Introduction

The Singapore National Survey of 1992 reported the prevalence of obesity to be 5.1%, increasing to 6.0% in 1998, and in the 2004 survey it had increased to 6.9%.\(^1\) The increase reflects the profound changes in our society’s lifestyle and eating habits. Today, obesity is not only a threat for the developed nations but is fast eating into the health resources of developing nations. Obesity which was once thought to have resulted from a lack of eating discipline is now increasingly being recognised as a disease that roots from in-born errors of metabolism thus resulting in impaired satiety and increased conversion of calories to fats.\(^2\)

Deurenberg-Yap et al studied the relation between body fat percentage and body mass index (BMI) among Singaporean adults. They found that in comparison to Caucasians, Asians had a higher percentage of body fat at lower BMI. They recommended the obesity cut-off point for Singaporeans to be lowered from 30 kg/m\(^2\) to 27 kg/m\(^2\).\(^3,4\) A re-calculation based on a BMI of 27 kg/m\(^2\) would raise the prevalence of obesity in Singapore from 6% to 16%.\(^5\)

Obesity not only results in an increased risk of mortality for matched age\(^6,8\) but these individuals are at a risk for important comorbidities including diabetes, hypertension, obstructive sleep apnoea, depression and impaired quality of life.\(^9,10\) The economic implications in terms of cost for treating these comorbidities are overwhelming.\(^11\) Treatment of morbidly obese individuals with diet, exercise and behavioural intervention results in modest and transient weight loss, so not surprisingly the results of such studies are poor.\(^12,13\) Although we live in hope, currently there is no drug either commercially available or in the research pipeline that promises to be as effective as surgery in

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Original Article

Surgical Management of Obesity – National University Hospital Experience

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Abstract

**Introduction**: The Singapore National Survey of 2004 reported the prevalence of obesity to have increased to 6.9%, thus reflecting the profound changes in our society’s lifestyle and eating habits. Bariatric surgery has steadily been increasing to counter the ill effects of obesity. **Materials and Methods**: We audited our prospective series of 31 patients who had laparoscopic adjustable gastric banding (LAGB) for morbid obesity performed by our multidisciplinary team at the National University Hospital, Singapore, between August 2004 and December 2006. **Results**: The median age at presentation was 40 years old including 6 males and 25 females. Their median BMI was 42.35 kg/m\(^2\). At a median follow-up of 26 months, the median percentage of excess weight loss (%EWL) was 41.95%. The positive impact of gastric banding on comorbidities are evident whereby 15 (94%) of the diabetics had improved glycaemic control with HbA\(_1\)C of 7.7% preoperatively improving to 5.9% postoperatively, and also 8 (58%) now take smaller doses of oral hypoglycaemic agents. Hypertension improved in 4 patients and 2 (11%) were cured. All our patients with dyslipidaemia had their statin doses reduced with marked lowering of serum lipid levels. We had 2 patients (6.45%) with band erosion and another 2 with reflux oesophagitis. Our article also summarises the available surgical procedures while discussing the pros and cons of each. **Conclusion**: Our results showed that a multidisciplinary programme can achieve significant weight loss for obese patients in Singapore. To achieve long-term weight loss, a commitment of both the medical team and the patient is necessary. Laporoscopy has revolutionised the practice of bariatric surgery worldwide. LAGB is an effective and safe procedure.


Key words: Laparoscopic adjustable gastric banding, Outcomes, Surgical technique review
controlling morbid obesity. For today and in the near future, bariatric surgery seems to be the best means of achieving a sustained weight loss and is also effective in reducing associated comorbidities with prolongation of life.14,15 In a study on gastric bypass outcomes, Pories et al16 reported an 83% cure of Type II diabetes mellitus at 14 years follow-up. An enormous literature on obesity surgery testifies to improvement and, in many cases, cure of dyslipidaemia, hypertension, obstructive sleep apnoea and joint problems after surgery.17-19 Also, successful weight loss surgery has been shown to normalise the risk of death and prolong life span in morbidly obese patients.7,8

National University Hospital Experience

When compared to the solo practice model, the multidisciplinary team model has the advantage of offering the patient the benefit of a treatment that covers all necessary areas by participation of members of different disciplines. Each individual team member has an ownership and plays a pivotal role in the patient’s long-term counselling and behavioural modification. Sharing of information is free within our multidisciplinary group.

On the first visit apart from obtaining a detailed medical history and ordering the necessary investigations, patients are reviewed by the dietician and physiotherapist. The patients continue with medical treatment and monitoring until a point where a decision has to be made for a change in the management plan such as when it is deemed necessary for surgery or medications are thought of.

As dietary changes need to be long-term, the dietician has a fundamental role in management. Our dietician generates and counsels patients on dietary prescriptions, adherence and changes in lifestyle. They cater to the needs of patients who suffer from obesity-associated comorbidities like diabetes and who require a different composition of diet regardless of calorie levels. Moreover, monitoring of patients’ dietary patterns to uncover any nutritional deficiency and institute appropriate measures also fall within their domain. Exercise is crucial in obesity for weight loss and maintenance. In our team, the physiotherapist assesses the patient’s baseline fitness level, and then develops, monitors and modifies the exercise plan while bearing in mind the impact of obesity-related comorbidities on exercise capacity. Obesity being the resultant of a complex interplay between various causal factors requires the expertise of a physician for assessment, management, counselling and coordination of the multidisciplinary team. In our team, the physician also conducts preliminary screening for eating and mood disorders and is also entrusted with the task of orders for medications. Patients who fail medical management and suitable candidates for surgery are discussed for surgical intervention and counselled for the same. The day-to-day requirements of an obese patient can vary much from those of the general population, and our nursing staff, besides carrying out their traditional functions, are tasked to educate and counsel obese patients as well.

Results

At the National University Hospital, Singapore, between August 2004 and December 2006, we had treated 31 patients with laparoscopic adjustable gastric banding (LAGB) for morbid obesity. Their median age at presentation was 40 years (range, 19 to 62). In this cohort, there were 6 (20%) males and 25 (80%) females with a median BMI (range) of 43.5 kg/m² (36.1-54.5) and 41.2 kg/m² (30-57), respectively. After a median follow-up of 26 months, the median percentage of weight loss (%EWL) was 41.95% with 45.1% for females and 38.8% for males. In our series, 24 patients had more than one comorbid condition. Hypertension was noted in 18 (58%) of the 31 patients, 16 (51%) were diabetic requiring medical treatment, while 9 (29%) had dyslipidaemia. Fifteen (48%) patients each were afflicted with obstructive sleep apnoea and osteoarthritis. The positive effect of gastric banding on comorbidities are evident in Table 1. Student’s t-test was used to compare the pre- and postoperative median values with significance set at P <0.05. We noted that 15 (94%) of the diabetics had improved glycaemic control, their HbA1C improved from a median of 7.7% preoperatively to 5.9% postoperatively ($P=0.001$) with 8 (58%) with their dose of oral hypoglycaemic agents reduced. About a quarter, 4 (22%) of the hypertensive now take lesser doses of anti-hypertensive drugs and 2 (11%) were cured of their hypertension. All 9 (100%) patients with hyperlipidaemia had their statin doses reduced and their serum cholesterol, triglycerides and low-density lipoprotein (LDL) were significantly lowered (Table 1). We had 2 patients (6.45%) with band erosion. Two of our patients also had symptoms of reflux.

Discussion

In our series, 1 patient failed to comply with lifestyle modifications and had a %EWL of only 0.23% that has skewed the data analysis. If his data point is excluded from analysis, the median EWL for males would be 46.0%. However, the median %EWL was 41.95% in our series which is in keeping with those reported in literature of 45% at 24 months median follow-up.20 In our series, 24 patients had more than one comorbid condition. Obesity is known to be associated with comorbid conditions such as hypertension, diabetes and dyslipidaemia. Not surprisingly, the figures for obesity-related comorbidities of our series are prominently different from the general Singapore population. In the 2004 National Health survey, diabetes, hypertension and dyslipidaemia were reported to be 8.2%, 20.1% and 19.8% versus our obesity related figures of 51%, 58% and 29%,
respectively. The positive effect of gastric banding on comorbidities are evident from this study and our results are akin to those in a meta-analysis by Buchwald et al who reported improvements in 80.8% of diabetics, 71.1% of hyperlipidaemics and 70.8% of hypertensives after LAGB. If weight loss and improvement in comorbid conditions are added up, it would not be wrong to say that weight loss surgery has led to a cut in the total cost that could have been spent on lifelong management of our patient’s obesity and its related problems. LAGB is deemed a safer procedure with overall mortality of 0.05%. In their series of 1120 patients undergoing Lap banding, O’Brien and Dixon reported an overall complication of 1.5%. However, the figures for morbidity vary ranging from 3.9% to 11.3% in other series. The commonly encountered preoperative complications include injuries to structures such as liver and stomach, atelectasis and wound/port site infections. We have no operative adverse events or mortalities to report. The incidence of band slippage which is a late complication has been reported to be 4% to 16%, but there is none in our series. We routinely use the pars flaccida technique which has been shown to result in lowering the incidence of band slippage. Another long-term complication of LAGB is the band eroding into the stomach cavity. The incidence of band erosion ranges from 7.5% to 11.1%. We had 2 patients (6.45%) who presented at 7 and 12 months with port site infection and on endoscopy found to have band erosion. These patients complained of mild pain over the port site with associated tenderness and were noted to have increasing weight. The 2 cases had stable band volumes and none went for recent tightening of the band to suggest a source of infection. A computed tomography scan was performed in both cases and these showed fat stranding along the abdominal wall next to the tubing to the reservoir port. Both cases were later confirmed on oesophagogastroduodenoscopy to have band erosions. Their bands were taken out laparoscopically with an uneventful postoperative course. Two of our patients also had symptoms of reflux. They had oesophagogastroduodenoscopy that confirmed them to have reflux oesophagitis, which was treated successfully with proton pump inhibitors and dietary modifications without the necessity of loosening the band. The incidence of reflux oesophagitis has been reported to be high in some LAGB series due to its restrictive nature. The general recommendation has been to deflate the band and dietary modification. However, loosening of the band is associated with an increase in weight.

**Conclusion**

Our results showed that a multidisciplinary programme involving surgeons, physicians and paramedical therapists can achieve significant weight loss for obese patients in Singapore. The advent of laparoscopy has revolutionised the practice of bariatric surgery worldwide. LAGB is an effective and safe procedure. To achieve long-term weight loss, a commitment of both the medical team and the patient is necessary.

**Literature Review**

**Multidisciplinary Approach**

Bariatric surgery should not be staged as a cosmetic procedure but offered to obese patients as a therapeutic procedure that aims at prolonging life by reducing the chances of premature death. It can never be stressed enough that surgery by itself does not produce long-term favourable results. It has to be coupled with modification in lifestyle to obtain the best outcomes. Thus, management of obesity has to be the domain of a multidisciplinary team. This team can tailor and cater to the needs of individual patients. The essentials of this multidisciplinary team would be a physiotherapist, dietician, physician, bariatric surgeon, anaesthetist, radiologist and dedicated nursing staff.

**Goals of Surgery**

The goals of surgery in obesity are to achieve a sustained weight loss over a prolonged period of time with least complications and to improve the outcomes of associated comorbid conditions.

**Eligibility Criteria**

The criteria for eligibility of adult bariatric surgery as per

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**Table 1. Effect of Laparoscopic Adjustable Gastric Banding on Comorbidities**

<table>
<thead>
<tr>
<th>Comorbidity</th>
<th>n</th>
<th>Parameter</th>
<th>Pre-LAGB</th>
<th>Post-LAGB</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>16</td>
<td>HbA1C (%)</td>
<td>7.7 (5.5-11.4)</td>
<td>5.9 (5.2-9)</td>
<td>0.001</td>
</tr>
<tr>
<td>Hyperlipidaemia</td>
<td>9</td>
<td>S. Cholesterol (mmol/L)</td>
<td>5.42 (4.36-6.3)</td>
<td>4.3 (3.6-4.9)</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. Triglyceride (mmol/L)</td>
<td>1.7 (0.8-3.1)</td>
<td>1.3 (0.5-1.7)</td>
<td>0.021</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. LDL (mmol/L)</td>
<td>3.47 (3.08-4.36)</td>
<td>2.50 (2.05-3.24)</td>
<td>0.022</td>
</tr>
<tr>
<td>Hypertension</td>
<td>18</td>
<td>Number of medications</td>
<td>2 (1-4)</td>
<td>1 (1-3)</td>
<td></td>
</tr>
</tbody>
</table>
the National Institute of Heath guidelines are:
1. Young patients who are 18 to 55 years old, who are fit for surgery
2. BMI >40 or 35-39 with comorbidities that can be improved with surgery
3. Agreeable to lifelong follow-up
4. Failed conservative treatment

Surgery is contraindicated in patients suffering from major psychiatric illnesses such as depression, psychosis, drug/alcohol dependence and those with prohibitive anaesthetic risk.

**Perioperative Management**

Prior to surgery, patients need to be educated on what surgery can achieve for them, so that they have realistic expectations. It is important for the patients to understand their commitment to lifelong follow-up, adherence to dietary restrictions and exercise. The anaesthetic risk of surgery is less objective and decisions are usually on ad hoc basis after weighing the risks and benefits of weight reduction. However, this does not go without saying that it is prudent for all patients to be optimised to the maximum prior to surgery. In the postoperative period, patients may need to be nursed in high dependency or intensive care units, antibiotics are advisable and anti-thrombosis prophylaxis is mandatory. Surgery, ideally, should be performed in a high volume centre that not only has the expertise but is also equipped to look after the needs of this special group of patients. This approach has been shown to reduce morbidity and mortality and results in better outcomes.

**Open versus Laparoscopic Bariatric Surgery**

Interest in bariatric surgery has waxed and waned over the years. The first bariatric procedure, that is, the jejunoileal bypass was performed in 1954 by Kerman. The migration of bariatric procedures from open to laparoscopy technique has been a big step forward in the struggle to decrease postoperative complication rates. Advantages of the laparoscopic approach including decreased postoperative pain, shorter length of hospital stay and early return to work are well established. Open surgery especially in obese patients is known to be associated with an increased risk of wound infection, pulmonary complications and incisional hernias, yet the occurrence of these complications is remarkably low if bariatric surgery is done laparoscopically.

**Bariatric Surgical Procedures**

Bariatric surgical procedures are broadly divided into restrictive and malabsorptive procedures based on the primary mechanism by which they accomplish weight loss. Some procedures such as gastric bypass effectively utilise the benefits of both components. While restriction of calorie intake and malabsorption are important mechanisms in bariatric surgery, postoperative alterations in the neuroendocrine hormones that regulate appetite, satiety and energy expenditure have been shown to be instrumental in augmenting weight loss.

**Restrictive Procedures**

The pure restrictive procedures are vertical banded gastroplasty and gastric banding. They achieve weight loss by restricting the volume of intake as a result of reduced stomach reservoir capacity after surgery. They are relatively easy to perform as compared to their more complex malabsorptive counterparts and are associated with fewer complications. After restrictive procedures, strict dietary discipline is prudent for a successful sustained excess weight loss. Patients who consume liquid and semi-solid high calorie diets have high procedural failure rates as these foods easily flow into the remnant stomach without achieving much satiety.

**Vertical Band Gastroplasty (VBG)**

The VBG involves the creation of a 20 mL proximal gastric pouch. A Gortex mesh is used to create a collar to restrict flow from the pouch (Fig. 1). The ends of the mesh are overlapped for 1 cm so that in future should dilatation be required, the sutures will give way during dilatation without the need for surgery. VBG is now less commonly performed and this is largely because it is technically more challenging with a higher incidence of complications when compared to gastric banding.

**Laparoscopic Adjustable Gastric Banding**

The number of gastric banding cases has been steadily rising worldwide. There are many types of bands available for commercial use; all of them have an infusion reservoir, tubing and an adjustable silicone band with a bladder. On the operating table, the patient is placed in Lloyd-Davis position with the upper abdomen upright and the leg fitted with intermittent pneumatic compression devices. The patient is strapped to the table to prevent a fall. A 10-mm port is
inserted midway between the xiphoid and the umbilicus with the aid of the optiview trocar. Pneumoperitonium is created and the remaining ports as shown in Figure 2 are inserted under direct vision. A snake liver or Nathanson’s liver retractor is used to elevate the liver through the subxyphoid port. We use the pars flaccida technique for the creation of a retrogastric tunnel. Starting at the angle of His the gastrophrenic attachments to the left crus are taken down. The pars flaccida of lesser omentum is entered and the right crus identified. The peritoneum over the base of the right crus is divided for a short distance and the dissection deepened. Using a grasper, a retrogastric tunnel is dissected from right to left emerging at angle of His staying as close to the stomach as possible. A Goldfinger (Obtech Medical GMBH, Germany) is threaded through this tunnel. The gastric band is inserted through the 15 mm port and retrieved through the retrogastric tunnel after mounting a retrieving suture on the Goldfinger’s tip. Care needs to be taken to orientate the band so that the bladder faces the stomach and then the buckle is fastened. Four interrupted intracorporeal gastrogastric sutures are placed to cover the band taking care to avoid covering the buckle (Fig. 3). The tubing is retrieved through one of the port and fixed to the reservoir which itself is anchored to the anterior rectus sheath over distal sternum. The patient is allowed to recover and is started on a low calorie liquid diet. The band is adjusted to provide adequate restriction 6 to 8 weeks after surgery. A few sessions may be required before an adequate adjustment is possible.

**Malabsorptive Procedures**

The weight loss observed after malabsorptive surgery results from the minimal contact of digested food with secretions from the liver, pancreas and intestine along with impaired nutrient absorption from the shortened length of the functional small intestine. The malabsorptive procedures suit people with a sweet tooth well. After consumption of a high sugar meal, the altered anatomy results in a dumping syndrome characterised by light-headedness, nausea, perspiration, abdominal pain and diarrhoea. These unpleasant symptoms generate a negative conditioning bio-feedback.

The length of the common channel has significant bearing on the mixing of ingested food with digestive juices and also on the absorptive surface area. So a shorter common channel will have a shorter contact time for digestion and lesser surface area of absorption. This will translate into greater weight loss with a higher risk of malnutrition.

Commonly performed malabsorptive procedures are
1. Gastric bypass or more commonly termed Roux en Y gastric bypass (RYGB)
2. Biliopancreatic diversion (BPD)
3. Duodenal switch (DS)

These procedures are more suited for patients with gastroesophageal reflux disease, for diabetics and people who like to eat sweet food.

Jejunoileal bypass was fraught with multiple severe complications such as liver failure, renal stone formation, nutritional deficiencies and high mortality. Its importance lies in the caring of those who had undergone jejunoileal bypass and survive to date.

**Gastric Bypass**

RYGB is technically considered the simplest of the malabsorptive procedures. The procedure involves creating a 30 mL proximal gastric pouch using a linear cutting stapler leaving the distal gastric remnant separate from the pouch. Then 50 to 100 cm away from the ligament of Trietz, the jejunum is divided and this creates a proximal biliopancreatic limb. Jejunum 150 cm distal from the divided end is anastomosed to the biliopancreatic limb, thus forming a distal common channel and proximal alimentary limb called the “Roux limb”. The proximal end of the Roux limb is anastomosed to the gastric pouch creating a tight gastrojejunostomy (Fig. 4). The lengths of the Roux limb and common channel vary depending on the surgeon’s choice and patients’ BMI.
Biliopancreatic Diversion

BPD was pioneered by Scopinaro to address some of the shortcomings of the jejunoileal bypass.42 The anatomy post-surgery is much like that of RYGB with a few differences (Fig. 5):

1. The gastric pouch has a capacity of about 150 mL. This bigger pouch inherits with it an increased risk of developing stomal ulcers at the gastrojejunostomy site.
2. The remnant stomach is resected, which obviates the need for surveillance of the remaining stomach as in RYGB.
3. A longer alimentary limb of 200 cm results in greater weight loss.
4. The common channel is shorter and predisposes patients to severe protein and calorie malnutrition which requires chronic dietary supplements.

This procedure is highly effective but may have higher risks. Considering the challenges posed to surgeons and patients, the role of BPD as a primary procedure for morbid obesity has to be carefully thought out prior to recommending it to patients. However, its place in revisional obesity surgery for those who failed other surgical procedures might be more appropriate.

Biliopancreatic Diversion with Duodenal Switch

Technically, this is the most demanding and complex bariatric procedure with greater perceived preoperative and malnutrition risk in comparison to others.43 It was designed to overcome nutritional problems associated with BPD. The first step is to perform a sleeve gastrectomy, the technique of which is described further in the text under discussion of sleeve gastrectomy. Following a sleeve gastrectomy, the duodenum is mobilised and transected with a cutting stapler 3 to 5 cm distal to the pylorus; 250 cm from the ileocaecal valve, the ileum is divided with a cutting stapler. The distal ileal loop is anastamosed end to end to the gastroduoenal stump creating the alimentary loop and, 50 to 100 cm from the ileocaecal valve, the proximal ileal loop is anastamosed to the ileum creating a common channel distally. The proximal loop forms the biliopancreatic loop with an oversewn duodenal stump (Fig. 6).

Miscellaneous Procedures

Sleeve Gastrectomy

In super obese patients with life threatening comorbidities, poor quality of life and high risk for surgery, sleeve gastrectomy offers a safer and less invasive procedure for initial weight loss.44 Following this when the patient is more stable, a completion procedure can be done as a stage II. The use of sleeve gastrectomy as a definitive restrictive bariatric procedure is increasingly being studied and practiced, but long-term results are still pending.45 In this procedure, the greater curve of the stomach starting at approximate 6 to 10 cm proximal to the pylorus all the way to the angle of His is freed of greater omentum and vessels. Over a 36 French orogastric bougie, a gastric tube is created by resecting the greater curve of the stomach using a cutting stapler along a line joining the initial point of dissection and the angle of His. The reservoir capacity of the stomach is reduced to 200 mLs with the advantage of preserving most of the normal digestive stomach function (Fig. 7).

Results of Bariatic Surgical Procedures

Bariatric procedures are no longer only assessed by the %EWL and complications but, increasingly, the improvement in comorbidities is being recognised as an indicator of success.

Percentage of Excess Weight Loss

Dietel et al46 reported VGB to achieve 58% EWL at 5 years. In a study by Zinzindohoue et al,47 the EWL at 3 years follow-up for LAGB was 54.8% which is comparable to VGB. However VGB has fallen in favour of gastric...
banding not only because it is technically simple, but because LAGB has a lower mortality, is adjustable, reversible, and able to achieve good EWL with improvement in comorbidities. A series from O’Brien and Dixon et al had a 50% EWL up to 6 years follow-up after LAGB. The percentage EWL after malabsorptive procedure is higher; EWL after gastric bypass is reported to be 68% at 5 years. EWL for BPD and BPD with DS at 8 years are 77% and 70%, respectively. Ti et al in their series of 26 patients undergoing VBG or RYGB reported EWL of 56.3% and 48.3% at 4 and 8 years, respectively. The use of laparoscopic sleeve gastrectomy as a primary bariatric surgical procedure is a relative new concept with paucity in literature of long-term follow-up. In a prospective trial of 163 patients, Nocca et al reported 61.25% EWL at 2 years follow-up. They proposed to use the technique for volume-eaters and as a bridging procedure to definitive surgery like BPD or DS.

**Improvement in Comorbidities**

Bariatric surgery is associated with improvements in associated comorbid conditions. In a meta-analysis by Buchwald et al, it was reported that there was improvement in 80.8% of diabetics, 71.1% of hyperlipidaemics and 70.8% of hypertensives after LAGB. The results of malabsorptive procedures in this meta-analysis were even better with 98.9% and 83.4% having resolution of DM and hypertension, respectively.

**Complications**

Higher incidence of complications after VGB surgery such as staple line disruption, stomal stenosis, mesh erosion, reflux disease and vomiting had called for revisional surgery in 20% to 56% of patients. In a local series of 22 patients undergoing VBG in Singapore, Ti et al reported 1 patient to have had a wound infection and 3 patients complained of vomiting but none of them required any surgical intervention at 10 years’ follow-up.

In the initial phase, the general complications associated with malabsorptive surgery are no different from those seen in obese patients undergoing other forms of surgeries. The construction of multiple anastomoses in malabsorptive procedure increases the potential risk of leak. Anastamotic leak have been reported to occur in 2.2% and 1.8% of patients after RYGB and BPD surgeries, respectively. As RYGB incorporates a restrictive procedure with the creation of a small gastrojejunostomy stoma, it exposes the patient to a risk of stenosis. Irrespective of technique of anastomosis, that is hand-sewn or stapled, the incidence of gastrojejunostomy stenosis has been reported to be as high as 5%. The dramatic differences in EWL and improvement in comorbidities between restrictive and malabsorptive procedures cannot go without notice in Buchwald et al’s report. What one needs to understand also are the long-term implications of these procedures. Altering the gastrointestinal anatomy to achieve weight loss predisposes patients in the long term to increased risk of nutritional deficiencies. In particular, the common deficiencies seen are those of iron, vitamin B12, Vitamin D, calcium and thiamine. Hypocalcaemia is the result of decreased intestinal absorption and deficiency of Vitamin D. In the meta-analysis by Maggand et al which analysed 70 RYGB, 41 LAGB and 7 BPD trials, postoperative gastrointestinal side effects were significantly higher in the malabsorptive group when compared to the restrictive surgery group with reports of 7%, 16.9%, and 37.7% after LAGB, RYGB and BPD/DS, respectively. Also, in the RYGB group, 16.9% patients were diagnosed to have nutritional complications while 5.9% patients presented with ongoing vomiting after BPD. These are long-term complications that require continuous monitoring and intervention. The overall perioperative complication rate of sleeve gastrectomy is 7.36%. The classical complications are haemorrhage of staple line, gastric stenosis and staple line failure leading to leak and fistula formation postoperatively. Also reported is a high incidence of reflux oesophagitis of 11.8% to 21.8%, making sleeve gastrectomy a less attractive procedure for this group of patients.
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