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Risk factors associated with complication
following gastrectomy for gastric cancer :
Prospective analysis based on the
Clavien-Dindo system

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Risk factors associated with complication
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Prospective analysis based on the
Clavien-Dindo system

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ABSTRACT

Risk factors associated with complication following gastrectomy for gastric cancer : Prospective analysis based on the Clavien-Dindo system

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Introduction: The Clavien-Dindo classification has been advocated as being superior to the current classification system of postoperative complications which does not take into consideration the severity of complications. The purpose of this study was to analyze all postgastrectomy complications and to identify risk factors related to postoperative complications.

Methods: Complication data was collected prospectively through weekly conferences with all gastric adenocarcinoma patients who underwent gastrectomy between March 2011 and February 2012 at Seoul National University Hospital. Complications were categorized according to the

Clavien-Dindo classification.

Results: Out of the 881 patients who underwent gastrectomy, 197 (22.4%) had complications with 254 events (28.8%). The numbers of grade I, II, IIIa, IIIb, IVa, and V complications according to the Clavien-Dindo classification, were 71 (8.1%), 58 (6.6%), 108 (12.3%), 8 (0.9%), 5 (0.6%), and 4 (0.5%), respectively. Total gastrectomy (OR, 2.14; 95% CI, 1.40-3.28, $p < 0.001$), combined resection (OR, 1.99; 95% CI, 1.30-3.05, $p = 0.002$), and age of 60 years or more (OR, 1.69; 95% C.I., 1.20-2.39, $p = 0.003$) were found to be significant independent risk factors for overall complications of gastrectomy. ASA score 3 or 4 (OR, 3.67; 95% CI, 1.52-8.89, $p = 0.004$) and moderate or severe malnutrition (OR, 1.76; 95% C.I., 1.01-3.08, $p = 0.047$) with total gastrectomy, combined resection and age of 60 years or more were significant risk factors for systemic complications

Conclusions: Prospective collection and systemic categorization of complication data may be useful for identifying clinical events and defining meaningful complications. Extensive gastric cancer surgery in old age may increase the risk of postoperative complications.

Keywords: complication, gastric cancer, Clavien-Dindo classification

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List of abbreviations

AST/ALT, aspartate aminotransferase/alanine
aminotransferase

TPN, total parenteral nutrition

G/A, general anesthesia

ICU, intensive care unit

CRRT, continuous renal replacement therapy

ASA, American Society of Anesthesiologist

BMI, body mass index

Cx, complication

Op, operation

TG, total gastrectomy

Introduction

Postoperative complications of gastric cancer surgery result in several events, including longer hospital stays, increased medical expenses, and delayed adjuvant chemotherapy. Although there have been recent advances in operative techniques and perioperative management, they have not considerably decreased postoperative complication rates, which vary from 15% to 25% at various centers¹⁻⁵. However, most studies have been based on retrospective reviews of medical records or have been performed without consideration of the severity of each complication or with their own criteria. Therefore, it is probable that not all complications have been fully documented, and it is difficult to compare complication rates reliably and directly.

Since 2004, the Clavien-Dindo classification has been advocated as being superior to the current classification system of postoperative complications which does not take into consideration the severity of complications^{6,7}. There have also been an increasing number of studies using this classification for assessing gastric cancer surgery⁸⁻¹⁰. However, there are still some ambiguous portions to apply this classification to gastric cancer surgery.

The aims of this study were to analyze postgastrectomy complications for gastric adenocarcinoma by prospectively collecting complication data and by classifying the complications according to severity and type. In addition, risk factors related to postoperative complications were investigated.

Materials and methods

We collected data prospectively on consecutive patients with gastric adenocarcinoma who underwent gastrectomy at Seoul National University Hospital between March 2011 and February 2012. Postoperative course including complications in patients were followed up by the attending surgeon every day. And together with all other faculty at a weekly conference, we tried to define the type and classification of the complications and to make a consensus for uniformed application of Clavien-Dindo grading to all operations.

At our center, D1 lymph node dissection was restrictively conducted in non-curative setting or very high risk patients. Basically, laparoscopic gastrectomy with more than D1+ lymph node dissection was performed on patients preoperatively diagnosed with clinically early gastric cancer (EGC), while open gastrectomy with D2 lymph node dissection was conducted on patients with advanced gastric cancer (AGC)¹¹. When the tumor was located in the lower third of the stomach, the modified double stapling Billroth I reconstruction following distal gastrectomy (DG) was usually performed¹². However, if the tumor extended to the upper part of the stomach, or was close to the pylorus, Billroth II gastrojejunostomy was performed.

For Borrmann type IV AGC or AGC located in the upper third of the stomach, total gastrectomy (TG) was performed. Depending on the

operator's preference, either TG or proximal gastrectomy was performed for EGC in the upper third, and pylorus-preserving gastrectomy or DG was performed for EGC in the middle third.

Various parameters were collected through medical records for risk factor analysis: age, sex, BMI, a history of previous surgery, operation method (open gastrectomy vs. laparoscopic gastrectomy), American Society of Anesthesiologist (ASA) score, operation time, the extent of resection, the extent of lymph node dissection, combined resection, nutritional status using SNUH-NSI (assessment tool of our hospital)¹³, and 7th TNM staging.

Definition and classification of complications

We collected data regarding early complications reported within 30 days of surgery. Patient who were discharged and returned to the emergency department or was readmitted to the hospital via outpatient clinic, was defined as one with complications. We grouped complications into 2 categories: local and systemic.

Local complications included the followings; A wound problem was defined as seroma, hematoma, infection, or dehescence of the wound. Fluid collection was defined as loculated fluid collection confirmed by CT scan. Intra-abdominal bleeding was defined as hemorrhage confirmed by CT scan or nasogastric tube drainage. Intraluminal

bleeding was defined as bleeding confirmed by nasogastric tube drainage or endoscopy. Stenosis was noted only if it was demonstrated by endoscopy or upper gastrointestinal series (UGIS). Ileus/motility disorder was defined as delayed oral intake with delayed intestinal activity but no apparent stenosis. Anastomotic leakage was defined as such leakage confirmed by UGIS, fistulography or endoscopy, and pancreatic leakage was defined as elevated amylase of percutaneous drainage (3 times the upper normal limit of serum amylase). Vascular insufficiency was defined as insufficient blood flow to any organs associated with surgical procedures, including infarction of the remnant stomach, spleen, and liver.

Systemic complications included pulmonary complications, such as atelectasis, pleural effusion or pneumonia; urinary complications, such as voiding difficulty or urinary tract infection; renal complications, such as acute renal failure; hepatobiliary complications, such as significantly elevated liver enzymes (double of the upper normal limit) or acute cholecystitis; cardiac complications, such as arrhythmia, angina, or myocardial infarction; endocrine complications, such as diabetic ketoacidosis or hypothyroidism; neurologic complications, such as transient ischemic attack, brain infarct or hemorrhage; vascular complications, such as deep vein thrombosis; and infections, such as phlebitis or pseudomembranous colitis.

We classified complications according to the severity using Clavien-Dindo classification (Table 1). In case of wound repair, if the wound was approximated at bed side, it was classified as grade I; grade IIIa, if the wound was repaired under local anesthesia in operation theatre; and grade IIIb, if repaired under intravenous and inhalation anesthetics.

Statistical analysis

Statistical analysis was performed with the χ^2 test, Fisher's exact test, and independent t test using SPSS® software version 18.0 (SPSS Inc, Chicago, IL, USA). A binary logistic regression model was used for multivariate analysis. Variables with a univariate $p < 0.10$ were considered in a multivariate analysis. A p value of < 0.05 (2-sided) was considered significant.

This study was approved by the Institutional Review Board of our hospital (H-1305-043-488)

Results

Patient characteristics

The clinicopathological characteristics of total 881 patients are summarized in Table 2.

There were 563 male(63.9%) and 318 female(36.1%), with mean age of 59.6 ± 12.4 years (range 16 to 95 years). The mean BMI was 23.6 ± 3.1 kg/m². By ASA score, 52.8% of the patients were classified as score 2 or more. In terms of extent of resection, distal gastrectomy was most commonly performed (539 cases, 61.2%). Open and laparoscopic gastrectomy were performed in 447 (50.7%) and 434 (49.3%) cases. There were 128 cases (14.5%) of gastrectomies that accompanied combined resection. Forty-six cases of combined resections were performed in order to achieve R0 resection of gastric cancer including 29 cases of splenectomy; 5 cases were due to intraoperative event; 77 cases were for treatment of concomitant disease including 46 cases of cholecystectomy.

Postoperative complications

Of 881 patients who underwent gastrectomy, 197 (22.4%) developed complications, which had 254 events (28.8%) of clinical manifestations. The numbers of Clavien-Dindo grade I, II, IIIa, IIIb, IVa, IVb, and V complications were 71 (8.1%), 58 (6.6%), 108 (12.3%), 8 (0.9%), 5 (0.6%), 0 (0%), and 4 (0.5%), respectively.

The local complication rate was 20.0%, and the systemic complication rate was 8.8% (Table 3). Among local complications, wound problems, fluid collection, and motility disorders were relatively common (5.2%, 4.3%, and 4.0%, respectively). Complications of vascular insufficiency included partial splenic infarctions relieved spontaneously (n=1) or treated by antibiotics (n=2). Most cases of anastomotic leakage required intervention (16/19 cases). Reoperation under intravenous or inhalation anesthesia was performed on 8 patients (0.9%) at grade IIIb: 5 patients due to intra-abdominal bleeding, 2 patients due to wound problems, and 1 patient due to anastomotic leakage. As for systemic complications, pulmonary and hepatobiliary complications were common (4.2% and 1.2%, respectively). There were 4 deaths (grade V) due to anastomosis leakage, cardiac disease, neurologic disease, or suicide.

Complication rates according to variables

Figure 1 shows complication rates according to different age groups. The overall complication rate was significantly different between patients aged ≤ 60 years and those aged >60 years (17.4% versus 27.1%, $P=0.001$). Complication rates between 6 age groups showed significant difference in overall ($P=0.006$), grade IIIa and over ($P=0.005$), and systemic complication ($P<0.001$). And the proportion of ASA score 2 or more showed significant difference. ($P<0.001$). Deaths occurred only in patients in their 70s and 80s.

In terms of operation method, there were significant differences in patient characteristics, especially age, operation type, and staging between the open and laparoscopic groups. In patient who underwent distal gastrectomy, the

complication rates of open and laparoscopic gastrectomy groups were 21.6% and 14.8%. In patients with T1 gastric cancer, there were also significant differences in patient characteristics, especially age between the open and laparoscopic gastrectomy groups (61.7 ± 11.3 vs. 57.5 ± 11.1 , $p < 0.001$). Complication rates were also higher in the open gastrectomy group than in the laparoscopic gastrectomy group (23.1% vs. 16.6%). However, it was not statistically significant in multivariate analysis.

In our institution, there were 3 surgeons. Of 881 cases, operators A, B, and C performed 354, 343, and 184 surgeries, respectively. There were no significant differences between operators A, B, and C in the overall complication rate (21.9% vs. 20.6% vs. 22.4%; $p = 0.992$) and complication rates (11.7% vs. 11.2% vs. 14.8%; $p = 0.463$) of grade IIIa and over.

Risk factors for complications

In terms of overall complication, higher complication rates correlated with age of 60 years or more, open surgery, total gastrectomy, combined resection, malnutrition status, and higher TNM staging in univariate analysis (Table 4). In multivariate analysis, total gastrectomy (OR, 2.14; 95% CI, 1.40-3.28), combined resection (OR, 1.99; 95% CI, 1.30-3.05), and age of 60 years or more (OR, 1.69; 95% C.I., 1.20-2.39) were significant risk factors for overall complications; total gastrectomy (OR, 1.86; 95% C.I., 1.12-3.09) and age of 60 years or more (OR, 1.67; 95% C.I., 1.08-2.59) were significant risk factors for the complications of grade IIIa and over (Table 5).

In terms of complication type, total gastrectomy (OR, 1.94; 95% CI, 1.22-3.06), combined resection (OR, 1.88; 95% CI, 1.19-2.95), and age of 60 years or more (OR, 1.55; 95% C.I., 1.07-2.26) were significant risk factors for local complications; ASA score 3 or 4 (OR, 3.67; 95% CI, 1.52-8.89), total gastrectomy (OR, 3.63; 95% C.I., 1.93-6.85), age of 60 years or more (OR, 2.44; 95% CI, 1.32-4.50), combined resection (OR, 2.41; 95% CI, 1.34-4.34), and moderate or severe malnutrition (OR, 1.76; 95% C.I., 1.01-3.08) were significant risk factors for systemic complications (Table 6).

Discussion

Surgery still remains the main method for successful treatment of gastric cancer, and the incidence of postoperative complications can be regarded as an index showing the outcomes of surgical treatment. However, the lack of consensus on how to define and grade adverse postoperative events has greatly hampered the evaluation of surgical procedures. The classification of postoperative complications should be simple, reproducible, flexible, and applicable irrespective of the cultural background.⁷ Such requirements are met by the Clavien-Dindo classification. We can apply this classification to many surgeries, including gastric cancer surgery^{8-10, 14-17}. The inaccurate and often confusing term, "major and minor complications," is disappearing from the area of surgery and being replaced by simple and easily understood Clavien-Dindo classification. However, an additional classification in terms of local and systemic complications is needed. We analyzed postgastrectomy complications in gastric adenocarcinoma cases by collecting complication data and by classifying them according to severity using the Clavien-Dindo classification. We were able to easily apply this classification to our cases because our data collected from the database and discussed at weekly conference. Our previous retrospective study reported that the overall complication rate after gastric cancer surgery was 17.4% and that the rates of surgical and non-surgical complications were 14.7% and 3.3%, respectively¹. In the present study, overall, local, and systemic complication rates were

16.1%, 14.4%, and 6.3%, respectively, except for grade I complications. This may be due to the difference between retrospective and prospective studies. Most studies did not include grade I complication cases^{2-4, 14}.

In the present study, multivariate analysis showed no significant differences in the operation method, the extent of lymph node dissection, and TNM stages. These results suggest that D2 lymph node dissection can safely apply to the standardized center. Overall complication rates have been reported higher after total gastrectomy than after distal gastrectomy because severe complications, including esophagojejunal anastomotic leakage, occurred more frequently after total gastrectomy^{18,19}. In our study, total gastrectomy was also associated with a higher overall complication rate; however, there were no significant differences in the incidence of anastomotic leakage between total gastrectomy and subtotal gastrectomy (1.9% vs. 2.2%).

Although some authors have concluded that age did not increase the incidence of postoperative morbidity^{14,20}, many studies have reported that age was a significant risk factor for postoperative complications^{1,4,21}, which are consistent with our results. In terms of complication type, systemic complication rates showed higher tendency with increased age in our study. This might be influenced by comorbidity in addition to age factor because the proportion of ASA score 3 or 4 were considerably higher in age of 70s or 80s. Patients with heart or liver disease were at higher risk of morbidity following radical surgery of gastric cancer²², and an important risk factor for postoperative complications after laparoscopic gastrectomy is reported to be the presence of comorbidity in a large-scale multicenter study²³. As for body

weight, there is continuing controversy regarding correlation between BMI and postoperative complications^{24,25}. In the present study, complication rates were rather higher in patients with lower BMIs. Although malnutrition has been proved to be a risk factor for only systemic complications in this study, several studies have demonstrated that malnutrition increases the overall postoperative complication rate²⁶⁻²⁸.

In conclusion, prospective collection and categorization of complication data may be useful for identifying clinical events and defining meaningful complications. In the present study, the overall complication rate was 22.4%, and the complication rate requiring intervention was 12.4%. The mortality rate was 0.5%. The results of the present study suggest that age of 60 years or more, total gastrectomy, and combined resection may be risk factors for postgastrectomy complications in gastric cancer.

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Table 1. Classification of the complications after gastrectomy (adapted from Clavien-Dindo classification⁶)

Grade	Definition	Examples
I	Any deviation from normal postoperative course Conservative management	Delayed oral intake due to ileus/motility disorder Wound problem treated in bedside (stapler reapply) Atelectasis requiring physiotherapy Transient hepatic function abnormality(AST,ALT>100IU/L) under observation Bladder dysfunction requiring urinary catheterization
II	Pharmacologic treatment, TPN, Blood transfusion	Infection requiring antibiotics (wound infection, phlebitis, fluid collection, pneumonia) Stenosis and anastomosis leakage and prolonged ileus/motility disorder requiring parenteral nutrition Packed RBC transfusion due to active postoperative bleeding or severe anemia Tachyarrhythmia requiring β -receptor antagonists for heart rate control Transient ischemic attack requiring treatment with anticoagulants Delirium requiring anti-psychotic drug
IIIa	Intervention (under non G/A)	Closure of wound under local anesthesia Fluid collection, anastomosis leakage and pleural effusion requiring percutaneous drainage Intraabdominal/intraluminal bleeding, anastomosis leak and stenosis requiring radiologic and endoscopic intervention
IIIb	(under G/A)	Closure of wound under intravenous and inhalation anesthesia Anastomosis leakage, intraabdominal bleeding requiring relaparotomy

IVa	ICU care (single organ dysfunction)	Lung failure due to pneumonia requiring mechanical ventilation CRRT for acute renal failure
IVb	(multiple organ dysfunction)	
V	Death	Any cause leading to death in hospital during postoperative care or within postoperative 30 days

Table 2. Patient characteristics

Variables	Total (N=881)
Age (years)	59.6 ± 12.4 (range 16-95)
Sex ratio (M : F)	563: 318 (1.8 : 1)
BMI (kg/m ²)	23.6 ± 3.1
ASA score	
1	416 (47.2%)
2	417 (47.3%)
3	45 (5.1%)
4	3 (0.3%)
Malnutrition (SNUH-NSI)	
Low	559 (63.5%)
Moderate	240 (27.2%)
High	80 (9.1%)
Previous abdominal operation	
No	685 (77.8%)
Yes	196 (22.2%)
Extent of resection	
Distal gastrectomy (DG)	539 (61.2%)
Pylorus-preserving gastrectomy (PPG)	137 (15.6%)
Proximal gastrectomy (PG)	40 (4.5%)
Total gastrectomy (TG)	165 (18.7%)
Operation method	
Open	447 (50.7%)
Laparoscopic	434 (49.3%)
Lymph node dissection	
<D2	295 (33.5%)
D2	586 (66.5%)
Combined resection	

No	753 (85.5%)
Yes	128 (14.5%)
Operation time (min)	180.0 ± 69.4
TNM staging (AJCC 7 th)	
I	566 (64.2%)
II	112 (12.7%)
III	182 (20.7%)
IV	21 (2.4%)

Table 3. Detailed items grouped as local and systemic complications

Local Cx	Total	Grade \geq IIIa	Systemic Cx	Total	Grade \geq IIIa
Wound problem	46 (5.2%)	42 (4.8%)	Pulmonary	37 (4.2%)	15 (1.7%)
Fluid collection	38 (4.3%)	25 (2.8%)	Urinary	8 (0.9%)	0
Intraabdominal bleeding	12 (1.4%)	8 (0.9%)	Renal	3 (0.3%)	0
Intraluminal bleeding	5 (0.6%)	1 (0.1%)	Hepatobiliary	12 (1.4%)	1 (0.1%)
Stenosis	10 (1.1%)	8 (0.9%)	Cardiac	2 (0.3%)	2 (0.2%)
Ileus/ Motility disorder	35 (4.0%)	1 (0.1%)	Endocrine	1 (0.1%)	0
Anastomosis leakage	19 (2.2%)	16 (1.8%)	Neurologic	4 (0.5%)	2 (0.2%)
Other leakage/ fistula	6 (0.7%)	4 (0.5%)	Infection	4 (0.5%)	0
Vascular insufficiency	3* (0.3%)	0	Vascular	0	0
Others	2 (0.2%)	0	Others	7 (0.8%)	1 (0.1%)
Total	176 (20.0%)	115 (11.9%)	Total	78 (8.8%)	20 (2.3%)

* partial splenic infarctions relieved spontaneously (n=1) or treated by antibiotics (n=2)

Table 4. Univariate analysis for risk factors associated with complications of gastrectomy

Variables	No. of patients	Overall Cx (%)		Cx \geq IIIa (%)	
		n	p	n	p
Age (years)			0.001		0.001
<60	430	75 (17.4%)		39 (9.1%)	
\geq 60	451	122 (27.1%)		70 (15.5%)	
Sex			0.867		0.395
Male	563	127 (22.6%)		74 (13.1%)	
Female	318	70 (22.0%)		35 (11.0%)	
BMI (kg/m ²)			0.460		0.383
<18.5	42	12 (28.6%)		8 (19.0%)	
\geq 18.5, <25	561	128 (22.8%)		69 (12.3%)	
\geq 25	278	57 (20.5%)		32 (11.5%)	
ASA score			0.088		0.187
1	416	81 (19.5%)		43 (10.3%)	
2	417	101 (24.0%) [†]		58 (13.9%)	
3 or 4	48	15 (31.3%)		8 (16.7%)	
Malnutrition (SNUH-NSI)*			0.004		0.001
Low	559	108 (19.3%)		53 (9.5%)	
Moderate or severe	320	89 (27.8%)		56 (17.5%)	
Previous abdominal operation			0.174		0.712
No	685	146 (21.3%)		83 (12.1%)	
Yes	196	51 (26.0%)		26 (13.3%)	
Op extent			<0.001		<0.001
Partial	716	130 (18.2%)		69 (9.6%)	
Total	165	67 (40.6%)		40 (24.2%)	
Op method			<0.001		<0.001
Open	434	130 (29.1%)		78 (10.7%)	

Laparoscopic	447	67 (15.4%)		31 (7.1%)	
Op time (min)			0.089		0.308
<180	429	85 (19.8%)		48 (11.2%)	
≥180	452	112 (24.8%)		61 (13.5%)	
Lymph node dissection			0.603		0.745
<D2	295	69 (23.4%)		38 (12.9%)	
D2	586	128 (21.8%)		71 (12.1%)	
Combined resection			<0.001		<0.001
No	753	146 (19.4%)		80 (10.6%)	
Yes	128	51 (39.8%)		29 (22.7%)	
TNM staging(7 th AJCC)			<0.001		<0.001
I	566	101 (17.8%)		52 (9.2%)	
II	112	30 (26.8%)		15 (13.4%)	
III	182	57 (31.3%)		36 (19.8%)	
IV	21	9 (42.9%)		6 (28.6%)	

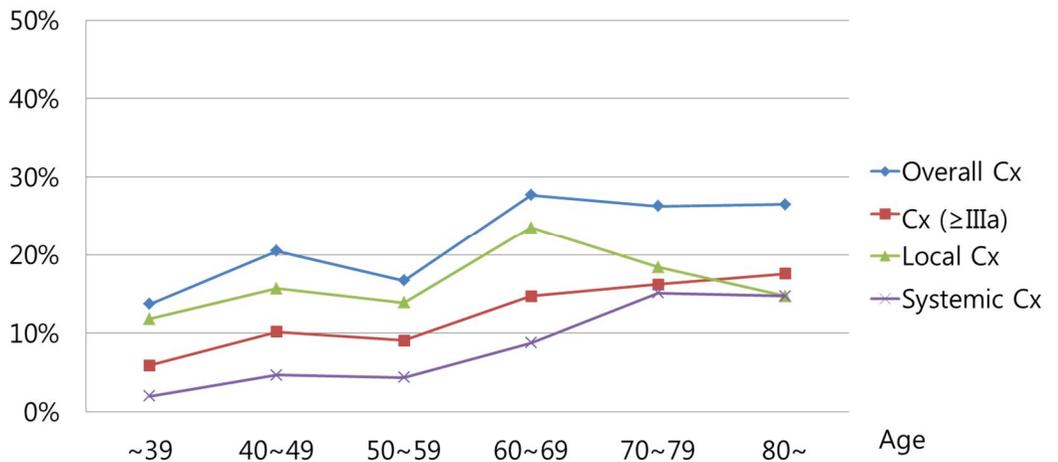
Table 5. Multivariate analysis for risk factors associated with complications of gastrectomy

Overall complication				Cx \geq IIIa			
Variables	p	OR	95% CI	Variables	p	OR	95% CI
Age (years)				Age (years)			
≥ 60	0.003	1.693	1.199-2.390	≥ 60	0.022	1.671	1.076-2.594
Op extent				Op extent			
TG	<0.001	2.140	1.397-3.276	TG	0.016	1.863	1.121-3.094
Combined resection	0.002	1.989	1.298-3.047				

Table 6. Multivariate analysis for risk factors associated with complications of gastrectomy according to complication type

Local complication				Systemic complication			
Variables	p	OR	95% CI	Variables	p	OR	95% CI
Age (years)				Age (years)			
≥60	0.021	1.553	1.070-2.255	≥60	0.004	2.442	1.324-4.502
Op extent				Op extent			
TG	0.005	1.938	1.227-3.059	TG	<0.001	3.632	1.926-6.851
Combined resection	0.006	1.878	1.194-2.954	Combined resection	0.003	2.414	1.341-4.344
				Malnutrition (SNUH-NSI)			
				Moderate or severe	0.047	1.762	1.006-3.084
				ASA score			
				3 or 4	0.004	3.674	1.517-8.894

Figure 1. Complication rates according to different age groups



No. of patients	51	127	252	238	179	34	Total 881	p*
Overall Cx	13.7%	20.5%	16.7%	27.7%	26.3%	26.5%	22.4%	0.006
Cx (≥IIIa)	5.9%	10.2%	9.1%	14.7%	16.2%	17.6%	12.4%	0.005
Local Cx	11.8%	15.7%	13.9%	23.5%	18.4%	14.7%	17.6%	0.107
Systemic Cx	2.0%	4.7%	4.4%	8.8%	15.1%	14.7%	8.1%	<0.001
ASA score								
≥2	19.6%	26.8%	42.9%	62.2%	76.4%	82.3%	52.8%	<0.001
3 or 4	0	1.6%	2.4%	3.4%	14.6%	17.6%	5.5%	<0.001

* χ^2 test (linear by linear association)

국문 초록

서론: Clavien-Dindo classification 은 합병증의 중증도를 고려하지 않는 수술 후 합병증의 현재 분류 체계보다 더 우수한 것으로 옹호되고 있다. 이 연구의 목적은 모든 위절제술 후 합병증을 분석하고 그와 관련된 위험 인자를 찾아내는 것이다.

방법: 2011 년 3 월부터 2012 년 2 월까지 서울대 병원에서 위절제술을 시행받은 위선암 환자들의 합병증을 분석하였다. 이 합병증 데이터는 매주 집담회를 통해 전향적으로 수집되었으며 Clavien-Dindo classification 에 따라 중증도를 분류하였다.

결과: 위절제술을 시행받은 881 명의 환자 중 197 명(22.4%)에서 합병증이 발생하였고 254 건(28.8%)의 합병증 발생율을 보였다.

Clavien-Dindo classification 에 따른 grade I, II, IIIa, IIIb, IVa, V 의 합병증 수는 각각 71 (8.1%), 58 (6.6%), 108 (12.3%), 8 (0.9%), 5 (0.6%), 4 (0.5%) 였다. 전체 합병증의 위험인자로는 위전절제술 (OR, 2.14; 95% CI, 1.40-3.28, $p < 0.001$), 합병절제 (OR, 1.99; 95% CI, 1.30-3.05, $p = 0.002$), 60 세 이상의 나이 (OR, 1.69; 95% C.I., 1.20-2.39, $p = 0.003$) 등이 유의한 것으로 밝혀졌고, 전신적 합병증 분석에서는 위전절제술, 합병절제, 60 세 이상의 나이와 함께 3 이상의 ASA score (OR, 3.67; 95% CI,

1.52-8.89, $p=0.004$)와 중증도 이상의 영양불량 (OR, 1.76; 95% C.I., 1.01-3.08, $p=0.047$) 이 또한 유의한 위험인자인 것으로 분석되었다.

결론: 합병증 데이터에 대한 전향적 수집과 체계적인 분류는 임상사건을 빠짐없이 찾아내고 의미있는 합병증을 규정짓는 데 유용할 수 있다. 고령의 환자에서 광범위한 위암수술은 수술 후 합병증 위험을 증가시킬 위험성이 있다.

주요어 : 합병증, 위암, Clavien-Dindo classification

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