

general the risks of remaining obese are substantially higher than the small risk of surgical complications. Nevertheless, one should be fully aware of all the possible risks before undergoing surgery. Some of the complications can be serious and life threatening if not detected on time.

Does bariatric surgery lead to nutritional deficiencies?

This depends on the type of operation.. This problem is commoner after gastric bypass surgery, a procedure which leads to malabsorption of food. It is important that one understands the need for postoperative life-long compliance with multivitamins and supplements while opting for gastric bypass surgery. After sleeve gastrectomy, the chances of developing nutritional deficiencies are low. However, long term follow-up studies for sleeve gastrectomy are lacking. Hence nutritional surveillance in the form of regular monitoring of the vitamin levels is required.

To conclude, surgery for morbid obesity is the only method, which

provides long-term weight loss. It leads to improvement and often resolution of diseases associated with obesity. Diabetes gets cured in a large number of patients. Surgery has a favorable impact on overall quality of life. The safety is well established. The complication rates are fairly low and acceptable. With proper counseling, bariatric surgery leads to a successful outcome in majority of the patients.

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Bariatric Surgical Procedures

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Abstract: Bariatric surgical procedures involve gastric stapling to reduce the size of the stomach with or without bypass of a variable length of small bowel to induce malabsorption. The surgical procedures can thus be classified as mainly restrictive, mainly malabsorptive or a combination of both. Bariatric surgery does not involve any liposuction or abdominoplasty. The common procedures popular in India are sleeve gastrectomy, roux-en-y gastric bypass and gastric banding. Sleeve gastrectomy is getting increasingly popular as it has been shown to be equivalent to gastric bypass in terms of weight loss and impact on co-morbidities. There are minimal long-term nutritional complications after sleeve gastrectomy.

HISTORICAL PERSPECTIVE

Bariatric surgery is not something new, although it is not more than a decade old in India. Intestinal bypass was the first procedure to be used to induce malabsorption and weight loss at University of Minnesota in United States in year 1954.¹ However complications like bacterial overgrowth and renal oxalate stones led to its failure. Later, gastric bypass was started at University of Iowa in 1966. This operation originated from the fact that Billroth II gastrectomy, used for peptic ulcer disease, caused weight loss as an undesirable side-effect. Dr Scopinaro designed an operation called Bilio-Pancreatic diversion (BPD) in 1979.² This operation involved two parts- creation of smaller stomach and bypass of a large portion of small intestine to create a lot of malabsorption. Later, restrictive operations, which did not involve any malabsorption, were started. Vertical banded gastroplasty (VBG) was introduced in 1980 by Dr Edward Mason³ and gastric banding was started in 1986 by Dr Kuzmak⁴. VBG is no longer used and gastric banding's popularity is also on the wane. Sleeve gastrectomy was initially a part of a more complex operation and it was also used as a first step of a staged operation in super-obese (BMI>50 Kg/m²) patients. However, it was seen that a number of these patients did not require the second stage operation. Thus sleeve gastrectomy has become a standard stand-alone weight loss procedure over last decade.⁵ It has been popularized by Michel

Gagner. The exponential growth of bariatric surgery is attributable to the use of laparoscopy in these procedures. The first laparoscopic gastric bypass was done in 1993 by Dr Wittgrove and Dr Clarke from USA.⁶ Other important landmarks include introduction of banded gastric bypass by Dr Mal Fobi in which a band/ring is placed around the gastric pouch to prevent stretching of gastric pouch and ensure durability of weight loss.

STANDARD BARIATRIC SURGICAL PROCEDURES

The standard bariatric surgical procedures⁷ include the following:-

1. Sleeve Gastrectomy (SG)
2. Roux En Y Gastric Bypass (RYGBP)
3. Adjustable Gastric Banding (AGB)
4. Bilio-Pancreatic Diversion (BPD)
5. BPD with duodenal switch (BPD-DS)

These procedures can be classified into the following categories:-

- **Restrictive:** Sleeve Gastrectomy (SG); Adjustable Gastric Banding (AGB)
- **Malabsorptive:** Bilio-Pancreatic Diversion (BPD), BPD with duodenal switch (BPD-DS)
- **Mixed (Restrictive + Malabsorptive) :** Roux En Y Gastric Bypass (RYGBP)

For Indian obese patients, SG, RYGBP and AGB are the three

procedures which are suitable for weight loss. Purely malabsorptive procedures like Bilio-Pancreatic Diversion (BPD) and BPD with duodenal switch (BPD-DS) should not be done in our population as they can lead to severe protein energy malnutrition.

SLEEVE GASTRECTOMY

This is probably the most popular bariatric surgical procedure in India. Its popularity is also on the rise in most other countries. It is a part of duodenal switch operation. It was also used for high risk patients, intra-operative difficulties, obese patients with inflammatory bowel disease. Later it was used as a first stage of a two-stage operation for super-obese patients (BMI 60 mg/m^2). It was soon realized that a number of such patients have a good weight loss after sleeve gastrectomy and did not require the second stage. As a result, it rapidly evolved as a stand-alone operation for treatment of morbid obesity.

The procedure involves removal of more than $3/4^{\text{th}}$ of stomach along the greater curvature with removal of entire fundus; resulting in a long narrow gastric tube with preservation of about 5 cm of antrum. The popularity of this operation is due to its following advantages over gastric bypass:-

1. Technically less complex
2. Lesser nutritional problems in long term
3. No Intestinal anastomosis
4. Normal GI continuity is not altered; Pylorus is preserved.
5. No risk of late internal hernias.

Disadvantages are unknown long term results on weight loss and diabetes; possible increase in reflux symptoms after surgery.

Complications

1. *Staple like leak* is the most dreaded complication. Most of the leaks occur near angle of HIS where the fundus is thin. The aetiology is not well understood and possible cause include distal narrowing, inappropriate staple height, stapler misfire, staple line hematoma, Ischemia. Leaks are difficult to heal and may take 4 weeks or more for healing. Some of them get converted to chronic non-healing fistulas.
2. *Bleeding* can occur from staple line, detached omentum, short gastric vessels or port sites.
3. *Stricture* normally occurs at incisura-angularis. Its rate is higher if a narrow bougie like a 32 or a 28 F bougie is used.

Relative **contra-indications** of SG includes presence of a large hiatus hernia and/or reflux-esophagitis.

The **mechanism of weight loss** after sleeve gastrectomy is both restrictive and hormonal. The stomach capacity is reduced resulting in early satiety with a small amount of food. More important is the lack of appetite caused by a dramatic decrease in the levels of Ghrelin, a hormone which stimulates appetite. This hormone is mainly produced the fundus of stomach. SG also has a dramatic effect on Type II DM. The exact mechanism is not well understood but rapid gastric emptying, Ghrelin and altered gut hormones milieu has been postulated.

ROUX EN Y GASTRIC BYPASS (RYGBP)

Currently considered the gold standard procedure, this operation was popularized by Mason et al. It is a mixed restrictive- malabsorptive procedure. Restrictive component is due to a small gastric pouch of 15-20 ml created in the proximal stomach. The remaining stomach remains in situ. A malabsorptive component is created by bypassing

a segment of small intestine. The length of bypassed bowel varies from 100-150 cm. A small 1.5-2 cm gastro-jejunostomy is created between the gastric pouch and the proximal end of alimentary limb.

Complications of RYGBP

Early:- Leak from GJ, JJ; Bleeding (hematemesis, melena, Intra-abdominal), Stricture at GJ

Late: Internal hernias causing small bowel obstruction, nutritional deficiencies

Advantages over SG

- Long term results are well known
- Better impact on Type II Diabetes Mellitus
- It also acts an anti-reflux operation and leads to cure of reflux symptoms
- Leaks after Gastric bypass are easier to manage.

Mechanism of Action

- Restrictive effect caused by a small pouch and a narrow GJ stoma.
- Malabsorptive effect due to bypass of small bowel
- Dumping; resulting in aversion to sweets.
- Decrease in levels of Ghrelin
- Altered Gut hormones leading to impact on Diabetes mellitus.

ADJUSTABLE GASTRIC BANDING

It is a popular weight loss procedure in Europe and Australia. The procedure involves placement of a sialistic band around the upper part of stomach. The band is adjustable; the restriction caused by the band can be altered by instilling saline through a chamber connected to the inflatable part of the band by a long tube.

Advantages of Gastric Banding are:

- Simple procedure
- Least invasive
- Reversible
- Minimal nutritional disturbances
- Least chance of a life threatening complication

Disadvantages includes:

1. Requires strict follow-up
2. Weight loss is inferior to SG and RYGBP
3. Re-operation rate is high due to various complications

Complications includes:

- Slippage
- Infection
- Port-site problems
- Tubing Problems
- Band erosion
- Oesophageal dilatation

The popularity of gastric band is waning all across the world. Most of surgeons in India have stopped offering this option to the patient. Gastric banding is probably suitable for a well motivated patient with BMI below 45 Kg/m^2 who is willing for a close follow-up. Moreover it should be carried out by centres having a well organized follow-up program.

CHOOSING A BARIATRIC PROCEDURE

Patients should be counselled extensively about the various aspects of surgery. (See Table 1) Although the choice of procedure should be left to the patient, the following steps should always be followed to help the patient make a rationale decision.

Table 1: What Patient Must Understand

- Surgery-Not Liposuction/No Fat Removal
- Major Change in Life Style & Dietary habits
- Weight loss is gradual

- Not all excess weight is lost
 - Major Undertaking with risk of complications including mortality
1. Extensive patient counselling which involves discussion of all the three surgical options with special emphasis on the risks of each procedure.
 2. Careful evaluation of the patient's expectations is essential. Some patients want a better weight loss and don't mind the risks associated with a sleeve or a bypass while others are not prepared to take those risks and want a gastric banding.
 3. Factors like Hiatus hernia and reflux oesophagitis.
 4. Assessment of patient's compliance in future.
 5. A frank discussion of the surgeon's experience of a particular procedure.

Gastric banding is suitable only in a limited number of patients who are well informed and understand the working of a band. They understand the need for some self-discipline, need for a monthly follow-up initially, need for band adjustments. Weight loss after gastric banding is inferior to sleeve and bypass. So patient's expectations should be defined. They should understand that weight loss after a gastric banding is modest and can be variable.

Decision between sleeve gastrectomy and gastric bypass rests on the following factors:-

1. Patient's preference
2. Surgeon's preference
3. Duration of Diabetes Mellitus
4. Presence of reflux symptoms and hiatus hernia.

Bariatric surgery is an extremely effective means of sustained weight loss. The impact on co-morbidities is impressive with remission/improvement of Type II diabetes, sleep apnea, hypertension, PCOD in majority of the patients. Extensive patient counselling; both by a surgeon as well as a nutritionist, detailed clinical evaluation and a well trained team are the keys to a successful result.

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Surgical Cure for Type II Diabetes -From Bariatric Surgery to Metabolic Surgery

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Abstract: India is fast becoming the diabetes capital of the world. A significant proportion of these patients are overweight or obese. Bariatric surgery leads to a remarkable impact on type 2 diabetes mellitus. Remission of the disease occurs in 60-80% of the patients undergoing surgery i.e. these patients are off any anti-diabetic medication while maintaining normoglycemia. The impact occurs early in the post-operative course before any significant weight loss has occurred. Thus, factors other than weight loss are responsible. The possible mechanisms include role of gut hormones like GLP1, faster gastric emptying, decrease in inflammatory status and improvement in insulin resistance. Due to this remarkable impact of bariatric surgery on diabetes mellitus among the morbidly obese population, there is a lot of research going on in the field of metabolic surgery where standard bariatric surgery procedures or some similar novel procedures are being used in diabetic patients with class I obesity or normal BMI patients in hope of remission/resolution of diabetes. Surgical cure of diabetes is possible in near future and it may become the standard of care in a select group of diabetic patients.

Diabetes is a global epidemic affecting about 250 million people worldwide. Being overweight increases the chances of becoming diabetic ten-fold. For those who are obese, the risk of becoming diabetic increases 30-fold. The twin problem of diabetes and obesity in India is increasing at an exponential rate. India leads the world with the largest number of diabetic subjects, earning the dubious distinction of being termed the "diabetes capital of the world". According to the Diabetes Atlas 2009 published by the International Diabetes Federation, around 50.8 million people in India are affected with diabetes and this number is expected to rise to 87 million by 2030. The so-called "Asian Indian Phenotype" refers to certain unique clinical and biochemical abnormalities in Indians like increased insulin resistance, greater abdominal adiposity i.e. higher waist circumference despite lower body mass index, lower adiponectin and higher C-reactive protein levels. This phenotype makes Asian Indians more prone to diabetes and premature coronary artery disease.

Type II diabetes is considered a progressive and relentless disease with progressive beta cell failure. The progressive nature requires ongoing assessment of metabolic control and usually leads to an intensification of

therapy with increasing doses of hypoglycemic agents, including insulin. Furthermore, obesity appears to be the engine driving the epidemic of diabetes and it is most unfortunate that many of these therapeutic agents are associated with weight gain. Thus, the search for cure and/or better control of T2DM is an ongoing process.

In a landmark article entitled "Who would have thought it? An operation proves to be most effective therapy for adult onset diabetes", Pories et al highlighted the drastic impact of surgery on Type 2 diabetes Mellitus. Since then the conventional modality of treatment is being challenged by growing number of surgeons. Published research is providing further evidence that surgery can be more efficient than either standard or intensive medical treatment alone.

It has been well-documented that bariatric procedures such as sleeve gastrectomy, Roux en y gastric bypass and biliopancreatic diversion promote evident and sustained weight loss, with clear improvements in hyperglycemia, dyslipidemia, hypertension and associated co morbidities, as well as mortality in morbidly obese patients (BMI>35.0 kg/m²). The impact on type 2 diabetes is particularly impressive with 70-80% patients