

# Long-term complications of laparoscopic Roux-en-y gastric bypass: Strategies for prevention, diagnosis, and management

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## Abstract

*Background:* Laparoscopic RYGB simultaneously causes food malabsorption and restricts food intake and generally results in more weight loss than restrictive operations, including the Lap-Band gastroplasty. Patients who have laparoscopic RYGB generally lose about two-thirds of their excess weight in 2 years and within 3 years they lose 68-72% of excess weight. At ten years, most patients continue to keep off at least 50% of the excess weight. Long-term complications include pouch stretching, and gastrojejunal anastomotic strictures. Because gastric bypass operations cause food to skip the duodenum, risks for nutritional deficiencies are higher than for restrictive procedures. Anemia may result from malabsorption of vitamin B12 and iron in menstruating women, and decreased absorption of calcium may bring on osteoporosis and bone disease. Long-term complications may also include deficiencies in vitamins A, D, E, B1, B6, and folic acid. Patients must take nutritional supplements daily to manage these side effects.

*Patients and methods:* The study consisted of 40 patients operated upon from January 2005 to September 2009 with minimal follow up of 6 months. Patients, who are operated before May 2008, were 20 patients and they were studied retrospectively. Prospective study was conducted on 20 patients who were operated on from May 2008.

*Results:* Nineteen patients (57.5%) developed late complications (>30 days). One patient developed myocardial ischemia (2.5%) which was treated by stent and resolved, 3 patients developed prolonged nausea (7.5%) which resolved spontaneously, 2 patients (5%) developed repeated vomiting which resolved spontaneously, 2 patients developed gastrojejunal anastomotic stricture (5%) which resolved after endoscopic balloon dilatation, one patient (2.5%) developed symptomatic gall stones and was treated by laparoscopic cholecystectomy, one patient developed marginal ulcer (2.5%) and was treated by proton pump inhibitors and resolved. One patient developed depression and he was normal preoperatively, however he received medications and improved. One patient developed incisional hernia (2.5%) at trocar site which was repaired. Six patients (15%) developed iron deficiency anemia and were treated by iron. One patient (2.5%) developed protein-calorie malnutrition and improved with TPN and dietary counseling.

*Conclusions:* The important outcome related to the goal of bariatric surgery such as weight loss, important reduction in comorbidities and good quality of life results in this study appear acceptable if compared with other series.

*Key words:* Obesity, laparoscopic, gastric bypass.

## Introduction:

In the gastric bypass procedure a surgeon directly connects the upper portion of the stomach to a lower segment of the small intestine, bypassing part of the stomach, the duodenum and part of the jejunum. By creating a path for food that goes around part of the stomach and the small bowel, the operation

causes food to be poorly digested and absorbed (food malabsorption). The Roux-en-Y gastric bypass (RYGB) is currently the most common bypass procedure. It combines elements of both stomach-restricting and bypass operations.<sup>1</sup> Laparoscopic RYGB has the advantages of earlier mobilization with less pain in the postoperative period, shorter

postoperative hospital stay and sick leave, and a lower risk of incisional hernia than the open procedure.<sup>2</sup> Morbidity (complications) in the early post-operative Period from wound infection, leaks from staple-line breakdowns, marginal ulcers, various pulmonary problems and deep venous thrombosis (DVT) may be as high as 20%.<sup>3</sup> Gall stone formation is common following rapid weight loss either by dietary methods or by bariatric surgery.<sup>4</sup> Any patient with non specific post operative symptoms of crampy abdominal pain often warrants investigation. Severe chest pain out of proportion to physical examination is worrisome for cardiac ischaemia. Often patients with internal hernias will not vomit, but they may retch.<sup>5</sup>

Until recently, bariatric surgery protocol included annual screening of calcium, phosphorus, magnesium, and albumin after GB. With newer literature, suggesting that patients who undergo GB are at increased risk for vitamin D deficiency, screening was updated to include both 25-hydroxyvitamin D (vitamin D) and parathyroid hormone (PTH) levels.<sup>6</sup> Roux-en-Y gastric bypass (RYGB) results in a loss of approximately 65% of excess body weight in severely obese patients. However, up to 30% of GB patients regain weight after surgery and consistent presurgery predictors of long-term outcome have not been established.<sup>7</sup>

The purpose of this study was to evaluate long-term complications of laparoscopic Roux-en-Y gastric bypass and show strategies for prevention, diagnosis, and management.

### **Patients and methods:**

This study was conducted in El Demerdash and Ain Shams Specialized Hospitals in Egypt and AL-Nahda Hospital in KSA; on 40 patients operated on from January 2005 to September 2009 with minimal follow up of 6 months. Patients were selected for laparoscopic Roux-en-Y gastric bypass (LRYGB) if they met minimal criteria for bariatric surgery proposed by National Institute of Health (NIH) consensus Development panel report 1991; body mass index more than 40 or more than 35 with co-existing morbidity (diabetes, dyslipidemia or/ and hypertension) and the patients had history

of obesity for more than 5 years with failure of conservative treatment more than 2 years. According to American Society of Anesthesiologist (ASA) classification, patients of ASA III, IV or V were excluded from the study.

### **Preoperative assessment:**

All patients were preoperatively evaluated including history and physical examination, nutritional and psychiatric evaluation and specialty consultations if indicated. Laboratory evaluation included complete blood count, organ chemistry profiles, thyroid function testing, and blood sugar tolerance curve and glycated hemoglobin (A1C) level. ECG, echocardiography and abdominal sonography were done for all patients. If gall stones were detected then laparoscopic cholecystectomy was performed concomitantly. Pulmonary function tests were done to every patient. If dyspepsia was present; upper GI endoscopy was performed. Patients preparation for surgery consisted of a detailed explanation in written and oral form of the developmental aspect of laparoscopic RYGB and its benefits and risks, including short- and long-term complications, side effects, nutritional sequelae, and the possibility of conversion to the open procedure. Informed consent was obtained. Preoperative bowel cleansing and perioperative antibiotics were administered. Prophylaxis against venous thrombosis and pulmonary embolus consisted of perioperative pneumatic compression devices and low-molecular subcutaneous anti-thrombotic (Clexane). Data were collected and entered into a customized computer data base. Data sources included office charts, follow-up notes, hospital charts, and patient interview. Parameters included patient demographics, comorbidity, surgical time, blood loss, pain medication requirement, hospital stay, recovery, complications, weight loss, and change in comorbidity, quality of life changes, and patient satisfaction. Outcomes related to changes in comorbidities, quality of life, and patient satisfaction were assessed for patients at 6 months or more of follow-up. Late morbidity and mortality were considered after thirty days from the operation.

**Surgical technique:**

After induction of general anesthesia, creation of pneumo-peritoneum and introduction of ports, exploration of the abdomen was done. The greater omentum and transverse colon were passed to the upper abdomen to expose the ligament of Treitz. To create the Roux limb, the jejunum was transected with an Endo GIA II stapler (U.S. Surgical), 45-mm length and 3.5-mm staples, at approximately 30 cm from the ligament of Treitz, where a comfortable length of mesentery exists. A smaller staple size (2.5 mm) was later substituted to reduce staple line bleeds at the transected bowel. The jejunal mesentery was then divided with two applications of the Endo GIA II stapler using the vascular load (45-mm length, 2.0-mm staples). Vicryl stitch was sewn to the end of the Roux limb. The Roux limb was then measured 150 cm distally for the superobese, and a stapled side-to-side anastomosis was created with the proximal jejunal limb using one application of the Endo GIA stapler II (60-mm length, 3.5-mm staples). Later, a 2.5-mm staple cartridge was used. The enterotomy sites were stapled closed and the mesentery of jejunojejunostomy was sutured closed. A window was created in the lesser omentum near the gastric wall at the lesser curvature. The Endo GIA stapler (U.S. Surgical), 60-mm length and 4.8-mm staples, was inserted and applied three or four times to staple and cut the gastric pouch with three rows of staples on each side. A smaller staple size (3.5 mm) was later substituted to reduce staple line bleeds at the transected stomach. The gastrojejunostomy was then created using a linear technique. The gastrojejunostomy anastomosis was closed with interrupted 3-0 Polysorb suture (U.S. Surgical). The gastric pouch and Roux limb were irrigated with dilute methylene blue dye to detect leaks. A 10 French drain was placed posterior to the gastrojejunal anastomosis and brought out through a right subcostal port site.

**Postoperative assessment:**

Patients began ambulating on the evening of surgery. Pain management consisted of narcotics intravenously as needed. A Clear liquid diet was begun in the 2<sup>nd</sup> day and the

patient was discharged from the hospital after demonstrating tolerance to diet and return of bowel function, usually on the 3<sup>rd</sup> postoperative day. Gastrographin study was done in the 3<sup>rd</sup> post-operative day. The drain was removed on the 3<sup>rd</sup> postoperative day and the diet was advanced to solid food by the 4<sup>th</sup> postoperative week. Monitoring of early postoperative morbidity and mortality was done.

**Patient follow-up:**

Follow up was scheduled every 2 weeks, with laboratory evaluation every 2 months, and gastrographin study was done if dysphagia occurred. Follow up until weight loss stabilized (usually within one year), then twice per year.

**Statistical analysis:**

Analysis of data was done by IBM computer using SPSS (Statistical Program for Social Science version 12) as follows: description of quantitative variables as mean, SD and range, and description of qualitative variables as number and percentage, and paired t-test was used to compare quantitative variables in the same group before and after intervention. P-value (level of significance) was non significant (NS) if  $P > 0.05$ , significant if  $P < 0.05$  and highly significant (HS) if  $P < 0.01$ .

**Results:**

Twenty four females (60%) and 16 males (40%) were operated on. Mean age of females was 31 years (range from 23 to 48 years) and the mean age for males was 32 years (range from 21 to 47 years). The mean preoperative body mass index (BMI) was 42.4 (kg/m<sup>2</sup>) with range from 36 to 49 (kg/m<sup>2</sup>) and ASA class was 25 patients ASA.I (62.5%) and 15 patients ASAII (37.5%). A total of 224 comorbidities were identified in the 40 patients (5.6 per patient) of which 45 (20%) were newly diagnosed during the preoperative assessment. The most common comorbidities included, degenerative joint disease in 22 patients (55%), hypercholesterolemia in 21 patients (52.5%), hypertension in 18 patients (45%), gastroesophageal reflux disease in 18 patient (45%), depression in 16 patients (40%), hypertriglyceredemia in 16 patients (40%), sleep apnea 15 (37.5), fatty liver disease in

14(35%), urinary stress incontinence in 12 patients (30%), type II diabetes in 10(25%), cholelithiasis in 6 (15%) and asthma in 4 (10%) **Table(1)**.

The changes in obesity related comorbidities postoperatively whether aggravated, unchanged, improved, or resolved; are summarized in **Figure(1)**.

The mean excess weight loss after 6 months was 42.8%, after 12 months was 58.8%, after 18 months was 65.8% after 24 months 73.2%, after 30 months was 71.8% and after 36 months the mean was 69.8% **Figures(2)&(3)**.

Regarding postoperative recovery, patients began oral liquids in a mean of 1.58±0.2 days (range 1-3 days); the mean hospital stay was 3.6±0.8 days (range 1-17 days); the mean time of return to normal activities was 25.6±5 days (range 14-35 days); the mean time of return to work was 29.2±10 days (range 14-40 days) **Table(2)**.

Nineteen patients (47.5%) developed late complications (>30 days) one patient developed myocardial ischemia (2.5%) which was treated by stent and resolved, 3 patients

developed prolonged nausea (7.5%) and resolved spontaneously, 2 patients (5%) developed repeated vomiting and resolved spontaneously, 2 patients developed gastrojejunostomy anastomotic stricture (5%) and resolved after endoscopic balloon dilatation, one patient developed symptomatic gall bladder stones and was treated by laparoscopic cholecystectomy, one patient developed marginal ulcer (2.5%) and was treated by proton pump inhibitors and resolved, one patient developed depression and he was normal preoperatively, however he received medications and improved, one patient developed incisional hernia (2.5%) at trocar site and was repaired, 6 patients developed iron deficiency anemia and was treated by iron, one patient (2.5%) developed protein-calorie malnutrition and improved with TPN and dietary counseling **Table(3)**.

The mean change in body Fat Mass (FM) measured preoperatively by Bioelectrical Impedance Analysis (BIA) was 47.7% (range 42 to 52.8) and the mean change in preoperative Fat Free Mass (FFM) was 62% (range 47 to 68.2) **Figure(4)**.

**Table (1): Overview and demographics.**

Demographics	(n=40)
• Mean age	
◦ Females	31 years (23-48)
◦ Males	32 years (21-47)
◦ Females/Males	24/16,60% Females
• Mean preoperative BMI (kg/m <sup>2</sup> )(range)	42.4 (36-49)
• ASA classes	I (62.5%) II (37.5%)
• Mean number of comorbidity/patient	5.6
• %with joint disease	55%
• % with hypercholesterolemia	52.5%
• %with hypertension	45%
• %with gastroesophageal reflux disease	45%
• %with depression	40%
• %with hypertriglyceredemia	40%
• %with sleep apnea	37.5%
• %with fatty liver	35%
• %with urinary incontinence	30%
• %with type II diabetes	25%
• %with cholelithiasis	15%
• %with asthma	10%
<b>ASA, American Society of Anesthesiologist; BMI, body mass index</b>	

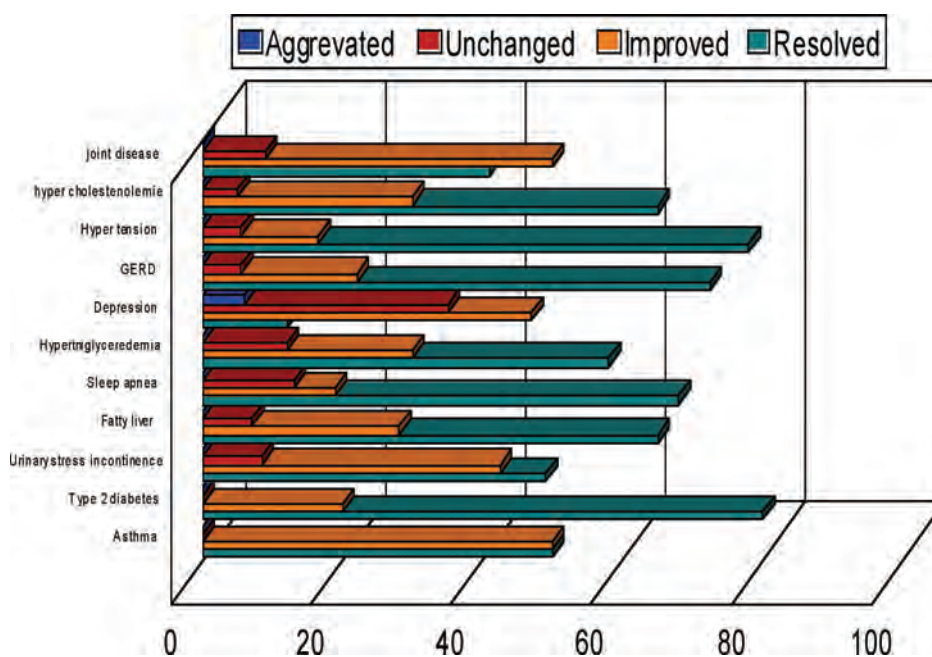
**Table (2): Postoperative recovery.**

Variables	Mean ±SD	Range
Begins oral liquids	1.58±0.2	1-3
Hospital stay	3.6±0.8	1-17
Return to normal activities	25.6±5	14-35
Return to work	29.2±10	14-40

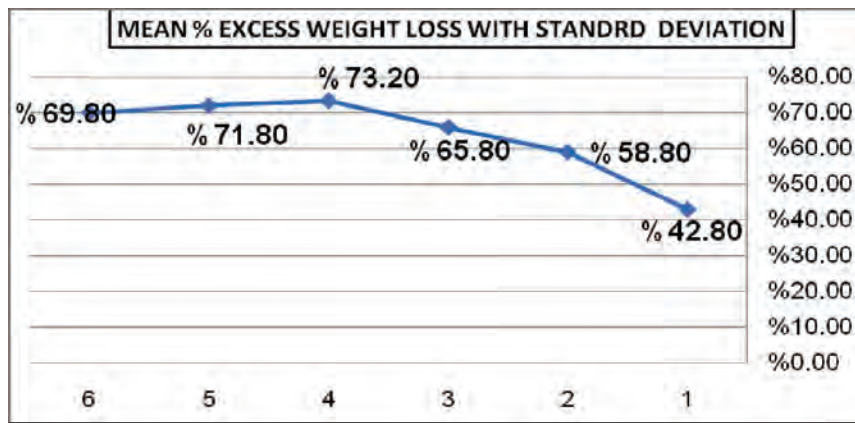
**Table (3): Distribution of the studied cases as regard late complications.**

Complication	N (%)	Outcome
Death	0(0%)	
Myocardial ischemia	1 (2.5%)	Cardiac Stent /resolved
Prolonged nausea	3(7.5%)	All resolved spontaneously
Prolonged vomiting	2 (5%)	All resolved spontaneously
Gastrojejunostomy anastmotic stricture	2(5%)	Endoscopic ballondilatation/resolved
Symptomatic gall stones	1(2.5%)	Lap. Chole/ resolved
Marginal ulcer	1(2.5%)	Proton pump inhibitors/resolved
Depression	1(2.5%)	Improved with medications
Incisional hernia at trocar site	1 (2.5%)	Repair/resolved
Iron deficiency anemia	6 (15%)	Resolved with replacement
Protein-calorie malnutrition	1(2.5)	TPN+ dietary counseling/improved
<b>Total</b>		<b>19(47.5%)</b>

TPN = total parenteral nutrition

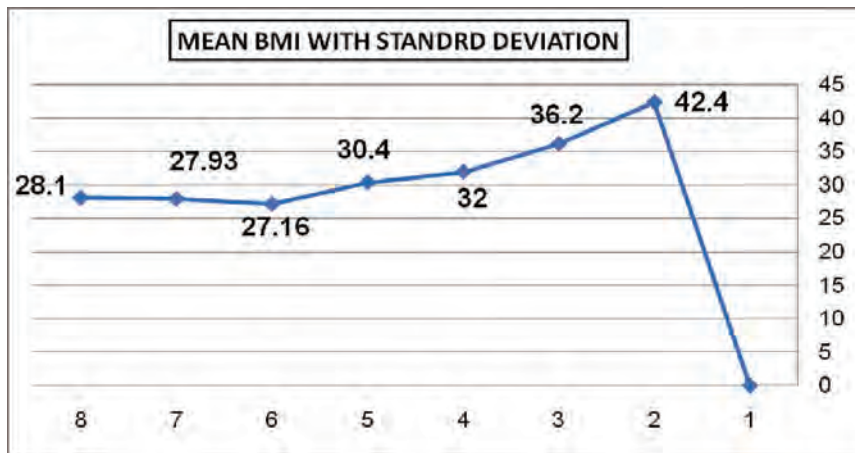


**Figure (1): Change in obesity- related comorbidity.**



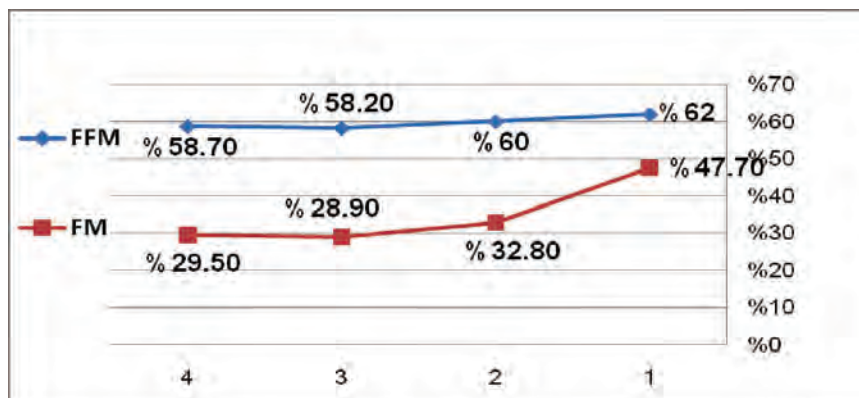
6 MONTH INTERVAL

Figure (2): Excess weight loss, 0 to 30 months.



6 MONTH INTERVAL

Figure (3): Change in body mass index, 0 to 30 months.



12 MONTH INTERVAL

Figure (4): Mean change in Fat Mass (FM) and Free Fat Mass (FFM). 0 to 36 months.

### Discussion:

RYGB is the surgical procedure of choice for morbid obesity because of its good long-term weight loss, excellent patient tolerance, and acceptable short- and long-term complication rate. Laparoscopic bariatric surgery, particularly laparoscopic GB, is technically challenging, as it requires skill in intestinal dissection and reconstruction

techniques coupled with advanced suturing and intra-corporeal knot-tying techniques. Therefore, the development of any new laparoscopic operations can be associated with a "Learning curve".<sup>1</sup> Mastering the technique of laparoscopic GB often requires between 75 and 100 cases. Results of laparoscopic surgery are more fairly compared to open bariatric surgery after the learning curve of the

laparoscopic operation has been achieved.<sup>8</sup> As with most complex laparoscopic procedures, the learning curve is steep, and long operation times are required. Wittgrove et al, 2000 have found that with experience, operating times can be reduced to close to those for open RYGB.<sup>2</sup>

A laparoscopic approach to RYGB may offer benefits that have been shown to occur with other introduced laparoscopic procedure including a reduction in post operative pain and complications, a shorter hospital stay, and faster recovery. High-risk morbidly obese patients with multiple comorbidities may in particular benefit from a less invasive approach because they are more vulnerable to cardiopulmonary and wound- related complications.<sup>2</sup>

A laparoscopic approach to RYGB was first described by Wittgrove et. al in 1994. 15- to 30-mL gastric pouch isolated from the distal stomach with a 21-mm stapled, circular anastomosis, a 75-cm retrocolic, retro gastric Roux limb, and a stapled side-to-side jejunojejunostomy. They have reported on their experience with 75 patients with 3 to 30 months of follow- up. The operating time was 159 to 343 minutes. The mean hospital stay and recovery time were 2.8 days (range 2-75) and 15 days (range 7-30), respectively. Excess weight loss at 12 to 30 months was 81% to 95%. The incidence of major complication was 11%, and the leak rate was 4/75 (5%). There were no deaths. Most comorbidities, such as hypertension and non-insulin-dependent diabetes mellitus, were either eradicated or significantly improved. They have recently reported on their experience with 500 patients with 5- year follow –up, demonstrating similar result and excess weight loss in the 70% to 80% range.<sup>2,9</sup>

Other investigators have reported various laparoscopic approaches to gastric bypass with similar benefit but relatively short follow-up.<sup>10</sup>

In this study, 40 patients underwent laparoscopic RYGB with an acceptable early complication rate (7.5% major, 30% minor), a low conversion rate (5%) a short mean hospital stay (3.6 days) and rapid recovery (25.6 days). The excess weight loss at 24 and 36 months was 73.2% and 69.8%, respectively,

and resulted in significant improvement in comorbidities and quality of life.

Surgical complications in this study appeared to be comparable to those in the open series. The early major complications were predominately related to sepsis from anastomotic leaks and pulmonary embolism. The overall incidence of these complications appears consistent with reports in the literature; however, slight higher incidence can be noticed due to small number of patients. In this study we were interested in the late complications and the long term outcome.

One of the most important late complications is the development of anastomotic (gastro-jejunal) stricture, in this study it occurred in 2 patients (5%) and the recorded incidence in other studies is 1-15% of patients who undergo LRYGB and typically occurs within 2 years of the procedure. However, most of strictures seem to occur within 4-8 weeks after surgery.<sup>11</sup>

In this study one stricture occurred 6 months postoperatively and the second occurred after 14 months of surgery.

It is controversial whether anastomotic technique, i.e., circular versus linear versus hand sewn, retrocolic versus antecolic, truly alters the incidence of stenosis. Some studies have suggested that circular stapled anastomosis may result in higher stricture rates than hand sewn or linear stapled.<sup>10</sup>

In a small, nonrandomized retrospective review Gonzalez et al. (2003), found a significantly higher stricture rate with the 21-mm circular stapled anastomosis than the hand sewn and linear stapled anastomosis (31% vs. 3% vs. 0%, respectively;  $P < 0.01$ ). However, the 31% with the circular seems quite high and although not stated, the linear technique was the first one used in our operative experience. There may be a trend toward a higher stricture rate with antecolic Roux limbs compared with retrocolic presumably secondary to tension on blood supply. Additionally, stapler diameter may influence the incidence of stenosis.<sup>11</sup> Nguyen et al. (2003) compared the stenosis rates with both the 21-mm and 25-mm stapler (26.8% vs 8.8%, respectively,  $P < 0.01$ ).<sup>12</sup>

Patients who develop anastomotic stenosis develop progressive vomiting first for solids and eventually liquids. The history of such

complaints is vital to recognition of this complication. Constant and progressive vomiting is characteristic of stenosis, while episodic or transient vomiting is more likely from dietary indiscretion. Although generally not life threatening, unrecognized and prolonged vomiting resulting from anastomotic stenosis can cause dehydration. Also chronic protein-calorie malnutrition, and vitamin or thiamine deficiency may occur.<sup>13</sup>

Anastomotic strictures can usually be diagnosed by history alone; UGI fluoroscopy can also be helpful in demonstrating narrowing of the gastrojejunal anastomosis and delayed emptying of the gastric pouch. However, should the suspicion of a stricture be high enough, upper endoscopy is superior because it not only can establish the diagnosis but treat it as well. Inability to pass a 9-mm endoscope through the anastomotic outlet is considered by many to be diagnostic of anastomotic stricture.<sup>13</sup>

Balloon dilatation with a through the scope balloon is highly effective in reestablishing an adequate lumen and resolving the patient's symptoms. A stepwise approach is usually performed, dilating 3-5 mm above the size of the lumen at the first endoscopy and then using subsequent endoscopy to dilate to a final lumen of 12 mm.<sup>14</sup>

In this study the 2 strictures which occurred, successfully responded to endoscopic dilatation and resolved completely.

Patients with marginal ulcers will usually present with upper epigastric pain and burning sensation. The pain may radiate to the back. Substernal chest pain can also occur. Nausea, vomiting, and food intolerance are often commonly seen with ulcers; while massive upper GI (UGI) bleeding is uncommon, iron deficiency anemia is more commonly associated with chronic or recurrent ulcers.<sup>1</sup>

Some studies have also suggested that the injudicious use of nonsteroidal anti-inflammatory agents, *Helicobacter pylori*, tobacco smoking, ischemia, and Roux limb tension are also possible etiologic factors.<sup>15</sup>

In divided RYGBs without gastro-gastric fistula, the etiology of marginal ulceration remains unclear. Acid output by parietal cells in the standard 30-cc gastric pouch is minimal

but not usually absent. Large pouches may likely contain more acid-producing parietal cells thus increasing the incidence of ulceration.<sup>16</sup>

The evaluation of a patient who presents with symptoms suggestive of ulceration is very straightforward. A barium swallow radiograph is simple, noninvasive, and often the first diagnostic test ordered. However, while it may delineate large deep ulcers and demonstrate gastro-gastric fistulas, it might miss more shallow ulcerations. Upper endoscopy, while more invasive, is a superior test to diagnose ulceration. It is much more specific for identifying ulcers. If an ulcer is found, the treatment includes removal of irritants such as tobacco or nonsteroidal anti-inflammatory drugs (NSAIDs) and the prescription of either a histamine-receptor antagonist or proton-pump inhibitor. Unless the ulcer is due to ischemia or a gastro-gastric fistula, medical therapy will usually succeed.<sup>16</sup>

In the literature; marginal ulceration has been reported to occur in 5-15% and 3-5% of patients who undergo undivided and divided RYGB respectively.<sup>17</sup>

One case of marginal ulceration was recorded in this study (2.5%) and developed 4 month after surgery and responded well to PPIs.

One case of incisional hernia was reported postoperatively (2.5%) that was comparable with other studies of LRYGB and much less with studies of open technique.

Iron is one of the most frequent deficiencies after obesity surgery; the incidence is about 14-16% in RYGB.<sup>17</sup>

Six patients (15%) developed anemia (mainly due to iron deficiency and other factors as folate and B12 deficiencies). The cases responded to parenteral iron and multivitamins.

Most multivitamin and mineral supplements contain sufficient amount of iron to prevent deficiency. However, iron deficiency anemia sometimes persist even in patients taking multivitamins. As a preventive measure, all menstruating women are prescribed ferrous sulfate 325 mg every day. Patients diagnosed with anemia are treated with ferrous sulfate 325 mg three times a day along with vitamin C.



Sometimes parenteral iron therapy is necessary to correct anemia. Iron therapy is associated with constipation as a common side effect.<sup>18</sup>

Refractory and severe anemia may require blood transfusion. Thiamine and folate deficiencies are suspected in patients who present after repeated vomiting. They should be treated with parenteral thiamine and folate before starting fluid replacement. Acute thiamine deficiency is treated with parenteral thiamine 100mg/d for 7 days followed by 10 mg/d orally until there is complete recovery. Vitamin B12 deficiency has to be corrected by supplementing 300-500 g/d orally or as 1000-2000 g/month intramuscular shots. Protein deficiencies are identified and corrected by dietary modification and protein supplementation. Total parenteral nutrition may be necessary for patients with extreme degree of malnutrition.<sup>19</sup>

In this study regular examination and laboratory work up were done for patients every 2 months, measuring; CBC, vitamin B12 level, albumin, and calcium. Replacement therapy was given if any deficiency was recorded in addition to vitamin and mineral supplementation to all patients.

In a low acid environment as seen in achlorhydria and gastric bypass, absorption of calcium carbonate is poor. A recent study reported that absorption of amino acid chelated calcium is twice that of calcium carbonate.<sup>20</sup>

Recommended screening tests include Serum Ca, 25-OH D, and PTH. Recommendations to prevent osteoporosis after GB include ingestion of 1200-1500 mg of calcium and 800 IU of vitamin D per day. If the patient has extreme malabsorption, higher doses are needed to prevent secondary hyperparathyroidism. The efficacy of calcium absorption varies inversely with the calcium intake. At low doses (<500 mg), calcium absorption is by active transport.<sup>20</sup>

The important outcome related to the goal of bariatric surgery such as weight

loss, important reduction in comorbidities and good quality of life results in that this study appears acceptable if compared with other series putting in consideration the limited number of patients. In this study the mean percent of excess weight loss after 1, 2 & 3 years was 58.8%, 73.2 and 69.8% respectively, similar results were recorded by Yale.<sup>21</sup>

Robert et al. (2007), studied 320 patients who underwent laparoscopic RYGB with gastric pouches smaller than 60cc. They lost about 55% of their excess weight after 6 months and after 12 months the mean loss was 69%, however, he concluded that; the theory why gastric bypass leads to weight loss depends on the pouch size to launch weight loss while maintenance depends more on endocrine changes such as decrease in Ghrelin hormone. He also added that; significant weight loss in patients undergoing LRYGB is mainly as a consequence of loss in Fat Mass (FM) with less importance on Free Fat Mass (FM).<sup>22</sup> Similar results can be obtained from our study.

Nearly all comorbidities improved or resolved after LRYGB with exception to neuropsychiatric comorbidities as depression even some cases deteriorated, however they improved by medications. Similar results can be seen in the study of Saltzman et al., 2005 .<sup>23</sup>

Improvement in quality of life in 95% of patients studied in this study was impressive; however weight gain was noticed after 18-24 months in some patients. Signore concluded that, patients having gastric bypass were divided into groups regarding weight regain:

**Group 1:** about 25% of patients lose 80% of their excess weight, regardless of medical or support group's aid.

**Group 2:** 25% of patients do not lose enough weight, or display weight regains, even with medical and support group care.

**Group 3:** about 50% of patients might achieve good results, but this is primarily dependent on efficacy of medical staff and the attention of support groups. For these patients,

the ability of the multi-professional team to keep patients involved in support group programs is vital. Should these data be confirmed, it is possible that, in long-term analysis (5-10 years after surgery), almost half of the patients could experience suboptimal results and he concluded that if the professionals involved in the obesity treatment don't work together to solve the weight regain problem and control the eating compulsion, surgical treatment will be compromised.<sup>24</sup>

The Laparoscopic RYGB is technically challenging but with experience it can be mastered and the learning curve is steep and long operating times are required. At the start of this study the operating time was around nine hours and less in some cases. Wittgrove et al. have found that with experience operating time can be reduced to close to those for open RYGB.<sup>9</sup>

#### Conclusion:

The results of this study indicate that laparoscopic RYGB is technically feasible and safe. It is associated with a low rate of postoperative complications, a short hospital stay, and rapid recovery. Laparoscopic RYGB is a promising bariatric procedure with potentially significant advantages over the open approach, but further evaluation is necessary to determine long term weight loss and complications. Also, additional studies with larger numbers of patients and longer follow-up will be required to answer the question unequivocally.

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