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Totally Laparoscopic Distal Gastrectomy for Elderly Patients with Gastric Cancer

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Abstract Introduction : This study evaluated the feasibility of totally laparoscopic distal gastrectomy (TLDG) in elderly patients with gastric cancer.

Methods : We retrospectively analyzed the data from 138 patients who underwent TLDG from April 2005 to March 2009. Of these 138 patients, 20 were older than 75 years of age, and 118 were 75 years of age or younger.

Results : The preoperative respiratory function and American Society of Anesthesiologists (ASA) –physical status were significantly worse in the elderly patients than in the younger patients ($P = 0.013$). Hypertension and respiratory disease were more common in the elderly patients than in the younger patients ($P = 0.032 / P = 0.005$). The findings for the following parameters were similar in the two groups : intraoperative blood loss, operation time, severe postoperative complication rate, time required to start a solid diet, and duration of postoperative hospital stay. The rate of major complications was not different between the two groups, although minor complications were more commonly observed in the elderly patients.

Conclusion : TLDG was found to be a safe procedure for elderly patients. This method can be used as one of the standard treatments for gastric cancer in elderly patients.

Key words : Elderly · Gastric cancer · Laparoscopic gastrectomy

Introduction

Among malignant diseases, gastric cancer is the second most common cause of death in Japan. The number of elderly patients with gastric cancer is anticipated to increase with the increasing number of elderly patients^{1,2)}. In Japan, gastric cancer is often detected early because of mass screening and endoscopic examination.

Laparoscopy-assisted gastrectomy and lymph node dissection with curative intent have been recommended and practiced for the treatment of early gastric cancers in Japan since the first report of the use of laparoscopy-assisted distal gastrectomy (LADG) with a Billroth I anastomosis for a patient with gastric cancer in 1994³⁾.

Age is an independent factor affecting the mortality and morbidity of patients undergoing

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gastrectomy^{4)~7)}. Therefore, minimally invasive surgery, such as an LADG, may have a greater impact on the survival of the elderly population than of the younger population by reducing cardiorespiratory complications, shortening the duration of hospital stay, and permitting a more rapid return to physical activities. Totally laparoscopic distal gastrectomy (TLDG) is defined as a method used to perform both resection and anastomosis intracorporeally by using a laparoscopic technique. TLDG has several advantages over LADG, including smaller wounds, less invasiveness, and greater possibility of secure ablation⁸⁾. However, the introduction of TLDG for all patients remains controversial because it is generally believed that the operation time is longer and the surgical procedure is more difficult in TLDG than in LADG. To elucidate whether TLDG is a safe procedure for elderly patients, we compared the factors associated with TLDG in patients older than 75 years of age to those younger than or of 75 years of age.

Patients and Methods

Patients

Between April 2005 and March 2009, 138 patients underwent TLDG for the treatment of gastric cancer at the National Kyushu Cancer Center, Japan. Of these 138 patients, 118 were \leq 75 years of age, and 20 patients were $>$ 75 years of age. TLDG was performed in patients with cT1N0M0 or T2N0M0 gastric cancers regardless of their gender, age, body mass index, or comorbidities. The concurrent diseases, operation time, blood loss, duration of hospital stay, and postoperative morbidity were compared between the two groups. The rate of change of body weight and the hematological data were measured in the period from before the operation to 1 year after TLDG. The following information was collected from previous medical and anesthesia records: age, gender, operation time, estimated blood loss, findings of blood and lung function tests, pathological findings, and postoperative complications or

parenteral nutritional support.

Operative procedures

Distal gastrectomy and lymph node dissection were performed according to the guidelines of the Japanese Gastric Cancer Association⁹⁾. The patient was placed under general anesthesia in the supine position. A 12-mm trocar was inserted in the umbilical region by using the cut-down method. A laparoscope was inserted through the trocar, and the liver was pulled up using a Penrose drain and a J-shaped retractor¹⁰⁾. The detailed surgical procedure has been reported previously⁸⁾¹⁰⁾. The distal stomach was removed and reconstructed using the Billroth I or Roux-en-Y method. The Billroth I reconstruction was performed by using a delta-shaped anastomosis¹¹⁾, and the Roux-en-Y reconstruction was performed using a linear stapler¹²⁾. Both anastomoses were completed intracorporeally.

Definitions of complications

Intraoperative complications were defined as conditions that required either an open conversion or procedures performed other than the planned surgery for whatever reason. Unexpected bleeding was defined as intraoperative bleeding of over 350 ml. Minor postoperative complications were defined as abdominal findings not requiring medication during the postoperative course, or systemic complications requiring pharmacological treatment. Major postoperative complications were defined as complications requiring surgical or radiological intervention.

Statistical analysis

Statistical analysis was performed by using the JMP 7 software package. All values are expressed as the mean \pm standard deviation. The chi-square test and Fisher's exact test were used for statistical analysis.

Results

Clinicopathological findings

The characteristics of the 138 patients are summarized in Table 1. The mean ages of the patients in the elderly and younger age groups were 80.8 ± 3.2 years and 60.5 ± 9.1 years, respectively. The gender and body mass index (BMI), stage of gastric cancer, extent of lymph node dissections, and type of reconstructions were not significantly different in the two groups. However, the vital capacity and ratio of the forced expiratory volume in one s were significantly

lower in the elderly group than in the younger group. In addition, the hemoglobin and albumin levels were significantly lower in the elderly group than in the younger group. Severe comorbidity (American Society of Anesthesiologists [ASA] class 3) was observed in 4 patients in the elderly group and in 8 patients in the younger group.

Concurrent disease

Table 2 shows the concurrent diseases in both groups. Of the 20 elderly patients, 8 (40.0%) had hypertension, 6 (30.0%) had a respiratory disease

Table 1 Clinicopathologic characteristics of patients who underwent totally laparoscopic distal gastrectomy

Characteristic		Age > 75 (n=20)	Age ≤ 75 (n=118)	p value
Mean age, years		80.8 ± 3.2	60.5 ± 9.1	< 0.001
Gender	M	10	65	0.67
	F	10	53	
BMI		22.5 ± 2.9	22.3 ± 3.1	0.34
VC		2678.5 ± 550.2	3403.9 ± 823.0	< 0.001
%FEV [#]		69.1 ± 10.5	77.1 ± 8.9	0.002
Hematological data	Hemoglobin (g/dl)	12.6 ± 2.0	13.7 ± 1.4	0.02
	Protein (g/dl)	6.90 ± 0.53	7.20 ± 0.49	0.03
	Albumin (g/dl)	4.00 ± 0.46	4.36 ± 0.31	< 0.001
ASA*	1	3	55	0.013
	2	13	55	
	3	4	8	
Cancer stage	Ia	17	93	0.57
	Ib	1	17	
	II	2	5	
	IIIa	0	3	
Extent of lymph node resection	D1 + α , β	33	85	0.91
	D2	6	33	
Type of operation	Billroth I	14	100	0.1
	Roux-en Y	6	18	

[#]%FEV: The ratio of the forced expiratory volume in 1 second.

*ASA: American Society of Anesthesiologists-physical status

Table 2 Concurrent diseases

Characteristic	Age > 75 (n = 20)	Age ≤ 75 (n = 118)	p value
Hypertension	8	22	0.032
Respiratory disease	6	10	0.005
Cardiovascular disease	3	9	0.279
Diabetes mellitus	5	12	0.516
Malignant disease	4	7	0.031
Liver disease	0	6	0.302
Operation history	0	7	0.264

such as emphysema, 3 (15.0%) had cardiovascular disease, 5 had diabetes mellitus, and 4 had malignant diseases. The most frequent concurrent disease in both groups was hypertension; moreover, hypertension and respiratory disease were significantly more frequent in the elderly patients than in the younger patients. Concurrent malignant diseases were also more frequently detected in the elderly patients than in the

younger patients.

Surgical and perioperative outcomes and postoperative complications

There was no difference in the operation time, estimated blood loss, and time required to start first solid diet (Table 3). The C-reactive protein level was slightly higher in the elderly patients than in the younger patients (Table 3). The

Table 3 Surgical outcomes of totally laparoscopic distal gastrectomy

Characteristic	Age > 75 (n = 20)	Age ≤ 75 (n = 118)	p value
Operation time (min)	342.6 ± 102.0	318.46 ± 66.3	0.53
Estimated blood loss (g)	104.8 ± 93.5	121.7 ± 146.09	0.86
Time to first diet (day)	3.55 ± 0.68	3.45 ± 1.00	0.26
CRP* (mg/dl)	4.54 ± 3.98	3.41 ± 4.09	0.06
Postoperative hospital stay (day)	25.5 ± 36.4	14.7 ± 6.5	0.01

* 7 days after operation

Table 4 Intraoperative complications

Characteristic	Age > 75 (n = 20)	Age ≤ 75 (n = 118)	p value
Open conversion	0	2	
Bleeding	0	8	
Re-anastomosis	0	1	
total	0	9*	0.201

*Duplicated cases were included

Table 5 Postoperative complications

Characteristic	Age > 75 (n = 20)	Age ≤ 75 (n = 118)	p value
Minor complication			
Wound infection	4	7	
Cholecystitis	0	1	
Lymphatic leakage	1	0	
Arrhythmia	1	0	
Delirium	0	1	
total	6	9	0.003
Major complication			
Leakage or intraabdominal fluid collection	1	2	
Leakage of pancreatic juice	0	3	
Liver infarction	0	1	
Colon injury	0	1	
Anastomosis bleeding	0	1	
Ileus	1	2	
total	2*	10*	0.5753

*Duplicate cases were included

Table 6 Changes in body weight and hematological data 1 year after totally laparoscopic distal gastrectomy

Characteristic	Age > 75 (n = 20)		Age ≤ 75 (n = 118)		p value
	Preoperation	1 year	Preoperation	1 year	
Body weight (kg)	51.7 ± 7.9	44.5 ± 6.4	58.3 ± 10.9	51.4 ± 9.8	
Rate of change (%)	12.7 ± 8.9		10.7 ± 6.7		0.328
Hemoglobin (g/dl)	12.7 ± 2.0	11.5 ± 1.8	13.7 ± 1.5	12.7 ± 1.3	
Rate of change (%)	8.0 ± 11.0		6.7 ± 6.1		0.768
Total protein (g/dl)	6.90 ± 0.53	6.75 ± 0.41	7.21 ± 0.49	6.92 ± 0.46	
Rate of change (%)	1.4 ± 7.7		3.7 ± 6.9		0.424
Albumin (g/dl)	3.99 ± 0.46	3.91 ± 0.48	4.36 ± 0.31	4.21 ± 0.24	
Rate of change (%)	0.8 ± 6.56		3.3 ± 6.5		0.120

duration of postoperative hospital stay was significantly longer in the elderly patients than in the younger patients (Table 3). Tables 4 and 5 summarize the perioperative complications. Two cases were converted from laparoscopic gastrectomy to open gastrectomy in the younger group. Unexpected bleeding (over 350ml) occurred in eight patients. One case in younger patient was converted open gastrectomy because of difficulty of anastomosis. Another case was converted open because of uncontrollable bleeding. Postoperative complications were categorized into minor or major complications. Minor complications were significantly more frequent in the elderly group because of the higher incidence of wound infection. However, no significant differences in the incidence of major complications such as anastomotic leakage, anastomotic bleeding, and colon injury were observed in the two groups. No surgical mortality occurred in either group.

Differences in clinical features 1 year after the gastrectomy

The preoperative body weight of the elderly group was lower than that of the younger group ; however, the decrease in body weight one year after TLDG was not different between the two groups. The levels of hemoglobin, total protein, and albumin were also not significantly different between the two groups (Table 6).

Discussion

Some previous studies have suggested that postoperative morbidity, mortality, or long-term survival were not associated with open gastrectomy for gastric cancer in the elderly or younger patients⁵⁾¹³⁾. However, other studies have shown high incidences of postoperative morbidity and mortality among elderly patients with gastric cancer who underwent open gastrectomies¹⁴⁾¹⁵⁾. Many surgeons believe that the laparoscopic approach for gastric surgery, rather than open surgery, would improve the morbidity and mortality of elderly patients. LADG is generally

used for the treatment of gastric cancer because this type of surgery is beneficial³⁾¹⁶⁾. Recently, TLDG has been used for the treatment of gastric cancer⁸⁾¹⁷⁾¹⁸⁾. TLDG is a method in which both resection and anastomosis are performed intracorporeally using laparoscopic procedures. Compared to other surgical procedures, TLDGs are associated with much less surgical trauma, less pain, more rapid recovery of gastrointestinal function, and shorter duration of hospital stay and impaired respiratory function⁸⁾¹⁹⁾. Previous studies have shown favorable results with TLDGs and have shown that this approach along with lymph node dissection is a technically feasible and acceptable surgical modality for treating gastric cancers ; moreover, the morbidity rate of patients undergoing this procedure is not high, and this procedure has several advantages over LADG⁸⁾. Therefore, TLDG should be used for all patients, particularly elderly patients because of its surgical advantages. However, the introduction of TLDG has been controversial because TLDG requires more time, and the surgical procedures tend to be more difficult than those for LADG²⁰⁾. In the current study, the operation time in the elderly group was 342.6 min, which was longer than that for a conventional open gastrectomy ; however, it was not longer than that for an LADG⁸⁾.

This study confirms that TLDG is a safe and useful procedure even for elderly patients. The average age of the elderly patients was 20 years older than that of the younger patients. Therefore, the findings of the blood analysis and respiratory function tests were significantly different between the groups (Table 1). Despite the differences in the patients' background, the length of the operation, estimated blood loss, time interval before starting the first solid diet, and rate of severe complications were not significantly different between the groups. Being elderly did not affect the rate of postoperative complications. The duration of postoperative hospital stay was slightly longer in the elderly group than in the

younger group. A 76-year-old patient who had anastomosis leakage and intraabdominal abscess recovered and was discharged after 174 days; the difference in postoperative hospital stay and levels of C-reactive protein after 7 postoperative days may be attributed to this particular case. Although previous reports have documented difficulties in performing laparoscopic surgeries in obese patients, we found that the body mass index (BMI) of the younger and elderly patients was not significantly different. Therefore, we evaluated the feasibility of performing TLGD in obese patients. On the basis of their BMI, the patients were divided into 2 groups: non-obese group (BMI < 25.0) and obese group (BMI ≥ 25.0). We found no differences in the duration of surgery, estimated blood loss, and rate of complications between the two groups (data not shown).

In this analysis, minor complications, such as wound infection, were more frequent in the elderly patients than in the younger patients. Most of the wound infections were in the umbilical port site. A 3- to 4-cm incision was made in the center of the umbilical port site, and the resected stomach was pulled out of the wound into a plastic bag. This method allows for the smallest and least noticeable wound for TLGD. However, the umbilical port site was sometimes infected possibly because of the indigenous bacteria, and complete sterilization may have been difficult. Umbilical port site infections were common in the early cases of TLGD. However, since the cleaning of the umbilical site 1 day before the operation was introduced in 2009, cases of umbilical port site infections have not been observed. This finding suggests that indigenous bacteria may have been responsible for the previously observed umbilical port site infections. The occurrence of umbilical port site infections is associated with all types of laparoscopic surgery. The rate of umbilical port site infection after laparoscopic cholecystectomy is 8–9%^{21)–23)}, and this finding was similar to that of our study. However, the infection rate associated with laparoscopic gastrectomy reported in

previous studies is lower than that observed in our study^{16)24)–26)}. The resected stomach is not removed from the umbilical port site in LADGs, instead it is removed via a small wound in the upper abdomen. The rate of wound infection after laparoscopic surgery may also be underreported²³⁾.

It is unclear why there were more umbilical port site infections in the elderly patients. The higher rate of infection might be caused by the greater amount of bacteria in the umbilicus of elderly patients than in younger patients; however, umbilical flora is reported to be not responsible for wound infection after laparoscopic surgery²⁷⁾.

An earlier study in elderly patients showed a short-term advantage of the laparoscopic approach²⁶⁾²⁸⁾²⁹⁾. However, the long-term effects remain controversial. The changes in body weight and levels of protein, albumin, and hemoglobin were examined 1 year after the operation. Although the level of hemoglobin, total protein, and albumin were lower in elderly patients than in the younger patients before the operation, the rate of change of the hematological data was not different in the two groups. The body weight of both the elderly and younger group apparently decreased after TLGD; however, the rate of the change in body weight was not different between the two groups. The change in postoperative body weight is not associated with age in patients undergoing an open distal gastrectomy³⁰⁾.

In conclusion, TLGD is considered to be a safe and effective procedure for elderly patients, since there were no significant differences in the estimated blood loss or in the rate of complications, in spite of the differences in the patients' backgrounds. This method can therefore be recommended as one of the standard treatments for elderly patients.

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76 歳以上高齢者に対する完全鏡視下幽門側胃切除術の検討

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【はじめに】 高齢者に対する腹腔鏡下幽門側胃切除術（以下 TLDG）の安全性とその有用性は確立されていない。本論文では、76 歳以上の高齢者に対する TLDG の安全性と有効性を 75 歳以下の症例と比較検討した。

【症例】 2005 年 4 月～2009 年 3 月までの間に行われた完全鏡視下幽門側胃切除 138 例のうち、76 歳以上 20 例と 75 歳以下の 118 例について、術中・術後合併症、術後経過などについて比較した。

【結果】 術前の ASA status は高齢者群で有意に悪く ($P = 0.013$)、高血圧と呼吸疾患の合併は高齢者で多かった ($P = 0.032/P = 0.005$)。術中の出血量や手術時間、入院日数などに両者の違いはなかった。術後合併症は、重症なものは両者に違いはなかったが、創感染など軽微なものが高齢者に多かった。術後 1 年後の体重減少率や血液データなどに両者の違いは認められなかった。

【結語】 背景因子には違いはあるが、高齢者の TLDG は若年者と変わらず安全に施行可能であると考えられる。