Introduction

Until several decades ago death rates for colorectal cancer were higher in developed western societies and lower in Southeast Asia, including Japan. In Japan, however, the incidence of this disease began rising around 1955 and this trend has subsequently continued even when viewed in terms of annual trends in mortality for the disease. It has been shown that, even in the past when the incidence of colorectal cancer was generally thought to be lower in Japan, the morbidity rate was greater among Japanese descendants.

Abstract: Malignant neoplasms have been the most common cause of death among Japanese since 1981, and the number of deaths from cancers has subsequently increased at a rapid pace. In the ensuing two decades, the frequency of colorectal cancer, among other malignant neoplasms, has increased nearly two-fold, while that of gastric cancer, which was formerly higher, has diminished. In fact, the death rate for colorectal cancer (per 100,000 population) has increased 6- to 7-fold in both males and females in the past 50 years. In Japan, the five-year survival rate in curatively resected cases of colorectal cancer has improved progressively over the past 25 years or so, and therapeutic outcome in cases of advanced cancer in particular, has improved to a remarkable extent with advances in surgical techniques. Furthermore, success in detection of early carcinomas that are treatable to a complete cure has also increased markedly as the result of improved diagnostic techniques. The increased mortality of the disease despite such improvement in the cure rate reflects the fact that the incidence rate for colorectal cancer has been increasing in Japan. It is generally considered that the westernization of living environment including dietary life in Japanese society is largely responsible for this trend.

Key words: Colorectal cancer; Death rate; Incidence rate; Survival rate after curative resection; Dietary life
of immigrants in the States of Hawaii and California. Using data from animal experiments on colorectal cancer development with chemical carcinogens, it has also been demonstrated that dietary life and other life-environmental factors influence the occurrence of colorectal cancer. It is thus considered that the lower incidence of the disease in the past was not due to racial differences but to life environment, the westernization of which has led to its increase.

This paper describes the annual trends in the occurrence of colorectal cancer in Japan from various perspectives, on the basis of statistical survey data, and comments on whether the incidence of this disease has been increasing or not.

Colorectal Cancer as Viewed from Causes of Death

The average life span of Japanese was 50.06 years for males and 53.96 years for females in 1947, and had become markedly prolonged to 77.64 years for males and 84.62 years for females in 2000 according to the Vital Statistics of Japan published by the Ministry of Health, Labour and Welfare. Under these circumstances, malignant neoplasms became the most common cause of death about the beginning of 1980’s and thereafter, replacing cerebrovascular disorders which had been the most common cause until then. Since that time, the number of individuals dying from malignant neoplastic diseases has increased rapidly; 295,399 patients died of malignant neoplasms in 2000, with a death rate of 235.2 per 100,000 population, accounting for 30.7% of total deaths.

Among malignant neoplasms, high death rates were formerly recorded for gastric cancer (malignant neoplasms of the stomach), being 44.2% for men and 36.2% for women in 1970. In 2000 the death rates were 18.3% for men and 15.3% for women; hence a substantial reduction in the proportion to total deaths from all malignant neoplasms to less than half in the last three decades. In contrast, the ratio of deaths from colorectal cancer (malignant neoplasms of the large bowel) to total deaths from all malignant neoplasms increased to 11.1% for males and 13.8% for females in 2000, compared to 6.4% and 7.9%, respectively, in 1970.

In 2000, the total mortality from colorectal cancer was 19,868 men and 16,080 women; when viewed in terms of the age-adjusted death rate, colorectal cancer ranked fourth after cancer of the lung, gastric and hepato-biliary tract cancer in men, and was the second most common malignancy after gastric cancer in women.

**Annual Trends in Death Rates for Colorectal Cancer**

According to the Vital Statistics of Japan, the death rate (per 100,000 population) for
Colorectal cancer was 4.5 for both men and women in 1950 and increased year on year to 13.5 for men and 11.9 for women in 1980 and to 32.4 and 25.1, respectively, in 2000 as seen in Table 1. Thus, there were 7.2-fold and 5.6-fold increases for males and females, respectively, as compared to the rates 50 years ago, and the increases were 2.4-fold for men and 2.1-fold for women in 1980 and increased year on year to 6.3-fold for men and 5.6-fold for women, compared to those 20 years previously (1980).

With the carcinomas of the large bowel being classified into cancer of the colon and cancer of the rectum, the death rate for both cancers has increased progressively in both genders although the increase has been more conspicuous for cancer of the colon.

Changes in the Frequency of Colorectal Cancer by Tumor Location

The total number of cases of colorectal cancer is on the increase. As for frequencies of colorectal cancer by tumor location according to the Multi-Institutional Registry of Large Bowel Cancer in Japan issued by the Japan Society for Cancer of the Colon and Rectum (JSCCR), as shown in Fig. 1, rectal carcinomas accounted for more than half (55.9%) of all cases of colorectal cancer in the mid 1970’s. The frequency of cancer of the rectum gradually declined thereafter, dropping to less than 50% in 1985, and further to 40% in 1997, this being the latest statistical data. The frequency of cancer of the colon, in contrast, has shown a tendency to increase for all sites of involvement. Currently, a marked increase in the incidence of carcinomas of the cecum and ascending colon, i.e., carcinomas of the right colon, is noteworthy while cancer of the sigmoid colon makes up about one-fourth (25.6%) of all cancers of the large bowel.

Notwithstanding the decline in the incidence of cancer of the rectum, the anorectal canal accounts for approximately 10% of the whole length of large bowel and nearly 40% of all colorectal carcinomas occur in that region. This region thus remains a site with a greater risk for cancer development than other regions.
Changes in Survival Rates for Cases with Curative Resection

In estimating the incidence rate from the death rate for colorectal cancer, it is important to clarify the percentage of patients with colorectal cancer in whom a complete cure is attained by treatment.

In terms of changes in five-year survival rates after curative resection of colorectal cancer (adenocarcinoma alone) in Japan since the Multi-Institutional Registry of Large Bowel Cancer in Japan was initiated in 1974, the overall five-year survival rate for curative resection cases of colorectal cancer was 71.1% for cancer of the colon and 57.7% for cancer of the rectum in 1974–1975. The outcome then improved year on year to become 83.9% and 79.8%, respectively, in 1994 according to the latest data; hence a remarkable improvement for both cancer of the colon and that of the rectum (Table 2).

The five-year survival rate by stages of carcinoma (Dukes staging) improved noticeably in cases of Dukes B or C disease, and the five-year survival rate for rectal carcinoma in particular, improved by more than 20% in 15 years in cases of Dukes B or C disease. This is considered to be largely attributable to the elucidation of the disease state of large bowel carcinoma, advances in surgical techniques, and development of surgical adjuvant chemotherapy. However, it should be pointed out that the increased opportunity for early detection of colorectal cancer as a result of the increased prevalence of examinations such as fecal occult blood tests and improved diagnostic techniques, has also contributed to the overall improvement in the five-year survival rate.

### Table 2 Annual Trends in the Five-Year Survival Rate for Curatively Resected Cases in Colorectal Cancer

<table>
<thead>
<tr>
<th>Year (No. of cases)</th>
<th>overall</th>
<th>Dukes A</th>
<th>Dukes B</th>
<th>Dukes C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer of colon</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1974-1975 (734)</td>
<td>71.1%</td>
<td>88.0%</td>
<td>73.0%</td>
<td>57.3%</td>
</tr>
<tr>
<td>1980-1981 (1,766)</td>
<td>72.3</td>
<td>82.5</td>
<td>75.7</td>
<td>63.6</td>
</tr>
<tr>
<td>1985 (1,576)</td>
<td>76.9</td>
<td>90.6</td>
<td>79.6</td>
<td>65.8</td>
</tr>
<tr>
<td>1994 (2,262)</td>
<td>83.9</td>
<td>93.4</td>
<td>84.5</td>
<td>74.0</td>
</tr>
<tr>
<td><strong>Cancer of rectum</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1974-1975 (1,015)</td>
<td>57.7%</td>
<td>78.2%</td>
<td>58.6%</td>
<td>42.7%</td>
</tr>
<tr>
<td>1980-1981 (2,033)</td>
<td>65.6</td>
<td>85.8</td>
<td>69.1</td>
<td>48.2</td>
</tr>
<tr>
<td>1985 (1,528)</td>
<td>70.1</td>
<td>84.9</td>
<td>74.6</td>
<td>52.9</td>
</tr>
<tr>
<td>1994 (1,517)</td>
<td>79.8</td>
<td>93.9</td>
<td>79.8</td>
<td>64.7</td>
</tr>
</tbody>
</table>

(from Multi-Institutional Registry of Large Bowel Cancer in Japan)

Colorectal Cancer Is Increasing in Japan

There are no exact figures for cases with colorectal cancer in Japan because no complete surveys have been conducted as to the actual state of the incidence rate. The numbers of patients dying as a result of cancer of the large bowel and the death rates (per 100,000 population) for the disease have increased 6- to 7-fold for both genders in the past five decades or so, as described above. There have been significant improvements in the therapeutic outcome in cases of colorectal cancer, especially of advanced carcinomas, and improved diagnostic techniques have led to the detection and treatment of a considerable number of cases of early carcinoma for which the cure rate is close to 100%. Under these circumstances, the fact that the number of patients dying from large bowel carcinoma has actually been increasing may well be construed as implying that the number...
of patients with this disease is increasing. Colorectal cancer is still on the increase in Japan.

Changes in Dietary Life

To date, it has been demonstrated that APC, K-ras, p53, MCC, and mutations of many other cancer-associated genes are involved in the carcinogenic process of colorectal cancer, but the precise causes for such changes remain to be clarified. Regarding the etiology of cancer of the large bowel, however, the following have been indicated to have bearing on the increase in the frequency of colorectal cancer, based on various epidemiologic investigations and experimental studies: increased secretion of bile acids, especially of secondary bile acids, due to a high-fat diet, and production of carcinogens through the metabolic process of bile acids, e.g., due to altered enteric bacterial flora; increased concentrations of carcinogenic substances in feces which are concentrated as a result of a low-fiber diet; a prolonged transit of the intestinal contents with a consequent extension of the contact time of carcinogens with the intestinal mucosa; and so forth.

Regarding the changes in dietary life in post-war Japan, annual trends in energy intake by nutrients presented in the National Nutrition Survey by the Ministry of Health and Welfare reveal that protein intake, which was 13.3% in 1960, has not changed appreciably (15.6% in 1993) and that carbohydrate intake decreased markedly from 76.1% in 1960 to 58.7% in 1993, while fat intake increased noticeably from 10.6% to 25.7% (Table 3). Furthermore, the proportion of animal fat in total fat intake has...
increased. According to the annual trends in dietary intake by food categories presented in the Survey, the intake of grains has decreased substantially while an increase of close to 4 fold was observed for meat (including chicken) and dairy products in 1993 as against intake in 1960 (Table 4).

Such westernization of dietary life, that is, increased intakes of animal fat and protein and decreased edible fiber intake, is considered to be chiefly responsible for the increase in the incidence of colorectal cancer in Japan.

Prevention of Colorectal Cancer

Measures against the increase of colorectal cancer in Japan, that is, prevention of the disease, include primary prevention to ward off the development of carcinoma of the large bowel and secondary prevention to prevent fatality from cancer of the colon and/or rectum via early detection of the carcinoma and early institution of treatment.

Primary prevention, as described above, includes committing to a well-balanced diet and maintenance of a regular bowel habit by avoiding high-fat meals (particularly animal fat), taking at least 20–25g of edible fibers daily, and ingesting vitamins C, E, and A which are thought to be useful in the suppression of formation and detoxification of carcinogenic substances.

A more realistic method of preventing colorectal cancer is secondary prevention. Detection and treatment of an early cancerous state and treatment of adenoma being regarded as a precancerous lesion by augmenting and improving the examination system including stool occult blood tests and periodic examination of the large bowel such as in a complete medical checkup are considered to be important aspects of treatment.

Conclusion

The incidence rate for colorectal cancer has definitely been increasing in Japan when viewed from various perspectives, and it would seem that cancers of the colon, especially those in the right-side colon, rather than of the rectum have increased. In order to further suppress the death rate for colorectal cancer, it is fervently hoped that primary prevention of the disease, to say nothing of the importance of secondary prevention, will become feasible through further pursuit of research on carcinogenetic mechanisms.

REFERENCES