



## Comparative Study of Gastric Bypass Using Three Types of Linear Cutting Staplers

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### Abstract

**Objective:** The present study analyzed the occurrence of complications among people receiving gastric bypass gastroplasty using three types of linear cutting staplers.

**Materials and Methods:** The same medical team retrospectively studied 178 patients receiving weight-reduction gastroplasty to control obesity at our service. The cases were grouped by the type of linear cutting stapler used: 53 patients-Group 1 (G1: Reach or ENDO RLC), 54 patients-Group 2 (G2: Johnson & Johnson-ETS, ECHELON FLEX ENDOPATH and ECHELON POWERED FLEX), and 71 patients-Group 3 (G3: Meditronic-ENDO GIA™ and iDRIVE ULTRA POWERED™). Demographic information such as gender, age, and Body Mass Index (BMI) was recorded, in addition to the basic information directly related to the immediate surgical outcomes such as drain placement, the presence of abnormal bleeding, the need for reoperation, and length of hospitalization.

**Results:** Of the 178 patients who underwent surgery, six (3.4%) had at least one complication, including the need for drain placement, the presence of abnormal bleeding, and the need for reoperation. In G2, one 59-year-old patient (BMI=46.3 kg/m<sup>2</sup>) required further surgical intervention (exploratory laparotomy for enterorrhaphy due to a small intestine lesion), and another 61-year-old patient (BMI=33.6) required the preventive placement of a drain. Despite the delay in hospital discharge, which was initially scheduled the day after surgery, both patients showed favourable recoveries.

**Conclusion:** This study did not show significant differences with regard to the use, complication rate, or handling of the REACH stapler compared with the other two stapler brands studied.

**Keywords:** Bariatric surgery; Gastric bypass; Linear cutting staplers

### Introduction

Obesity is defined as the excessive accumulation of body fat. This condition affects the health of the individual, reduces quality of life, and increases morbidity and early mortality [1]. The cause of obesity is complex and multifactorial and might differ across individuals. This condition results from a long-term imbalance between energy intake and energy production/expenditure. Complex interactions among genetics, hormones, and various socioeconomic, cultural, and environmental factors are involved in the regulation of energy balance and fat deposition [1]. Surgical treatment for obesity emerged as a preferential option for individuals with morbid obesity and severe obesity that are unresponsive to clinical treatment to significantly facilitate and sustain weight loss, as well as solve or improve the associated morbidities [2]. Bariatric surgery is based on food restriction and the reduction of nutrient absorption. Several procedures have been developed to alter the anatomical and physiological function of the stomach to meet therapeutic goals. Based on the mechanism of action, procedures can be generically categorized into restrictive procedures (e.g., laparoscopic adjustable gastric banding and Laparoscopic Gastric Sleeve [LGS]), mal absorptive procedures (e.g., biliopancreatic diversion), and hybrid procedures that combine restrictive and mal absorptive techniques (e.g., Roux-en-Y laparoscopic gastric bypass [BGLYR]). These procedures can be performed using conventional open surgery or laparoscopy [1,3,4]. BGLYR surgery is indicated for weight loss among patients with severe obesity. Mason and Ito developed the procedure in 1960 and observed significant weight loss among patients undergoing partial gastrectomy for peptic ulcers. This procedure was commonly performed by open laparotomy and showed a high incidence

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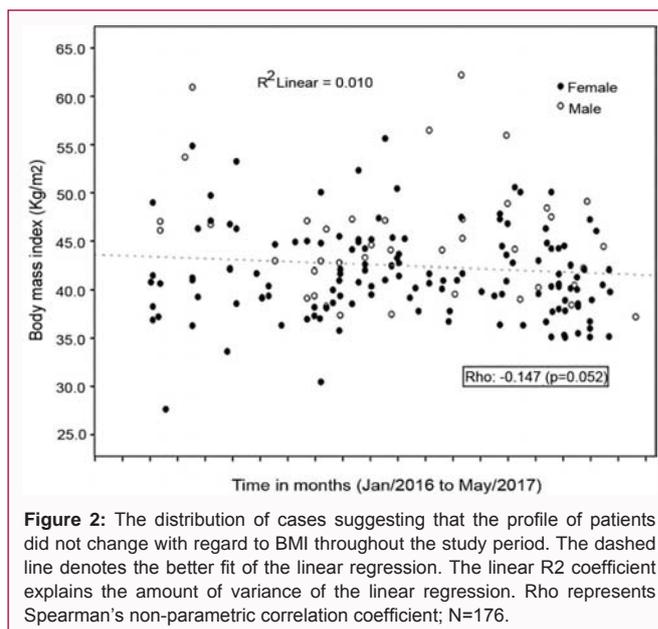
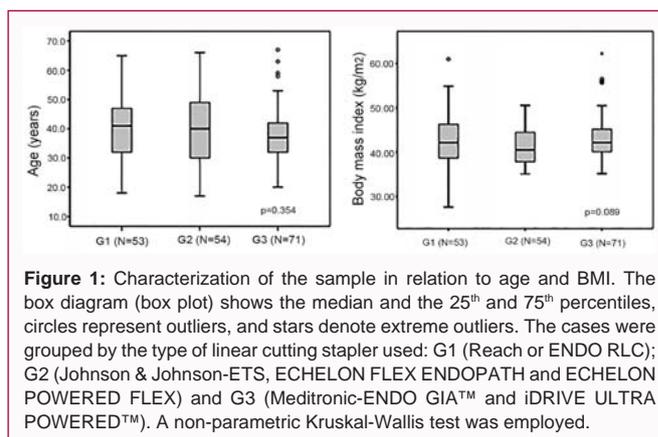
of incisional hernia and frequent surgical wound complications. With the arrival of laparoscopy, the number of complications decreased. Witt grove and Clark performed the first BGLYRs in 1994 [5]. Despite its lower surgical risk, LGS has decreased the likelihoods of diabetes mellitus remission and long-term weight loss compared with BGLYR. These results represent challenges for surgeons seeking to balance the benefits and risks of bariatric procedures [3,4,6]. Although BGLYR is well documented, few studies have examined the material used and the possible surgical complications associated with this procedure. We hypothesize that, regardless of the type of stapler used, postoperative complications will be similar. The present study analyzed the occurrence of complications in a case series of patients receiving gastric bypass using three types of linear cutting staplers.

## Materials and Methods

All of the participants completed an informed consent form, and the study was submitted to the ethics committee of our institution. The same medical team retrospectively studied 178 patients undergoing gastric bypass for obesity control between January 2016 and May 2017 at our service. The cases were grouped according to the type of linear cutting stapler used: 53 patients were allocated to Group 1 (G1: Reach or ENDO RLC); 54 patients were allocated to Group 2 (G2: Johnson & Johnson-ETS, ECHELON FLEX ENDOPATH and ECHELON POWERED FLEX), and 71 patients were allocated to Group 3 (G3: Meditronic-ENDO GIA™ and iDRIVE ULTRA POWERED™). Demographic information (e.g., gender, age and body mass index [BMI]) was recorded, as were the basic information directly associated with immediate surgical outcomes (e.g., drain placement, abnormal bleeding, need for reoperation, and length of hospitalization). The technique used was the simplified bypass procedure that Ramos AC et al., [7] described, consisting of the release of the Hiss angle, the section of the stomach in the lesser curvature just below the second vessel, the placement of a Fuchet probe, and the section of the stomach parallel to the probe in the direction of the Hiss angle. The loop gastrojejunal anastomosis was made in the posterior wall of the neo-stomach along the line of the staples, with the jejunal loop fixed on its counter-mesenteric border, right after the duodenal arc, counting 50 cm of loop. The posterior wall of the gastrojejunal anastomosis was made using a linear cutting stapler, and the anterior wall of the anastomosis was performed by a manual suture. Once the gastrojejunal anastomosis was made, a 1.5 m small intestine loop was measured to perform the entero-entero-anastomosis. The two loops were placed in parallel, and the linear cutting stapler was used for the posterior wall of the loops, followed by the manual suture of the orifice through which the stapler passed. A slit was opened on the loop's meso near the gastrojejunal anastomosis for the introduction of the stapler to section the intestinal loop and create the Roux-en-Y. The cases that presented with at least one complication during the intervention were described in relation to the respective adverse events that occurred. To check for late adverse events, the patients were monitored for 1 month initially through consultations and later by the telephone.

## Statistical Analysis

All statistical analyses were performed using SPSS for Windows (IBM, USA). Between-group comparisons were made with non-parametric statistics, and 0.05 was considered as the level of significance. Spearman's non-parametric correlation analysis was used to test the association between numerical variables. A linear regression analysis was used to verify variation trends within the



patient profiles throughout the study period (not as a significance test or predictive model).

## Results

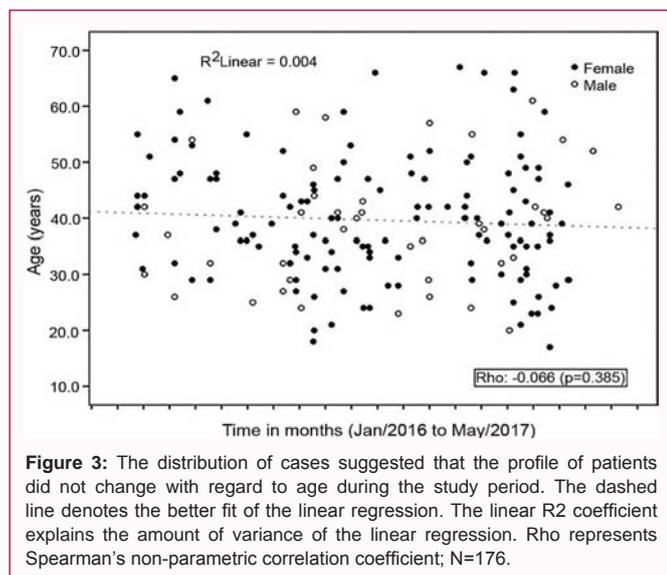
The mean time of surgery was 70 min, with a minimum of 50 min and a maximum of 150 min. In G1, the patients' ages ranged from 18 to 65 years (median =41 years), and their BMIs ranged from 27.6 to 60.9 kg/m<sup>2</sup> (median =42.1 kg/m<sup>2</sup>). In G2, patients' ages ranged from 17 to 66 years (median =41 years), and their BMIs ranged from 35.1 to 50.6 kg/m<sup>2</sup>. In G3, patients' ages ranged from 20 to 67 years (median =41 years), and their BMIs ranged from 35.1 to 62.2 kg/m<sup>2</sup>. No significant differences were found among the groups with regard to age or BMI (Figure 1). The linear regression analysis suggested that the profile of patients did not vary with regard to BMI or age over the study period. Similarly, no significant correlations were found between age and time or between BMI and time (Figure 2 and 3). Females were more prevalent in the sample (76%). The proportions of women in G1, G2, and G3 (76%, 85%, and 76%, respectively) are not significantly different (Figure 4).

### Occurrence of complications (Table 1)

Six (3.4%) out of 178 patients receiving surgery exhibited at least one complication, including the need for drain placement, abnormal bleeding, and the need for reoperation. In G1, two patients presented

**Table 1:** Comparative study of three brands of linear cutting staplers.

	Reach	J & J	Meditronic
n	53	54	71
Female	45	41	53
Male	8	13	18
Mean age	40.75	41.01	40.31
Mean BMI	41.18	42.72	43.11
Reoperations	0	1	0
Complications	1	1	0
Drains	0	1	0
Haemorrhagy	2	0	0
Discharge within 24 h	51	54	71

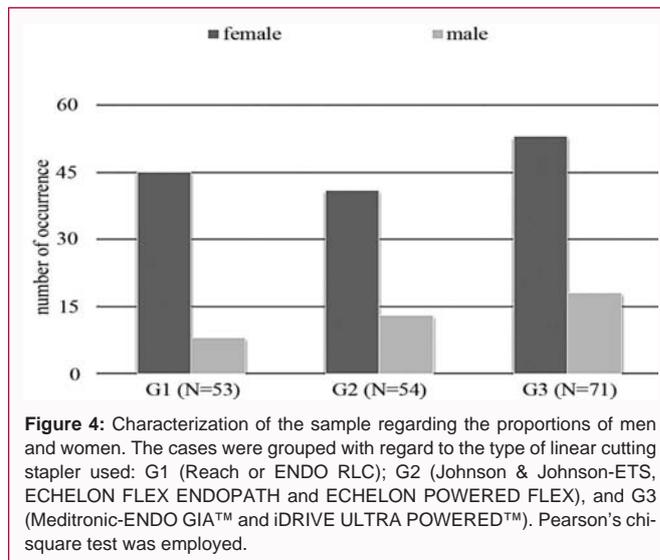


**Figure 3:** The distribution of cases suggested that the profile of patients did not change with regard to age during the study period. The dashed line denotes the better fit of the linear regression. The linear R2 coefficient explains the amount of variance of the linear regression. Rho represents Spearman's non-parametric correlation coefficient; N=176.

with enterorrhagy, which prevented early hospital discharge. After expectant management, both cases progressed without additional bleeding episodes. One patient (35 years old; BMI =40 kg/m<sup>2</sup>) was discharged within 48 h, and the other (36 years old; BMI =36.7 kg/m<sup>2</sup>) was discharged within 72 h. In G2, one patient (59 years old; BMI=46.3 kg/m<sup>2</sup>) required further surgical intervention (exploratory laparotomy for enterorrhagy due to a small intestinal lesion), and another patient (61 years old; BMI=33.6 kg/m<sup>2</sup>) required the preventive placement of a drain. Despite the delay in hospital discharge scheduled for the day after surgery, both showed favorable recoveries. No adverse events were observed in G3.

### Discussion

The 2013 Clinical Guidelines of the American Society for Metabolic and Bariatric Surgery (ASMBS) described the main procedures of bariatric and metabolic surgery, including biliopancreatic diversion, duodenal switch, laparoscopic adjustable gastric banding, BGLYR, and LGS [3,4]. To select the appropriate procedure, the surgeon must understand the indications and counter indications of each procedure. The choice of the procedure should also consider the individual conditions of the patient (e.g., BMI, comorbidities, and severity of diabetes mellitus), family conditions, socioeconomic status (postoperative care and understanding of the potential surgical risk of gastrectomy), family history, and past history. (Patients at high risk for gastric cancer should choose LGS; those with gastro esophageal



**Figure 4:** Characterization of the sample regarding the proportions of men and women. The cases were grouped with regard to the type of linear cutting stapler used: G1 (Reach or ENDO RLC); G2 (Johnson & Johnson-ETS, ECHELON FLEX ENDOPATH and ECHELON POWERED FLEX), and G3 (Meditronic-ENDO GIA™ and iDRIVE ULTRA POWERED™). Pearson's chi-square test was employed.

reflux should choose BGLYR.) The long-term complications of each type of procedure were identified for bariatric and metabolic surgery. For example, BGLYR results in higher rates of postoperative anemia and marginal ulcers, an increased risk of gastric cancer, and the need for vitamin supplementation and regular follow-up assessments [4]. Complications are classified as early or late based on whether they occur up to 30 days after surgery or later, respectively. Early complications include pulmonary thromboembolism, anastomotic fistula, infection, intestinal obstruction, and gastrojejunal stenosis. Late complications (those 30 days after surgery) included intestinal obstruction, dumping syndrome, marginal ulcer, gastro gastric fistula, biliary lithiasis, incisional hernia, and nutritional deficiency [5]. Venous thromboembolism and pulmonary embolism are the major causes of mortality among post-bariatric surgery patients. Therefore, prophylaxis by the use of compression stockings for the lower limbs, pneumatic leggings, brief surgery time, early ambulation, hydration, and heparinization are important [8]. We did not observe these comorbidities in our study. Gastrojejunal anastomosis fistula can be defined as an area of inadequate tissue healing that allows gastrointestinal secretions to escape through the staple line; this condition is the second leading cause of mortality after BGLYR surgery, and (together with pulmonary thromboembolism) it accounts for more than 50% of the causes of death among patients undergoing bariatric surgery [9-12]. We did not find this complication in our study. Superficial and deep abdominal infections, fistula, respiratory infection, and urinary tract infection are related to the surgical access route (laparotomy or laparoscopy), the history of previous abdominal surgery, and serum albumin level [13]. We did not observe these comorbidities in our study. The obstruction of the small intestine is a relatively frequent complication associated with BGLYR. The rates of intestinal obstruction caused by internal hernia are similar with or without the closure of the mesenteric gap, and its surgical treatment should be immediate [14]. We did not observe this complication in our study. The highest rate of gastrojejunal stenosis was associated with the original Witt grove bypass technique performed using a 21 mm circular stapler. This condition also occurred in manual anastomoses [15,16]. Bleeding, stenosis, and fistula are complications of anastomosis following BGLYR that occur in gastrojejunal anastomosis at the following incidence rates: 1% to 4%, 3% to 28%, and 0.1% to 5.8%, respectively [17,18]. Our service chose to perform gastrojejunal anastomosis using a linear

cutting stapler for the posterior gastric wall and manual suture for the anterior gastric wall. These choices were based on the decreases in surgical time [19]. Prolonged surgical time is associated with a significant increase in the probabilities of mortality and serious complications after laparoscopic bariatric surgery. Surgical time is a quality differential in laparoscopic bariatric surgeries [20].

## Conclusion

This article did not reveal significant differences in the use, complication rate, of handling of the REACH stapler compared with the other two brands studied; therefore, the cost-effectiveness of the REACH product should be considered.

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