric surgery, including T2DM, hypertension, OSA and dyslipidaemia, to the extent that some patients might have complete resolution of these conditions and not require medication or treatment. As always, success in the resolution of these diseases is multifactorial and patient factors and lifestyle behaviours have an important role.

Quality of life

Various studies have reported a general improvement in the QoL of patients postbariatric surgery, which might be closely associated with a general improvement in health and resolution of obesity-related diseases. With increased weight loss, patients report a greater improvement in mobility and their general physical and psychological well-being. However, some studies have reported patients suffering body image issues, particularly those who have abundant excess skin, and some patients can have post-traumatic stress disorder (PTSD) after bariatric surgery. Sadly, self-harm, alcohol, recreational drug addiction and even suicide has been reported in patients postbariatric surgery.⁹ This further highlights the importance of patient selection via an MDT approach and the crucial role that clinical psychologists and nurse specialists have in supporting these patients both pre- and postoperatively.

Failure to lose weight and weight regain

A small proportion of patients (estimated at ~10%) will fail to achieve their weight loss targets. The reasons for this are multifactorial, but invariably include patient selection, type of procedure undertaken in any individual patient as well as behavioural and lifestyle factors. Weight regain, which is defined as an increase in weight after the patient had initial weight loss, is a particular problem that can occur in up to 20–25% of patients.^{10,11} Currently, in the NHS, surgery for weight regain is not funded; however, when undertaken, a second procedure can offer significant reduction in weight. Medical therapy, such as GLP1 analogues, have demonstrated some benefit in achieving

weight loss post surgery irrespective of the initial bariatric surgery undertaken.¹²

Bariatric surgery health tourism

An increasing number of patients in the UK are seeking bariatric surgery abroad. The reasons for this might be multifactorial, but the relatively cheaper price of undergoing self-funded surgery abroad compared with the UK as well as the speed in which patients can undergo surgery has made this option attractive for many. Although many centres across the world provide high-volume, high-quality surgery, the concern remains that some centres or surgeons might not have the necessary experience to undertake more complex bariatric surgery. Furthermore, dealing with potential complications is also difficult remotely and patients who experience complications often present to UK centres as an emergency and require corrective procedures or surgery to deal with the complications. In addition, most centres abroad might not have the MDT support of psychologists, dietitians and nurse specialists, which is vital to improve chances of success.

Conclusion

Bariatric surgery is a highly effective treatment option for individuals with severe obesity who have not been successful with non-surgical methods of weight loss. The selection of the appropriate surgical procedure depends on various factors, such as the individual's BMI, medical history and overall health. With appropriate pre- and postoperative care, bariatric surgery can help individuals achieve significant weight loss and improve their overall health and QoL. However, careful patient selection, an MDT approach encompassing a variety of healthcare professionals, patient optimisation before surgery and good postoperative care and support are essential for a positive outcome. ■

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