Surgery for obesity

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Abstract

Obesity is a chronic progressive disease that decreases longevity and has associated co-morbidities. Diet, lifestyle and behavioural modifications are essential components in the armamentarium for treating obesity. These alone are, however, not always effective in the long term. Bariatric and metabolic surgery (BMS) safely results in maintained weight loss and amelioration of co-morbidities. This article aims to provide an overview of different BMS procedures, mechanisms of action, outcomes and potential complications.

Keywords Bariatric surgery; gastric band; gastric bypass; metabolic surgery; MRCP; neurohormonal changes; obesity; sleeve gastrectomy; weight loss

Key points

- Obesity is a major public health problem with associated co-morbidities and decreased life expectancy
- Bariatric surgery is the most effective and enduring method for weight loss, with amelioration of obesity-related diseases
- Bariatric and metabolic surgery (BMS) is generally indicated for patients with a body mass index (BMI) $\geq$ 40 or $\geq$35 kg/m^2 with two obesity-related co-morbidities. Surgery should also be considered as a treatment option in poorly controlled type 2 diabetes with a BMI >30 kg/m^2
- Food restriction and malabsorption are the main mechanisms. Neurohormonal changes affecting satiety also plays an important role
- Surgical outcomes vary by procedure, age, gender, initial BMI, patient perception, and psychological factors
- Micronutrient deficiency is common after BMS. Therefore, it is recommended that patients take nutritional supplements lifelong in addition to having a balanced diet

Introduction

Obesity is recognized as a major public health problem because of its associated co-morbidities and decreased life expectancy. In the UK in 2016, 26% of adults were classified as obese.[1] Diet, exercise and behaviour modification are effective but difficult to sustain in the long term. US Food and Drug Administration-approved weight loss medications such as liraglutide, lorcaserin, phentermine/topiramate, naltrexone—bupropion and orlistat can produce a maximum weight loss of 5—10% of total body weight at 6 months. Unfortunately, there is a high withdrawal rate secondary to adverse effects, and most individuals regain weight after stopping the medication. In contrast, bariatric and metabolic surgery (BMS) is a reliable method for obtaining significant and long-lasting weight loss, up to 30% of total body weight; but more importantly it improves co-morbidities and prolongs survival.

Indications

Body mass index (BMI; weight in kilograms divided by the square of the height in metres) is a crude indicator of obesity and is used to classify the severity of the disease. Based on BMI, the National Institute for Health and Care Excellence suggests that surgery may be appropriate for and should be considered in morbidly obese patients with a BMI $\geq$40, or $\geq$35 kg/m^2 with two obesity-related co-morbidities.[2] Other factors, such as Asian ethnicity and central obesity, are detrimental to health at any BMI and can influence indications for surgical intervention. Surgery should also be considered as a treatment option for BMI >30 kg/m^2 with poorly controlled type 2 diabetes mellitus (T2DM; glycated haemoglobin >53 mmol/mol, >7%) despite optimal medical treatment.[3]

Types of surgery

The most commonly performed procedures are described below.

Sleeve gastrectomy

Vertical gastrectomy (Figure 1) is performed by placing an orogastric tube (approximately 12 mm diameter) along the lesser curve of the stomach and resecting the extra stomach. Resection is therefore of the fundus of the stomach, which is the location of the fundic glands, responsible for secretion of the orexigenic neuropeptide ghrelin. Ghrelin acts on the hypothalamus to stimulate appetite and food intake, so decreased ghrelin concentrations produced reduced food intake. Sleeve gastrectomy also physically restricts food intake, alters gastric emptying and changes the secretion of other gut neuropeptides. Average excess weight loss (EWL) of 60—70% at 12 months is predicted, decreasing to 50% at 10 years. (%EWL = [(Initial Weight) − (Postop Weight)]/[(Initial Weight) − (Ideal Weight)] (in which ideal weight is defined by the weight corresponding to a BMI of 25 kg/m^2)).

Roux-en-Y gastric bypass

A 15—30 ml gastric pouch is created in the upper stomach, and a proximal limb of jejunum anastomosed with a Roux-en-Y

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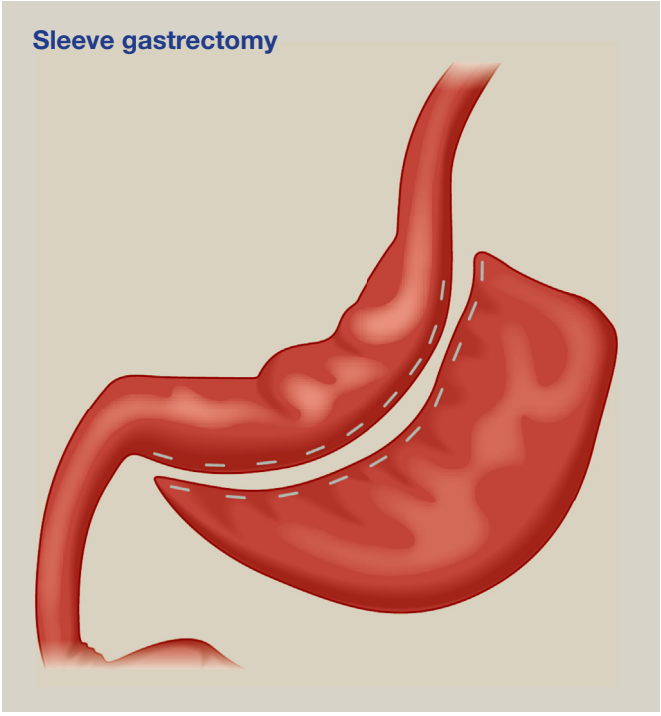

Figure 1

reconstruction (Figure 2). Food traverses the small pouch into the jejunum, bypassing the distal stomach and duodenum. This was originally thought to achieve weight loss by restriction of calories secondary to the small gastric pouch as well as some malabsorption. However, satiety secondary to neuropeptide alteration also seems to be important. Roux-en-Y gastric bypass increases concentrations of glucagon-like peptide-1 (GLP-1) and peptide YY; these are released from the ileal L-cells in response to meal ingestion, induce satiety and thus reduce food intake. GLP-1 also delays gastric emptying and intestinal motility, enhances insulin release and inhibits glucagon secretion. The predicted average EWL is 70% at 18 months, decreasing to 56% at 10 years.

Adjustable gastric banding

An adjustable silicone band is placed around the upper stomach, resulting in a micro-pouch (<15 ml) of stomach above the band (Figure 3). The lumen of the band is connected via tubing to a subcutaneous port, which allows band adjustments to be made in the outpatient setting. Satiety is thought to be achieved by neuromodulation of the vagal nerves by band adjustment. This, in conjunction with mechanical restriction, results in an average EWL of 50% at 12 months, with 40% EWL at 10 years. Of all bariatric procedures, adjustable gastric banding has one of the lowest morbidities and mortalities. Long-term complications include gastric erosion, band slippage and oesophageal dilation. Unfortunately, reoperation rates are high (>30%), reasons including inadequate weight loss and band-related complications.

Bilio-pancreatic diversion with duodenal switch

A sleeve gastrectomy is performed, followed by transection of the first part of the duodenum and the proximal ileum (Figure 4). Reconstruction involves the formation of a bilio-pancreatic limb, an alimentary limb and a common channel (50–100 cm of terminal ileum). The common channel allows food and bilio-pancreatic enzymes to join the tract, and digestion and absorption to occur. Satiety mechanisms are like those resulting from

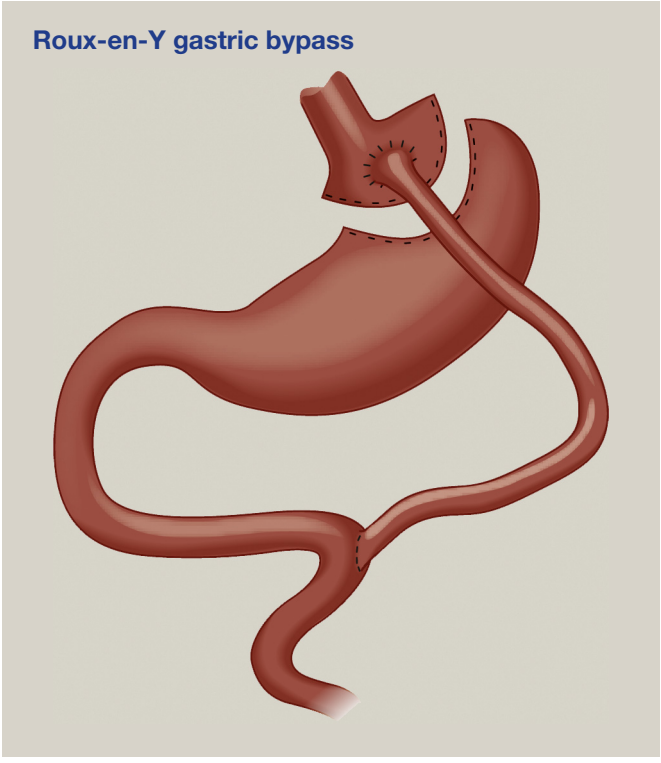

Figure 2

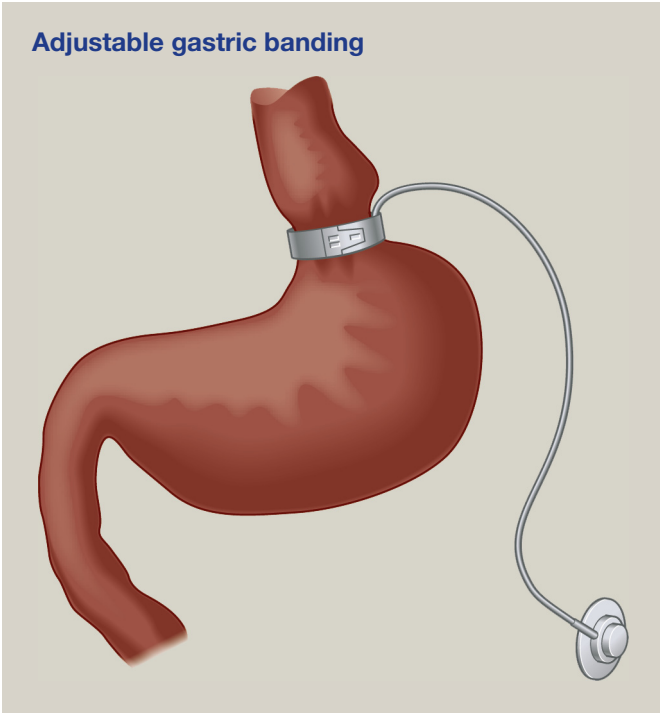

Figure 3

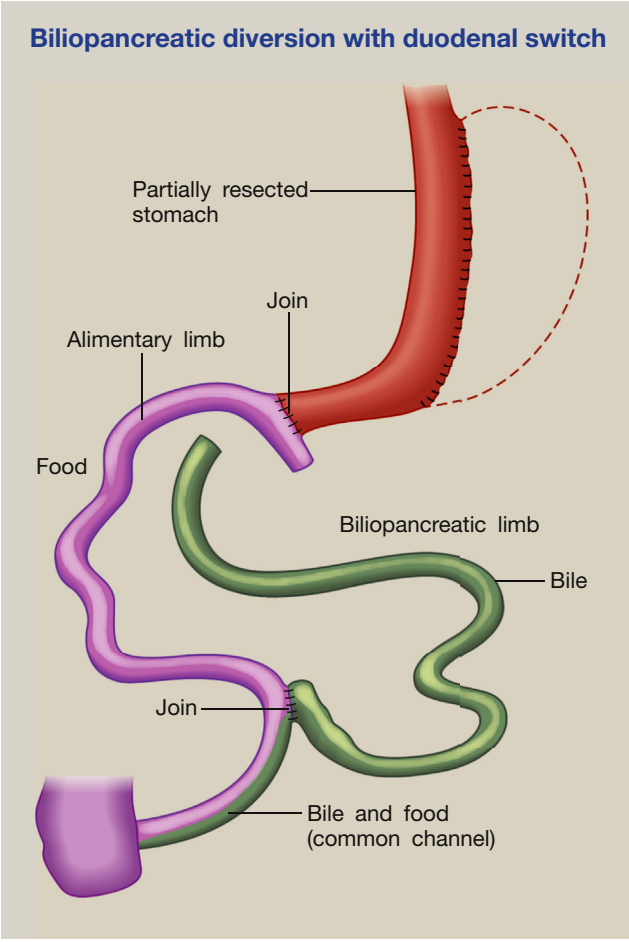

Figure 4

the Roux-en-Y gastric bypass. It is a technically challenging procedure, with the best weight loss and resolution of T2DM in the long term. Average EWL is 86% at 12 months, with 70% EWL maintained at 10 years; resolution of T2DM is >90%. It is, however, not without morbidity and mortality; complications include protein malnutrition (8%), diarrhoea and vitamin deficiencies.

Endoscopic interventions

These may be indicated for high-risk or lower BMI (27–35 kg/m^2) patients.

Intragastric balloon: this is a temporary method to achieve weight loss. A soft sodium chloride-filled balloon is placed in the stomach to promote a feeling of satiety. It results in up to 20–25% EWL, but the balloon has to be removed at 6 months (12 months for newer balloons). As soon as the balloon is removed, weight returns to pre-intervention values. Symptoms of nausea, vomiting and reflux sometimes necessitate early removal. Complications include gastric outlet obstruction and perforation of the balloon, with small bowel obstruction.

Endoscopic sleeve gastroplasty: this entails full-thickness endoluminal suturing to reduce gastric volume, mimicking a sleeve gastrectomy. Initial studies are promising, with an EWL of 50% at 1 year, but the results of long-term studies are still awaited.

Outcomes of surgery

BMS is effective in the management of obesity, with total body weight losses of 30%. Important factors for success include the type of procedure, the patient's age, sex, initial BMI and perceptions, and psychological factors. Marginal weight regain is considered normal, but 20% of patients regain >8% of EWL after 2 years. Reasons for weight regain are multifactorial and include poor eating habits, reduced physical activity, loss of adaptation of satiety hormones and technical issues from the original surgery. Weight regain is complex field that first requires careful evaluation of the underlying cause, followed by dietary counselling and increasing physical activity. Revisional operations can be indicated to correct technical failures or changes, such as pouch dilatation.

Overall mortality and obesity-related co-morbidities improve after BMS, with resolution of hypertension in 60% of individuals, obstructive sleep apnoea in 84%, and improvement of hyperlipidaemia in 70%.[4] T2DM remission occurs in up to 80% of patients. The mechanisms underlying the diabetes resolution are not fully understood, but weight loss after surgery is an important factor. Other weight-independent factors that may have a role are plasma bile acids, gut microbiota, increased insulin sensitivity, increased secretion of postprandial gut hormones (GLP-1) and inability of nutrients to access the duodenum.

Safety and complications

BMS is safe, especially in high-volume centres, with an in-hospital mortality of 0.14% and 90-day mortality of 0.35%, comparable to cholecystectomy. Follow-up in the postoperative period is essential for successful outcomes and to identify potential complications Postoperative complications, seen in 5–10% of patients, include haemorrhage (1%), anastomotic leak (1%) and pulmonary embolus. The latter is minimized by a strict protocol involving early mobilization, thromboembolic deterrent (TED) stockings and anticoagulation prophylaxis based on weight and given for a prolonged period (4 weeks).

Long-term risks include internal hernias, anastomotic stenosis, marginal ulceration, fistulae, dumping syndrome, gallstones, excess skin, emotional disorders and vitamin and mineral deficiencies. The latter can occur with any BMS procedure, and supplementation protocols are available, but compliance of both patients and general practitioners varies. Malabsorptive procedures are also commonly associated with micronutrient deficiencies, including vitamins A, C, D and K, thiamine, folic acid and vitamin B_{12}, and minerals including iron, selenium, zinc and copper; more severe deficiency is seen after bilio-pancreatic diversion with duodenal switch. It is recommended that patients take life-long nutritional supplements in addition to a balanced diet. ◆

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