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Tumor Size as a Prognostic Factor in Gastric Cancer Patient

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Purpose: The purpose of this study is to investigate the prognostic significance of tumor size for 5-year survival rate in patients with gastric cancer.

Materials and Methods: A total of 1,697 patients with gastric cancer, who underwent potentially curative gastrectomy, were evaluated. Patients were divided into 4 groups as follows, according to the median size of early and advanced gastric cancer, respectively: small early gastric cancer (tumor size ≤3 cm), large early gastric cancer (tumor size >3 cm), small advanced gastric cancer (tumor size ≤ 6 cm), and large advanced gastric cancer (tumor size >6 cm). The prognostic value of tumor size for 5-year survival rate was investigated.

Results: In a univariate analysis, tumor size is a significant prognostic factor in advanced gastric cancer, but not in early gastric cancer. Multivariate analysis showed that tumor size is an independent prognostic factor for 5-year survival rate in advanced gastric cancer (P=0.003, hazard ratio=1.372, 95% confidence interval=1.115~1.690). When advanced gastric cancer is subdivided into 2 groups, according to serosa invasion: Group 1; serosa negative (T2 and T3, 7th AJCC), and Group 2; serosa positive (T4a and T4b, 7th AJCC), tumor size is an independent prognostic factor in Group 1 (P=0.011, hazard ratio=1.810, 95% confidence interval=1.149~2.852) and in Group 2 (P=0.033, hazard ratio=1.288, 95% confidence interval=1.020~1.627), respectively.

Conclusions: Tumor size is an independent prognostic factor in advanced gastric cancer irrespective of the serosa invasion, but not in early gastric cancer.

Key Words: Gastric cancer; Tumor size; Prognosis

Introduction

The incidence of gastric cancer has gradually been declining worldwide. However, gastric cancer has exhibited the highest prevalence rate in Korea, and it ranks as one of the leading causes of cancer death, followed by lung cancer.(1,2) In recent years, early cancer detection in many cases is gradually increasing due to diagnosis technology advancement and frequent checkups. Moreover, a 5-year survival rate of gastric cancer has been showing an increasing trend.(3,4) Due to the advancement of endoscopic and laparoscopic surgery, the quality of life is improving and complications of surgery are reduced.(5) However, advanced gastric cancer (AGC) is still frequently detected,(6,7) and a 5-year survival rate of AGC is not promising despite curative gastrectomy.(8)

Clinico-pathologic characteristics affecting the prognosis of gastric cancer are depth of tumor invasion, nodal status, distant metastasis, macroscopic types of tumor, tumor size, histologic type and others.(3)

Tumor size belongs to the category of factors for determining stages of cancers including breast cancer, lung cancer, pancreatic cancer, and others.(9) Thus, stages are determined according to the sizes of tumor, and therapeutic treatments vary depending on the size. However, few studies have analyzed the effect of tumor size on the prognosis of gastric cancer. Hence, the authors of this study investigated the effect of tumor size on the prognosis of gastric

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cancer.

Materials and Methods

This study conducted a retrospective analysis on 1,697 patients who underwent curative surgery among the total of 1,897 patients who received gastrectomy after a diagnosis with gastric cancer in the Department of Surgery of Hanyang University Medical Center, from June 1992 to August 2009. The curative surgery was defined as a surgery which was performed on M0 patients who underwent lymph node dissection with more than 16 dissected nodes without any distant metastasis. In case of adjacent organ invasion of T4b (7th American Joint Committee on Cancer [AJCC] staging system),(10) combined resection of invaded organs was carried out, and the resection margin must be negative. Study population comprised of 720 early gastric cancer (EGC) patients and 977 AGC patients. The median follow-up period was 50 months until August 31, 2011. The follow-up rate was 97.0% (1,897/1,955). Tumor sizes ranged 0.3~15.0 cm (median=3 cm, mean±standard deviation [SD]=3.2 ±2.1 cm) in case of EGC and 1.0~20.0 cm (median=6 cm, mean ±SD=6.4±3.0 cm) in case of AGC. By taking the median tumor size as the standard, the study defined tumors less than 3 cm in size as small tumors and those that are more than 3 cm in size as large tumors in EGC. Meanwhile, tumors less than 6 cm in size were set as small tumors and more than 6 cm as large tumors in AGC.

To analyze the survival rate in each group, univariate and multivariate analyses were conducted on patient's factors (age, sex), tumor factors (depth of invasion, nodal status, tumor size, tumor site, histologic type, lymphatic invasion, venous invasion, perineural invasion), and treatment factors (type of surgery).

PASW Statistics ver. 18.0 (IBM Co., Armonk, NY, USA) was used for statistical analysis. Kaplan-Meier survival analysis was performed for univariate analysis of the survival rate, while Cox regression analysis was performed for multivariate analysis. A P-

Table 1. Univariate survival analysis in early gastric cancer

Variables		No.	5-ysr (%)	Mean ± SD (mo)	P-value
Age (yr)	≤60	408	96.9	202.4±3.8	<0.0001
	>60	312	87	154.3±8.7	
Gender	Male	477	91.4	190.5±4.8	0.113
	Female	243	95.7	183.7±5.2	
Depth of invasion	Mucosa	384	94.2	183.6±4.3	0.065
	Submucosa	336	91.5	188.1±5.6	
Nodal status (7th AJCC)	N0	622	94.3	194.6±4.2	0.002
	N1	49	89.8	142.6±5.4	
	N2	34	78.5	153.9±16.6	
	N3	15	79.4	149.7±18.7	
Type of surgery	Subtotal gastrectomy	648	92.8	189.0±4.1	0.966
	Total gastrectomy	72	94	197.7±8.0	
Lymphatic invasion	Negative	564	94.4	194.7±3.9	0.002
	Positive	156	87.8	177.4±9.2	
Venous invasion	Negative	696	93.5	194.0±4.0	0.003
	Positive	24	77	138.5±16.5	
Perineural invasion	Negative	689	93	193.2±3.8	0.867
	Positive	31	91.1	118.7±5.7	
Tumor site	Lower 1/3	368	92	183.9±5.4	0.151
	Middle 1/3	316	93.9	180.2±3.3	
	Upper 1/3	36	93.8	190.3±13.1	
Tumor size (cm)	≤3	455	93.1	190.4±5.8	0.909
	>3	265	92.6	192.5±4.8	
Differentiation	Differentiated	417	90.6	169.3±5.7	0.001
	Undifferentiated	303	96	205.0±3.7	

No. = number of patients; 5-ysr = 5-year survival rate; SD = standard deviation; AJCC = American Joint Committee on Cancer.

value of less than 0.05 was considered statistically significant.

Results

1. EGC

Among the 720 patients falling under EGC, patients with small tumors and large tumors were 455 and 265, respectively. The 5-year survival rate of small tumors was 93.1% (mean: 190±5.8 months), while that of large tumors was 92.6% (mean: 192.5±4.8 months) in EGC patients (P=0.909) (Table 1). Thus, no difference was observed in the survival rate depending on the tumor size in EGC.

According to the univariate analysis of small tumors on the survival in EGC, statistically significant factors were age, nodal status, lymphatic invasion, and venous invasion. According to the univariate analysis of large tumors on survival, statistically significant factors were age, nodal status, lymphatic invasion, venous invasion, and histologic type (Table 2).

Moreover, statistically significant factors were age and histologic type in the multivariate analysis on survival in all EGC groups and large tumors in EGC. On the other hand, age was the only factor in small tumors in EGC (Table 3).

2. AGC

According to the univariate analysis on survival of all patients with AGC (n=977), statistically significant factors were age, serosa invasion, nodal status, type of surgery, lymphatic invasion, venous invasion, tumor site, and tumor size (Table 4). The depth of tumor

Table 2. Univariate survival analysis in early gastric cancer according to tumor size

Variables		Small* EGC				Large† EGC			
		No.	5-ysr (%)	Mean±SD (mo)	P-value	No.	5-ysr (%)	Mean±SD (mo)	P-value
Age (yr)	≤60	249	96.4	203.1±5.1	<0.0001	159	97.8	198.4±5.5	0.007
	>60	206	88.7	132.5±9.7		106	83.9	165.8±6.5	
Gender	Male	307	91.7	190.8±6.5	0.378	170	90.9	187.0±6.8	0.176
	Female	148	95.9	176.3±9.9		95	95.5	164.4±4.2	
T	Mucosa	276	93.6	183.5±5.2	0.881	108	95.8	177.1±6.9	0.131
	Submucosa	179	92.4	179.6±10.6		157	90.5	190.2±5.7	
N‡	N0	422	94.2	191.8±5.9	0.029	200	94.7	195.6±5.5	0.015
	N1	18	83	104.0±7.2		31	92.8	145.3±6.0	
	N2	15	73.3	79.6±9.3		19	82.1	152.3±22.5	
	N3	0				15	79.4	149.7±18.7	
TOS	STG	426	92.9	180.6±5.7	0.214	222	92.6	192.5±5.4	0.815
	TG	29	96.4	200.3±12.1		43	92.6	172.6±8.9	
LI	Negative	382	94.2	188.1±4.7	0.01	182	94.7	196.1±6.1	0.04
	positive	73	86.5	148.5±22.2		83	88.2	160.5±7.2	
VI	Negative	449	93.5	191.0±5.8	0.015	247	93.5	194.6±4.9	0.022
	Positive	6	66.7	93.2±23.6		18	80.8	142.6±18.6	
PI	Negative	439	93.2	190.5±5.8	0.411	250	92.6	192.5±4.9	0.902
	Positive	16	87.5	71.1±2.7		15	93.3	118.7±8	
Tumor site	Lower 1/3	234	92.2	175.5±7.5		134	91.7	187.2±7.3	0.201
	Middle 1/3	206	93.6	178.1±4.9		110	94.4	182.2±3.9	
	Upper 1/3	15	100	203.0±14.2		21	89.7	107.3±7.7	
Differentiation	DIF	287	91.2	168.3±7.5	0.775	130	89.2	163.5±7.4	0.033
	UND	168	96.2	204.4±5.9		135	95.7	201.4±4.7	

EGC = early gastric cancer; No. = number of patients; 5-ysr = 5-year survival rate; SD = standard deviation; T = depth of invasion; N = nodal status; TOS = type of surgery; STG = subtotal gastrectomy; TG = total gastrectomy; LI = lymphatic invasion; VI = venous invasion; PI = perineural invasion; DIF = differentiated; UND = undifferentiated. *Less than 3 cm in diameter. †More than 3 cm in diameter. ‡American Joint Committee on Cancer 7th edition.

Table 3. Multivariate survival analysis in early gastric cancer

Variables			B	SE	P-value	HR	95% CI
All EGC	Age (yr)	≤60 >60	1.215	0.297	<0.0001	3.369	1.881~6.035
	Differentiation	Differentiated Undifferentiated	-0.951	0.325	0.003	0.386	0.204~0.731
Small* EGC	Age (yr)	≤60 >60	1.338	0.396	0.001	3.812	1.753~8.289
Large† EGC	Age (yr)	≤60 >60	1.174	0.470	0.013	3.235	1.287~8.135
	Differentiation	Differentiated Undifferentiated	-1.102	0.497	0.027	0.332	0.125~0.880

B = the coefficient for the constant; SE = standard error; HR = hazard ratio; CI = confidence interval; EGC = early gastric cancer. *Less than 3 cm in diameter. †More than 3 cm in diameter.

Table 4. Univariate survival analysis in advanced gastric cancer (all)

Variables		No.	5-ysr (%)	Mean±SD (mo)	P-value
Age (yr)	≤60	567	65	128.4±4.4	<0.0001
	>60	410	56.1	86.2±4.5	
Gender	Male	641	61	112.0±4.6	0.161
	Female	336	62.4	127.4±5.8	
Depth of invasion	Proper muscle	188	87	159.8±6.6	<0.0001
	Subserosa	250	78.6	155.2±7.3	
	Serosa exposure	494	47.5	92.5±4.4	
	Adjacent organ invasion	45	28.9	45.8±7.7	
Serosa invasion	Negative	438	82.6	163.1±5.4	<0.0001
	Positive	539	46	88.8±4.2	
Nodal status (7th AJCC)	N0	226	85.6	161.7±7.1	<0.0001
	N1	354	71.1	132.0±5.8	
	N2	213	51.2	99.5±7.2	
	N3	184	27.1	59.1±5.9	
Type of surgery	Subtotal gastrectomy	646	67.2	127.5±4.7	<0.0001
	Total gastrectomy	331	50.4	98.2±5.6	
Lymphatic invasion	Negative	174	77.8	146.1±8.2	<0.0001
	Positive	803	57.8	111.6±4.0	
Venous invasion	Negative	822	65.2	126.7±4.0	<0.0001
	Positive	155	41.8	72.0±8.0	
Perineural invasion	Negative	689	61.3	118.6±4.0	0.872
	Positive	288	62	91.5±6.0	
Tumor site	Lower 1/3	480	61.1	119.3±5.3	<0.0001
	Middle 1/3	354	65.7	119.6±5.5	
	Upper 1/3	122	59.2	114.8±9.7	
	Whole stomach	21	14.3	44.0±13.7	
Tumor size (cm)	≤6	573	71	138.7±4.8	<0.0001
	>6	404	48.5	90.5±4.9	
Differentiation	Differentiated	339	65.3	117.9±6.1	0.188
	Undifferentiated	638	59.4	116.9±4.3	

No. = number of patients; 5-ysr = 5-year survival rate; SD = standard deviation; AJCC = American Joint Committee on Cancer.

invasion of AGC were classified into the T2 or T3 (7th AJCC TNM staging system) group without serosal invasion, and the T4a or T4b (7th AJCC TNM staging system) group with serosal invasion. A significant difference was observed in the survival rate of two groups (Table 4).

The survival rates between small tumors (n=573) and large tumors (n=404) were compared among AGC patients. The 5-year survival rate of small tumors was 71.0% (mean: 138.7±4.8 months), while that of large tumors was 48.5% (mean: 90.5±4.9 months) in AGC patients (P<0.0001) (Table 4). Thus, a statistically significant difference was observed in the survival rate depending on the tumor size in AGC.

3. The relationship between tumor size and prognosis in advanced gastric cancer without serosal invasion

Statistical significance was observed in the depth of invasion, nodal status, type of surgery, venous invasion, tumor sites, as well as, tumor size, according to the univariate analysis on the prognosis related survival of T2 or T3 group without serosal invasion in AGC (Table 5, Fig. 1).

Table 5. Univariate survival analysis in serosa-negative and serosa-positive advanced gastric cancer

Variables		Serosa-negative AGC				Serosa-positive AGC			
		No.	5-ysr (%)	Mean±SD (mo)	P-value	No.	5-ysr (%)	Mean±SD (mo)	P-value
Age (yr)	≤60	257	83.4	169.0±6.3	0.139	310	51	100.3±5.3	< 0.0001
	>60	181	81.4	125.8±6.5		229	38.7	59.5±4.2	
Gender	Male	281	81.8	139.9±5.8	0.304	360	46.4	85.4±5.1	0.592
	Female	157	84.2	169.9±7.8		179	45.3	92.1±7.0	
T	S (-) S (+)								
	PM SE	188	87	159.8±6.6	0.038	494	47.5	92.5±4.4	< 0.0001
	SS SI	250	78.6	155.2±7.3		45	28.9	45.5±7.7	
N*	N0	165	91.8	185.9±6.7	<0.0001	61	70.3	110.2±8.8	< 0.0001
	N1	186	83.2	149.4±7.6		168	59.3	111.0±7.8	
	N2	63	70.4	104.5±8.6		150	43.9	86.3±7.8	
	N3	24	42.6	57.3±9.0		160	24.9	55.3±6.0	
TOS	STG	336	84	155.9±5.2	0.046	310	51.3	94.2±5.8	0.004
	TG	102	78.1	144.7±10.6		229	38.7	77.8±5.8	
LI	Negative	124	86.7	168.7±9.4	0.251	50	58.2	100.6±12.4	0.132
	positive	314	80.8	149.6±5.7		489	44.7	87.4±4.4	
VI	Negative	400	84.2	167.2±5.5	0.001	422	49.1	95.7±4.8	< 0.0001
	Positive	38	64.7	81.1±9.9		117	34.8	62.5±8.0	
PI	Negative	308	83.5	166.9±5.7	0.159	381	45	86.3±4.6	0.243
	Positive	130	79.9	86.8±3.8		158	49.4	81.0±6.4	
Tumor site	Lower 1/3	216	84.4	149.1±5.7	0.02	264	44.4	87.6±6.1	0.004
	Middle 1/3	169	79.3	146.5±7.5		185	54.4	96.8±6.9	
	Upper 1/3	52	87.4	165.1±14.5		70	38.9	68.2±8.1	
	WS	1	0	22.0±0		20	15	45.1±14.3	
Tumor size (cm)	≤6	312	86.6	172.9±6.0	<0.0001	261	54.2	104.9±6.4	< 0.0001
	>6	126	72.8	129.8±8.8		278	38.3	73.3±5.1	
Differentiation	DIF	177	86.3	152.6±8.0	0.282	162	45.4	82.5±7.4	0.671
	UND	261	80.1	161.5±6.7		377	46.2	90.7±5.0	

AGC = advanced gastric cancer; No. = number of patients; 5-ysr = 5-year survival rate; SD = standard deviation; T = depth of invasion; S (-) = serosa-negative; S (+) = serosa-positive; PM = proper muscle; SE = serosa exposure; SS = subserosa; SI = adjacent organ invasion; N = nodal status; TOS = type of surgery; STG = subtotal gastrectomy; TG = total gastrectomy; LI = lymphatic invasion; VI = venous invasion; PI= perineural invasion; WS = whole stomach; DIF = differentiated; UND = undifferentiated. *American Joint Committee on Cancer 7th edition.

4. The relationship between tumor size and prognosis in advanced gastric cancer with serosa invasion

Statistical significance was observed in age, depth of invasion, nodal status, type of surgery, venous invasion, tumor sites, as well as, tumor size, according to the univariate analysis on the prognosis related survival of T4a or T4b group with serosal invasion in AGC (Table 5) (Fig. 1).

5. Survival in advanced gastric cancer multivariate analysis

According to the multivariate analysis on survival of all patients with AGC, statistically significant factors were age, nodal status, serosal invasion, venous invasion, and tumor size. The degree of lymph node metastasis, along with tumor size (P=0.011, hazard ratio (HR)=1.810, 95% confidence interval (CI)=1.149~2.852), were independent prognostic factors in AGC without serosal invasion. Age, nodal status, and tumor size (P=0.033, HR=1.288, 95% CI=1.020~1.627) were independent prognostic factors in AGC with serosal invasion, according to the multivariate analysis on survival (Table 6).

Discussion

Tumor size can be determined quite easily in the preoperative exam and the accuracy of information is fairly reliable. In recent years, tumor size has been continuously pointed out as one of the critical factors determining the prognosis in gastric cancer. Hence, the necessity of study has lately been underscored as a crucial issue.

Establishing the standard of tumor size is a considerably critical issue in categorizing gastric cancers based on the tumor size. Previous studies classified tumors based on their own standards. When Adachi et al.(11) categorized patients' tumor sizes by 2 cm, relatively significant survival rate was observed between tumors with 4 cm and 10 cm in size. Subsequently, they categorized patients into 3 groups; with tumors less than 4 cm, in between 4 cm to 10 cm, and larger than 10 cm. Giuliani et al.(12) classified patients into three groups with sizes less than 26 mm, in between 26~50 mm, and more than 50 mm, based on the survival rate. Li et al.(13) took 10 cm or above as the standard by setting the standard at 90% depending on patient distribution. Saito et al.(14) took the most statistically significant result as the standard in terms of disease-specific survival when they set the standard as 8 cm in the study using the

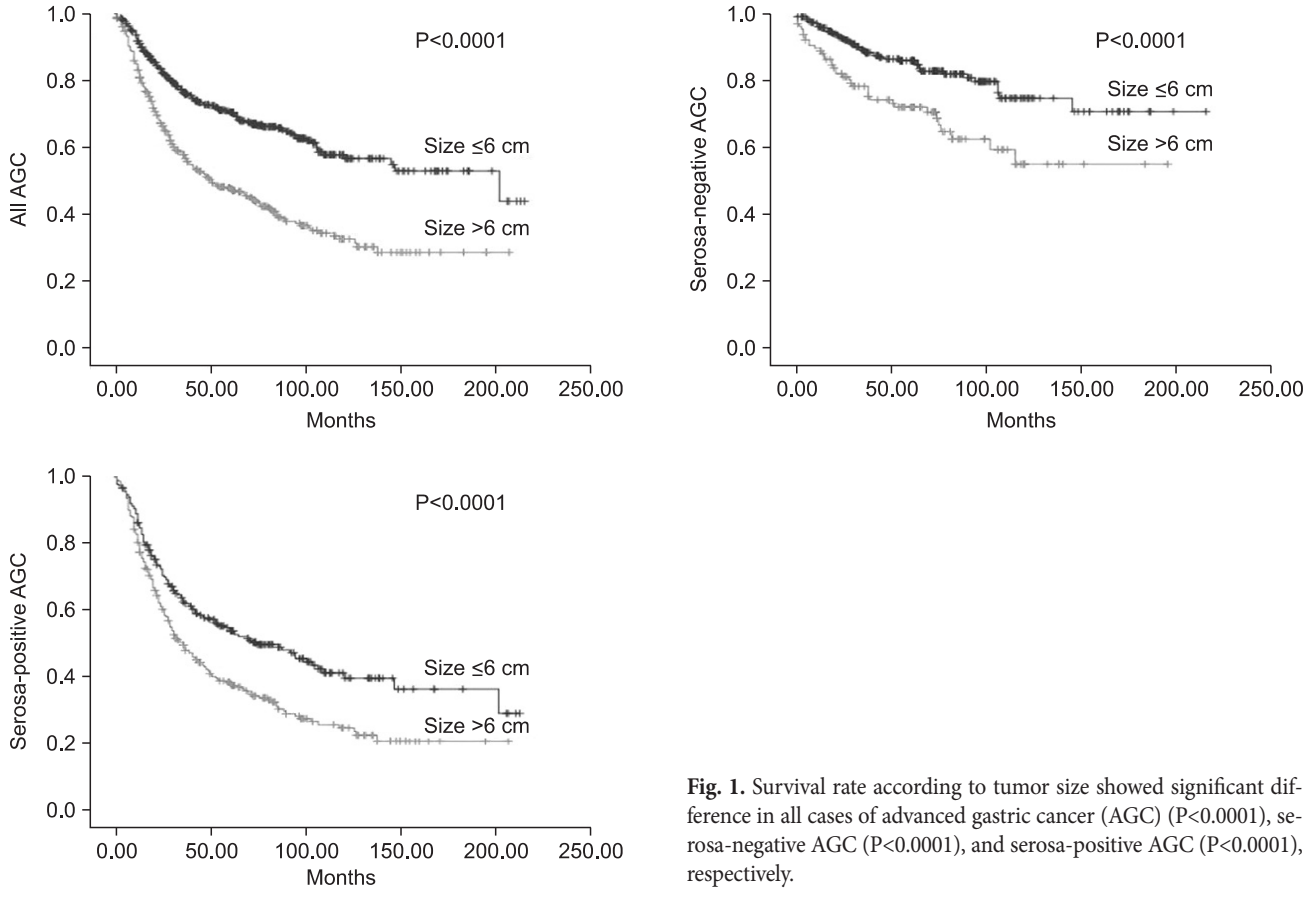

Fig. 1. Survival rate according to tumor size showed significant difference in all cases of advanced gastric cancer (AGC) (P<0.0001), serosa-negative AGC (P<0.0001), and serosa-positive AGC (P<0.0001), respectively.

Table 6. Multivariate survival analysis in advanced gastric cancer

Variables			B	SE	P-value	HR	95% CI
All AGC	Age (yr)	≤60					
		>60	0.401	0.103	<0.0001	1.494	1.221~1.828
	Serosa	Negative					
		Positive	0.822	0.133	<0.0001	2.276	1.754~2.954
	Nodal status (7th AJCC)	N0					
		N1	0.290	0.178	0.104	1.336	0.942~1.894
		N2	0.611	0.185	0.001	1.843	1.282~2.650
		N3	1.135	0.188	<0.0001	3.111	2.152~4.499
	Venous invasion	Negative					
		Positive	0.313	0.123	0.011	1.368	1.075~1.740
	Tumor size (cm)	≤6					
		>6	0.316	0.106	0.003	1.372	1.115~1.690
Serosa-negative AGC	Nodal status (7th AJCC)	N0					
		N1	0.582	0.290	0.045	1.789	1.013~3.159
		N2	0.970	0.336	0.004	2.638	1.366~5.096
		N3	1.535	0.412	<0.0001	4.640	2.069~10.406
	Tumor size (cm)	≤6					
		>6	0.593	0.232	0.011	1.810	1.149~2.852
Serosa-positive AGC	Age (yr)	≤60					
		>60	0.420	0.117	<0.0001	1.522	1.211~1.914
	Nodal status (7th AJCC)	N0					
		N1	0.036	0.223	0.872	1.037	0.669~1.606
		N2	0.334	0.222	0.132	1.396	0.904~2.155
		N3	0.873	0.219	<0.0001	2.394	1.558~3.680
	Tumor size (cm)	≤6					
		>6	0.253	0.119	0.033	1.288	1.020~1.627

B = the coefficient for the constant; SE = standard error; HR = hazard ratio; CI = confidence interval; AGC = advanced gastric cancer; AJCC = American Joint Committee on Cancer.

Cox proportional hazard model to find the critical point. Liu et al.(15) took 6 cm as the standard by calculating the mean of the tumor sizes in the study on the tumor size of T3 gastric cancer. This study calculated the median by classifying gastric cancers into EGC and AGC with tumor sizes of 3 cm and 6 cm, respectively. Using medians are thought to be valid to exclude statistic errors in tumor size and establish objective standards. However, this issue needs to be further discussed since there is no definite basis regarding the tumor size.

The significance of tumor size can be viewed from two aspects. First, the frequency of endoscopic and laparoscopic surgery has lately been surged in case of EGC. However, its indication has not yet been established. Independent factors are the tumor size, lymphatic invasion and submucosal invasion according to the multivariate analysis on lymph node metastasis in EGC.(16) Thus, Maehara et al.(16) asserted that tumor size is a reliable predictor in examining the tumor behavior in EGC. On the other hand, Tsujitani et al.(17) did not consider the tumor size as an independent prognostic factor. They reported that tumor size and macroscopic appearance are the most reliable factors in determining the indication of endoscopic mucosal resection since the predictability of preoperative depth of tumor invasion is inaccurate and determining nodal status is unreliable. In case of EGC, the tumor size does not belong to an independent prognostic factor in this study. Second, the tumor size is a crucial factor in the evaluation of the prognosis. A previous study reported that tumor size is more significant prognostic factor than depth of invasion in gastric cancers without serosal invasion and lymph node metastasis.(18) However, the tumor size does not fall under one of the factors determining the different stages in gastric cancer.(19,20) Hence, further studies on the effects

and prognosis depending on the tumor size are essential by analyzing the characteristics of gastric cancer, based on detailed clinicopathologic classifications. This study analyzed the relationship between tumor size and prognosis in all patients with AGC. Although a poor prognosis was assessed in case of large tumors, this study reclassified and reanalyzed AGC, according to the depth of tumor invasion, one of the main factors determining the prognosis of gastric cancer. A statistically significant difference ($P<0.0001$) was shown in the prognosis depending on the depth of tumor invasion of AGC (T2, T3, T4a, T4b). A meaningful difference was observed in the survival rate ($P<0.0001$) (Table 4), when each survival rate was examined by classifying AGC, according to serosal invasion (T2, T3 vs. T4a, T4b). This study further investigated on the relationship between the tumor size and prognosis by a depth of tumor invasion in AGC. Moreover, this study analyzed the prognostic significance of tumor size in each group by dividing AGC into 2 groups, based on the presence of serosal invasion by considering an adequate number of the cases. As a result, the tumor size was an independent factor affecting in the prognosis of both groups, regardless of differences in the depth of tumor invasion.

The clinical characteristics of tumor size have not yet been adequately clarified in terms of large gastric cancers. However, large tumor size is profoundly associated with Borrmann type IV, adjacent organ invasion (T4) and higher lymph node and distant metastasis rate.(21,22) For this reason, most patients have stage III or stage IV cancers, low possibility of radical resection in many cases, and lower 5-year survival rate.(23) Likewise, clinico-pathologic characteristics vary depending on the tumor size, and distinct differences are present in the survival rate. Therefore, utilizing a standardized tumor size could be substantially meaningful in arranging the treatment during the postoperative follow-up period by analyzing the evaluation factors of prognosis of cancers.

Adachi et al.(11) categorized patients into 3 groups- with tumors less than 4 cm, in between 4 cm to 10 cm, and larger than 10 cm in size- and compared the 10-year survival rate of the 3 groups. The survival rates were 92%, 66%, and 33%, respectively, exhibiting the statistically significant difference. The tumor size was an independent prognostic factor along with T and N according to multivariate analysis. Therefore, they reported that tumor size is a simple predictor in the progress of tumor and survival of patients. Saito et al.(14) compared the 5-year survival rate in 2 groups with tumors less than 8 cm and more than 8 cm in size. The survival rates were 89.7% and 54%, respectively, showing a statistically significant difference. Moreover, they reported that tumor size is an independent prognostic factor along with T and N factors and lymphatic invasion, according to the multivariate analysis. Jun et al.(24) compared the 5-year survival rates of 2 groups with tumors below and above 3.5 cm. The survival rates were 86.8% and 62%, respectively, showing a statistically significant difference. In addition, the tumor size was reported to be an independent prognostic factor through multivariate analysis. Liu et al.(15) also reported that the tumor size is an independent prognostic factor by taking 6 cm, the standard in the multivariate analysis. A significant difference was found in the prognosis depending on the tumor size, especially in stages IIIb and IV.

In this study, no difference was present in the survival rates by using the median value of 3 cm for the tumor size as the standard in case of EGC. However, when the median value of 6 cm in AGC was used as the standard, significant differences of 71.0% and 48.5% ($P<0.0001$) were observed, respectively. Moreover, the 5-year survival rates were 86.6% vs. 72.8% ($P<0.0001$) and 54.2% vs. 38.3% ($P<0.0001$) in serosa negative group and positive group, respectively, exhibiting a statistically significant difference in both groups. Tumor size was an independent prognostic factor in AGC, along with the patient's age, depth of tumor invasion, nodal status, and venous invasion. Therefore, the tumor size is thought to be a simple but significant factor in the evaluation of the prognosis.

To investigate the effect of tumor size on the prognosis of gastric cancer patients, this study examined 1,697 patients who underwent curative surgery. The study defined tumors less than 3 cm as small tumors, and those that are more than 3 cm as large tumors, in 720 EGC patients. Meanwhile, tumors less than 6 cm in size were set as small tumors, while more than 6 cm as large tumors, in 977 AGC patients. The study has acquired the following results.

Tumor size was an independent prognostic factor in AGC, unlike in EGC. Independent prognostic factors in EGC were age and histologic type. A statistically significant difference was observed in the survival rate, based on tumor size in AGC. Tumor size in AGC was an independent prognostic factor. Furthermore, it was an independent prognostic factor in the result of analysis carried out based on the presence of serosal invasion.

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