

ORIGINAL ARTICLE

REAPPRAISAL OF PYLORUS-PRESERVING GASTRECTOMY FOR EARLY GASTRIC CANCER IN THE ERA OF LAPAROSCOPIC SURGERY; ITS INDICATION AND EARLY OUTCOME

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Abstract INTRODUCTION: Pylorus-preserving gastrectomy (PPG), which had been developed in 1960s, has been reappraised for years and now accepted as a type of function-preserving limited surgery for early-stage gastric cancer in the latest version of the Japanese guideline for the treatment of gastric cancer. Laparoscopy-assisted pylorus-preserving gastrectomy (LAPPG) may compensate for the weak points of PPG in magnifying the view of many anatomic tissues around the stomach. The aim of this study was to investigate the usefulness of LAPPG regarding the early surgical outcomes, as compared with those of laparoscopy-assisted distal gastrectomy (LADG), which does not preserve the pylorus and involves resection of the suprapyloric lymph nodes.

METHODS: Ninety six patients diagnosed as having gastric cancer of cT1N0 underwent either LADG (n=66) or LAPPG (n=30). The patient demographics and the early surgical outcomes were evaluated retrospectively. The quality of lymph node dissection in LAPPG was also assessed pathologically.

RESULTS: Among 96 patients preoperatively diagnosed as cT1, pT1 was 88 cases and pT2 in 8, 91.7 % of diagnostic accuracy. There were no differences in patient demographics, operative time, blood loss, the number of dissected lymph nodes, postoperative morbidity and length of hospitalization. Pathologically, the number of dissected lymph nodes at No. 3, 4, 6 were equal between the two groups. Among our LADG cases, 35 (53%) were lesions confined to the mucosa with a distance between the pylorus and the anal margin of the tumor <4 cm.

CONCLUSIONS: Our initial experience suggests that LAPPG can be performed with acceptable quality of lymph node dissection and early surgical outcome. Because LAPPG was thought to be applied for about a half of our LADG cases according to the new guideline, LAPPG is expected to be indicated for more cases with early gastric cancer as a function-preserving limited surgery.

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Key words: Laparoscopy-assisted pylorus-preserving gastrectomy; early gastric cancer; limited surgery; minimally-invasive surgery; function-preserving surger.

原著

腹腔鏡手術時代における早期胃癌に対する幽門輪温存胃切除術の再評価； 適応と初期成績に関する検討

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抄録 【目的】 幽門温存胃切除は、早期胃癌に対する機能温存縮小手術として再評価されている。腹腔鏡手術は低侵襲性と拡大視効果を生かした機能温存手術への応用が期待されている。我々は腹腔鏡補助下幽門温存胃切除(以下 LAPPG)の有用性を腹腔鏡補助下幽門側胃切除(以下 LADG)と比較することで検討した。

【方法】 LADG(66例)および LAPPG(30例)を対象とし、症例背景と手術成績を比較検討した。さらに LAPPG のリンパ節郭清精度についても検討した。

【結果】 pT1は88例、pT2は8例であり正診率は91.7%であった。2群で手術精度に有意差は認められなかった。また、リンパ節部位別郭清個数は #3、#4d、#6 で有意差を認めなかった。

【結語】 LAPPG は LADG と同等の術後成績を示し、リンパ節郭清精度の観点からも妥当と思われた。LAPPG は機能温存を重視した縮小手術としてさらに汎用されるべき手術手技であると考えられた。

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キーワード: 腹腔鏡補助下幽門温存胃切除；早期胃癌；縮小手術；低侵襲手術；機能温存手術。

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Introduction

Patients who have undergone gastrectomy for gastric cancer sometimes suffer from dumping syndrome or alkaline reflux gastritis^{1,2)}, which causes weight loss and consequent deterioration of their quality of lives. The loss of pyloric muscle and procedure-related damage to the vagal nerve and the peripyloric vasculature significantly attributes to these troublesome complications.

Pylorus-preserving gastrectomy (PPG), in which the pylorus is maintained intact, was first developed for the treatment of peptic ulcer diseases by Maki et al. in 1960s to yield superior postoperative gastric function. Theoretically, it could be applied for the cases with early gastric cancer, however, it was rarely adopted for malignant cases because most surgeons stressed the importance of radical resection to improve oncological outcomes of the gastric cancer patients these days. Recently, more gastric cancers are being detected at an early stage because of improvements in diagnostic techniques, PPG has been reappraised and included as an optional limited surgery for early gastric cancer in the latest version of the Guidelines for Diagnosis and Treatment of Carcinoma of the Stomach in Japan.

Laparoscopic gastrectomy is a type of minimally invasive surgery and it is now widely employed in the fields of gastric cancer treatment³⁾. Because laparoscopic surgery is able to yield a magnified view of the abdominal cavity, it is very useful for preservation of important nerves and vessels. Now, laparoscopy-assisted pylorus-preserving gastrectomy (LAPPG) is expected to compensate for the weak points of PPG in magnifying the view of many anatomic tissues around the stomach and improve postoperative quality of life in patients with early gastric cancer. However, the surgical outcome of LAPPG has not been reported enough to date.

The aim of this study, conducted in our

hospital, was to investigate the usefulness of LAPPG in comparison to laparoscopy-assisted distal gastrectomy (LADG), which does not preserve the pylorus and involves resection of the suprapyloric lymph nodes.

Patients and Methods

Between April 2000 and May 2011, 96 patients diagnosed as having early gastric carcinomas restricted to the mucosa or submucosa without lymph node metastasis (cT1, cN0) underwent laparoscopic gastrectomy (LADG in 66 patients and LAPPG in 30). The indication of LAPPG in our cases was that the carcinoma had to be located in the middle body of the stomach >5 cm proximal to the pyloric ring, with a maximum diameter of <5 cm. The clinical and pathological records of all patients were reviewed in terms of gender, age, tumor location, tumor size, microscopic findings, macroscopic findings, depth of invasion, numbers of dissected perigastric lymph nodes, presence of lymph node metastasis, and distance between the distal edge of the tumor and the pylorus. Operative parameters (operative time, blood loss), postoperative morbidity, mortality, and length of hospitalization were also documented.

Surgical procedure

For LAPPG, the laparoscope is inserted through the umbilical port and laparoscopic surgery is conducted under carbon dioxide insufflation. The right side of the greater omentum is dissected from the transverse colon as far as the omental bursa. The origin of the right gastroepiploic vein and artery (No.6) is dissected, and the infrapyloric artery is preserved to maintain the blood supply to the remnant stomach. The left gastroepiploic vein and artery are then dissected. The left gastric artery and vein are resected, with concomitant lymph node dissection of No. 7, and the pyloric

branch of the vagus nerve is preserved without No. 5 lymph node. The lesser omentum is dissected, along with the hepatic branch of the vagus nerve. A midline incision about 5 cm long is made in order to resect and reconstruct the stomach. The distance between the pylorus and the cut line of the anal margin is 4 cm. The proximal portion of the stomach is then resected to remove the center of the stomach and preserve the pylorus. To reconstruct the remnant stomach, gastrogastrostomy is performed extracorporeally using the Arbert-Lembert method.

Results

The characteristics of the patients are shown in Table 1. Among 96 patients preoperatively diagnosed as cT1, pT1 was 88 cases and pT2 in 8, the preoperative diagnostic accuracy being 91.7%. The features of the tumors were comparable in regard to differentiation, depth of invasion, lymph node metastasis, and final pathological stage between the two groups. Distances of the pyloric rim to the anal edge of the tumors were 7.2 (4.0-14.5) cm in the LAPPG cases, while those were 22.4 (0.5-11.5) cm in LADG. Among our LADG cases, 35 (53%) were lesions confined to the mucosa with a distance between the pylorus and the anal margin of the tumor <4 cm.

In the technical aspects, the mean operation time for LAPPG was 224 (112-370) min, and the mean blood loss was 194 (20-1076) ml. Both were equal to those for LADG. Complications occurred in 4 (13%) of the LAPPG cases, involving stasis in 3 cases and intraabdominal abscess in one. In each of the cases of stasis, the vagus nerve was preserved. The mean period of hospitalization was 16 days. So far, postoperative morbidity and mortality, and length of hospitalization were comparable between the two groups (Table 1).

Table 2 shows a comparison of the data for

each part of the lymph node dissection between the LAPPG and LADG. The numbers of lymph nodes dissected for #3, #4d and #6 did not differ significantly between the two groups.

Discussion

In this preliminary observation, LAPPG showed acceptable surgical outcomes for cT1N0 gastric cancer if it was strictly indicated to the lesions where enough surgical margins could be secured.

Recently, limited surgery for early gastric cancer has been actively performed because it can offer complete cure and a good postoperative quality of life. Pylorus-preserving gastrectomy (PPG) is one form of function-preserving surgery that has recently attracted interest in the surgical field. PPG was originally proposed as an improved operative procedure for benign gastric ulcer by Maki *et al.* in 1967⁴⁾. PPG has become one of the forms of limited surgical therapy for early gastric cancer. The advantage of this operation is that it preserves the function of the pylorus as a physiologic regulator of gastric emptying, thus preventing post-gastrectomy symptoms of accelerated gastric dumping syndrome, and gastroesophagitis⁵⁾. As the vagus plays an important role in the regulation of gastric motor activity⁶⁾, preservation of the hepatic branch of the vagus nerve reduces the incidence of cholecystolithiasis⁷⁾, and preservation of the pyloric branch is important for pylorus movement. One technical disadvantage of PPG is that dissection of the suprapyloric (No. 5) lymph nodes may make it difficult to preserve the pyloric and hepatic branches of the vagus, although the right gastric and gastroepiploic arteries present near these nerves may be preserved to supply blood flow to the remnant antral segment⁸⁾. Therefore, there is a concern about possible insufficiency of suprapyloric lymph node dissection^{9,10)}. Generally, metastases

Table 1 Patient demographics and outcomes

Variable	LAPPG (N=30)	LADG (N=66)	P value
Age (year)	59.5	65.0	0.14
Gender			
Male	22 (73%)	42 (64%)	0.10
Female	8 (17%)	24 (36%)	
Histology			
Differentiated	16 (53%)	48 (73%)	0.19
Undifferentiated	14 (47%)	18 (27%)	
Depth of invasion			
pT1a (M; tumor within the lamina propria)	18	36	0.98
pT1b (SM; tumor within the submucosa)	9	25	
pT2 (MP; tumor within the muscularis propriae)	3	5	
Distance of between pylorus and tumor anal margin (cm)	7.2 (4.0-14.5)	22.3 (0.5-115)	0.006
Stage*			
Ia	27	57	0.53
Ib	3	8	
II	0	1	
Operative time (m)	224 ± 32.1	222 ± 50.5	0.83
Blood loss (ml)	194 ± 157	173 ± 197	0.62
Complications	4	3	0.66
Stasis	3	1	
Surgical site infection	1	1	
Anastomotic leakage	0	1	
Mortality	0	0	-
Length of hospitalization	16.0 (8-32)	14.8 (8-56)	0.49

*According to the Japanese Classification of Carcinoma of the stomach

LAPPG, laparoscopy-assisted pylorus-preserving gastrectomy

LADG, laparoscopy-assisted distal gastrectomy

Table 2 Comparison between each part of the lymph node dissection of the LAPPG and LADG

Lymph nodes	LAPPG	LADG	P value
#3	6 (0-20)	4 (0-18)	0.17
#4d	5 (0-26)	5 (0-15)	0.08
#5	0	1	-
#6	3 (0-13)	4 (0-14)	0.61
Total	20 (0-59)	22 (4-48)	0.21

LAPPG, laparoscopy-assisted pylorus-preserving gastrectomy

LADG, laparoscopy-assisted distal gastrectomy

to the suprapyloric lymph nodes are found in 4% of cases^{11,12}. Needless to say, as the quality of lymph node dissection is critical for gastric cancer, the indications for PPG must be decided strictly with consideration of both complete cure and function.

Laparoscopic surgery has been applied to gastric cancer, and LAPPG has become one

of the most popular options^{13,14}. Because of its minimal invasiveness in comparison with abdominal surgery, laparoscopic surgery facilitates earlier postoperative healing, minimal bowel paralysis, earlier meal intake, and shorter hospitalization³. In addition, the magnification function of the laparoscope is beneficial for preservation of both nerves and gastric

function¹⁵⁾. The latest version of the Guidelines for Diagnosis and Treatment of Carcinoma of the Stomach in Japan now recommend that the indications for PPG are cT1N0, tumor location in the middle of the stomach, and a distance between the distal edge of the tumor and the pylorus exceeding 4 cm. In our series, a preoperative diagnosis of T1 was made in 96 cases; the pathological grade was T1 was 88 cases and T2 in 8. The rate of correct diagnosis was 91.7%. Among our LADG cases, 35 (53%) showed tumor invasion to the mucosa and a distance between the pylorus and the anal margin of the tumor of <4 cm. These cases were considered amenable to LAPPG. Strict preoperative judgment of early gastric cancer, including the depth of tumor invasion, lymph node metastasis, and distance between the pylorus and the tumor are very important for deciding whether LAPPG can be performed. The numbers of lymph nodes dissected for #3, #4d and #6 did not differ significantly between the two groups. Therefore, the quality of lymph node dissection did not differ between LADG and LAPPG. LAPPG goes toe-to-toe with LADG about radical cure.

In summary, our initial experience suggests that LAPPG for early-stage gastric cancer is an acceptable strategy for ensuring complete cure and a good postoperative quality of life. It is expected that the indications for LAPPG will expand in the future with further refinement of the guidelines.

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