Original Article

Novel metabolic surgery: first Asia series and short-term results of laparoscopic proximal jejunal bypass with sleeve gastrectomy

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Background: There has been a rapid rise in incidence of obesity and its associated metabolic consequences in Asia where 60% of the world population resides and who are already at an elevated risk of developing diabetes. Though laparoscopic Roux-en-Y gastric bypass (LRYGB) has established itself as a standard, considering its technical difficulty and long term morbidity, there are possible alternatives being developed for equally effective but less morbid. Laparoscopic proximal jejunal bypass with sleeve gastrectomy (LPJB-SG) was first described by de Menezes in 2004 and further studies had shown it to be effective in weight loss and in remission of type 2 diabetes mellitus.

Methods: Sixty five patients with obesity/uncontrolled type 2 diabetes underwent LPJB-SG between October 30th, 2014 and April 15th, 2016. This is an ongoing prospective study on Asian patients. All surgeries were performed by a single surgeon and consisted of a sleeve gastrectomy and bypassing proximal jejunum about 250–300 cm in length. Intra and post-surgical data were collected and operation time, length of hospital stay (LOS) and early complications were documented. BMI, percentage of excess weight loss (%EWL), fasting sugar and HbA1c, were assessed at 1 month and 3 monthly follow-up visits thence for a year. Surgical complications were recorded.

Results: All surgeries were completed laparoscopically. The operation time was 93.13 minutes on average with a mean hospital stay of 2.2 days. The average EWL was 26.49, 44.77 and 65.87 percentages at 1, 3 and 6 months respectively. The percentage of diabetic patients achieving an HBA1c of <6.0 without medicines was 11.5, 60.56 and 66.66 at 1, 3 and 6 months respectively. There were 3 (6.5%) complications developed (1 bleeding, 1 dehydration and 1 gastric stenosis).The gastric stenosis required a conversion to a Roux-en-Y bypass and the patients with bleeding and dehydration were successfully managed conservatively.

Conclusions: LPJB-SG is a feasible, safe and effective surgery for treatment of obesity and diabetes in this first Asia short-term result. It is technically simpler to perform and is easily reproducible. Long term and randomized controlled studies comparing with other surgical procedures would be required to assess it further.

Keywords: Obesity; bariatric surgery; metabolic surgery; type 2 diabetes mellitus; sleeve gastrectomy; jejunal bypass

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Introduction

With the advent of rapid urbanization, shift if diet preferences and sweeping socio-cultural changes in Asia where the majority of the world population resides, obesity and its associated metabolic consequences have risen to alarming proportions (1-3). Asians, in general, are different phenotypically from Caucasians and it has been recognized that Asians are genetically prone for metabolic syndrome, adiposity and are at a heightened risk for cardio-vascular mortality (3-5).

Though bariatric surgery has evolved through the years, there is a scope for further refinement as our knowledge and understanding of the processes that lead to and sustain obesity grows. Newer surgeries and innovations need to be designed that incorporates this knowledge and which can be shown to be equally or more effective while minimizing the short and long term adverse effects seen in the currently performed obesity surgeries (6). Patients with obesity come in a very wide range of BMIs and varying degree of co-morbidities. Instead of a few routine surgeries applied to all patients, what would be ideal is a surgery tailored to the patients uniquely altered physiology that would give the best possible results while minimizing the adverse effects. Hence, a wider repertoire of surgical options need to be created.

Laparoscopic proximal jejunal bypass with sleeve gastrectomy (LPJB-SG) was developed in 2004 and had shown good results. Further publications by de Menezes Ettinger and Alamo showed it to be an effective surgery in weight loss and in control of the metabolic syndrome in a South American cohort (7,8).

Methods

This is a prospective cohort study and was conducted between October 30th, 2014 and April 15th, 2016. Inclusion criteria was morbid obesity as defined as BMI ≥32 and/or those with type 2 diabetes mellitus as defined by ADA guidelines and associated with obesity (BMI >27) and uncontrolled with medical therapy were included. Excluded were patients who were <18 years of age and those with pregnancy, psychiatric illnesses and ongoing drug/alcohol abuse.

Patients were evaluated by a multi-disciplinary team including a dietician, psychologist, psychiatrist, physical trainer, physiotherapist and physicians.

Baseline measurements included body height, weight, BMI, body fat composition analysis, baseline blood studies, thyroid and liver function tests , lipid profile, a bone density measurement and an upper gastro-intestinal scopy.

Surgical technique (Figure 1)

All patients were required to sign surgical consents before surgery. Surgery was performed under general anesthesia with the patients in a reversed Trendelenberg position. Four ports were used with an initial entry either with a Veress needle or with an optical bladeless trocar. A Fr 38 Oro-gastric tube was inserted and confirmed. The greater curvature, starting from 4 cm proximal to the pylorus, was devascularised with a 5 mm Ligasure (Covidien™) vessel sealing device. All attachments including the short gastric vessels were freed till the left crus was identified and displayed. Gastrectomy was carried out over a 38 Fr Oro-gastric tube with 60 mm Endo GIA (Covidien™) black cartridges for the first firing distally on the stomach followed by purple Tristapler reloads (Covidien™) proximally. The specimen of excised stomach was removed at the end of the procedure. The ligament of Trietz was identified and jejunum was divided at 20 cm with an Endo GIA stapler white cartridge (Covidien™). Distally, the jejunum was measured to a distance varying from 250 to 300 cm and was anastomosed to the (proximal) bilio-pancreatic jejunal limb with an Endo-GIA stapler white reload (Covidien™) and the enterotomy defect closed with 3-0 poliglecaprone continuous sutures. The mesentery defect was closed with 2-0 polyester sutures.

Post-operative care

Patient were started on oral liquids as sips on the day of the surgery and increased as tolerated. They were discharged when they could tolerate an adequate oral liquid diet. All were prescribed proton pump inhibitors for one month. Patients were followed up a week, a month, 3 months later and three monthly thereafter for the first year. Post-operatively, length of stay, major and minor complications were recorded. Weight, BMI and EWL, fasting sugar, HBA1C, C-peptide and clinical parameters were recorded a month, 3 month post op and every 3 months thereafter.

All data were recorded on and statistical analyses were performed using SPSS software version 15.0 (SPSS, Inc., Chicago, IL, USA). Characteristics were reported as mean and range for continuous variables and frequencies and percentages for categorical variables.

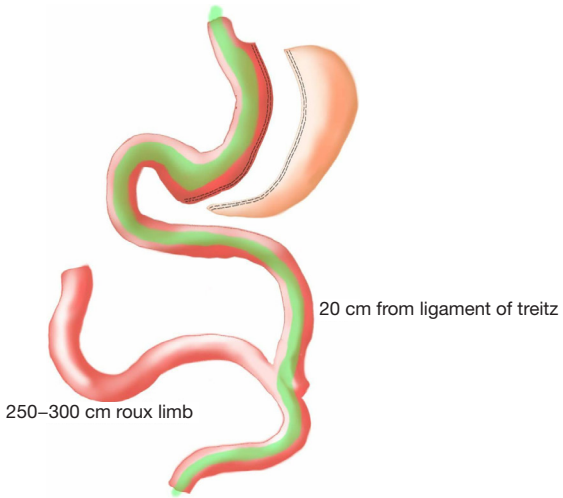

Figure 1 Schematic figure of laparoscopic proximal jejunal bypass with sleeve gastrectomy.

Table 1 Patient characteristics and pre-surgical data

Characteristics	Number (N=65)/values	Range/% (SD)
Age (years)	38.72	19–71
Females	33	50.7%
BMI preoperative	45.3	27–92.8/11.74%
T2DM	37	56.9%
Duration T2DM (months)	4.96	1–15
HBA1c	8.26	5.9–11.9
Fasting sugar (mg/dL)	166.4	94–343/55.9%
C-peptide (ng/mL)	3.7	1.5–11.4 (SD: 2.01)
Hypertension	44	67.69%
Dyslipidaemia	56	86.15%
Fatty liver	63	96.92%

Results

Sixty five [65] patients under LPJB-SG during the duration of the study. Thirty three of them (50.76%) were females. The mean age was 38.72 (range, 19–71). The average BMI was 45.32 (range, 23.9–92.8). A total of 37 patients (56.9%) had T2DM. The mean duration of diabetes was 4.96 months (range, 1–15) and the mean HBA1C was 8.26 (range, 5.9–11.9). The average C-peptide level was 3.7 (range, 1.5–11.4). None of them were on Insulin injections (*Table 1*).

Other co-morbidities were Hypertension in 44 (67.69%), hyperlipidaemia in 56 (86.15%) and fatty liver is 63 (96.92%). All surgeries were completed laparoscopically. The mean operating time was 93.13 minutes (41–180 minutes). The LOS was about 2.2 days on average (1–16 days).

There were no intra-operative or immediate complications. The percentage of excess weight loss percentages (%EWL) were 26.44 (range, 4.7–167.4), 44.77 (19.7–169.3) and 65.87 (28.3–210.7) at 1, 3 and 6 months respectively (*Figure 2*). The mean HBA1C dropped from a mean of 6.9 preoperative to 6.04 at 6 months (*Figure 3*). For diabetic patients, at 1, 3 and 6 months, 11.53%, 60.86% and 66.66% patients respectively had achieved an HBA1C of <6.0 and stopped diabetic medications. The 13.33% had an HBA1C of <6.5 without OHA another 13.33% had an improvement in their glycaemic status while on OHA (*Table 2*). There were three complications. One patient presented with dehydration and another with a bleeding, the later surprisingly happened at 47 days post-op and both were managed conservatively with a brief hospitalization. There was one patient who presented with gastric stenosis and underwent a conversion to laparoscopic Roux-en-Y bypass successfully.

Discussion

Laparoscopic sleeve gastrectomy (LSG) and laparoscopic Roux-en-Y gastric bypass (LRYGB) dominate the bariatric scene in the current era and have grown out of years of research and evidence. Both are effective in producing weight loss and in controlling co-morbidities. Laparoscopic gastric bypass is considered the gold standard with more than 80% of patients achieving greater than 70% EBW loss over 2 years (9). Remission of diabetes in impressive around 80% with a further 15% experiencing substantial improvement (10-13). LSG initially performed as a first stage procedure, has recently gained ground as an effective independent procedure. Its technical ease translates to a wider adoption worldwide and recent results show it to be as effective as gastric bypass (14,15) though some other studies have shown long term diabetes remission rates being worse (16).

LRYGP has a higher incidence of immediate and long term complications including anaemia, marginal ulcers, dumping syndrome and nutritional deficiencies that require lifelong supplements and surveillance. Other mal-absorptive procedures like bilio-pancreatic diversion, though gives

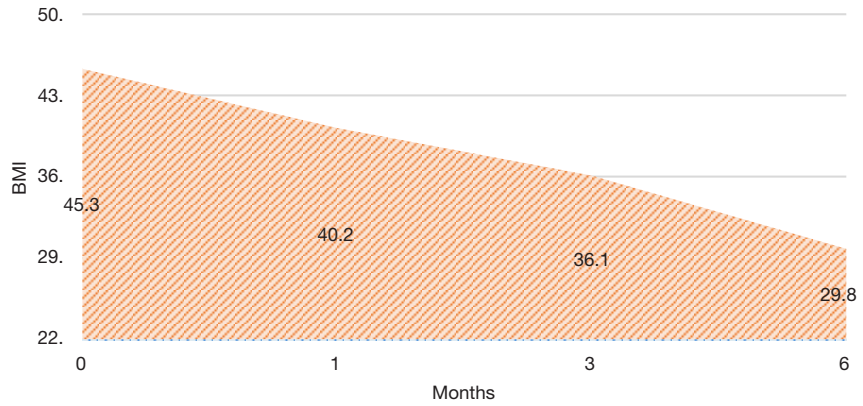

Figure 2 BMI (mean) over 6 months post-operatively.

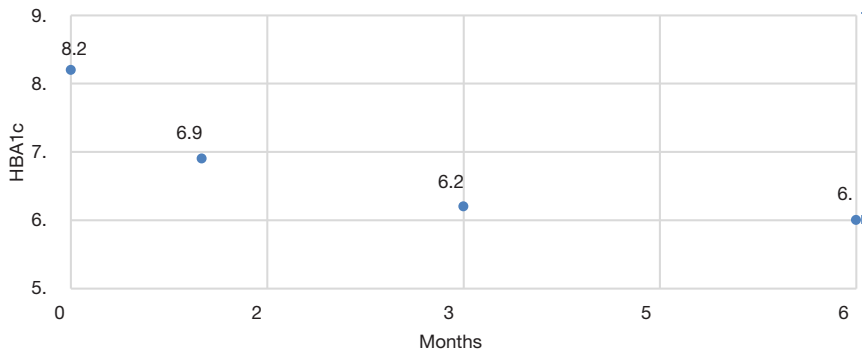

Figure 3 HBA1c levels (mean) over 6 months post-operatively.

Table 2 Reduction in mean HBA1c and improvement in glycaemic status at 1, 3 and 6 months

Variable	1 month	3 months	6 months
HBA1C			
Mean	6.9	6.2	6.0
Range	5.3–9.2	5.2–9	4.8–8.2
HBA1c <6.0, not on OHA			
No.	3	14	10
Percentage	11.5%	60.8%	66.6%
HBA1c <6.5, not on OHA			
No.	5	6	2
Percentage	19.2%	26.0%	13.3%
HBA1c <7.0, on OHA			
No.	5	1	2
Percentage	19.2%	4.3%	13.3%

the best results in terms of weight loss and remission of co-morbidities, is fraught with even higher nutritional problems, bowel disturbances and frequent hospital visits (17,18).

With the current knowledge of the roles played by intestinal hormones in obesity and diabetes, there is a much better and detailed understanding of the way modification of the gut anatomy produces weight loss and control of metabolic syndrome (6). In this context, it is apt to consider a newer procedure or a modification thereof, that can achieve similar results but which is devoid of long term complications, is less difficult to perform, and is reproducible and reversible.

Jejunal bypass performed along with sleeve gastrectomy was first described in 2004 and the concept was based on a restrictive procedure combined with a jejunal bypass of 300 cm with a Roux limb sutured to the remnant bypassed stomach. This was subsequently modified to excise the remnant stomach.

Alamo *et al.* had published their results in 2012 of 49 patients with type 2 DM and BMI <35 where they had reported a EWL of 76.1% at 18 months follow up. The remission of diabetes occurred in 81.6% of patients with a marked improvement in the remainder (19). There was no mortality and till the time followed up, no nutritional deficiencies were detected.

LPJB-SG subscribes to the prevalent and accepted theory of incretins in the remission of diabetes. By early exposure of the food to ileum, there is an increase in GLP-1 and Peptide YY secreted by the L cells of the ileum that has been postulated to decrease apoptosis of beta cells, enhance insulin secretion, decrease glucagon response and also decreases the gastric emptying time (20-23). These factors as well as others are responsible for control of diabetes seen in similar operations involving intestinal bypass. The easiest way to produce an early exposure of the food to the ileum is to bypass the intervening jejunum by anastomosing the very proximal jejunum to the ileum.

In the present study, a EWL of 65.87% and a significant improvement in glycaemic status in more than 90% of patients in 6 months shows this to be an effective procedure. Mean C-peptide levels of more than 3 ng/mL and hence good pancreatic function at the baseline would definitely have contributed to this excellent outcome. Sleeve gastrectomy in itself gives good results in terms of weight loss and control of metabolic syndrome. An addition of a mal-absorptive component such as a jejunal bypass would be additive in terms of sustenance of weight loss and definitely in the resolution and control of diabetes. This additive benefit, if it comes at a low cost in terms of operative time or the post-operative complication rate, would make this surgery a feasible and practicable option.

Given an intact pylorus and longer common channel and, it can be theorized that problems of dumping syndrome and malnutrition of macro/micro nutrients should occurs less. The creation of a blind loop of intestine might cause bacterial overgrowth and the blind loop syndrome. We had not seen any case in the follow-up presenting with symptoms of bacterial overgrowth. Alamo *et al.* consider this occurrence unlikely since there is no food transit through the bypassed bowel, which the resident bacteria can use as a substrate and that an iso-peristaltic orientation helps in mitigating against this possibility (19,24). The fact that the bowel anatomy can be easily reversed in the future if some complications happen due to the bypassed limb.

We believe that technical ease of the procedure, easy reproducibility, reversibility of bowel anatomy and comparable results would translate it to wider adoption worldwide soon. It's a logical combination of excellent results from sleeve gastrectomy with minimal malabsorption to add in weight loss, would play an important role in remission of diabetes. Long term results and comparative studies with other surgeries in vogue are definitely required to validate this concept.

Conclusions

LPJB-SG is a feasible, safe and effective surgery for treatment of obesity and diabetes in this first Asia short-term result. It is technically simpler to perform and is easily reproducible. Long term and randomized controlled studies comparing with other surgical procedures would be required to assess it further.

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Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/ales.2016.10.05). CKH serves as an unpaid editorial board member of *Annals of Laparoscopic and Endoscopic Surgery* from Jul 2016 to Jun 2018. The other authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Institutional ethical approval and individual informed consent were waived.

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