

ORIGINAL ARTICLE

LAPAROSCOPY-ASSISTED DISTAL GASTRECTOMY (LADG) FOR EARLY GASTRIC CANCER - A REVIEW OF FORTY CASES

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Abstract Forty patients with an average age of 64.6 years (range: 45-83) with early gastric cancer of cT1 (M, SM) underwent a curative-intended laparoscopy-assisted distal gastrectomy (LADG) where laparoscopic D1+ α nodal clearance and extra-abdominal Billroth-I stapled anastomosis were performed. There was no conversion to open gastrectomy. The operation time for the 40 cases ranged 150 - 482 min (median: 285), while that for the latest 10 cases reduced to 154-278 min (median: 216). The length of hospital stay of the patients varied 10-85 days (median: 17). Postoperative complications encountered were anastomosis-related: 2 anastomotic bleeding and 2 anastomotic passage disturbance (1 stricture and 1 temporary stenosis) occurred but no dehiscence. Four inaccurate preoperative diagnoses of tumor invasion depth were revealed by postoperative pathology of the resected specimens. Thereafter the accuracy in the preoperative diagnosis was highly enhanced with implementation of endoscopic ultrasound. Recurrence occurred in one patient with pT2 (SS) pN2, who died of pleural carcinomatosis 4 years and 3 months after surgery.

As the reduced operation time in LADG came closer to that in open distal gastrectomy, we will continue this procedure for early gastric cancer. For this, the importance of an accurate preoperative diagnosis can't be overemphasized.

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Key words: laparoscopy-assisted distal gastrectomy; LADG; early gastric cancer; depth of intramural invasion.

原 著

早期胃癌に対する腹腔鏡補助下幽門側胃切除術 (Laparoscopy-assisted distal gastrectomy)—40症例の検討

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抄録 当院でのLADGは早期胃癌に対し、鏡視下操作にてD1+ α 郭清を、小開腹操作にて胃切離と再建を行っている。これまでの40症例について手術時間、出血量、合併症、術後病理所見を検討した。

症例は男性22例、女性18例で平均年齢64.6歳(45~83歳)であった。開腹術への移行例はなく、全体の手術時間は中央値285分(150~482分)で、最近の10例は216分(154~278分)と短縮していた。出血量は48 g(7~565 g)、術後在院日数は中央値17日(10~85日)であった。合併症は吻合部の出血が3例、狭窄が2例で縫合不全は認めなかった。術後病理所見にて進行癌4例を認めたがEUS導入により正診率は向上した。リンパ節転移は3例、再発はpT2(SS)pN2の1例のみで術後4年3か月で癌性胸膜炎にて死亡した。

早期胃癌に対するLADGは手技的に安定し、経過も良好であるが、正確な術前診断が重要と思われた。

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INTRODUCTION

Since its contrivance and inception in a Japanese medical facility in 1991¹⁾, laparoscopy-assisted distal gastrectomy (LADG) for early gastric cancer has been performed with an increasing frequency. Though this surgical procedure has already been officially registered in the governmental medical fee payment table, it has not yet appeared as the standard surgical method in the Guideline for Treatment of Gastric Cancer.^{2,3)} Up to the present, LADG has been recommended only within the confines of investigational trials. One probable reason for such an inconsistent situation may be a lack of collective data from nation-wide surveillances or RCTs.

In this study, we retrospectively review and analyze our cases of LADG for early gastric cancer for an advocate of this procedure and for a modicum of special concern for extending its application to advanced gastric cancer.

METHOD

Patients and Analysis

Between April 2002 and October 2007, 40 patients preoperatively diagnosed with early gastric cancer underwent LADG, which was curative intended with lymphadenectomy.

Preoperative diagnostic method of early gastric cancer in the hospital consisted of gas-

troendoscopy, gastrofluoroscopy and endoscopic ultrasound, the latter of which was implemented in December 2002. The lesion for each case had an intramural invasion of cT1 (M, SM) and located at the L or M division of the stomach but the gastrointestinal physicians in the hospital abandoned endoscopic mucosal resection, EMR (Table 1).

The clinical and pathological records on all of the 40 cases were reviewed with particular reference to technical difficulty of LADG represented by surgery duration (operation time), hemorrhage (intraoperative bleeding) and sequels (postoperative complications). A special concern was also made of the influence on the applicability (indication) of LADG of the extent of spread represented by intramural invasion depth of tumor and lymph node involvement.

Surgical Procedure

Curative-intended LADG with D1+ α lymph node dissection used in the hospital had been described in detail elsewhere⁴⁾. α denoted #7 nodes for a cancer locating in the M division of the stomach and #7 nodes plus #8a nodes for a cancer in the L division²⁾. Briefly, lymph node dissection (lymphadenectomy) was totally accomplished laparoscopically, while gastrectomy and reconstruction of passage, extraperitoneally.

Nodal clearance was performed along the left gastric artery (#7 nodes) in addition to D1 node dissection: The greater omentum

Table 1 Patients Data

	Number	Range
Total number	40*	
Male	22	
Female	18	
Age (mean)	64.6(yrs)	45-83
Tumor		
Location		
M(body)	14	
L(antrum)	26	
Preoperative diagnosis of intramural invasion depth		cT1 (M or SM)

*The gastrointestinal physicians in the hospital abandoned to take EMR.

was divided using laparoscopic coagulating shears (an ultrasonic incision device). The left gastroepiploic vessels were dissected at the point proximal to the first branch or at their root as case in need. The right gastroepiploic vein and artery were divided individually at their root. The right gastric vessels were divided in the hepatoduodenal ligament. The lesser omentum was opened and the lymph nodes around the celiac axis were dissected.

A minilaparotomy incision, about 5 cm in length, was placed in the epigastrium, through which the skeletonized part of the gastroduodenum was pulled out of the abdominal cavity. The duodenum and stomach were excised and Billroth-I stapled anastomosis was performed.

RESULTS

The essential facts are contained in Table 2 – 6, which are largely self-explanatory and require only minor amplification.

Technical Difficulties in LADG

As Table 2 indicates, there was no case of LADG converted to open distal gastrectomy.

The operation time (duration of surgery) in

this series varied from 154 to 382 min with a median of 285 min. In the earliest 10 cases, it was from 280 to 382 min (median: 312 min), while in the latest 10 cases, it was largely reduced to a range of 154 to 278 min (median: 216 min)

The intraoperative blood loss (hemorrhage) ranged from 7 to 565 g (mean: 48 g)

There was no dehiscence of anastomosis (0%), but bleeding from the anastomosis occurred in 3 cases (7.5%). Passage disturbance through the anastomosis was observed in 2 cases (5%): one was caused by stricture and the other by functional stenosis, i.e., a variety of temporary motor dysfunction. Treatments given for these anastomosis-related complications were explained in Table 2. The length of hospital stay among the 40 patients widely varied from 10 to 85 days (median: 17).

Postoperative Pathological Analysis

The depths of intramural invasion determined by histological examination of the resected specimens were listed in Table 3: pT1 (M) in 19 cases (47.5 %), pT1 (SM) in 16 (40 %), pT2 (MP) in 2 (5 %) and pT2 (SS) in 2 (2 %). Positive lymph node metastases found in the dissected specimens were

Table 2 Technical difficulties in LADG

Conversion to open surgery		0 case (none)	
Operation time		Median	Range
	For the 40 cases (overall)	285 min	150 – 483 min
	For the earliest 10 cases	312 min	280 – 382 min
	For the latest 10 cases	216 min	154 – 278 min
Intraoperative hemorrhage	For the 40 cases (overall) ^A	48 g (mean)	7 – 565 g
Postoperative complications	Bleeding from the stapled B-I anastomosis ^B	3 cases	
	Disturbed passage through the stapled B-I anastomosis ^C	2 cases	
	Stricture	1 case	
	Stenosis	1 case	

^AHemorrhage occurred during the extra-abdominal anastomosis procedure.

^BBlood transfusion was given in all of the 3 cases. Endoscopic hemostatic cauterization was applied to in 1 case.

^CFor the patients with stricture of the stapled anastomosis, endoscopic balloon-dilatation was performed. For the patient with stenosis of the anastomosis, conservation with administration of a liquid meal was the treatment given. The stenosis was thought due to hypomotility of the residual stomach and edema of the gastric outlet. The patient recovered spontaneously.

Table 3 Pathological attributes of the tumors

	Attribute	Number of cases
Stage	IA	33(82.5%)
	IB	5(12.5%)
	II	0(0.0%)
	IIIA	0(0.0%)
	IIIB	1(2.5%)
Histological Type	pap	3(07.5%)
	tub1	19(47.5%)
	tub2	7(17.5%)
	por1	4(10.0%)
	por2	4(10.0%)
	sig	1(2.5%)
	muc	1(2.5%)
Invasion Depth	pM	19(47.5%)
	pSM	16(40.0%)
	pMP	2(5.0%)
	pSS	2(5.0%)
Lymph node metastasis	pN0	37(92.5%)
	pN1	2(5.0%)
	pN2	1(2.5%)

shown in Table 3: pN0 in 37 cases (92.5%), pN1 in 2 (5 %) and pN2 in 1 (2.5 %) Three patients with positive nodal involvement were explained in Table 4.

Inaccuracy in the preoperative diagnoses of invasion depth of tumor revealed by histological examination of the resected specimens was summarized in Table 5: pT2 (MP) for 2 patients (5 %) and pT2 (SS) for 2 patients (5 %). These 4 patients presumed to be with early gastric cancer turned out, after LADG, to be with advanced one.

DISCUSSION

We commenced a less invasive surgical method of LADG with lymphadenectomy for early gastric cancer in April 2002 when the governmental medical fee payment system acknowledged this procedure. We reported that LADG was less invasive but had a comparable curability to open surgery⁴⁾. We also reported that a clinical pathway implemented in the hospital for LADG gave the patients undergoing LADG the well-known benefits of a quicker recovery, an earlier

Table 4 Pathological diagnosis of nodal involvement

Serial case no.	Histologic type of tumor	Depth of intramural invasion	Lymph node metastasis	Stage of tumor (disease)
6	por2	pT2(SS)	pN2	IIIB
27	por2	pT1(SM)	pN1	IB
35	por1	pT1(SM)	pN1	IB

**Lymph node involvement was found exclusively in the tumors of poorly differentiated adenocarcinoma.

Table 5 Inaccurate preoperative diagnoses of mural invasion depth

Serial case no.	Histologic type of tumor	Depth of intramural invasion		Lymph node metastasis	Stage of tumor (disease)
		Preoperative	Postoperative		
5	por2	cT1(SM)	→ pT2(MP)	pN0	IB
6	por2	cT1(SM)	→ pT2(SS)	pN2	IIIB
7	tub1	cT1(SM)	→ pT2(SS)	pN0	IB
11	por2	cT1(SM)	→ pT2(MP)	pN0	IB

oral intake, an earlier ambulation and a shorter hospital stay⁵). As we experienced 40 cases of LADG for early gastric cancer, we evaluated the accumulated clinical and pathological data to advocate LADG as a safe and less invasive modality for cure and to discuss the applicability of this procedure even to advanced gastric cancer.

There was no notable technical difficulty in performing LADG. The operation time (surgery duration) largely reduced with experiences, and intraoperative blood loss stayed in an acceptable amount. The length of hospital stay postulated in the clinical pathway had been 10 to 14 day. There was a great variance in this issue which was, in most cases, caused by individual patient's request to stay in the hospital longer (so-called "social indication of hospitalization").

Complications related to stapling procedures for anastomosis in LADG have been reported in the JSES surveillance⁶. Though not specific to LADG, postoperative complications in this series were related to the staled anastomosis: bleeding from the anastomosis in 3 cases and passage disturbance through the anastomosis in 2 cases but no dehiscence. All of the 3 patients with anastomotic bleeding were given a whole blood transfusion of 2 to 8 unit. Besides, one patient needed endoscopic hemostatic cauterization. Thereafter, we have avoided this complication by stitches of bleeding points closely identified under direct vision during the extra-abdominal procedure.

The causes of 2 passage disturbance were: organic stricture of the anastomosis probably resulted from localized (regional) ischemia and functional stenosis probably resulted from a mismatch between the size of gastric outlet (i.e., the caliber of gastroduodenal anastomosis) and the receptacle volume of the remaining gastric part (i.e., the size of "residual stomach"). The treatment for the former was bougienage by a means of balloon-dilatation and for the latter conservation with a liquid meal. Thereafter, we

have employed meticulous maneuvers depicted in Figure 1 with a good result: To avoid the regional ischemia, a more than 2 cm distance (space) should be placed between the stapled gastroduodenal anastomosis and the stapled gastric closure (A), while, to avoid the functional stenosis, an adequate size of residual stomach should be prepared (B).

Although the indication for LADG in this study was confined to patients presumed to have mucosal or submucosal carcinoma, postoperative histological examination revealed a deeper than submucosal invasion (i.e., advanced gastric cancer) in 4 patients. Of these, 2 patients were with a pT2 (MP) tumor and other two with a pT2 (SS) tumor. Unfortunately enough, endoscopic ultrasound, an effective means of intramural infiltration diagnosis, had not yet been employed in the hospital.

All of the 3 patients with nodal metastases had a lesion of poorly differentiated adeno-

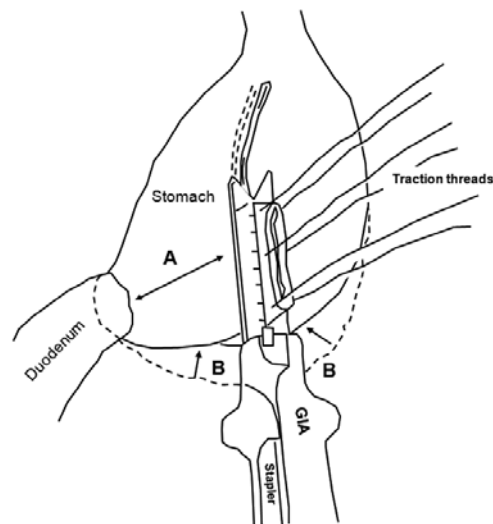


Fig. 1 Countermeasures to passage disturbance through the stapled gastroduodenostomy.
A. To avoid stricture, the anastomosis and the stapled gastric closure should be spaced by more than 2 cm (i.e., "not too close" to each other) not to jeopardize for blood flow to the anastomosis site.
B. To avoid functional stenosis, an adequate size (i.e., "not too big") of residual stomach should be prepared to match gastric outflow volume to the gastric outlet (i.e., the caliber of the stapled gastroduodenostomy).

carcinoma. For the 3 patients, postoperative chemotherapy with TS1 was given. Of these, 2 patients have been well with no sign of recurrence, but one patient had accumulation in the left pleural cavity 4 years after the surgery and died of pleural carcinomatosis 3 months later. Recurrence in this patient did not seem to be related to LADG skills. Nonetheless, as port site recurrence resulting from poor laparoscopic technique has been reported⁷⁾, caution should be exercised in patients undergoing potentially curative LADG.

Only one disadvantage found in LADG for early gastric cancer, when compared with open distal gastrectomy was a long operation time as previously reported⁵⁾. This disadvantage had, however, gradually been overcome with concentrated experience. Therefore, it is our conclusion that LADG with lymphadenectomy is a feasible and satisfactory method for cure of early gastric cancer. We can not overemphasize the need to adhere to an accurate preoperative diagnosis of the depth of intramural invasion of tumor.

There has been a trend to expand the indication of LADG to advanced gastric cancer, where, unlike in cases of early gastric cancer, a strict and secure nodal dissection is mandatory because of a high possibility of lymph node metastasis in advanced gastric cancer. The extent and degree of nodal dissection that should be achieved in LADG is the second-tier lymph node dissection, D2^{8,9)}. The dissection procedure in LADG, however, is technically difficult and the result may not be the same as in conventional open surgery. One problem is functional limitations of the apparatuses used and surgeons' skills. As the anatomical area to be dissected (i.e., peripancreatic region) contains large vessels to be clipped (bleeding) and is very easy to bleed (oozing), a meticulous and high-level manipulation must be exercised. Another problem is laparoscopic stapled

duodenotomy to facilitate node dissection^{8,9)}. If the stump of sectioned duodenum is damaged or too short for B-I stapled anastomosis, another more complicated reconstruction procedure such as Roux-en-Y gastrojejunostomy has to be taken^{10, 11)}. Unpremeditated dissemination or nodal involvement of higher levels seen in advanced cases is also a problem. Therefore, the efficacy of nodal dissection with LADG compared with conventional open gastrectomy requires further investigation before LADG can supplant open curative gastrectomy as the standard surgical method, as has been accomplished in laparoscopic cholecystectomy. It is our opinion that LADG can be utilized as a curative method for advanced cancer is still premature.

CONCLUSION

A retrospective analysis of 40 patients who underwent a curative LADG for early gastric cancer was carried out to evaluate the efficacy of this procedure. Acknowledging the obvious limitation of this study, a more liberal use of LADG for early gastric cancer appears to be resulting in benefits of patients. We will continue to use LADG; however, we again emphasize the importance of definitive statements of early gastric cancer which have to be obtained before surgery.

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