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Short communication

Increasing body mass index in Japanese patients with gastric cancer

Makoto Kubo, Takeshi Sano, Takeo Fukagawa, Hitoshi Katai, and Mitsuru Sasako

Gastric Surgery Division, National Cancer Center Hospital, 5-1-1 Tsukiji, Chuo-ku, Tokyo 104-0045, Japan

Abstract
We studied the body mass index (BMI) of 986 patients who underwent potentially curative gastrectomy for gastric cancer at the National Cancer Center Hospital, Tokyo, in 1971, 1981, 1991, and 2001. The median BMI increased from 20.8 kg/m² in 1971 to 22.6 kg/m² in 2001 ($P < 0.01$). The increase was significant in both early and advanced gastric cancers, and in males, but not in females. The proportion of overweight patients (BMI ≥ 25.0 kg/m²) increased from 9.2% in 1971 to 24.0% in 2001. Obese patients (BMI ≥ 30.0 kg/m²) were rare. In conclusion, surgeons at the National Cancer Center Hospital, Tokyo, are increasingly having to operate on fat patients, but obese patients are still uncommon compared to the West.

Key words Body mass index · Gastric cancer · Gastrectomy · Operative morbidity

Introduction

Operative morbidity and mortality rates for gastric cancer in Asian countries have been reported to be better than those in the West [1]. Possible explanations for this are that Western gastric cancer patients are older and fatter, and more frequently have significant comorbidities compared with their Asian counterparts. While it is true that Japanese surgeons have developed and practiced surgical techniques in thin and fit patients, there is a consensus that Japanese patients are becoming fatter and sometimes require special caution or even technical modifications to the D2 lymphadenectomy and postoperative management. In order to validate this impression, we examined the changes in body mass index (BMI) of Japanese patients over the past three decades.

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Subjects and methods

The National Cancer Center Hospital, Tokyo, is a specialized referral center, established in 1963, where more than 10 000 gastric cancer patients have undergone gastrectomy. The vast majority of patients are residents of the metropolitan area. We reviewed the records of all of the patients who underwent potentially curative gastrectomy (R0) at our hospital in the years 1971, 1981, 1991, and 2001 — a total of 986 patients. We excluded patients with noncurative operations, as these patients may have had considerable weight changes preoperatively due to gastrointestinal obstruction, cachexia, ascites, or other conditions related to advanced malignancy. The height and weight data were collected from the preoperative summary charts or anesthetic records. The disease was categorized as either early or advanced according to the histological depth of tumor invasion (pT1 vs pT2/3/4).

The BMI was calculated as the weight in kilograms divided by the square of the height in meters (kg/m²), and was categorized according to the WHO cutoff points [2], i.e., underweight, less than 18.5 kg/m²; normal, from 18.5 to 24.9 kg/m²; and overweight, 25.0 kg/m² or more. The trends of BMI and patients' age were statistically examined using Dunn's test for multiple comparisons setting the values of 1971 as the reference.

Results and discussion

The patient demographics and BMIs are shown in Table 1. The male/female ratio was almost constant, while the median patient age in 2001was significantly higher than that in the other three periods in both males and females. The proportion of early gastric cancer in potentially curative cases steadily increased, from 41.8% in 1971 to 61.8% in 2001.

Table 1. Patient demographics and body mass indices

Year of surgery	1971	1981	1991	2001
Number of patients	153	184	232	417
Age in years; median (range)	58 (19–80)	57.5 (27–83)	59 (31–87)	62 (26–87)
Sex ratio (M/F)	1.5	2.0	2.1	1.8
Early cancer (%)	41.8	53.8	56.6	61.8
BMI; median (range)	20.8 (14.6–31.2)	20.9 (12.0–34.2)	21.8 (14.8–35.3)	22.6 (15.0–31.8)
Male	20.5	21.0	22.8	23.0
Female	21.1	20.6	20.7	21.9

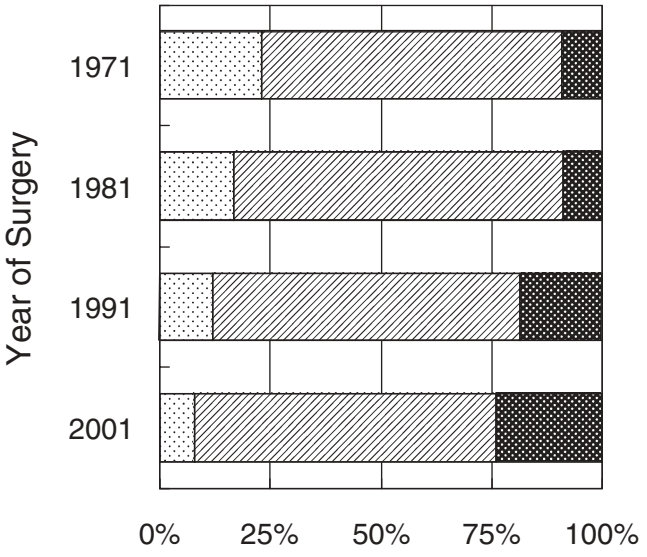

Fig. 1. Trend of body mass index (BMI) distribution. *Dotted bars*, BMI < 18.5; *gray hatched bars*, normal; *dark gray bars*, BMI > 25

The median BMI increased from 20.8 kg/m^2 in 1971 to 22.6 kg/m^2 in 2001 ($P < 0.01$). The increase was statistically significant in males but not in females. The median BMI in patients with early cancer (22.1 kg/m^2) was significantly higher than that in patients with advanced cancers (21.5 kg/m^2; Mann-Whitney U-test; $P = 0.013$), possibly reflecting disease-related weight loss in the advanced group. In both early and advanced cancers, the patients' median BMI increased significantly from the first two periods to the last two periods.

In 1971, only 9.2% of patients were overweight, while 22.9% were underweight. In 2001, in contrast, 24.3% of patients were overweight, while only 7.9% were underweight (Fig. 1). Obese patients (BMI ≥ 30.0 kg/m^2) were rare at all times (0.7% in 1971 and 1.4% in 2001). These results confirm that surgeons in our institution are operating, with increasing frequency, on older and fatter patients with gastric cancer, especially in the past 20 years.

The trend seems to reflect the changes in age and BMI of the Japanese population. The median age of the total Japanese population has increased rapidly, from 29.1 years in 1970 to 41.4 years in 2000 [3]. The National Nutrition Survey showed that, in the 20-year period from 1976 to 1995, the BMIs of Japanese men in all age groups, and that of elderly women, increased, while that in younger women, especially in metropolitan areas, decreased [4]. In addition, the expansion of indications for gastrectomy in old and obese patients in recent years may have facilitated the trend in this study, i.e., we are now frequently operating on old or overweight patients, for whom gastrectomy might not have been performed 30 years ago.

BMI does not necessarily measure the body fat volume. Interestingly, the relationship between BMI and body fat varies considerably among ethnic groups, and Asian people tend to have more fat for a given BMI than Caucasians [5]; some researchers have proposed 23.0 kg/m^2 instead of 25.0 kg/m^2 as a BMI cutoff point of overweight for Asians [6]. If we apply this criterion, 43.9% of our patients in 2001 were overweight compared with 24.2% in 1971.

Nevertheless, the majority of our patients are still normal or underweight according to the WHO criteria and, as compared to Western series, we have only limited occasions to operate on obese patients (BMI ≥ 30.0 kg/m^2). Barry et al. [7], in the United Kingdom, reported that nearly half of their patients who had undergone potentially curative gastrectomy were overweight, and 7% had a BMI of more than 30 kg/m^2. Gretschel et al. [8], in Germany, reported that 58.8% of their 199 patients with total gastrectomy had a BMI of more than 25 kg/m^2 and 18.1% had a BMI of more than 30 kg/m^2. It is interesting that these two European groups maintain that BMI does not affect operative morbidity or survival after D2 gastrectomy, whereas Japanese surgeons report high BMI as an important risk factor for morbidity and recurrence [9,10]. This may suggest that D2 gastrectomy in obese patients requires some different surgical techniques that are not quite familiar to Japanese surgeons.

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