

Review of Various Aspects of Laparoscopic Roux-en-Y Gastric Bypass to Emphasize its Significance in Bariatric Surgery

Danish Javed

ABSTRACT

Obesity is a form of malnutrition and it has been growing globally. Surgical management of morbid obesity is increasing in response to its epidemic rise. The growth of laparoscopic bariatric surgery greatly exceeds that of open bariatric surgery. The aim of this study is to review the various aspect of the laparoscopic Roux-en-Y Gastric Bypass (LRYGBP) to emphasize its significance in Bariatric Surgery. Laparoscopic Roux-en-Y gastric bypass is a well-structured and well-understood operation that is valuable for the treatment of rigorous obesity. The laparoscopic Roux-en-Y gastric bypass has been shown to be safe and effective. The individual will recognize that the best preference for most patients looking for surgical treatment of clinical severe obesity is laparoscopic RYGBP.

Keywords: Morbid obesity, Laparoscopy bariatric surgery, Roux-en-y, Comparison obesity surgery, Open laparoscopy bariatric, Complication Roux-en-Y.

How to cite this article: Javed D. Review of Various Aspects of Laparoscopic Roux-en-Y Gastric Bypass to Emphasize its Significance in Bariatric Surgery. *World J Lap Surg* 2012;5(3): 116-120.

Source of support: Nil

Conflict of interest: None declared

INTRODUCTION

Obesity is the commonest form of malnutrition and it has been increasing over the last few decades globally.¹⁻³ In India up to 50% of women and 32.2% of men in the upper socioeconomic class come under the obese category. In Delhi, the prevalence of obesity is 33.4% in women and 21.3% in men.^{4,5} According to Framingham data for each pound weight gained between ages 30 and 42 years, there is 1% increased mortality within 26 years, and for each pound gained after that, it is the 2% increased mortality. In morbid obese, average life expectancy is reduced by 12 years in men and 9 years in women.⁶ Type 2 diabetes, hypertension, hyperlipidemia, stroke, atherosclerosis, osteoarthritis, hypoventilation, sleep apnea syndrome, GERD, infertility and urinary stress incontinence in females, certain cancers (endometrium, colon, breast, prostate) and sudden death are comorbidities.⁷ Surgical management of morbid obesity is increasing in response to its epidemic rise.⁸ Between 1998 and 2002, there was a 450% increase in the number of bariatric operations performed in the United

States, a 144% increase in the number of American Society for Bariatric Surgery bariatric surgeons, and a 146% increase in the number of bariatric centers. The growth of laparoscopic bariatric surgery during this 5-year period greatly exceeds that of open bariatric surgery.⁹ National Institutes of Health Consensus (NIH) Conference convened in 1991, specifically identified Roux-en-Y gastric bypass (RGB) and vertical banded gastroplasty (VBG) as surgical options that provide significant benefits for patients with clinical severe obesity. In 1994, Wittgrove, Clark and Tremblay performed the first laparoscopic RYGB (LRYGB), which at the time was considered a technical tour de force.¹⁰

There are following different options available in bariatric surgery.¹¹

- Purely malabsorptive procedures
 - Jejunioileostomy
 - Biliopancreatic diversion
- Combined malabsorptive and restrictive procedures
 - Duodenal switch
 - Gastric bypass
 - Digestive adaptation
- Restrictive procedures
 - Gastroplasty
 - Gastric banding
 - Sleeve gastrectomy
 - Gastric pacing
- Robotic surgery
- Endoluminal bariatric surgery
- Restrictive endoluminal procedures
- Malabsorptive endoluminal procedures.

AIM

The aim of this study is to review the various aspect of the LRYGB to emphasize its significance in bariatric surgery.

MATERIALS AND METHODS

A thorough literature and clinical search was performed. The following search terms was used: Morbid obesity, laparoscopy bariatric surgery, Roux-en-Y, comparison obesity surgery, open laparoscopy bariatric, complication Roux-en-Y.

HISTORY

In 1954, Kremen et al performed the first intestinal bypass via jejunostomy, and in 1956, Payne and DeWind performed a distal jejunoileostomy. Later it was modified by Sherman et al, who sutured 14 inches of proximal jejunum end-to-side to the terminal ileum, 4 inches proximal to the ileocecal valve. Mason and Ito devised a gastric bypass procedure for morbid obesity in 1966, after noting the weight reduction in gastric resection for gastric ulcer. Initially, they transected the stomach horizontally and performed a loop gastrojejunostomy to the proximal portion of the stomach. Over several decades, the gastric bypass has been modified into its current form, using a Roux-en-Y limb of intestine (RYGBP). In 1994, Wittgrove, Clark and Tremblay reported the first case series of laparoscopic RYGBP.¹⁰

SURGICAL TECHNIQUE

In LRYGBP procedure, six small incisions are made, through which ports are inserted for abdominal access. Dissection is started at the fundus of stomach with division of phrenico-gastric ligament. The stomach is divided with laparoscopic straight four row cutting 60 mm stapler to create a 15 to 20 cc pouch. The ligament of Treitz is identified initially, and the proximal jejunum is divided approximately 50 cm distal to this point. A gastrojejunostomy is performed either hand sutured, linear staplers or by circular staplers. A jejunojunction is performed with laparoscopic staplers. A Roux limb of between 75 and 200 cm is formed depending on the BMI, and the jejunojunctional mesenteric defect is closed to avoid postoperative internal hernias. The Roux limb is placed in an antecolic fashion. The anastomosis is tested by gastroscopy for evidence of any leak after the procedure.

COMPARISON OF LRYGBP WITH OTHER METHODS OF LAPAROSCOPIC BARIATRIC SURGERY

LRYGP is in reality, a well-structured and well-understood operation that is valuable for the treatment of clinical severe obesity. Longer follow-up evaluation and experience with VBG shows that patients frequently changes dietary habits postoperatively, ingests high-calorie soft foods and liquids and regains weight.¹² Because of these long-term results, the operation has been largely abandoned.

A prospective, comparative analysis performed by Bowne et al (2006), has shown that the laparoscopic gastric bypass is superior to adjustable gastric band in super morbidly obese patients. The patients who underwent laparoscopic adjustable gastric banding (LAGB)

experienced a greater incidence of late complications ($p < 0.05$), reoperations ($p < 0.04$), less weight loss ($p < 0.001$) and decreased overall satisfaction ($p < 0.006$). Likewise, patients who underwent LRYGB had a greater resolution of concomitant diabetes mellitus ($p < 0.05$) and sleep apnea ($p < 0.01$) compared with the LAGB group. Furthermore, postoperative adjustments to achieve consistent weight loss for LAGB recipients ranged from 1 to 15 manipulations. Single mortality was also in this LAGB group.¹³ In one another study, LAGB is found significantly associated with more late complications, reoperations, less weight loss, less reduction of medical comorbidity and patient dissatisfaction compared with LRYGB.¹⁴

The following table shows the outcome of different types of bariatric operations (Table 1).¹⁵

RYGBP IS SAFE AS WELL AS EFFECTIVE PROCEDURE

The LRYGB has been shown to be safe and effective for the non superobese patient (BMI < 50) by Wittgrove et al.¹⁶ Using same techniques, Nguyen et al were able to perform RYGBP on a patient with a BMI of 61.¹⁷ Higa et al (2000) studied a case series of 400 morbidly obese and superobese individuals who underwent the LRYGB over a 22-month period. They observed that RYGBP can be safely and effectively performed in the community setting using advanced laparoscopic techniques.¹⁸

LRYGP IS A REDO PROCEDURE FOR FAILED RESTRICTIVE GASTRIC SURGERY

From the conclusion based on the various text, it can be assumed that restrictive surgery for morbidly obesity will certainly require many reoperations in the future. The standard operation of choice is LRYGBP. The study conducted by Van Dessel et al (2006), has shown this procedure a higher, but not significantly early morbidity rate when the indication for redo surgery was a technical complication of the initial procedure.¹⁹

EFFECT OF RYGBP ON THE LEVEL OF SERUM GHRELIN

Ghrelin, an acylated protein, is an orexigenic hormone, decreases after feeding and increases before meals, achieving concentrations sufficient to stimulate hunger and food intake. This hormone is basically produced from entero-endocrine cells of gastric mucosa and somewhat from the duodenum. RYGBP seems to achieve a very strong suppression of serum ghrelin level in contrast with gastric banding procedure. These findings are consistent with the assumption that by suppression of ghrelin, gastric bypass

Table 1: Outcomes of laparoscopic bariatric operations

	LAGB	RYGB	BPD	DS
Excess weight loss (%)	49-80	60-81	61-78	66-80
Mortality (%)	0-0.2	0-1.0	0.5-1.9	0.4-2.0
Overall morbidity (%)	8.5-25	9-25	22-28	12-20
Nutritional complications (%)	Rare	15-25	40-77	39-77
Poor long-term weight loss (%)	10-25	10-15	4-6	3-6
Avg. hospital LOS (days)	1-2	1.9-4	–	–
Anastomotic stenosis (%)	–	0.1-5	2-13	5-10
Marginal ulcer (%)	2-14	2-14	8-15	0
Hemorrhage (%)	0	0.66	0.2-0.5	0.2-0.5
Wound infection (%)	0	14	0.8	1.0
Leak (%)	1-3	1.3-3	1.2	4.1
Pulmonary embolism (%)	0	0.36-1.2	1-3.6	0.7-1.7
Incisional hernia (%)	0	4.5-14.6	–	–

VBG: Vertical banded gastroplasty; RYGB: Roux-en-Y gastric bypass; BPD: Biliopancreatic diversion; DS: Duodenal switch; LOS: Length of hospital stay

can reduce body weight in long-term, more than gastric banding. Still, the mechanism by which gastric bypass leads to reduction in ghrelin level is not completely understood. It was advanced by the hypothesis that a permanent absence of food in stomach resulting from gastric bypass could cause an uninterrupted stimulatory signal that ultimately decreases ghrelin production by overriding inhibition.²⁰

RYGBP IS THE MOST EFFECTIVE TREATMENT FOR TYPE 2 DIABETES MELLITUS IN MORBIDLY OBESE PATIENTS

Many studies clearly demonstrated that LRYGBP is highly effective in achieving excellent control in patients with type 2 diabetes mellitus (T2DM). After 6 months of surgery, most patients easily withdraw there all antidiabetic medications, including insulin. Improvement in glucose metabolism occurs early after LRYGB and, therefore, is not entirely related to weight loss. A study by Alfonso et al (2005) suggests that central obesity negatively influences the likelihood of T2DM resolution after RYGB. They also suggest that RYGBP should be considered as standard treatment of T2DM in obese.²¹ A recent research paper of Luigi (2007) also says that bariatric surgery appears to be an effective and beneficial intervention in selected obese (BMI >35 kg/m²) patients with diabetes, when medical and nutritional approaches have failed to achieve the desired outcomes. This becomes especially true when metabolic control in these individuals has not been achieved despite aggressive medical therapy.²²

LRYGBP AND EFFECT OF LEARNING CURVE

Studies conducted by Papisavas et al (2002) and Bal et al (2004) tells that it is a technically demanding procedure with significant morbidity during the learning curve. The learning curve soon overcomes, and reaches a rate plateau of complications after adequate training. The mean operating

room time and the conversion rate improves with experience. Morbidly obese patients should be operated on in expert bariatric surgical laparoscopic units to obtain the best results.^{23,24}

TOTALLY ROBOTIC ROUX-EN-Y GASTRIC BYPASS

In 2003, Muhlmann et al conducted a study to compare laparoscopic vs robotic bariatric procedures. The robotic aided procedure proved to be 30% faster than were even experienced laparoscopic surgeons.²⁵ Catherine et al (2005) study details the report and demonstrates the feasibility, safety and potential superiority of such a procedure. They say that learning curve may also be significantly shorter with the robotic procedure.²⁶

COMPLICATIONS

Complications can be of two types, early and late.

Early

1. Anastomotic leak
2. Pulmonary embolism.

Late

1. Anastomotic stricture
2. Internal hernia (IH)
3. Dumping syndrome
4. Nutritional deficiencies.

Comparison with open and laparoscopic RYGBP is associated with reduction in frequency of iatrogenic splenectomy, wound infection, incisional hernia and mortality; however, there is an increase in the frequency of early and late intestinal obstruction, gastrointestinal tract bleed and stomal stenosis. There are no significant differences in the frequency of anastomotic leak, pulmonary embolism or pneumonia.²⁷

Retrospective study of 400 consecutive RYGB patients (1999-2002) supports that, enteric leakage is an important complication of the RYGB. Leaks that are more insidious can be treated successfully with percutaneous drainage.²⁸ Leak after LRYGB may be difficult to detect. Evidence of respiratory distress and tachycardia exceeding 120 beats per minute may be the most useful clinical indicators of leak after LRYGP.²⁹

Comeau et al (2003) documented 35 cases of internal hernia (overall incidence of 3.3%). The IH occurred in 6.0% of patients with retrocolic procedures and 3.3% of patients with antecolic procedures. Most were in the Petersen defect (55.9%) and at the enteroenterostomy site (35.3%). A bimodal presentation was observed, with 22.9% of patients with IH diagnosed in the early postoperative period (2-58 days) and 77.1% in a delayed fashion (187-1,109 days). A laparoscopic approach to the repair of IH was possible in 60.0% of patients. Complications occurred in 18.8% of patients, including one death (2.9%).³⁰

CONCLUSION

The selection of surgical technique for a particular patient must be decided by a surgeon who has all of the tools accessible to him in his surroundings. Decisions should be made depending on the individual clinical scenario. No single tool or procedure can be considered suitable for all patients. Assimilation of all the known data is essential for the surgeon to offer the correct procedure to the correct patient. The well-informed and well-trained individual will recognize that the best preference for most patients looking for surgical treatment of clinical severe obesity is RYGBP.

REFERENCES

- Kuczumarski RJ, Flegal KM, Campbell SM, Johnson CL. Increasing prevalence of overweight among US adults. The national health and nutrition examination surveys, 1960 to 1990. *JAMA* 1994;272:205-11.
- Sjostrom CD, Lissner L, Wedel H, Sjostrom L. Reduction in incidence of diabetes, hypertension and lipid disturbance after intentional weight loss induced by bariatric surgery: The SOS intervention study. *Obes Res* 1999;7:477-84.
- Fried M, Peskova M, Kasalicky M. Bariatric surgery in some central and East-European (formerly Eastern block) countries—current status and prediction for the next millennium. *Obes Surg* 2000;10:255-58.
- Gopalan C. Obesity in the urban middle class. *NFI Bulletin* 1998;19:1-4.
- Gopinath N, Chadha SL, Jain P, Shekhawat S, Tandon R. An epidemiological study of obesity in adults in the urban population of Delhi. *J Assoc Physicians India* 1994;42:212-15.
- Bauchwold H, Consensus Conference Parell, bariatric surgery for morbid obesity: Health implications for patients, health professionals and third party payers. *J Am Coll Surg* 2005; 200:593-604.
- Hagen J, Deitel M, Khanna RK, Ilves R. Gastroesophageal reflux in the morbidly obese. *Int Surg* 1987;72:1-3.
- Benotti PN, Forse RA. The role of gastric surgery in the multidisciplinary management of severe obesity. *Am J Surg* 1995;169: 361-67.
- Nguyen NT, Root J, Zainabadi K, Sabio A, Chalifoux S, Stevens CM, et al. Accelerated growth of bariatric surgery with the introduction of minimally invasive surgery. *Arch Surg* 2005;140:1198-202.
- Wittgrove AC, Clark GW, Tremblay LJ. Laparoscopic gastric bypass, Roux-en-Y: Preliminary report of five cases. *Obes Surg* 1994;4:353-57.
- Saber AA, Elgamil MH, McLeod MK. Bariatric surgery: The past, present and future. *Obes Surg* 2008 Jan;18(1):121-28.
- Brolin RE, Robertson LB, Kenler HA, et al. Weight loss and dietary intake after vertical banded gastroplasty and Roux-en-Y gastric bypass. *Ann Surg* 1994;220:782-90.
- Bowne WB, Julliard K, Castro AE, Shah P, Morgenthal CB, Ferzli GS. Laparoscopic gastric bypass is superior to adjustable gastric band in super morbidly obese patients. A prospective, comparative analysis. *Arch Surg* 2006;141:683-89.
- Schirmer B. Laparoscopic bariatric surgery. *Surg Endosc* 2006 Apr;(20 Suppl)2:545-55.
- Kreitz K, Rovito PF. Laparoscopic Roux-en-Y gastric bypass is safe and effective in patients with a BMI of 70 or greater. *Laparoscopic Roux-en-Y Gastric Bypass in the Megaobese. Arch Surg* 2003;138:707-09.
- Wittgrove AC, Clark GW, Tremblay LJ. Laparoscopic gastric bypass, Roux-en-Y: Technique and results in 75 patients with 3 to 30 months follow-up. *Obes Surg* 1996;6:500-04.
- Nguyen NT, Ho HS, Palmer LS, Wolfe BM. Laparoscopic Roux-en-Y gastric bypass for super/super obesity. *Obes Surg* 1999;9: 403-06.
- Higa KD, Boone KB, Ho T, Davies OG. Laparoscopic Roux-en-Y gastric bypass for morbid obesity. Technique and preliminary results of our first 400 patients. *Arch Surg* 2000;135: 1029-33.
- Van Dessel E, Hubens G, Ruppert M, Balliu L, Weyler J, Vaneerdeweg W. Roux-en-Y gastric bypass as a redo procedure for failed restrictive gastric surgery. *Surg Endosc* 2008 Apr; 22(4):1014-18.
- Cummings DE, Weigle DS, Frayo RS. Plasma ghrelin levels after diet-induced weight loss or gastric by-pass surgery. *N Engl J Med* 2002;346:1623-30.
- Torquati A, MSCI, Lutfi R, Abumrad N, Richards WO. Is Roux-en-Y gastric bypass surgery the most effective treatment for type 2 diabetes mellitus in morbidly obese patients? *J Gastrointest Surg* 2005;9(8):1112-18.
- Meneghini FR. Impact of bariatric surgery on type 2 diabetes. *Cell Biochem Biophys* 2007 Jul;48(2-3):97-102.
- Ballesta-Lopez C, Poves I, Cabrera M, Almeida JA. Learning curve for laparoscopic Roux-en-Y gastric bypass with totally hand-sewn anastomosis: Analysis of first 600 consecutive patients. *Surg Endosc* 2005 Apr;19(4):519-24.
- Papasavas PK, Hayetian FD, Caushaj PF, Landreneau RJ, Maurer J, Keenan RJ, et al. Outcome analysis of laparoscopic Roux-en-Y gastric bypass for morbid obesity. The first 116 cases. *Surg Endosc* 2002 Dec;16(12):1653-57.
- Muhlmann, et al. DaVinci robotic-assisted laparoscopic bariatric surgery: Is it justified in a routine setting? *Obes Surg* 2003;13(6): 848-54.

26. Mohr CJ, Nadzam GS, Curet MJ. Totally robotic Roux-en-Y gastric bypass. *Arch Surg* 2005;140:779-86.
27. Podnos YD, Jimenez JC, Wilson SE, Stevens CM, Nguyen NT. Complications after laparoscopic gastric bypass. A Review of 3464 Cases. *Arch Surg* 2003;138:957-61.
28. Marshall JS, Srivastava A, Gupta SK, Rossi TR, DeBord JR. Roux-en-Y gastric bypass leak complications. *Arch Surg* 2003; 138:520-24.
29. Comeau E, Gagner M, Inabnet WB, Herron DM, Quinn TM, Pomp A. Symptomatic internal hernias after laparoscopic bariatric surgery. *Surg Endosc* 2005 Jan;19(1):34-39.
30. Hamilton EC, Sims TL, Hamilton TT, Mullican MA, Jones DB, Provost DA. Clinical predictors of leak after laparoscopic Roux-en-Y gastric bypass for morbid obesity. *Surg Endosc* 2003 May;17(5):679-84.

ABOUT THE AUTHOR

Danish Javed

Clinical Registrar, Department of Surgery, Ch. Brahm Prakash Ayurved Charak Sansthan, Najafgarh, New Delhi, India
e-mail: danish_surgeon@rediffmail.com