Langenbecks Arch Surg (2003) 388:375–384
DOI 10.1007/s00423-003-0420-4

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Laparoscopic surgical concepts of morbid obesity

Received: 9 December 2002
Accepted: 25 August 2003
Published online: 30 October 2003

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Abstract *Background:* According to the WHO, obesity and obesity with associated morbidity constitute a chronic, multi-factorial condition requiring treatment. Conservative treatment has been shown in long-term studies to be ineffective in morbid obesity. Surgical treatments break down into restrictive, malabsorptive, combined restrictive and malabsorptive or motility-reducing procedures. *Method and results:* Laparoscopic implantation of an adjustable gastric band is an efficient restrictive measure for treating the majority of patients with this condition. The adjustable gastric band enables weight loss and food intake to be adapted to the individual patient's need. Of these patients, 80–90% can expect to lose 55–70% of their excess weight. Vertical banded gastroplasty is losing ground among the restrictive options. Preliminary experiences are encouraging, but the long-term results are disappointing when assessed by the standard criteria. Gastric bypass is gaining ground in Europe and is a standard procedure in the USA. This operation is estimated to give a 70–80% loss in excess weight, and provides a better quality of life than do restrictive procedures. The biliopancreatic diversion with duodenal switch combines a sleeve gastrectomy with a duodeno-ileal switch to achieve maximum weight loss. Consistent excess weight loss of between 70% and 80% is achieved, with acceptable decreased long-term nutritional complications. The laparoscopic approach to this procedure has successfully created a surgical technique with optimum benefit and minimal morbidity, especially in the super-obese patient. Intra-gastric stimulation is the least invasive surgical procedure at present. However, the excess weight loss is lowest with this method, at only 32% in the first 2 years after the operation. *Conclusion:* Provided that safety recommendations are observed, laparoscopic operations for obesity have a fairly low risk. The mortality rate in centres with experienced staff is less than 0.3%. The death rate due to untreated morbid obesity is significantly higher than in a comparable group of patients after surgery.

Keywords Morbid obesity · Obesity surgery · Adjustable gastric banding · Gastric bypass · Biliopancreatic diversion · Duodenal switch · Implantable gastric stimulation

Introduction

Morbid obesity is a chronic lifelong, multi-factorial, congenital disorder, causing the patient to have excessive fat deposits and associated medical, psychological, physical, social and economic problems [1]. Aetiological factors include the involvement of hereditary, biochemical, hormonal, environmental, behavioural, health and cultural elements. Extreme forms of obesity are hardly likely to respond to diet, behavioural therapy or medication [1]. Obesity is directly correlated with type II diabetes and cardiovascular disease [2, 3]. Non-surgical treatments for morbid obesity have relapse rates of up to 90%, irrespective of the choice of conservative treatment [1, 3]. As early as 1991, the US National Institute of Health issued a statement recognising the known lack of success with conservative forms of treatment, noting that operations to constrict or bypass the stomach were justified for fully informed and consenting patients and constituted an acceptable risk [4, 5]. Safe and effective surgical treatment increases the life expectancy and quality of life for extremely obese individuals [6, 7].

Surgical operations

Minimally invasive surgery or laparoscopic procedures have made inroads into almost every surgical discipline, and they have shown a more marked increase since the beginning of the 1990s due to on-going improvements in operating techniques. Vertical banded gastroplasty, gastric bypass and biliopancreatic diversion are now performed laparoscopically (Chua and Mendiola [8], Wittgrove et al. [9], Cleator et al. [10]). The operations most amenable to laparoscopic techniques are adjustable gastric banding and Roux-en-Y gastric bypass.

Indication for surgery

A body mass index (BMI = body weight in kilogrammes divided by body height in metres squared) of 40 or over constitutes clinical obesity requiring medical treatment. Surgical treatment is considered to be justified if desired by the patient and accepted as indicated by the surgeon. Patients with a BMI of 35–40 should be considered for surgical treatment if they are suffering from associated conditions that would be likely to improve as a result of weight loss (Table 1).

The patient should have a BMI of 40 kg/m^2 or more, i.e. 45 kg or more above the ideal weight according to a body-weight table and depending on physical constitution (a BMI of 40 corresponds approximately to 45 kg overweight in relation to ideal weight and average height). If the BMI is between 35 and 40 kg/m^2 (i.e. fewer than 45 kg above ideal weight), the risk of a proposed operation would need to be justified by a serious medical problem that could be substantially improved if the patient were to lose weight. A highly motivated patient and an interdisciplinary treatment approach are more influential on the outcome than strict exclusion criteria that are rejected repeatedly year after year. The follow-up to the fitting of an adjustable gastric band, including band adjustment, psychological care and dietary counselling, forms a major part of the treatment. The operation should never be performed unless proper

Table 1 Post-operative care in our institute. Optional and if needed at any time: psychological counselling, dietary advice, therapeutic physical exercise and self-help groups (*GBP* gastric bypass, √ recommended, ∅ not essential, √/∅ optional)

Timing	Therapy	VBG	AGB	IGS	GBP
Day 1 post-op.	X-ray	√	√	∅	√
Days 7–8	Check during suture removal	√	√	√	√
	X-ray	∅	∅	√	∅
Weeks 4–6	Check-up	∅	√	∅	√
	Dietary advice	√	√	∅	∅
	Adjustment (optional)	∅	√	√	∅
	Programming	∅	√	√	∅
	X-ray (if with adjustment)	∅	√	∅	∅
3 Months	Check-up	∅	√	√	∅
	Adjustment, programming (optional)	∅	√	∅	∅
	X-ray (if with adjustment)	∅	√	√	∅
3–9 Months	Check-up	√	√	√	√
	Adjustment, programming (optional)	∅	√	√	∅
	X-ray (if with adjustment)	∅	√	∅	∅
	Sonography (to exclude gallstones)	√	√	∅	√
Once a year	Check-up (BAROS)	√	√	√	√
	Adjustment, programming (optional)	∅	√	√	∅
	X-ray	∅	√	∅	∅
	Sonography (to exclude gallstones)	√	√	√	√
General treatment	Vitamin supplements (A, D, B12, calcium etc.)	√/∅	√/∅	∅	√

follow-up is assured. Further recommendations issued by the American Society for Bariatric Surgery (ASBS) and the International Federation of Surgery for Obesity (IFSO) say that a centre should have sufficient experience in open and laparoscopic intestinal surgery. Furthermore, it should have access to a suitable infrastructure of trained dieticians, psychologists, well-motivated nursing staff and, if possible, a self-help group. The appropriate equipment such as examination couches, operating tables, hospital beds and instruments should be available in case it is necessary to switch from laparoscopy to open surgery. Peri-operative monitoring facilities are also necessary. That the surgeons should have appropriate training and experience goes without saying. Informed consent from the patient, i.e. the first interview with the patient, takes time and is extremely important. The success or failure of this type of operation depends, more than almost any other, on the patient's co-operation and compliance. The patient needs to be fully informed about obesity as a disorder, laparoscopic gastric banding, possible complications, warning signs and symptoms and the post-operative follow-up.

Pre-operative procedure

The usual patient history is taken and a physical examination performed, and, additionally, endocrinological disorders need to be properly managed and treated. Internal examination by a specialist, an ultrasound scan of the abdomen and spirometry are recommended by the anaesthesiologist in our centre. If gallstones are present, they should be removed at the same time, because gallstone complications are frequent with intensive weight loss [11]. The patient sees the anaesthetist for the test results a few days before the operation. Dietary counselling and a psychological diagnosis of eating disorders are essential to determine which procedure should be appropriate for the patient. It is also highly advisable for the patient to have compressive stockings fitted by the ward nurse before admission to the ward, to prevent deep-vein thrombosis. On the day of admission to hospital, the patient should bring documents confirming that the cost will be reimbursed by the health insurance fund. In our department, we prefer to obtain informed consent from the patient well before the date for the operation.

Peri-operative care

Unlike many other types of surgical intervention, the operation for obesity represents the first stage of treatment. Regular check-ups and active patient compliance are essential for a successful outcome. A prophylactic single dose of antibiotics and low-molecular-weight heparin are recommended. On the day of the operation the patient is allowed to sip some tea or water. On post-operative day 1, the diet run-in phase begins after an oral Gastrografin X-ray has been taken. If possible, the patient should be given another dietary counselling session before the first band adjustment. Further checks may vary according to the particular operation; naturally, individual needs are taken into consideration. A summary of post-operative management is shown in Table 1.

Gastric bypass

The gastric bypass procedure was published as a treatment for morbid obesity as early as 1967 by Mason and Ito (see [1]). The introduction of laparoscopy surgery led to the development of many new procedures, although the principle of the gastric bypass remained the same. The concept of the gastric bypass is that the gastric pouch and the malabsorption effect of a Roux-en-Y anastomosis with an 80 to 120-cm length of the limb will cause a feeling of fullness. Between 1993 and 1999, Wittgrove and Clark [12] performed over 500 laparoscopic bypass procedures. The stomach is transected with a linear stapler (3.5-mm staples, 45 mm long) to form a proximal gastric pouch. The Roux-en-Y limb is brought to the upper abdomen either behind the colon and stomach, with an incision at the base of the mesentery of the transverse colon, or is placed in an ante-colic position. The end-to-

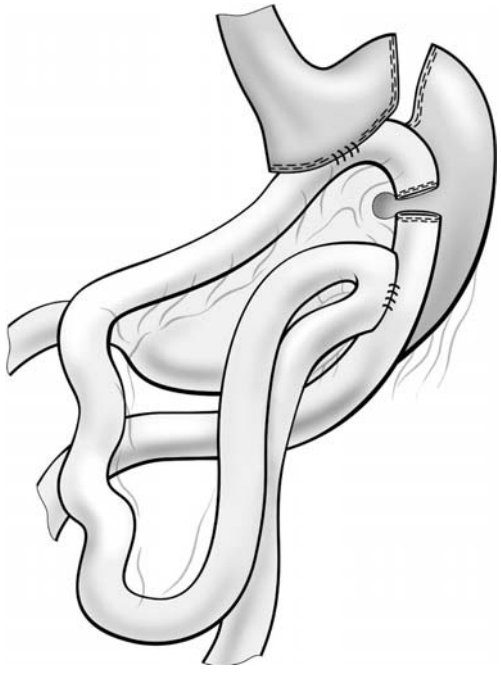

Fig. 1 Laparoscopic Roux-en-Y gastric bypass with linear stapling technique [13]

side anastomosis of the remaining part of the stomach is made either with a circular stapler under percutaneous endoscopic control, or with an anastomosis technique that uses a linear stapler, side-to-side, as described by Lönroth et al. [13] (Fig. 1). The small-bowel anastomosis is also made with a linear stapler.

The average weight loss resulting from a gastric bypass is 60–70% of the excess weight after 5 years and 55–60% after 10 years; 90% of patients can expect to achieve this result [14, 15]. A comparative study [16] at our hospital showed that higher weight loss and a better quality of life were obtained than with a vertical banded gastroplasty or the adjustable gastric band. The complications specific to this operation are anastomotic leakage 0.5 to 9%; marginal ulcer 4.5–16%; long-term micronutrient deficiencies in B12, folate and iron of up to 73%; weight regain in the long-term follow-up studies; and a mortality rate of 0.1–2.5% [9, 10, 11, 12, 13, 14, 15, 16, 17]. Higa et al. reported a total complication rate of 14.8% in a series of 1,500 consecutive patients [18]. The laparoscopic gastric bypass is a viable alternative to traditional open techniques. It is as safe and effective and can be performed with equal or greater efficiency. Vitamin (A, D, E and B12 and folic acid) and mineral (calcium) supplements are obligatory. Peri-operative procedures are described in Table 1.

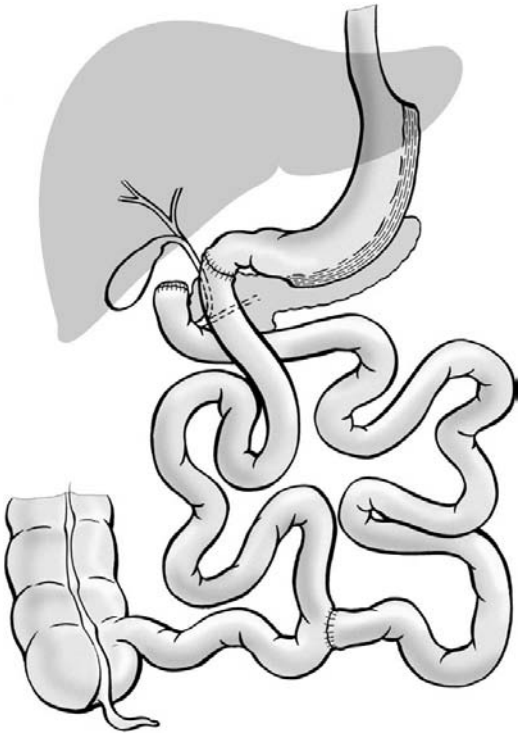

Fig. 2 Duodenal switch procedure

Biliopancreatic diversion/duodenal switch

The basic principle of the biliopancreatic diversion/duodenal switch (BPD/DS) procedure is similar to that of the biliopancreatic bypass. Scopinaro et al., who developed the procedure, report the largest experience with biliopancreatic bypass. The procedure, in a series of 2,241 patients operated on during a 21-year period, caused a mean permanent reduction of approximately 75% of the initial excess weight [19]. The authors report that during the first 3 to 4 months after the surgery, patients have decreased appetites related to the dumping syndrome. Scopinaro, Marinari, and Camerini reported similar early results with the laparoscopic technique [20].

The duodenum is divided between the stomach and the bile ducts, diverting pancreatic juice and bile. The duodenal stump is then closed. Ninety percent of the stomach is removed. The small intestine is divided. Using this separated section of small intestine, the surgeon makes a new connection to the open end of the duodenum. The remaining end of the small intestine is re-attached approximately 30 in. from the colon. This biliopancreatic segment now carries the digestive enzymes and bile. Food and digestive juices mix in the final short 30-in. section of the intestine. Baltasar et al. [21] and Feng and Gagner [22] described a laparoscopic variant of the biliopancreatic bypass, the duodenal switch procedure (Fig. 2). Instead of performing a distal gastrectomy, the surgeon performs a "sleeve" gastrectomy along the vertical axis of the stomach, preserving the pylorus and initial segment of the duodenum, which is then anastomosed to a segment of the ileum, similar to the above procedure, to create the alimentary segment. Preservation of the pyloric sphincter is designed to be more physiological. The sleeve gastrectomy decreases the volume of the stomach and also decreases the parietal cell mass, with the intent of decreasing the incidence of ulcers at the duodeno-ileal anastomosis. However, the basic principle of the procedure is similar to that of the biliopancreatic bypass, i.e. it produces selective malabsorption by limiting food digestion and absorption to a short, common ileal segment. The potential for metabolic complications exists with this procedure. Patients undergoing the duodenal switch procedure require long-term medical follow-up and regular monitoring of fat-soluble vitamins, vitamin B12, iron and calcium.

Marceau et al. [23] reported on 465 patients with a duodenal switch procedure compared with 252 patients who underwent the biliopancreatic bypass. In addition to the preservation of the duodenum, the common segment was elongated to 100 cm. The authors noted similar weight loss in the two groups. In the duodenal switch group, a lower incidence of metabolic abnormalities such as protein malnutrition was noted, which prompted reversal of the procedure in 1.7% of those undergoing biliopancreatic bypass vs only 0.1% after the duodenal

switch procedure. The excess weight loss varied between 70% and 90%, depending on the length of the common segment and alimentary limb. The biliopancreatic diversion with duodenal switch combines a sleeve gastrectomy with a duodeno-ileal switch to achieve maximum weight loss. Consistent excess weight loss of between 70% and 80% is achieved, with acceptable decreased long-term nutritional complications. With a higher entry weight, the super-obese patient (BMI >50 kg/m^2) benefits the greatest from a procedure that produces a higher mean excess weight loss. The laparoscopic approach to this procedure has successfully created a surgical technique with optimum benefit and minimum morbidity, especially in the super-obese patient [24].

Vertical banded gastroplasty

Vertical banded gastroplasty (VBG) is a purely non-adjustable restrictive procedure and, recently, has been performed laparoscopically [25, 26]. In this procedure the upper stomach near the oesophagus is stapled vertically for about 2.5 in. (6 cm) to create a smaller stomach pouch. The outlet from the pouch is restricted by a band or ring that slows the emptying of the food and thus creates the feeling of fullness. Moreover, MacLean and colleagues reported staple-line perforations in 48% of patients, of whom 36% underwent re-operation [27]. Preliminary experiences are encouraging [26] but the long-term results of VBG are disappointing when assessed by the standard criteria [28].

In a prospective non-randomized 9-year follow-up study we could demonstrate an advantage of the adjustable restrictive procedure, namely the adjustable gastric band (AGB) [29]. The overall re-intervention rate for long-term complications in 1,011 patients was 15.6% for the VBG and 7% for the AGB group (P<0.0001). No statistically significant difference in outcome in terms of weight loss, reduction of co-morbidity and improvement in quality of life following AGB or VBG was observed. VBG was performed from 1977 but, therefore, was abandoned by our institute in 2001.

Adjustable gastric band

Early experience gained in Europe with the LAP-BAND system made by Bioenterics (Inamed Corporation, USA) led to repeated modification of the technique and resulted in great improvements in outcome [30, 31, 32, 33, 34, 35, 36, 37, 38, 39]. As with the adjustable band, the so-called Swedish band (SAGB, Obtech AG, ETHICON), which makes a smaller pouch, significantly reduced the post-operative complication rate [40, 41, 42, 43]. The AGB is a 12-mm-wide soft silicone band with an elastic balloon that can be inflated by injection according to individual need. The band is fitted around the upper part of the stomach, dividing it into two sections, the smaller of which is above the band and has a capacity of approximately 15–20 ml (pouch); the larger remaining part is below the band. The constriction is called a stoma. The following are the main differences in technique for gastric banding: by means of a calibration balloon positioned in the stomach, the site of incision is determined at the small curvature. At this site, a 0.5 to 1-cm window is placed close to the cardia. The fenestration is continued along the posterior wall of the gastro-oesophageal junction up to the angle of His. Another so-called pars flaccida technique starts at the medial edge of the right crus of the diaphragm after incision of the pars flaccida of the lesser omentum dissecting to the angle of HIS (Fig. 3). Tunnelled suturing is obligatory to prevent band slippage and to ensure that the fundus does not slide under the band. We also recommend gastropexy in addition to the stomach wall suture (fundus sutured to the left side of the diaphragm). The AGB makes it possible for the surgeon to alter the stoma diameter. Laparoscopic implantation of an AGB requires approximately the same level of skill as laparoscopic Nissen fundoplication. As with all laparoscopic procedures, there is a learning curve [44, 45] for banding that can vary quite substantially. Good surgical training, careful patient selection and inter-disciplinary follow-up management are some key factors. Trouble-free banding requires experience and practice. De Jong and van Ramshorst report a re-operation rate of 30% in their first 50 patients and a significant reduction of 13% for the next 47 [45]. Elmore et al. report that the largest number of

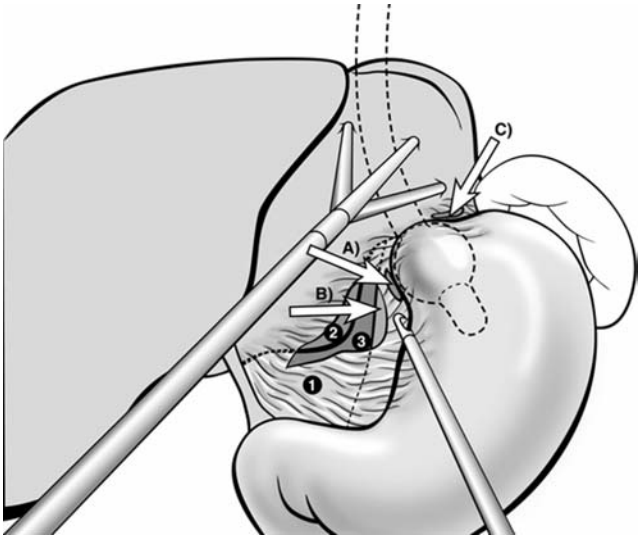

Fig. 3 Adjustable gastric band techniques. *A)* Preparation at the lesser curvature after calibration with an intra-gastric balloon (15 cc). *B)* Preparation at the medial margin of the right crus of the diaphragm (*3*) after incision of the pars flaccida (*1*) of the lesser omentum. *C)* Angle of His. Caudal lobe of the liver (*2*)

Table 2 Complications with the adjustable gastric band (30–53)

Complication	Incidence (%)
Peri-operative complications	
Fatalities	0–2.1
Stomach wall lesion	0–3.5
Pneumothorax	0–0.2
Haemorrhage	0.5–2.0
Late complications	
Pouch dilatation with/without band slippage	0–13.4
Erosion	0–4.6
Port or band system complications	0.5–10.4
Wound infection	0–7.7
Motility irregularities (clinically manifest)	0–1.5

complications occurred in the first 25 patients [46]. Angrisani and colleagues [47] report "disappointing results" in the early laparoscopic operations. Table 2 gives a summary of complications. Weight loss is given in the literature as BMI 43–46 pre-operatively to BMI 28–32 post-operatively. The target of a 50–60% reduction of excess weight is achievable [31, 47, 48, 49, 50, 51, 52]. Belachew et al. [31] have demonstrated that 80% of their patients reduced their excess weight by 60%. O'Brian et al. [38] reported excess weight loss of 51% in the first year, 58% in the second, 61% in the third and 68% in the fourth year post-operatively. Studies with a follow-up of over 5 years confirm that the weight loss is long-term. A prospective study in our department, comparing the two bands, found no difference in weight loss and complication rate between LAP banding and SAGB after a 4-year follow-up [53]. Complications break down into peri-operative and late complications. Top priority is given to the prevention of complications, however. Thorough training and an inter-disciplinary approach to therapy are essential. We believe that the laparoscopically implanted AGB, both the LAP-BAND system and SAGB, is an efficient treatment method for patients with morbid obesity. It dispenses with the need for open surgery on the stomach or small intestine, which remain intact in terms of anatomy and digestive physiology. Long-term metabolic complications are not anticipated. Weight loss and food intake can be adapted to individual patient needs. Of the patients, 80–90% can expect to lose 60–70% of their excess weight. It is much easier with this method than with other procedures for the surgeon to remove the band and restore the original situation. The surgical technique is difficult in the learning phase, but it becomes easy with practice and is fairly low risk provided that the safety recommendations are observed. All these reasons make gastric banding a relatively safe and efficient treatment for morbid obesity, and it is likely to be an important surgical addition to the treatments available for most of these patients.

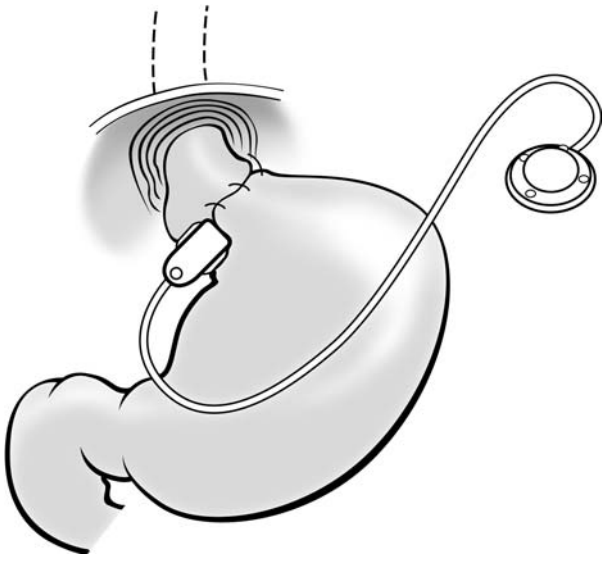

Fig. 4 Tunnelled sutures in adjustable gastric banding. To prevent the fundus slipping under the band, we recommend gastropexy (fundus sutured with left crus of diaphragm) in addition to the fundus–stomach wall sutures

Gastric pacemaker

In 1995, Cigaina et al. discovered, when experimenting with pigs, that electrical stimulation of the stomach wall resulted in characteristic patterns of gastric peristalsis in both directions [54]. A further pig study demonstrated that stimulation of the stomach wall influenced the animals' eating habits. Animals whose stomach wall had been stimulated ate less. Weight loss is attributed to lower absorption of food or absorption in the gut [55].

In February 2000, a randomised, placebo-controlled double-blind trial was launched in the USA and Europe to check the clinical effectiveness and safety of the Transcend implantable gastric stimulator (Fig. 4). The implantable gastric stimulation (IGS) system consists of two electrodes that are introduced into the stomach wall with a needle. A wire connects the electrodes to a 60×40×10.3-mm stimulator, which is implanted below the left costal arch in a subcutaneous pouch and can be programmed from outside. A suitable site is selected on the stomach wall in the gastro-oesophageal transition region, at which the electrodes can be placed in a strictly intra-mural position. The needle entry and exit points should be 2.5 cm apart and are marked with electrocautery. The electrodes are then introduced under gastroscopic control to prevent perforation of the stomach wall The probe is secured proximally with two PDS sutures and distally with a clip (Fig. 5). The conductor wire is then taken to the outside and connected to the stimulator system. Forty-eight IGS systems have been implanted in patients throughout Europe in a clinical trial. There have been

Fig. 5 Implantable gastric stimulation. The lead is secured proximally with two PDS sutures and distally with a clip

no serious complications, either post-operatively or later. Among the implants in Austria, two patients required tightening of the connection between the wire and the stimulator. This was done under local anaesthetic in day surgery. Current results of trials in all the centres show a significant excess weight loss of 32% after 15 months with a stimulator. All the implantations of IGS systems have been successful, and there have been no life-threatening or fatal complications [56, 57].

The principle of gastro-intestinal stimulation for weight loss in morbid obesity is currently one of the least invasive surgical techniques. Many more studies and examinations of eating habits and quality of life will be necessary before clear statements about the ranking of implantable gastric stimulation can be made in comparison with other treatment methods for morbid obesity. Whether the high costs (about five-times higher than the material cost of an AGB) will be justified in terms of outcome remains to be seen from further studies.

Weight loss and co-morbidity

Weight loss from BMIs of 43–46 pre-operatively to BMIs of 28–32 is reported in the literature. The target of a 50–60% reduction in excess weight is achievable. Studies with a long-term follow-up of over 5 years confirm that weight loss is maintained after obesity surgery. A prospective study in our department has shown that 80% of associated disease has either improved or resolved completely only 3 years after VBG, adjustable gastric banding and Roux-en-Y gastric bypass [16] have been performed. Morbid obesity is associated with a large number of health risks [58]. Studies have produced evidence of a significant reduction in blood sugar and cholesterol levels and blood pressure even with a modest weight loss of "only" 10% after surgical treatment. The improvement in co-morbidity is in direct proportion to weight loss after gastric banding. In 50% of patients with associated disease (diabetes, high blood pressure, dyslipidaemia), this had resolved after only 1 year, with significant improvement in a further 24% of patients [58]. Dixon and O'Brien [59] describe 83% of patients with high blood pressure (78 out of 88), which was normal after 17 months (RR <140/90). Dixon and O'Brien [59] documented the effects on 48 consecutive patients with reflux disease (GERD) and gastric banding. Of the GERD patients, 76% were found to be symptom free only 3 weeks after the operation. The effect was directly linked to the banding system rather than weight loss. Examination of 32 patients with bronchial asthma 12 months after banding noted a significant improvement of this condition in all of them (100%) based on the number of attacks, medication requirements, hospitalisation and physical stress [60].

Dixon et al. [60] reported a reduction of sleep apnoea and a significant reduction in obstructive airways disease in patients with the LAP-BAND system.

Similar results were published by Alvarez-Cordero et al. [61]. Nine out of ten of his patients needed no medication for hypertension, and six out of 11 no longer needed medication by mouth for diabetes. Sleep apnoea resolved in all patients who had suffered from this disorder before their operation [60]. Improvement in co-morbidity as a result of significant weight loss due to adjustable gastric banding and gastric bypass is confirmed in many publications [58, 59, 60, 61, 62, 63, 64, 65]. If the patient fails to lose weight quickly enough, complications such as band slippage or leakage should be ruled out before the patient is referred to the psychologist and dietician.

Quality of life

Quality of life is significantly improved in morbid obesity patients [66, 67, 68, 69], both in terms of life expectancy [70] and physical activity, as well as satisfaction [66]. According to an analysis by Weiner et al. [67], quality of life improved significantly in 92% of patients. Our studies have shown a direct correlation between quality of life and BMI [7]. Moreover, statistically significant improvements in all areas of life (social contacts, physical activity, self-confidence, and sexuality, working and family life) were demonstrated after a BMI reduction of 5 [7]. The bariatric analysis and reporting outcome system (BAROS) has now become the accepted assessment method for quality of life and treatment outcome after AGB surgery. The BAROS assessment score covers weight loss (−1 for weight increase to +3 for 75–100% excess weight loss), co-morbidity (−1 for deterioration to

Table 3 Health status and QoL after surgical treatment for obesity [15] (*Y-GBP* Roux-en-Y gastric bypass, NS not significant)

Parameter	VBG	AGB	Y-GBP	*P*
Weight loss	1.6	1.5	2.7	<0.05
Co-morbidity	2.57	2.48	1.9	NS
QoL	1.96	2.01	2.55	NS
BAROS				
Total score	6.13	5.99	7.15	<0.05
Failure (%)	3	3	0	NS
Satisfactory (%)	3	7	7	NS
Good (%)	13	17	10	NS
Very good and excellent (%)	71	73	83	NS

+3 for completely resolution) and the quality of life questionnaire (self-esteem, physical activity, social contacts, job satisfaction, sexuality (+3, maximum and −3, minimum). Points are lost for complications (1 point) and re-operation (1 point). A score of 7–9 points is thus an excellent result, 4–6 points is good and 1–3 points is a satisfactory score, with −3 to 0 points indicating failed treatment. The health status and quality of life (QoL) assessment after surgery for obesity is summarised in Table 3 [16]. Favretti et al. report on 170 LAP-BAND-system patients, with excellent and good results in 48% [68]. The failure rate in this group is reported as 10%. Klaiber et al. reported the failure rate in their patients with the SAGB system as only 3.9% [50].

Because the band system is adjustable, the stoma can be adjusted in a female patient to assure a normal pregnancy if this occurs [71]. Patients rate the success of adjustable gastric banding very highly due to weight loss, reduction in co-morbidity and the improvement of quality of life it gives them. The positive assessment and laparoscopic implantation techniques result in a high level of acceptance among patients, GPs, specialists in internal medicine, psychologists, dieticians and sports researchers [69, 72].

The overall BAROS assessment of laparoscopically implanted gastric banding, band-assisted gastroplasty and stomach bypass shows a significantly higher rate of excellent results for the stomach bypass (Table 3; [16]). In terms of failure of a surgical procedure Orlistat (Roche) could be a good option as an adjuvant medical therapy [73].

Surgical treatment for obesity has proved that it is the best and most effective means of preventing the life-threatening complications and serious degenerative problems associated with pathological obesity. It is indicated by the ineffectiveness of non-surgical treatment methods and the high risk resulting from untreated obesity [70, 74]. Safe, effective surgical treatment methods increase life expectancy and quality of life for patients with extreme excess weight.

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