Gastroenterol Hepatol. 2017;40(6):409–416

Gastroenterología y Hepatología

www.elsevier.es/gastroenterologia

REVIEW

Role of the gastroenterologist in the management of the obese patient☆

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Received 17 June 2016; accepted 28 August 2016
Available online 1 June 2017

KEYWORDS
Digestive system;
Surgery;
Complications;
Gastrointestinal endoscopy;
Morbid obesity

Abstract Obesity is a highly prevalent disease worldwide, and one in which gastroenterologists can play an important role. Some digestive diseases are more common in obese patients, and preoperative evaluation may be required in some cases. Additionally, bariatric surgery can lead to digestive complications in the short and long term that require intervention, and endoscopic treatment can be an important factor in weight loss. The aim of this review is to highlight the role of the gastroenterologist in the management of obese patients who are either scheduled for or have undergone surgical or endoscopic treatment for obesity.

PALABRAS CLAVE
Aparato digestivo;
Cirugía;
Complicaciones;
Endoscopia gastrointestinal;
Obesidad mórbida

Papel del digestólogo en el manejo del paciente obeso

Resumen La obesidad es una enfermedad con una elevada prevalencia a nivel mundial en la que el digestólogo puede tener una labour importante. Por una parte, algunas enfermedades digestivas son más frecuentes en este grupo de pacientes y es posible que sea necesario evaluarlos antes de la cirugía. Por otra, la cirugía bariátrica puede presentar complicaciones digestivas a corto y largo plazo en las que sea imprescindible nuestra actuación. Además, no podemos olvidar el papel que el tratamiento endoscópico puede tener en la pérdida de peso. El objetivo de la presente revisión es destacar el papel del digestólogo en el manejo del paciente obeso candidato y/o sometido a tratamiento quirúrgico o endoscópico de la obesidad.

☆ Please cite this article as: López-Serrano A, Ortiz Polo I, Sanz de la Vega J, Moreno-Osset E. Papel del digestólogo en el manejo del paciente obeso. Gastroenterol Hepatol. 2017;40:409–416.
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Introduction

Obesity is a disease associated with a lower life expectancy. A worldwide prevalence of more than 700 million patients was estimated for 2015; thus it is considered a pandemic. Lifestyle changes are the mainstay of its treatment; however, long-term results are disheartening. To date, only bariatric surgery has achieved suitable, lasting weight loss.[1] Therefore, demand for this therapeutic option is increasing in a large number of countries.[2] In this context, the gastroenterologist plays an increasingly important role in assessment of gastrointestinal diseases associated with obesity, in endoscopic treatment of obesity in itself and in initial management of certain adverse effects deriving from surgery.

The obese patient with gastrointestinal symptoms

The obese patient with gastrointestinal symptoms requires clinical management similar to that of any other patient; however, some disorders, such as gastro-oesophageal reflux disease (GORD), disorders deriving from gallstones, functional abnormalities, non-alcoholic steatohepatitis (NASH) and colorectal cancer (CRC) require a special approach.

Many factors that promote *gastro-oesophageal reflux* in obesity have been reported. Multiple studies have shown that obese people are at higher risk of GORD and its complications, such as peptic oesophagitis, Barrett's oesophagus and oesophageal adenocarcinoma.[3–5] The factors involved include: (a) visceral fat, with a significant association between oesophagitis and visceral fat measured by computed tomography[6]; (b) increased intra-abdominal pressure, which is associated, on the one hand, with an increased gastro-oesophageal pressure gradient[7] (thus promoting disruption at the gastro-oesophageal junction and a hiatal hernia) and, on the other hand, a higher pressure gradient through the lower oesophageal sphincter, all directly related to body mass index (BMI) and waist circumference[8–10]; (c) decreased anti-inflammatory factors (such as adiponectin, tumour necrosis factor alpha and interleukin 6) and increased pro-inflammatory factors (such as leptin), which may promote the development of cancer at the gastro-oesophageal junction[11,12]; (d) exposure to oestrogens produced by adipose tissue; (e) dietary habits, such as diets that are predominantly high in calories, fats and simple carbohydrates and low in fibre[13]; (f) use of proton-pump inhibitors (PPIs), which cause an increase in non-acid reflux episodes in obese patients[14]; and (g) *Helicobacter pylori* (Hp) infection, although its role in GORD is controversial.[15,16] The therapeutic approach to GORD in the obese patient does not differ from that of the general population, although weight loss, as well as hygienic and dietary recommendations, do take on a particular importance. Among drug treatment options, PPIs are the drugs of choice.[17]

Obesity also promotes the formation of *gallstones*, thereby increasing the incidence of events (such as biliary colic, cholangitis and cholecystitis) that will require a cholecystectomy[18,19] and sometimes endoscopic retrograde cholangiopancreatography (ERCP) to treat possible choledocholithiasis. In this context, obesity has been associated with an increased risk of post-ERCP pancreatitis, probably due to excess subcutaneous adipose tissue.[20] Factors such as abnormal lipid metabolism help to form conglomerates of crystals of cholesterol monohydrate, mucin, calcium bilirubinate and proteins.[21] High-calorie, low-fibre diets; sedentary lifestyle; and metabolic syndrome also increase the risk of gallstones,[22] primarily due to secretion of bile supersaturated with cholesterol.[23] In addition, rapid weight loss (>1.5 kg/week) secondary to very low-calorie diets or bariatric surgery also promotes the development of gallstones. In fact, when weight loss exceeds 25% of the original weight, the likelihood of developing gallstones increases to 48%. Consequently, some authors have proposed preventive treatment with ursodeoxycholic acid.[24]

Gallstones are the main aetiological factor for acute pancreatitis (up to 40% of cases). Consequently, the likelihood of developing acute pancreatitis is higher in obese people.[25] In addition, obesity acts as an independent risk factor for seriousness of pancreatitis. Different hypotheses have been formulated as to its pathogenesis: a chronic mild pro-inflammatory situation in the obese patient[26]; increased peripancreatic fat, which may promote the onset of necrosis; slight deterioration of the microcirculation; and decreased respiratory capacity, which may lead to a higher likelihood of hypoxaemia.[27]

Studies linking obesity to gastrointestinal *functional disorders*, such as functional dyspepsia and irritable bowel syndrome, have shown contradictory results, but have agreed that diarrhoea and pain in the upper half of the abdomen are more prevalent in obese patients.[28,29] One hypothesis for pathogenesis linking diarrhoea to obesity is an increase in simple sugars in the diet, which may promote the development of osmotic diarrhoea. However, to date, no concrete studies have been conducted on specific dietary variables.[30] In addition, using PPIs for GORD could promote bacterial overgrowth and related symptoms such as tympanites, abdominal pain and diarrhoea.[31] More contradictory is a possible relationship between obesity and other common symptoms such as nausea, abdominal distension and rectal tenesmus.[32]

NASH and metabolic syndrome, often present in the obese patient, increase the risk of developing several types of gastrointestinal cancer,[33] including *CRC*, predominantly in males.[34] An increased incidence of adenomatous polyps and CRC in people with NASH,[35] especially in the right colon, has been confirmed, thereby demonstrating the need for strict monitoring in screening programmes in this type of patient. In addition, colonoscopy may be more complex in these patients, especially women, with a longer-than-usual caecal intubation time.[36] At present, the exact pathogenic mechanism that predisposes obese patients to developing neoplasms is unknown, although a state of chronic inflammation, with an imbalance in cytokine production, could play a significant role.[37] Low blood levels of adiponectin (an inhibitor of the growth of tumour cells in the colon) are associated with an increased risk of developing arteriosclerosis and NASH in patients with a high BMI or hypertriglyceridaemia,[38,39] as well as a higher risk of CRC.[40]

Gastrointestinal assessment of obese patients who are candidates for bariatric surgery

Upper gastrointestinal endoscopy (UGE) is the best diagnostic method for detecting abnormalities in the upper gastrointestinal tract. The European Association for Endoscopic Surgery and the American Society for Gastrointestinal Endoscopy[41,42] recommend performing UGE in all patients before bariatric surgery, primarily before a Roux-en-Y gastric bypass (RYGB).[41] Despite this, subjecting asymptomatic patients to routine UGE prior to bariatric surgery remains controversial.[43] There is no good correlation between symptoms and endoscopic findings. This would support the usefulness of UGE in this context.[44] Moreover, one concern in endoscopy is anaesthetic risk. The possible cardiopulmonary complications associated with sedation must be borne in mind due to the high incidence in these patients of restrictive lung disease, obstructive sleep apnoea, pulmonary hypertension and heart diseases, with a mortality rate of 0.03% and a morbidity rate of 0.54%.[45] Therefore, it is extremely important that endoscopy in obese patients be performed in a well-equipped environment by an experienced anaesthetist. Bearing in mind the limited clinical significance of most lesions discovered,[46] together with the cost, risks of the procedure and secondary examinations generated by those findings, many authors have demonstrated opposition to a routine endoscopic approach in asymptomatic patients.[47,48]

In Spain, *Hp infection* is present in up to 60% of patients who are candidates for bariatric surgery.[46] Those who are infected and undergo a RYGB are at higher risk of marginal ulcers. This risk may be reduced by eradicating the infection prior to surgery.[49] A recent study did not confirm this. Consequently, the usefulness of diagnosing and treating the Hp infection before the procedure would be questionable.[49,50]

After a RYGB, obese patients with (asymptomatic) *gallstones* have a risk of secondary symptoms of 28–71%,[41–53] and an emergency cholecystectomy is required in up to a third of patients in the 3 years following surgery.[51] Even so, most studies and meta-analyses have shown that prophylactic cholecystectomy during laparoscopic surgery should not be performed routinely since, compared to patients with no associated cholecystectomy, it has a higher rate of complications and further surgery,[54–56] a longer hospital stay, and a higher mortality.[57] Cholecystectomy during a RYGB would be reserved for the subgroup of patients with symptomatic gallstones or a diseased gallbladder wall.[56,57] It would be advisable to determine whether patients with gallstones have choledocholithiasis so that, in that case, ERCP may be performed prior to surgery. This technique may be very complex after surgery, depending on the type of surgical procedure used.

The incidence of *NASH* in patients with morbid obesity is 70%. Hepatic cirrhosis may develop in 4% of cases.[58–61] Generally, steatosis is mild and remains stable, and liver histology improves or normalises after a RYGB in most patients.[62,63] The onset of hepatic fibrosis leads to a higher risk of cirrhosis and hepatocellular carcinoma and a higher mortality.[63,64] Consequently, it is important to investigate its presence and seriousness. Liver biopsy remains the main diagnostic technique for determining the degree of fibrosis and the prognosis for the disease;[65] however, it is not free of possible complications.[66,67] Non-invasive alternative techniques have been developed to identify patients with fibrosis based on blood samples.[68,69] Alternatively, elastography-based ultrasound techniques using special probes could be useful in these patients.[70] Therefore, before performing a RYGB, it is recommended that a liver assessment be performed using a combination of blood testing and ultrasound to investigate the degree of hepatic fibrosis non-invasively depending on the resources available at the centre. Any well-grounded suspicion of hepatic cirrhosis should be confirmed using liver biopsy.

Management of complications of bariatric surgery

The most common surgical techniques to treat obesity, generally laparoscopically, are a RYGB, adjustable gastric banding and sleeve gastrectomy. Postoperative complications may be early (e.g. gastrointestinal haemorrhage, anastomotic dehiscence, surgical wound infection or anastomotic ulcer) or late (e.g. anastomotic stenosis, primary surgical failure, dilated gastric remnant, oesophagitis, bezoar, steatosis and gallstones). Most of them are related to the type of technique used and the experience of the surgeon.[71] Therapeutic endoscopy could be useful in some cases.[72] It is indicated in case of onset of nausea, vomiting, dysphagia, retrosternal pain, epigastric pain or haematemesis, for purposes of ruling out GORD, ulcer, stenosis and suture dehiscence.

Gastrointestinal bleeding may occur in up to 4% of patients who undergo a RYGB. It is rarer if other surgical techniques are performed.[73] It usually presents within the first 48 h following the procedure. It generally originates on the suture line (gastric remnant and pouch) or on the anastomosis (gastrojejunostomy or jejunojejunostomy). It must be borne in mind that the gastric remnant and the jejunojejunostomy are inaccessible to regular endoscopes and that enteroscopes must be used. Endoscopy should preferably be performed in an operating theatre under general anaesthesia. If a RYGB was performed recently, minimal insufflation or, if possible, insufflation of carbon dioxide should be performed. The bleeding point is usually located 40 cm from the dental arch, on the suture line. If there is active bleeding, it is recommended that dual therapy be applied, preferably using mechanical methods (clips) and adrenaline,[74] and that large-volume clips be used if necessary.[75]

Stoma ulcers or *marginal ulcers* have an incidence of 0.6–16%,[76] especially from the second to the fourth month after surgery, and are often asymptomatic. They are usually located on the anastomosis or, in a RYGB, on the jejunal side of the gastrojejunal anastomosis. Although uncommon, they may start in the form of complications such as haemorrhage or perforation; if endoscopy is performed in this situation, regular therapeutic endoscopic techniques are used and efforts will be made to remove any adjacent non-resorbable suture stitch. In addition, treatment will be started with PPIs or sucralfate for 2–4 months and Hp infection will be investigated (preferably using an Hp stool antigen test).[77] As a preventive measure, non-steroidal anti-inflammatory drugs should be avoided.

To diagnose an excluded stoma ulcer and/or a duodenal ulcer, endoscopic access to the distal stomach and the duodenum may be complex, since they could be located around 2–3 m from the mouth. This requires the use of enteroscopes, with a technical success rate of 65–87%.[78] It is sometimes necessary to perform a percutaneous gastrostomy and access the excluded stomach following dilation of the tract.

Stenosis in anastomoses appears in 1–5% of patients, generally 3–6 months after surgery. Only a third of cases are symptomatic.[79] Early stenosis is usually due to anastomotic oedema; this is why dilation is not performed in this phase.[74] Late stenosis is usually located in the gastric banding area, jejunal-pouch anastomosis or jejunojejunal anastomosis, or due to adhesions. If it is accessible by endoscope, the treatment of choice is pneumatic dilation (generally requiring one to three sessions),[79] using balloons 10–15 mm in diameter. This has a rate of effectiveness of 60–100%.[74] It is recommended that minimal dilation (10 mm) be performed initially to pass a 9-mm endoscope through the stenosis and rule out ulcers in the area distal to said stenosis, and that this be followed by dilations up to 15 mm in diameter. The factors predictive of therapeutic success reported with a single dilation are a greater lapse of time between surgery and onset of symptoms, and a greater diameter achieved following the first dilation.[80] Dilations may also be performed with dilators (Savary-Gilliard dilators); in this case, the ''rule of 3'' (not dilating more than 3 mm in a single session) must be heeded to prevent perforations. The use of coated prostheses may be an alternative in case of refractoriness.

Erosion or migration of the band or ring is intraluminal migration of the band, a complication of late onset that may occur in 10% of patients.[81] Surgical treatment is reserved for cases that require a new surgical technique. Endoscopic removal is the treatment of choice. It may be performed in a single session whenever there is significant erosion of the gastric mucosa. Otherwise, intragastric migration of the band must be induced. The procedure must be performed in 2 sessions. In the first session, necrosis of the gastric mucosa between the band and the prosthesis is induced by placing a coated prosthesis between the band and the rest of the stomach wall. In the second session, after 3–6 weeks, the band is removed.[82] Before the band may be removed, it must be fragmented using argon plasma at 80 W of power or endoscopic scissors.[83] Any cellulitis or perigastric infection must always be treated previously.

Gastrointestinal fistula is a potentially serious early complication. Different types of fistula may appear, depending on the surgical technique used. Following a RYGB, leaks are usually located in the gastrojejunal anastomosis, or less often on the suture lines of the gastric remnant or on the jejunojejunal anastomosis. In a sleeve gastrectomy, leaks are usually located in the proximal third of the stomach, near the gastro-oesophageal junction.[84] A gastrogastric fistula is a pathological communication between the new stomach that has been created and the rest of the stomach that has been excluded. It may appear in up to 5% of patients with a RYGB and is suspected in patients without the expected weight loss or with symptoms of GORD. In early leaks (in the first 2 weeks following surgery), surgical repair is usually standard. The fistulas that subsequently develop usually heal spontaneously. Otherwise, endoscopy may be useful through the placement of both plastic- and metal-coated prostheses,[42,85] or of standard- or large-sized clips.[86,87] However, in small fistulas (less than 10 mm in diameter), tissue adhesives and endoscopic suture systems may also be used.[88]

GORD usually improves simply with weight loss. In patients who have undergone surgery, most studies have shown an improvement in GORD following a RYGB, while laparoscopic sleeve gastrectomy and gastric banding are not as effective in this regard.[89] The accumulation of gastric acid in the gastric remnant in laparoscopic sleeve gastrectomy or the proximal stomach in gastric banding, together with the possible existence (or even deterioration) of a pre-existing motor disorder or decreased gastric distensibility following surgery seem to explain this.[90] Therefore, a RYGB may be considered the technique of choice in obese patients with GORD.

Dumping syndrome is usually associated with a RYGB and its symptoms may appear following surgery in up to 40% of patients.[91] The cause is the rapid passage of nutrients into the small bowel. Treatment consists of eating higher-frequency, lower-volume meals throughout the day, as well as avoiding simple sugars and not drinking liquids until 2 h after meals.[92] In severe cases, somatostatin analogues may be useful. Endoscopic treatment using suture systems may also be effective.[93] Further surgery is reserved for very selected patients. This syndrome is not expected to develop following restrictive techniques, although it was recently reported in up to 40% of patients.[94] In any case, it is important to also provide specific supplementary treatment to prevent possible fluid and electrolyte disorders and *deficiencies in nutrients* such as vitamins (A, D, B_1 and B_{12}), folic acid, iron, calcium, zinc, magnesium and copper.[95]

Patients who undergo a RYGB may require therapeutic *ERCP*, with a technical success rate of more than 80% when performed using a retrograde technique through a paediatric enteroscope or colonoscope,[96] using an anterograde technique through a percutaneous gastrostomy,[97] or even using transgastric access to the bile duct guided by endoscopic ultrasound.[98,99]

Endoscopic treatment of obesity

Obese patients likely to be treated using endoscopic techniques are usually those with a BMI of 30–40 kg/m^2 and no comorbidities in whom medical treatment fails. However, its indication may be accepted in other scenarios, such as in patients suffering from morbid obesity at high surgical risk as a step prior to bariatric surgery, in patients with a BMI > 40 kg/m^2 in whom bariatric surgery is contraindicated or who reject said surgery and in patients with a BMI < 30 kg/m^2 under special circumstances following a case-by-case analysis (e.g. in diabetics).

The *intragastric balloon* is the most common endoscopic treatment for obesity. It is a system with a medium technical complexity that fully respects the anatomy of the stomach. Its short-term efficacy is acceptable, and its long-term efficacy is suboptimal. It has a moderate beneficial effect on diseases associated with moderate obesity, even though its safety profile is acceptable.[100–102] The balloon causes a feeling of early satiety after eating, which leads to a

lower caloric intake. During the first 48–72 h, the patient usually has nausea, vomiting, a feeling of fullness and spasmodic epigastric pain. These have a limited response to conventional medication, but generally remit gradually. The balloon is usually removed 6 months after it is placed, although some models may be kept in place for as long as 12 months.[103] A meta-analysis published in 2008 compiled 3608 patients from 15 studies in which a mean weight loss of 14.7 kg was seen in a 6-month period,[104] translating to a percentage of excess weight lost of 32.1%. Regarding tolerance, the rate of early removal of the balloon for different reasons was 4.2%. The best results were achieved when, after the intragastric balloon had been placed and during the 6 months that the implant remained in place, a consistent supervised and structured programme featuring re-education in food and in modification of eating habits, incorporation of exercise into the daily routine, and adaptation of daily energy expenditure to daily caloric intake was established. Patients who follow a programme of this type and subsequently add drug therapy may achieve better medium- and long-term results. However, 2.5 years after the removal of the balloon, only a third of patients usually maintain their weight loss.[100] Some complications have been reported following intragastric balloon placement, such as gastric perforation in patients with a fundoplication, gastric dilation in patients suffering from insulin-dependent diabetes mellitus, gastric perforation concealed by the formation of an inflammatory mass, intestinal occlusion due to balloon deflation, oesophageal perforation, serious atrial fibrillation and acute renal failure. Some of these complications have had a fatal outcome. Therefore, the intragastric balloon could be contraindicated in patients with serious psychological disorders, drug addictions, insufficient understanding of the process, chronic and/or serious diseases, prior gastric surgery (including surgery for GORD), a medium or large hiatal hernia, or an active duodenal or gastric ulcer.

Endoscopic bypass (or malabsorptive) procedures seek to decrease the contact of the food bolus with a stretch of the intestinal wall and thus decrease absorption of nutrients. Among them,[74] the most common procedures are duodenojejunal bypass procedures, which consist of lining the duodenum and the beginning of the jejunum with 60-cm-long waterproof sleeves. Although they have high short-term efficacy in patients with morbid obesity, their use has been discontinued due to their high incidence of complications, although most are mild.[105] *Restrictive endoscopic techniques*, based on decreasing gastric volume using transmural gastric sutures, require excellent training. Currently, the most common techniques are the primary obesity surgery endolumenal (POSE) procedure using an incisionless operating platform (IOP) (USGI Medical, San Clemente, California, United States)[106] and endoscopic gastroplasty (e.g. using OverStitch™, Apollo Endosurgery, Austin, Texas, United States).[107] These techniques have good results after a year and after 6 months of follow-up, respectively, and a low incidence of minor complications. Finally, the AspireAssist® *suction system* (Aspire Bariatrics, King of Prussia, Pennsylvania, United States) suctions the gastric contents simply using a percutaneously placed gastrostomy tube, with acceptable results after 6 months of treatment.[108]

Some patients may have an increase in food tolerance and/or unexplained weight gain, in many cases due to the development of progressive dilation of the gastrojejunal anastomosis or a gastric remnant more than 5 cm in diameter.[109,110] Further surgery may be very technically complex in these cases. Alternatively, *endoscopic rescue treatment* using sclerotherapy could be effective,[111,112] as could the use of restrictive techniques such as endoscopic suture systems[85] or the placement of large clips.[112]

Conflicts of interest

The authors declare that they have no conflicts of interest.

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