Surgical Techniques

Intracorporeal semi-handsewn Billroth I reconstruction in totally laparoscopic distal gastrectomy

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Short title: Semi-handsewn Billroth I reconstruction

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Word count: 1003 words

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Abstract

Introduction: Intracorporeal Billroth I (B-I) reconstruction using an endoscopic linear stapler (ELS) is widely performed in totally laparoscopic distal gastrectomy. However, conventional procedures require many ELSs for anastomosis. Here, we introduce the novel intracorporeal semi-handsewn (SHS) B-I reconstruction.

Materials and Surgical Technique: After the transection of stomach and duodenum using ELS following adequate lymph node dissection, small entry holes were made on the anterior wall in the greater curvature of the stomach and the duodenal stump. And the posterior walls of both the remnant stomach and the duodenum were attached with the ELS and fired to create the posterior wall of the B-I anastomosis. All the transection line of the duodenum and one-third of the transection line of the stomach were dissected, finally the anterior wall suturing at the anastomotic site was performed by the laparoscopic hand-sewn technique.

Discussion: SHS procedure was performed for 17 gastric cancer patients. There was no intraoperative complications or conversions to open surgery. One intra-abdominal abscess was observed although there was no anastomotic leakage. The median reconstruction time was 48 min (32 – 63). The SHS procedure was safe, feasible, and economical, although it requires sufficient laparoscopic suturing and ligation skill.

Key words: laparoscopic distal gastrectomy, Billroth I reconstruction, gastric cancer

Introduction

Laparoscopic gastrectomy is widely accepted as a surgical treatment for gastric cancer in many countries [1-3]. It has been reported that the laparoscopic approach has several advantages, such as a smaller wound and faster recovery after surgery, compared to conventional open surgery [3, 4]. Currently, totally laparoscopic gastrectomy, which consists of intracorporeal resection and anastomosis, is increasing. Kanaya and colleagues developed a delta-shaped (DS) anastomosis for intracorporeal Billroth I (B-I) reconstruction after laparoscopic distal gastrectomy (LDG) [5]. Although the DS anastomosis has been widely performed as a simple and easy procedure, it requires further mobilization and rotation of the remnant stomach and duodenum, and the remaining duodenal stump edge may be ischemic. To overcome this issue, some intracorporeal triangular anastomoses, such as book-binding technique (BBT) without mobilization and rotation of the duodenum and leaving a duodenal stump, have been developed [6-9]. However, these procedures require at least 3 endoscopic linear stapler (ELS) cartridges for anastomosis, which is not economical. They also have double-stapling points at an anastomotic site, which may promote anastomotic leakage.

We have developed a semi-handsewn (SHS) intracorporeal anastomosis for B-I reconstruction. The technical details are described in the current report

Materials and Surgical Techniques

The study was approved by the Institutional Review Board of Okayama University Hospital (No. 1807-012) and informed consent or substitute for it was obtained from all patients for their being included in the study.

The patient was placed in the supine position with the legs apart. Using an open technique, a 12-mm trocar was inserted through an umbilical incision, and pneumoperitoneum was created. Four other trocars (one 12-mm and three 5-mm) were inserted in a rhombus position. After mobilization of the gastroduodenum and adequate

lymph node dissection, the stomach and duodenum were transected using an ELS, and intracorporeal reconstruction was performed. Small entry holes were made on the anterior wall in the greater curvature of the stomach and the duodenal stump. A 60-mm or 45-mm ELS was inserted through the left lower 12-mm port via the entry holes. The posterior walls of both the remnant stomach and the duodenum were attached with the ELS (**Fig. 1a**). The ELS was fired to create the posterior wall of the B-I anastomosis. All the transection line of the duodenum and one-third of the transection line of the stomach were dissected using laparoscopic coagulating shears (**Fig. 1b**). The anastomotic processes up to this point were performed according to the BBT. After this step was completed, the surgeon moved between the patient's legs, with the camera operator positioned on the right side of the patient. The anterior wall suturing at the anastomotic site using the Albert-Lembert method was performed by the laparoscopic hand-sewn technique through the right and left lower ports. A stay-suture of whole-layer approximation was anchored at the greater curvature. Whole-layer suturing was started from the intra-luminal side using continuous 4-0 PDS-II (**Fig. 1c**), the suturing needle was put out to the serosal side at the lesser curvature on the way, and the suturing proceeded from the serosal side. After the whole-layer approximation, seromuscular suturing was performed from the lesser curvature to the greater curvature using a 3-0 barbed suture (**Fig. 1d**). Intracorporeal SHS anastomosis for B-I reconstruction was completed (**Fig. 1e, Video 1**).

Discussion

Between November 2015 and August 2016, 17 consecutive patients underwent totally laparoscopic distal gastrectomy (TLDG) with SHS procedure B-I reconstruction for gastric cancer at Okayama University Hospital. The clinicopathological characteristics and surgical outcomes are summarized in **Table 1** and **Table 2**. There was no intraoperative complications or conversions to open surgery. The median reconstruction time was 48 (32 –

63) min, and the number of ELS cartridges in all patients required for anastomosis was only one. One intra-abdominal abscess was observed although no anastomotic leakage was seen as an anastomosis-related complication.

Although DS anastomosis has been widely accepted as a simple and easy procedure, the potential risk of postoperative anastomotic stenosis has been pointed out when the length of duodenal bulb is short [10, 11]. Some modified DS anastomosis have been reported to prevent anastomotic stenosis [11, 12]. However, these procedures are functional end-to-end anastomosis and the SHS procedure is a true end-to-end anastomosis modified BBT, at least 30 mm length of staple is enough to fix the posterior wall of anastomosis and the anterior wall of anastomosis was performed by hand sewing. Thus, the SHS procedure minimize the potential risk of anastomotic stenosis. Moreover, the SHS procedure was completed without leaving the duodenal stump edge which might be ischemic postoperatively. And the SHS procedure requires only one ELS, though the conventional procedure requires at least 2 or 3, demonstrating that the SHS procedure requires 200-500 dollars lower than conventional DS or BBT for anastomosis. The anastomotic time of SHS procedure was 48 min, which was comparable to the BBT (41 min) although it was longer than the conventional DS anastomosis (13 to 26 min) [6, 13]. The anastomotic time of SHS might be shortened because the posterior wall of the B-I anastomosis is created by ELS in the SHS procedure. Similar procedure has been reported in intracorporeal gastro-gastrostomy for the reconstruction after laparoscopic pylorus-preserving gastrectomy [14]. This first posterior wall stapling fixes the anastomotic site, and it might facilitate anterior wall suturing. However, the SHS procedure requires sufficient laparoscopic suturing and ligation skill. In recent years, several new vision systems, such as three-dimensional (3D) and ultra-high resolution (4K) imaging, have been introduced in laparoscopic surgery. Several reports demonstrated that these new technologies improved the surgical procedure and reduced technical errors, especially in suturing and handling the needle [15, 16]. These new vision systems may reduce the anastomotic time in

the SHS procedure for intracorporeal B-I reconstruction.

The SHS procedure is safe, feasible and economical. We believe that the SHS procedure is a useful option for intracorporeal B-I reconstruction, although it requires sufficient laparoscopic suturing and ligation skill.

Acknowledgement

This work was supported by JSPS Early Career Scientists, Grant Number 18K16362. The authors declare that they have no conflict of interest for this study.

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Figure Legends

Fig. 1 Semi-handsewn (SHS) procedure for intracorporeal Billroth-I (B-I) reconstruction

a The posterior walls of both the remnant stomach and the duodenum are attached with the ELS.

b All of the transection line of the duodenum and one-third of the transection line of the stomach are dissected.

c Whole-layer suturing is started from the intra-luminal side at the lesser curvature of the stomach.

d After the whole-layer approximation, seromuscular suturing is performed from the lesser curvature to the greater curvature.

e Intracorporeal SHS anastomosis for B-I reconstruction is completed.

ELS, endoscopic linear stapler; SHS, semi-handsewn; B-I, Billroth-I