Postoperative pancreatic fistula after robot distal gastrectomy

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ABSTRACT

Background: To compare the incidences of postoperative pancreatic fistula (POPF) between robot-assisted distal gastrectomy (RADG) and laparoscopy-assisted distal gastrectomy (LADG).

Materials and methods: A total of 40 patients with gastric cancer who underwent RADG were compared with 40 initial patients who underwent LADG by a single surgeon. We evaluated and compared the clinicopathologic characteristics, surgical outcomes, and operative complications including POPF in two groups.

Results: The POPF was observed more frequently in the LADG group than in the RADG group (22.5% *versus* 10%, $P < 0.001$). Although the serum amylase levels in the 20 first-half cases did not statistically differ between LADG and RADG ($P = 0.32$), those in the 20 latter-half cases were significantly lower in the RADG group ($P < 0.05$). Univariate and multivariate analyses identified laparoscopic surgery and visceral fat area as POPF-associated risk factors.

Conclusions: RADG is feasible and safe for distal gastrectomy in terms of POPF.

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1. Introduction

Although the incidence of gastric cancer has declined in recent decades [1], it remains the second-leading cause of death worldwide. In fact, in Korea and Japan, the incidence of early gastric cancer has increased [2,3]. Early detection of gastric cancer enhances the feasibility and facilitates the development of minimally invasive surgical options.

Laparoscopic gastrectomy with lymph node dissection, for instance, has been established as standard treatment for gastric cancer [4,5]. It can aid recovery of bowel functionality and minimize postoperative pain, whose benefits have profoundly positive effects on patients' clinical recovery. Several retrospective and prospective studies have confirmed the operative safety of laparoscopy-assisted distal gastrectomy (LADG) and its compatibility with open gastrectomy [6—8].

However, LADG with radical lymph node dissection, specifically as performed in and around the suprapancreatic area, remains challenging even for experienced surgeons, because of factors such as the limited range of movement, amplification of hand tremors, two-dimensional imaging, and inconvenient surgical positioning. Major postoperative complications, such as bleeding or aggravated postoperative pancreatic fistula (POPF), are not uncommon results [9,10].

As a means of overcoming the limitations and drawbacks of LADG, a new-concept robotic surgery system entailing three-dimensional imaging, tremor filtering, and ergonomic instrumentation has been introduced. This system has inaugurated a new era of minimally invasive surgery; its feasibility and benefits have been demonstrated in a variety of surgical fields including urological and cardiac surgery, among others [11—13].

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Recently, robot-assisted distal gastrectomy (RADG) has been trialed for application to patients with gastric cancer. Thus far, studies comparing robotic with laparoscopic surgery in this regard have been few. The benefits of RADG over LADG remain controversial; it's considerably greater expense is one of the most important factors determining the use or non-use of the robotic system in gastric cancer surgery [14,15].

In this study, to elucidate the benefits of RADG, we examined post-RADG clinical outcomes with surgical complications including POPF. Additionally, the RADG outcomes were compared with those of LADG in patients with gastric cancer.

2. Material and methods

2.1. Subjects and study design

Patient data were prospectively collected from The Gastric Cancer Patients Registry maintained by Seoul St. Mary's Hospital in Seoul, South Korea. A total of 80 cases were selected: 40 consecutive cases of LADG and RADG, respectively. Both type of surgery was performed by a single surgeon (K.Y.S.) and has been begun on a different period; LADG June 2004, RADG March 2009. Because the surgeon had performed more than 500 conventional open gastrectomies and 350 LADG before undertaking RADG, the initial 40 cases of LADG and RADG were compared to minimize the effect of the learning curve. The indication of both types of surgery was basically same and RADG has been chosen only when patient selected it. At our institution, laparoscopic or robotic gastrectomy has been performed for patients with clinical T1N0, T1N1, or T2N0 at preoperative staging. Preoperative staging was performed by endoscopy, endoscopic ultrasonography, and computed tomography. The following parameters were recorded prospectively: age and gender, body mass index (BMI), visceral fat area (VFA), tumor characteristics, docking times for RADG, operative time, reconstruction time, estimated blood loss, postoperative hospital stay, postoperative complications (denoted according to the Clavien—Dindo classification system) [16], and postoperative white blood cell- and amylase serum levels. The VFA were preoperatively measured (both in squared centimeters) using a cross-sectional computed tomography scan at the level of the umbilicus. The Institutional Review Board of Seoul St. Mary's Hospital approved this study (KC13RISI0029).

2.2. Definition of pancreatic fistula

The serum amylase and drain amylase level was checked on postoperative day 3 and rechecked later if suspicious for pancreatic fistula. POPF was defined according to the International Study Group on Pancreatic Fistula definition: output, via an operatively implanted drain, of any measurable volume of drain fluid on or after postoperative day 3, with an amylase content greater than three times the upper normal serum value [17]. The POPF grading system used was as follows: grade A, "transient fistula" with no significant impact on postoperative course; grade B, change in management or clinical pathway required; and grade C, significant change in management or clinical pathway required, even aggressive intervention considered. In this study, grade B or C was regarded as significant.

2.3. Operative procedure

The procedure of LADG was performed as described previously [6]. In RADG, it is essential that the central axis of the robot be in line with the head-to-leg axis of the patient. And, when this docking process is properly completed, each robot arm must be parallel to that axis. Furthermore, because the operating table cannot be changed once the robot has been docked, the height and slope of the operating table must be reconfirmed beforehand. The two 8-mm ports on the right side of the patient were used for Cadiere forceps and an ultrasonic shear, and the one on the left side was used for bipolar Maryland forceps.

The procedure is similar to the previously reported one [18]: partial omentectomy, resection margin >2 cm from the lesion, and at least D1 + β (including 8a, 9) lymphadenectomy based on Japanese Gastric Cancer treatment guidelines, and D2 lymphadenectomy [6,19]. The robot-arm positioning and utilization procedure for suprapancreatic lymph node dissection is as follows. First, Cardiere forceps are used as a third arm to dissect lymph node-bearing tissues around the common hepatic artery and portal vein while applying constant traction toward the right side of the patient; with Maryland forceps, the operator holds the soft tissues of the portal vein medially, and a harmonic scalpel is used to dissect the lymph nodes around the vessels (Figure A). Second, Cardiere forceps are set as a third arm to lift up the lymph node-bearing tissues around the left gastric artery; the Maryland forceps and a harmonic scalpel are used to dissect the soft tissues (Figure B). Third, Cardiere forceps are applied for constant compression of the upper border of the pancreas in approaching the splenic artery and vein, where lymph node station number 11 is located (Figure C). Billroth I or II reconstruction was used to facilitate the confluence of the gastrointestinal tract. Roux-en Y reconstruction was used for the later periods of RADG, and intracorporeal reconstruction was facilitated by the laparoscopic procedure even for the RADG.

2.4. Statistical analysis

Post-normality test and categorical-variable analysis were done by chi-square test, continuous variables were analyzed using the Mann—Whitney test or independent sample t-test. Risk factors that might complicate POPF were investigated by univariate analysis, and a multivariate analysis was performed by logistic regression.

All the statistical analyses were carried out using SPSS version 17 (SPSS, Chicago, IL), and a P value <0.05 was considered statistically significant.

3. Results

3.1. Clinicopathologic characteristics

The mean age was younger in the RADG group than that in the LADG group (51.6 versus 55.1, P < 0.05). There were no differences in gender, BMI, performance score (Eastern Cooperative Oncology Group), or AJCC stage between the groups, and neither could any comorbidity distinction be made (Table 1).