

Clinicopathologic Features of Asymptomatic Gastric Adenocarcinoma Patients in Korea

Seong-Ho Kong¹, Do Joong Park^{1,3}, Hyuk-Joon Lee^{1,3}, Hyun Chae Jung², Kuhn Uk Lee¹, Kuk Jin Choe¹ and Han-Kwang Yang^{1,3}

¹Department of Surgery, ²Department of Internal Medicine and ³Cancer Research Institute, Seoul National University College of Medicine, Seoul, Korea

Received September 1, 2003; accepted December 8, 2003

Objective: The aim of this study was to analyze the characteristics of patients diagnosed with gastric adenocarcinoma without the presence of symptoms and to evaluate the usefulness of screening programs for gastric cancer in Korea.

Methods: We retrospectively analyzed the characteristics of 1277 gastric adenocarcinoma patients at Seoul National University Hospital (SNUH) (665 in 1996; 612 in 2001) by dividing them into two groups according to the presence or absence of symptoms (symptomatic group vs asymptomatic group).

Results: The proportion of asymptomatic patients increased from 1996 (4.7%) to 2001 (17.2%) ($P < 0.001$). Gastroscopy was the most commonly used screening tool (77.4% in 1996, 95.2% in 2001). The proportion of early gastric cancer (EGC) in the asymptomatic group was higher than in the symptomatic group (74.2% vs 25.9% in 1996, 78.1% vs 35.7% in 2001) ($P < 0.001$). The curative operation rate was significantly higher in the asymptomatic group. The asymptomatic group had a higher 5-year survival rate (87.7%) than the symptomatic group (51.6%) ($P < 0.01$). Complementary data from a screening program at the SNUH showed that 19 gastric cancer cases (0.76%) were detected out of 2501 endoscopic examinations; of these, 78.9% (15/19) were early gastric cancer cases, which is in agreement with our results.

Conclusion: Patients with asymptomatic gastric adenocarcinoma had fewer advanced lesions, a greater chance for curative operation and a higher survival rate than symptomatic patients. An increase in the number of asymptomatic patients contributed to the increase in overall EGC from 1996 to 2001. These results seemed to support the usefulness of gastroscopy as a screening test for gastric cancer in Korea, where the incidence of gastric cancer is high.

Key words: gastric cancer – asymptomatic – screening – gastroscopy – Korea

INTRODUCTION

Gastric adenocarcinoma is the most common malignancy in Korea, although its incidence is slowly decreasing (1). According to a report of the Ministry of Health and Welfare in Korea, gastric cancer was the most common cancer in Korean males (24.1%) and the second most common cancer in Korean females (15.3%) in 2001. Gastric cancer was also the second leading cause of death by malignancy (19.4%) in 2001 (2).

Since the prognosis of early gastric cancer (EGC) is highly favorable (5-year survival rate >90%), early detection is very important (3). In Japan, the proportion of EGC reached almost 50% after the institution of mass screening (4). However, according to a report of the Korean Gastric Cancer Society, the EGC percentage of Korean gastric cancer patients was only 35.4% in 1999. The purpose of this study was to analyze the clinicopathologic characteristics of asymptomatic gastric adenocarcinoma patients and to evaluate whether the screening programs for gastric cancer would be useful in Korea, where the incidence of gastric cancer is high.

For reprints and all correspondence: Han-Kwang Yang, Department of Surgery and Cancer Research Institute, Seoul National University College of Medicine, 28 Yongon-dong, Chongno-gu, Seoul 110-744, Korea.
E-mail: hkyang@plaza.snu.ac.kr

Table 1. Chief complaints of the symptomatic group

Chief complaints	1996			2001		
	No. of patients	(%) of total patients	(%) of patients with symptoms	No. of patients	(%) of total patients	(%) of patients with symptoms
Epigastric pain and discomfort	566	85.1	89.3	423	69.1	83.4
GI bleeding	21	3.2	3.3	39	6.4	7.7
Nausea/Vomiting	17	2.6	2.7	17	2.8	3.4
Weight loss	10	1.5	1.6	11	1.8	2.2
General weakness	10	1.5	1.6	5	0.8	1.0
Dizziness	4	0.6	0.6	4	0.7	0.8
Diarrhea	6	0.9	0.9	3	0.5	0.6
Others	0	0.0	0.0	5	0.8	1.0
Asymptomatic	31	4.7	–	105	17.2	–
Total	665	100	–	612	100	–

METHODS

We retrospectively analyzed the clinicopathologic characteristics of 1277 gastric adenocarcinoma patients who were operated upon at SNUH. Of these, 665 patients were operated upon in 1996 and 612 in 2001. Based on the presence or absence of symptoms, we divided the patients into a symptomatic group and an asymptomatic group. Many Koreans have non-specific abdominal symptoms unassociated with gastric cancer. Therefore, if non-specific abdominal discomfort was not the reason for undergoing gastric examination and the test was taken for health screening, then the patient concerned was placed in the asymptomatic group.

Age, sex, operation method, size of lesion, location of cancer in the stomach, stage, proportion of EGC and survival rate were analyzed in both the groups, retrospectively. In this report, 'R0 resection' refers to curative resection of all lesions without remnant tumor, 'R1 resection' refers to microscopically confirmed remnant tumor cells after surgical resection of curative intent without any macroscopically visible remnant tumor and 'R2 resection' refers to remnant tumor, which included resection of the stomach in cases with distant metastasis, palliative bypass operation, open biopsy, etc. Data on survival was collected by medical record review and phone interviews.

Clinicopathologic data was compared using the chi-square test and Fisher's exact test. Survival rates were calculated by the Kaplan–Meier method and analyzed using the log-rank test. *P*-values <0.05 were considered significant.

RESULTS

CHIEF COMPLAINT

The numbers in the asymptomatic and symptomatic groups were 31 (4.7%) and 634 (95.3%) in 1996 and 105 (17.2%)

and 507 (82.8%) in 2001, respectively. The proportion of the asymptomatic group had thus increased significantly between 1996 and 2001 (*P* < 0.001).

In 1996, 25 of 31 asymptomatic patients (80.6%) were diagnosed by a health screening test. Three patients (9.7%) were diagnosed with gastric cancer when they underwent a follow-up gastroscopy for liver diseases. Three patients were incidentally detected with gastric cancer due to presence of other diseases. In 2001, 96 of 105 asymptomatic patients (91.4%) were diagnosed with gastric cancer by a health screening test. Four patients (9.7%) were diagnosed with gastric cancer when they underwent follow-up gastroscopy for liver diseases. Five patients were diagnosed with gastric cancer during workup for other medical diseases.

In 1996, the screening tools used were gastroscopy in 24 patients (77.4%), upper GI series in four patients (12.9%) and ultrasonography in one patient (3.2%). Records of the screening test for the other two patients were not available. In 2001, gastroscopy was used in 100 patients (95.2%) and upper GI series was used in five patients (4.8%).

The most common chief complaint was epigastric pain and discomfort. These symptoms were evident in 89.3% of the symptomatic patients in 1996 and 83.4% of the symptomatic patients in 2001 (Table 1).

AGE

The mean ages of the asymptomatic and symptomatic groups in 1996 were 53.97 ± 9.68 years and 55.81 ± 11.19 years, respectively, whereas those in 2001 were 57.95 ± 10.76 years and 55.82 ± 11.90 years, respectively. These differences were not significant in either of the years (*P* = 0.311 in 1996, *P* = 0.089 in 2001).

Patients below 30 years of age accounted for less than 2% and those above 40 years of age accounted for about 90% of all patients (Table 2).

Table 2. Age distribution across the asymptomatic and symptomatic groups

Age	1996						2001					
	Sx (-)	(%)	Sx (+)	(%)	Total	(%)	Sx (-)	(%)	Sx (+)	(%)	Total	(%)
11-20	0	(0.0)	1	(0.2)	1	(0.2)	0	(0.0)	0	(0.0)	0	(0.0)
21-30	0	(0.0)	10	(1.6)	10	(1.5)	1	(1.0)	8	(1.6)	9	(1.5)
31-40	2	(6.5)	60	(9.5)	62	(9.3)	9	(8.6)	54	(10.7)	63	(10.3)
41-50	10	(32.3)	127	(20.0)	137	(20.6)	15	(14.3)	101	(19.9)	116	(19.0)
51-60	10	(32.3)	198	(31.2)	208	(31.3)	31	(29.5)	141	(27.8)	172	(28.1)
61-70	8	(25.8)	191	(30.1)	199	(29.9)	39	(37.1)	152	(30.0)	191	(31.2)
71-80	1	(3.2)	45	(7.1)	46	(6.9)	9	(8.6)	49	(9.7)	58	(9.5)
81-90	0	(0.0)	2	(0.3)	2	(0.3)	1	(0.0)	2	(0.4)	3	(0.5)
Total	31	(100)	634	(100)	665	(100)	105	(100)	507	(100)	612	(100)

Sx (-), asymptomatic patients diagnosed in health screening tests. Sx (+), patients with symptoms.

Table 3. Location of lesions in the asymptomatic and symptomatic groups

Location	1996						2001					
	Sx (-)	(%)	Sx (+)	(%)	Total	(%)	Sx (-)	(%)	Sx (+)	(%)	Total	(%)
Lower 1/3 rd of stomach	10	(32.6)	284	(45.5)	294	(44.9)	50	(47.6)	204	(40.4)	254	(41.6)
Lower 2/3 rd of stomach	3	(9.7)	77	(12.3)	80	(12.2)	4	(3.8)	61	(12.1)	65	(10.6)
Mid 1/3 rd of stomach	16	(51.6)	173	(27.7)	189	(28.9)	41	(39.0)	159	(31.5)	200	(32.8)
Upper 1/3 rd of stomach	2	(6.5)	66	(10.6)	68	(10.4)	8	(7.6)	54	(10.7)	62	(10.2)
Whole body	0	(0.0)	24	(3.8)	24	(3.7)	2	(1.9)	27	(4.4)	29	(4.8)
Total	31	(100)	624	(100)	655	(100)	105	(100)	505	(100)	610	(100)

Sx (-), asymptomatic patients diagnosed in health screening tests. Sx (+), patients with symptoms.

SEX

The ratio of males to females was 2.1:1 (21:10) in the asymptomatic group and 2.2:1 (435:198) in the symptomatic group in 1996, with no significant difference. On the other hand, the ratio of males to females in the asymptomatic group in 2001 was 3.8:1 (83:22), which is higher than that of the symptomatic group, in which the ratio was 1.8:1 (325:180) ($P = 0.004$).

LOCATION

The carcinomas were located most frequently in the lower third of the stomach, 44.9% (294/655) of all patients in 1996 and 41.6% (254/610) in 2001 had lesions at this location.

There were no significant differences in the proportions of the lesion locations with respect to the presence of symptoms or the year of operation (Table 3).

SIZE OF THE LESION

The average size of the carcinoma in the asymptomatic group was smaller than that of the symptomatic group (3.84 ± 1.93 cm, $n = 31$ vs 4.89 ± 2.84 cm, $n = 566$) ($P = 0.044$).

The average size of the lesions in the asymptomatic group was also smaller than that of the symptomatic group in 2001

(3.12 ± 2.13 cm, $n = 104$ vs 5.48 ± 3.28 cm, $n = 465$) ($P < 0.001$) (Table 4).

STAGES

The proportion of EGC in the asymptomatic group was higher than that in the symptomatic group. In 1996, it was 74.2% (23/31) in the asymptomatic group and 25.9% (164/634) in the symptomatic group ($P < 0.001$). Similarly, in 2001, it was 78.1% (82/105) in the asymptomatic group and 35.7% (181/507) in the symptomatic group ($P < 0.001$).

The overall proportion of EGC in all patients increased from 28.1% (187/665) in 1996 to 43.0% (263/612) in 2001 ($P < 0.001$).

According to TNM staging, the proportions of stages Ia, I and I + II in the asymptomatic group were 67.7% (21/31), 83.9% (26/31) and 90.3% (28/31), respectively, in 1996, and these were higher than those of the symptomatic group, which were, 22.3% (140/627), 39.1% (245/627) and 58.7% (368/627), respectively ($P < 0.001$).

In 2001, there were more patients with early TNM stages in the asymptomatic group than in the symptomatic group. In the asymptomatic group, the proportions of stages Ia, I and I + II were 74.3% (78/105), 89.5% (94/105) and 95.2% (100/105),

Table 4. Size of lesions in the asymptomatic and symptomatic groups

Size	1996						2001					
	Sx (-)	(%)	Sx (+)	(%)	Total	(%)	Sx (-)	(%)	Sx (+)	(%)	Total	(%)
<2 cm	6	(19.4)	88	(15.5)	94	(15.7)	40	(38.5)	53	(11.4)	93	(16.3)
2–5 cm	20	(64.5)	260	(45.9)	280	(46.9)	49	(47.1)	198	(42.6)	247	(43.4)
5–10 cm	5	(16.1)	196	(34.6)	201	(33.7)	14	(13.5)	178	(38.3)	192	(33.7)
>10 cm	0	(0.0)	22	(3.9)	22	(3.7)	1	(1.0)	36	(7.7)	37	(6.5)
Total	31	(100)	566	(100)	597	(100)	104	(100)	465	(100)	569	(100)
Average size (cm)	3.84 ± 1.93		4.89 ± 2.84				3.12 ± 2.13		5.48 ± 3.28			

Sx (-), asymptomatic patients diagnosed in health screening tests. Sx (+), patients with symptoms.

Table 5. TNM stage in the asymptomatic and symptomatic groups

Stage	1996						2001					
	Sx (-)	(%)	Sx (+)	(%)	Total	(%)	Sx (-)	(%)	Sx (+)	(%)	Total	(%)
Ia	21	(67.7)	140	(22.3)	161	(24.5)	78	(74.3)	158	(31.2)	236	(38.6)
Ib	5	(16.1)	105	(16.7)	110	(16.7)	16	(15.2)	78	(15.4)	94	(15.4)
II	2	(6.5)	123	(19.6)	125	(19.0)	6	(5.7)	77	(15.2)	83	(13.6)
IIIa	2	(6.5)	95	(15.2)	97	(14.7)	3	(2.9)	59	(11.6)	62	(10.1)
IIIb	0	(0.0)	46	(7.3)	46	(7.0)	0	(0.0)	27	(5.3)	27	(4.4)
IV	1	(3.2)	118	(18.8)	119	(18.1)	2	(1.9)	108	(21.3)	110	(18.0)
Total	31	(100)	627	(100)	658	(100)	105	(100)	507	(100)	612	(100)

Sx (-), asymptomatic patients diagnosed in health screening tests. Sx (+), patients with symptoms.

Table 6. Histologic types in the asymptomatic and symptomatic groups

Histology	1996						2001					
	Sx (-)	(%)	Sx (+)	(%)	Total	(%)	Sx (-)	(%)	Sx (+)	(%)	Total	(%)
Well differentiated	13*	(41.9)	41	(7.1)	54	(8.9)	33*	(31.7)	47	(9.7)	80	(13.6)
Moderately differentiated	9	(29.0)	215	(37.3)	224	(36.8)	35	(33.7)	140	(28.8)	175	(29.7)
Poorly differentiated	6	(19.4)	189	(32.8)	195	(32.1)	22	(21.2)	200*	(41.2)	222	(37.6)
Signet ring cell	3	(9.7)	80	(13.9)	83	(13.7)	12	(11.5)	78	(16.0)	90	(15.3)
Mucinous	0	(0.0)	45	(7.8)	45	(7.4)	2	(1.9)	18	(3.7)	20	(3.4)
Papillary	0	(0.0)	3	(0.5)	3	(0.5)	0	(0.0)	1	(0.2)	1	(0.2)
Undifferentiated	0	(0.0)	4	(0.7)	4	(0.7)	0	(0.0)	2	(0.4)	2	(0.3)
Total	31	(100)	577	(100)	608	(100)	104	(100)	486	(100)	590	(100)

* $P < 0.001$. Sx (-), asymptomatic patients diagnosed in health screening tests. Sx (+), patients with symptoms.

respectively. In the symptomatic group, the proportions were 31.2% (158/507), 46.5% (236/507) and 61.7% (313/507), respectively ($P < 0.001$) (Table 5).

HISTOLOGY

In both 1996 and 2001, the proportion of well differentiated carcinomas was considerably higher in the asymptomatic

group than in the symptomatic group. However, in 2001, the proportion of poorly differentiated carcinomas was higher in the symptomatic group.

Moreover, signet-ring cell carcinomas, mucinous carcinomas and undifferentiated carcinomas were more evident in the symptomatic group (Table 6).

Table 7. Methods and radicalities of operation in the asymptomatic and symptomatic groups

Operation method	1996						2001					
	Sx (-)	(%)	Sx (+)	(%)	Total	(%)	Sx (-)	(%)	Sx (+)	(%)	Total	(%)
Wedge resection	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	2	(0.4)	2	(0.3)
Subtotal gastrectomy	24*	(77.4)	364	(57.5)	388	(58.4)	85*	(81.0)	278	(54.8)	363	(59.3)
Total gastrectomy	7	(22.6)	150	(23.7)	157	(23.6)	15	(14.3)	100	(19.7)	115	(18.8)
Extended operation	0	(0.0)	29	(4.6)	29	(4.4)	4	(2.9)	49	(9.7)	53	(9.0)
Palliative operation	0	(0.0)	90	(14.2)	90	(13.6)	1	(1.0)	76	(15.0)	77	(13.6)
Total	31	-	633	-	664	-	105	-	505	-	610	-
Radicality of Operation	1996						2001					
	Sx (-)	(%)	Sx (+)	(%)	Total	(%)	Sx (-)	(%)	Sx (+)	(%)	Total	(%)
R0	31†	(100)	536	(85.5)	567	(86.9)	104*	(99.0)	428	(84.4)	532	(86.9)
R1/R2	0	(0.0)	91	(14.5)	91	(13.1)	1	(1.0)	79	(15.6)	80	(13.1)
Total	31	-	627	-	658	-	105	-	507	-	612	-

* $P < 0.01$. † $P = 0.015$. Sx (-), asymptomatic patients diagnosed in health screening tests. Sx (+), patients with symptoms.

OPERATION METHODS AND CURABILITY

The proportion of patients who underwent radical subtotal gastrectomy was higher in the asymptomatic group. In 1996, 77.4% (24/31) of the asymptomatic group and 57.5% (364/633) of the symptomatic group underwent subtotal gastrectomy ($P < 0.01$). Similarly, in 2001, 81.0% (85/105) of the asymptomatic group and 54.8% (278/507) of the symptomatic group underwent subtotal gastrectomy ($P < 0.01$).

In 1996, all asymptomatic patients could be operated upon radically, but only 85.5% (536/627) in the symptomatic group had R0 resection. In 2001, all but one asymptomatic patient who received palliative subtotal gastrectomy due to intraperitoneal seeding underwent radical operation, but in the symptomatic group, only 84.4% (428/507) of the patients had R0 resection (Table 7).

SURVIVAL

We followed up the patients operated upon in 1996 by reviewing their medical records and through phone interviews for a mean follow-up of 52 months.

The 5-year survival rate of the asymptomatic group was 87.7% ($n = 25$) and that of the symptomatic group was 51.6% ($n = 575$), which is significantly different ($P < 0.01$) (Fig. 1).

In the multivariate analysis, TNM stage ($P < 0.001$) and R0 resection ($P < 0.001$) were the independent prognostic factors. Although the presence of symptoms was found to be a significant prognostic factor for survival in the univariate analysis ($P = 0.001$), multivariate analysis revealed that it was not an independent prognostic factor ($P = 0.312$).

DISCUSSION

Gastric cancer is the most prevalent malignancy in Korea. There has been an increase in gastric screening as well as in the

proportion of EGC. Among 2501 individuals (1397 males and 1104 females) who underwent gastroscopy at the Health Promotion Center of SNUH in 2001, 19 individuals were diagnosed with gastric cancer (0.76%, 15 males and 4 females). Fifteen of these 19 patients had EGC (79%).

If gastric cancer is diagnosed at an early stage, patients can have highly favorable prognosis and can avoid extended surgery, which may produce complications, especially in the elderly (5).

However, the symptoms of gastric cancer are non-specific and vague, as shown by our series in which more than 80% of the symptomatic patients experienced epigastric pain and discomfort (6). Moreover, when cancers are diagnosed due to definitive symptoms such as weight loss or due to obstructive symptoms, early lymphatic metastases often impede curative radical resection. Additionally, the results presented for gastric cancer treatment do not differ markedly from the past results despite improved surgical techniques and adjuvant treatments.

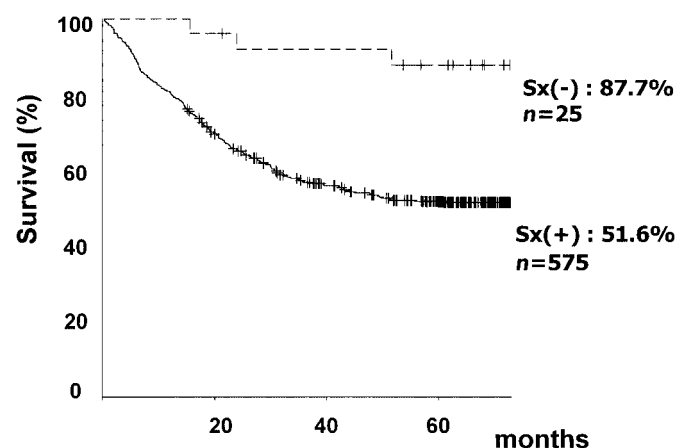


Figure 1. Survival curves of patients operated upon in 1996.

Korenaga et al. (7) showed that the prognosis of gastric cancer has not changed in the past 20 years, and this also holds true in Korea. Therefore, the only methods likely to improve survival rates are early detection and strategies that decrease the incidence of gastric cancer.

In Japan, mass screening has been performed since 1966, and this has resulted in a significant decrease in the mortality rates as compared to countries without such cancer-screening programs (8).

According to Everett et al. (9), the clinicopathologic features of Western patients are similar to those of Eastern patients. It appears that the early diagnosis, achieved by screening, is the main contributor to the higher proportion of EGC in Japan as compared to the West.

A public screening system for gastric cancer has not yet been introduced in Korea. Although occasional small-scale screening tests by communities or workplaces are increasing, it is difficult to study the efficacy of screening tests. In order to evaluate the usefulness of the gastric cancer screening system in Korea, we retrospectively analyzed gastric cancer patients diagnosed during the asymptomatic period. A majority of patients (80.6% in 1996, 91.4% in 2001) were diagnosed with gastric cancer by the screening test. The increase in asymptomatic patients from 4.7% in 1996 to 17.2% in 2001 seems to reflect the current increase in screening tests.

The proportion of EGC was significantly higher in the asymptomatic group than in the symptomatic group. The proportions of EGC in the asymptomatic group were not very different between 1996 (74.2%) and 2001 (78.1%). However, a significant increase in proportions of asymptomatic patients mainly contributed to the increased proportions of EGC from 28.1% in 1996 to 43.0% in 2001. Therefore, we suggest that the overall proportion of EGC in gastric cancer patients would increase with an increase in the proportion of the patients diagnosed during the asymptomatic period by health screening programs.

This study revealed that asymptomatic patients underwent subtotal gastrectomy more frequently. It indicated that high proportions of EGC made it possible to perform more subtotal gastrectomies, especially for patients with carcinomas located in the middle third of the stomach.

The 5-year survival rate was significantly higher in the asymptomatic group. However, multivariate analysis showed that the presence of symptoms was not an independent prognostic factor, rather, high proportions of early-stage diseases and radical curable resection contributed to better survival rates in the asymptomatic group.

Approximately 75% of the asymptomatic patients were diagnosed with EGC. This corresponds with the findings of Matsukuma et al. (10) and with the complementary data for 2001 at the SNUH Health Promotion Center. Moreover, stage IV asymptomatic cases are identified by screening. These results re-emphasize the non-specificity of gastric cancer symptoms and the need for an early screening test.

The most commonly used screening tool was gastroscopy. In nations where gastroscopy is expensive and the incidence of

gastric cancer is low, gastroscopy may not be a cost-effective screening tool; therefore, other methods have been used. The upper GI series could be such an alternative. However, Portnoi et al. (11) studied patients diagnosed by gastric mass screening in Moscow and reported that the most common type of EGC was type IIb. Moreover, the sensitivity of the upper GI series was only 12.2% in type IIb EGC cases. In Japan, the overall sensitivity of the upper GI series was reported to be 82.4%, with a specificity of 77.2% (2). Methods using *Helicobacter pylori* antibodies have also been introduced, but the effectiveness of these methods does not adequately justify their use as screening tools for gastric cancer (12).

Gastroscopy has the advantages of direct visualization and simultaneous biopsy. Although EGC may not be detected by inexperienced doctors (13), gastroscopic examinations performed at Korean medical centers have reasonable sensitivity (14).

Although gastric cancer screening tests are on the rise in Korea, Han (15) reported that among 2133 individuals who were enrolled randomly and were over the age of 40 years, only 11.2% had undergone a periodic gastroscopic examination. The characteristics of those who did not present for a routine gastric examination were that they resided in the countryside and had a low income.

In our series, patients in their sixties and seventies predominated in both the symptomatic and asymptomatic groups to similar extents. As patients aged over 40 years accounted for 90% of the total number of patients, we suggest that gastroscopic examination be recommended for individuals aged over 40 years in the general population.

In the asymptomatic group, the ratio of males to females was 3.8:1, which was higher than that observed in the other group (approximately 2:1). This result suggests that the percentage of males who undergo gastric screening is higher than that of females, and this finding corresponds with the result of a retrospective study involving 2146 Japanese individuals (10). Since screening programs in Korea were initiated at workplaces rather than communities, males had greater accessibility to screening tests than females. This supports the need for community-based mass screening tests covering the individuals who do not have access to the current workplace-based screening programs.

In terms of establishing a national policy for cancer screening tests, further studies on the intervals and the cost-effectiveness of these examinations is needed. Riecken et al. (16) reported that gastroscopic examination with a 4–5 year interval had no impact on the mortality rate of gastric cancer in China and suggested that more frequent examinations are needed. In a follow-up study, Tsukuma et al. (17) reported on patients who were diagnosed with EGC and progressed to advanced gastric cancer due to the lack of immediate therapy, the mean duration of progression from EGC to advanced cancer was estimated as 37 months. Moreover, in some cases, the EGC lesions may appear as healed benign ulcers, depending upon the aggravating-healing cycles of EGC. Therefore, it is advisable that a gastric examination be performed every one or two

years. We expect that an increase in the number of cancer screening programs at the workplace and in the community could facilitate optimizing the frequency of gastric examinations.

In 2002, the cost of gastroscopy in Korea was approximately 35 US dollars (41 587 Won) and that of gastroscopy with biopsy was approximately 50 US dollars (62 317 Won). Considering that 15 EGC patients were detected out of 2501 individuals who had undergone gastroscopy at the SNUH health promotion center in 2001, we can state that 15 people were diagnosed earlier at a cost of 85 000–125 000 US dollars (100–150 million Won). Therefore, in Korea, gastroscopy could be a cost-effective screening tool for gastric cancer. Further studies are needed with respect to the optimal examination interval and the targeting of specific groups for screening.

In conclusion, several symptoms of gastric cancer are non-specific. Asymptomatic gastric adenocarcinoma patients, a majority of whom were identified during health screening, had a better chance of being cured by operation and a higher survival rate than symptomatic patients. The proportion of patients diagnosed during the asymptomatic period increased from 1996 to 2001, which increased the overall proportion of EGC. These results support the usefulness of screening tests in Korea, where the incidence of gastric cancer is high. Gastroscopy appears to be an effective screening tool, but further studies are required to establish if and how mass screening programs should be instituted in this country.

Acknowledgment

This study was supported by a grant from the Seoul National University College of Medicine Research Fund 2000.

References

1. Lee HJ, Yang HK, Ahn YO. Gastric cancer in Korea. *Gastric Cancer* 2002;5:177–82.
2. Ministry of Health and Welfare. Annual Report of the Korea Central Cancer Registry 2001 (Published in 2003).
3. Lee HJ, Kim YH, Kim WH, Lee KU, Choe KJ, Kim JP, et al. Clinicopathological analysis for recurrence of early gastric cancer. *Jpn J Clin Oncol* 2003;33:209–14.
4. Hisamichi S. Screening for gastric cancer. *World J Surg* 1989;13:31–7.
5. Katai H, Sasako M, Sano T, Maruyama K. The outcome of surgical treatment for gastric carcinoma in the elderly. *Jpn J Clin Oncol* 1998;28:112–5.
6. Choi MG, Lee JH, Park KJ, Yang HK, Park JG, Lee KU, et al. Chronological changes of clinicopathologic features in gastric cancer. *J Korean Surg Soc* 1999;57:514–22 (in Korean).
7. Korenaga D, Moriguchi S, Orita H, Kakeji Y, Haraguchi M, Maehara Y, et al. Trends in survival rate in Japanese patients with advanced carcinoma of the stomach. *Surg Gynecol Obst* 1992;174:387–93.
8. Lambert R, Guillox A, Oshima A, Pompe-Kirn V, Bray F, Parkin M, et al. Incidence and mortality from stomach cancer in Japan, Slovenia, and the USA. *Int J Cancer* 2002;97:811–8.
9. Everett SM, Axon AT. Early gastric cancer in Europe. *Gut* 1997;41:142–50.
10. Matsukuma A, Furusawa M, Tomoda H, Seo Y. A clinicopathological study of asymptomatic gastric cancer. *Br J Cancer* 1996;74:1647–50.
11. Portnoi LM, Kazantseva IA, Isakov VA, Nefedova VI, Gaganov LE. Gastric cancer screening in selected population of Moscow region: retrospective evaluation. *Eur Radiol* 1999;9:701–5.
12. Whiting JL, Hallissey MT, Fielding JWL, Dunn J. Screening for gastric cancer by *Helicobacter pylori* serology: a retrospective study. *Br J Surg* 1998;85:408–11.
13. Sano T, Katai H, Sasako M, Maruyama K. The management of early gastric cancer. *Surg Oncol* 2000;9:17–22.
14. Youn HD, Jung HC, Song IS, Choi KW, Kim CY, Oh IH, et al. Endoscopic diagnosis of early gastric cancer. *Korean J Gastroenterol*. 1989;21:790–7 (in Korean).
15. Han CH, Rhee CW, Sun WS, Kim YS, Cheon KS, Hoang HH, et al. The factors related to the screening of stomach cancer. *J Korean Acad Fam Med* 2001;22:528–37 (in Korean).
16. Riecken B, Pfeiffer R, Ma JL, Jin ML, Li JY, Liu WD, et al. No impact of repeated endoscopic screens on gastric cancer mortality in a prospectively followed Chinese population at high risk. *Preventive Medicine* 2002;34:22–8.
17. Tsukuma H, Mishima T, Oshima A. Prospective study of early gastric cancer. *Int J Cancer* 1983;31:421–6.