



# Initial Experience with Laparoscopic Loop Duodenojejunal Bypass with Sleeve Gastrectomy in Korean Obese Patients

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Laparoscopic loop duodenojejunal bypass with sleeve gastrectomy (LDJB-SG) has theoretical advantages compared with laparoscopic Roux-en-Y gastric bypass. We performed 7 cases of LDJB-SG from May 2019 to September 2019. All procedures were successfully completed by laparoscopy. The mean operative time was 282.9 (210~335) minutes and the mean estimated blood loss was 82.9 (20~150) ml. There was no intraoperative complications, however, there was 1 case of postoperative anastomotic leakage. The average length of postoperative hospital stay was 5.3 (3~12) days. The mean body weight at baseline was 117.1 (88.4~151.1) kg, and was decreased to 90.4 (69.4~130.9) kg at postoperative 3 month. The mean of HbA1c at baseline was 7.6 (5.5~9.4) %, and was decreased to 5.3 (4.8~5.6) % at postoperative 3 month. Although LDJB-SG is a technically demanding procedure, it can be a feasible and safe procedure if the learning curve can be overcome.

**Keywords:** Loop duodenojejunal bypass, Sleeve gastrectomy, Metabolic surgery, Obesity, Weight loss

**Supplementary video file:** This article contains supplementary material (<https://doi.org/10.7602/jmis.2020.23.1.52>).

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Received December 4, 2019

Revised February 4, 2020

Accepted February 26, 2020

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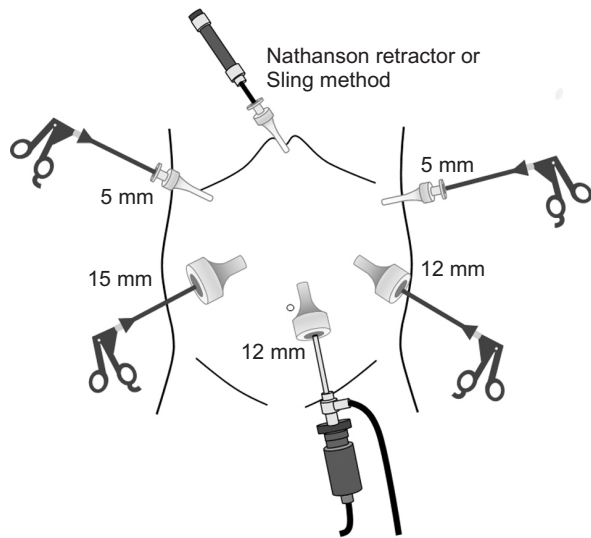
## INTRODUCTION

Huang et al.<sup>1</sup> introduced the laparoscopic loop duodenojejunal bypass with sleeve gastrectomy (LDJB-SG) procedure in 2011. The LDJB-SG has theoretical advantages over a laparoscopic Roux-en-Y gastric bypass (LRYGB). First, preservation of the pylorus can reduce the possibility of dumping syndrome, bile reflux, and marginal ulcers. Moreover, it can reduce the postprandial glucose excursions in diabetic patients after bariatric surgery.<sup>2,3</sup> Second, endoscopic surveillance of the remnant stomach is accessible after LDJB-SG; this is particularly important in Asia, where gastric cancer is prevalent.<sup>4</sup> Third, the number of anastomoses is reduced to one, and the

possibility of an internal hernia and anastomotic complications, such as leakage or stenosis, can be reduced in LDJB-SG. Despite these advantages, the procedure is not practiced widely because of the technical difficulties of a duodenal dissection and hand-sewn duodenojejunal anastomosis. This paper reports the initial experiences with LDJB-SG in Korean obese patients.

## PROCEDURE

Under general anesthesia, the patient was placed in the supine position with their legs pulled apart. Five or six trocars were used, as shown in Fig. 1. The surgeon stood on the right



**Fig. 1.** Position of the trocars in laparoscopic loop duodenojejunal bypass with sleeve gastrectomy.

side of the patient; the scopist stood between the legs of the patient while an assistant stood on the left side of the patient. Liver retraction was achieved using the sling method with a straight needle or Nathanson retractor. Devascularization of the greater curvature of the stomach (4 cm from the pylorus to the left crus of the diaphragm) was performed with a Ligasure™ (Medtronic). Using a 38 Fr bougie placed within the stomach, a sleeve gastrectomy was performed with sequential shoots of the Signia™ stapling system (Medtronic). The initial firing was performed with a black cartridge, followed by purple cartridges. A reinforcement suture of the staple line on the sleeved stomach was added in some cases. A stay suture was placed at the distal part of the staple line on the stomach for counter-traction and a better surgical view of the 1st portion of the duodenum. Window formation at the supra- and infra-duodenal areas and tunneling behind the duodenum using a retractor for gastric banding (Karl storz) was performed. The duodenum was retracted anteriorly using umbilical tape to insert the stapler easily, and then the duodenum was transected using the curved tip of the tan cartridge. The omentum was divided in some cases to avoid tension of the anastomosis during an antecolic reconstruction. Two hundred centimeters of the jejunal loop from the ligament of Treitz was measured and fixed to the pylorus using a stay suture. Enterotomy from 1.5 cm to 2 cm at the 1st portion of the duodenum and jejunum was done, and hand-sewn anastomosis with V-LOC™ 90 absorbable 3-0 (Medtronic) was performed in an isoperistaltic manner. An air leak test was performed with air insufflation through the inserted bougie to check the anastomosis. An interrupted suture with non-absorbable thread (2-0 Ethibond

**Table 1.** Patient's characteristics at baseline

Variables	Baseline (N = 7)
Age (years)	43 (28 ~ 55)
Female (%)	5 (71.4%)
BMI (kg/m <sup>2</sup> )	41.4 (32.7 ~ 59.9)
Type 2 diabetes mellitus (%)	6 (85.7)
Use of insulin (%)	3 (42.9)
Glycated hemoglobin (%)	7.9 (5.5 ~ 10.8)
Fasting plasma glucose (mg/dL)	193.1 (92 ~ 305)

Excel®; Ethicon) was then done between the antrum and the jejunum a few centimeters proximal to the duodenojejunostomy. The interrupted suture between the His angle of the stomach and the left crus was performed to prevent gastroesophageal reflux. A few interrupted sutures between the sleeved stomach and the retroperitoneum were performed to fix the stomach and prevent twisting of the stomach. A continuous suture with V-LOC™ non-absorbable 3-0 (Metronic) was then used to close the Peterson defect. Finally, a Jackson-Pratt drain was inserted behind the duodenojejunal anastomosis along the staple line of the stomach.

This study was approved by the Institutional Review Board of Soonchunhyang University Hospital Seoul.

## RESULTS

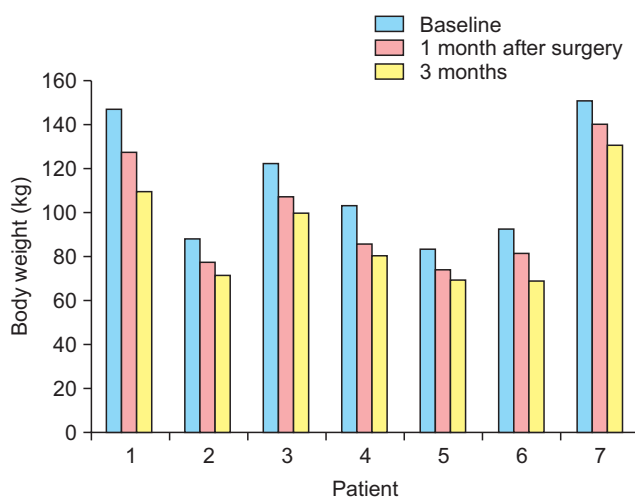
In the author's institution, patients who have uncontrolled type 2 diabetes mellitus (T2DM) with glycated hemoglobin (HbA1c)  $\geq 8.0\%$  or T2DM using insulin, or super-obese patients with a body mass index (BMI)  $\geq 50$  kg/m<sup>2</sup> were eligible for bypass surgery, such as LDJB-SG or LRYGB. The surgical procedure is determined according to the endoscopic findings, severity of gastroesophageal reflux symptoms, familial history of gastric cancer, cigarette smoking, the persistence of non-steroidal anti-inflammatory drugs, and the patient's preference for one of the two procedures.

Seven cases of LDJB-SG were performed from May 2019 to September 2019. All procedures were completed successfully by laparoscopy. Table 1 lists the patient baseline characteristics. The average age was 43 years (range 28~55 years); five patients (71.4%) were female, and the mean body mass index (BMI) was 41.4 (32.7~59.9) kg/m<sup>2</sup>. Six patients (85.7%) had T2DM, and three patients (42.9%) were using insulin. The mean HbA1c and mean fasting plasma glucose (FPG) levels were 7.9 (5.5~10.8) % and 193.1 (92~305) mg/dl, respectively.

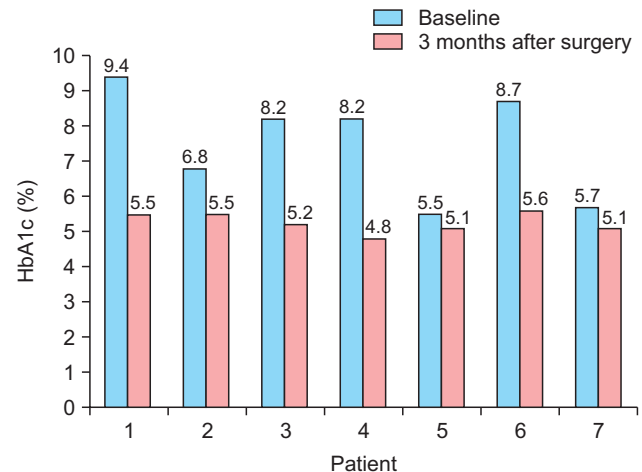
Table 2 lists the perioperative outcomes. The number of trocars used was 5.3 (5~6), and the number of sling methods for

**Table 2.** Perioperative outcomes

Variables	Number/mean (N = 7)
Number of trocar	5.3 (5 ~ 6)
Sling method by liver retraction	5 (71.4%)
Operative time (minutes)	282.9 (210 ~ 335)
Estimated blood loss (ml)	82.9 (20 ~ 150)
Intraoperative complication	0 (0)
Postoperative complication	1 (14.3)
Postoperative hospital stay	5.3 (3 ~ 12)
Readmission	1 (14.3)

**Fig. 2.** Individual's body weights after laparoscopic loop duodenojejunal bypass with sleeve gastrectomy.

liver retraction was five (71.4%). The mean operative time was 282.9 (210~335) minutes and the mean estimated blood loss was 82.9 (20~150) ml. No intraoperative complications were encountered, but there was one case with postoperative complications. This was the first case of LDJB-SG and the patient was male, 180.4 cm in height, 147.7 kg in weight, and a BMI of 45.2 kg/m<sup>2</sup>. He had a high fever over 38°C on postoperative day (POD) 4. The abdominopelvic computed tomogram (APCT) revealed mild mesenteric fat infiltration with a small amount of fluid collection and air densities in the upper abdomen. Anastomosis leakage was suspected and the administration of intravenous broad-spectrum antibiotics was started. After seven days, APCT was re-checked with gastrograffin. No leakage of contrast material was observed and the level of mesenteric fat infiltration had improved. The patient was discharged on the next day. The average length of the postoperative hospital stay was 5.3 (3~12) days. One case of readmission was encountered. She had a history of cerebral infarction and

**Fig. 3.** Individual's glycated hemoglobin (HbA1c) levels after laparoscopic loop duodenojejunal bypass with sleeve gastrectomy.

she was readmitted due to a severe headache on POD 14. She was discharged four days after conservative management.

Fig. 2 presents the individual body weights. The mean body weight at the time of surgery was 117.1 (88.4~151.1) kg, which decreased to 99.5 (78~140.6) kg and 90.4 (69.4~130.9) kg at postoperative one and three months, respectively. Fig. 3 shows the individual's HbA1c levels. The mean of HbA1c at the baseline was 7.6 (5.5~9.4) %, which decreased to 5.3 (4.8~5.6) % at postoperative three months.

## DISCUSSION

LDJB-SG is a novel bariatric procedure that was introduced less than 10 years ago. Although it is not popular, the number of cases, particularly in Korea, is very small.<sup>5</sup> To the best of the authors' knowledge, there are no reports of the long-term outcomes of LDJB-SG, nor have there been randomized controlled trials comparing LDJB-SG with other bariatric procedures, such as LRYGB or laparoscopic sleeve gastrectomy (LSG). A few studies showed that LDJB-SG is a relatively safe and effective metabolic surgery with significant weight loss and resolution of the co-morbidities during a short- and mid-term follow up period.<sup>1,6-8</sup> Other studies compared retrospectively LDJB-SG with other procedures, such as mini-gastric bypass (MGB), LRYGB or LSG.<sup>9,10</sup> Lee et al.<sup>9</sup> reported that LDJB-SG has a significantly longer operative time and higher weight loss at one year after surgery than MGB or LRYGB. In addition, Huang et al.<sup>10</sup> suggested that LDJB-SG was comparable to LRYGB in terms of weight loss, glycemic control, and co-morbidity resolution in T2DM patients with a BMI <35 kg/m<sup>2</sup> in the short-term. According to one study comparing the one-year results between LDJB-SG and LSG, LDJB-SG was superior to LSG in T2DM remission, triglyceride improvement,

and excess weight loss.

Despite the low number of cases, there were some difficulties encountered during surgery. The first is that loop duodenojejunal bypass is difficult if pancreatic tissue covers the duodenum or if there is a duodenal deformity caused by a previous duodenal ulcer. In such cases, it is advisable to sacrifice the pyloric vessels and convert it to Rouxen-Y fashioned duodenojejunal bypass. Loop duodenojejunal bypass has the theoretical advantages of lower complication rates, such as anastomotic leakage, stenosis, or internal hernia, and shorter operative time in that it has fewer anastomosis and no jejuno-jejunal mesenteric defect compared to a Rouxen-Y duodenojejunal bypass.<sup>19</sup> To date, however, there have been no comparative studies of these two techniques. In addition, when loop anastomosis is made by cutting the pyloric vessels, the incidence of complications, such as dumping symptoms, bile reflux, and marginal ulcer, may increase due to loss or weakening of the pyloric function. The second thing is to use a stapler with a curved tip for the transection of the duodenum. The movement of the duodenum is quite limited when preserving the blood vessels around the pylorus and duodenum. Therefore, it is difficult to insert the stapler below the duodenum through the small window. The curved tip makes it easier to pass through the posterior wall of the duodenum than with a straight tip because the curved tip is curved upward with a smaller sized tip.

In how many cases does LDJB-SG need to be performed to overcome the learning curve? This depends on the definition of the learning curve. According to Wehrtmann et al.,<sup>11</sup> 60 to 100 LSG and 70 to 150 LRYGB were required to reach the 'proficiency' phase of the learning curve, this means a further decrease in the number of postoperative complications and stabilization of the operative time. In the author's experience, the most difficult parts of LDJB-SG were transecting the duodenum while preserving the pyloric vessels and suturing the duodeno-jejunal anastomosis using a hand-sewn method. The technical level of the duodenal transection was similar to making a gastric pouch of LRYGB, but duodeno-jejunal hand-sewn anastomosis was slightly more difficult than gastro-jejunal or jejuno-jejunal anastomosis. Thus, the authors believe that slightly more than 70 to 150 LDJB-SG cases are necessary to reach the 'proficiency' phase of the learning curve, which known as the learning curve of LRYGB.

In conclusion, although LDJB-SG is a technically demanding procedure, it can be feasible and safe if the learning curve can be overcome. A skilled laparoscopic suture technique is essential for safety.

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## CONFLICT OF INTEREST

None.

## FUNDING

None.

## ACKNOWLEDGMENTS

We would like to thank Dr. Manabu Amiki, who is working in the department of surgery at Kawasaki Saiwai Hospital in Japan, for illustrating Fig. 1.

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