Bariatric surgery in old age: a comparative study of laparoscopic Roux-en-Y gastric bypass and sleeve gastrectomy in an Asia centre of excellence

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Abstract

Bariatric surgery has been proved to be the safest and efficient procedure in treating morbid obese patients, but data is still lacking in the elderly population. The aim of our study was to compare the safety and efficacy of laparoscopic Roux-en-Y gastric bypass (LRYGB) and sleeve gastrectomy (LSG) in patients aged more than 55 years. We performed a retrospective review of a prospectively collected database. All patients with body mass index (BMI) ≥ 32 kg/m² and aged more than 55 years undergoing LRYGB or LSG in BMI Surgery Centre, E-Da Hospital between January 2008 and December 2011 with at least one year of follow up were included for the analysis. Demography, peri-operative data, weight loss and surgical complications were all recorded and analyzed. Mean age and BMI of these 68 patients (22 males and 46 female) were 58.8 years (55–79 years) and 39.5 kg/m² (32.00–60.40 kg/m²). LRYGB was performed in 44 patients and LSG in 24 patients. The two groups were comparable in their preoperative BMI, American Society of Anaesthesia (ASA) score and gender distribution. LSG patients were significantly older than patients receiving LRYGB. The proportion of type 2 diabetes preoperatively was significantly higher in LRYGB patients as compared to LSG patients (88.63% vs. 50%; $P < 0.01$). The prevalence of other co-morbidities was similar and comparable between the groups. Mean BMI in the LRYGB and LSG groups at the end of 1 year were 28.8 kg/m² and 28.2 kg/m², respectively, and there was no statistically significant difference in mean percentage of excess weight loss (%EWL) at 1 year. The percentage of resolution of diabetes was significantly higher in LRYGB (69.2%) as compared to LSG (33.3%). On the other hand, there was no statistical difference in the percentage of resolution of hypertension, hyperlipidemia and fatty liver hepatitis. The overall morbidity and re-operation rate was higher in LRYGB patients. In morbidly elderly patients, both surgeries achieved good weight loss and resolution of comorbidities. LRYGB is superior to LSG in terms of diabetes remission but carries higher complication rates even at high volume centres.

Keywords: obesity, metabolic surgery, Roux-en-Y gastric bypass, laparoscopic, sleeve gastrectomy, efficacy, safety

Introduction

Concurrent with the pandemic of obesity, we are experiencing a phenomenon of global ageing with a

marked increase in the population of elderly obese people. Bariatric surgery has been proved as the most effective treatment of morbid obesity and associated co-morbidities. However, old age is still a relative

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contraindication for bariatric surgery. Elderly patients have more associated co-morbidities >which give rise to a higher operative risk and postoperative complications. Previous studies have demonstrated a higher morbidity and mortality as well as decreased excess weight loss following bariatric surgery in older subjects^[1]. NIH consensus conference had set age of more than 55 years as the upper limit for surgery^[2].

Several studies have shown that, with the evolution and advance of minimally invasive surgery in recent few years, bariatric surgery in elderly patients achieved significant weight reduction and resolution of co-morbidities^[3,4,5]. The improvement in surgical techniques and perioperative management has led to decreased morbidity, which is comparable to younger patients, especially in high volume centres with experienced surgeons^[6]. Laparoscopic Roux-en-Y gastric bypass (LRYGB) is the most frequently performed bariatric procedure, providing significant and sustained weight loss at long-term follow-up and several investigators have published their results regarding the safety and efficacy of LRYGB in older patients^[7,8].

Laparoscopic sleeve gastrectomy (LSG), which was developed as the first stage of the BPD-DS (biliopancreatic diversion with duodenal switch) in high risk morbidly obese patients, has now been established as a standalone bariatric procedure. In a comparative study of LSG and LRYGB in the younger age group, the percentage of excess weight loss (% EWL) and comorbidity resolution was comparable for both procedures^[9,10]. Though a number of studies have demonstrated the safety and efficacy of various bariatric procedures in the elderly population, comparative data are still lacking. The aim of our study was to compare the safety and efficacy of LRYGB and LSG in elderly patients aged more than 55 years.

Materials and methods

We performed a retrospective review of the prospectively collected database. All patients aged more than 55 years undergoing LRYGB or LSG in a high surgical volume centre, E-Da Hospital, between January 2008 and December 2011, with at least one year of follow up were included for the analysis. The operative criteria were based on the Asia-Pacific guidelines for bariatric surgery, i.e. body mass index (BMI) $\geq 32 \text{ kg/m}^2$ in the presence of comorbidities and BMI $\geq 37 \text{ kg/m}^2$ with or without comorbidities. All the operations were performed by the same surgical team. The patients received LRYGB or LSG according to our surgeons' suggestion and their preference. Otherwise, surgeons intended to suggest LSG in older

aged patient to avoid nutritional complications and suggest LRYGB in diabetic patients to expect better remission result of diabetes. Vitamin and mineral supplementation was prescribed to both LRYGB and LSG patients in a uniform manner according to the ASMBS Guidelines/Surgery for Obesity and Related Diseases 4 (2008) S73-S108^[11].

Demographics of these patients included age, gender, body weight, BMI and American Society of Anaesthesia (ASA) score. The data regarding major comorbid illnesses, namely, diabetes mellitus, hypertension, hyperlipidaemia and fatty liver hepatitis, was recorded. The operative variables including the type of surgery, operative time, length of hospital stay, postoperative complications were recorded and analysed. Complications were classified according to the Bariatric Analysis and Reporting Outcome System (BAROS) as major and minor^[12]. The patient follow up visits were scheduled at 1, 3, 6, 9 and 12 months following the surgery at which the BMI and percentage of EWL was calculated and the remission of comorbid illnesses was noted. Resolution of comorbidities was based on cessation of medicine taken and normalization of laboratory values.

Statistical analysis

Statistical analysis was done using the software packages SPSS, version 17 (SPSS Inc., Chicago, IL, USA). The continuous variables were expressed as mean and standard deviation and compared using Student's *t* test while categorical variables were expressed as percentages and analysed using the Fischer exact test. All statistical tests were two tailed and *P* value of < 0.05 was considered as statistically significant.

Results

A total of 68 patients aged more than 55 years between January 2008 and December 2011 were included in this study. The mean age was 58.88 years (55–79 years) and the mean preoperative BMI was 39.5 kg/m^2 ($32.00\text{--}60.40 \text{ kg/m}^2$). There were 22 males and 46 female patients. LRYGB was performed in 44 patients and LSG in 24 patients. The two groups were comparable in their preoperative BMI, ASA score and gender distribution. The patients undergoing LSG were significantly older than LRYGB (**Table 1**). The percentage of associated type 2 diabetes preoperatively was significantly higher in LRYGB patients as compared to LSG patients (88.63% vs. 50%; $P < 0.01$). However, there was no significant difference in the mean duration of diabetes (80.3 vs. 84 months;

Table 1 Baseline characteristics of patients receiving LRYGB and LSG

Patient Characteristics	LRYGB	LSG	P value
Patients studied , <i>n</i>	44	24	
Mean age (years)	58 ± 2.6	60.6 ± 5.9	0.014 [#]
Males : Females	16 : 28	8 : 16	0.803
Mean body weight (kg)	104.4 ± 17.75	97.99 ± 21.51	0.191
Mean BMI (kg/m ²)	40.5 ± 7.3	37.6 ± 5.2	0.111
ASA score 2, <i>n</i> (%)	23 (52.27)	12 (50)	0.407
ASA score 3, <i>n</i> (%)	21 (47.73)	12 (50)	0.482
Type 2 Diabetes, <i>n</i> (%)	39 (88.63)	12 (50)	0.000 [#]
Mean duration, months	80.3 ± 64.9	84 ± 61.83	0.860
Mean FBS, mg/dL	149.5 ± 67.1	132.3 ± 47.7	0.416
Mean HbA1c, (%)	7.79 ± 1.46	7.86 ± 1.40	0.859
Mean C- peptide, ng/mL	3.32 ± 1.74	3.54 ± 1.27	0.709
Hypertension, <i>n</i> (%)	25 (56.8)	15 (62.5)	0.649
Hyperlipidemia, <i>n</i> (%)	16 (36.4)	8 (33.3)	0.784
Fatty liver hepatitis, <i>n</i> (%)	26 (59.1)	16 (66.7)	0.539

[#]P <0.05 - inter group comparison; NS- Not significant (P >0.05); BMI – Body mass index; ASA- American Society of Anaesthesia; *n*- Number of patients; FBS- Fasting blood sugar; LRYGB – Laparoscopic Roux – en – Y gastric bypass; LSG – Laparoscopic sleeve gastrectomy

$P = 0.860$), preoperative FBS (149.46 vs. 132.3 mg/dL; $P = 0.416$), HbA1c (7.79 vs. 7.86 gram%; $P = 0.859$) and C-peptide levels (3.32 vs. 3.54; $P = 0.709$) between the two groups. The prevalence of other co-morbidities was similar and comparable among the groups (**Table 1**). Mean BMI in the LRYGB and LSG groups at the end of 1 year were 28.8 kg/m² and 28.2 kg/m², respectively; otherwise, there was no statistically significant difference in mean %EWL at 1 year between the two groups. The percentage of resolution of diabetes (HbA1c < 6.5% and FBS < 100 mg/dl) was significantly higher in the LRYGB patients (69.2%) as compared to LSG patients (33.3%), $P < 0.001$. The glycemia parameters and C-peptide levels were also lower after LRYGB than LSG, but did not reach a statistically significant level. All the comorbidities were significantly reduced after both operations one year postoperatively. Additionally, on comparison of resolution of other comorbidities among both groups, there was no statistical difference in percentage of resolution of hypertension (56% vs. 60%; $P = 286$), hyperlipidemia (81.2% vs. 75%; $P = 0.792$) and fatty liver hepatitis (76.9% vs. 62.5%; $P = 0.347$) (**Table 2**). Further analysing the relation of weight loss and the diabetic remission, we found that the diabetes remission group (DR) had a significantly higher % EWL compared with diabetes non remission group (DNR). Moreover, 8 patients receiving LSG even reached 65.01% EWL in average; they still could not achieve remission of diabetes (**Table 3**).

The mean operative time was significantly higher in LRYGB than LSG (103.97 vs. 70.04 minutes; $P =$

0.0015). However, there was no significant difference in the mean length of hospital stay (2.54 vs. 2.21 days; $P = 0.834$). The overall morbidity and re-operation rate was 14.71% and 11.8%, respectively. It was 20.45% and 15.9% for LRYGB and 4.2% and 4.2% for LSG patients. There was only one mortality from gastrojejunostomy leakage in patients undergoing LRYGB. There was no statistically significant difference in these parameters (**Table 4**). In the LRYGB group, there were 9 complications (6 early and 3 late), 7 of which required re-operation. Totally, 3 patients (6.8%) had anastomotic leakage from gastrojejunostomy and all were repaired laproscopically. One of them developed a re-leak after repair, and progressed to septic shock and expired because of multi-organ failure after 30 days. Two patients (4.6%) developed intestinal obstruction. One patient had adhesions of the small bowel into the para-rectal space due to previous hysterectomy and was managed by adhesiolysis. The second patient had incarceration of the small bowel into the port site defect which required reduction of the small bowel and repair of the defect. One patient (2.3%) developed jejunojejunostomy stricture causing bilio-pancreatic limb obstruction, was relieved by gastrostomy, resection and re-do of the jejunojejunostomy stricture.

Of the late complications, 2 patients (4.6%) developed gastrojejunostomy ulcer with a stricture. One patient responded well to endoscopic balloon dilations and another required laparoscopic revision of gastrojejunostomy. One patient (2.3%) had a minor complication of marginal ulcer and responded to

Table 2 Results of LRYGB vs. LSG at 1 year follow up

Variables	LRYGB	LSG	p value
Mean body weight (kg)	74.54 ± 12.12*	72.93 ± 13.55*	0.616
Mean BMI (kg/m ²)	28.8 ± 5.2*	28.2 ± 4.9*	0.177
Mean % EWL, (%)	65.07	68.52	0.689
Type 2 Diabetes, n (%)	12 (27.3)*	8 (33.33)	0.786
Δ Type 2 Diabetes, n (%)	27 (69.2)	4/12 (33.3)	0.001 [#]
- Mean FBS, mg/dL	98.6 ± 12.84*	107.25 ± 18.47*	0.090
- Mean HbA1c %	5.96 ± 0.77*	6.8 ± 0.96*	0.008 [#]
- Mean C- peptide, ng/mL	1.60 ± 0.75*	2.15 ± 1.10*	0.079
Hypertension, n (%)	11 (25.6)*	6 (25)*	0.141
Δ Hypertension, n (%)	14 (56)	9 (60)	0.286
Hyperlipidemia, n (%)	3 (7)*	2 (20.83)*	1.000
Δ Hyperlipidemia, n (%)	13 (81.2)	8 (75)	0.792
Fatty liver hepatitis, n (%)	6 (13.9)*	6 (25)*	0.324
Δ Fatty liver hepatitis, n (%)	20 (76.9)	10 (62.5)	0.347

* $P < 0.05$ – within group comparison; [#] $P < 0.05$ – inter group comparison; Δ denotes a reduction in number (%) of patients with the diagnosis of comorbidity in relation to the baseline prevalence; n – Number of patients; FBS – Fasting blood sugar; LRYGB – Laparoscopic Roux – en – Y gastric bypass; LSG – Laparoscopic sleeve gastrectomy; BMI – Body mass index; EWL – Excess weight loss; Calculation of %EWL was made based on reported BMI and weight loss with ideal BMI of 22 kg/m² for Asian population.

conservative treatment. Among the LSG group, only one patient developed adhesion induced stricture in incisura area of the stomach. On re-laparoscopy, it was relieved by adhesiolysis.

Discussion

The increased prevalence of obesity together with longer life expectancy brings more elderly obese patients requiring bariatric surgery now and in the future. The NIH guidelines which established age > 55 years as a relative contraindication was based on earlier studies showing a high morbidity and mortality and decreased efficacy in older patients, particularly after open bariatric surgery^[13]. However, recent reports have demonstrated that laparoscopic bariatric surgery in old age is not only safe, but also very effective in remission of obesity associated disease and improvement in quality of life^[14–16]. Numerous comparative studies have demonstrated that the efficacy and safety

of LRYGB in old age patients is similar to their younger counterparts^[17,18]. Reports on LSG in old age patients have shown significant %EWL and comorbidity reduction, although comparative data with LRYGB are lacking^[19].

In the present study, we had 47% patients with ASA score 3 and 75% patients with diabetes, indicating less favourable operative risk profile in old age. In our previous study^[20], the incidence of diabetes reported in young morbidly obese undergoing LRYGB with mean age of 32.1 years was only 46% whereas in the present study 88.6% patients undergoing LRYGB were diabetic. This may contribute to the higher complication rates. Moreover, between procedures, LSG truly has much fewer complication rates than LRYGB. Additionally, LSG is a technically less demanding procedure and required significantly less operative time than LRYGB. LSG proved to be equally effective as LRYGB for the remission of old age comorbidities except diabetes.

Table 3 Correlation between %EWL and diabetes remission

Excess weight loss	Combined LRYGB & LSG	LRYGB	LSG	P value
Total diabetic patients, % (n)	66.8 (51)	63.47 (39)	68.12 (12)	0.1219 [#]
Diabetes remission group, % (n)	70.3 (31)	69.8 (27)	74.34 (4)	0.1482 [#]
Diabetes non- remission group, % (n)	56.5 (20)	49.5 (12)	65.01 (8)	0.000 [#]
P value	0.000*	0.000*	0.054*	

* P value when compared %EWL between diabetes remission patients and diabetes non remission patients; [#] P value when compared %EWL between LRYGB and LSG patients; %EWL – Percentage of Excess weight loss; n- number of patients; LRYGB- Laparoscopic Roux-en-Y gastric bypass; LSG- Laparoscopic sleeve gastrectomy.

Table 4 Operative parameters and postoperative morbidity after LRYGB and LSG

Variable	LRYGB	LSG	P value
Mean operative time (minutes)	103.97 ± 62.8	70.04 ± 28.8	0.015 [#]
Mean length of stay in hospital (days)	2.54 ± 1.36	2.21 ± 1.35	0.834
Total morbidity, n (%)	9 (20.45)	1 (4.2)	0.085
Early < 30 days, n (%)	6 (13.6)	0	
a) G.J. leak, n (%)	3 (6.8)	0	
b) Intestinal obstruction, n (%)	2 (4.6)	0	
c) J.J. stricture, n (%)	1 (2.3)	0	
Late >30 days, n (%)	3 (6.8)	1 (4.2)	
a) G.J. ulcer with stricture, n (%)	2 (4.6)	0	
b) Stomach mid body stricture, n (%)	0	1 (4.2)	
c) Marginal Ulcer, n (%) [*]	1 (2.3)	0	
Re operation	7 (15.9)	1 (4.2)	0.244
Mortality	1 (2.3)	0	1.000

^{*}Patients with minor complications; [#] $P < 0.05$ – when compared LRYGB with LSG; n – Number of patients; LRYGB – Laparoscopic Roux – en – y gastric bypass; LSG – Laparoscopic sleeve gastrectomy; GJ – Gastro jejunostomy; JJ – jejunojejunostomy.

Arthur in a cohort study of 9000 patients observed % EWL of 60% and 69% after LRYGB and LSG, respectively^[21]. Despite a comparable weight loss between our two study groups, diabetes remission was significantly higher after LRYGB than those who had LSG (**Table 2**). 66.67% patients after LSG failed to get diabetes remission despite of significant weight loss (65.01%). Jian-Fang Li^[22] in his meta-analysis of randomized controlled trials also showed similar results. However, in contrast to our study, they reported higher weight loss after LRYGB than LSG and concluded that difference in remission was related to the degree of weight loss. We also observed significantly better weight loss in diabetes remission group when looking into individual procedure (**Table 3**). It revealed that weight loss is an important factor in remitting diabetes but also some other mechanism needed to be explored, such as the role of duodenal exclusion. Lower C-peptide level after LRYGB in our series seemed provoked the clues of better decreased insulin resistance compared with LSG. As Bikman and colleagues^[23] found that improved insulin sensitivity after gastric bypass may be due to duodenal exclusion effect along with weight loss.

The patients undergoing LRYGB seemed to experience more complications, reoperations and mortality than LSG, although this difference did not reach statistical significance probably due to the limited sample size. Anastomotic leaks are the most dreaded and potentially devastating complication after LRYGB with a mortality rate of 6%–14.7%^[24]. The incidence of leak in our study is similar to the incidence rates reported in the literature, which range from 1.0%–5.6%^[24]. In our 3 GJ leak patients, 2 of them were found to have chronic renal insufficiency or secondary

Cushing's syndrome. Zeigler et al.^[25] in their study of 5123 patients reported that preoperative steroid use led to increased rates of anastomotic leak in diabetic patients. He also found that diabetic patients who had an anastomotic leak had more than a 4-fold higher mortality compared with non diabetic patients.

In our study, 2 patients developed intestinal obstruction. The reported incidence of intestinal obstruction due to port site hernia mentioned in the previous studies ranges from 1% and 6%^[26]. In addition to raised intra-abdominal pressure in morbidly obese patients, lax and lower tone of abdominal muscles may predispose them to development of port site hernia in elderly patients^[27]. In our study, the incidence of GJ stricture was 4.6%; however, in the literature it is reported to range from 3 to 27%^[28]. Although, previous studies have suggested old age, hypertension, sleep apnoea and gastroesophageal reflux as the factors that are important in gastrojejunostomy stricture formation after LRYGB^[30]. However, our patients with gastrojejunostomy ulcer had no other predisposing factor except diabetes and hypertension, which along with old age may have led to tissue ischaemia and ulcer formation.

Elderly patients have more associated comorbidities which may account for the higher surgical risk and increased postoperative morbidity, and these patients have much decreased physiological reserves to tolerate, resulting in increased mortality after such events. Livingston et al.^[29] demonstrated a three times higher mortality for patients over the age of 55 years as compared to young patients. Otherwise, in a study of 71 obese patients of age > 55 years receiving LRYGB, Papasavas et al.^[30] reported perioperative morbidity and mortality of 16.8% and 1.4%, respectively. Flum

et al.^[31] reported a higher mortality rate of 4.8%. He concluded that the higher risk is strongly associated with an older age, male gender and low volume centres. We observed an overall mortality rate of 1.5%, which may be due to the fact that all primary surgeries and reoperations in our centre were undertaken by the laparoscopic approach, which may have contributed to a faster recovery. The rapid propagation of minimally invasive approach and comprehensive perioperative care would make bariatric surgery in elderly patients feasible and safer in the near future.

In present study, though there was selection bias that patients were not randomized to two different surgeries, this study is still very worthwhile because it is the first study to report the bariatric surgical result in old-age Asian patients, and showed good weight loss and comorbidity resolution after surgery.

In morbid elderly patients, both surgeries achieved good weight loss and resolution of comorbidities. LRYGB is superior to LSG in terms of diabetes remission but carries higher complication rates even at high volume centres.

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