



Laparoscopic bariatric surgery in the treatment of morbid obesity

Laparoskopska bariatrična kirurgija pri zdravljenju čezmerne debelosti

Karl Miller

From the Surgical Division and the Ludwig-Boltzmann-Institute for Gastroenterology and Experimental Surgery at the General Austrian Hospital Hallein

Avtor za dopisovanje (*correspondence to*):

Karl Miller, MD, Assoc. Prof. of Surgery, Head of the Surgical Department, a.ö. Krankenhaus Hallein, Bürgermeisterstr. 34, A-4500 Hallein; e-mail: karl.miller@kh-hallein.at; www.miller.co.at

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Abstract

Long-term studies have shown conservative methods to be ineffective in the treatment of morbid obesity. Surgical approaches are divided into restrictive, malabsorptive, combined restrictive and malabsorptive and motility-reducing procedures. 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 adjusted to the individual patient's needs. Eighty to ninety percent of these patients can expect to lose 55% - 70% of their excess weight. Vertical banded gastroplasty is losing ground among the restrictive options. Preliminary experience with this technique is encouraging but the long-term results are disappointing when assessed by the standard criteria. Gastric bypass is gaining ground in Europe and has been established as a standard procedure in USA. This operation is estimated to provide 70% - 80% excess weight loss and to afford better quality of life than restrictive procedures. The biliopancreatic diversion with a duodenal switch combines a sleeve gastrectomy with a duodenoileal switch to achieve maximum weight loss. Consistent excess weight loss between 70% and 80% is achieved with acceptable decreased long-term nutritional complications. The laparoscopic approach is a surgical technique with optimum benefit and minimal morbidity, especially in super obese patients. Intra-gastric stimulation is the least invasive surgical procedure available. However, it provides lowest excess weight loss in 32% in the first two years after the operation. Provided 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%. Currently, surgery offers the only viable treatment option with long-term weight loss and maintenance for the morbidly obese. There is no single operation that is effective for all patients.

Key words. *Morbid obesity, bariatric surgery, adjustable gastric banding, gastric bypass, biliopancreatic diversion, duodenal switch, implantable gastric stimulation.*



Izveček

Konzervativno zdravljenje čezmerne debelosti se je v dolgoročnih študijah izkazalo kot slabo uspešno. Kirurško zdravljenje lahko razdelimo na restriktivne, malabsorpcijske, kombinirane restriktivno-malabsorpcijske metode in metode, ki zmanjšujejo motiliteto prebavnega trakta.

Laparoskopska vstavitev nastavljive želodčne preveze (gastric banding) je uspešna restriktivna metoda za zdravljenje čezmerne debelosti. Nastavljiva želodčna preveza omogoča individualno prilagajanje izgube telesne teže in vnosa hrane skladno z bolnikovimi potrebami. Zmanjšanje čezmerne telesne teže za 55 - 70% lahko pričakujemo pri 90% teh bolnikov. Vertikalno bandažirana gastroplastika izgublja svoj pomen glede na restriktivne metode. Preliminarne izkušnje so bile ohrabrujoče, dolgoročni uspehi, ocenjevani po standardnih merilih, pa so bili slabi. Obvodne operacije (gastric bypass) pridobivajo svoj pomen pri zdravljenju čezmerne debelosti v Evropi, medtem ko so v ZDA že standardno zdravljenje. Pri tej operaciji pričakujemo zmanjšanje čezmerne telesne teže za 70 do 80%, ob tem pa boljšo kakovost življenja teh bolnikov kot pri restriktivnih metodah. Zmanjšanje čezmerne teže za 70 do 80% se pri tej metodi doseže, ob tem pa so prisotne tudi sprejemljivi manjši nutricionistični zapleti. Laparoskopski pristop pri omenjeni operativni metodi se je izkazal za zelo uspešnega z optimalnimi rezultati zdravljenja in minimalnimi zapleti, še zlasti pri skrajno debelih bolnikih. Intragastrična stimulacija je najnovejša invazivna kirurška metoda, vendar je izguba čezmerne teže s to metodo najmanjša in znaša le 32% v prvih dveh letih po operaciji.

Če upoštevamo priporočila o varnem operiranju, je laparoskopsko zdravljenje čezmerne debelosti varno z razmeroma nizkim tveganjem. Stopnja smrtnosti pri teh metodah je v centrih z izkušenimi ekipami manj kot 0,3%. Trenutno lahko le s kirurškimi metodami dolgoročno in uspešno zdravimo čezmerno debelost, seveda pa ni nobena operativna metoda uspešna pri vseh bolnikih.

Ključne besede. Čezmerna debelost, kirurško zdravljenje, bariatrična kirurgija, nastavljiva želodčna preveza, obvodne operacije, intragastrična stimulacija.

Morbid obesity is a chronic, lifelong, multifactorial, congenital disorder characterised by excessive fat deposits and associated medical, psychological, physical, social and economic problems (1). Etiological 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 U.S. 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 Options

The number of gastrointestinal surgeries performed annually for morbid obesity increased from about 16 in the early 1990s to about 103,000 in 2003 (Figure 1). Minimally invasive surgery or laparoscopic procedures have made inroads into almost every surgical discipline. Their use has markedly increased since the beginning of the 1990s due to on-going improvements in operative techniques. Vertical banded gastroplasty, gastric bypass and biliopancreatic diversion are now performed laparoscopically (8-10). The operations most amenable to laparoscopic techniques are adjustable gastric banding and Roux-en-Y gastric bypass.

Indications for surgery

A body mass index (BMI = body weight in kilograms divided by body height in metres



squared) of 40 or over constitutes clinical obesity requiring medical treatment. Surgical treatment is considered justified if desired by the patient and accepted by the surgeon as indicated. 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 (1,4,5).

The patient should have a BMI of 40 kg/m² or more, i.e. 45 kg or more above ideal weight according to a body weight table depending on physical constitution (a BMI of 40 corresponds approximately to 45 kg overweight in relation to ideal weight with average height). If the BMI is between 35 and 40 kg/m² (i.e. less than 45 kg above ideal weight), the risk of a proposed operation needs to be justified by the presence of a serious medical problem that could be substantially improved by weight loss. 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, constitutes a major part of the treatment. The operation should never be performed unless proper follow-up is assured. Further recommendations issued by the American Society for Bariatric Surgery (ASBS) and the International Federation of Surgery for Obesity (IFSO) state 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 conversion from laparoscopy to open surgery is required. Peri-operative monitoring facilities are also necessary. It goes without saying that the surgeons should have appropriate training and experience. The first interview with the patient for obtaining his/her informed consent takes time and is extremely important. The success of this type of operation depends, more than almost any other, on the level of the patient's co-operation and compliance. The patient needs to be fully informed about obesity as a disorder, as well as

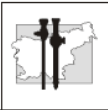
about the operative procedure, possible complications, warning signs and symptoms, and post-operative follow-up.

Pre-operative procedure

In addition to routine patient history taking and physical examination, proper management of endocrinological disorders is required. Internist examination by a specialist, an ultrasound scan of the abdomen and spirometry are recommended by the anaesthetists in this centre. Gallstones, if present, should be removed at the same time, because gallstone complications are frequent with intensive weight loss (11). A routine cholecystectomy is not necessary in gastric bypass and restrictive procedures (12). The patient sees the anaesthetist with the test results a few days before the operation. Dietary counselling and a psychological diagnosis of eating disorders are essential to determine the procedure appropriate for the patient. It is also highly advisable that the patient has compressive stockings fitted by the ward nurse before admission to the ward to prevent deep vein thrombosis. On the day of admission, the patient should bring documents confirming that the cost will be reimbursed by the health insurance fund. This department's policy is to obtain informed consent from the patient well before the date of the operation.

Peri-operative care

Unlike many other types of surgery, 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 day 1 post-operatively, 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 depending on the particular operation, and are adjusted to meet the individual patient's needs. Table 1 summarizes the recommended post-operative management at this department. Note that the follow-up of patients with morbid obesity is comparable to that for oncology patients.



Gastric bypass (RYGBP)

The gastric bypass procedure was described in the literature as a treatment for morbid obesity as early as 1967 by Mason and Ito (Mason & Ito 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 the Roux-en-Y anastomosis with an 80- to 120-cm long limb will cause a feeling of fullness. Between 1993 and 1999, Wittgrove and Clark (13) performed over 500 laparoscopic gastric bypass procedures. The stomach is transected with a linear stapler (3.5 mm-staples, 45 mm long) forming 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 antecolic position. The end-to-side anastomosis of the remaining part of the stomach is accomplished by a hand-sewn method, with a circular stapler (13), or with an anastomosis technique that uses a linear stapler, side-to-side, as described by Lönroth (14). Figure 2 demonstrates an example of a laparoscopic Roux-en-Y gastric bypass with an antecolic, antegastric circular stapled gastro-jejunoanastomosis. The entero-entero anastomosis is usually accomplished using a linear stapler.

The average weight loss resulting from a gastric bypass is 60% - 70% of the excess weight after five years (Figure 7), and 55% - 60% after ten years. This result is expected to be achieved by 90% of patients (15,16). A comparative study (16) carried out at this institution showed that greater weight loss and a better quality of life were obtained with this technique than with a vertical banded gastroplasty or the adjustable gastric band. The complications specific to this operation include: anastomotic leakage in 0.5% to 9%, marginal ulcer in 45% to 16%, long-term micronutrient deficiencies of B12, folate and iron in up to 73%, weight regain in long-term follow-up studies, and a mortality rate of 0.1% to 2.5% (9-11,13-18). Higa et al. reported a total complication rate of 14.8% in a series of 1,500 consecutive patients (19). The laparoscopic gastric bypass is a viable alternative to traditional open techniques. It is equally safe and can be performed with equal

or greater efficiency. Supplements of vitamins A, D, E and B12, as well as of folic acid and calcium are obligatory.

Biliopancreatic diversion / duodenal switch (BPD/DS)

The basic principle of the procedure is similar to that of the biliopancreatic bypass. Scopinaro, who developed the procedure, reports the largest experience with a biliopancreatic bypass. The procedure, performed in a series of 2,241 patients during a period of 21 years, afforded a mean permanent reduction of approximately 80% of the initial excess weight (20) (Figure 6). The authors report that during the first three to four months after the operation the patients have decreased appetites related to the dumping syndrome. Scopinaro, Marinari, and Camerini reported similar early results with the laparoscopic technique (21).

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, and using this separated intestinal section a new connection is created to the open end of the duodenum. The remaining end of the small intestine is re-attached approximately 30 inches from the colon. This biliopancreatic segment now carries the digestive enzymes and bile. Food and digestive juices mix in the final short 30-inch section of the intestine. Baltasar et al. (22), and Feng and Gagner (23) described a laparoscopic variant of the biliopancreatic bypass, the duodenal switch procedure (Figure 2). Instead of a distal gastrectomy, a "sleeve" gastrectomy is done along the vertical axis of the stomach, preserving the pylorus and the initial segment of the duodenum. The latter is then anastomosed to a segment of the ileum 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 reduces the parietal cell mass with the intent of lowering 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., producing 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 B-12, iron and calcium levels. Marceau et al. (24) reported on 465 patients with a duodenal switch procedure compared to 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. The duodenal switch group showed a lower incidence of metabolic abnormalities, such as protein malnutrition, 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 ranged from 70% to 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 70% to 80% is achieved with acceptable decreased long-term nutritional complications. The super-obese patient (BMI >50 kg/m²) with a higher entry weight derives most benefits from a procedure affording a higher mean excess weight loss. The laparoscopic approach to this procedure has created a surgical technique with optimum benefit and minimal morbidity, especially in the super-obese patient (25).

Two-stage procedures (“sleeve” gastrectomy and RYGB or DS/BPD)

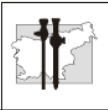
Surgical treatment of super-super obese patients with a BMI of >60 kg/m² has been a significant challenge, and consistent results were difficult to obtain in these patients. In addition to less consistent long-term weight loss, the super-super obese patient also has higher peri-operative morbidity and mortality associated with one-stage bariatric procedures. Gagner et al. reported a 38% major complication rate and a 6.25% mortality rate associated with a one-stage laparoscopic BPD-DS in patients with a BMI of > 65, compared to an 8.3% major complication

rate and zero mortality in patients with a BMI of 40-64 (26). RYGBP has become the most widely used bariatric procedure in the United States. It provides good weight loss results in properly selected patients, and carries no risk of malnutrition associated with BPD-DS. We believe that a two-stage operation is a reasonable approach for the super-super obese patient, allowing for both procedures to be done laparoscopically. It is important to note that these results are preliminary and were obtained after a 21-month follow up (27). The patients underwent the first-stage laparoscopic sleeve gastrectomy, which included removal of the greater curvature of the stomach from the angle of His to the distal antrum, creating a gastric tube over a 60-french bougie. Six to 12 months after the restrictive procedure, when the weight loss plateaued, the patients had a second-stage BPD-DS or RYGB. This management algorithm requires two major laparoscopic operations under general anaesthesia, but allows for a simpler procedure when the patient is most at risk with a BMI of >60, and a safer definitive weight loss operation after a significant drop of his/her BMI (27). A sleeve gastrectomy is a relatively uncommon bariatric procedure, but a similar operation, called the Magenstrasse and Mill procedure, has already gained wide acceptance (28,29).

Vertical banded gastroplasty (VBG)

Vertical banded gastroplasty is a purely non-adjustable restrictive procedure, and has been recently performed laparoscopically (30,31). The upper stomach near the oesophagus is stapled vertically for about 2.5 inches (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 (Figure 4). MacLean and colleagues reported staple-line perforations in 48% of patients; 36% of these underwent re-operation (32). Preliminary experiences are encouraging (33) but the long-term results of VBG are disappointing when assessed by the standard criteria. (34)

A prospective non-randomized 9-year follow-up study demonstrated the advantage of the adjustable restrictive procedure, i.e. the adjustable gastric band (AGB). (34). 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 ($p < 0.0001$). There was no statistically significant difference between AGB and VBG in terms of weight loss, reduction of co-morbidity and improvement of quality of life. VBG was performed at this institution from 1977 to 2001, when it was abandoned because of a significantly higher long-term complication rate.

Adjustable gastric band (AGB)

Early experience with the LAP-BAND® system made by Bioenterics (Inamed Corp., USA) gained in Europe, led to repeated modifications of the technique and resulted in great improvements in outcome (30-39). Similarly to the adjustable gastric band (AGB), the so-called Swedish band (SAGB®, Obtech AG, ETHICON), which makes a smaller pouch, significantly reduced the post-operative complication rate (35-48). 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 part above the band with a capacity of about 15-20 ml (pouch), and the larger part below the band (Figure 5). The constriction is called a stoma. The technique of gastric banding is as follows: the site of incision is determined at the small curvature using a calibration balloon positioned in the stomach. At this site, a 0.5- to 1-cm window is placed closed 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. Tunnelled suturing is required 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) (Figure 5). The AGB makes it possible for the surgeon to alter the stoma diameter. As with all laparoscopic procedures, the technique has a learning curve that can vary quite substantially, and requires about the same level of skill as laparoscopic Nissen fundoplication (49,50). 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 et al. report a re-operation rate of 30% in his initial 50 patients, and a significant reduction of 13% for the next 47 (50). Elmore et al. report that the largest number of complications occurred in the first 25 patients (51). Angrisani and colleagues (52) report "disappointing results" of initial laparoscopic operations. Table 2 gives a summary of complications. In the literature, weight loss is defined as a drop of a preoperative BMI of 43-46 to a BMI of 28-32 postoperatively. The target of a 50% -60% reduction of excess weight is attainable (36, 41-58). Belachew et al. (36) demonstrated that 80% of their patients had lost 60% of their excess weight. As documented by O'Brian et al. (43), the excess weight loss was 51% in the first year, 58% in the second, 61% in the third and 68% in the fourth year postoperatively. Studies with a follow-up of over five years confirmed long-term weight loss. A prospective study conducted at this department found no difference in weight loss and complication rate between LAP banding and SAGB after a 4-year follow-up period (58). Top priority is given to the prevention of complications, which are divided into peri-operative and late. Thorough training and an inter-disciplinary approach are essential to the success of treatment. We believe that the laparoscopically implanted AGB, either the LAP-BAND System® or the SAGB®, is an efficient treatment method for patients with morbid obesity. It obviates the need for open surgery on the stomach or small intestine, leaving their anatomy and digestive physiology intact. Long-term metabolic complications are not anticipated. Weight loss and food intake can be adjusted to individual patient needs. A 60% to 70% excess weight loss can be expected in 80% to 90% of patients. As compared to other procedures, this method makes it much easier for the surgeon to remove the band and restore the original situation. It may appear difficult during the learning phase, yet once it has been mastered it proves to be a fairly simple and low-risk operation provided that all safety recommendations are observed. Gastric banding is therefore a relatively safe and efficient treatment for morbid obesity, and it is promising to become an important surgical option in most of these patients.



Gastric pacemaker

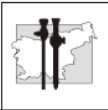
In experiments on pigs in 1995, Cigaina discovered that electrical stimulation of the stomach wall resulted in characteristic patterns of gastric peristalsis in both directions (59). A further pig study demonstrated that stimulation of the stomach wall influenced the animals' eating habits. Animals whose stomach wall had been stimulated ate less. Weight loss is attributed to lower absorption of food or absorption in the gut (60) (Figure 7).

In February 2000, a randomised, placebo-controlled double-blind trial was launched in the U.S.A. and Europe to determine the clinical effectiveness and safety of the Transcend Implantable Gastric Stimulator (IGS). The system consists of two electrodes, which are introduced into the stomach wall with a needle. A wire connects the electrodes with a 60 x 40 x 10.3-mm stimulator, which is implanted below the left costal arch in a subcutaneous pouch, and is programmable from outside. A suitable site is selected on the stomach wall in the gastro-oesophageal transition region. The electrodes are 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 (Figure 6). The conductor wire is then taken to the outside and connected there to the stimulator system (61). Investigation in over 500 patients world wide has shown IGS to be safe and free of long-term complications. With refinements in patient selection and device application, the weight loss results have been steadily improving (62). The IGS may someday become a reliable and safe surgical option for weight loss. No serious post-operative or late complications have been observed with the method. Among the implants in Austria, two patients required tightening of the connection between the wire and the stimulator. This was done under local anaesthesia in day surgery (63). Current results of trials in all the centres show a significant excess weight loss of 32% after 24 months with a stimulator. All IGS implantations have been successful, and there have been no life-threatening or fatal complications (59-63).

Gastro-intestinal stimulation for weight loss in morbid obesity is one of the least invasive surgical techniques available. Many more studies of eating habits and quality of life will be necessary before the effectiveness of IGS relative to other treatment methods for morbid obesity can be definitively established. Whether the high costs (about three times higher than the material cost of an adjustable gastric band) will be justified by outcome remains to be determined by further studies.

Weight loss and co-morbidity

Currently, surgery offers the only viable treatment option with long-term weight loss and maintenance for the morbidly obese. Reduction of a pre-operative BMI of 43-46 to a BMI of 28-32 postoperatively is reported in the literature. A target of a 50-60% reduction of excess weight is achievable. Studies with a long term follow-up of over five years confirmed the maintenance of weight loss after obesity surgery (Figure 7). A prospective study done at this department has shown that 80% of associated diseases have either improved or resolved completely only three years after vertical banded gastroplasty, adjustable gastric banding and Roux-en-Y gastric bypass (17). Morbid obesity is associated with a large number of health risks (64). Studies have produced evidence of a significant reduction of blood sugar, 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, the associated disease (diabetes, high blood pressure, dislipidaemia) resolved after only one year, with significant improvement in a further 24% (64). Dixon et al (65) reported that 17 months after treatment normal blood pressure (RR < 140/90) was observed in 83% of hypertensive patients (78/88). Dixon et al (65), who studied the effects on 48 consecutive patients with reflux disease (GERD) and gastric banding, found that 76% of GERD patients were symptom free only three 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 revealed a significant improvement of this condition in all



of them (100%) in terms of attack rate, medication requirements, hospitalisation and physical stress (66).

Dixon et al (66) reported a reduction of sleep apnoea and a significant improvement of obstructive airways disease in patients with the LAP-BAND® system.

Similar results were published by Alvarez-Cordero et al (67). Nine of ten patients in their study needed no medication for hypertension, and six of 11 no longer needed oral antidiabetics. Sleep apnoea resolved in all patients who had suffered from this disorder before the operation (69). Reduction of co-morbidity as a result of significant weight loss due to adjustable gastric banding and gastric bypass has been confirmed in many publications (64-71). If the patient fails to lose weight quickly enough, complications, such as band slippage or leakage, should be ruled out before referring the patient to the psychologist and dietician.

In most patients, surgically induced weight loss will improve hypertension, type II diabetes mellitus, sleep apnea, obesity hypoventilation syndrome, gastroesophageal reflux, venous stasis disease, urinary incontinence, female sexual hormone dysfunction, pseudotumor cerebri, pains due to degenerative joint diseases, and will improve self-image and employability.

Quality of life

Severe obesity has been associated with disordered eating, impaired quality of life and decreased physical activity. Quality of life is significantly improved in morbid obesity patients (72-75), both in terms of life expectancy (76), physical activity and satisfaction (72). According to an analysis by Weiner et al (73), quality of life improves significantly in 92% of patients. In one of our studies we 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 Moorehead-Ardelt Quality of Life Questionnaire (75) was originally developed as a disease-specific instrument to measure post-operative outcomes of self-perceived quality of life in obese patients. Five key areas were

examined: self-esteem, physical well-being, social relationships, work, and sexuality. Each of these questions offered five possible answers, which were given + or - points according to a scoring key. The Bariatric Analysis and Reporting Outcome System (BAROS), developed by Oria and Moorehead (76) has become the accepted assessment method for quality of life and treatment outcome after bariatric surgery. The BAROS assessment score covers weight loss (from -1 for weight increase to +3 for 75-100% excess weight loss), co-morbidity (from -1 for deterioration to +3 for completely resolved) and the quality of life questionnaire (self-esteem, physical activity, social contacts, job satisfaction, sexuality - (+3 max. and -3 min.)). Points are lost for complications (1 point) and re-operation (1 point). A score of 7-9 points is thus excellent, a score of 4-6 points good and a score of 1-3 points satisfactory, with -3 to 0 points indicating failed treatment. The health status and quality of life assessment after surgery for obesity is summarised in Table 3 (75). Favretti et al report on excellent and good results in 48% of patients with the 170 LAP-BAND® system (74). The failure rate in this group was 10%. Klaiber et al. reported a 3.9% failure rate in his patients with the SAGB® system (55). Thanks to the adjustability of the band system, in female patients the stoma can be adjusted to assure a normal pregnancy if this occurs (77). Patients rate the success of adjustable gastric banding very highly due to weight loss, reduction of comorbidity and improvement of quality of life (78).

The overall BAROS assessment of laparoscopically implanted gastric banding, band assisted gastroplasty and gastric bypass shows a significantly higher rate of excellent results for the gastric bypass compared to gastroplasty (80% vs. 71%)(16). Biliopancreatic diversion (BPD) is the most effective bariatric procedure in terms of weight loss. The BAROS score revealed good, very good and excellent results in 92% of patients (79).

In the case of surgery failure, Orlistat® (Roche Comp.) could be a good option as an adjuvant medical therapy (73), especially in patients with lower weight loss due to surgical complications. Chronic diseases and poor psycho-social functioning associated with obesity often lead to considerable functional impairment and loss of



working capacity. The Swedish Obese Subjects (SOS) study showed that the length of sick leave and the rate of disability retirements are nearly doubled in obese subjects compared to the general population (81). This five-year prospective study indicated that surgical treatment results in a decrease in sick leave and disability retirement rates in the obese population (81).

Conclusion

Surgery for obesity has proved to be the most effective option for preventing life-threatening complications and serious degenerative problems associated with morbid obesity, which is indicated by the ineffectiveness of non-surgical treatment methods and high risk associated with

untreated obesity (82-83). Safe and effective surgical methods increase life expectancy and improve quality of life in patients with extreme excess weight. Operations for massive obesity, which have been developed over the last 40 years, are based on malabsorption or gastric reduction, or a combination of both. These operations are being extended into the laparoscopic realm. Surgery has been found to be the only way leading to sustained significant weight loss, with reversal of co-morbidities and rehabilitation, and with an acceptable complication rate in the majority of these patients. The most obese patients are the ones who benefit the most, but they are also the highest risk. (84).

Table 1

Postoperative care provided in this institute. VBG - vertical banded gastroplasty, AGB - adjustable gastric banding, IGS – implantable gastric stimulation, GBP - gastric bypass.

Key: √ - recommended ∅ - not essential √/∅ optional

Optional and if needed at any time: psychological counselling, dietary advice, and therapeutic physical exercise and self-help groups

Timing	Therapy	VBG	AGB	IGS	GBP
Day 1 postop.	X-ray	√	√	∅	√
Day 7-8	Check during suture removal	√	√	√	√
	X-ray	∅	∅	√	∅
Week 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.)	√/∅	√/∅	∅	√

**Table 2**

Complications with the adjustable gastric band (34-58)

Complications:	Incidence (%)
Perioperative 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

Practice Points

- Surgery is now considered to be the most effective way of reducing weight and maintaining weight loss, and is indicated in morbidly obese (BMI > 40) and severely obese (BMI > 35) subjects with comorbidity.
- Adjustable gastric banding, Roux-en-Y gastric bypass, biliopancreatic diversion / duodenal switch and the use of certain laparoscopic techniques are among the procedures considered effective.
- Surgery should be undertaken only by experienced surgeons in an appropriate clinical setting which incorporates expert medical surveillance, access to ventilator facilities and the support of a multi-disciplinary team.
- Weight reduction surgery has been reported to improve or resolve several comorbid conditions, such as sleep apnea and obesity-associated hypoventilation, glucose intolerance, frank diabetes mellitus, hypertension, and serum lipid abnormalities.
- Liposuction of unwanted subcutaneous fat depots is being used extensively for cosmetic reasons but offers no medical benefit in terms of co-morbidity associated with obesity.

Research Agenda

- Patient selection criteria for different operative procedures have to be determined
- The “gold standard” surgical procedure has not yet been found
- There is a lack of comparative studies of bariatric procedures
- Significance of two-stage procedures in high-risk cardiopulmonary patients

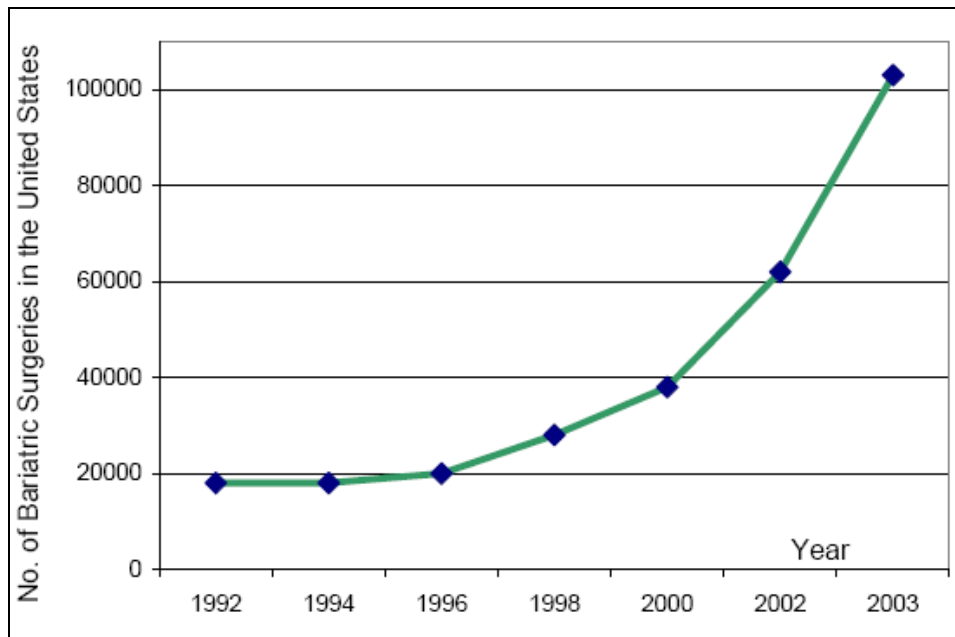


Figure 1
 Estimated Number of Bariatric Operations performed in the United States, 1992-2003. Data from the American Society for Bariatric Surgery

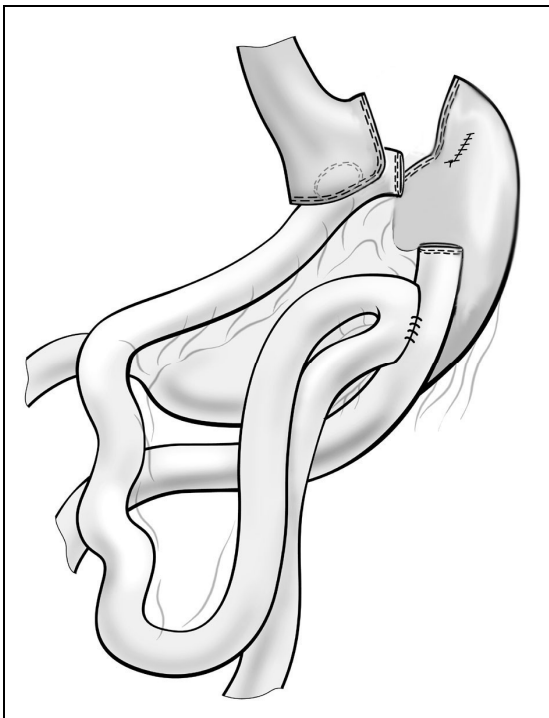


Figure 2
 Laparoscopic Roux-en-Y gastric bypass. Example of the laparoscopic antecolic circular stapled gastro-jejunostomy and a side-to-side enterostomy.

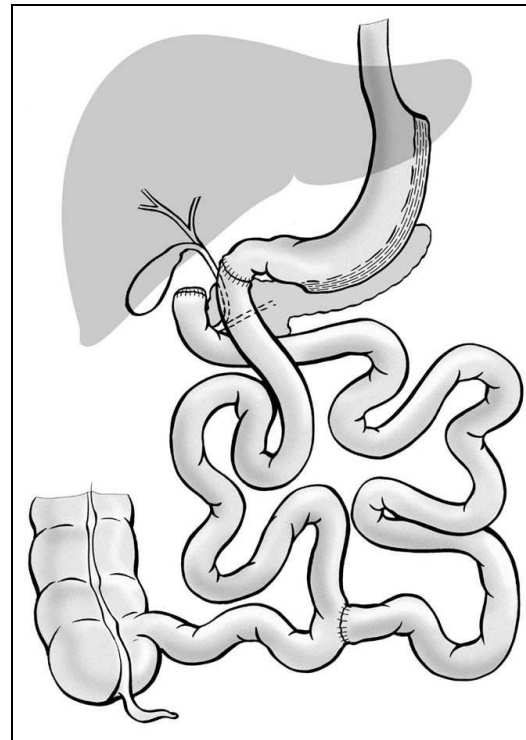


Figure 3
 Duodenal switch procedure

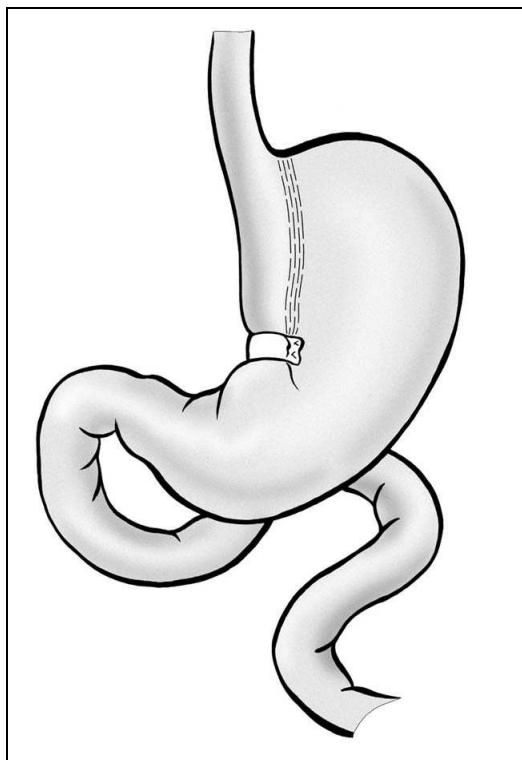


Figure 4
Vertical banded gastroplasty

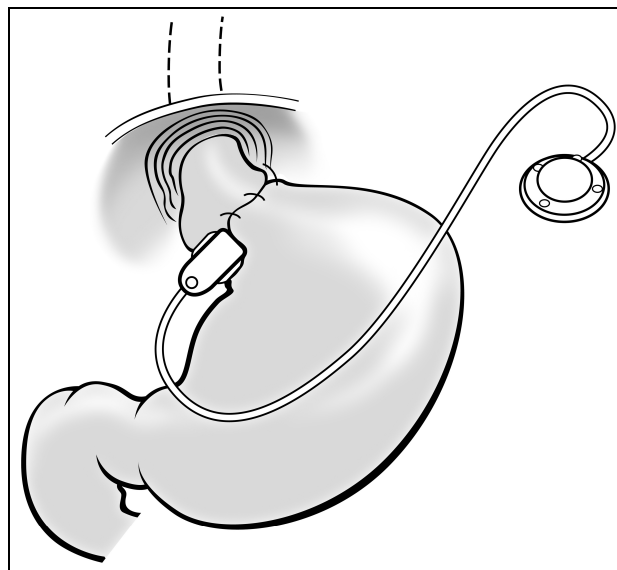


Figure 5
Adjustable gastric banding. Tunnelled sutures to prevent slipping of the band or of the stomach

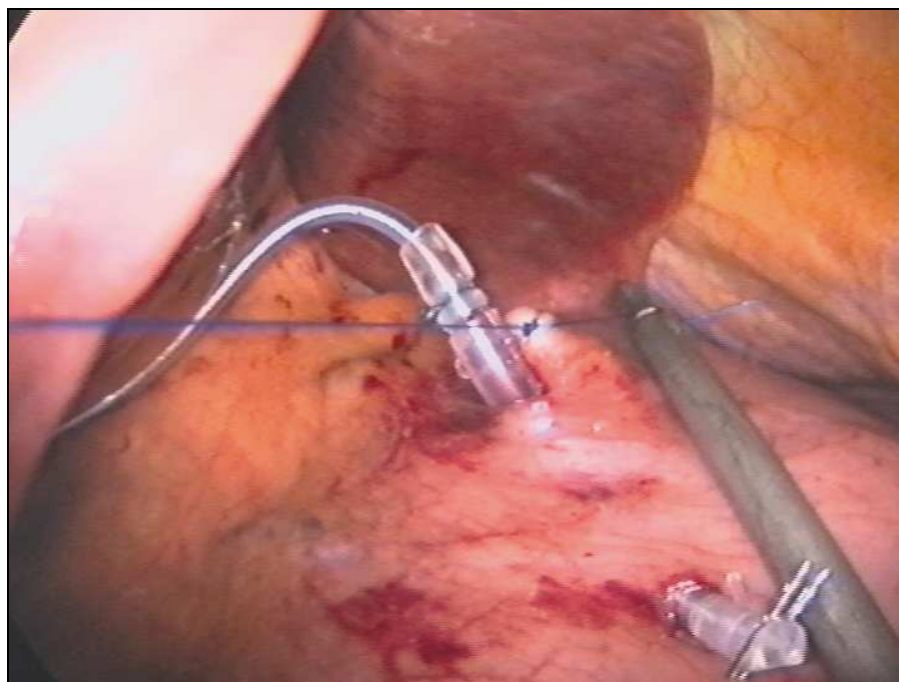


Figure 6
Implantable gastric stimulation (IGS). The lead is secured proximally with two PDS sutures, and distally with a clip

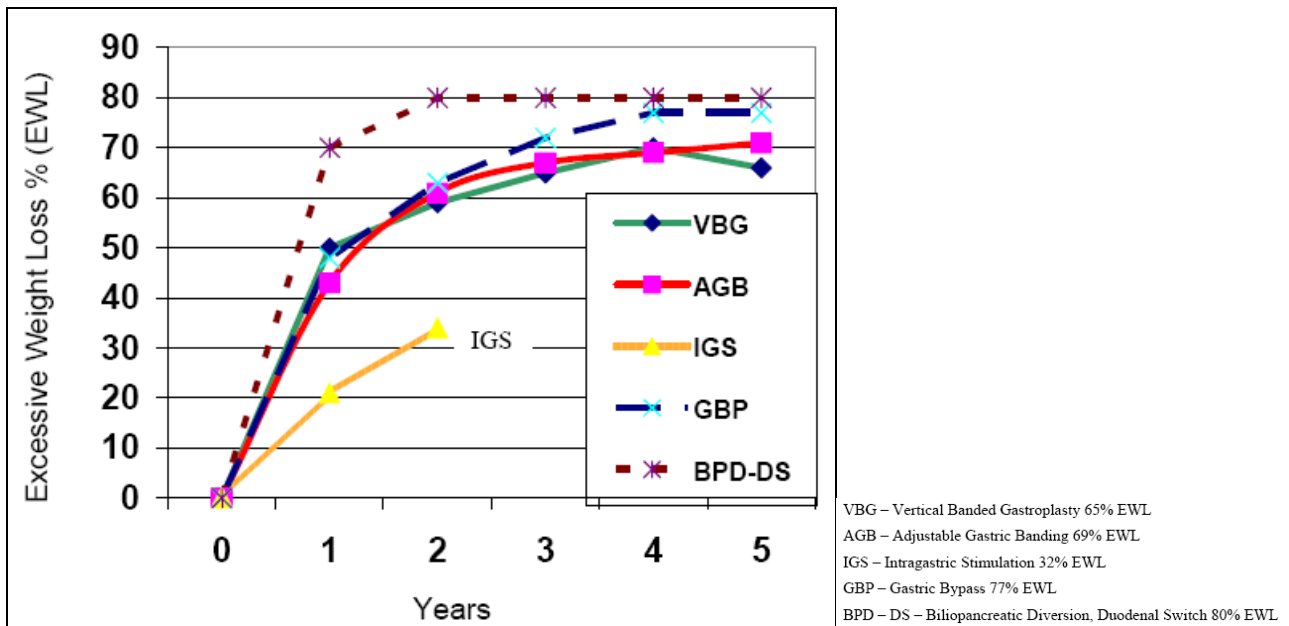
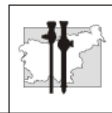
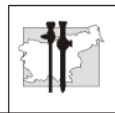


Figure 7
Excessive weight loss in % after different bariatric procedures

Literature

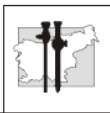
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