

Complications of bariatric surgery presenting to the general surgeon

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Introduction

Trends in the UK and many other parts of the developed world show a steady increase in obesity over the last 30 years and there are no signs that this is decreasing. Obesity places an enormous health burden on our society because of the medical comorbidities that are associated with it, such as type II diabetes, hypertension, dyslipidaemia, steatohepatitis, obstructive sleep apnoea, arthritis of the weight-bearing joints, gastro-oesophageal reflux, depression and infertility. In general, these medical problems improve or even resolve in parallel with weight loss. Surgery specifically aimed at weight loss ('bariatric' surgery, from the Greek word *baros* = weight, *iatrikos* = medical) has been developing since the 1950s but it is only in the last 20 years, in the wake of advances in laparoscopy, that surgery has become increasingly popular.

Over the past decade, following the publication of several long-term outcome studies that showed a significant improvement in cardiovascular risk and mortality after bariatric surgery,¹⁻³ the number of bariatric procedures being carried out annually in the UK has grown exponentially. Surgery remains the only way to produce significant, sustainable weight loss and resolution of comorbidities. Nevertheless, relatively few surgeons have developed an interest in this field. Most bariatric surgery is now performed in centres staffed by surgeons with a bariatric interest, usually as part of a multi-disciplinary team.

✓✓ Bariatric surgery is the only method of producing long-term, reliable and significant weight loss with resolution of the associated morbidities of morbid obesity.²

Although the number of hospitals providing a bariatric service in the UK is undoubtedly growing, many patients still have to travel long distances for their surgery – some even go overseas. Procedures are generally performed using laparoscopic and/or endoscopic techniques and lengths of stay are short. In the event of postoperative complications, patients can therefore present back at their local hospital or clinic, where there may be no specialised knowledge or expertise in the field. The aim of this chapter is to inform general surgeons on the disease process of obesity and the current bariatric procedures that are commonly performed, to outline the common complications that may arise and to provide management guidance for those patients that present in an emergency setting. Several articles have been written on the topic recently,⁴⁻⁶ which reflects its current level of interest.

Causes of obesity

While obesity is the result of a chronic energy imbalance when food (calorie) intake exceeds energy expenditure, such an explanation on its own is too simplistic. Obesity should be considered a multifactorial socio-psycho-endocrine disease process.

It is now clear that there is a complex physiological adipostatic system in place that works to maintain a constant body weight in the face of daily fluctuations in energy balance.⁷ The hypothalamus is an important control centre for this process, integrating a variety of both short-term and long-term energy flux signals. The gastrointestinal (GI) tract produces a number of hormones including ghrelin, glucagon-like peptides (GLP)-1 and 2, peptide tyrosine, insulin and cholecystokinin, which not only influence gut motility and exocrine secretions but also exert positive and negative feedback on the hypothalamus to regulate appetite. Ghrelin, the 'hunger hormone', is released from the gastric body and promotes appetite, while leptin, a hormone that circulates in proportion to the body's fat mass, has a negative feedback on the hypothalamus to promote negative energy balance. Neural pathways are also involved via vagally innervated stretch receptors in the stomach wall, which induce satiety (and even nausea) in response to gastric distension.

There are also social and psychological drivers to eat. Eating is a pleasurable activity and, for many, meals are the hub of family and social events. Eating may also provide comfort to address fear, loneliness or anxiety. There is now evidence that such negative emotions increase food consumption and that obese people eat in response to emotions more than normal-weight people.⁸

Dieting is known to be difficult and, for many, is not successful in the long term. Modern human beings have evolved from nomadic hunter-gatherers and our physiology defaults to energy storing in periods of food shortage. Thus dieting induces a physiological adaptation to starvation. This stimulates appetite, induces the bowel to absorb a greater proportion of food eaten, reduces energy loss by a subtle lowering of body temperature and promotes fat storage.

Surgery is the most effective treatment for severe and complex obesity because it alters the physiological processes at the heart of weight homeostasis. Different procedures do this in different ways.

Mechanisms of weight loss surgery

Traditionally, weight loss operations have been described as either restrictive or malabsorptive, influencing either the volume of food that can be ingested or the absorption of food at the mucosal level, respectively (or both). However, it is more likely that surgery interacts in a beneficial way with the complex adipostatic system outlined above. Gastric band patients, for example, who are restricted in their oral intake by the constricting ring around their upper stomach, do not show the normal

hormonal adaptation to starving. Part of the band's action appears to be through feedback to the adipostat, possibly via vagal afferents. Similarly, patients undergoing a so-called malabsorptive operation, such as gastric bypass, do not suffer chronic diarrhoea; their weight loss is mediated by a series of gut hormonal changes that influence appetite, food choices and gut motility, amongst other things.

Even so, iatrogenic manipulations of the adipostat are not the full story. In order to achieve the best outcomes, patients still need to make a series of healthy dietary and lifestyle changes along the lines of eating sensibly and being physically active. Authorities agree that postoperative weight maintenance is improved by the ongoing encouragement, advice and support obtained from long-term follow-up in a bariatric clinic.⁹⁻¹¹

While weight control is a complex process, the mechanisms behind the postoperative resolution of obesity-related comorbidities are also complex and, even now, not fully understood. Control of type II diabetes mellitus, for example, is known to improve in parallel with the gradual weight loss that follows gastric band surgery.¹² However, the gastric bypass and duodenal switch operations can normalise glucose tolerance much more quickly, even before there has been any appreciable weight loss.^{13,14} Such changes are mediated by gut hormones that are stimulated either by a lack of nutrients in the foregut or by the rapid post-prandial delivery of food to the hindgut, with a resultant improvement in pancreatic function and a reduction in peripheral insulin resistance. These processes are well explained elsewhere^{7,13,15} and will not be expanded upon here.

Bariatric operations

The commonest weight loss procedures performed around the world at present are the gastric band, the gastric bypass and the sleeve gastrectomy. In very obese patients, an alternative operation is the duodenal switch, while the new ileal transposition procedure represents one of the few purely metabolic operations designed specifically for the treatment of type II diabetes. Older operations such as vertical banded gastroplasty and jejuno-ileal bypass are now obsolete, although patients who have undergone such procedures in the distant past may still present to hospital with complications. The main endoscopic option at present is insertion of a gastric balloon, with newer procedures like the endoscopic duodenojejunal barrier and gastric plication on the horizon. Implantable neuroregulatory devices (gastric 'pacemakers') represent a new direction for surgical weight control by harnessing neural feedback signals to help control eating.

The reason that so many options exist is because no procedure is perfect. Each brings its own benefits and risks. There is little evidence to indicate which operation suits which patient, although most series demonstrate greater average weight loss from operations with a malabsorptive component over restrictive operations alone.^{11,16} In practice, the final choice of operation emerges from a detailed discussion between the patient and their surgeon about the options available and the potential risks and benefits of each one.

Gastric band

The gastric band is an inflatable silicone ring fixed around the proximal stomach to create a zone of constriction with a small proximal gastric pouch of approximately 30 mL. The band sits around the angle of His, runs along the line of the left crus of the diaphragm and typically lies at about 45° to the horizontal in the 8-to-2 o'clock direction (Fig. 19.1). Many surgeons secure the band in position with a number of gastro-gastric sutures from the fundus below the band up on to the small gastric pouch. The band connects by tubing to an injection port, which is then secured subcutaneously on the anterior abdominal wall. Instillation or aspiration of saline via the subcutaneous injection port adjusts the degree of constriction produced by the band. The amount of saline required in the band varies from patient to patient and often a number of fine adjustments are needed to achieve just the right level of restriction so that patients can manage small portions of normal food.

Roux-en-Y gastric bypass

This is the most common bariatric operation now performed worldwide. The first step involves using



Figure 19.1 • Barium meal showing band sitting at a normal angle of approx 45°, in the 8-to-2 o'clock direction (arrow).

the linear cutting stapler to separate a small proximal gastric pouch, again approximately 30 mL in volume, from the distal stomach, which is left in situ. The small bowel is then divided 50–100 cm beyond the duodenojejunal (DJ) flexure and the distal side anastomosed to the gastric pouch, in an antecolic or retrocolic position. The proximal side, representing the biliopancreatic limb of the Roux-en-Y reconstruction, is anastomosed 100–150 cm distal to the gastro-jejunostomy (Fig. 19.2). Any mesenteric defects are closed to prevent subsequent internal herniation.

Mini-gastric bypass

A more recent modification of the gastric bypass is the mini-gastric bypass, so called because it is quicker and easier to perform. The essential differences between this and a conventional bypass are that a longer gastric pouch is created and a Polya-type antecolic loop gastro-jejunostomy, rather than a Roux-en-Y configuration, is constructed (Fig. 19.3). Early results are satisfactory but long-term outcome data are lacking. Many authors remain sceptical, believing this operation to be a retrograde progression in technique as the Polya reconstruction has been largely abandoned in both benign and malignant upper gastrointestinal surgery because of the problems of bile reflux.

Sleeve gastrectomy

This operation was originally developed as the first stage of a duodenal switch operation but soon became a stand-alone procedure when its weight

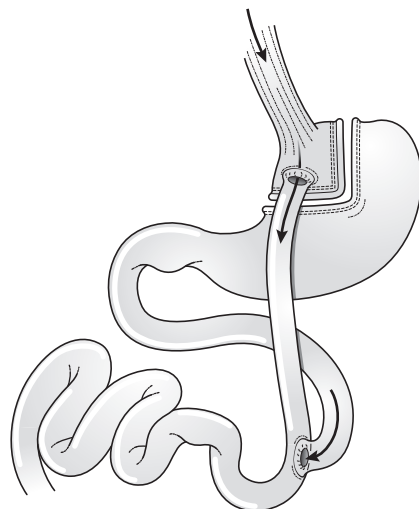


Figure 19.2 • Diagram of a gastric bypass.

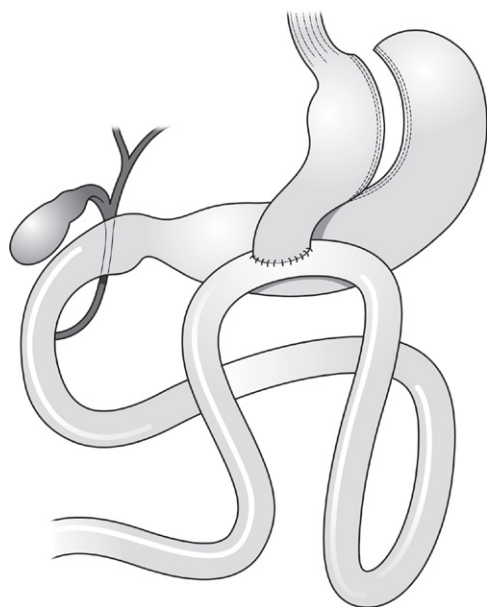


Figure 19.3 • Diagram of a mini-gastric bypass.

loss outcomes were, at least initially, similar to what was achievable with a gastric bypass.^{17,18} It is also technically easier to perform than any of the Roux-en-Y procedures, particularly in super-obese patients. The greater curve of the stomach is separated from the omentum from the angle of His to a point 5–6 cm proximal to the pylorus. A bougie, commonly around 34 French in size, is inserted down to the antrum and manipulated up against the lesser curve. Using a linear cutting stapler and with the bougie as a guide, the body and fundus of the stomach are excised and removed (**Fig. 19.4**).

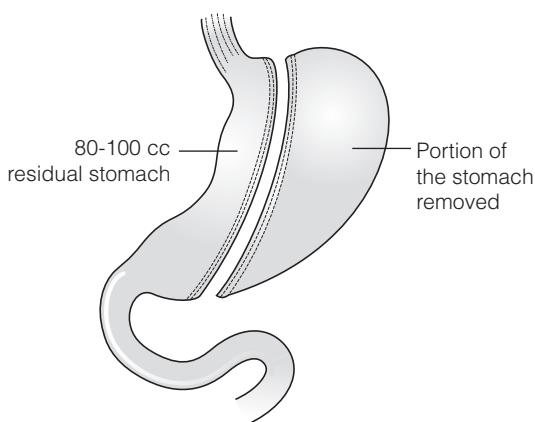


Figure 19.4 • Diagram of sleeve gastrectomy. The omentum (not shown) is preserved on the gastro-epiploic arcade.

Duodenal switch

The duodenal switch operation can be performed as a two-stage procedure but is more commonly carried out in one sitting.¹⁹ The first stage is a conventional sleeve gastrectomy. The second stage involves dividing the duodenum just distal to the pylorus and then dividing the small bowel halfway between the DJ flexure and the ileocaecal junction. The distal part of the divided small bowel is then anastomosed to the proximal end of the divided duodenum just beyond the gastric outlet (pylorus). Thus the jejunum is ‘switched’ for the duodenum. The biliopancreatic (Roux) limb of the divided small bowel is then joined to the ileum 1 metre proximal to the ileocaecal valve (**Fig. 19.5**). This creates a longer bypassed segment and a much shorter common channel than a standard gastric bypass procedure, resulting in significantly more malabsorption. An earlier version of this operation, which involved a more conventional partial gastrectomy instead of a pylorus-preserving sleeve resection, is known as a biliopancreatic diversion (BPD) or Scopinaro procedure.²⁰

Intragastric balloon

This plastic balloon is inserted endoscopically and inflated with saline under vision to between 500 and 700 mL (**Fig. 19.6**). This induces a feeling of fullness and thus reduces oral intake. Because the satiety effect wanes after several months and there also remains a small risk of leakage/deflation in situ, with the possibility of distal migration of the collapsed balloon, it is recommended that the balloon is removed after 6 months. Removal involves another endoscopic procedure in which the balloon is punctured, aspirated and withdrawn.

✓ There is little evidence to indicate which operation suits which patient, although most series demonstrate greater average weight loss from operations with a malabsorptive component over restrictive operations alone.¹¹

Older, more obsolete operations

Jejuno-ileal bypass (JIB)

It is rare to see patients with an intact jejuno-ileal bypass today. This operation involved anastomosing the proximal jejunum to the terminal ileum less than 100 cm from the ileo-caecal valve (**Fig. 19.7**). It gained popularity between the 1950s and 1970s before the emergence of the Roux-en-Y gastric bypass operation. The jejuno-ileal bypass resulted

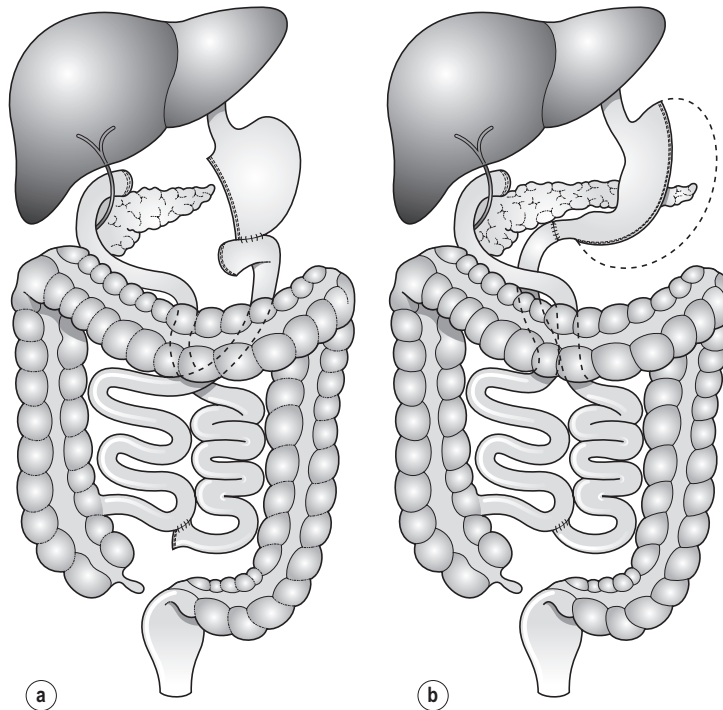


Figure 19.5 • Diagram of bilio-pancreatic diversion (BPD) (a) and duodenal switch (b). The common channel is approximately 100 cm long.

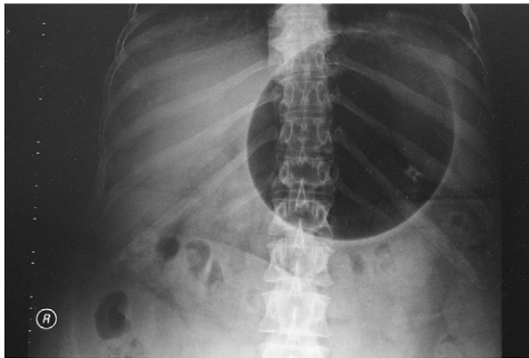


Figure 19.6 • Abdominal X-ray of a patient with a gastric balloon in situ.

in significant protein malabsorption and vitamin/mineral deficiency, the long blind jejunal limb commonly led to bacterial overgrowth, and patients were prone to liver failure as a result of both protein malnutrition and toxemia from bacterial overgrowth in the blind loop.⁹ The majority of patients, if still alive, have had their operations reversed.

Vertical banded gastroplasty (VBG)

This operation gained popularity in the 1980s and early 1990s but its high failure rate, and the advent of

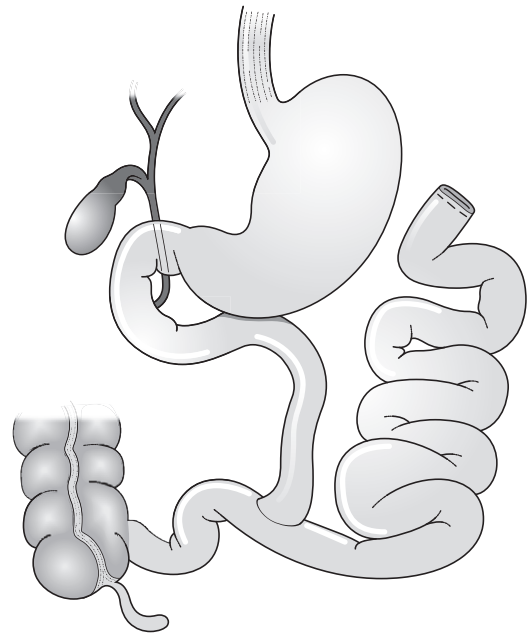


Figure 19.7 • Diagram of a jejunio-ileal bypass (JIB) procedure. Note the long blind loop of jejunum.

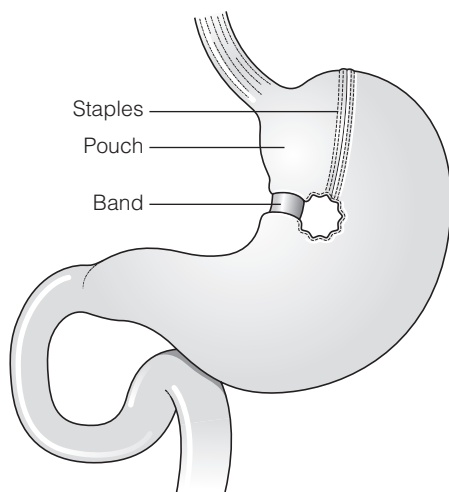


Figure 19.8 • Diagram of the vertical banded gastroplasty (VBG) procedure.

better procedures, has resulted in it being abandoned. Just above the incisura, a short distance in from the lesser curve, the anterior and posterior walls of the stomach were stapled together with a circular stapler. Through the resultant hole made by the stapler, a linear stapler could be applied vertically towards the angle of His. This staple line fixed the anterior and posterior gastric walls together but did not divide the stomach. The outlet of the small gastric pouch thus created was then 'banded' with a 360° ring of tape to prevent dilatation (**Fig. 19.8**). The high failure rate resulted from pouch outlet stenosis and/or pouch dilatation (usually caused by overeating), and this was often followed by disruption of the vertical staple line with the consequent loss of restriction to eating.

Newer procedures

Ileal transposition

This operation is still experimental although it may have an emerging role in patients with diabetes who have a lower body mass index (BMI) than would traditionally be offered weight loss surgery, or in those with no more than truncal obesity (sometimes termed 'normal-weight obesity'). In essence, a short segment of terminal ileum is excised with preservation of its mesentery, and then re-implanted in an isoperistaltic fashion into the proximal jejunum. This brings endocrine receptors from the hindgut mucosa into the foregut environment, with dramatic effects on the insulin/glucagon axis, pancreatic function and GI tract motility.²¹

Endoscopic duodenojejunal sleeve

This endoscopically inserted tube of thin, impervious plastic material has its proximal end secured to

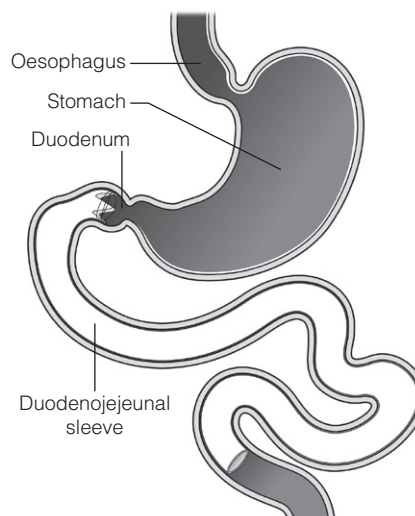


Figure 19.9 • Diagram of the duodenojejunal scene

the mucosa of the first part of the duodenum with small barbs and then runs distally, effectively lining the duodenum and upper small bowel, preventing ingested food from making contact with the mucosa until the proximal jejunum is reached (**Fig. 19.9**). Its effect on the gut hormone milieu mimics that of the gastric bypass and early clinical results have shown a similar improvement in type II diabetes control, along with modest weight loss. At present it is suggested that such barriers be removed at around 1 year. As yet, however, no long-term follow-up information is available regarding the extent of weight regain or the return of glucose intolerance after the barrier is removed.

Gastric plication

Reducing the size of the stomach either endoscopically or laparoscopically has been described where the greater curve of the stomach at the fundus is invaginated to reduce gastric volume.²² Infolding the gastric wall in this way may also provide stimulation of mural stretch receptors to reduce hunger. Endoscopically this can be performed by firing a series of staples or clips that 'gather' the stomach wall from the inside.²³ Outcomes are not yet known, but the same technology has been described previously for plicating the gastro-oesophageal junction for treating reflux where, despite early successes, long-term results have been disappointing.

Implantable neuroregulators (gastric 'pacemakers')

A number of laparoscopically implantable devices are now undergoing trials. They register the presence of food in the stomach and are designed to mediate satiety by vagal feedback. Lack of outcome

data in addition to concerns about battery life and cost are currently a block to their more widespread use.

Complications of bariatric surgery

There are *general* complications such as might follow any abdominal operation, and *specific* complications that relate to the procedure performed.

General complications

It should be within the capability of any abdominal surgeon to manage the general complications of bariatric surgery, which include pulmonary atelectasis/pneumonia, intra-abdominal bleeding, anastomotic or staple-line leak with or without abscess formation, deep vein thrombosis (DVT)/pulmonary embolus and superficial wound infections. Patients may be expected to present with malaise, pallor, features of sepsis or obvious wound problems. However, clinical features may be difficult to recognise owing to body habitus. Abdominal distension, tenderness and guarding may be impossible to determine clinically due to the patient's obesity. Pallor is non-specific. Fever and leucocytosis may be absent. Wound collections may be very deep. These complications in a bariatric patient should be actively sought with appropriate investigations. In particular, it is vital for life-threatening complications such as bleeding, sepsis and bowel obstruction to be recognised promptly and treated appropriately. A persistent tachycardia may be the only sign heralding significant complications and should always be taken seriously.²⁴

It is useful to classify complications as 'early', 'medium' and 'late' because, from the receiving clinician's point of view, the differential diagnosis will differ accordingly (Table 19.1). Early complications usually arise within the first few days of surgery but, with ever-advancing laparoscopic surgery and shorter lengths of stay, these may still present to the non-bariatric surgeon after the patient has left the specialist centre.

Specific complications

These relate to the procedure performed. Again, they may be grouped into 'early', 'medium' and 'late', although the 'early' complications overlap with the general complications mentioned above. Medium-term complications are likely to arise while the patient is still overweight and thus may be difficult to diagnose. Late complications may

Table 19.1 • General complications following bariatric surgery (similar to those that may arise following any GI operation)

Early	Medium or late
Bleeding: Intraluminal (staple/suture line) Intraperitoneal (staple/suture line, mesentery, omentum, liver/spleen injury) Subcutaneous (trocar site) Staple/suture line leak Inadvertent GI tract perforation Port-site haematoma/infection DVT/pulmonary embolism Anaesthetic drug reaction, etc. Chest infection/atelectasis Port-site hernia with or without bowel obstruction	Chest infection DVT/pulmonary embolism Haematoma or abscess Incisional or port-site hernia

develop many years later. Patients at this stage may be of normal weight, and therefore a link to their previous bariatric surgery may not be obvious (Table 19.2).

Clinical presentation

Once the receiving clinician understands the operation that has been performed and the specific complications to look out for, the next step is the interpretation of the presenting clinical features and formulation of a management plan.

Gastric band patients

Vomiting and/or dysphagia

These are very common and not surprising symptoms, considering that the band works by causing a constriction ring around the upper stomach. Band patients are accustomed to a degree of dysphagia and occasional vomiting, so for them to present for medical attention implies that it is 'worse than usual'. These symptoms indicate a degree of obstruction at the level of the band and there are three main causes.

Band too tight

Has the patient had an adjustment recently? Perhaps they have a food bolus obstruction. Once the patient begins to vomit the gastric wall becomes

Table 19.2 • Specific complications of bariatric surgery: early, medium and late

Procedure	Early	Medium	Late
Band	Gastric perforation Liver/spleen injury with bleeding	Slippage (with or without gastric necrosis) Injection-port migration or infection	Slippage Erosion Injection-port problems Mega-oesophagus
Sleeve	Reflux oesophagitis Staple-line bleed or leak Splenic infarct Omental necrosis	Intra-abdominal abscess or haematoma	Fistula Stenosis of sleeve
Bypass/duodenal switch/BPD	Anastomosis/staple-line bleed or leak Small-bowel enterotomy Early small-bowel obstruction	Intra-abdominal abscess or haematoma Roux limb obstruction Biliopancreatic (blind) loop obstruction	SBO (internal hernia, volvulus, adhesions) Anastomotic ulcer Anastomotic stricture Dumping syndrome Micronutrient malnutrition Gastro-gastric fistula Hypoglycaemia
Mini-gastric bypass	As above	As above	As above plus bile reflux
Intragastric balloon	Nausea/vomiting Gastric ulceration Gastric or oesophageal perforation	Dehydration and electrolyte imbalance Reflux oesophagitis	Bowel obstruction from deflated balloon
VBG		Stomal stenosis	Staple-line disruption
JIB		Bowel obstruction (internal hernia, adhesions)	Malnutrition Blind loop syndrome Liver failure
Duodenal barrier	Duodenal bleeding Duodenal perforation	Dumping syndrome Food bolus obstruction Migration of the device with mechanical bowel obstruction	Liver failure Unknown
Gastric plication	Bleeding Splenic or liver injury	—	—
Gastric pacing	Nausea/vomiting Infection of subcutaneous implant	—	—

oedematous within the confines of the band and the apparent obstruction becomes worse. The treatment is urgent band decompression using the subcutaneous injection port (see [Box 19.1](#) and [Fig. 19.10](#)). Once the patient can drink freely they can be discharged, with arrangement for follow-up by their bariatric specialist team.

Acute band ‘slippage’

This is the term commonly used to describe what is really a process of gastric prolapse upwards through the band. It typically occurs months or years after the original operation and is possibly more common when no gastro-gastric tunnelling sutures are

used to secure the band in place. The patient usually presents with vomiting, often in association with being able to eat a sizeable meal, as the food accumulates in the large gastric pouch above the band before eventually being regurgitated. Urgent decompression often provides relief but if not, then an urgent contrast swallow should be ordered. Slippage is often evident on a plain abdominal or chest radiograph, with the band lying at an unusual angle (see [Fig. 19.11](#)), although a contrast swallow provides more conclusive information. The most serious complication of band slippage is ischaemic necrosis of the prolapsed fundus, secondary to dis-tension and/or occlusion of the blood supply to the

Box 19.1 • Urgent percutaneous band decompression

The subcutaneous injection port should be palpable beneath the skin on the abdominal wall, usually close to one of the longer laparoscopic scars. Some surgeons place it over the lower sternum. The patient usually knows where it is. Using a strict aseptic technique, the port is steadied between the fingers of one hand while the other holds an empty 10-mL syringe with needle attached. Ideally a non-coring 'Huber' or spinal needle is used so as not to damage the port, but in an emergency a conventional 23-gauge hypodermic needle works well (although it may not be long enough). Entering at right angles to the skin, the rubber diaphragm of the port is punctured. The needle hits the metal base-plate with a 'clunk' and aspiration can begin. The reservoir is aspirated to dryness; it may contain up to 14 mL. The needle is simply withdrawn when finished and a small dressing applied.

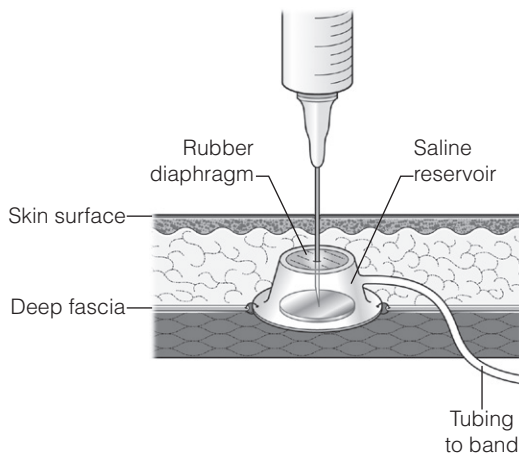


Figure 19.10 • Diagram of needle access to the subcutaneous injection port. Strict aseptic technique is important and a non-coring Huber needle should be used.



Figure 19.11 • Abdominal X-ray of an acute band slip. The band lies 90° out of alignment (compare with Fig. 19.1).

proximal stomach as it passes through the band. Failure of the symptoms to resolve with percutaneous band decompression is an indication for urgent surgical intervention.

The operation to remove the band is generally by laparoscopy. The tight band must be released. Unclipping it may be difficult, especially laparoscopically, but if possible – and if the stomach is viable – then it may be left in situ for an experienced bariatric surgeon to re-position at a later date. An alternative to unclipping the band is simply to cut it in half, after which it should be removed. Once local adhesions have been divided the band should just slide out. If there is gastric necrosis then laparotomy and some form of gastrectomy will be required along with complete removal of the band, tubing and injection port.

Band erosion

This is not usually an acute problem but presentation may be precipitated by an aggravation of dysphagia with or without pain and sepsis. Symptoms will not improve after percutaneous band decompression. An urgent contrast swallow may also demonstrate band erosion with leakage of contrast around the band (see Fig. 19.12) but the most definitive test for erosion is gastroscopy, where a portion of the white silicone band will be visible from within the lumen.

Abdominal pain

This is uncommon in band patients (as a result of the band) and so should alert the clinician to a serious problem such as visceral distension from acute slippage (see above), inflammation related to band erosion (see above), peritonitis from gastric necrosis with or without perforation or postoperative haematoma. If the symptoms are of recent onset (hours) and pain is a prominent feature, necrosis

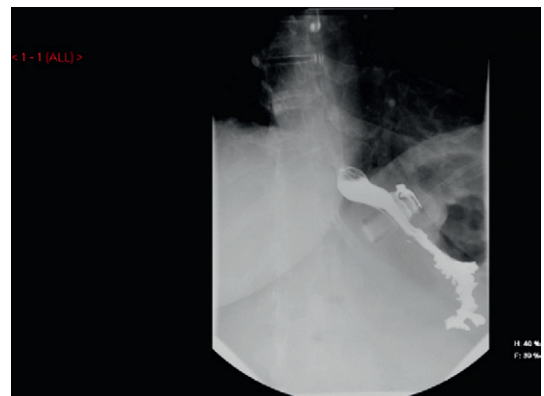


Figure 19.12 • Barium swallow demonstrating band erosion. Note the barium leaking out around the band (arrow). Compare with Fig. 19.1.

and/or perforation should be suspected and urgent imaging is required, followed by laparoscopy with or without laparotomy if necessary. Peritonitis is an unlikely consequence of band erosion but may occur with gastric necrosis (acute band slippage) or perhaps foreign body perforation of the gastric pouch.

Chest pain

This is a common reason for anyone to present to the hospital emergency department and cardiac causes need to be excluded. In patients with a gastric band, the possibility of band slippage, erosion and reflux oesophagitis (secondary to a tight band) needs to be considered.

Mega-oesophagus

This is the result of long-standing, excessive restriction and usually follows either a period of excessive band tightness, or chronic malpositioning due to band slippage. It is recognised on a contrast swallow. It usually improves over a period of several weeks following band decompression but may necessitate band removal to prevent recurrence.

Port problems

Migration

The subcutaneous injection port may move about within its subcutaneous pocket, depending on how well it has been fixed in position. This makes it difficult to access for percutaneous needle aspiration and if it has flipped over completely, the band will be impossible to decompress.

Leakage

Repeated attempts to needle the subcutaneous reservoir should be avoided as damage to the rubber diaphragm or perforation/rupture of the tubing can produce a slow leak.

Infection

The injection port may become infected through breach of sterile technique; this may present as abdominal wall cellulitis or an abscess. An infected port will need to be removed but can be replaced at a later date when the sepsis has completely cleared. Sometimes an infected subcutaneous port may be the first manifestation of band erosion (see above), as the tubing effectively acts as a conduit to convey infected material from the eroded band to the skin surface.

Skin erosion

The port may also erode through the skin surface (Fig. 19.13). While not an emergency, this situation may present to the general surgeon. Again, plans will need to be made for removal, then later replacement, of the injection port.



Figure 19.13 • Port erosion through the skin.

Sleeve gastrectomy patients

Early postoperative reflux/vomiting and dysphagia are common as the narrow and oedematous gastric sleeve tends to empty poorly at first. Some degree of reflux oesophagitis is common. Patients are usually discharged from hospital on proton-pump inhibitor (PPI) medication with instructions to adhere to a fluid diet, gradually thickening their intake over several weeks. However, if the problem is severe or associated with early signs of dehydration, then specific complications should be sought.

Staple-line leak or bleed

Any disruption of the staple line along the narrow sleeve of remaining stomach is likely to cause luminal compression, either from oedema or direct pressure such as from a collection or haematoma. A contrast swallow or computed tomography (CT) should demonstrate this, although both imaging modalities may be falsely negative. Furthermore, some obese patients may be too large for the scanner or X-ray table. If there is reasonable clinical concern of a staple-line leak or bleed, perhaps because of grumbling sepsis or worsening anaemia, laparoscopy should be arranged as this is likely to both confirm the diagnosis and allow repair/control/drainage as necessary.

Splenic infarction

As the greater omentum is separated from the fundus of the stomach it is possible to take one or more apical splenic vessels, leading to segmental infarction. This will present as left upper quadrant pain with or without some features of sepsis. A contrast CT should demonstrate this. Conservative management is likely to be successful.

Omental necrosis

The blood supply to the omentum may be compromised if the gastro-epiploic arcade is damaged as it is separated from the stomach. Ischaemic necrosis may be the result, presenting with abdominal pain and features of sepsis. Surgical debridement of the

necrotic tissue is likely to be required, either laparoscopically or by open surgery.

Sleeve stenosis

This is usually a late complication of a staple-line problem but may be evident within the first week postoperatively if an intense local inflammatory reaction is established, usually following an otherwise undetected leak. After imaging as above, rehydration and possibly nutritional support are all that is required initially. At a later date, once any evidence of active perforation or leak has settled, endoscopic dilatation may help, although this brings its own risk of causing further disruption/perforation. Completion gastrectomy with conversion to a Roux-en-Y bypass may ultimately be required.

Gastric bypass/BPD/duodenal switch patients

Staple-line leak

These operations have several staple lines to consider: the gastric pouch, the gastro-jejunal anastomosis, the gastric remnant (in a gastric bypass) and the more distal jejuno-jejunostomy. Only the first two of these can be imaged on a contrast swallow. CT may show the others but the receiving surgeon should have a low threshold for returning the patient to theatre for laparoscopy if a leak is suspected. It should be remembered that a tachycardia or elevated C-reactive protein (CRP) may be the only evidence of such a problem in obese patients. If more than 48–72 hours have elapsed since the initial operation, then laparoscopic repair is less likely to be feasible and laparotomy may be required. Surgical treatment should address drainage of sepsis, control of any ongoing leakage and the provision of nutrition (Box 19.2).

Staple-line bleed

Patients may bleed into the GI tract or into the peritoneal cavity. A bleed into the ‘blind’ gastric remnant after a bypass will only be evident on CT, or by

Box 19.2 • Nutritional support in the bariatric patient

It is a mistake to assume that obese patients are well nourished: although their diets may have been high in calories, they have often been deficient in protein, vitamins and other micronutrients. As for any patient with an upper GI anastomotic leak, consideration should be given to commencing enteral feeding or total parenteral nutrition. When re-operating on a bariatric patient for complications, it is sensible to place a feeding gastrostomy or jejunostomy at the same time.

early return to the operating theatre (see Box 19.3). Treatment involves establishing drainage of the collection of the haematoma by gastrotomy and controlling the bleeding point, usually by oversewing the staple line. Placement of a transcutaneous gastrostomy tube is wise, not only to decompress the stomach but also to use for later nutritional support if required. Angiographic embolisation of the bleeding point may be an alternative but the surgeon must not allow the inherent delays of such intervention to postpone what might be life-saving re-operative surgery.

Small-bowel enterotomy

Full-thickness injury to the small bowel can easily be incurred as a result of handling with instruments, and perforations may occur ‘off-camera’, out of the laparoscopic field of view. Missed enterotomies may take several days to become apparent, usually presenting with increasing abdominal pain, tachycardia and fever. Enteric fluid may leak out from one or more of the laparoscopic port sites. CT may demonstrate free intraperitoneal fluid and even intraperitoneal gas, but these findings are non-specific. Return to theatre for laparoscopy or laparotomy and drainage/repair is required.

Early small-bowel obstruction

Early postoperative small-bowel obstruction is uncommon after laparoscopic surgery and should not immediately be attributed to a paralytic ileus. Port-site bowel herniation, often of the Richter type, is always a possibility but after operations involving Roux-en-Y reconstruction one should always consider internal herniation, small-bowel volvulus and iatrogenic jejuno-jejunal anastomotic stricture or distortion. Vomiting will be absent if the blind gastroduodenal limb is obstructed and abdominal X-rays may be unreliable, especially in a morbidly obese patient. CT is indicated (Fig. 19.14). The treating surgeon should not delay operating to correct an established obstruction.

Late small-bowel obstruction

Small-bowel obstruction arising months or years after laparoscopic gastric bypass is a well-recognised problem. The most frequent cause is internal herniation, occurring in up to 7% of cases if the

Box 19.3 • Early recognition of complications is essential

Many of the early complications after gastric bypass and duodenal switch are potentially life threatening. Prompt recognition is important. CT scanning is useful but delay in the diagnosis will worsen a perilous situation so urgent return to theatre is often a better strategy.

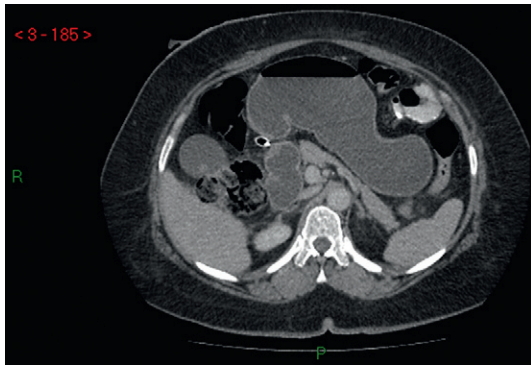


Figure 19.14 • CT scan showing 'blind' gastroduodenal biliopancreatic limb obstruction. Note the dilated, fluid-filled stomach and duodenum (large arrows) and the oral contrast in the non-distended alimentary limb (small arrow).

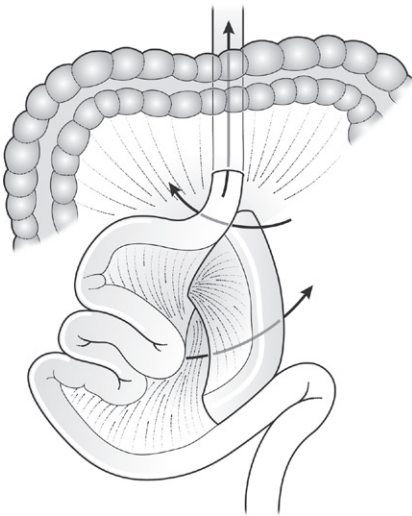


Figure 19.15 • The three common sites for internal hernia after Roux-en-Y reconstruction: the mesocolic defect (green arrow), Petersen's space (blue arrow) and the jejunal mesenteric window (red arrow).

mesenteric defects are not closed.^{25,26} Hernias typically develop through the mesocolic defect if the retrocolic route is used, the jejunal mesenteric defect at the site of jejuno-jejunostomy, and Petersen's space between the alimentary limb and the transverse colon (see **Fig. 19.15**). For many patients the presentation is insidious, with post-prandial pain and/or bloating. Imaging may not reveal significant small bowel dilatation. Laparoscopy is the investigation and treatment of choice, where chyle within the abdominal cavity is a clue to the diagnosis. The ileo-caecal junction is identified first and then the small

bowel is carefully 'walked' back until the point of internal herniation is seen and reduced. The defect is then closed with non-absorbable material to prevent recurrence.

Gastro-gastric fistula

This is a consideration in the medium to long term if a patient develops weight regain. It may also present with dysphagia or pain on eating. It is often associated with stomal ulcers in the gastric pouch, which prove resistant to acid suppression medication, and likely arises following a staple-line leak with abscess formation that discharges into the gastric remnant. The treatment is surgical to divide the fistula and resect some of the distal stomach. This may be achievable laparoscopically.

Dumping syndrome

A recognised complication of gastric resectional surgery, this syndrome comprises post-prandial cramping abdominal pain, nausea, sweating, light-headedness and sleepiness. It reflects hyperinsulinaemic hypoglycaemia, usually precipitated by a high carbohydrate load in the jejunum from rapid gastric emptying,²⁷ although it is also described after Nissen fundoplication where vagal injury is the likely cause.²⁸ Mild forms are common and it is rarely severe enough to present as a surgical emergency, but surgeons should nevertheless be aware of it as a cause of post-bypass malaise. Dietary regulation, medication to slow gut motility and/or somatostatin analogues generally provide relief.

Mini-gastric bypass patients

A similar spectrum of complications can be expected as might follow a Roux-en-Y bypass, BPD or duodenal switch. However, because of the loop gastro-jejunostomy, bile reflux can be a problem – especially if the efferent limb takes a long time to function. Prolonged nasogastric drainage and nutritional support may be required, with or without the addition of somatostatin analogues or other agents to reduce secretions. If the problem is intractable, conversion to a Roux-en-Y configuration may be necessary.

Gastric balloon patients

Nausea and vomiting are almost universal symptoms after balloon insertion but usually subside by the end of the first week. Patients may need intravenous hydration, PPI medication and parenteral anti-emetics over this time. A small minority of patients cannot tolerate oral intake even after several weeks and, in

this group, early balloon removal should be offered and will provide instant relief. Although a special kit is produced for balloon removal, it can easily be performed by using a standard endoscopic injection needle (to puncture and empty the balloon) and some strong grasping forceps, or a snare, to remove the deflated balloon.

Abdominal or chest pain is uncommon and should raise the possibility of reflux oesophagitis, gastric ulceration or even gastric/oesophageal perforation. If relief is not obtained with hydration, PPI and anti-emetic medication, then gastroscopy is warranted – though urgent CT is the preferred investigation if perforation is a serious consideration.

Duodenojejunal barrier patients

There is little information about the long-term outcomes of this new procedure. Epigastric discomfort, attributable either to the transmucosal barbs that fix the collar of the device into the first part of the duodenum, or simply to the foreign body sensation itself, is common and usually settles within a week or two with PPI medication and analgesics. However, several specific complications have been reported.

Migration

The device may fail to fix adequately in the duodenal cap and shift out of position. This may cause pain, nausea, bleeding or a degree of gastric outflow obstruction. Abdominal X-ray and/or gastroscopy should diagnose the problem, and endoscopic removal is likely to be required. A special kit is needed and so either the original bariatric surgeon, or alternatively the manufacturers, should be contacted.

Duodenal bleeding

This may be minor or catastrophic. Diagnosis and management would be along the lines of any upper GI bleed, although removal of the device is likely to be required if simple endoscopic means do not control the bleeding.

Bowel obstruction

This may occur with a food bolus if the patient does not eat slowly and chew well, but may also arise if the device migrates distally into the small bowel. The wire frame of the collar of the device will be visible on abdominal X-ray but, without some knowledge of the endoscopic procedure done, these appearances may be difficult to interpret. Because of the metal barbs, simply waiting for the device to pass spontaneously is risky and as a result laparotomy is likely to be required.

Gastric plication patients

Whether this is done laparoscopically or endoscopically, the procedure-specific risks include gastric trauma (bleeding or perforation), liver/spleen trauma incurred by traction, direct pressure or injury and perforation of the stomach.¹⁸

Patients with older, now obsolete operations

As patients will have had their operations many years earlier, only late complications will arise. These include exacerbations of long-standing problems such as blind loop syndrome following a JIB and pouch outlet stenosis after a VBG. Nutritional deficiencies, which may manifest in many ways, are also possible complications (see below).

Other postoperative problems

Gallstones

Dramatic weight loss from any cause promotes gallstone formation owing to mobilisation of cholesterol from peripheral fat stores and changes to the enterohepatic cycle. Patients may present with biliary colic, cholecystitis, pancreatitis or obstructive jaundice and should be managed according to established protocols. Laparoscopic cholecystectomy is generally no more difficult after a bariatric surgical operation than otherwise, but the management of common bile duct stones can be problematic because endoscopic retrograde cholangiopancreatography (ERCP) may be impossible if there has been a previous bypass or duodenal switch/BPD. Intraoperative cholangiography is therefore recommended at the time of cholecystectomy, with concurrent surgical duct exploration as required.

Nutritional deficiencies

The common nutritional deficiencies seen in the bariatric surgery population concern thiamine, iron, zinc, vitamin D and vitamin B₁₂. These may have been present preoperatively, in which case replenishment can be difficult, especially if a malabsorptive-type operation has been done. The clinical features of various deficiency syndromes are well documented but, like the neurological manifestations of thiamine deficiency presenting as Wernicke–Korsakoff's syndrome, may not be readily recognised by general surgeons. If one deficiency is diagnosed then others should be sought. These are of particular importance if re-operative surgery

is planned because of the possible detrimental effects that nutritional deficiencies might have on wound healing.

Failure to lose weight

Even the best operations do not work for everyone. While most patients do well in the first few months after surgery, and for many the weight loss is maintained indefinitely as they adopt a new and healthy lifestyle, some degree of late weight regain is very

common. This rarely means that the operation has been done incorrectly or failed in some way, although this should be excluded first: bands may become too loose, gastric pouches may stretch, staple lines may disrupt, bypassed bowel may adapt. More usually, however, weight regain reflects a re-emergence of underlying poor eating behaviours – in other words, patients tend to slip back into their old eating habits.²⁹ Ongoing follow-up with the multidisciplinary bariatric team is important to both prevent and manage postoperative weight regain.^{9–11}

Key points

- Weight loss operations are becoming more common and complications are increasingly likely to present to the general surgeon on call.
- Knowledge of the operation performed will help the receiving surgeon anticipate any problems that might arise.
- It is wise to contact the original bariatric surgical team as they may provide useful advice but, as for all emergency admissions, the prime clinical responsibility for the patient rests initially with the receiving surgeon.
- Physical examination may be difficult and X-rays may be hard to interpret. Look carefully for clinical and biochemical features of dehydration and sepsis.
- Beware the acute band slippage in a gastric band patient. Percutaneous band decompression may provide short-term relief but definitive operative release/removal/resection may be required.
- Urgent CT to demonstrate a bleed, leak or obstruction in a patient who is unwell following a gastric bypass or duodenal switch procedure can help to make the diagnosis but immediate return to theatre may be a better strategy.
- Incessant vomiting after gastric balloon insertion may respond to inpatient gut rest and anti-emetic medication but instant and permanent relief will be obtained by removal of the balloon.
- Tachycardia should never be disregarded as it may be the only clue to an intra-abdominal catastrophe.
- Because complications may arise some years after bariatric surgery, patients may no longer be overweight and thus the link to the initial procedure may not be obvious.

References

1. Adams TD, Gress RE, Smith SC, et al. Long-term mortality after gastric bypass surgery. *N Engl J Med* 2007;357(8):753–61.
2. Sjöström L, Narbro K, Sjöström CD, et al. Swedish Obese Subjects Study. Effects of bariatric surgery on mortality in Swedish obese subjects. *N Engl J Med* 2007;357:741–52.
A classic study and the first to show conclusively that bariatric surgery produced lasting health benefits.
3. Pories WJ, Swanson MS, MacDonald KG, et al. Who would have thought it? An operation proves to be the most effective therapy for adult-onset diabetes mellitus. *Ann Surg* 1995;222:339–52.
4. Monkhouse SJW, Morgan JDT, Norton SA. Complications of bariatric surgery: presentation and emergency management: a review. *Ann R Coll Surg Engl* 2009;91:280–6.
5. Kirshtein B, Lantsberg L, Mizrahi S, et al. Bariatric emergencies for non-bariatric surgeons: complications of laparoscopic banding. *Obes Surg* 2010;20:1468–78.
6. Hamdan K, Somers S, Chand M. Management of late post-operative complications of bariatric surgery. *Br J Surg* 2011;98:1345–55.
7. Tadross JA, le Roux CW. The mechanisms of weight loss after bariatric surgery. *Int J Obes (Lond)* 2009;33(Suppl. 1):S28–32.
8. Canetti L, Bachar E, Berry EM. Food and emotion. *Behav Processes* 2002;60:1–10.

9. Lim RB, Blackburn GL, Jones DB. Benchmarking best practices in weight loss surgery. *Curr Probl Surg* 2010;47:79–174.
10. Keren D, Matter I, Rainis T, et al. Getting the most from the sleeve: the importance of post-operative follow-up. *Obes Surg* 2011;21:1887–93.
11. Franco JVA, Ruiz PA, Palermo M, et al. A review of studies comparing three laparoscopic procedures in bariatric surgery: sleeve gastrectomy, Roux-en-Y gastric bypass and adjustable gastric banding. *Obes Surg* 2011;21:1458–68.
A good review of several series comparing the outcomes of these three popular operations.
12. Dixon JB, O'Brien PE, Playfair J, et al. Adjustable gastric banding and conventional therapy for type 2 diabetes: a randomised controlled trial. *JAMA* 2008;299:316–23.
13. Mingrone G, Castagneto-Gissey L. Mechanisms of early improvement/resolution of type 2 diabetes after bariatric surgery. *Diabetes Metab* 2009;35:518–23.
14. Vetter ML, Cardillo S, Rickels MR, et al. Narrative review: effect of bariatric surgery on type 2 diabetes mellitus. *Ann Intern Med* 2009;150:94–103.
15. le Roux CW, Welbourn R, Werling M, et al. Gut hormones as mediators of appetite and weight loss after Roux-en-Y gastric bypass. *Ann Surg* 2007;246:780–5.
16. Tice JA, Karliner L, Walsh J, et al. Gastric banding or bypass? A systematic review comparing the two most popular bariatric procedures. *Am J Med* 2008;121:885–93.
17. Nocca D, Krawczykowsky D, Bomans B, et al. A prospective multicenter study of 163 sleeve gastrectomies: results at 1 and 2 years. *Obes Surg* 2008;18:560–5.
18. Kueper MA, Kramer KM, Kirschniak A, et al. Laparoscopic sleeve gastrectomy: standardized technique of a potential stand-alone bariatric procedure in morbidly obese patients. *World J Surg* 2008;32(7):1462–5.
19. Sudan R, Jacobs DO. Biliopancreatic diversion with duodenal switch. *Surg Clin North Am* 2011;91:1281–93.
20. Scopinaro N, Marinari GM, Camerini G. Laparoscopic standard biliopancreatic diversion: technique and preliminary results. *Obes Surg* 2002;12:241–4.
21. Zhang GY, Wang TT, Cheng ZQ, et al. Resolution of diabetes mellitus by ileal transposition compared with biliopancreatic diversion in a non-obese animal model of type 2 diabetes. *Can J Surg* 2011;54:243–51.
22. Skrekas G, Antiochos K, Stafyla VK. Laparoscopic gastric greater curve plication: results and complications in a series of 135 patients. *Obes Surg* 2011;21:1657–63.
23. Mikami D, Needleman B, Narula V, et al. Natural orifice surgery: initial US experience utilizing the StomaphyX device to reduce gastric pouches after Roux-en-Y gastric bypass. *Surg Endosc* 2010;24(1):223–8.
24. Abdemur A, Sucandy I, Szomstein S, et al. Understanding the significance, reasons and patterns of abnormal vital signs after gastric bypass for morbid obesity. *Obes Surg* 2011;21:707–13.
25. Abasbassi M, Pottel H, Deylgat B, et al. Small bowel obstruction after antecolic antegastric laparoscopic Roux-en-Y gastric bypass without division of small bowel mesentery: a single-centre, 7-year review. *Obes Surg* 2011;21:1822–7.
26. Bauman RW, Pirrello JR. Internal hernia at Petersen's space after laparoscopic Roux-en-Y gastric bypass: 6.2% incidence without closure – a single surgeon series of 1047 cases. *Surg Obes Relat Dis* 2009;5:565–70.
27. Tack J, Arts J, Caenepeel P, et al. Pathophysiology, diagnosis and management of postoperative dumping syndrome. *Nat Rev Gastroenterol Hepatol* 2009;6:583–90.
28. Hejazi RA, Patil H, McCallum RW. Dumping syndrome: establishing criteria for diagnosis and identifying new etiologies. *Dig Dis Sci* 2010;55: 117–23.
29. Niego SH, Kofman MD, Weiss JJ, et al. Binge eating in the bariatric surgery population: a review of the literature. *Int J Eating Disorders* 2007;40(3):349–59.