

Michael Korenkov, Wendy A. Brown,
Andrew I. Smith, Leonid Lantsberg,
Thomas Manger, Rishi Singhal, and Paul Super

Introduction

Gastric banding is one of the so-called restrictive procedures in bariatric surgery. The aim is to limit the size of the stomach to a small pouch, which is created by tightening the gastric band (Figs. 2.1 and 2.2).

At first the idea of restricting the size of the stomach was carried out by performing gastropasty. This procedure however was irreversible and the laparoscopic procedure faced major technical difficulties. Also the band was not adjustable, which is why this procedure is hardly performed anymore and has been replaced by adjustable gastric banding.

M. Korenkov (✉)

Abteilung für Allgemein- und Visceralchirurgie,
Klinikum Werra-Meißner, Akademisches
Lehrkrankenhaus der Universität Göttingen,
Elsa-Brendström-Straße 1, 37269 Eschwege, Germany
e-mail: michael.korenkov@klinikum-wm.de

W.A. Brown

Australian Centre for Obesity Research and Education,
Monash University Clinical School, The Alfred Hospital,
Commercial Road, Prahran, Vic, 3181, Australia
e-mail: wendy.brown@med.monash.edu.au

A.I. Smith

Australian Centre for Obesity Research and Education,
Monash University Clinical School, The Alfred Hospital,
Commercial Road, Prahran, Vic, 3181, Australia

L. Lantsberg

Surgical Unit, Chairman of Israeli Endoscopic Surgical Society,
Soroka University Hospital, Beer-Sheva, 84100, Israel
e-mail: leolant@bgu.ac.il

T. Manger

Department of General, Abdominal and Paediatric Surgery,
SRH Hospital Wald-Klinikum Gera GmbH, (Teaching Hospital
of the Friedrich-Schiller-Universität at Jena), Germany

R. Singhal • P. Super

Upper GI and Minimally Invasive Unit, Birmingham
Heartlands Hospital, Bordesley Green East, Birmingham,
B5 9SS, Great Britain
e-mail: singhal_rishi@rediffmail.com;
paul.super@heartofengland.nhs.uk

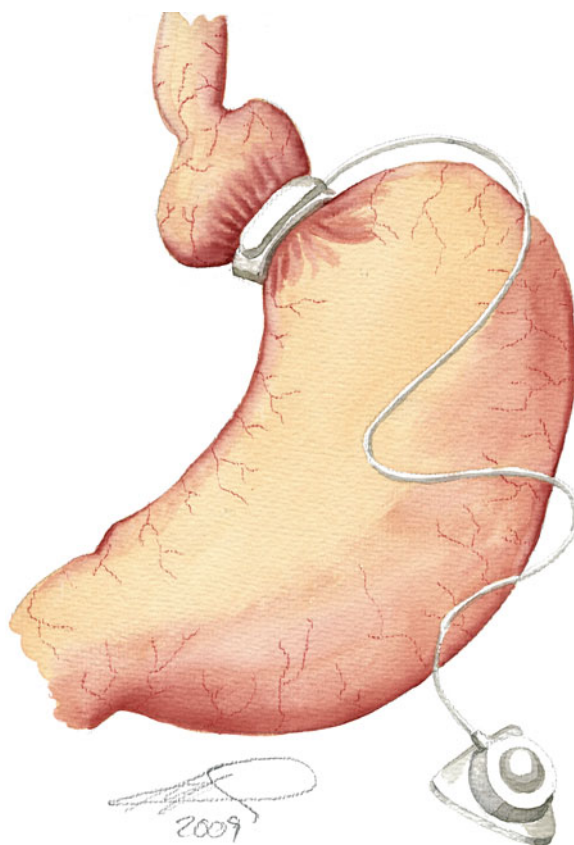


Fig. 2.1 Gastric banding

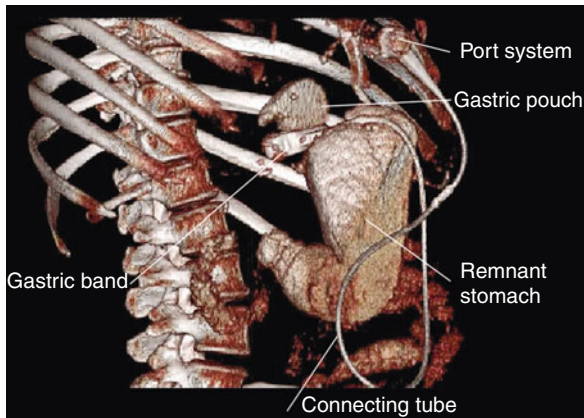


Fig. 2.2 CT-reconstruction of a gastric band (courtesy of Dr. Ingrid Harth, Radiologisches Institut, Kreiskrankenhaus Eschwege)

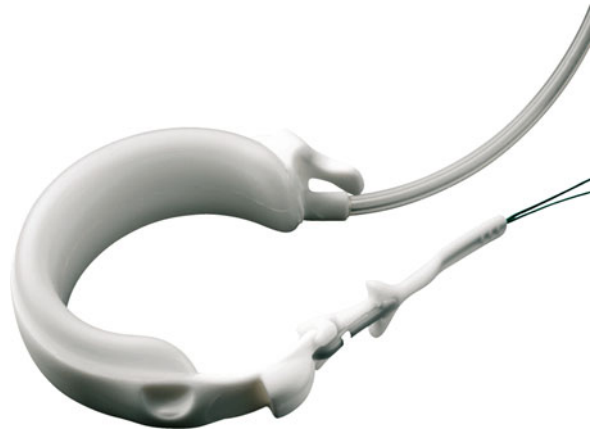


Fig. 2.4 SAGB (courtesy of Ethicon)



Fig. 2.3 Lap-band (courtesy of Allergan)

Today inflatable adjustable bands are usually chosen. A silicone ring with a soft inflatable balloon inside is connected to an access port just under the skin via a small tube. The band is then adjusted by injecting saline through the port. The most popular bands are the Lap-Band (Allergan) and the SAGB (Ethicon) (Figs. 2.3 and 2.4).

Frequent problems occur concerning the port (port rotation, leakage, difficult injections, pain around the port, exposure to radiation etc.) which is why better ports are developed today or alternatively remote adjustable gastric bands, which are tested in clinical trials at the time (Fig. 2.5).

Even though the laparoscopic placement of an adjustable gastric band is considered to be one of the simpler bariatric procedures, there still are several technical difficulties and pitfalls.



Fig. 2.5 Remote adjustable Gastric band (courtesy of Allergan). (1) A control unit sends energy and information telemetrically to the easyband through magnetic induction. (2) Antenna: magnetic induction is sent to the antenna, which is connected to the easyband. (3) A microchip saves the adjustments of the easyband

The first to place an adjustable gastric band was Belachew (1983). His technique is referred to as the perigastric pathway. A higher rate of intraoperative complications (i.e., stomach perforation) and band-related complications (i.e., slippage or band migration) was observed, however. The method was therefore abandoned in favor of the pars-flaccida approach. There are only a few occasions when the perigastric pathway may be preferable.

Fig. 2.6 Positioning of the patient for laparoscopic gastric banding



Preparation

Setting, Positioning, and the Surgical Team

- The monitor is placed on the patient's right side, either above or below the outstretched right arm. An additional monitor can be placed on the left side (Fig. 2.6 and 2.7).
- As in every laparoscopic procedure, gastric banding also begins with positioning the obese patient correctly. He is positioned in the lithotomy position, with the upper body tilted upward in a 45° angle (reversed Trendelenburg position). Adequate measures to prevent slipping are mandatory.
- The surgical team consists of the surgeon, an assistant holding the camera, a second assistant, and the scrub nurse. A post to secure the liver retractor can be used instead of a second assistant.
- The surgeon stands between the patient's legs. If there is one assistant, he will stand on the patient's left side, work the camera with his left hand and a grasper with his right hand. If there are three surgeons on the team, the first assistant can stand on either side.
- The scrub nurse stands next to the patient's left leg. If the operating surgeon is left-handed, she can also stand on the right side.



Fig. 2.7 Set up of the surgical team and the laparoscopy stack

Installation of the Pneumoperitoneum

Many bariatric surgeons use the well-established approach with the extra-long Veress needle (Fig. 2.8).

Some surgeons prefer optical trocars that allow visual control of the access to the peritoneum and the creation of the pneumoperitoneum, thereby requiring only a minimal depth of puncture for entering the peritoneum and gas insufflation. They provide a good alternative to the Veress needle. We use the fiber optic equipped safety needles for the creation of the pneumoperitoneum more often now, but they are more expensive than the Veress needle (Fig. 2.9).



Fig. 2.8 Insertion of the Veress needle into the left upper abdomen under the costal margin

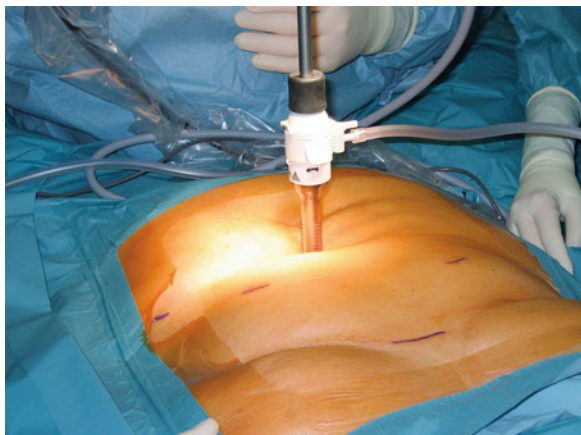


Fig. 2.9 Insertion of an optical trocar under visual control

In some rare occasions an “open” approach is chosen. The incisions are placed either supraumbilically or on the left upper abdomen, where some larger incisions for the port placement will be performed toward the end of the procedure anyway. These approaches are not suitable for severely obese patients with a BMI over 50, because a comparatively large cut will be necessary. A complete insulation is also difficult to achieve, which may lead to continuous gas leakage during the procedure.

- Place the needle in the left upper abdomen just under the left costal margin on the medioclavicular line. Another possibility is the supraumbilical approach via the incision for the camera.

We prefer the approach through the left upper abdomen, because the abdominal wall is thinner here than around the umbilicus and therefore the puncture path for the needle is shorter. This close to the costal margin the abdominal wall is also more “taut” which facilitates the insertion of the needle.

- The puncture site in the left upper abdomen will be widened after removing of Veress needle and used for the working trocar.

In obese patients with a long distance between the skin and peritoneum, one can lose the “feel” for the Veress needle during placement. In these cases we prefer the so-called double-click technique; after the second “click” the needle is not inserted any further.

- Install a maximum intraabdominal pressure of 14 mmHg.

In patients with a BMI over 50, this pressure is sometimes not high enough to lift the heavy abdominal wall sufficiently. In this case, we begin with a pressure of 20 mmHg and reduce to 14 mmHg after positioning the optic.

Positioning the Trocars

Lifting the abdominal wall for the closed approach is difficult and sometimes impossible. The abdominal wall is stretched and decompressed in the process, which elongates the distance between the skin and the peritoneum. In some cases the peritoneum cannot be reached, not even with the extra-long trocars. For these reasons we do not lift the abdominal wall from the outside, but take care to lift it by establishment of a pneumoperitoneum.

Attention: The trocar sites are indicated as seen from the patient’s view and not from the surgeon’s; the left working trocar is therefore inserted left to the patient’s middle line (Fig. 2.10).

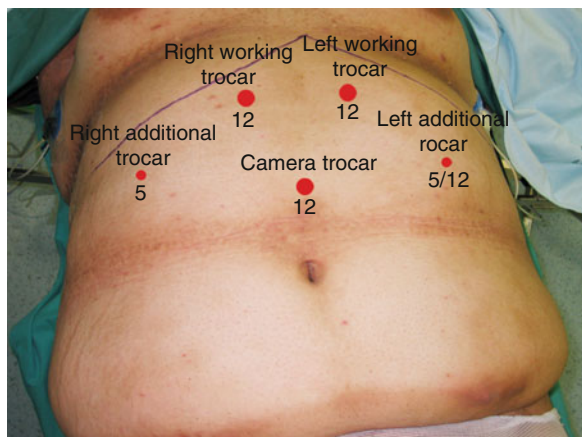


Fig. 2.10 Position of the trocars in relation to the patient

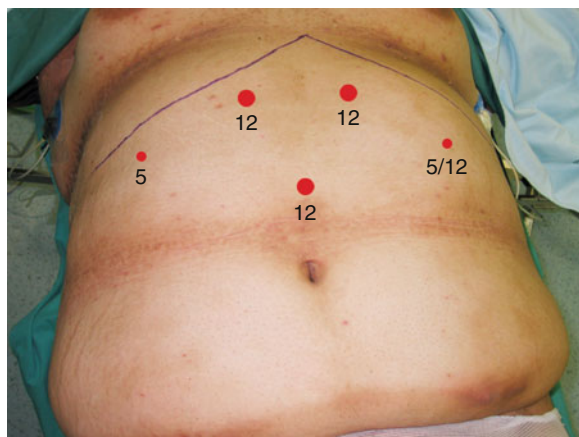


Fig. 2.11 High position of the working trocars

- Insert the first trocar in the middle line above the umbilicus.

We suggest to insert the optical trocar slightly left of the middle line to avoid having to go through a thick ligamentum teres hepatis. In patients with a BMI under 50 we insert the first trocar a short distance left of the line between the xiphoid and the umbilicus, about one third of the distance above the umbilicus. In patients with a BMI over 50, we place the first trocar a short distance left of the middle between xiphoid and the umbilicus to avoid the optic being “too short.”

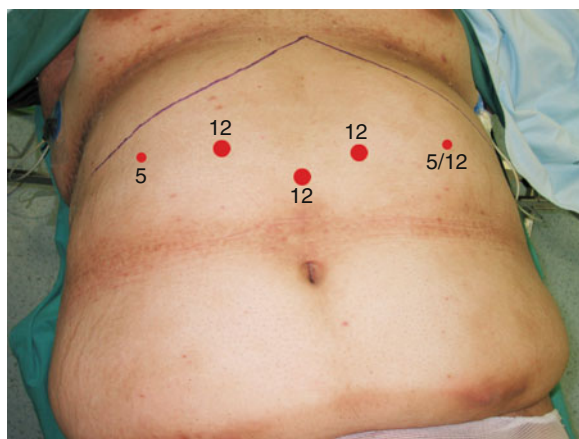


Fig. 2.12 Low position of the working trocars

- Some surgeons prefer five trocars, other use four. They are placed above the umbilicus in the upper abdomen, the exact positioning varying from surgeon to surgeon. Basically a high position is distinguished from a low position.
- For the high position place the working trocars (both 12 mm) left and right of the middle line below the xiphoid (Fig. 2.11). For the low position the trocars are placed much further laterally and lower on the medioclavicular line just under the costal margin (Fig. 2.12). The additional trocars (5 or 12 mm, depending on the graspers and the liver retractor in use) are positioned in the upper abdomen lateral to the medioclavicular line.

Some surgeons prefer a so called *compact-pyramidal position of the trocars*. The additional trocars are placed, similar to the working trocars in the high position, left and right to the middle line, just below the xiphoid. The working trocars are placed much further down (slightly below the optical trocar) medial to the medioclavicular line (Fig. 2.13).

Surgical Technique: Pars-Flaccida Pathway

After placing the trocars and exploring the abdominal cavity with either an angled or a straight laparoscopic camera the left hepatic lobe is lifted upward

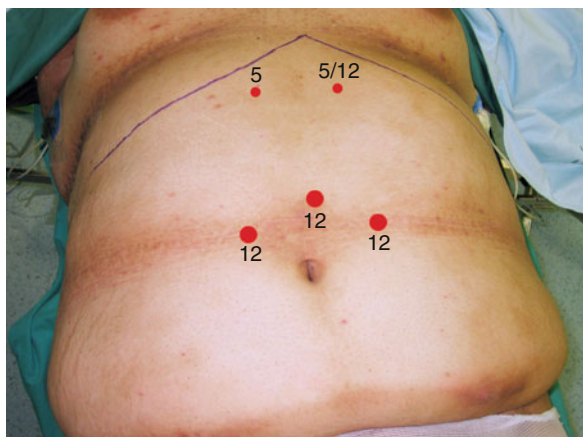


Fig. 2.13 Compact-pyramidal positioning of the trocars in laparoscopic gastric banding



Fig. 2.14 Pars flaccida

and to the right with a liver retractor. The stomach is grasped close to the lesser curvature below the cardia and stretched to the left. Now the dissection can be performed.

There are basically three different pathways:

- Pars-flaccida pathway
- Perigastric pathway
- Combined approach (perigastric/pars-flaccida).

Today the pars-flaccida approach is usually chosen. This pathway was developed by Rudolf Weiner (1997) as an alternative to the perigastric pathway and its high rate of complications (stomach perforation, slippage).

Step 1 – Dissection of the Pars Flaccida

- Place the trocars in your preferred position. Grasp the stomach through the left additional trocar with a Babcock forceps just below the cardia close to the lesser curvature and pull it to the left. The pars flaccida (the transparent section of the lesser omentum) is now visible.

Step 2 – Opening the Pars Flaccida

- Cut into the pars flaccida with a cautery hook through the left working trocar (Fig. 2.14). Grasp the perigastric fat tissue through the opened pars flaccida, using the Babcock forceps through the left additional trocar and again pull to the left.

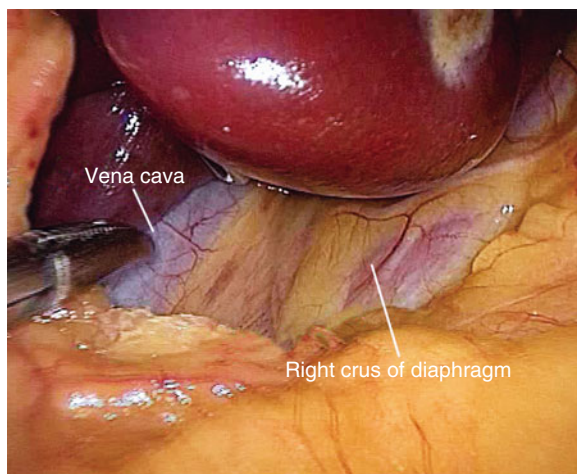


Fig. 2.15 Dissection of the right crus of diaphragm and the vena cava

Take care not to grasp the blood vessels of the lesser curvature!

Step 3 – Dissection of the Right Crus of Diaphragm

- The right crus of diaphragm is now visible.

Not to be confused with the vena cava! (Fig. 2.15).

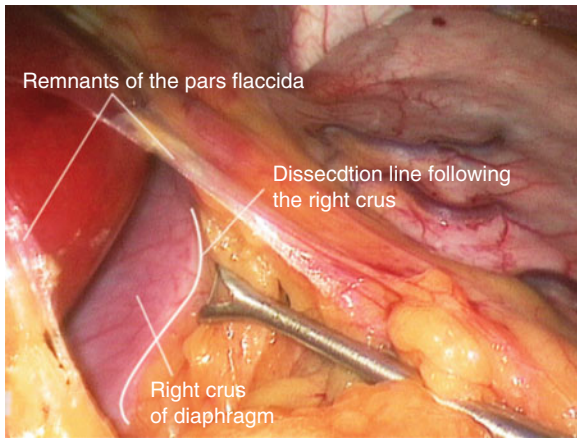


Fig. 2.16 Cutting along the right crus of diaphragm

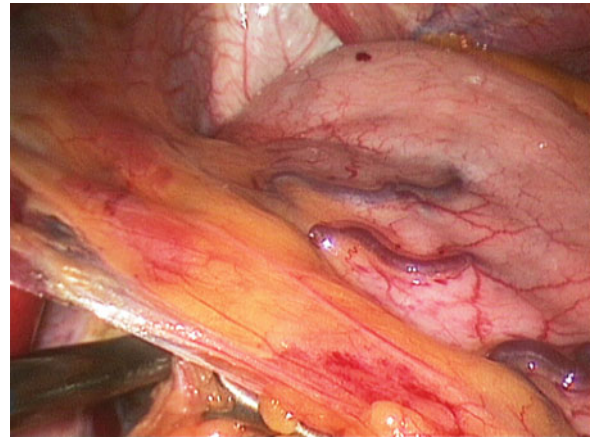


Fig. 2.17 Blunt retrogastric dissection toward the angle of His

Step 4 – Splitting the Peritoneum Along the Medial Edge of the Right Crus of Diaphragm

- Now open the peritoneum with a cautery hook close by and along the right crus of diaphragm, going caudally. To tense the peritoneum, pull the right crus of diaphragm in the opposite direction with an atraumatic grasper through the right working trocar (Fig. 2.16).

Step 5 – Preparation of a Retrogastric Channel

After opening the retroperitoneal space continue the preparation toward the angle of His. You are now between the left crus of diaphragm and the backside of the stomach.

Do not enter the posterior mediastinal cavity behind the left crus of diaphragm.

- For the blunt dissection use the grasper (right working trocar) and the dissection probe (coagulation suction tube, left working trocar) (Fig. 2.17). To avoid sliding behind the left crus of diaphragm and thereby producing a false tunnel in the posterior mediastinal cavity, always hold the instrument in the right working trocar parallel to the stomach. We avoid producing a too broad retrogastric tunnel.
- Finish dissection in projection to the right angle of His, without cutting the tip of the instrument free

there. Dissection can take place in a practically avascular area. A slight capillary hemorrhage that might occur here will stop spontaneously.

Step 6 – Introducing the Gastric Band into the Abdomen

- After dissection the prepared gastric band is introduced into the abdomen. This can either be done through the working trocar or the working channel left after removal of the working trocar. If using the trocar, insert a guiding rod into the trocar in the left upper abdomen and remove the trocar. Use the rod to then insert a special 18-mm trocar.
- Introduce the gastric band through the “band trocar” (Fig. 2.18). Hold the band by its locking area (not by the tube) with an atraumatic grasper and introduce the stretched band into the abdomen.

Using a 15 mm “universal” trocar from the start saves changing the trocars.

- The introduction of the band can be done in different ways. One possibility is *from the outside to the inside*: Dilate the working channel with a custom-made rod. Then push the band, held and stretched with an atraumatic grasper, into the abdomen; first the band itself, then the tube (Fig. 2.19). Another possibility is going *from the*



Fig. 2.18 Introduction of the gastric band through the “band trocar” into the abdomen

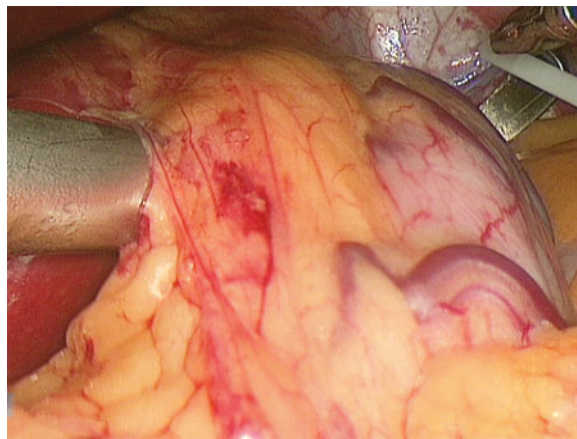


Fig. 2.20 Dissecting the tip of the flexible dissector near the angle of His

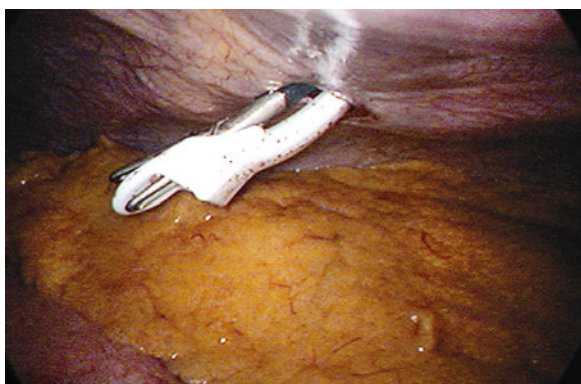


Fig. 2.19 Introduction of the gastric band through the trocar’s canal into the abdomen

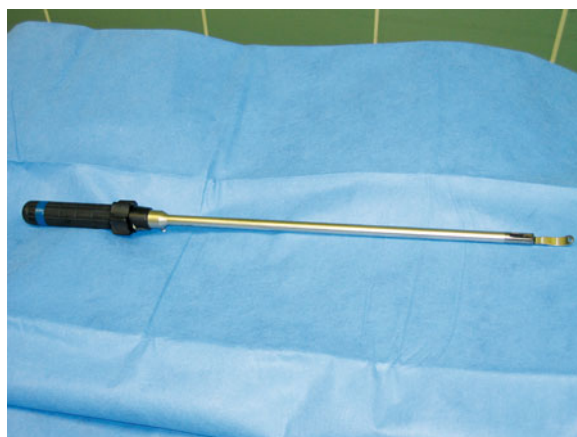


Fig. 2.21 Flexible dissector for the implantation of the lap-band

inside to the outside. Here a grasper, preferably one with a stable tip, is inserted into the abdomen through the right working trocar and out again through the left working (or the additional) trocar. This trocar is then removed, leaving the tip of the grasper showing 5 cm above skin level. Now hold the band by the locking area (not the band itself) and pull it into the abdomen. Then return the removed trocar to its place.

Step 7 – Placing the Band

- Now place the flexible dissector into the before prepared retrogastric tunnel. Dissecting the tip of the dissector near the angle of His free (Fig. 2.20). Technical details may vary at this point depending on the brand of the band.

Some surgeons prefer an atraumatic grasper or a dissector with a markedly bent tip to the flexible dissector.

Implantation of the Lap-Band

- We favor the flexible dissector for the lap-band (Fig. 2.21). The tip features a slot for the strap of the lap-band. Grasp it between the end of the strap and the beginning of the tube with a grasper and pull it into the slot from the in- or the outside.
- Then pull the strap up through the slot up to the beginning of the tube. This maneuver ensures a safe hold of the strap in the slot; it is kept from falling out while the flexible retractor is pulled back.

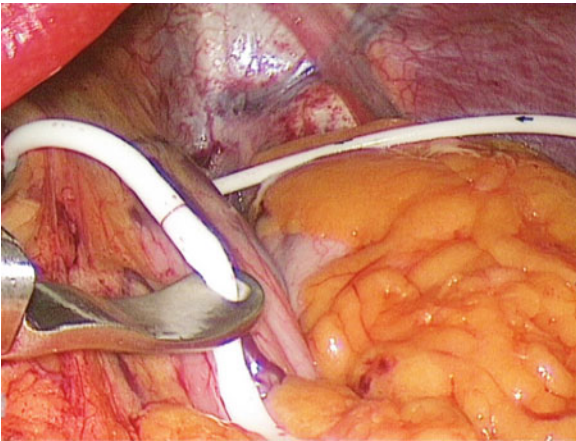


Fig. 2.22 Pulling the band around the backside of the cardia

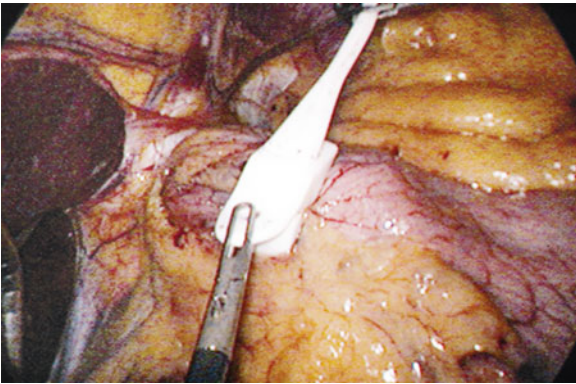


Fig. 2.23 Locking the lap-band

- Then straighten the tip of the articulating dissector and pull the end of the gastric band around the back side of the cardia. Then remove the strap from the slot with a grasper (Fig. 2.22).
- After removing the flexible retractor from the right working trocar insert a second atraumatic grasper. Close the band with the two graspers. The lap-band features a strap at the end; pull it through the loop of the locking mechanism until it is closed completely (Fig. 2.23).

We do not use a calibration balloon for the creation of the pouch. We consider this step redundant when using the pars-flaccida pathway, because the gastric band is always located at the same place and can hardly move vertically because the preparation tunnel is very narrow.

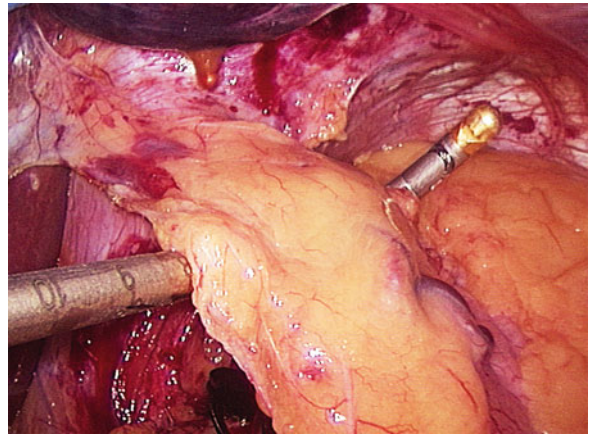


Fig. 2.24 Goldfinger for the placement of an SAGB

Implantation of a SAGB

The implantation of a SAGB differs from the procedure for the lap-band in some steps.

- Retrocardiac dissection and placement of the band is performed with the so-called goldfinger instead of a flexible retractor (Fig. 2.24).
- Insert the string attached to the end of the band into the slot at the tip of the device.
- Then straighten the goldfinger and pull the band into the retrogastric tunnel.
- To close the SAGB, insert an atraumatic grasping forcep through the loop of the locking mechanism. Then grasp the other end of the band and close the band. It is not necessary to pull the entire band's tube through the loop.

Step 8 – Anterior Gastroplication

After closing the band, perform an anterior gastroplication to prevent dislocation of the band. Suture the anterior wall of the stomach to the anterior wall of the pouch with several single sutures, using nonabsorbable material. In patients with a large fat pad around the gastroesophageal junction the dissection of the serosa above the band can be difficult.

In patients with a BMI over 50 we deliberately omit anterior gastroplication, because the procedure is often difficult and may lead to serious complications, such as esophageal perforation or hemorrhage from the perigastric tissue. We believe on the other hand that the gastric band is already secured safely in the narrow preparation tunnel (pars-flaccida approach) and the massive perigastric fat tissue, especially the precardial fat pad.

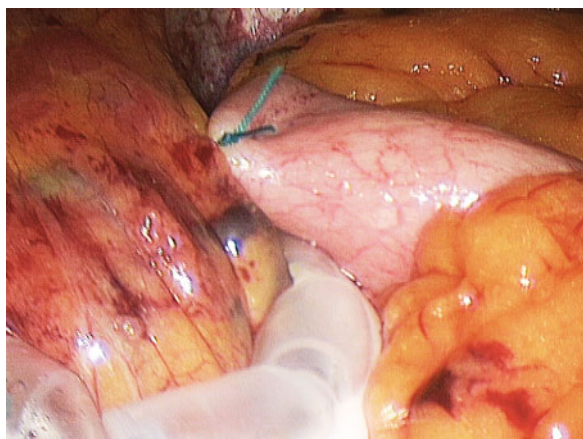


Fig. 2.25 First suture in gastropllication

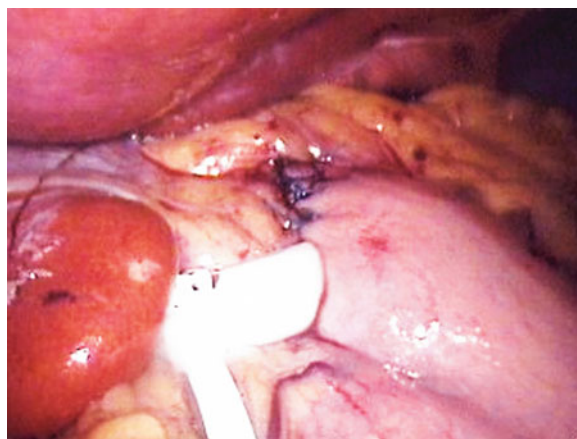


Fig. 2.26 Completed gastropllication

- For precise placement of the suture hold the gastric band with an atraumatic grasper through the left additional trocar close to the locking area. Pull the tube downward diagonally toward the right lower abdomen and hold under slight tension.
- Now grasp the anterior wall of the stomach above the band with a Babcock forceps through the right working trocar and pull cranially. This way the serosa of the stomach wall above the band can be dissected more easily.
- Place four to five single sutures (nonabsorbable).

We consider it important to place the first suture on the left side (toward the spleen) as far laterally into the fundus as possible (Fig. 2.25).

- The sutures are directed toward the lesser curvature. This way up to five single sutures can easily be placed (Fig. 2.26). We believe that a more effective way of avoiding slippage can be thus achieved, although evident data are not available yet.
- Alternatively the gastric fundus can be sutured to the right crus of diaphragm (three sutures on average). Sometimes, however, the stomach is sutured to tightly over the band, which may lead to a persistent singultus or shoulder pain.

Never suture the gastric fundus to the anterior wall of the esophagus. This can produce too much tension, resulting in rupture of the sutures, perforation of the esophagus, and consequent complications.

Step 9 – Implantation of the Port

The intraabdominal part of the procedure is finished after anterior gastropllication. The implantation of the port system is next. A careful execution of this part of the procedure is of great importance, as most of the late complications in gastric banding are related to the port system.

The port chamber can be placed on top of the aponeurosis of the rectus abdominis muscle in the left upper abdomen or presternally over the lower third of the sternum. In patients with a BMI under 50, we position the port in the abdominal wall; in patients with a BMI over 50, we chose the presternal location.

A port positioned in the abdominal wall in the widened insertion site of the working trocar is aesthetically more pleasing, an additional incision is not necessary. Inserting a cannula, however, is much more difficult and is usually performed under x-ray or ultrasound control. A presternally positioned port is much easier to puncture, but the port chamber is clearly visible and can cause chronic pain in women, if the elastic band of a bra runs over it.

- The tube is pulled out through one of the trocar insertion sites, depending on the chosen position. We always avoid the insertion site that will hold the port chamber. The tube might tear off due to shear forces resulting from a strong kinking of the tube. For the presternal port position, the tube is pulled out through the left working trocar, for the position in the abdominal wall through the supraumbilical trocar.
- Then the incision is enlarged to about 4–5 cm or a new horizontal incision is made presternally.

When planning a presternal position for the port in women, mark the lower edge of the bra beforehand so that the port chamber can be placed below this line. This way chronic pain which can result from pressure from the bra can be avoided.

- Insert an atraumatic grasper at the port site and move it subcutaneously over to the tube.
- Grasp the end of the tube and pull it back to the prepared pouch. Fasten a suture to the tube, with which it can be pulled back in place after the port chamber is positioned.
- Connect the tube to the port and suture the port chamber per hand or with a stapler to the fascia. Take care to fasten the port chamber straight and securely to keep it from tilting later.

Fastening the port chamber with a stapler is faster than suturing per hand, but the incision must be 1–1.5 cm larger in order to use the stapler correctly.

- After fastening the port pull the excess length of the tube back with the suture. Then remove the suture and push the excess length of the tube back into the abdomen with an atraumatic clamp.
- There are several different stapler systems commercially available, depending on the brand of the band. The implantation of the port chamber is done a little faster with a stapler than per hand, but it requires a slightly larger incision. Insert the chamber into the lower part of the stapler. Then position the stapler onto the fascia, press it down slightly, and fire. The chamber is fastened with the metal clamps in the stapler. So far there are no long-term evaluation data available comparing the fixation of the port chamber with a stapler to a suture performed by hand.

Surgical Technique: Perigastric Pathway

The perigastric pathway has almost completely been abandoned in favor of the pars-flaccida approach today, but in certain situations it can be helpful. We use this technique very rarely in revision procedures after



Fig. 2.27 Perigastric pathway, beginning dissection close to the lesser curvature

failed gastric banding, because the technical steps of revision procedures vary greatly, which is why we describe the perigastric pathway as a primary procedure for educational reasons.

- Dissection begins at the lesser curvature just above the first branch of the small curvature's vessels (crow's foot). The right crus is not dissected (Fig. 2.27).

The crow's foot is not always easily found, especially not in extremely obese patients. In this case a calibration balloon can be used or the exact point of dissection is chosen by intuition.

- If a calibration balloon is used, the tube is introduced into the stomach. Make sure the tip of the tube is inside the stomach by moving it up and down slightly.
- Then fill the balloon with 25 cm³ of saline and pull it back to the GE junction.
- The tip of the balloon marks the starting point for dissection (Fig. 2.28). When working without a calibration balloon, begin as far cranial as possible and close to the GE junction. Grasp the upper third of the stomach with the Babcock forceps (left additional trocar) and pull to the left toward the spleen.
- Grasp the densely vascularized fat tissue of the lesser curvature with the atraumatic grasper (right working trocar) and pull it toward the liver.

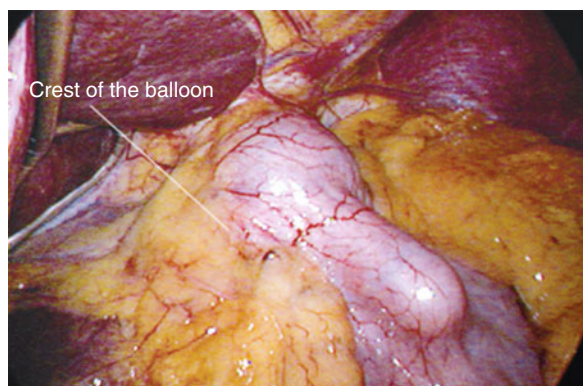


Fig. 2.28 The apex of the calibration balloon at the lesser curvature marks the starting point for dissection

- When sufficient tension is established, begin dissection in the avascular zone between stomach wall and fat tissue. Use a cautery hook or an ultrasound cutter.

At this point a slight diffuse hemorrhage occurs usually, which stops spontaneously. Injury of a blood vessel at the lesser curvature however leads to massive bleeding, which can be quite difficult to control. The bleeding vessel must be secured tightly with ultrasound scissors or clips.

- The dissection tunnel should be narrow (only about as wide as the band itself) and run above the omental bursa at all times. After skeletonizing a small section of the lesser curvature, proceed to blunt dissection toward the angle of His, staying close to the stomach wall.

We avoid the use of monopolar electricity or the ultrasound scissors within the retrogastric tunnel in order to protect the stomach wall from thermal injury.

- The slight diffuse hemorrhage that may occur during blunt dissection stops spontaneously. A coagulation hook is very rarely ever needed.
- After reaching the fat tissue on the opposite side, insert a flexible dissector or a “goldfinger” into the retrogastric tunnel. Dissect the tip of the instrument in the angle of His.
- Continue as above (pars-flaccida pathway).

Difficult Situations and Intraoperative Complications

Troublesome intraoperative situations during gastric banding can result from hemorrhage, anatomic abnormalities, injury of organs, or difficulties during dissection.

There is a direct correlation between the patient’s BMI and the difficulty of the procedure.

Hemorrhage

Hemorrhage occurs mostly through an injury of the left hepatic lobe with the liver retractor. Patients with a massive fatty liver (BMI over 50, long standing morbid obesity) are especially at risk. A fatty liver is easily injured by simply positioning the liver retractor or through the retracting force, but the enlarged hepatic lobe makes it difficult to get an overview of the surgical field. In an effort to see better, the hepatic lobe is pulled to the right with great force, which can result in deep tears of the liver tissue with massive hemorrhage. It can be stopped using a coagulatory hook or argon plasma coagulation without having to switch to an open conventional surgical approach. These hemostatic measures however prolong the procedure substantially.

To avoid this situation, the liver retractor should always be positioned under visual control. The retracting force of the instrument should always be distributed evenly over the backside of the liver. The retractor should always be held parallel to the bottom surface of the liver. Avoid applying high pressure to the edges of the liver during traction.

Anatomic Particularities and Difficulties During Dissection

The correct dissection of the surgical field can be difficult in patients with a high BMI. This is the result of a massively enlarged left hepatic lobe and marked perigastric fat tissue. Some bariatric surgeons do not perform gastric banding in patients with very massive obesity. Surgeons who do not fix any limits of BMI are confronted with this problem time and again.

A massively enlarged liver lobe is always in the way. A second liver retractor can be helpful here. One

is introduced through the trocar in the right upper abdomen, another through a trocar in the epigastrium. An additional assistant will be necessary.

An experienced camera guide is of great importance. A very large left hepatic lobe simply cannot be retracted to the right sufficiently. To show a surgical field, the camera must be inserted under the liver. The camera guiding assistant must be able to produce a more or less sufficient image of a small operation field and keep the camera from fogging at the same time.

In rare cases, massive perigastric fat tissue prohibits the identification of the pars flaccida and the right crus of diaphragm altogether. The perigastric approach can be chosen here, but this option comes with a higher risk of intraoperative complications, such as hemorrhage from the perigastric tissue and perforation of the stomach wall. Before choosing the perigastric pathway, every option to perform the pars-flaccida technique should be explored.

- Assign an additional assistant. Place one or two additional working trocars in the left middle and upper abdomen.
- Pull the stomach toward the spleen with a grasper (left additional working trocar), holding it proximally close to the lesser curvature.
- Insert another grasper through the other additional working trocar and pull the lesser omentum also toward the spleen.
- Push the lateral parts of the lesser omentum toward the liver with the third grasper (right working trocar) and cut it with a cautery hook through the left working trocar.
- Now grasp the perigastric fat tissue (grasper through the left additional working trocar) and pull it toward the spleen.
- Then the right crus must be identified. If successful, use the pars-flaccida pathway, and implant an extra long gastric band.

If the right crus cannot be identified and the pars-flaccida pathway cannot be used, the perigastric approach is chosen as the very last option.

Early Postoperative Complications After Gastric Banding

Injuries of the backside of the stomach can occur with the perigastric approach. The number of stomach perforations has been reduced drastically by following the pars-flaccida pathway.

A perforation of the esophagus can occur with either technique. It is often discovered only postoperatively, with grave consequences for the patient. We believe this to be the result of a gastroesophageal instead of a gastrogastrial suture during anterior gastroplication. In patients with a massive fat pad the anterior stomach wall cannot always be dissected. Some surgeons then suture the anterior stomach wall below the band to the anterior wall of the esophagus above the band. If the resulting tension is too high, this suture might break and lead to esophagus perforation. We strictly avoid gastroesophageal sutures. If the anterior wall of the stomach above the band cannot be identified, we do not perform an anterior gastroplication at all. We do not recommend suturing the stomach wall to the diaphragm, because of the danger of accidentally injuring the phrenic nerve, which can lead to persistent singultus and shoulder pain.

Therapy of a ruptured esophagus varies depending on the symptoms and extent of the damage. A conservative therapy (esophageal stent and thoracic drain) may be considered; in other cases a surgical procedure, either laparoscopic or conventional, needs to be performed.

Revision Procedures

Intraoperative complications are very rare in gastric banding, but revision procedures for late complications are necessary more often and remain a so far unsolved problem for this procedure. The procedures are performed either as emergency- or urgent operations (in complications such as slippage or band migration) or planned in cases of a malfunction of the band or inadequate weight loss.

A Water-Soluble Contrast Swallow, Performed Because of Dysphagia Even After Complete Opening of the Band, Reveals Slippage of the Band

Predisposing factors: Slippage of the band is a typical complication after gastric banding, which was very common with the perigastric approach. Weiner defines three different types of slippage: anterior, posterior, or combined. The number of cases has been reduced drastically since the introduction of the pars-flaccida pathway and the character of the slippage,

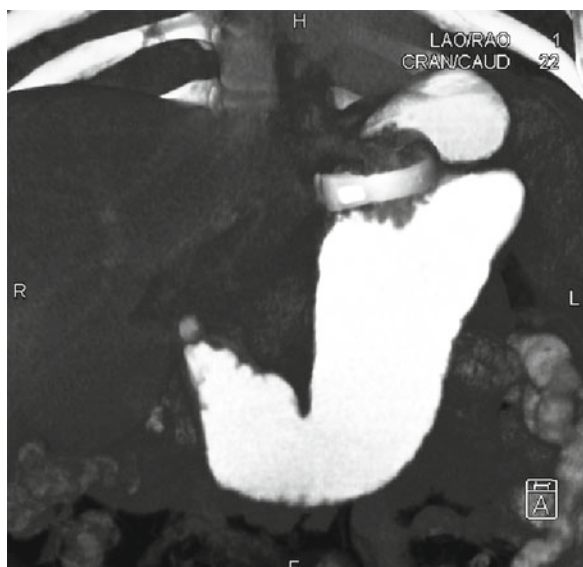


Fig. 2.29 X-ray showing anterior slippage after gastric banding (pars-flaccida approach)(Courtesy of Dr. Ingrid Harth, Radiologisches Institut, Kreiskrankenhaus Eschwege)

too, has changed. The anterior type is seen in these cases, with a part of the fundus or the anterior wall of the stomach gliding upward through the band. Depending on the clinical situation and the result of the water-soluble contrast swallow, a complete or incomplete slippage is diagnosed. With complete slippage, patients tolerate neither solids nor liquids, everything is regurgitated immediately. The water-soluble contrast swallow shows a complete stop above the band with no entrance of contrast into the rest of the stomach. In an incomplete slippage, a small amount of liquid may pass. The enlarged pouch will often be tilted to the front; the passage of contrast through the rest of the stomach will be slowed (Figs. 2.29 and 2.30).

Prevention: The introduction of the pars-flaccida technique has reduced the rate of slippages dramatically, but the problem is not completely solved. Many authors suggest various tricks and ruses to avoid slippage. Some of them are described in the following chapter. Tried and tested techniques to avoid slippage are:

- A narrow retrogastric tunnel (not wider than the band)
- At least five sutures for gastroplication (if possible)

Management: If slippage of the band is diagnosed, an emergency procedure must be performed because of the danger of ischemia and necrosis of

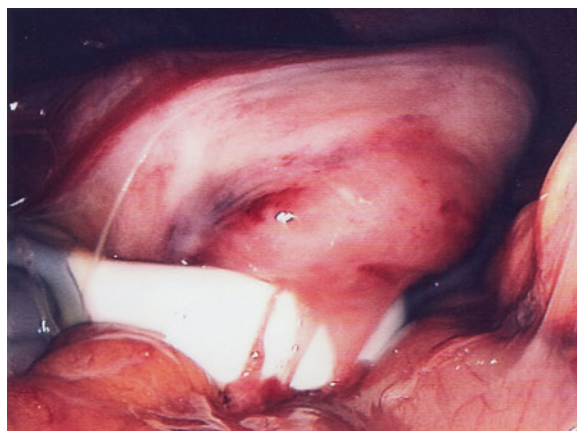


Fig. 2.30 Intraoperative picture of slippage after gastric banding

the pouch. In case of an incomplete slippage, the procedure is to be performed urgently, because an incomplete slippage can turn into a complete slippage any time.

In *slippage after using the perigastric pathway* we remove the band and produce completely new tunnel with the pars-flaccida approach. If the band is still in working order, it is reused; if not, a new band should be implanted.

In *slippage after using the pars-flaccida pathway* we perform an endoscopic reposition of the stomach. Position of the patient, creation of the pneumoperitoneum, and placing of the trocars are done as usual. Preferably the old scars are used for placement of the trocars. If the port chamber was placed in the left upper abdomen, take care to not damage the tube while placing the trocars.

Step 1 – Transection Adhesions Between the Liver and the Lesser Curvature

- After placing the trocars identify the tube and follow it from the abdominal wall to the band.
- Then cut the scar tissue between the left hepatic lobe and the lesser curvature. The amount of tissue ranges from small transparent adhesions to thick layers of connective tissue. Several different techniques can be applied to transect the adhesions. We use an atraumatic grasper and scissors for dissection and cutting and a coagulation hook.

Step 2 – Opening the Gastric Band Tunnel and Dissection of the Lock

- After removing the adhesions dissect the locking mechanism of the band. If the procedure was performed correctly before, the lock is close to the lesser curvature.

The operation protocol of the original procedure should be studied carefully before a revision procedure. It is important to know which kind of band was implanted in order to plan the following steps.

- The band and part of the tube close to it are foreign bodies and therefore covered with a fibrous capsule. If the band is to be reused, take care not to damage it irreversibly while transection of a fibrous capsule.
- Cut the outer layers of the fibrous capsule with scissors.
- Then open the fibrous tissue with an endodissector, until a part of the band is visible.
- Now open the capsule completely under visual control and dissect the locking mechanism.

Step 3 – Dissolving the Anterior Gastroplication

- After opening the gastric band tunnel and dissecting the locking mechanism dissolve the anterior gastroplication. There are several ways of doing so: Some surgeons cut close to the suture line with scissors. If the band has been in place for several years, it can be difficult to identify the suture line; cutting will open the stomach or produce a massive hemorrhage. We open the anterior gastroplication with a linear cutter (Endo-GIA, blue cartridge).

Step 4 – Reposition of the Dislocated Portions of the Stomach

After dissolving the anterior gastroplication reposition the dislocated parts of the stomach.

- Grasp the tube close to the band with an atraumatic grasper (right working trocar) and lift the band.
- Insert the other grasper (or preferably a Babcock forceps) (left working trocar) between the stomach wall and the band, moving upward. Grasp the protruding parts of the stomach and push them back under the band. This maneuver is, however, rarely

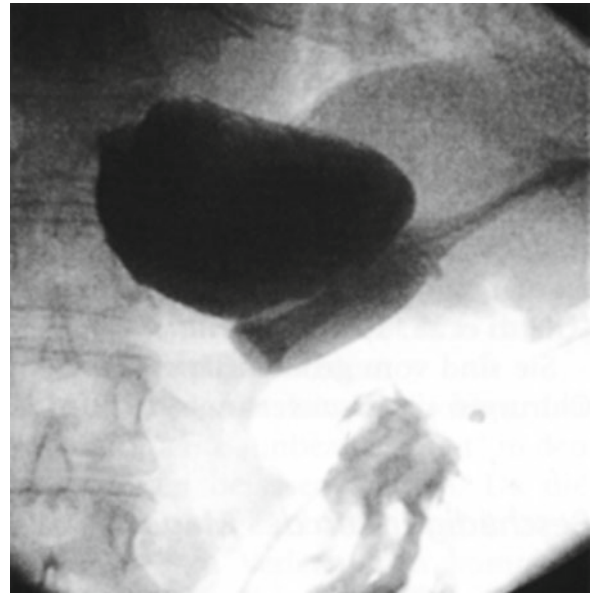


Fig. 2.31 Pouch dilatation after gastric banding

successful, which is why you should rather open the band and close it again after reposition.

Step 5 – Regastropliation

- After repositioning the stomach, perform a regastropliation. The gastro-gastric sutures are easy to place, because the stomach wall is stretched after slippage. After reposition and closure of the band, parts of the stomach can easily be pulled up over the band and sutured to wall of the pouch.
- After performing the anterior gastroplication the procedure is completed.

Dysphagia: A Water-Soluble Contrast Swallow Reveals Marked Pouch Dilatation

Predisposing factors: Inappropriate eating habits (binge-eating, compulsive eating), insufficient after-care, and a too tight band. These factors are often combined and result in dilatation of the pouch.

Prevention: The best prophylaxis of pouch enlargement is regular follow-up examinations and timely reaction to signs of inadequate function of the band.

Diagnostic measures: If a pouch enlargement is suspected, perform a water-soluble contrast swallow. An enlargement of the pouch (without anterior tilt of the stomach) with slow passage of the contrast is usually seen in these cases (Fig. 2.31).

Management: Pouch dilatation is at first treated conservatively. The band must be opened completely and adjusted after 6 weeks. Patients should be put on a liquid diet to avoid massive weight gain during this period. After 6 weeks the band is refilled and the patient is followed-up closely. If the pouch dilates again, a surgical revision procedure is indicated (conversion into a gastric bypass or duodenal switch, gastric sleeve resection with or without removing the band or removal of the band without other procedures).

Large Amounts of Food Are Tolerated, Although the Band Is Filled and Has Been Readjusted, Intermittent “Black” Stool, Gastroscopy Reveals Intraluminal Position of a Part of the Band

Predisposing factors: The perigastric pathway definitely is a predisposing factor for these complications. Band erosions belong to the past since the introduction of the pars-flaccida pathway. The importance of other factors, such as “band too tight,” “unconventional” band, port infection etc., is not scientifically proven.

Prevention: These complications can be avoided by choosing the pars-flaccida approach and “established” band brands, such as the Lap-band or the SAGB.

Management: After diagnosing band migration, the band must be removed. This is followed by another bariatric procedure to avoid excessive weight gain. If this is to be done in one operation, there are in our opinion two possibilities: a distal gastric bypass and the duodenal switch, because the operation field is far away from the migration site. We favor the distal gastric bypass, because the procedure is much easier done laparoscopic than an endoscopic duodenal switch. If the bariatric procedure is performed later, other techniques, such as the classic (proximal) gastric bypass or a sleeve gastrectomy can be performed.

If the original band was implanted through the perigastric pathway, it can easily be rebanded using the pars-flaccida approach.

Technically the removal of the migrated band is similar to band removal in case of a slippage:

- After dissection of the fibrous capsule around the band, open it to show a part of the band.



Fig. 2.32 Gastric band in a “pregastric” position

- Cut the band and remove it from the tunnel, which is by now sealed with fibrous tissue; nothing else has to be done here.

Some surgeons insist on suturing the band tunnel and the opening in the stomach wall. We believe this to be impossible and also unnecessary. The “classic” damage through band migration is situated at the back of the stomach deep inside the band tunnel and cannot be reached without major dissection work. The damage also does not reach the open abdominal cavity, but opens only into the usually rather thick fibrous tissue around the band.

- We do not position a drain tube after removal of the gastric band.

Band Cannot Be Tightened, a Water-Soluble Contrast Swallow Reveals “Pregastric” Position of the Band

Predisposing factors: This situation can occur after using the pars-flaccida-technique (Fig. 2.32). Predisposing factors are a high BMI and massive

perigastric fat tissue. In very obese patients, the flexible dissector or the goldfinger can accidentally be positioned between the anterior stomach wall and the perigastric fat tissue. The tip of the retractor is dissected in the angle of His; the band is positioned and closed around perigastric fat tissue.

Prevention: This complication happens to the unexperienced bariatric surgeon. Difficulties of the procedure due to extreme obesity, such as excessive perigastric fat tissue, a large left hepatic lobe or a “too short” optic lead to a complicated and confusing situation. The surgeon must be very sure to insert the flexible dissector or the goldfinger behind the GE junction toward the angle of His. A calibration tube, inserted into the stomach during the procedure, can be helpful. The wall of the esophagus can be identified during the insertion; the instrument can then be guided around the GE junction.

Management: A faultily placed band does not have a restricting effect and needs to be removed or repositioned. An undamaged band can be reused.

A Water-Soluble Contrast Swallow Reveals Excessive Esophageal Dilatation

Predisposing factors: In some patients with normal band position and adequate adjustment of the band, an esophageal dilatation after gastric banding is seen; a late stage of the so-called gastric band-induced pseudo-achalasia. The main reason is inadequate eating habits; the patient eats much more than can fit through the adequately tightened band and then has to regurgitate due to esophageal congestion.

Prevention: This complication arises when an unsuitable patient receives a gastric band. There are, however, no reliable criteria by which to decide which patient is “suitable.” The only way to reduce the incidence of this complication is consequent and close lifelong monitoring.

If a patient complains about daily nausea and vomiting, he is to be considered at risk for esophageal dilatation and must be monitored closely. If everything (band adjustment, counseling, behavior therapy) has been tried and nausea still persists, the band must be opened for a longer period of time or removed altogether.

Management: If the above mentioned conservative measures do not help, a revision procedure is indicated, which can be anything from a simple removal of the

band up to conversion procedures for a gastric bypass or a duodenal switch.

Inadequate Weight Loss or “Band Intolerance”

Predisposing factors: Inadequate weight loss and the so-called band intolerance are the most frequent reasons for late revision procedures after gastric banding. Two groups of patients can be distinguished: In the first group band position and band function (ease of adjustment) are normal. Patients with band malfunction belong to the second group (difficult port puncture, frequent need of adjustment, no lasting tightening possible without leakage, or disconnection of the tube), as well as those with unwanted anatomical changes, such as beginning slippage and beginning pouch or esophageal dilatation. The two groups are described separately in the following.

Management: The following revision procedures are possible in cases of inadequate weight loss or “band intolerance”:

- Removal of the gastric band
- Repositioning of the gastric band
- Addition of another bariatric procedure, such as “banded” gastric bypass or a “banded” sleeve gastrectomy
- Removal of the band and performance of another bariatric procedure, such as a gastric bypass or a duodenal switch

Weight Gain, a Water-Soluble Contrast Swallow Confirms Correct Band Position and Adjustment Without Leakage

Predisposing factors: The role of a patient history of clinical depression, binge eating, or sweet eating is discussed controversially.

Prevention: This situation is obviously due to the patient’s inadequate eating habits. There are so far no valid criteria available to identify potential “failures” beforehand.

Management: If a revision procedure is indicated, either an addition of another bariatric procedure (such as “banded” gastric bypass or “banded” sleeve gastrectomy) can be considered or the removal of the band and the performance of another bariatric procedure, such as a gastric bypass or a duodenal switch.

Frequent Nausea, Tolerance for Liquids Only, Tight Band, Rapid Weight Gain After Band Adjustment; Repeated Tightening Leads to More Frequent Nausea Again, No Improvement After Several Repetitions; a Water-Soluble Contrast Swallow Reveals a Beginning Pouch Enlargement

Predisposing factors: These complaints are called “band intolerance.” The factors leading to this condition are so far unknown.

Prevention: We use the rule “under 40, under 50,” meaning that patients aged under 40 and with a BMI under 50 have a better outcome after gastric banding than older patients with a higher BMI. There is not much scientific evidence for this theory; it should be tested in a controlled prospective study.

Management: If a revision procedure is indicated, a band removal with or without the performance of another bariatric procedure (gastric bypass or duodenal switch) can be considered.

Pain and Redness Around the Port Chamber with Clinical Signs of an Infection

Predisposing factors: The development of an infection of the port chamber early after the implantation is usually due to faulty implantation technique without strict consideration of the rules of hygiene or it is due to a postoperatively infected hematoma around the port chamber. If the infection occurs later, the reason can either be a contamination of the port chamber during adjustment or an ascending infection after band erosion.

Prevention: The implantation of the port chamber is a very important part of gastric banding, considering that up to 25% of all patients who receive a gastric band need revision procedures because of port-related problems. But it is probably quite customary for the surgeon to leave after the intraabdominal part of the procedure and let the assistant perform the implantation of the port chamber. We recommend to have the implantation of the port chamber done by an experienced bariatric surgeon. Careful intraoperative hemostasis, strictly aseptic conditions, and the mandatory application of subcutaneous sutures on top of the fastened port chamber help reduce the number of early postoperative port infections.

Management: Port infection is a serious complication that requires the complete removal of the gastric band in many cases (Fig. 2.33). If the infection occurs late and is due to band erosion, removal of the band is



Fig. 2.33 Loose port chamber after persistent infection of the port chamber. This patient refused to have a revision procedure for a long time and continued using the port, fastened to the skin with surgical dressing

the only choice (see therapy band erosion). If the infection occurs early after the procedure, there is a chance to save the band. We recommend to remove the infected port chamber, close the end of the tube with a suture and push it into the abdomen. These patients must be monitored closely. When there are no signs of an infection any more or signs of a band erosion, a new port chamber is implanted. The end of the tube is pulled out of the abdomen in a minilaparoscopic procedure and connected to the new port chamber. If the end of the tube cannot be found, perform a laparoscopy to identify the tube.

Port Puncture Impossible: An X-Ray Reveals a Flipped Chamber

Predisposing factors: The port chamber tilts or flips over the most often if fastened to the aponeurosis of the rectus abdominis muscle in the left upper abdomen. Other predisposing factors are fastening the chamber onto fat tissue instead of onto the aponeurosis or using less than four sutures. So far there are no long-term data available regarding the influence of stapler systems on the rate of flipped over port chambers.

Prevention: We recommend positioning the port chamber presternally in patients with a BMI over 45. Less subcutaneous fat tissue and a more “taut” skin help secure the chamber tightly within the surrounding tissue. The thinner subcutaneous fat layer also facilitates the even placement of the sutures within the fascia. We recommend placing all four sutures within the

planned pouch first, positioning the port chamber next and tying the knots afterward.

Management: If the port chamber is flipped over, it must be turned back into the correct position in a revision procedure. If it flips again, it should be repositioned from the left upper abdomen to a presternal position.

2.1 Surgical Technique by Wendy A. Brown and Andrew I. Smith (Australia)

Wendy A. Brown and Andrew I. Smith

Preparation

Setting, Positioning, and the Surgical Team

- The patient is positioned in the lithotomy position. We use a table with either a buttock support or an adjustable seat as the patient will ultimately be tilted head-up to around 45°.
- The legs are supported in stirrups with the knees angled toward the opposite shoulder. The legs must be kept relatively low so that when the operator is between the legs their arms and instruments do not clash with the legs.
- The surgeon will stand between the patient's legs. The assistant surgeon will stand on the patient's left and the scrub nurse will be between the assistant and the surgeon on the patient's left.
- The screen and the laparoscopic stack are at the top of the bed on the patient's right, with diathermy also on that side. The leads for the camera and the insufflator are secured at the top end of the operative field; the lead for the laparoscopic diathermy comes across to be placed in a sheath on the patient's right hip.

We pin the hand-held diathermy on the top drape separate to the camera leads so that it will be retained at the end of the case when other equipment is passed off.

- The post for securing the liver retractor should be positioned at the level of the costal margin on the patient's right.
- Betadine is used to prepare the skin.

We prepare the skin widely from the level of the nipple line down to the pubis in case an open procedure is required.

- The operative field is square draped from the nipple line to below the umbilicus.

We do not use "booties" for the leg as we find these impossible to place in a clean manner in the obese. Instead, we use a large drape over each leg and then a drape across the pelvic region.

- We do not routinely use suction; however, we have it available in the theatre.
- We prefer to have a Mayo table behind the surgeon so that we may take the graspers we require. We also have a warmer for the laparoscope to be easily accessible for the assistant surgeon.
- Our patients will generally have their blood pressure monitored with a non-invasive cuff on the upper arm. Only rarely is an arterial line inserted. Intravenous access is via a peripheral line.
- DVT prophylaxis consists of subcutaneous low molecular weight heparin on induction and all patients wear compression stockings. Sequential calf compression devices are used only for high risk patients.

We choose antibiotics to cover skin and bowel organisms. Most commonly this is flucloxacillin and ceftriaxone as a single dose on induction.

- A patient warming device is placed above the nipple line.
- The anesthetist passes a calibration tube orally that will be used to check the position of the band during the operation.

Trocar Placement and Pneumoperitoneum

- We make a 5-mm incision just below the left costal margin at a 45° angle from the umbilicus. Further port positions are as shown in the diagram below (Fig. 2.34).
- We will generally make these incisions prior to insufflation. If, however, the patient has a deep waist crease or if we are unable to palpate their

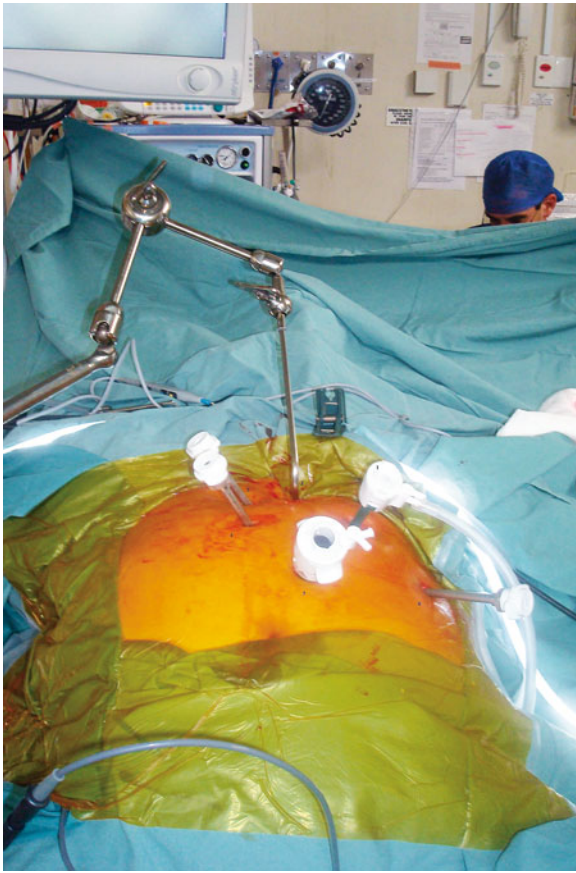


Fig. 2.34 Trocar placement

ribs, we do not site the subsequent ports until insufflation is achieved as we find that we can place them more appropriately once a pneumoperitoneum is in place.

- We currently use a 5-mm optical separating device to enter the peritoneal cavity in the left upper quadrant. This requires a 0° telescope.
- Insufflation with CO₂ is commenced at low flow (3 l/min) after confirming the catheter is in the peritoneal cavity. If the patient tolerates low flow, high flow (20 l/min) is used for the rest of the case to a maximal intraabdominal pressure of 15 mmHg.
- The patient is then tilted to a head-up position.
- The 0° laparoscope is changed to a 30° angled laparoscope which has been warming in hot water.
- The next instrument placed is the Nathanson liver retractor. Using the epigastric incision, a 5-mm trocar is used to make a pathway. This should enter the patient at a 90° angle to the skin and should be at the level of the liver edge.

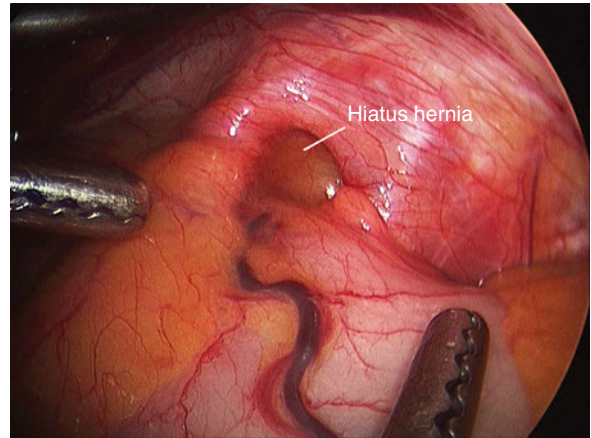


Fig. 2.35 Hiatus hernia

- The Nathanson retractor is then passed with the arm facing toward the patient's left. After the stem is inserted, it is rotated into place and the liver gently retracted toward the patient's right shoulder.
- After the liver is retracted, three further 5-mm ports and a 15-mm port are introduced. All are long ports, and are angled toward the hiatus.

Surgical Technique with Hiatoptasty

- The camera is placed in port 1. Atraumatic graspers are placed in ports 3 and 6.
- The hiatus is assessed and if a hiatus hernia is known, or if laxity is found intraoperatively, then the hiatus is explored. If no hernia is seen, then the hiatus is not explored and I would proceed to simply opening the angle of His.
- In this case, the patient was known to have a hiatus hernia. In Fig. 2.35 it can be seen that there is a clear hiatus hernia.
- To dissect out the hiatus, the angle of His is displayed by retracting the fundus with the retractor in trocar 6, and esophago-gastric fat pad with the retractor in trocar 3.
- Using the hook diathermy, dissection starts at the point where the peritoneal reflection of the esophago-gastric fat pad is clearly at the level of the spleen, above the first short gastric artery. The peritoneum is divided along the line of the left crus.
- The left crus is then completely cleared using blunt dissection, and the dissection is continued on to the

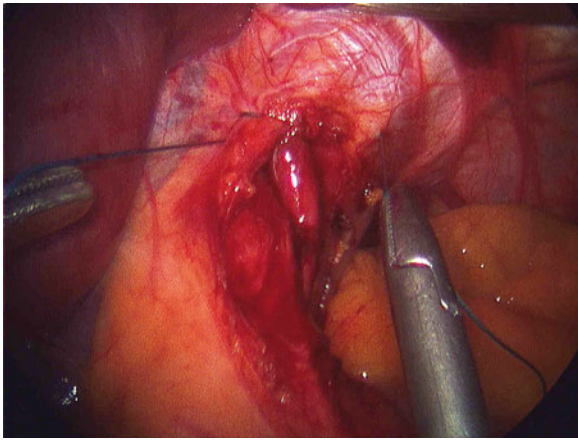


Fig. 2.36 An anterior crural repair is performed using 2/0 Ethibond in a U-shaped stitch

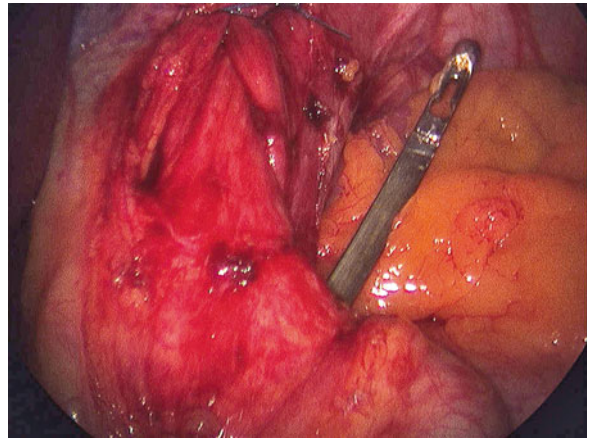


Fig. 2.37 The tip of the placer is seen in the angle of His. If less than 2.5 cm of the end of the placer is visible then a larger band size is selected

right crus. Once the crura are cleared, the esophagus is readily displayed.

- An anterior crural repair is performed using 2/0 Ethibond in a figure of 8 stitch (Fig. 2.36).
- The pars flaccida is then opened using the hook diathermy and a point just anterior to the right crus is chosen to start the dissection behind the esophagus. This is usually at the level of a line of fat crossing the base of the right crus.
- With an atraumatic grasper, retract the lesser curve fat from trocar 6.
- A blunt-nosed retractor is passed through trocar 3 and is gently advanced in front of the right crus from this point. It should pass easily.
- A lap-band placer is then passed through the same pathway via trocar 4. It is a curved instrument with a blunt end and an eye at the tip. At the beginning of the passage the convexity should face caudally. As it is gently advanced, it is rotated clockwise, so that the convexity faces cephalad.
- The tip of the placer is seen in the angle of His. It is essential that the placer comes out accurately at this point.
- The placer is then pushed through (Fig. 2.37). If less than 2.5 cm of the end of the placer is visible then a larger band size is selected.
- The band is primed with normal saline and the end of the tubing is cut at an oblique angle before introducing it into the abdomen through the 15-mm port. The tubing is then threaded through the eye of the placer.

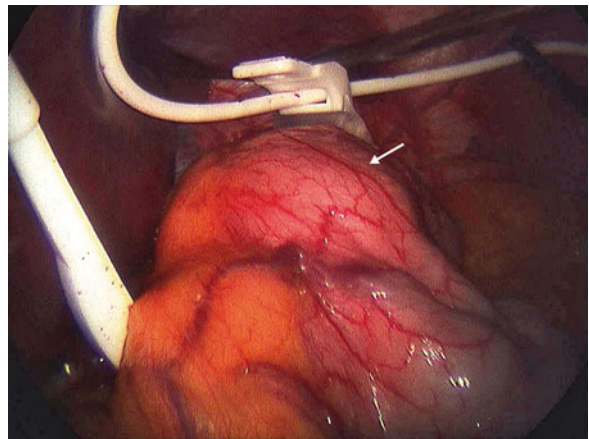


Fig. 2.38 Balloon at the end of the calibration tube, filled with 20 cm³ of air

- The placer is pulled back through to the lesser curve side. The tubing is therefore delivered through a pathway behind the esophago-gastric junction, above the lesser sac. By pulling the tubing through along this pathway, the band is placed correctly.
- Prior to closing the band the position is confirmed by passing an orogastric calibration tube. The end of this tube has a balloon on it. This is inflated with 20 cm³ of air after the tube is seen to pass through the esophago-gastric junction and into the stomach. The whole catheter is then gently pulled back until the balloon lodges at the esophago-gastric junction. The band should be seen to be lying at the equator of this balloon. This also allows us to check for hiatus herniae that may have previously been missed (Fig. 2.38).

- After confirming the position, the oro-gastric calibration tubing is removed and the band is closed. We pull the tubing out of the body through trocar 4 and secure it to the drapes with an artery forceps so that the buckle rotates out of the way for suturing. We cover the exposed tubing with a betadine soaked gauze.
- The fundus is then secured around the band by a series of interrupted gastro-gastric sutures. We usually use 2/0 Ethibond on an atraumatic needle. We use trocar 6 for the needle holder, and use a blunt nosed instrument through trocar 3 as the other suturing tool. I place an atraumatic grasper through trocar 5 and use this to retract the fundus so that we can clearly see the most lateral point on the fundus. This is where I start my suture line
- The suture is completed into gastric tissue above the band. If the gastric wall cannot be clearly seen, it is important to retract or remove the esophago-gastric fat pad so that it is well displayed. Otherwise there is a danger that the suture will secure the band across the esophagus and no gastric pouch will be created.
- Generally three gastro-gastric sutures are used to secure the fundus around the band. Take care to not have these sutures under tension, and the sutures should not impinge on the buckle device of the band, as these factors are thought to contribute to band erosion.
- One suture is placed below the band. This gastro-gastric suture apposes the tissue from the medial edge of the folded fundus to the lesser curve – the band tubing is reintroduced into the abdomen and the buckle is rotated to sit in front of the lesser curve. If the band is left rotated, revisional surgery is much more difficult. The band tubing is then passed out through trocar 5 (Fig. 2.39).
- The laparoscopic equipment is now passed off and the trocars removed.
- The port is primed with normal saline. It is connected to the band tubing.
- The skin incision at trocar 5 is extended, and the anterior rectus sheath is displayed by blunt dissection. Often Scarpa's fascia is very dense at this point, so care must be taken to ensure that the correct layer is displayed. An area inferior to the exit point of the tubing is cleared. It is important that the tubing gently drops into the abdomen. If the angle of entry into the abdomen is too acute the tubing is

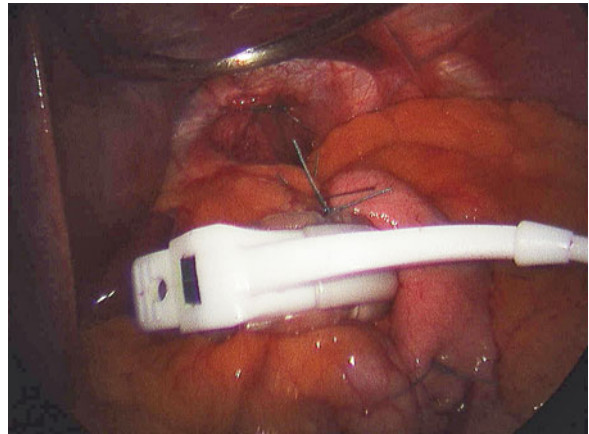


Fig. 2.39 Completed placement of a gastric band

in danger of cracking. The port is secured to the anterior rectus sheath with either 2/0 Prolene sutures or with one of the commercially available stapling devices.

- Deep tissues are closed with vicryl and the skin is closed with subcuticular monocryl. If the patient has a particularly heavy apron, then we will generally reinforce the port incision with interrupted prolene sutures.

2.2 Surgical Technique by Leonid Lantsberg (Israel)

Leonid Lantsberg

Introduction

Keep it simple and stupid (KISS). As long as you follow the simple principles and rules and avoid doing stupid mistakes, the chances of getting into trouble with this surgical procedure are very little. My preferred technique is the pars-flaccida approach, which is used to overcome the problems associated with the perigastric technique.

Preparation

Setting, Positioning, and the Surgical Team

Instrument requirements:

- One “Goldfinger”
- Two atraumatic graspers

- Two needle holders
- A 45° scope
Suction and electrocautery are needed in rare cases and should be requested only if necessary during the procedure.
- The patient lies on the operating table in the “French position” (surgeon standing between the patient’s legs), head up 20°–30°, and tilted to the right (left shoulder up) 10°–15°.
- A five trocar approach is used (three 10 mm and two 5 mm) to obtain pars flaccida retrogastric blunt dissection to create a tunnel for the band.

If the patient has a big left liver lobe (mainly males) introduce a sixth trocar in advance and ask for a second assistant.

- Have a constant contact with the anesthetist; if the patient shows bradycardia, hypotension, or desaturation (due to ventilation difficulties) reduce or deflate the abdomen completely until the problem is resolved.
- Good abdominal wall muscle relaxation is mandatory for achieving a free intraabdominal maneuver environment. In a patient with a “heavy abdominal wall” (highly resistant to insufflations) increase the insufflation pressure up to 18 mmHg.

Trocar Placement

A Veress needle is usually inserted in the left upper quadrant, but if the patient has a scar from previous surgery, keep away from it as far as possible.

Insert the first trocar for the camera high enough so you can reach the appropriate structures (such as GE junction, crus of diaphragm etc.) usually around 20–25 cm below the xiphoid.

Use the length of your palm as a measure for the distance below the xiphoid to the point of the trocar insertion.

- A 10-mm trocar will be inserted next in the left upper quadrant in anterior axillary line below 10th rib. This trocar is used for stomach fundus retraction and its inlet is used for band introduction into the abdominal cavity in later stages of the operation.

- Two 5-mm working trocars are inserted approximately at the crossing of the midclavicular and hypogastric lines on each side.
- The last 10-mm trocar is inserted through a transverse subxiphoid incision and is used for retraction of the left hepatic lobe by a single grasper and for subcutaneous presternal pocket creation for the port positioning at the end of the procedure.

Surgical Technique: Pars-Flaccida Approach (SABG)

- Identification of the left crus is achieved by disruption of the gastrophrenic ligament through a small 1–1.5 cm dissection created by a “goldfinger.”

The size of the dissection is crucial since a preserved gastrophrenic ligament is used as a band-anchor, in an attempt to minimize the incidence of slippage.

- Now open the pars flaccida just anterior to the caudate lobe of liver followed by the identification of the right crus.
- Create a retrogastric tunnel under direct vision by using a “goldfinger” and a needle holder and gently progress toward retro/supragastric fat which is recognized by the typical yellow color.
- Only when reaching the fat pad the surgeon will bend the “goldfinger” (the right side assistant should simultaneously grip and pull the fundus downward using atraumatic forceps). The tip of the “goldfinger” should appear superior and posterior to the fundus without any additional tissue on it.

Rules for the creation of the retrogastric tunnel

- Gentle, cautious, and powerless smooth motions toward the GE junction behind the posterior gastric wall will prevent gastric wall perforation.
- The tunnel should be created high enough, just above the lesser sac, in order to prevent the possibility of posterior slippage (no need for a gastrotensometer once experience in the procedure has been gained).

Intrabdominal Band Introduction

- Opening the gastric band kit only after the completion of the retrogastric tunnel will prevent wasting bands which will not be inserted for different uncommon intraoperative situations (such as inability to create the tunnel, bleeding, perforations etc.) and will also minimize band exposure, thus decreasing the risk of infection. Preparation of the band on the bedside table before insertion should include examination of band's integrity (water filling or vacuum tests), the addition of a thread loop when necessary (for specific modules in which this is not built in) and creation of a notch at the distal edge of the connecting tube in order to preserve the band vacuum in a flattened position for the whole procedure.
- Remove the 10 mm left upper sided trocar.
- The flattened band should be mounted on a needle holder and inserted intraabdominally through the same inlet.

Positioning of the Band

- Anchor the thread loop on the “goldfinger” groove and pull the “goldfinger” under direct vision from the exit site.

Be sure that no excessive tissue exists between the band and the gastric wall at the point of exit.

The use of excessive force or lack of visualization during this maneuver may lead to a tear of the thread loop or the band and in worse cases induce gastric wall damage.

If the band does not progress smoothly through the tunnel, stop pulling! Extract the band from the tunnel and recreate the tunnel using the “goldfinger.”

Band Closure

- Band closure should be accomplished by using its mechanism followed by a visual and manual confirmation of a good seal. Buckles should be directed toward the liver.

In my experience, no gastro-gastric or gastro-phrenic sutures are required for band fixation. It does not seem to reduce the anterior slippage rate and further more even increases the risk of intragastric band migration.

- After locking the band, be sure it is positioned in a loose and appropriate manner so that no additional structures are incarcerated between the band and the stomach. If the band is too large (VANGUARD or AP-LARGE for example), 2–3 cc of saline should be injected into the band in order to prevent acute gastric incarceration due to band slippage which will require emergency reoperation.

If at any stage of the procedure a loss of vacuum or injected fluids is detected, the band has a puncture and should be replaced by a new one. For this reason and others, always have a spare band at hand.

Connection of the Band to the Port

- Retrieve the connecting tube through the epigastric port using grasping forceps.
- Deflate the abdomen and create a subcutaneous pre-sternal pocket by hand.
- Clamp the connecting tube and cut the notch before connecting the tube to the port. A good positioning of the port in the pocket will not require additional sutures for fixation.

Be sure there are no twisting forces on the port that may cause future port rotation and use a gentle traction maneuver to confirm the port-tube connection.

Revision Procedures

Band Slippage

The rear (dorsal slippage) or front (anterior slippage) stomach wall shifts upward through the band are called band slippage. This is the most common complication (6–12%), mainly caused by operational circumstances. Upon introducing a contrast medium, the pouch will look eccentric on x-rays. Due to the enlargement of the pouch, a valve-like mechanism occurs, in which passage to the main stomach is progressively obstructed by parts of the stomach wall (partial to complete stoma occlusion). As the pouch increases in size, a part of the stomach wall can cause a shift of the gastrostoma which progressively obstructs the passage. Inflammatory changes can also lead to an obstruction.

This is reflected in intolerance toward solid food and then to liquids until obstruction is complete:

- Chronic: Increasing passage disorders for solid foods; repeated vomiting after meals; regurgitation (back-flow of food remains, indigestion, also at night). Progressively increasing capacity limitations even for liquids; drinking is only possible in little sips; solid food is not tolerated anymore at all, excessive weight-loss, reflux symptoms (pain or heartburn), general complaints like tiredness and deficient nutrition. Left untreated, any chronic form can escalate into an acute form.
- Acute: Complete halt of food passage. Consequences of untreated total food intolerance, dehydration, electrolyte imbalance, prerenal failure (caused by dehydration), extremely heightened risk of aspiration mostly at night (breathing reflux stomach contents into the airways causing a risk of pneumonia). I use the term “wet pillow syndrome” which describes the patients as they wake up in the morning with a puddle of saliva on their pillow.
- Conservative management:
 - Complete opening the stomach band
 - Insertion of a naso-gastric tube to relieve the pouch and to avoid aspiration
 - Immediate intravenous rehydration and balancing electrolytes
 - Start administration of an antacid (e.g., Omeprazole) to protect against or treat mucosal changes within the pouch and add substitutive therapy (iron, vitamins, etc.)

Laparoscopic band reposition without exchanging the band is usually possible by creating a new path (Fig. 2.40).

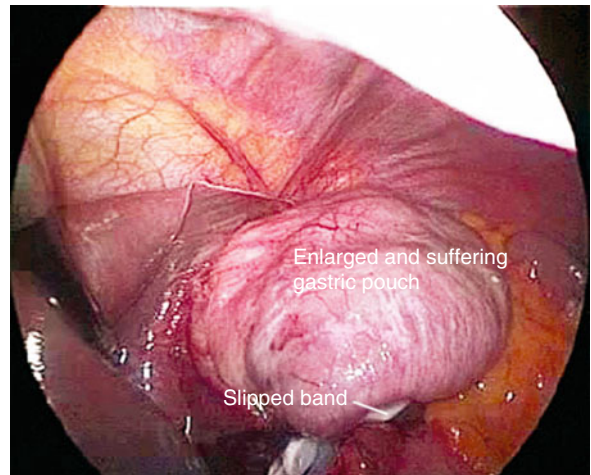


Fig. 2.40 Acute anterior slippage

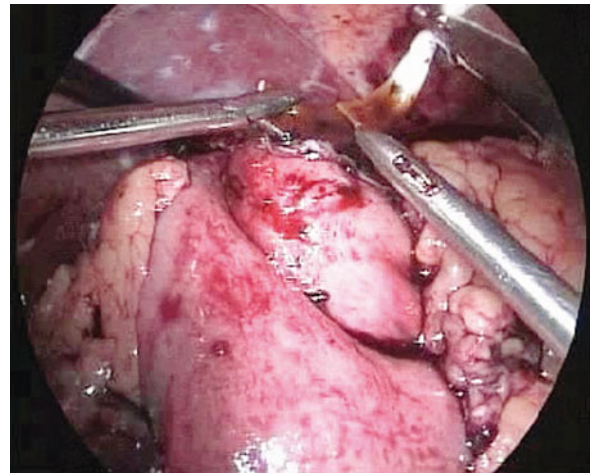


Fig. 2.41 Removal of the migrated band

Band Migration

An erosion of the stomach or penetration of the stomach wall by the band occurs very rarely (<2%). It usually occurs more than 2 years after the original surgery. The causes of this are still being discussed but may include:

- Primary undiscovered stomach wall injuries
- Pressure-related stomach wall necrosis caused by strong filling of the band
- A secondary infection along the band system

There may be a complete lack of symptoms or the only sign may be regaining of weight – or there may be pain complaints related to an infection of the upper abdomen. Diagnosis is made after decongesting the band by a gastroscopy, which enables viewing of the

whole band and not only the constricted part at the stomach entrance and by X-ray contrast swallow revealing an inability to adjust the band. Treatment consists of removal of the band (Fig. 2.41) and securely closing the stomach wall.

If the stomach wall was penetrated completely, the band may be removed endoscopically after severing the catheter. Three to six months later most patients will regain weight and an additional bariatric procedure will be required. According to my experience, rebanding these patients 4–5 months later is the preferable strategy due to the fact that this procedure remains to be the one with the least number of complications.

Esophageal Dilatation

Severe deviations in function (dysfunctional movement, motility) and anatomy of the esophagus after using gastric bands have been reported. How often and how long after surgery they appear, under optimal conditions and operative techniques, is unclear so far. Esophageal dysfunction is usually indicated by discomfort. It may either result from continuing increased pressure on the esophagus, or from the effects of exposure to stomach acids with the corresponding inflammatory reactions of the mucous membrane. Should these dysfunctions manifest themselves, they may be visualized radiologically, endoscopically, and by corresponding pressure and acid measurements. This allows for diagnostic differentiation and determination of further treatments.

If the esophageal diseases cannot be controlled by adjusting the band or eating habits, removal of the gastric band or laparoscopic band unlocking must be considered. In later stages, patient may regain weight, thus, performing rebanding (my preference) or an alternative procedure (sleeve resection, Roux-en-Y gastric bypass) may become necessary.

Gastric Pouch Dilatation

There are several different forms; namely early and late stage and acute and chronic pouch enlargements. An early dilatation may occur a few weeks after surgery; this is usually caused by an incorrectly positioned band. The main effect of this is a creation of a pouch that is too large. The late-stage form manifests itself after weeks, often even after a year, and is usually caused by abnormal eating habits like meal sizes that are too large (possibly even pre-operative binge-eating), or a gastrostoma that is too constricted. This may also include a sliding hiatal hernia (diaphragmatic hernias with an upward-shifting stomach entrance) in front of an otherwise well-positioned band. Radiological visualization will show a concentric pouch. If left untreated (complete deflation, laparoscopic band reposition), the dilatation may progress into real “slipping,” including upward-shifting of the stomach wall above the band.

Stoma Occlusion

Unchewed chunks of food may cause a shifting gastrostoma with subsequent complete halt of food and liquid passage. Thus, it is of utmost importance to chew very consciously. Certain foods may have to

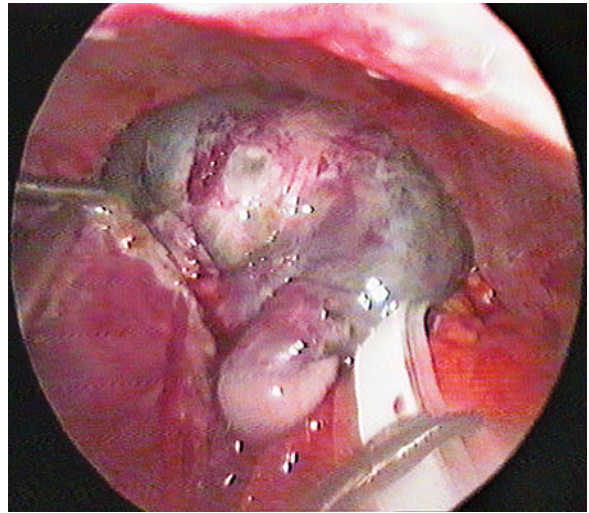


Fig. 2.42 Gastric pouch necrosis

be avoided completely under certain circumstances, especially with repeated vomiting (long-grained vegetables, legumes, coarse-grained meats, pasta). Initially an attempt is made to remove the congestion by opening the band and drinking fluids. If this is unsuccessful, a gastroscopy is almost always sufficient. If congested for more than 6 h the band should remain open for approx. 1 week, and acid reducing treatment should be implemented to treat inflammation and swelling of the mucous membrane. If the time needed to restore passage through the band exceeds 6 h, then there is a risk of acute pouch extension with stomach rupture. In this case, emergency intervention with partial gastrectomy may be necessary (Fig. 2.42).

2.3 Surgical Technique by Thomas Manger (Germany)

Thomas Manger

Introduction

The treatment of morbid obesity with gastric banding was begun in 1983 by Kuzmak. Today this technique is performed almost worldwide in about 25% of all bariatric procedures. In Europe gastric banding is the most widespread procedure (more than 70%) [1]. The prospective multicenter study on quality standards in

bariatric surgery in Germany we conducted shows that gastric banding was the most frequently performed procedure until 2006. From 2007 on, combined malabsorptive procedures have been performed more often, so gastric banding moved back to second place behind the Roux-en-Y gastric bypass [4].

Gastric banding is a little invasive technique with low morbidity and mortality. A great advantage is that it can be performed laparoscopic (in 98.4%) and that the procedure is reversible. Conversion rates are low (0.7%). The pars-flaccida approach for band implantation has established itself in 98% of all procedures. About 73% of all surgeons calibrate the pouch, only 9% do not cover the band with stomach serosa.

Long-term results are mostly affected by band-related problems, such as complications with the port (0.4–6.8%), pouch dilatation/slippage (1.4–21%) and band migration (0.3–11%). This results in a revision rate of up to 4% per year [2–4].

Preparation

Setting, Positioning, and the Surgical Team

- The patient is positioned half sitting (15–30° anti-Trendelenburg position) with spread legs in general anesthesia on a 2.5 cm gel mat. Cardia and stomach are exposed this way; gravity lowers other internal organs out of the way.
- You as the surgeon stand between the patient's legs.
- The monitor and the first assistant are positioned on the patient's right side.
- After a single shot antibiotic prophylaxis the pneumoperitoneum is created with 15 mmHg pressure.
- This first trocar is inserted 25 cm below the xiphoid through a 10 cm cut into the fascia between two Kocher's forceps.
- The other four working trocars (11–15 mm) are inserted according to Fig. 2.43.

Surgical Technique

Calibration of the Gastric Pouch

- Determine the position of the band with a calibration tube. It is inserted into the stomach by the anesthetist and filled with 25 mL of saline. Then it is carefully pulled back up unto the GE junction (Fig. 2.44).

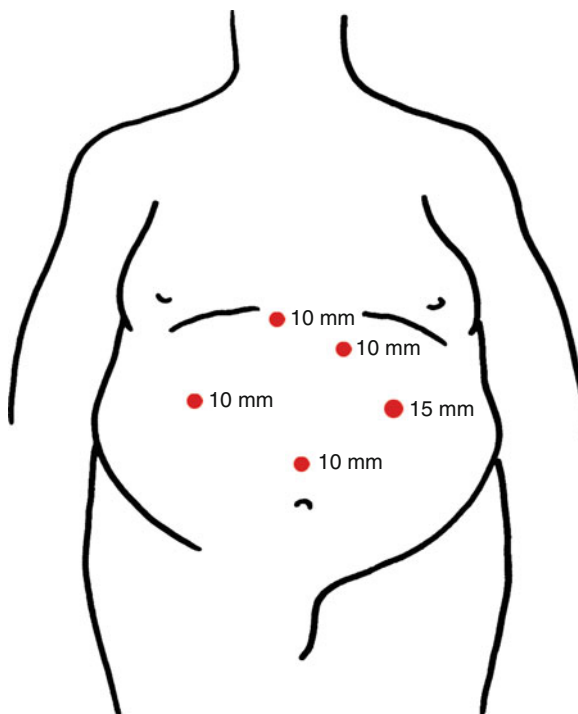


Fig. 2.43 Placement of the trocars

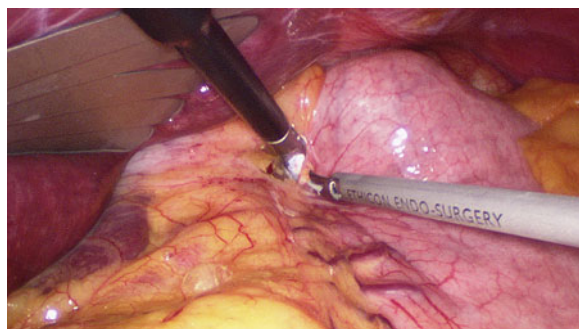


Fig. 2.44 Calibration of the pouch with 25 mL of saline by carefully pulling it toward the GE junction; dissection begins at the equatorial plane at the lesser curvature

- Mark the equatorial plane of the balloon by ticking the serosa with an electrical device at the lesser and the greater curvature.
- Empty the balloon and remove it.

Creation of the Retrogastric Channel, Pars-Flaccida Approach

- Begin dissection of the hepatogastric ligament close to the lesser curvature in an avascular area, taking care to spare the hepatic branch of the vagus nerve.

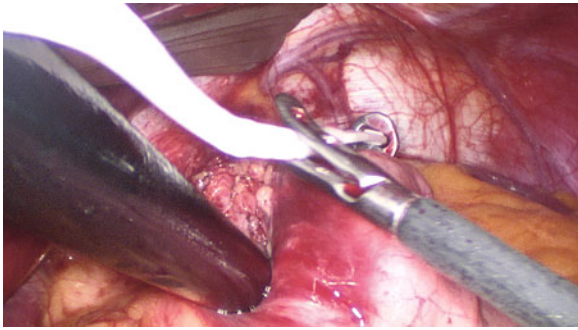


Fig. 2.45 Flexible retractor with retrogastric tunnel, connection to the gastric band

- Continue up to the right crus of diaphragm, dissecting the backside of the stomach under visual control. The medial border of the right crus can now be seen next to the loose connective tissue between the left and the right crus.
- Now pull the greater curvature in mediocaudal direction with a large grasper and open the peritoneum at the marked spot proximal to gastric blood vessels near the angle of His; the cut is about 10-mm long.
- Dissect and mobilize the stomach wall alongside the greater curvature up to the left crus of diaphragm, using a 30° angled camera.

Retrogastric Tunnel

- Passage through the retrogastric tunnel is possible with an atraumatic angled blunt dissector. We prefer the flexible retractor; the flat and approximately finger-wide tip can be angled and allows safe dissection.
- Insert the dissector through the paraxiphoid trocar No 3 alongside the lesser curvature up to the right crus of diaphragm.
- Form a 90° angle with the instrument and insert it with gentle pressure into the retrogastric tunnel. Push it through the prepared channel behind the stomach to the greater curvature. If done correctly, the tip of the angled dissector will appear in the angle of His at the greater curvature (Fig. 2.45).

Inserting the Band

- We use the Lap-band (INAMED Health, Santa Barbara, USA) or the Swedisch Gastric Band (SAGB/Obtech, Ethicon-Endo-Surgery).
- Insert the band into the abdomen through the 15-mm trocar.

- Place the strap of the band into the slot of the flexible retractor and pull the band back through the retrogastric channel.
- Now you can position the band around the cardia in the equatorial plane and lock it with or without a special instrument.

Covering the Band

- Position the lock of the gastric band medially, dorsal to the left hepatic lobe.
- Cover the band completely with serosa beginning far dorsally at the greater curvature. Place 3–4 seromuscular single sutures with absorbable monofilament material.
- Pull the tube of the gastric band out of the abdomen through trocar No 4.
- Remove the instruments under visual control and desufflate the pneumoperitoneum.

Positioning the Port Chamber

- Fasten the port chamber on the fascia of the rectus sheath in the middle upper abdomen with four non-absorbable single sutures. Widen the skin incision for trocar No 1 for this step and guide the silicone tube to trocar No 4 subcutaneously.

Take great care to prevent kinking of the tube close to the port chamber.

- After connecting the port chamber with the tube, check the function of the band by injecting 2 mL of saline in the chamber (huber needle). Remove the saline completely afterward.
- Close fascia and skin of all trocar incisions.

Aftercare

Let patients drink immediately after surgery. Reaffirm the correct position of the band radiologically before the patient is released from hospital. An emergency health card informs other doctors about the procedure. Tightening of the band is performed no earlier than 6–8 weeks after the procedure on an outpatient basis, depending on the individual patient's situation. The first filling is usually performed when weight loss stagnates. Lifelong aftercare is mandatory.

2.4 Surgical Technique by Karl Miller, (Austria)

Karl Miller

Introduction

Minimal invasive or laparoscopic techniques have found their way into almost all surgical disciplines and have been performed much more frequently since the early 1990s due to constant technical improvements. Vertical banded gastropasty, gastric bypass, and even biliopancreatic diversions are performed laparoscopic [1–3]. The least invasive laparoscopic procedure is the implantation of the adjustable gastric band.

In bariatric surgery, the surgical procedure is not the final point, but the beginning of the treatment.

Regular aftercare and cooperation of the patient are crucial for success.

Indication for Surgery

Indication for surgery is defined in evidence-based guidelines. A BMI over 40 defines severe obesity that needs to be treated. Surgical therapy is justified if it is the patient's wish and the surgeon believes it to be indicated, too. A BMI over 40 is about 45 kg excess weight over ideal body weight in a person with average height. Patients with a BMI between 35 and 40 should be considered for surgery if they suffer from comorbidities that can be improved substantially through weight loss.

The patient must be able to take care of himself or otherwise have somebody at hand to secure aftercare. High motivation on the side of the patient and interdisciplinary treatment are much more important for success than strict exclusion criteria that are changed yearly anyway.

Adjustment of the band, psychological care, and dietary advice constitute a major part of therapy with the adjustable gastric band. If aftercare cannot be guaranteed, absolutely refrain from performing the procedure.

Follow the guidelines of the American Society for Bariatric and Metabolic Surgery (ASMBS) and the International Federation for the Surgery of Obesity (IFSO) requiring a hospital to have sufficient experience in both open and laparoscopic abdominal surgery. It must also offer qualified nutritionists, psychologists, a motivated nursing staff, and if possible a support

group. Special examination couches, operating tables, beds, and instruments in case of the need to switch to conventional surgery must be provided as well as facilities for perioperative monitoring. The necessity of well trained and experienced surgeons is obvious.

Information of the patient, especially the first counseling interview, is time-consuming and of great importance. There is almost no other surgical procedure in which success or failure is so dependent on the patient's cooperation. Patients must learn about obesity as a disease, current surgical procedures, laparoscopic band implantation, possible complications, warning symptoms, and aftercare. Patients with extreme morbid obesity (triple obesity, BMI over 60), severe eating disorders such as binge eating or insulin-dependent type II diabetes should rather be treated with complex procedures, such as a gastric bypass or biliopancreatic diversion.

Preoperative Proceedings

- Apart from taking the medical history and a physical examination, endocrinological diseases must be treated sufficiently. An internal medical examination, an abdominal ultrasound scan and spirometry are recommendable.
- Existing gallstones should be removed during the same procedure, as massive weight loss often leads to gallstone-related complications.
- The patient is introduced to the anesthetist several days before the procedure with the examination results. Dietary advice and a psychological examination are mandatory.
- It makes sense to have compression stockings custom made before admittance to the hospital. Patients bring a cost acceptance declaration from their health insurance company (Table 2.1).
- In our department we conduct the educational talks not on the day of the procedure, but some time earlier.

Perioperative Care

- We recommend perioperative antibiotic prophylaxis (cephalosporin single shot) and low molecular weight heparin (medium to high risk).
- The patient may drink small amounts of tea immediately after the procedure. A water-soluble contrast swallow is performed the next day, and then the step-by-step return to the recommended diet begins.

Table 2.1 Checklist for perioperative measures and diagnostics

Information of the patient, medical history, physical examination
Internal preoperative examination
Blood tests preoperatively
Spirometry
Abdominal ultrasound scan
Gastroscopy if indicated
Functional diagnostics of the upper gastrointestinal tract if indicated
Tests on metabolism if indicated
Dietary advice
Psychological tests
Fitting of compression stockings
Application for cost acceptance declaration from the health insurance company
Schedule appointment for procedure (not in first interview)

Table 2.2 Postoperative measures

Time after surgery	Measure
Day 1	Water-soluble contrast swallow
Day 7/8	Removal of the stitches
Weeks 4–6	Dietary advice, band adjustment, (water-soluble contrast swallow)
Month 3	Clinical examination, band adjustment if necessary
Months 6–9	Clinical examination, band adjustment if necessary
From then on once a year	Ultrasound scan, medical history, quality control, physical examination, water-soluble contrast swallow

Optional and according to demand: psychological care, dietary advice, and support groups anytime

- More dietary counseling should take place before the band is tightened for the first time.
- Further control examinations depend on the procedure and individual needs of the patient (Table 2.2)

Preparation

Setting, Positioning, and the Surgical Team

- The patient is positioned overstretched slightly with spread legs.
- The pneumoperitoneum (12 mmHg) is created from the left middle upper abdomen. The patient is brought into an anti-Trendelenburg position only after the trocars are placed to avoid an injury of the liver.

Positioning the Trocars

There are many different suggestions for positioning the trocars. Their placement depends on the patient's habitus and is the key to success in extreme obesity. In contrast to normal abdominal walls the trocars cannot be tilted within obese abdominal walls. Preoperative assessment of the size of the left hepatic lobe with an ultrasound scan can be very useful.

- The first incision for the optic trocar is placed about a hand width below the xiphoid a little left to the middle line and should be performed under visual control to avoid injury of the liver.
- The liver retractor is inserted in the right middle/upper abdomen or in the epigastrium.
- Through a puncture with a long needle in the epigastrium right to the middle line the best position for a dissector and later the closing instrument is determined.
- The trocar for the dissector and for the insertion of the band is placed in the left middle/upper abdomen. The 15-mm trocar for the insertion of the band can be placed here.
- Insertion of another 5-mm trocar next to the left costal arch is optional; it can be used to tense the stomach wall or to retract the greater omentum.

Surgical Technique

After placing the trocars lift the left hepatic lobe far enough to display the diaphragm. The band must always be placed around the upper part of the stomach and not the esophagus. There are three different techniques for band implantation. Perigastric placement after creation of a retrogastric channel has been abandoned in the last years in favor of the so-called pars-flaccida approach. A combined procedure (pars-flaccida to perigastric) needs to be performed especially in patients with massive fat tissue around the cardia.

Perigastric Approach

- Insert the gastric tube that comes with the band into the stomach, fill the balloon at the tip with 15–20 m³ of air and pull it back to the GE junction.
- Dissect a 0.5 cm opening at the equatorial plane at the lesser curvature. Continue dissecting along the stomach wall on the backside up to the angle of His, but take care not to open the omental bursa.
- At the greater curvature dissect the left crus of diaphragm and the GE junction in the angle of His. Do

not cut the gastrophrenic ligament; the band will be positioned within it.

- Insert the dissector (we prefer the “goldfinger”) through the opening up the lesser curvature and place it into the angle of His inside the gastrophrenic ligament by bending the tip.
- The band can only be inserted into the abdomen through 15 or 18 mm trocar. You can also position the band around the GE junction with an angled atraumatic grasper.
- Before locking the band, fill the balloon at the tip of the gastric tube with 15 mL of air. The band will lock below this pouch; no further sutures are necessary to secure it.
- To avoid slippage of the band, add 3–4 seromuscular single sutures to the front side of the stomach.
- Pull the end of the tube out through the 15 or 18 mm trocar and connect it to the port.
- Fasten the port with four nonabsorbable sutures (upon or under the front fascia of the rectus sheath) near the incision for the 15 or 18 mm trocar. You could also use a port stapler (Fig. 2.46a and b).

Pars-Flaccida Approach

- After reaching the operative site, open the pars flaccida of the lesser omentum to display the right crus of diaphragm.
- Create a channel in the avascular part of the gastrophrenic ligament by dissecting in the angle between the crus of diaphragm and the GE junction.
- The band is prepared for implantation by rinsing it with saline and testing for tightness.
- Insert the band system into the abdomen through the 15 or 18 mm trocar.
- Above the omental bursa, dissection is performed with an atraumatic forceps, the retrogastric channel is created with the atraumatic flexible “goldfinger.” Fat tissue around the lesser curvature and the ventral vagus nerve are included within the band system in this technique. A 2-0 Ethibond suture at the end of the band system connects it to the “goldfinger.”

We recommend fastening the fundus to the left crus of diaphragm to keep the fundus from slipping proximally (Fig 2.47).

- Three to four nonabsorbable sutures are placed onto the front wall of the stomach to avoid slippage of the band.

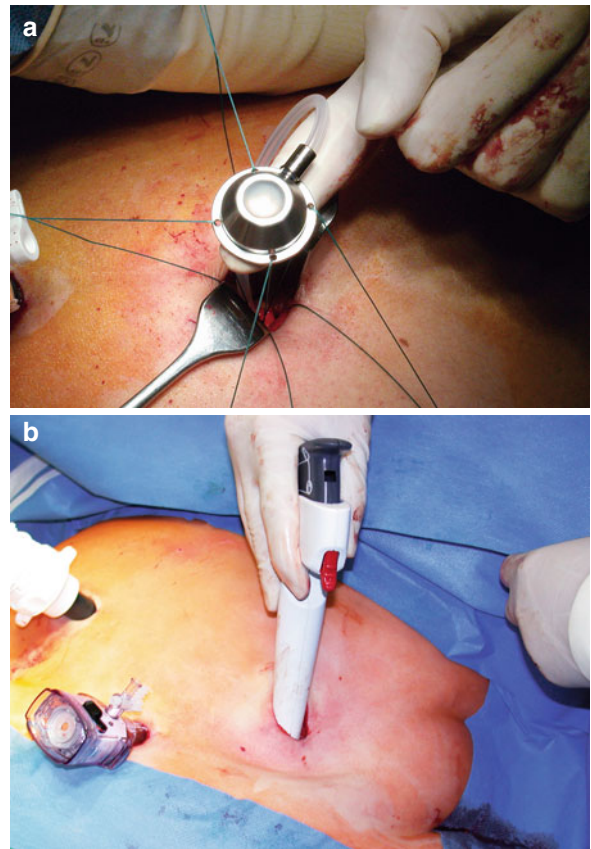


Fig. 2.46 (a) Fastening the port with four nonabsorbable sutures. The sutures are placed first, then the port is positioned onto the fascia, then the knots are tied. (b) Fastening the port chamber with a port stapler

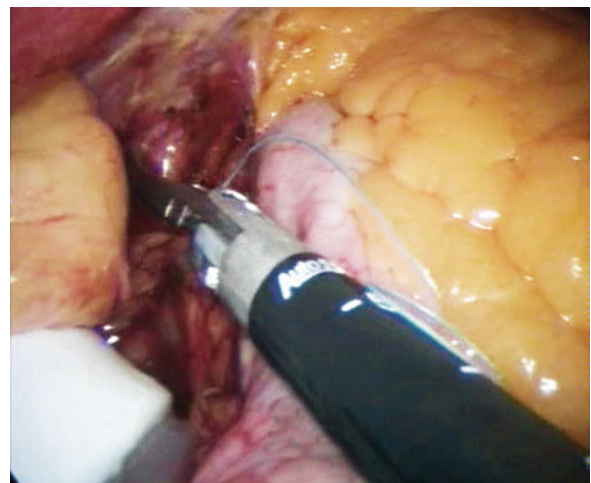


Fig. 2.47 The fundus is sutured to the left crus of diaphragm to prevent proximal slippage

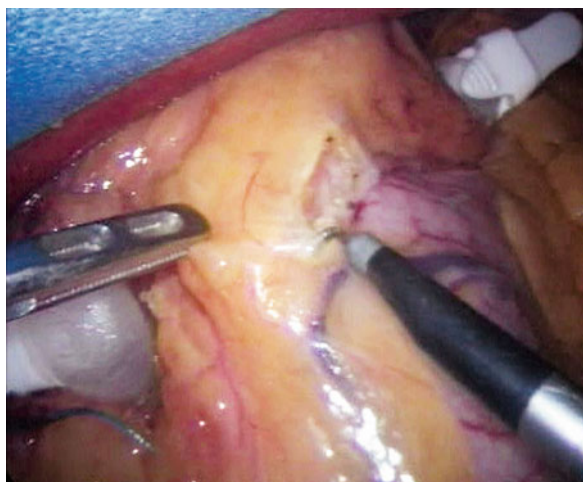


Fig. 2.48 In patients with massive fat pads the band might be too small. Dissect a channel between the stomach and the fat pad before locking the band

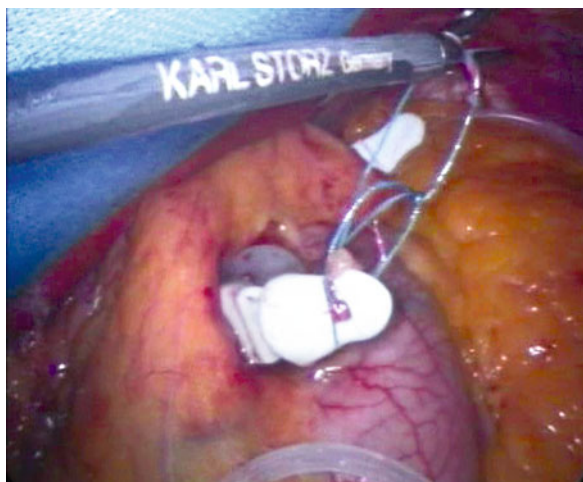


Fig. 2.49 The left part of the band is pulled between the stomach and the fat pad with a “goldfinger” or the flexible dissector and then locked

Combined Technique

The band might be too short in patients with massive fat tissue around the cardia.

Before locking the band, it is first positioned following the pars-flaccida approach, and then a channel is created between the stomach wall and the surrounding fat tissue (Fig. 2.48). Then the band is pulled through with the “goldfinger” or a dissector and finally is locked close to the stomach wall (Fig. 2.49).

Latest developments in surgical technique can be summarized as following:

Table 2.3 Complications after placement of an adjustable gastric band [4–26]

Complication	Incidence (%)
Perioperative complications	
Lethality	0–2.1
Injury of the gastric wall	0–3.5
Pneumothorax	0–0.2
Hemorrhage	0.5–2.0
Late complications	
Pouch dilatation with/without slippage	0–13.4
Banderosion	0–4.6
Complications concerning the port and the band system	0.5–10.4
Wound infection	0–7.7
Motility disorders (clinically apparent)	0–1.5

- Reduction of the pouch to 15 cm³
- Placement of the band above the omental bursa
- Pars-flaccida approach
- The band should be within the gastrophrenic ligament
- Band is secured tightly with sutures at the front wall of the stomach
- If the omental bursa is opened, the band is placed so far away from the GE junction that additional stay sutures need to be placed on the back of the stomach.
- The band should not be filled in the first weeks after surgery to avoid vomiting. This could lead to a breakdown of the stay sutures and slippage of the band.
- If the band is too tight, the combined technique is chosen.

Difficult Situations and Intraoperative Complications

Complications can arise early or later (Table 2.3). Preventing complications altogether is first priority. Thorough training and an interdisciplinary treatment concept have been mentioned before. The incidence of surgical complications such as slippage or band erosion has been lowered significantly by following the pars-flaccida approach [4].

Perioperative Complications

Mortality

Perioperative deaths have been reported after perforation or necrosis of the stomach wall, cardiogenic shock, and pulmonary embolism. Large centers figure mortality of adjustable gastric band surgery to be about 0–0.1% [5–8].

Injury of the Stomach Wall

The stomach wall can be injured fairly easy in confusing situations. During the “learning curve,” the first 50 procedures, usually one or two stomach perforations occur [8–11]. The incidence of this complication is about 0–3.5% [9].

If the perforation is located distally of the band, the latter can be implanted after suturing the injury. This complication can be avoided by working carefully and using suitable atraumatic instruments.

We recommend injecting 5 mL methylene blue with 15 mL saline through the gastric tube before positioning the gastric band, if the procedure is difficult or the site confusing.

Other Perioperative Complications

Other complications, such as hemorrhage or pneumothorax, can also occur, just as in conventional abdominal surgery. Literature reviews confirm that complication rates are lower in laparoscopic procedures than in conventional surgery. Always have an effective hemostyptic, such as FloSeal (Baxter), at hand.

Late Complications

Pouch Dilatation with Slippage of the Band

Many authors report pouch dilatation at the backside of the stomach near the omental bursa [9–12]. The frequency of this complication was lowered significantly by placing stay sutures to the backside of the stomach or by positioning the band above the omental bursa and within the gastrophrenic ligament [4–13]. O’Brien conducted an impressive study with 350 patients; he reduced the incidence of pouch dilatations and band slippage from 30% to 2.5% by placing sutures on the backside of the stomach [14]. Pouch dilatations usually occur about 8 months post surgery [13].

Pouch Dilatation Without Slippage of the Band

This rarely reported complication [15] is probably due to a pouch that was created too large from the beginning [13]. Desai published a study comparing revision rates after two different pouch sizes: 25 cm³: 33%, 15 cm³: 5.1% [16]. The size of the pouch can be measured perioperatively with the calibration balloon that comes with the system (BioEnterics Corporation) or a gastric tube with an excentric balloon fastened to the tip (Ethicon). The size of the pouch should not exceed 15 cm³.

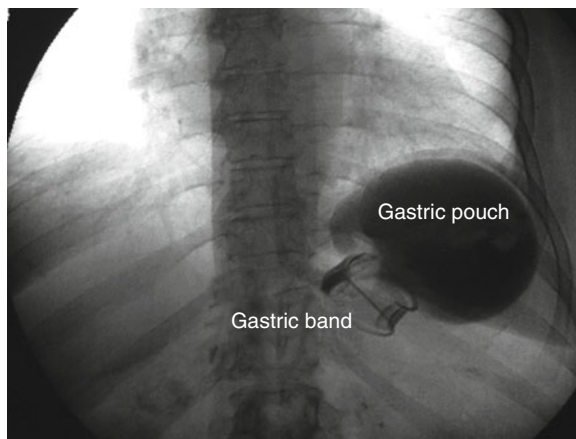


Fig. 2.50 Complete slippage after gastric banding. Contrast cannot pass into the remnant stomach, the pouch is dilated

Pouch dilatation is marked by early impaired food ingestion. Possible causes are eating beyond satiety, eating too fast, induced vomiting, or consuming large amounts of carbonated drinks. Chelala showed that repeated vomiting can lead to pouch dilatation [17]. An adjustment of the band should therefore be performed a few weeks after the implantation.

Therapy of Pouch Dilatation and Band Slippage

This complication can be avoided by correct positioning of the band (above the omental bursa) and intraoperative measurement of the pouch. Diagnosis is made with an X-ray showing an asymmetrical pouch. Extreme dilatations lead to complete obstruction (“internal herniation”; Fig. 2.50); an emergency procedure is required.

If the problem is recognized early, the band can be adjusted by removing saline to widen the exit. Sometimes the pouch dilatation can thus be reversed. Alvarez-Cordero succeeded in doing so in three out of eight cases [18]. If the procedure is not successful, the band needs to be repositioned.

One can either reposition the old band or remove it and position a new band correctly. This procedure can well be performed laparoscopic [19].

Band Erosion

Migration of the band into the stomach is usually treated by removal of the system (Fig. 2.51). Dargent has treated 500 patients; 3 of whom experienced band erosion 17, 18, and 21 months after surgery. One patient needed a 2/3 gastrectomy, in the other two cases the band was removed laparoscopic [4].

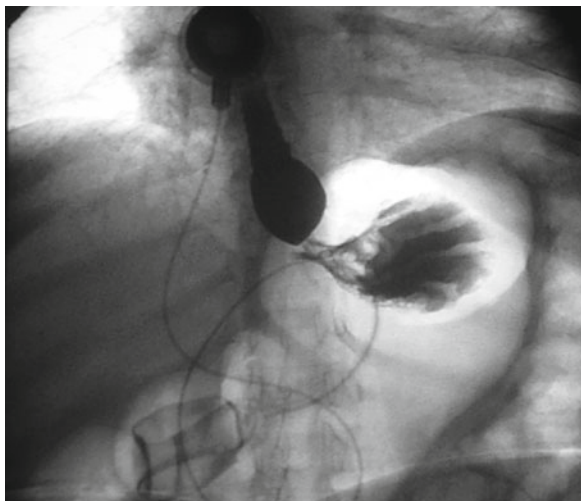


Fig. 2.51 Band erosion X-ray. The band has migrated through the stomach wall completely and is now inside the distal stomach

Band erosion is usually diagnosed because of symptom-free weight gain or heartburn and upper abdominal pain. In an analysis of 3,800 patients wearing the Lap-Band an erosion rate of 0.6% was found. Reasons might be increased pressure within the band (overfilling), injury of the stomach wall during dissection or sutures and clips. No definite cause however has been verified. The gastric band can be removed gastroscopically with a band cutter (AMI, Austria) or with a laparoscopy.

Complications of the Port System and the Tube

Use nonabsorbable sutures to prevent the *port chamber from flipping over*. The port should be positioned a few centimeters away from the point at which the tube exits the abdomen to prevent kinking.

Port inflammation can be caused by band erosion; colonization of the port chamber by germs comes through the stomach. Always perform gastroscopy in case of port inflammation for this reason. Insufficient hygiene while puncturing the port is also discussed.

Leakage of the band usually results in symptom-free weight gain. Leakage can be proved by injecting Jopamiro or Uromiro. Very small leaks can take hours to days before they show symptoms, i.e., days later the patient can suddenly eat much more. In this case a thallium-201-szintigraphy can show the miniature leak

[22]. If the diagnosis is made, either the port or the complete system are exchanged.

Management of port inflammation without erosion includes removal of the port, filling of the band with the before used amount of saline, closure of the tube, and placement of the tube into the peritoneum. If inflammation persists, the complete system will have to be removed. A new port or band system can be implanted laparoscopic 6–8-weeks later [23].

Esophageal Dysmotility

Greenstein postulates that preexisting esophageal hernia and/or esophageal dysmotility predispose to revision procedures [24]. In this study, patients with esophageal dysmotility have revision rates of 33%, so do patients with hiatus hernia. But he had an all-over revision rate of 18%; all of these were among his first 30 patients. We found no such correlation for our patients [25]. Morbidly obese patients have symptom-free esophageal dysmotility in up to 60%. If dysmotility becomes symptomatic after surgery (achalasia – like signs in radiological and manometrical examinations), we recommend removing the saline from the band completely or removing the entire band system laparoscopic and performing a different bariatric procedure, such as a gastric bypass.

Adjuvant Pharmaceutical Therapy

If the band system is dysfunctional, patients can receive Orlistat 3×120 mg to avoid weight gain while waiting for the revision procedure. Our pilot study proved that patients continued to lose weight with Orlistat even if the band was dysfunctional or removed [26].

Summary

Obesity and morbid obesity are a chronic multifactorial disease in need of treatment. We believe that the laparoscopic implantation of an adjustable gastric band is an efficient treatment for most of the morbidly obese patients. Stomach or intestine do not have to be opened, anatomy and physiology of the gastrointestinal tract are left intact. Late metabolic complications are not to be expected. Weight loss and food intake can be adjusted individually according to the patient's needs. Eighty percent can expect to lose 50–60% of their excess weight.

Removal of the band and restoration of the original situation is much easier than after other procedures.

Surgical technique is difficult in the beginning, but easy later on and bears comparatively little risk as long as the safety recommendations are followed.

In bariatric surgery, the surgical procedure is not the final point, but the beginning of the treatment.

Regular aftercare and cooperation of the patient are crucial for success.

2.5 Surgical Technique by Rishi Singhal and Paul Super (Great Britain)

Rishi Singhal and Paul Super

Preparation

Setting, Positioning, and the Surgical Team

- Patients are positioned in reverse Trendelenburg position either with legs straight or in leg supports.

Trocar Placement

Five laparoscopic ports are used (15 mm, 10 mm, and 3 × 5 mm). Essentially these are placed as high as possible on the abdomen as long as they are not above the left lobe of liver. Where the liver is large, they must be placed in a correspondingly lower position so that the instruments clear under the liver.

- The 5-mm liver retractor (Snowden Pencer Inc.) is placed via the mid-clavicular LUQ port site.
- The surgeon's left hand working port (5 mm) is just to the right of the midline.
- The 30° camera port (10 mm) is medial to the left mid-clavicular line.
- The surgeon's right hand working port (15 mm) is lateral to the mid-clavicular line. It is used for introduction of the band and for suturing.

Bleeding from the epigastric artery is minimized by always being lateral to the mid-clavicular point.

- A final 5-mm port is placed in the anterior axillary line and used for assistant retraction, usually on the stomach but also on the band during fixation suturing.

In order to enable smooth instrument control and manipulation all ports should be directed through the abdominal wall in the direction of the hiatus. This ensures that instruments pass through the ports smoothly with little drag on the port edges. This is most important in BMI greater than 50 where the thicker abdominal walls make pivoting of the port to change direction in the abdomen very difficult if not impossible. The greater the abdominal wall thickness, the greater the requirement to have all ports inserted in the direction of the cardia. The exception is that for the liver retractor which is inserted in the direction of the left iliac fossa.

Surgical Technique: Pars-Flaccida Approach, SAGB

All dissection in our practice is carried out with simple hook diathermy.

- Surgery starts with the creation of a window in the lesser omentum. Usually a large cruciate incision is all that is required and this is made in the avascular portion below the hepatic branches of vagus and vessel bundle which run transversely from the left lobe of liver to the cardia.
- Fat pads attached to the cardia can be retracted by the assistant to the left to reveal the right crus.
- A 2-cm vertical incision is made in the myomesium over the medial border of the right crus to reveal the muscle surface.
- Gentle retraction of the fascia to the left and the crural bundle to the right allows a grasper to probe the path of least resistance and to pass between the cardia and the aorta and at the same time to pass in front of the left crus which at this stage can usually be seen behind the cardia in the lower BMI patients.
- Next attention is drawn to the angle of His and to display the left crus.
- The peritoneal reflection of the angle of His is taken down. The assistant retracts the fundus close to the cardia downward, and the surgeon retracts the fat pad over the cardia to the right. This maneuver usually reveals the left crus.

- The crus is followed downward in a caudal direction and a similar 2 cm vertical incision is made in the myomesium over the left crus using the hook diathermy. This mirrors the incision in the myomesium made over the right crus.

Occasionally a sliding hiatus hernia is encountered and if less than 3 cm, usually band insertion alone is all that is required. The band reduces the hernia and subsequently will produce fibrosis of the band tunnel and prevent prolapse of the stomach and band above the hiatus. If the hiatus hernia is greater than 4 cm we always carry out a 2-suture posterior crural repair (nonabsorbable sutures) from the right side of the cardia which is fairly straightforward given the dissection over the right crus which we have already undertaken as part of our insertion technique. In this case we incise the myomesium over the medial border of the right crus over a 5-cm length and the assistant retracts the cardia to the patients left to display both crura.

Delivery of the Band

- A blunt retrogastric dissector is passed from the opening in the myomesium over the right crus, behind the cardia to the opening in the myomesium over the left crus where it exits into the abdomen.

Many types are available and we favor the Goldfinger (Snowden Pencer Inc).

- The band is usually prepared by priming with normal Saline and almost fully aspirating.
- A 2/0 vicryl loop is secured to the band and this usually fits snugly into the groove on the retro-gastric dissector.
- The band is delivered into the abdomen via the 15-mm port. The band is fastened below the peri-gastric fat pad which we never resect.

If the fat pad is bulky we favor the use of a larger size gastric band and pull the fat pad cranially above the band.

Gastric Fixation (Tunnelling) Sutures

We have developed the “Birmingham Stitch” which incorporates a plication suture to gather up the redundant superior fundus which is fixed high up on the left crus. We believe this significantly reduces the risk of slippage.

- This is started high on the fundus approximately 5 cm lateral and parallel to the band and plicates up the fundus in a line toward the angle of His (Figs. 2.52 and 2.53).
- Next two gastro-gastric sutures are inserted, the first from the anterior fundus and the second from the fundus close to the lesser curve, each suture again plicating the fundus in a line parallel to the band and approximately 5 cm lateral to it. These sutures are nonabsorbable and extra-corporeal suturing is used which allows multiple (up to 10) points of suture fixation to be drawn together as the suture loop closes securely.

If there has been any minor bleeding from the sutures or dissection then this can be controlled using a small swab inserted via the 15-mm port. Formal irrigation is seldom necessary.

- The band tubing is delivered into the abdominal wall via the 10-mm camera port site.
- We always place the adjustment port over the xiphisternum and so we enlarge the 5-mm incision closest to the site. Using the hook diathermy, we then clear a 2 cm area of muscle fascia over the linea alba as high up as possible.

We feel that the subcutaneous fat layer is thinnest here and patients prefer the port not to be near the left costal margin where some surgeons place the port. This area is relatively avascular with less risk of hematomas (and infection). Besides this, the port in this position is more easily palpable for subsequent port adjustments.

- Three or four nonabsorbable sutures are placed in the linea alba and a tunnel is made from this port wound to the 10-mm tubing exit wound. It is important that

Fig. 2.52 Diagram of the Birmingham stitch

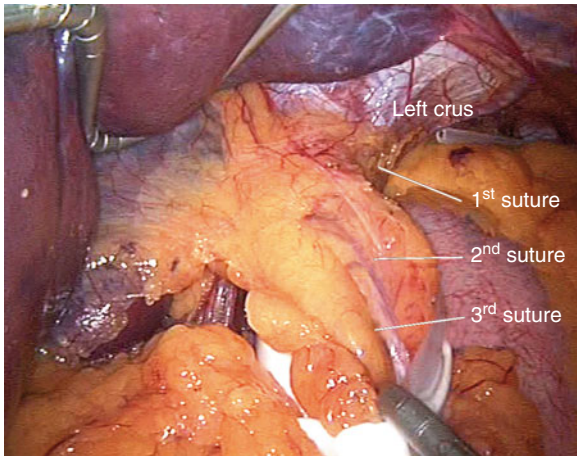
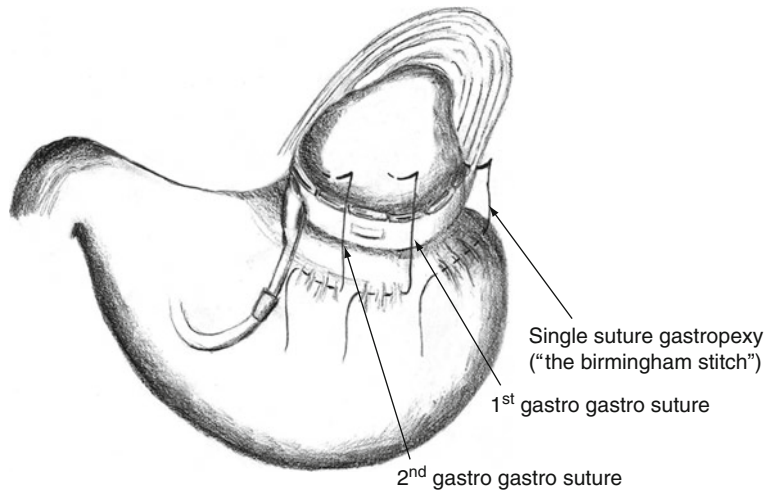


Fig. 2.53 Positions of gastropexia and gastrogastric sutures

this subcutaneous tunnel for the tubing is in contact with the fascia and that the tubing is exiting a 10-mm port wound. This facilitates easy replacement of the tubing into the abdomen without any further requirement for laparoscopy.

- When the adjustment port is attached to the tubing it is extremely important to remove any axial twist in the tubing so that there are no axial forces on the port which we believe are the most common reason for subsequent port rotation.

Wound Closure

- We never try to suture the fascial or muscle layer in any of our port sites. A fine absorbable suture is used to close the superficial fascia over the port and all wounds are closed with tissue glue.

If there is a persistent ooze from the 10 mm or 15 mm port sites then a large surgical pack (Johnson and Johnson) is inserted beneath the fascial layer to compress any bleeding. If the bleeding is brisk then the fascia should be sutured directly to secure hemostasis.

Band Adjustments

- We favor radiological adjustments at 3 monthly intervals which always ensures an appropriate and optimal band fill and patient satiety. In addition, inappropriate band fills are largely avoided if radiology detects esophageal dilatation and if pouch enlargements are the reasons for lack of satiety.

Difficult Situations and Intraoperative Complications

Early Postoperative Dysphagia

This is usually because too much residual fluid was left in the band system at the end of surgery. If this persists after 24 h and the patient cannot tolerate sips, we remove all residual band fluid by deflation.

If dysphagia to liquids persists, a trial of a short course of Hydrocortisone 100 mg twice daily for 2 days usually improves swallowing.

If not, a repeat laparoscopy should be performed and a larger size of band inserted, usually by suturing the new band to the opened end of the band being

removed. This means that one band replaces the other without disturbing the tunnel sutures covering the band.

Early Postoperative Pain and Sepsis

At the end of the procedure we always perform a local anesthetic block of each of the wounds using 0.5% bupivacaine or equivalent. This is introduced into the rectus sheath taking care not to damage the band tubing in those port sites close to the adjustment port.

In nearly all cases Diclofenac 100 mg and paracetamol 1.0 g are given rectally at the end of the procedure which gives gradual pain control over the first few postoperative hours. Postoperative opiates are avoided since this impedes early resumption of oral intake and early mobilization (important factors in the prevention thrombo-embolism and in the promotion of same day discharge).

It is uncommon to have *severe postoperative pain* following gastric banding although shoulder pain may persist for several days if there has been any accumulation of hematoma in the subphrenic area or if any gastric fixation sutures have been inserted into the right hemi-diaphragm (suturing into the left crus does not cause shoulder pain).

If patients develop severe pain in the postoperative period which is constant and associated with sepsis then this must be investigated by contrast swallow looking specifically for evidence of leak secondary to gastric trauma at the time of insertion. This pain may be upper abdominal or epigastric but usually chest pain. Even if the contrast study is normal and pain and sepsis persist we would advocate early laparoscopy and direct inspection of the band with methylene blue testing of the gastric pouch as such a complication remains a possibility.

If evidence of a *gastric perforation* exists then this should be treated by band removal and drainage of the area. Usually any perforation is tiny, usually affecting the posterior cardia and will heal spontaneously without any requirement for suture repair.

Early Postoperative Bleeding

This is usually port-site bleeding and usually from the port in the left upper quadrant which is the largest. Normally the bleeding is greatest after administration of anti-coagulation in which case the bleeding should stop spontaneously and surgical control of the bleeding will not be necessary. If signs of bleeding persist

then the patient should be returned to the theatre for repeat laparoscopy, washout, and suture of the bleeding point.

Port Site Infection

This may be a simple superficial problem but may also be a feature of a true band infection. We advocate laparoscopy in all cases in order to inspect the tubing. If the band tubing is clearly visible and free of omental adhesions then the band is unlikely to be infected. In this circumstance we would cut the tubing and remove the port at the end of the operation with subsequent re-laparoscopy and replacement of a new port 3 months later. Antibiotic cover for *Staphylococcus aureus* should be given. If at the initial laparoscopy the band tubing is covered in omental adhesions and not directly visible then usually there is a band infection. We favor immediate band removal (without taking down fixation sutures) and subsequent band replacement 6 months later when inflammation and fibrosis will have almost fully resolved.

Punctured Band Balloon

This usually is only a feature with bands which have thin balloons which are not pre-formed such as the old type Swedish band (Ethicon). The puncture is usually seen using contrast radiology as the leaks are due to material failure. A fracture line allows contrast to escape from the balloon into the tissues following contrast injection into the port. In this case we laparoscope the patient and exchange one band for another using a lower profile band. This is usually done without taking down the fixation sutures as the replacement band can be attached to the old band using a single suture. As one band is removed, the new band replaces it in the same retro-gastric tunnel.

Esophageal and Pouch Dilatation

These radiological findings are secondary to high pressures in the stomach and esophagus and develop gradually and chronically due to overeating. In some cases they will always appear if the band has been tightened inappropriately beyond optimum and are an inevitable consequence of a normal fluid and soft food intake. In the first instance the band should be partially deflated and the patient given further dietary advice regarding optimal meal consistency and volume. If there is a large pouch dilation then this usually

behaves like a partial slippage and the patient may well obstruct again even with a partially deflated band. The key here is to have a lower threshold for radiological evaluation if there is a past history of these complications developing.

Partial Band Slippage – Responds Clinically to Band Deflation

A partial slippage usually will respond to full deflation of the band. This means that patients who had obstructive symptoms to fluids will now be able to drink. The band cannot be inflated fully without first being replaced higher around the cardia. This only makes sense if the patient has had successful weight loss whilst the band was in a good position before the slippage developed. If the patient demonstrated no success with the lap-band system the slippage of the band should be considered a reason for band removal and subsequent conversion to another type of bariatric surgery.

Full Slippage – No Clinical Response to Band Deflation

This is a surgical emergency, the consequences of which could result in gastric necrosis, leak, and death of the patient. Immediate laparoscopy once fluid resuscitation has taken place should be performed with band removal. The fundus may have been strangulated above the band and exhibit signs of necrosis. Once decompressed by band removal one usually finds a loose and redundant fundus which is amenable to excision if there is any suggestion of gastric necrosis. Excision is facilitated by laparoscopic stapling with articulated stapling device which cuts and seals the resected tissues.

Band Erosion or Migration into the Gastric Lumen

This is a rare complication in some units and common in others. This suggests that surgical techniques and band fill protocols in some way influence this complication. It is the experience of the authors of this chapter that erosion is always preceded by partial slippage which perhaps results in stretching and pressure necrosis of the gastric wall over the top edge of the band which results in erosion developing. Once erosion has occurred the band can be cut endoscopically using a band cutting device. The band is then pulled into the stomach lumen and removed endoscopically. If this is

not possible or not available then removal for erosion can be carried out laparoscopic but the band may only be accessible via a gastrotomy made high on the fundus. The band should be grasped, cut with scissors, and pulled into the abdominal cavity followed by closure of the gastrotomy.

References

2.3 Surgical technique

1. Buchwald H, Avidor Y, Braunwald E, Jensen MD, Pories W, Fahrback K, Schoelles K (2004) Bariatric surgery. A systematic review and meta-analysis. *YAMA* 292:1724–1737
2. Stroh C, Hohmann U, Schramm H, Manger T (2005) Langzeitergebnisse nach Gastric Banding. *Zentralbl Chir* 130: 410–418
3. Stroh C, Hohmann U, Will U et al (2008) Experiences of two centers of bariatric surgery in the treatment of intragastrale band migration after gastric banding – the importance of the German multicenter observational study for quality assurance in obesity surgery 2005–2006. *Int J Colorectal Dis* 23(9):901–908
4. Stroh C, Birk D, Flade-Kuthe R et al (2009) A nationwide survey on bariatric surgery in Germany-results 2005–2007. *Obes Surg* 19(1):105–112

2.4 Surgical technique

1. Chua Ty, Mendiola RM (1995) Laparoscopic vertical banded gastroplasty: the Milwaukee experience. *Obes Surg* 5:77–80
2. Wittgrove AC, Clark GW, Schubert KR (1996) Laparoscopic gastric bypass, Roux-en-Y: technique and results in 75 patients with 3–30 months follow-up. *Obes Surg* 6:500–504
3. Cleator IGM, Litwin D, Phang PT, Brosseuk DT, Rae AJ (1994) Laparoscopic ileogastrostomy for morbid obesity. *Obes Surg* 4:358–360
4. Fried M, Miller K, Kormanova K (2004) Literature review of comparative studies of complications with Swedish band and Lap-Band®. *Obes Surg* 14:256–260
5. Dargent J (1999) Laparoscopic adjustable gastric banding: lessons from the first 500 patients in a Single Institution. *Obes Surg* 9:446–452
6. Favretti F, Cadiere GB, Segato G, De Marchi F et al (1999) Lap-band for the treatment of morbid obesity. A 6-year experience of 509 patients. *Obes Surg* 9:327
7. Klaiber Ch, Metzger A, Forsell P (2000) Laparoskopisches gastric banding. *Chirurg* 71:146–151
8. Miller K, Pump A, Hell E (2007) Vertical banded gastroplasty versus adjustable gastric banding: prospective long-term follow-up study. *Surg Obes Relat Dis* 3(1):84–90
9. Belva PH, Takieddine M, Lefebvre JC, Vaneukem P (1998) Laparoscopic LAP-BAND gastroplasty: European results. *Obes Surg* 8:364

10. De Jong JR, van Ramshorst B (1998) Re-interventions after laparoscopic gastric banding. *Obes Surg* 8:386
11. Elmore U, Restuccia A, Perrotta N, Polito D, De Leo A, Silecchia G, Basso N (1998) Laparoscopic Adjustable Silicon Gastric Banding (LASGB): analyses of 64 consecutive patients. *Obes Surg* 8:399
12. Angrisani L, Lorenzo M, Santoro T, Nicodemi O, Da Prato D, Ciannella M, Persico G, Tesaro B (1998) Follow-up of LAP-BAND Complications. *Obes Surg* 8:384
13. Chapman AE, Kiroff G, Game P et al (2004) Laparoscopic adjustable gastric banding in the treatment of obesity: a systematic literature review. *Surgery* 135:326–351
14. O'Brian P, Brown W, Smith A, Chapman L, Kotzander A, Dixon J, Stephens M (1998) The LAP-BAND provides effective control of morbid obesity – a prospective study of 350 patients followed for up to 4 years. *Obes Surg* 8:398
15. Mizrahi S, Avinoah E (2007) Technical tips for laparoscopic gastric banding: 6 years' experience in 2800 procedures by a single surgical team. *Am J Surg* 193:160–165
16. Desai C (1995) Influence of the initial volume of the gastric pouch on the rate of complication after adjustable silicone gastric banding. *Obes Surg* 5:247
17. Chelala E, Cadière GB, Favretti F, Himpens J, Vertruyen M, Bruyns J, Maroquin L, Lise M (1997) Conversions and complications in 185 laparoscopic adjustable silicone gastric banding cases. *Surg Endosc* 11:268–271
18. Alvarez-Cordero R, Ramirez-Wiella G, Aragon-Viruet E, Toledo-Delgado A (1998) Laparoscopic gastric banding: initial two year experience. *Obes Surg* 8:360
19. Miller K, Hell E (1999) Laparoscopic adjustable gastric banding: a prospective 4-year follow-up study. *Obes Surg* 9:183–187
20. Forsell P, Hellers G, Hell E (1998) The Swedish adjustable gastric banding (SAGB) for morbid obesity – weight loss, complications, pouch volume, and stoma diameter in a four-year follow up. *Acta Chir Austriaca* 30:161–165
21. Silecchia G, Polito D, De Leo A, Trentino P, Restuccia A, Basso N (1997) Major complications following laparoscopic adjustable silicone gastric banding (LAGB): a proposal for a minimally invasive treatment. *Obes Surg* 7:304
22. Miller K, Rettenbacher L, Hell E (1996) Adjustments and leak detection of the adjustable silicone gastric band (ASGB) and Lap-band TM adjustable gastric (LAGB) band system. *Obes Surg* 6:406–411
23. Miller K., Hell E (1999) Laparoscopic treatment of complications after adjustable gastric banding. *Obes Surg* 9:352–353
24. Greenstein RJ, Nissan A, Jaffin B (1998) Esophageal anatomy and function in laparoscopic gastric restrictive bariatric surgery: implications for patient selection. *Obes Surg* 8:199–206
25. Miller K, Amerhauser A, Rettenbacher L, Hell E (1999) Esophageal motility after vertical banded gastroplasty and laparoscopic adjustable gastric banding. *Eur J Coelio-Surg* 29:61
26. Miller K, Hell E (1999) Orlistat treatment after failure of the adjustable gastric band system. *Obes Surg* 4:333

Further Reading

2 Adjustable Gastic Banding

- Cunneen SA (2008) Review of meta-analytic comparisons of bariatric surgery with a focus on laparoscopic adjustable gastric banding. *Surg Obes Relat Dis* 4(3 Suppl): 47–55
- Dapri G, Cadiere GB, Himpens J (2009) Feasibility and technique of laparoscopic conversion of adjustable gastric banding to sleeve gastrectomy. *Surg Obes Relat Dis* 5(1): 72–76
- Dargent J (2008) Isolated food intolerance after adjustable gastric banding: a major cause of long-term band removal. *Obes Surg* 18(7):829–832
- Gagner M, Milone L, Yung E, Broseus A, Gumbs AA (2008) Causes of early mortality after laparoscopic adjustable gastric banding. *Obes Surg* 20(4):664–649
- Iannelli A, Negri C, Piche T, Becaud A, Gugenheim J (2008) Iatrogenic injury of the intrathoracic esophagus sustained during a gastric banding procedure. *Obes Surg* 18(6): 742–744
- Hudson SM, Dixon JB, O'Brien PE (2002) Sweet eating is not a predictor of outcome after Lap-Band placement. Can we finally bury the myth? *Obes Surg* 12(6): 789–794
- Korenkov M, Sauerland S, Yuucel N, Köhler L, Goh P, Schierholz J, Troidl H (2003) Port function after laparoscopic adjustable gastric banding for morbid obesity. *Surg Endosc* 17(7):1068–10671
- Korenkov M, Kneist W, Heintz A, Junginger Th (2004) Technical alternatives in laparoscopic placement of an adjustable gastric band: experience of two German university hospitals. *Obes Surg* 14:806–810
- Miller KA, Miller KA (2008) Evolution of gastric band implantation and port fixation techniques. *Surg Obes Relat Dis* 4(3 Suppl):22–30
- Prosch H, Tscherny R, Kriwanek S, Tscholakoff D (2008) Radiographical imaging of the normal anatomy and complications after gastric banding. *Br J Radiol* 81:753–757
- Snyder B, Nguen A, Scarbourough T, Yu S, Wilson E (2009) Comparison of those who succeed in losing significant excessive weight after bariatric surgery and those who fail. *Surg Endosc* 23(10):2302–2306. Epub 2009 Jan 30
- Stroh C, Birk D, Flade-Kuthe R, Frenken M, Herbig B, Höhne S, Köhler H, Lange V, Ludwig K, Matkowitz R, Meyer G, Pick P, Horbach T, Krause S, Schäfer L, Schlensak M, Shang E, Sonnenberg T, Susewind M, Voigt H, Weiner R, Wolff S, Lippert H, Wolf AM, Schmidt U, Manger T (2009) Bariatric Surgery Working Group: A nationwide survey on bariatric surgery in Germany – results 2005–2007. *Obes Surg* 19:105–112
- Wölnerhanssen BK, Peters T, Kern B, Schötzau A, Ackermann C, von Füe M, Peterli R (2008) Predictors of outcome in treatment of morbid obesity by laparoscopic adjustable gastric banding: results of a prospective study of 380 patients. *Surg Obes Relat Dis* 4(4):500–506

2.1 Surgical technique

- Dixon JB, O'Brien PE (2002) Neck circumference a good predictor of raised insulin and free androgen index in obese premenopausal women: changes with weight loss. *Clin Endocrinol (Oxf)* 57(6):769–778
- Colles SL et al (2006) Preoperative weight loss with a very-low-energy diet: quantitation of changes in liver and abdominal fat by serial imaging. *Am J Clin Nutr* 84(2):304–311

2.4 Surgical technique

- Council on Scientific Affairs (1988) Treatment of obesity in adults. *JAMA* 260:2547–2551
- Segal L, Carter R, Zimmet P (1994) The cost of obesity, the Australian perspective. *Pharmacoeconomics* 5(suppl. 1): 45–52
- Martin LF, Hunter S, Lauve R, O'Leary JP. Severe obesity: expensive to society, frustrating to treat, but important to confront. *South Med J* 1995, 88, 9, 895–902.
- National Institute of Health Consensus Statement. (1991) Gastrointestinal surgery for severe obesity. *Obes Surg* 1: 243–256

- Finigan KM, Martin LF, Robinson AF, Roth N (1997) Improvement in quality of life one year after gastric Lap-Band®. *Obes Surg* 7:281
- Miller K, Mayer E, Pichler M, Hell E (1997) Quality-of-life outcomes of patients with the LAP-BAND® versus non-operative treatment of obesity. Preliminary results of an ongoing long-term follow-up study. *Obes Surg.* 7:280
- Pories WJ, Swanson MS, MacDonald KG et al (1995) Who would have thought it? An operation proves to be the most effective therapy for adult-onset diabetes mellitus. *Ann Surg* 222:339–352
- Chapman AE, Kiroff G, Game P et al (2004) Laparoscopic adjustable gastric banding in the treatment of obesity: a systematic literature review. *Surgery* 135:326–351
- Fried M, Hainer V, Basdevant A et al (2007) Clinical guidelines inter-disciplinary European guidelines on surgery of severe obesity. *Int J Obes* 10:1–9
- Sugerman HJ, Brewer WH, Shiffman ML et al (1995) A multicenter, placebo-controlled, randomized, double-blind, prospective trial of prophylactic ursodiol for the prevention of gallstone formation following gastric-bypass-induced rapid weight loss. *Am J Surg* 169:91–96
- Miller K, Hell E, Lang B, Lengauer E (2003) Gallstone formation prophylaxis following gastric restrictive procedures for weight loss: a randomized doubleblind placebo controlled trial. *Ann Surg* 238:697–702



<http://www.springer.com/978-3-642-16244-2>

Bariatric Surgery

Technical Variations and Complications

Korenkov, M. (Ed.)

2012, XIX, 217 p., Hardcover

ISBN: 978-3-642-16244-2