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Laparoscopic sleeve gastrectomy with loop bipartition: A novel metabolic operation in treating obese type II diabetes mellitus☆

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ABSTRACT

INTRODUCTION: We report the first case of laparoscopic sleeve gastrectomy with loop bipartition (a modified form of Santoro's operation) in the treatment of type II diabetes mellitus associated with obesity.
PRESENTATION OF CASE: A 46-year-old gentleman (baseline BMI 32.9; BW 98.5 kg) with 7-year history of type II diabetes mellitus (DM) underwent the procedure in Hong Kong. The control of DM was poor even with intensive medical therapy before the operation. Standard laparoscopic sleeve gastrectomy (SG) was performed and a loop gastroileostomy was fashioned at the antrum 250 cm from the ileocecal valve without division of the 1st part of duodenum after SG. The resultant gastric tube has two outlets, one to the first part of duodenum and the other to the ileum with preferential passage of food through the gastroileostomy as shown on subsequent contrast study. The patient's recovery was uneventful. The excess BMI loss was 97% with complete normalization of all metabolic parameters at 1-year follow-up.
DISCUSSION: This new surgical procedure (sleeve gastrectomy with loop bipartition: SG+LB) was evolved and derived from the combined concepts of sleeve gastrectomy with transit bipartition (SG+TB), single anastomosis duodenal-ileostomy (SADI), mini-gastric bypass (MGB) and duodenal-jejunal bypass (DJB) with less nutritional and surgical complications.
CONCLUSION: Sleeve gastrectomy with loop bipartition may be a very effective and simple operation to treat uncontrolled DM associated with obesity with a lot of apparent advantages over most current metabolic procedures available at the moment.

1. Introduction

Type II diabetes mellitus associated with obesity is becoming a worldwide epidemic and in most patients, the control of the disease is suboptimal even with maximum medical therapy currently available. The evidence for surgical intervention of DM is emerging and the International Federation of Diabetes (IDF) has formally laid down the recommendations recently. This has changed the whole concept and approach to this dreadful disease and opened the green light for the development of metabolic surgery.

The culprit of developing DM and obesity are associated with the imbalance of foregut and hindgut alimentation (hyperalimentation of foregut and hypoalimentation of hindgut) due to over ingestion of high-calorie, high-glycaemic index diet in modern society.[1] All current metabolic procedures such as gastric bypass, duodenal switch (DS) and ileum interposition address and reverse this imbalance and their principles are based on the foregut or hindgut theory or the combination of both. Santoro et al. has recently reported his long-term data regarding sleeve gastrectomy with transit bipartition (SG + TB), which is a similar operation to DS but without complete exclusion of duodenum in order to minimize nutritional complications.[2] We modified the operation by performing a loop rather than Roux-en-Y bipartition reconstruction in Santoro's operation and we are reporting the first patient who underwent this operation, laparoscopic sleeve gastrectomy with loop bipartition (SG + LB) in the treatment of poorly controlled type II diabetes mellitus associated with obesity.

2. Case report

A 46-year-old gentleman with a 7-year history of type II diabetes mellitus underwent laparoscopic sleeve gastrectomy with loop bipartition in a private hospital in November 2012 in Hong Kong. He weighted 98.5 kg with BMI 32.9 kg/m^2 before the operation. He also suffered from hypertension and hyperlipidaemia. He required 50 units of Lantus® injection (insulin glargine, Sanofi-Aventis) daily and was on multiple medications to control his blood pressure and lipid level. His glucose control was very poor even with intensive medical therapy and behavioural modifications. His baseline HbA1c was 10.1% and C-peptide was 1.8 nmol/L. In view of his conditions, intestinal bypass in addition to sleeve gastrectomy

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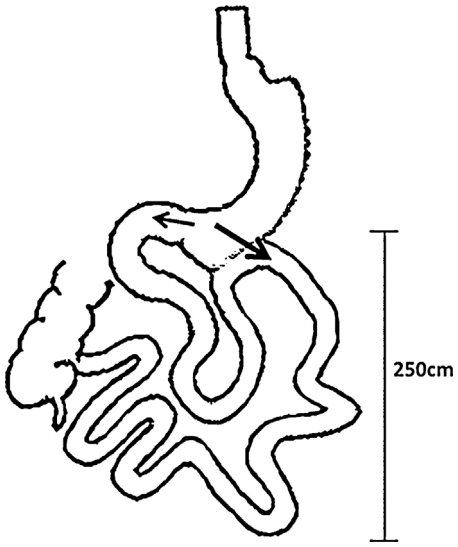

Fig. 1. Sleeve gastrectomy with loop bipartition.

was offered to him. The patient was fully informed regarding the modification of this operation (sleeve gastrectomy with loop bipartition) from the current metabolic procedures and formal consent was obtained.

The procedure was performed by minimally invasive approach in French position with five ports (12 mm at umbilicus, 1 mm × 5 mm at right upper quadrant, 1 mm × 10 mm and 1 mm × 5 mm at left upper quadrant and 1 mm × 5 mm ports at epigastrium for liver retraction) as in our standard laparoscopic sleeve gastrectomy. The greater curvature of stomach including the posterior fundus was mobilized completely from pylorus to the angle of His exposing the left crus of diaphragm. The greater curvature of stomach was transected by a linear stapler (Echelon 60 Endopath Stapler and Cutter. 60 mm, Ethicon, Cincinnati, OH) from antrum (6 cm from pylorus) to angle of His with 38 Fr. calibration tube and the staple line was oversewn with suture. A loop gastroileostomy 250 cm from the ilececal valve was created at the dependent part of the antrum with 2 layers of handsewn suture but without division of the 1st part of duodenum. The resultant stomach tube has two outlets, one to the first part of duodenum through the pylorus and one to the terminal ileum through the gastroileostomy (Fig. 1). The operation time was 189 min with minimal blood loss. The staple line and anastomosis was tested with methylene blue test at the end of the procedure.

The patient had an uneventful recovery. Oral contrast study was performed on Day 7, which revealed no leakage and preferential passage of contrast through the gastroileostomy. The patient was kept in the hospital for 10 days for diet education and blood glucose monitoring. Upon discharge from the hospital, the patient did not require insulin injection and was put on oral hypoglycaemic agents and adjusted doses of anti-hypertensive medications.

The patient was monitored regularly in a standardized pathway and protocol after surgery. He was prescribed a high protein liquid diet for the first two weeks and soft diet from week 3 to 4. A regular diet was gradually introduced thereafter. He was put on a proton pump inhibitor for one month and multivitamin supplement. He was evaluated monthly at the outpatient clinic by his endocrinologist and our surgical team.

His metabolic parameters were completely normalized with cessation of all oral medications at 2-month. The patient reported a change of bowel habit with increased frequency of passing flatus and bowel motion 2–3 times/day after the operation. Gastroscopy was performed at 6-month and it confirmed patency at the anastomosis. The patient had progressive weight loss throughout the follow-up period with no major complaint except for occasional mild itchiness of skin.

At 1-year follow-up, his BW and BMI dropped from 98.5 to 69.8 kg and 32.9 to 23.3 kg/m^2, respectively. The excess BMI loss was 97.0% with reference to ideal body weight at BMI 23 for an Asian population. There was a significant improvement of HBA1c level from 10.1 at baseline to 4.8% at 1-year follow-up. The patient developed mild hypoalbuminaemia and anaemia with albumin level decreased from 41 to 31 g/L and haemoglobin level from 13.8 to 11.5 g/dL after operation as compared to the baseline.

3. Discussion

This new surgical procedure (sleeve gastrectomy with loop bipartition; SG + LB) was evolved and derived from the combined concepts of sleeve gastrectomy with transit bipartition (SG + TB),[1,2] single anastomosis duodenal-ileostomy (SADI),[3] mini-gastric bypass (MGB)[4–6] and duodenal–jejunal bypass (DJB)[7–9] that we have learnt from past years. We believe the outcome of this operation would be comparable to the above metabolic procedures but with less nutritional issue and a much safer and easier operation. Our first patient had a remarkable early outcome with complete resolution of DM and obesity at 1-year follow-up.

In Hong Kong, the gold standard treatment of obesity and diabetes is sleeve gastrectomy (SG).[10] We are very satisfied with the results of SG and the majority of our patients can achieve excellent outcomes with the operation. Intestinal bypass added to SG, primary or staged, is only reserved and offered to those with extreme obesity and poorly controlled DM. Gastric bypass (both Roux-en-Y and MGB) were not well received in Hong Kong for some reasons, namely a relatively higher incidence of stomach cancer and common bile duct stones in our locality.[11] On the other hand, DS is almost being abandoned in Asia due to the nutritional consequences and complexity of surgery.[12] As a result, DJB or SADI, which is a complementary procedure to SG, is gaining popularity in Asia countries recently.[7–9] We modified the Santoro's operation (SG + TB) by creating a loop bipartition at antrum instead and the resultant reconstruction (SG + LB) in fact is a very similar operation to the SADI and loop DJB but without division of the duodenum. As shown by Santoro et al., the majority of nutrients and food still preferentially pass through the gastroileostomy rather than through the physiological sphincter, the pylorus and this observation obviate the necessity for complete exclusion of duodenum in SADI or DJB.[2]

There are a lot of apparent advantages of this procedure over the other current metabolic operations. First, SG + LB is very straightforward and simple to perform without the need for division of duodenum. It is a single step complementary to SG and can be accomplished easily by minimally invasive approach with a relatively short operation time. It can be offered to patients as a primary or staged operation for the treatment of obesity and DM. In addition, from the experience of gastric cancer and ulcer surgery, we anticipate that the gastroileostomy anastomosis fashioned at the dependent part of the antrum in SG + LB rarely develops leakage or serious morbidity. This anastomosis should be the most robust and safest as compared to other procedures with minimal tension. Moreover, without division of duodenum, it completely eliminates the possibility of duodenal stump leakage, which can be troublesome in SADI, DJB or DS. The alimentary limb length we chose (250 cm from ileal caecal valve) was derived from the experience of SADI as popularized by Sanchez et al.[3] In SG + LB, the limb length can be adjusted and modified according to the patient's BMI and DM status and the procedure can be reversed and converted to other procedure if needed at ease. There are no foreign bodies, blind

loops or excluded segments involved and the whole GI tract and bile duct can be assessed by endoscopy if necessary after the operation. What is more important, the nutritional issue of this operation should be less prominent. One of the major problems of MGB and DJB is that up to 5% of patients may develop severe iron deficiency anaemia, which is related to the length of bilipancreatic limb being bypassed.[4–6] SG + LB preserves the foregut for iron absorption and potentially diminish the severity and possibility of this complication. Last but not the least, there is a theoretical benefit by adding this step to SG to decrease the stomach tube pressure. This may potentially minimize the staple line leakage rate in SG. It has been shown that MGB rarely develop staple line leakage at the angle of His and this may attribute to the omega loop created at the distal end of the stomach tube decreasing the tube pressure in MGB. At the moment of time, we think LS + LB appears to be close to the ideal metabolic surgery and exhibits a lot of advantages as compared to other procedures.

As in MGB, we foresee that there will still be controversial issues and potential criticisms for this operation namely bile reflux and dumping syndrome in non-diabetic patients. The debate is outside the scope of this discussion. The bottom-line is that SG + LB can be completely reversed for dumping or revised to Braun's reconstruction to eliminate bile reflux in case it happens in a minority of patients undergoing this procedure.

4. Conclusions

Sleeve gastrectomy with loop bipartition may be proven to be a very effective, safe and simple operation with numerous theoretical advantages over the current procedures for the treatment of obesity and diabetes. However, we need more experts to explore and investigate this operation before we can draw any solid conclusions.

Conflict of interest

The authors declare no conflict of interest.

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Ethical approval

Consent was obtained.

Author contributions

Dr. Lee Danny Wai Hung is the assistant surgeon and co-writer. Dr. Lam Katherine Kar Yee is the anaesthetist for the case and for preparation for the surgery.

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