Minimal Access Bariatric Surgery

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INTRODUCTION

Obesity has become an epidemic. Over 36% of the population of the USA is morbidly obese. Since 1980, the incidence of morbid obesity has quadrupled. Obesity is now the second leading cause of preventable death. Morbid obesity is responsible for approximately >500,000 deaths per year. 14% of all cancer deaths in men and 20% of all cancer deaths in women are due to morbid obesity. Current definition of obesity is body mass index (BMI): Weight (kg)/Height (m^2).

- Normal weight—BMI ≥ 18.5–24.9 kg/m^2
- Overweight—BMI ≥ 25–29.9 kg/m^2
- Obesity—BMI ≥ 30 kg/m^2
- Morbid obesity—BMI ≥ 40 kg/m^2 (or ≥35 kg/m^2 in the presence of comorbidities)
- Supermorbid obesity—BMI ≥ 50 kg/m^2

Obesity results into many comorbidities, which ultimately leads to early death. Most of the comorbidities are shown in **Figure 1**.

LAPAROSCOPIC TREATMENT FOR MORBID OBESITY

Indications of surgical treatment of obesity are:

- Body mass index of 35 kg/m^2 or over with any comorbidity
- Body mass index of 40 kg/m^2 or greater without comorbidity

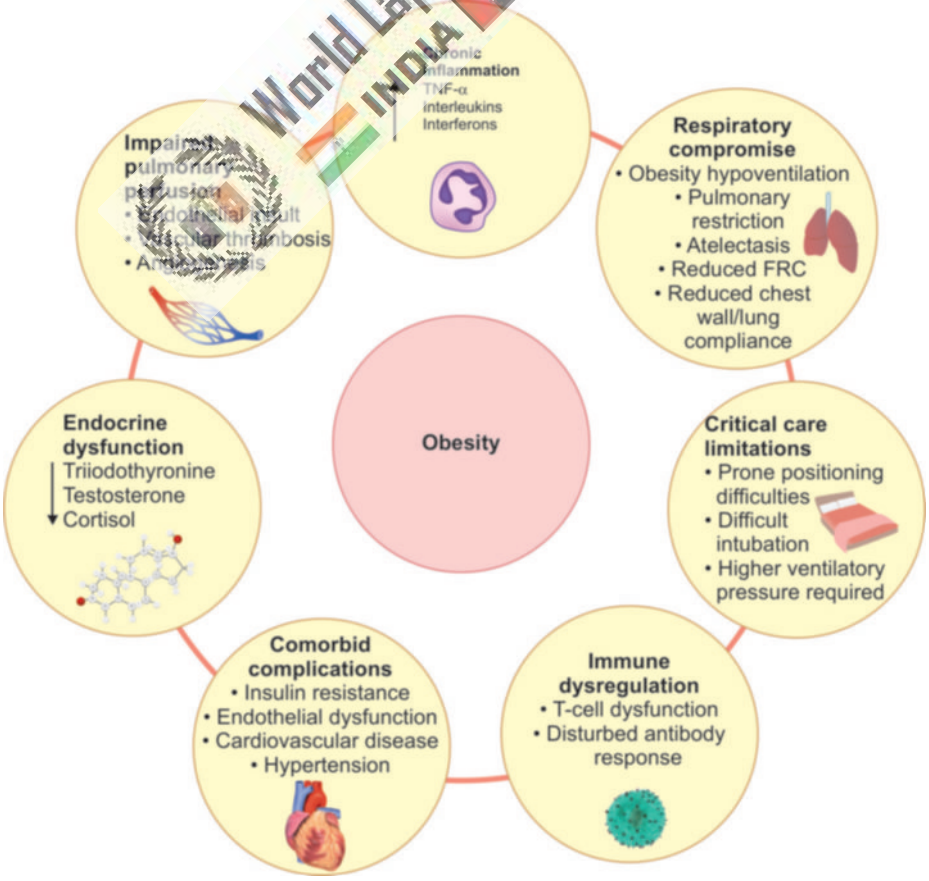


Fig. 1: Obesity-related diseases.
(FRC: functional residual capacity; TNF-α: tumor necrosis factor-α)

- Traditionally, age should be 18–60-year-old
- Nonendocrine-related cause of obesity
- Patients dedicated to permanent lifestyle changes and long-term follow-up

There are many types of surgical option available to treat morbid obesity, most common are:

- *Restrictive procedures*:
  - Lap-Band
  - Vertical-banded gastroplasty (VBG)
  - Sleeve gastrectomy/Gastric plication
- *Malabsorptive procedure*:
  - Jejunoileal (JI) bypass
- *Combination procedures*:
  - Roux-en-Y gastric bypass (RYGB)/Mini gastric bypass (MGB)
  - Biliary pancreatic diversion/duodenal switch

The most frequently performed gastric procedures for morbid obesity today include the sleeve gastrectomy and MGB. However, four basic approaches have been traditionally used for the treatment of obesity. The first operation done for obesity was the JI bypass. This operation was aimed to bypass 90% of the jejunum and ileum to induce malabsorption. This operation was abandoned due to a high incidence of severe complications such as hepatic failure, cirrhosis, nephropathy, and numerous other metabolic complications. The gastroplasty was developed to limit the amount of oral intake per meal. This operation involves partitioning the stomach into a small upper pouch that empties through a restricted stoma. The VBG was popular version of the gastroplasty but now abandoned. The third approach to obesity was RYGB. This operation also involves formation of a small upper gastric pouch that is anastomosed to a Roux-en-Y jejunal limb. The operation both limits oral intake per meal as well as induces dumping syndrome. Lastly, the partial biliopancreatic bypass induces a selective maldigestion and malabsorption. This operation involves a partial gastrectomy and diversion of the biliary and pancreatic secretions to the distal 50 cm of ileum; it is primarily performed in the "super" obese population (BMI > 60 kg/m^2). There was a time of modification of the adjustable silicone gastric band developed by Kuzmak. This gastric banding device has been modified for laparoscopic placement and is a form of gastric restriction or gastroplasty, but this procedure has also lost its popularity.

RESULTS OF DIFFERENT BARIATRIC SURGERY

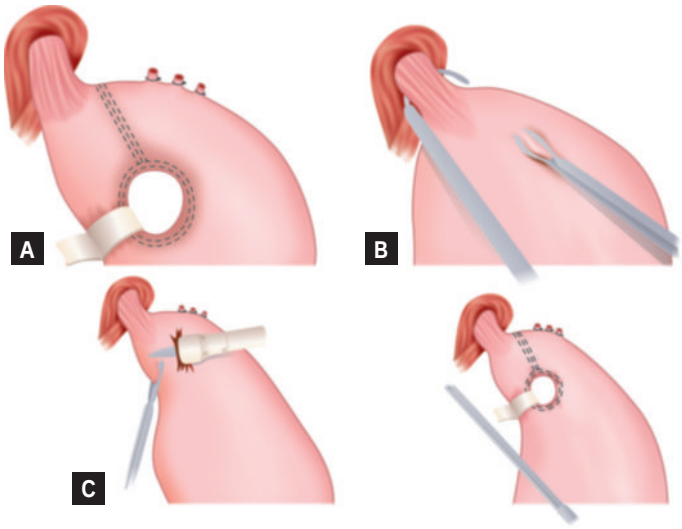
The goals of surgery are to induce and maintain weight loss. Outcome from surgery is usually expressed as the amount or percent of excess weight loss. Several trials have compared the effect of gastric restriction versus gastric bypass. Subsequently, these trials have confirmed that RYGB and MGB result in more weight loss compared with gastric banding. The early complications following RYGB operation for obesity include subphrenic abscess or leak from an anastomosis or staple line. This complication is usually amenable to percutaneous aspiration and drainage; however, a small number of patients may require reoperation. The majority of early postoperative complications are minor wound infections and seromas. Late complications of the RYGB include vitamin B_{12} and iron deficiency. On the other hand, vitamin B_{12} and iron deficiency anemia are uncommon after VBG. Incisional hernia is another complication of morbidly obese patients undergoing laparotomy. Other late complications include failure to lose weight, late weight regain, and outlet stenosis. Staple line disruption has been a common problem and has prompted the use of four rows of staples instead of two. Another approach has been to divide the stomach to produce an isolated gastric pouch.

LAPAROSCOPIC VERTICAL-BANDED GASTROPLASTY

To perform laparoscopic VBG, the patient is placed in reverse Trendelenburg position with the legs separated in low stirrups. The surgeon stands between the patient's legs. An alternative approach is to place the patient supine with a footrest in the reverse Trendelenburg position. The surgeon stands on the patient's right side with an assistant on the left side. Five trocars are placed in the standard manner for gastric surgery. The telescope is placed through the 10 mm midepigastric port and the liver retractor is placed through a right subcostal port **(Figs. 2A and B)**.

There are two operating ports, one in each paramedian position (right, 10–33 mm; left, 15 mm). A window is created at the lesser curve of the stomach in an avascular plane using harmonic shears. The posterior stomach wall is freed of any adhesions. An alternative approach to the lesser sac is made by dividing the gastroepiploic vessels along the greater curvature. A 32-F dilator is placed via the mouth into the stomach. A site on the anterior stomach 4–5 cm from the gastroesophageal junction and 3 cm from the lesser curve is marked with the electrocautery. This site will be the center of the circular stapler. The right paramedian port is upsized to a 33-mm port to allow introduction of the circular stapling device. The anvil of the circular stapler is then placed posterior to the stomach. The pointed trocar is inserted through the stomach at the site previously marked with the cautery. The stapler is then connected and fired **(Fig. 2C)**.

The attachments from the diaphragm to the fundus of the stomach are divided and the fundus is dissected inferiorly using blunt technique. A linear 60 mm, four-row, noncutting stapler is introduced through the left paramedian port. The stapler is inserted through the circular window along the dilator and fired. A linear cutter is applied lateral to the previously placed rows of staples. At the circular window, a strip of polypropylene or polytetrafluoroethylene (1.5 × 5 cm) is brought around the stoma. The band is sutured into place



Figs. 2A to C: Laparoscopic vertical-banded gastroplasty.

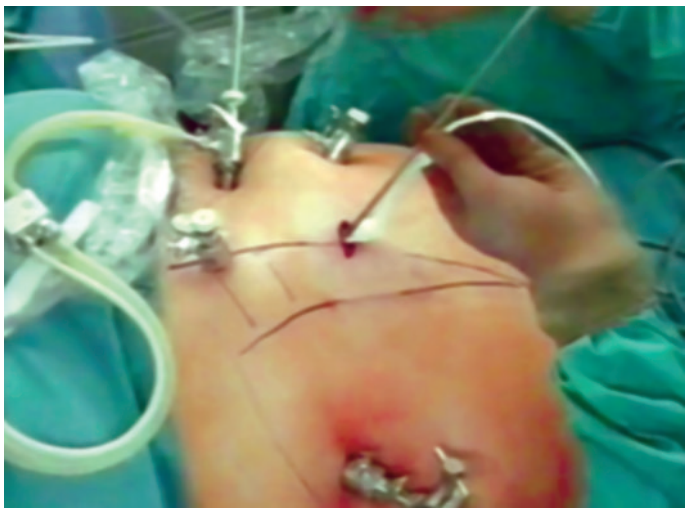


Fig. 3: Port position of laparoscopic gastric banding.

around the dilator. A nasogastric tube is not mandatory with this procedure.

LAPAROSCOPIC ROUX-EN-Y GASTRIC BYPASS

Patient positioning and port placement are as for other gastric procedures. The dissection starts at the fundus of the stomach with division of the phrenicogastric ligament. The fundus is mobilized in an inferior direction by blunt dissection. On the anterior wall of the stomach, an electrocautery mark is made 4–5 cm distal to the angle of His to serve as a landmark for the size of the gastric pouch. The lesser omentum is then opened adjacent to the mark at 4–5 cm inside the nerve of Latarjet. Dissection is carried through the lesser sac to an opening near the angle of His. The medial subcostal port is changed to an 18-mm port and a straight, four-row, cutting 60 mm stapler is used to divide the stomach. A standard 60 mm Roux limb is fashioned by dividing the proximal jejunum with a 60-mm linear stapler. The limb is brought up in a retrocolic, retrogastric path to the small (15 mL) proximal gastric pouch. A circular stapler is used for the gastrojejunostomy. The anvil is inserted via the oral cavity by endoscopic approach and using a percutaneous pull wire technique. An anastomosis is fashioned by connecting the anvil to the stapler introduced through the 18 mm port. A stapled side-to-side enteroenterostomy is then done to restore gastrointestinal continuity.

LAPAROSCOPIC ADJUSTABLE GASTRIC BANDING

An alternative gastric restrictive operation is the adjustable silicone gastric banding (ASGB) procedure. It was first introduced for placement through laparotomy by Kuzmak in 1986. This operation has the advantage of being the least invasive operation as it is completely reversible and allows for adjustment of the gastric pouch outlet.

The main steps of laparoscopic ASGB are given in **Figure 3**.

The patient is placed in a lithotomy position and in reverse Trendelenburg position as for the most gastric operations. A total of six ports are placed. The liver retractor is placed through a right subcostal one; the telescope is inserted through a subxiphoid positioned port. The main operating ports are in the right and left paramedian positions. The assistant uses a left subcostal and an epigastric port. The left paramedian port is 15 mm for introduction of the band device. All of the other ports are 10 mm.

A gastric calibration tube is placed via the mouth into the stomach. The balloon is inflated to 15 cc and pulled up through the gastroesophageal junction.

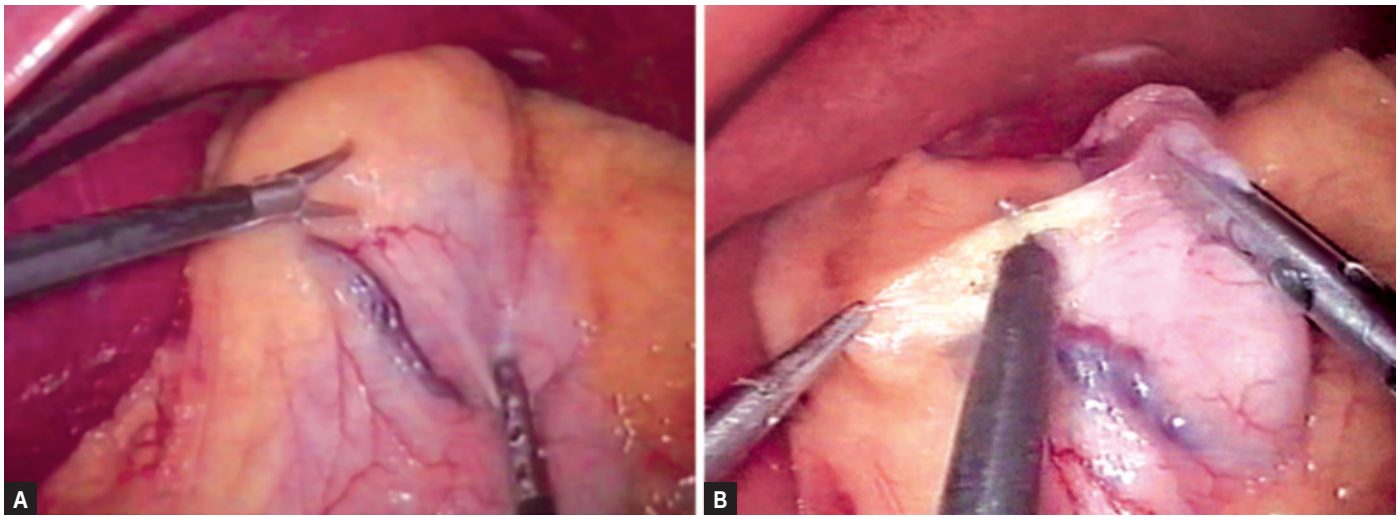
A site on the lesser curve is chosen to begin dissection that corresponds to the widest circumference of the balloon inside stomach. The balloon is deflated and the tube is withdrawn back into the esophagus **(Figs. 4A and B)**.

A retrogastric tunnel is then created using blunt dissection, staying close to the gastric wall. The posterior gastric wall should be easily recognized to prevent injury. A small opening in the phrenicogastric ligament is made with electrocautery **(Figs. 5A and B)**.

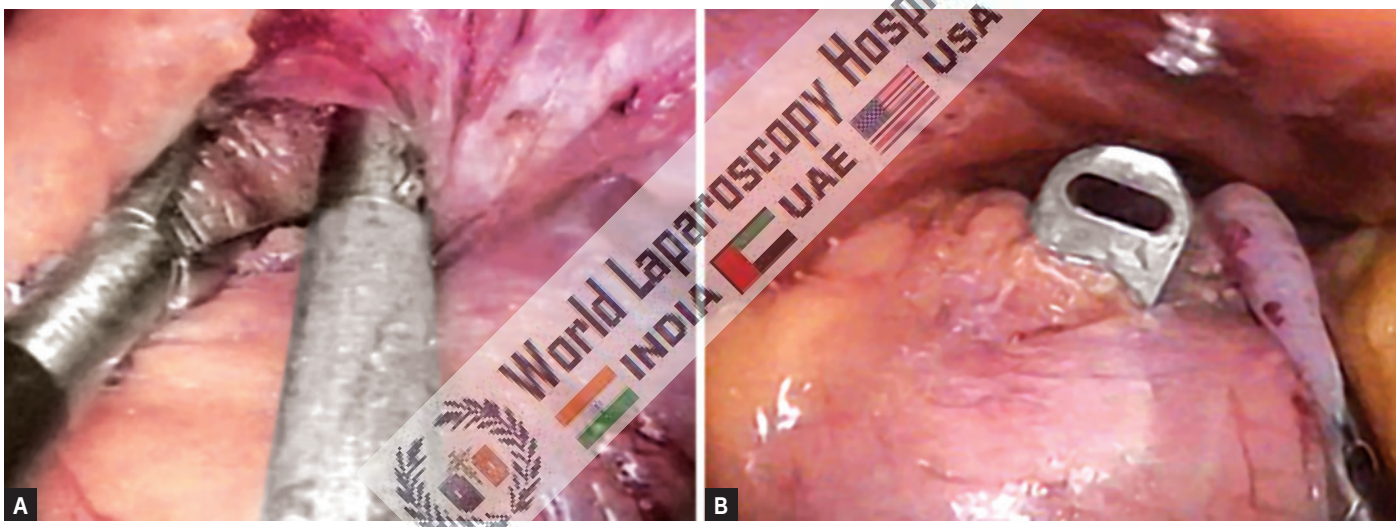
A grasping instrument is then placed through the retrogastric tunnel. The band is then introduced into the abdomen and grasped with the instrument. The band is pulled into position around the stomach **(Figs. 6A and B)**.

The calibration tube is then reinserted into the proper position and the band closed around the tube. The calibration tube allows for proper stoma calibration **(Figs. 7A to D)**.

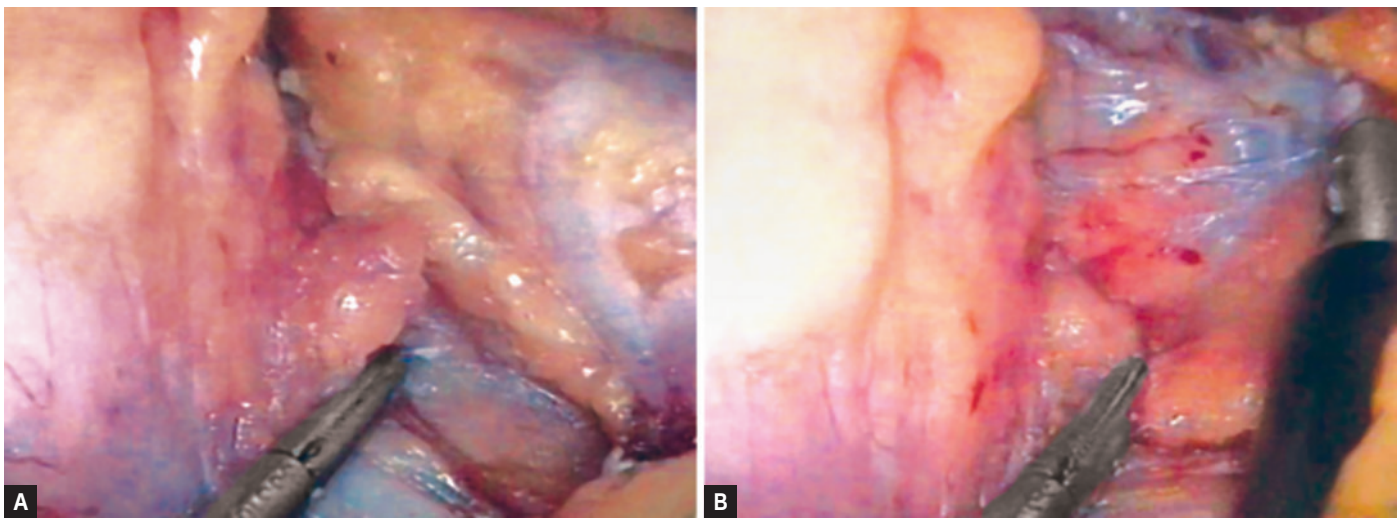
At least four sutures are then placed in the seromuscular layer of the stomach just proximal and distal to the band to keep it in the proper position, otherwise the chances of displacements are there. The injection port is then connected to the band tubing and implanted into the left rectus sheath at the paramedian port site **(Figs. 8A to D)**.



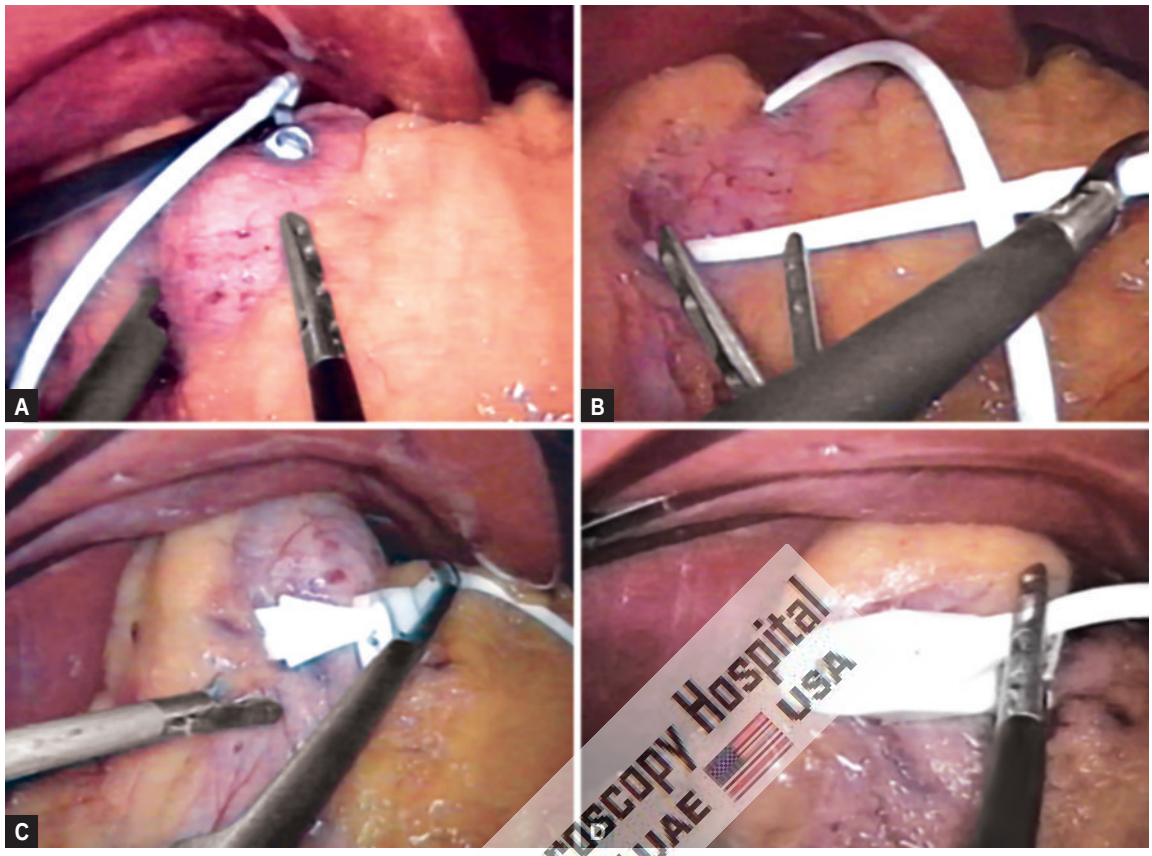
Figs. 4A and B: Lesser curvature, a site chosen to start dissection.



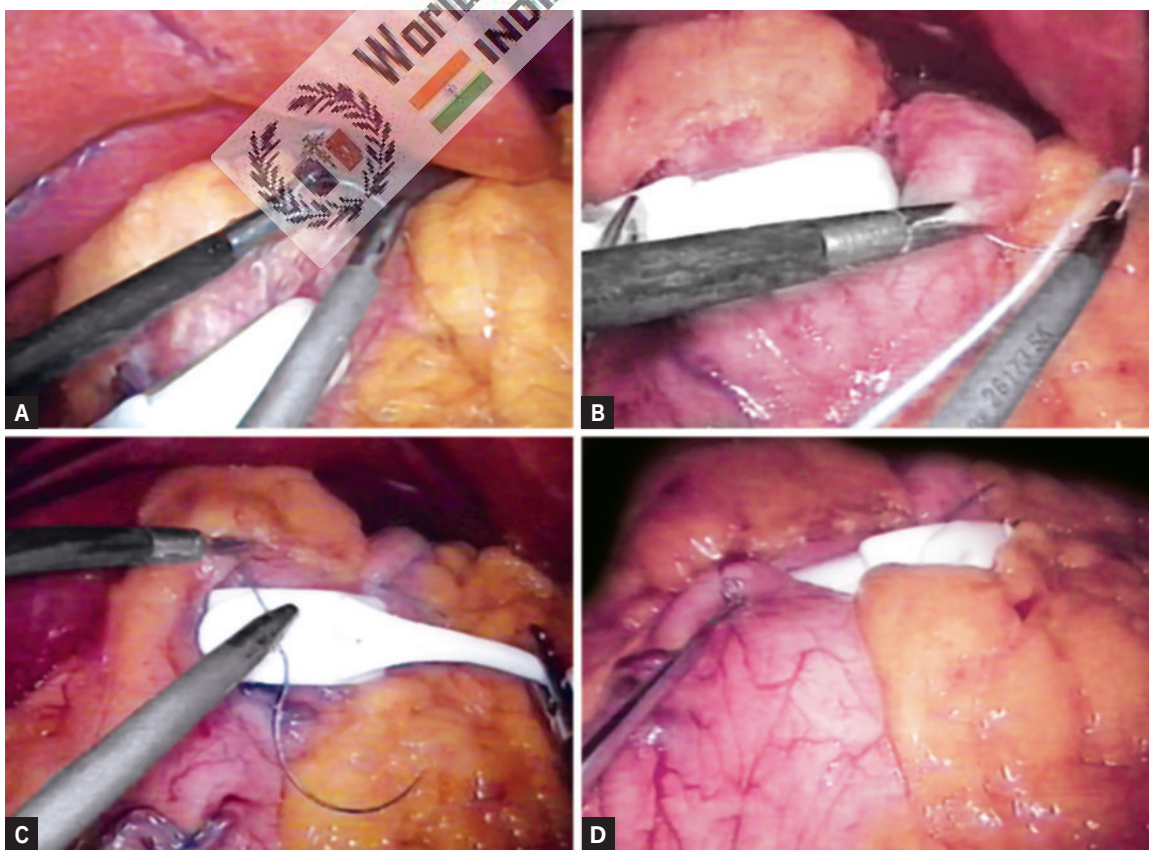
Figs. 5A and B: Grasping instrument coming from behind through retrogastric tunnel.



Figs. 6A and B: Creation of a retrogastric tunnel.



Figs. 7A to D: Band is pulled from below the stomach through retrogastric tunnel and is tightened leaving 15 mL volume of stomach above.



Figs. 8A to D: Suture is placed to fix the band in position.

SLEEVE GASTRECTOMY, MINI GASTRIC BYPASS, AND ROUX-EN-Y GASTRIC BYPASS

Refer Chapter 21: Laparoscopic Bariatric Surgery.

COMPLICATIONS

Adjustable Gastric Banding

Early complications of the adjustable gastric band procedure are as follows:

- Injury of the stomach or esophagus
- Bleeding
- Food intolerance (most common immediate post-operative complication)
- Wound infection
- Pneumonia

Late complications are as follows:

- Food intolerance or noncompliance to band
- Band slippage (stomach prolapse)
- Pouch dilatation
- Band erosion into the stomach
- Port complications
- Reoperation rate
- Esophageal dilatation
- Failure to lose weight
- Port infection and band infection
- Leakage of the balloon or tubing
- Mortality

Gastric Bypass

Early complications of RYGB are as follows:

- Anastomotic leak
- Pulmonary embolism and deep vein thrombosis (DVT)
- Wound infection (more common with open approach)
- Gastrointestinal hemorrhage and bleeding
- Respiratory insufficiency and pneumonia
- Acute distention of the distal stomach

Late complications (less frequent and less dramatic than with gastric banding) of the RYGB procedure are as follows:

- Stomal stenosis, most common
- Bowel obstruction, small bowel obstruction
- Internal hernia
- Cholelithiasis
- Micronutrient deficiencies
- Marginal ulcer
- Staple line disruption
- Ventral hernia formation (more prevalent after open approach)

Biliopancreatic Diversion with Duodenal Switch

This procedure is less well known, so the complications are potentially more problematic if the surgeon is unfamiliar with the procedure.

Fat malabsorption results in diarrhea and foul-smelling gas in approximately 30% of patients.

The potential nutritional deficiencies mandate frequent follow-up visits with close monitoring and supplementation of multivitamins and minerals.

- Malabsorption of fat-soluble vitamins (vitamins A, D, E, and K)
- Vitamin A deficiency, which causes night blindness
- Vitamin D deficiency, which causes osteoporosis
- Iron deficiency (similar incidence to RYGB procedure)
- Protein-energy malnutrition (may require a second operation to lengthen the common channel)

CONCLUSION

In developed world, obesity is a major national health problem. It is clear that morbidly obese patients suffer from significant comorbidity and die at younger age than healthy weight individuals. Weight loss and maintenance of normal weight correct the majority of weight-related morbidity and return life expectancy to that of the general population. All the laparoscopic surgeons should remember that morbidly obese patients are at an increased risk of significant morbidity and mortality with laparoscopic surgery. However, strict attention to detail allows for proper selection of patients for surgery with reduction in the perioperative risk.

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