

# Surgery in the Aged in Korea

Jin-Pok Kim, MD; Soo-Jin Kim, MD; Joo-Ho Lee, MD; Sung-Won Kim, MD; Min-Gew Choi, MD; Hang-Jong Yu, MD

**Objective:** To compare clinical characteristics, including postoperative outcomes, in Korean patients 65 years and older with those of younger patients.

**Design:** A retrospective medical record review.

**Setting:** An adult university hospital.

**Participants:** All patients who underwent various operative procedures, especially for stomach cancer, acute surgical abdomen, and abdominal wall hernia, in the Department of Surgery at Seoul National University Hospital, Seoul, Korea, in 1994 and 1995.

**Main Outcome Measures:** Demographics, disease pattern, length and extent of operation, hospital course including postoperative complications, and mortality.

**Results:** A clear increase in the patients 65 years and older was found. Of 2893 patients who underwent surgery in 1994, 735 were 40 years and younger (group 1), 1691 were 41 to 64 years old (group 2), and 467 were 65 years and older (group 3). The most common disease was stomach cancer in all age groups, with the highest incidence in group 3. Emergency operations were performed most often in group 1 ( $P < .05$ ;  $\chi^2$  test). Malignant neoplasm requiring a surgical procedure was identified more frequently with age ( $P < .001$ ). Among patients with acute surgical abdomen, acute appendicitis was the most common disease in all age groups, whereas more serious diseases were found with age. In the analysis of stomach cancer, male patients increased with age ( $P < .001$ ). Patients in group 3 had a poor preoperative physical status, and their perioperative courses were the most eventful

among all groups ( $P < .05$ ). However, no statistical differences among groups were present for resectability, postoperative length of hospitalization, postoperative complication, and mortality. In the analysis of operations for acute surgical abdomen including acute appendicitis, with their unfavorable preoperative physical status and eventful postoperative courses, perforation of the appendix and postoperative complications were most common in group 3 ( $P < .001$ ). No statistical differences among groups were noted for operative mortality. In addition, in the analysis of abdominal wall hernia, no statistical differences among groups were found for postoperative complication and mortality.

**Conclusions:** The proportion of patients 65 years and older among all surgical cases has increased in recent years. The proportion of malignant neoplasms, especially stomach cancer, was higher in the aged patients. Most operations were performed electively on the aged patients, as were those on younger patients. In the case of the acute surgical abdomen, severe diseases with an underlying malignant neoplasm were more frequently found in the aged patients. Despite their generally poor physical status, the patients 65 years and older proved to be able to tolerate elective major operations, such as radical gastrectomy for stomach cancer, when optimal perioperative management was provided. However, results of emergency operations in these elderly patients were poorer, with a higher complication rate. Therefore, the aged patient should be regarded as a candidate for surgery but with a more careful and comprehensive approach to his or her treatment perioperatively.

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From the Department of Surgery, College of Medicine, Seoul National University Hospital, Seoul, Korea.

**A**S A RESULT of widely provided public health programs and medical benefits as well as the overall improvement in individual nutrition, there has been an increase in the aged population in Korea. Data from the National Statistical Office of the Republic of Korea (**Figure 1**) show the rapid increase in the population 65

years and older.<sup>1</sup> Despite many unfavorable medical aspects in this population, such as reduced physical capacity and serious comorbid diseases, desirable results have been achieved after major surgical interventions.<sup>2,3</sup> Still, surgical treatment in the aged population is challenging and should be reappraised periodically. This study consists of 2 data sets, 1 from our own department and the other from

## PATIENTS AND METHODS

In 1994, 3031 patients underwent operative intervention in the Department of Surgery, Seoul National University Hospital, Seoul, Korea. Of these, 2893 patients were enrolled in this study. We divided the patients into 3 groups according to their age: patients 40 years and younger (group 1; n=735), those who were 41 to 64 years old (group 2; n=1691), and those who were 65 years and older (group 3; n=467). Demographics, disease pattern, ratio of emergency to elective operations, and the ratio of malignant to benign disease were compared among these groups. We chose 4 diseases (stomach cancer, acute surgical abdomen, abdominal wall hernia, and acute appendicitis) for this analysis. Extensive laboratory studies as well as American Society of Anesthesiology physical status class<sup>4</sup> of each surgery patient were reviewed. Operative procedures for stomach cancer were called a resection when either subtotal or total gastrectomy including extended total gastrectomy was performed. Operative mortality was defined as a death related to surgery within 30 postoperative days.

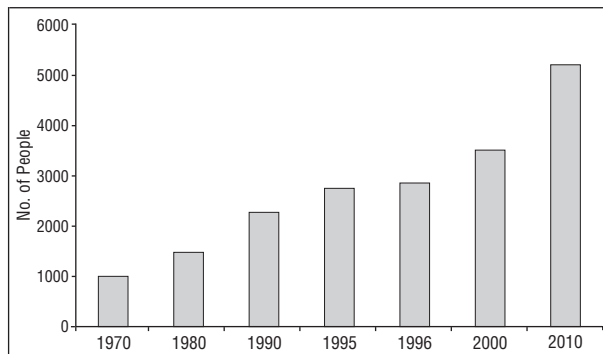
The results were compared by Student *t* test for the means and a  $\chi^2$  or Fisher exact test for proportions. Calculations were done with the SPSS software system (SPSS Inc, Chicago, Ill), and statistical significance was set at  $P < .05$ .

a review of articles published after 1990 in Korea. In our study, the aged patient was defined as one who was at least 65 years old at the time of surgery.

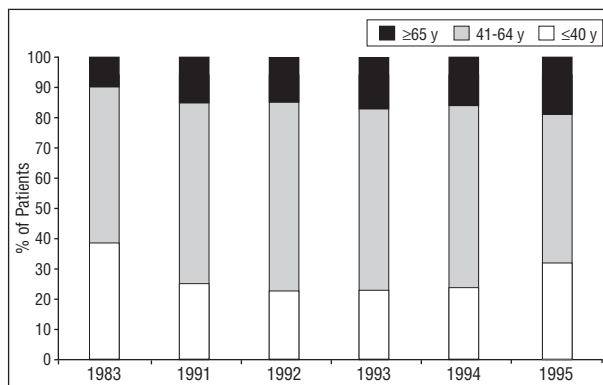
## RESULTS

### AGE DISTRIBUTION AND DIAGNOSIS

In 1994, patients 65 years and older who underwent various operations in our department comprised 15.2% of all patients operated on in that year. This percentage increased to 18.3% in 1995, and was only 9.19% in 1983 (**Figure 2**). **Table 1** gives the diagnosis of all surgical cases in 1994 categorized according to the patient's age. For each age group, stomach cancer was the most common disease, clearly increasing with age. The ratio of malignant to benign disease was found to be highest in group 3 (66.6%). Most of the operations were performed as elective surgery in all age groups. **Figure 3** shows diagnoses among the acute surgical abdominal problems by age group. Acute appendicitis, which was the most common acute surgical abdominal diagnosis in all groups, tended to be most common in the youngest age group, whereas perforation of a hollow viscus and intestinal obstruction tended to occur more often in the aged patients. Gastrointestinal tract bleeding, especially upper gastrointestinal tract bleeding (which includes peptic ulcer bleeding, small bowel bleeding, and intraperitoneal hemorrhage) occurred in about 10% of acute abdominal operations in all groups. Patients with malignant neo-



**Figure 1.** Population 65 years and older in Korea (data from the National Statistical Office, Seoul, Korea, 1996).



**Figure 2.** Age distribution of patients who underwent surgery in the Department of Surgery at Seoul National University Hospital, Seoul, Korea.

plasms manifesting as an acute abdomen made up 24.2% of group 3, 20.5% of group 2, and 1.4% of group 1 ( $P < .001$ ).

### STOMACH CANCER

In **Table 2**, clinical findings are listed for patients who underwent operations for stomach cancer. Among the 720 patients with stomach cancer in 1994, data for 536 patients were available for this study. Of these patients, 156 belonged to group 3, 269 to group 2, and 111 to group 1. Mean ages were  $72.5 \pm 4.1$ ,  $55.1 \pm 6.4$ , and  $35.2 \pm 4.2$  years, respectively. Significant findings included male predominance, fewer patients in American Society of Anesthesiology class 1, longer operating time, greater need for transfusion, more concomitant disease, longer postoperative ileus, and more electrocardiographic and pulmonary function test abnormalities in group 3 (the elderly), without any significant difference in early or late complications or deaths.

### ACUTE APPENDICITIS

A total of 107 cases of acute appendicitis were diagnosed and operated on during 1994 and 1995. **Table 3** summarizes the results. Fifty-eight patients belonged to group 1, in contrast to 24 and 25 patients from groups 2 and 3, respectively. Male patients were dominant in all groups. Significant findings included longer hospital stay, more concomitant disease, longer

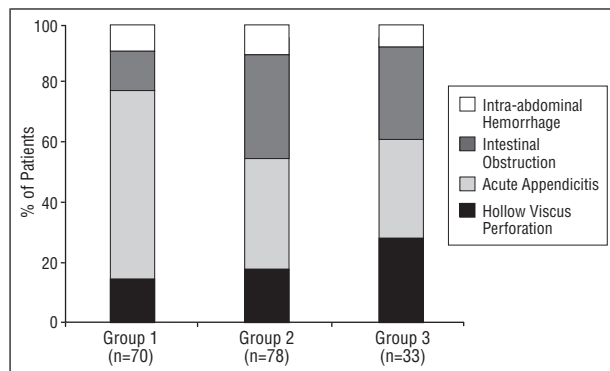
**Table 1. Diagnoses of Patients Who Underwent Operations in the Department of Surgery at SNUH in 1994\***

Group 1 (n=735)		Group 2 (n=1691)		Group 3 (n=467)	
Operation	% of Patients	Operation	% of Patients	Operation	% of Patients
Stomach cancer	15.3	Stomach cancer	27.3	Stomach cancer	34.7
Adenomatous goiter	8.8	Colorectal cancer	11.1	Colorectal cancer	15.2
Breast cancer	8.2	Breast cancer	8.1	GB stone	6.4
Vascular disease	6.7	Liver cancer	8.0	Hernia	5.6
Acute appendicitis	6.0	GB stone	7.2	Acute abdomen	4.7
Thyroid cancer	5.6	Adenomatous goiter	4.3	Vascular disease	4.7
GB stone	5.3	Vascular disease	4.3	CBD & IHD stone	3.6
Colorectal cancer	5.2	Thyroid cancer	3.1	Liver cancer	3.4
Benign tumor of breast	5.2	Acute abdomen	2.9	Breast cancer	2.4
Benign H & N disease	3.7	CBD & IHD stone	2.0	Acute appendicitis	2.4
Emergency operation†	9.5	Emergency operation	4.6	Emergency operation	7.3
Malignant neoplasm‡	37.4	Malignant neoplasm	63.6	Malignant neoplasm	66.6

\*First 10 diseases in order of decreasing incidence are shown for each group. SNUH indicates Seoul National University Hospital, Seoul, Korea; GB, gallbladder; H & N, head and neck; CBD, common bile duct; and IHD, intrahepatic duct. Group 1 involves patients 40 years and younger; group 2, between 41 and 64 years old; and group 3, 65 years and older.

†P=.02.

‡P<.001.



**Figure 3.** Disease pattern of patients who underwent surgery because of acute surgical abdomen in the Department of Surgery at Seoul National University Hospital, Seoul, Korea, in 1994 and 1995. Group 1 included patients 40 years and younger; group 2, 41 to 64 years old; and group 3, 65 years and older.

intensive care unit time, longer period of ileus, greater incidence of perforation, and a higher postoperative complication rate in the elderly (group 3), but again there was no significant difference in mortality among the groups.

### ACUTE SURGICAL ABDOMEN

**Table 4** gives results in 101 patients who underwent emergency surgery for an acute abdomen in 1994 and 1995. Acute surgical abdomen could be categorized further into 3 groups: intestinal obstruction, hollow viscus perforation, and intra-abdominal hemorrhage. Twenty-eight patients belonged to group 1, while 37 and 36 patients belonged to groups 2 and 3, respectively. Male patients were preponderant in all groups. Significant differences among the groups included increased rates of concomitant disease, underlying malignant neoplasm, electrocardiographic abnormalities, intensive care unit treatment, transfusions, and postoperative complications in the elderly, but without significant increase in operative mortality. Sepsis was the most common cause of death in these patients.

### ABDOMINAL WALL HERNIA

A total of 106 patients with abdominal wall hernia who underwent operation during 1994 and 1995 were studied. Twenty-five patients (23.6%) belonged to group 1, whereas 42 (39.6%) and 39 (36.8%) belonged to groups 2 and 3, respectively (**Table 5**). Male patients were preponderant in all groups ( $P=.24$ ). Inguinal hernia, especially right sided, was the most common hernia type observed in all patients, with others having umbilical, femoral, and incisional hernias. Hospital stay tended to increase with age. American Society of Anesthesiology status based on examination and laboratory values was significantly increased in group 3, but postoperative complications and operative mortality were similar in all groups.

### COMMENT

We reviewed the Korean surgical literature, studying outcomes of operations in the aged (65 years and older) published after 1990 (**Table 6**). The results were analyzed separately according to the setting (university hospital or community hospital). The aged patients who underwent surgery accounted for 6.7% (range, 5.3%-10.2%) and 3.6% (range, 2.0%-5.2%), respectively, of all operations performed primarily between 1991 and 1993. The most common surgical disease in the aged patients was benign biliary tract disease in the university hospitals, in contrast with acute appendicitis at community hospitals. Operative procedures for malignant neoplasm were performed on 28.5% (range, 25.5%-30.6%) and 32.1% (range, 22%-46.5%) of these patients, respectively. Stomach cancer was the most prevalent malignant neoplasm in both hospital settings. Of the elderly surgical patients at university hospitals, 43.7% (range, 35.2%-59.4%) reportedly had 1 or more concomitant diseases, in contrast with 59.2% (range, 36.6%-72.8%) in community hospitals. Hypertension was reportedly the single most common concomitant disease in all of these

**Table 2. Patients Who Underwent Operations in the Department of Surgery at SNUH in 1994 Because of Stomach Cancer\***

Variable	Group 1 (n=111)	Group 2 (n=269)	Group 3 (n=156)	P
Mean ( $\pm$ SD) age, y	35.2 $\pm$ 4.2	55.1 $\pm$ 6.4	72.5 $\pm$ 4.11	<.001
Male-female ratio	1:1.1	1:0.36	1:0.36	<.001
Mean ( $\pm$ SD) hospital postoperative stay, d	12.9 $\pm$ 7.8	12.9 $\pm$ 5.1	12.2 $\pm$ 3.9	.97
Resectability, %	90.1	91.8	91	.99
ASA class I, %	58.6	40.4	10.3	<.001
Mean ( $\pm$ SD) length of operation, † min	177 $\pm$ 48	195 $\pm$ 50	201 $\pm$ 62	
% With 90-150 min	34.6	26	19.2	.005
Perioperative transfusion, %	15.3	21.5	37.8	<.001
Albumin <30 g/L, %	0.9	5.2	7.7	.01
Concomitant disease, %	25.2	40.1	59.6	<.001
PFT abnormality, %	16.7	44.3	59.7	<.001
ECG abnormality, %	2.8	11.9	19.7	<.001
ICU care, %	0.9	1.1	4.5	.04
Postoperative ileus >5 d, %	5.4	9.3	22.5	<.001
Postoperative complication, %				
Early	10.8	7.4	10.3	.13
Late	9.9	9.7	10.9	.55
Operative mortality, %	0	0.4	0.6	.40

\*SNUH indicates Seoul National University Hospital, Seoul, Korea; ASA, American Society of Anesthesiology (ASA physical status class I is described as "The patient has no systemic disease, including the pathologic process for which the operation is needed, which is localized"); PFT, pulmonary function test; ECG, electrocardiogram; and ICU, intensive care unit. Group 1 involves patients 40 years and younger; group 2, between 41 and 64 years old; and group 3, 65 years and older.

†Evaluated only in patients who underwent resections.

**Table 3. Patients Who Underwent Operations at SNUH in 1994 and 1995 Because of Acute Appendicitis\***

Variable	Group 1 (n=58)	Group 2 (n=24)	Group 3 (n=25)	P
Mean ( $\pm$ SD) age, y	29.0 $\pm$ 6.4	51.5 $\pm$ 6.5	76.0 $\pm$ 6.5	<.001
Male-female ratio	1:0.8	1:0.7	1:0.9	.85
Mean ( $\pm$ SD) hospital postoperative stay, d	6.3 $\pm$ 3.3	9.6 $\pm$ 6.4	10.6 $\pm$ 6.9	<.001
% With $\leq$ 7 d	77.6	45.8	32	<.001
Length of operation, min	70 $\pm$ 28.7	84.8 $\pm$ 42.3	86.0 $\pm$ 43.5	.34
% With $\leq$ 60 min	50	21.7	44	.02
Concomitant disease, %	13.8	54.2	72	<.001
ECG abnormality, %	5.9	17.4	38	<.001
ICU care, %	1.7	8	16	.05
Mean ( $\pm$ SD) postoperative ileus, d	1.9 $\pm$ 1.0	2.7 $\pm$ 1.0	3.5 $\pm$ 1.0	<.005
% With $\leq$ 2 d	75.9	39.1	37.5	<.001
Perforation rate, %	29.5	40	63.6	<.001
Postoperative complication, %	12	16.7	40	<.001
Operative mortality, %	0	0	4	<.11

\*SNUH indicates Seoul National University Hospital, Seoul, Korea; ECG, electrocardiogram; and ICU, intensive care unit. Group 1 involves patients 40 years and younger; group 2, between 41 and 64 years old; and group 3, 65 years and older.

patients. Emergency operations were required in 44.6% (range, 40.5%-51.7%) of those patients at community hospitals compared with 37.9% (range, 26.9%-44.7%) at university hospitals. Postoperative complications developed in 22.0% (range, 14.0%-28.5%) in university hospitals and 32.4% (range, 17.9%-52.6%) in community hospitals. Postoperative mortality was 4.2% (range, 2.8%-4.7%) and 4.1% (range, 2.2%-7.4%), respectively, indicating an approximately 2 to 3 times higher rate than the 0.9% to 2.3% reported for all surgical patients. The most frequent diagnoses requiring emergency operations in the aged were acute appendicitis, followed by benign biliary tract disease, hollow viscus perforation, intestinal obstruction, and upper gastrointestinal tract bleeding, mainly caused by peptic ulcer bleeding. The postoperative complication

rates in these patients with acute abdomen varied from 27% to 54% between the 2 hospital groups, remarkably higher than 15% of all surgical postoperative patients with acute abdomen reported in Korea. Postoperative mortality of 4% to 6% in these patients was also found to be higher than the 0.6% to 2.3% of all surgical patients with acute abdomen reported in Korea. Perforation of the appendix was more common in the aged, with a rate of 41.1% or 55.0% as opposed to 8.7% or, at most, 23% in all surgical patients with acute appendicitis in the series most recently published in Korea. The rate of postoperative complications from acute appendicitis was 26.9% in the aged patients, higher than the reported 10% to 20% overall in Korea. No mortality related to surgery for acute appendicitis was noted.

**Table 4. Patients Who Underwent Operations at SNUH in 1994 and 1995 Because of Acute Surgical Abdomen\***

Variable	Group 1 (n=28)	Group 2 (n=37)	Group 3 (n=36)	P
Mean (±SD) age, y	31.0±7.2	54.9±6.5	74.3±4.1	<.001
Male-female ratio	1:0.40	1:0.37	1:0.64	.35
Mean (±SD) hospital postoperative stay, d	16.6±16.9	19.4±16.8	19.6±11.9	.07
% With ≤14 d	67.9	48.6	47.1	.06
Mean (±SD) length of operation, min	146±57	188±114	144.4±74.1	.81
% With ≤120 min	32.1	29.7	45.7	.24
Concomitant disease, %	21.4	72.2	79.3	<.001
Underlying malignant neoplasm, %	1.4	20.5	24.2	<.001
ECG abnormality, %	4.2	8.1	33.3	<.001
ICU care, %	10.7	30	39	.04
Perioperative transfusion, %	14.3	40.5	47.2	.01
Mean (±SD) postoperative ileus, d	3.3±1.1	4.2±1.5	3.8±2.6	.54
% With ≤3 d	60.7	27.3	46.4	.23
Postoperative complication, %	25	45.9	61.1	.003
Operative mortality, %	0	8.1	5.6	.35

\*SNUH indicates Seoul National University Hospital, Seoul, Korea; ECG, electrocardiogram; and ICU, intensive care unit. Group 1 involves patients 40 years and younger; group 2, between 41 and 64 years old; and group 3, 65 years and older.

**Table 5. Patients Who Underwent Operations at SNUH in 1994 and 1995 Because of Abdominal Wall Hernia\***

Variable	Group 1 (n=25)	Group 2 (n=42)	Group 3 (n=39)	P
Mean (±SD) age, y	30.0±7.9	54.8±6.6	72.6±5.4	<.001
Male-female ratio	1:0.4	1:0.17	1:0.18	.24
Mean (±SD) hospital postoperative stay, d	4.3±2.2	6.0±2.4	7.4±4.3	<.001
% With ≤6 d	76	69	41	.002
Mean (±SD) length of operation, min	82.9±28.2	84.5±39.5	72.6±43.5	.05
% With ≤80 min	58.3	61	76.5	.13
ASA class I, %	57.1	44.4	14.8	.003
Concomitant disease, %	40	61.9	82.1	.001
ECG abnormality, %	8.3	11.9	28.9	.02
PFT abnormality, %	0	61.5	72.4	<.001
% With inguinal hernia, %	96	78.6	79	.12
Postoperative complication, %	4	9.5	7.7	.65
Operative mortality, %	0	0	0	0

\*SNUH indicates Seoul National University Hospital, Seoul, Korea; ASA, American Society of Anesthesiology (ASA physical status class I is described as "The patient has no systemic disease, including the pathologic process for which operation is needed, which is localized"); PFT, pulmonary function test; and ECG, electrocardiogram. Group 1 involves patients 40 years and younger; group 2, between 41 and 64 years old; and group 3, 65 years and older.

**Table 6. Surgery in Patients 65 Years and Older in Korea: Review of Korean Articles Between 1990 and 1996**

	University Hospital	Community Hospital
Mean (±SD) proportion among all operations, %	6.65±2.03	3.60±1.59
Disease pattern	Benign biliary disease, acute appendicitis, stomach cancer, colorectal cancer, hernia	Acute appendicitis, benign biliary disease, stomach cancer, hernia, colorectal cancer
Mean (±SD) malignant neoplasm, %	28.54±1.98	32.08±10.82
Mean (±SD) concomitant disease, %	43.70±9.35	59.20±16.79
Mean (±SD) postoperative complication, %	21.98±5.84	32.35±15.97
Mean (±SD) operative mortality, %	4.18±1.87	4.13±2.26
Mean (±SD) emergency operation, %	37.92±8.30	44.63±6.15
Surgical acute abdomen		
Disease pattern	Acute appendicitis, benign biliary disease, hollow viscus perforation, intestinal obstruction, UGI* bleeding	Acute appendicitis, benign biliary disease, intestinal obstruction, hollow viscus perforation, UGI bleeding
Postoperative complication, %	27	54
Operative mortality, %	4	6
Acute appendicitis		
Perforated appendicitis, %	41.1	55.0
Postoperative complication, %	Not reported	26.9
Operative mortality	None	None

\*UGI indicates upper gastrointestinal tract.

The above results from the Korean literature review showed several differences from our results. The proportion of patients 65 years and older among all surgery patients and patients with malignant neoplasm, perforation of the appendix, concomitant diseases in cases of acute surgical abdomen, postoperative complications in cases of acute abdomen, and acute appendicitis were all found to be higher in our department, whereas emergency operations were performed less frequently in our department than in the reports in the Korean literature. The higher rate, in our department, of postoperative complications in the aged patients with acute abdomen other than acute appendicitis resulted partly from the relatively higher incidence of concomitant disease, especially underlying malignant neoplasm, in these patients (24.2%). The higher postoperative complication rate in our patients with acute appendicitis also correlates with a higher perforation rate and concomitant disease rate in these patients. The standard radical surgery for stomach cancer in our department consists of a resection with free margins confirmed during the operation by pathologic examination of frozen sections; modified D<sub>3</sub>, so-called D<sub>2</sub>+α, a lymph node dissection (lymph nodes 12 and 13 by the Japanese Research Society for Gastric Cancer classification<sup>5</sup>); and various types of gastrointestinal tract anastomoses.<sup>6</sup> We perform these operations when exploratory findings are compatible with a curative

resection even in aged patients. This is different from the usual resection performed in the United States, and the cure rate is higher.<sup>7</sup> Postoperative intestinal obstructions in patients with stomach cancer were mostly partial and managed nonoperatively. Anastomotic leakage most often could be managed conservatively with effective external drainage and nutritional support combined with antibiotic therapy.

Reprints: Jin-Pok Kim, MD, Department of Surgery, Seoul National University Hospital, 28 Yunkun-Dong, Chongno-Ku, Seoul 110-744, Korea (e-mail: jpkim@plaza.snu.ac.kr).

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## IN OTHER AMA JOURNALS

### JAMA

#### A Prospective Study of Risk Factors for Pulmonary Embolism in Women

Samuel Z. Goldhaber, MD; Francine Grodstein, ScD; Meir J. Stampfer, MD; JoAnn E. Manson, MD; Graham A. Colditz, MBBS; Frank E. Speizer, MD; Walter C. Willett, MD; Charles H. Hennekens, MD

**Objective.**—To investigate risk factors for pulmonary embolism in women.

**Design.**—Prospective study based on biennial, mailed questionnaires.

**Setting.**—Nurses' Health Study with 16 years of follow-up from 1976 to 1992.

**Patients.**—A group of 112 822 women aged 30 to 55 years in 1976, free from diagnosed cardiovascular disease or cancer at baseline. Overall, there were 1 619 770 person-years of follow-up.

**Measurements.**—Based on self-report and medical records, we documented 280 cases of pulmonary embolism, of which 125 were primary (no identified antecedent cancer, trauma, surgery, or immobilization). Information on height, weight, cigarette smoking, hypertension, diabetes, and hypercholesterolemia was collected by questionnaire.

**Results.**—In multivariate analysis, obesity, cigarette smoking, and hypertension were independent predictors of pulmonary embolism. Specifically, obese women (body mass index  $\geq 29.0$  kg/m<sup>2</sup>) had an increased risk of primary pulmonary embolism (multivariate relative risk=2.9; 95% confidence interval [CI], 1.5-5.4). Heavy cigarette smokers also had an increased risk of primary pulmonary embolism. The relative risk (RR) of primary pulmonary embolism was 1.9 (95% CI, 0.9-3.7) for women currently smoking 25 to 34 cigarettes per day and 3.3 (95% CI, 1.7-6.5) for those smoking 35 cigarettes or more daily as compared with never smokers. Hypertension, even after adjustment for body mass index, was also associated with an increased risk of primary pulmonary embolism (RR=1.9; 95% CI, 1.2-2.8). High serum cholesterol levels (RR=1.1; 95% CI, 0.62-1.8) and diabetes (RR=0.7; 95% CI, 0.3-1.9) did not appear to be related to primary pulmonary embolism.

**Conclusion.**—These prospective data indicate that obesity, cigarette smoking, and hypertension are associated with increased risk of pulmonary embolism in women. Control of these risk factors will decrease risks of pulmonary embolism as well as coronary heart disease. *JAMA*. 1997;277:467-471

Reprints: Samuel Z. Goldhaber, MD, Cardiovascular Division, Brigham and Women's Hospital, 75 Francis St, Boston, MA 02115 (e-mail: szgoldhabe@bics.bwh.harvard.edu).