

Epidemiology Note

Trends in Colorectal Cancer Incidence by Subsite in Osaka, Japan

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To date, the time trends of left-to-right shift of colorectal cancer incidence have been reported in Western countries. In the present study, we calculated the average annual number of colorectal cancer incidence and the age-adjusted colorectal rates, and examined the change of subsite distribution using the data from the Osaka Cancer Registry between 1974 and 2003. Mucosal carcinoma cases were excluded from the analyses. The proportions of right colon cancer among all colorectal cancer cases were consistently increased; from 21.5% in 1974–78 to 25.6% in 1999–2003 among men, and from 28.2% in 1974–78 to 36.8% in 1999–2003 among women. The age-adjusted incidence rates of right colon cancer among men and women recently levelled off, while the rates of left colon and rectal cancers showed a declining trend. Among women, right colon cancer was more common in the elderly than in the young. The change of subsite distribution seemed to be associated with population aging, changes of life style and the development of total colonoscopy. Careful monitoring is necessary to confirm these findings.

Key words: colorectal cancer – incidence – subsite

BACKGROUND

Colorectal cancer is the third cause of cancer death in Japan, with 22 392 men and 18 664 women dying from colorectal cancer in 2006 (1).

To date, the time trend of left-to-right shift for colorectal cancer incidence has been reported in Western countries (2–6). However, the left-to-right shift was not observed in Japan before 1989 by population-based study (7). Meanwhile, there were some studies that reported the left-to-right shift of colorectal cancer incidence based on the data from the site-specific cancer registry of the Japanese Society for Cancer of Colon and Rectum (JSCCR) between 1974 and 98 (8,9). The trends in subsite distribution of colorectal cancer should be examined by population-based cancer registry rather than site-specific registry, in which limited institutes participated.

In the present study, we updated the recent trends in colorectal cancer incidence by subsite, and tried to examine the left-to-right shift of colorectal cancer using the data from a population-based cancer registry in Japan.

PATIENTS AND METHODS

The Osaka Cancer Registry (OCR), which started in 1962, is a population-based cancer registry covering Osaka prefecture (population: 8.8 million, 2005 census). Using OCR data on colorectal cancer incidence (International classification of diseases 10th revision C18–C20), we calculated the average annual incidence, the age-adjusted rates, and the age-specific rates according to subsite. Since there would be many un-registered cases, the mucosal carcinoma cases were excluded from the analyses.

Subsites were categorized into right colon (cecum, ascending colon, hepatic flexure, transverse colon and splenic flexure; C180 and C182–C185), left colon (descending colon and sigmoid colon; C186 and C187) and rectum (C19

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and C20). Cancer cases of appendix (C181) were excluded from the analyses. Incident years were divided into 5-year time periods: 1974–78, 1979–83, 1984–88, 1989–93, 1994–98 and 1999–2003.

The data from OCR on colon cancer incidence include a substantial number of cases not classified into any specific subsite (C188 and C189). Therefore, based on the assumption that the distribution of subsites in the same sex, age group and incident year was the same between those with and without specific subsite information, we compensated for the proportion of colon cancer cases without specific subsite information.

The detailed procedure was followed by the similar study for trends in lung cancer incidence by histological type (10); first, the sex-, age (5-year)- and incident year- specific colon cancer incidences were calculated for all cases, including the cases without specific subsite information. Second, the sex-, age (10-year)- and incident year-specific proportion of each subsite among the cases with specific subsite information was calculated. Finally, the sex-, age (5-year)- and incident year-specific incidences were multiplied by the corresponding sex-, age- and incident year-specific proportion to approximate the incidence by subsite.

RESULTS

The proportions of colon cancer cases without subsite information in 1974–78, 1979–83, 1984–88, 1989–93, 1994–98 and 1999–2003 were 15.1%, 15.0%, 18.0%, 19.0%, 18.6% and 21.7% among men, and 18.0%, 19.0%, 18.6%, 21.7%, 23.2% and 25.5% among women, respectively. The incidence by sex, age, subsite and incident year were calculated according to the above-mentioned assumption.

Table 1 shows the trends in the average annual colorectal cancer incidence by subsite. The annual colorectal cancer incidence for all subsites increased consistently. Right colon cancer was more common among women than among men. The right colon cancer incidence among women overtook left colon cancer and rectal cancer incidence in 1999–2003 and

1994–98, respectively. The proportion of right colon cancer gradually increased during the study period among men and women; from 21.5% to 25.6% among men, and from 28.2% to 36.8% among women. The proportion of left colon cancer peaked in 1989–93 among men and in 1984–88 among women, and subsequently levelled off. The proportions of rectal cancer among men and women decreased consistently.

Table 2 shows the trends in age-adjusted incidence rate by subsite. The rate of right colon cancer increased until 1994–98 among men and women, and subsequently levelled off. The rate of left colon cancer peaked in 1989–93 and 1994–98 among men and women, respectively, and subsequently decreased. The rate of rectal cancer peaked in 1994–98 and 1989–93 among men and women, respectively, and subsequently decreased.

In age-stratified analyses, the proportion of right colon cancer among men and women in the elderly increased remarkably: from 22.5% to 34.6% among men and from 25.0% to 46.8% among women for aged ≥80 years. Among women, right colon cancer was more common in the elderly than in the young; the proportion in 1999–2003 for the aged ≥80, 70–79, 60–69, 50–59 and aged 40–49 years was 46.8%, 40.7%, 32.0%, 28.0% and 17.8%, respectively.

DISCUSSION

The present study updated the recent trends in colorectal cancer by subsite in Osaka, Japan. The recent declining trends in age-adjusted incidence rates of rectal cancer and left colon cancer were observed, while the rate of right colon cancer has levelling off since 1994–1998. As a result, a gradual left-to-right shift of colorectal cancer incidence was observed, particularly among women. Furthermore, right colon cancer was more common in the elderly than in the young, among women. These findings were similar with the previous studies using site-specific registry of JSCCR (8,9). There were some possible factors that contributed to the change of subsite distribution of colorectal cancer incidence: population aging (2,8,9,11–15), life-styles changes (16–20),

Table 1. Trends in the average annual number of colorectal cancer incidence according to subsite

	Incident year					
	1974–78	1979–83	1984–88	1989–93	1994–98	1999–2003
Men						
Right colon (%)	126 (21.5)	194 (20.8)	278 (20.8)	470 (23.0)	591 (24.4)	666 (25.6)
Left colon (%)	162 (27.6)	299 (32.0)	482 (36.0)	793 (38.9)	897 (37.0)	960 (36.9)
Rectum (%)	298 (50.9)	442 (47.3)	579 (43.2)	776 (38.1)	938 (38.7)	977 (37.5)
Women						
Right colon (%)	137 (28.2)	188 (25.4)	290 (27.6)	457 (30.6)	613 (34.3)	731 (36.8)
Left colon (%)	132 (27.1)	242 (32.6)	380 (36.2)	539 (36.1)	644 (36.0)	695 (35.0)
Rectum (%)	217 (44.7)	311 (42.0)	380 (36.2)	499 (33.4)	533 (29.8)	558 (28.1)

Table 2. Trends in age-adjusted incidence rates per 100 000 person-years according to subsite

	Incident year					
	1974–78	1979–83	1984–88	1989–93	1994–98	1999–2003
Men						
Right colon	5.3	7.2	8.8	12.7	13.6	12.8
Left colon	7.0	11.1	15.2	20.7	19.9	18.1
Rectum	12.5	16.0	17.8	19.8	20.4	18.2
Women						
Right colon	4.7	5.5	6.9	9.2	10.2	10.1
Left colon	4.4	6.9	9.1	11.0	11.2	10.3
Rectum	7.3	8.8	9.1	10.3	9.3	8.5

the development of total colonoscopy and endoscopic treatment (2,8,9). The combination of these factors probably caused the change of subsite distribution.

The present study has some limitations. First, the data from OCR included a substantial number of colon cancer cases without specific subsite information: the proportion of these cases among all colorectal cancer cases in OCR was 20.1%, while those in the reports from the Western countries were 2.0–9.0% (2,5,6,11–14). Therefore, we had to use some assumptions in order to calculate the number of incidence by subsite. Care is necessary to interpret the findings. Second, there may be some missing cases in OCR. The proportion of death certificates only for colorectal cancer in OCR in 1998–2002 was 5.6% among men and 8.7% among women, respectively (21). Therefore, colorectal cancer incidence might be underestimated as a whole.

In conclusion, we reported the recent trends in colorectal cancer incidence by subsite in Osaka, Japan. Careful monitoring is necessary to confirm these findings.

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Conflict of interest statement

None declared.

References

1. Vital and Health Statistics Division, Statistics and Information Department, Minister's Secretariat, Ministry of Health, Labour and Welfare. Death Table 15; Vital Statistics. 2006; Available from <http://www.mhlw.go.jp/toukei/saikin/hw/jinkou/suii06/deth15.html>.
2. Saltzstein SL, Behling CA. Age and time as factors in the left-to-right shift of subsite of colorectal adenocarcinoma: a study of 213,383 cases from the California Cancer Registry. *J Clin Gastroenterol* 2007;41:173–7.
3. Cucino C, Buchner AM, Sonnenberg A. Continued rightward shift of colorectal cancer. *Dis Colon Rectum* 2002;45:1035–40.
4. Leon MP, Mario M, Benatti P, Rossi G, Menigatti M, Pedroni M, et al. Trend of incidence, subsite distribution and staging of colorectal neoplasms in the 15-year experience of a specialized cancer registry. *Ann Oncol* 2004;15:940–6.
5. Devesa SS, Chow WH. Variation in colorectal cancer incidence in the United States by subsite of Origin. *Cancer* 1993;71:3819–26.
6. Cress RD, Morris C, Ellison GL, Goodman MT. Secular changes in colorectal cancer incidence by subsite, stage at diagnosis, and race/ethnicity, 1992–2001. *Cancer* 2006;107:1142–52.
7. Murakami R, Kitagawa T, Tsukuma H, Hanai A. Descriptive epidemiology of colon cancer in Osaka, Japan. *CRC* 1993;2:854–62 (in Japanese).
8. Kotake K, Honjo S, Sugihara K, Kato T, Kodaira S, Takahashi T, et al. Changes in colorectal cancer during a 20-year period: an extended report from the multi-institutional registry of large bowel cancer, Japan. *Dis Colon Rectum* 2003;46(Suppl. 10):S32–43.
9. Takada H, Ohsawa T, Iwamoto S, Yoshida R, Nakano M, Imada M, et al. Changing site distribution of colorectal cancer in Japan. *Dis Colon Rectum* 2002;45:1249–54.
10. Sobue T, Ajiki W, Tsukuma H, Oshima A, Hanai A, Fujimoto I. Trend of lung cancer incidence rate by histological type: A population-based study in Osaka, Japan. *Jpn J Cancer Res* 1999;90:6–15.
11. Wu XC, Chen VW, Martion J, Roffers S, Groves FD, Correa CN, et al. Subsite-specific colorectal cancer incidence rates and stage distributions among Asians and Pacific islanders in United States, 1995 to 1999. *Cancer Epidemiol Biomarkers Prev* 2004;13:1215–22.
12. Wu XC, Chen VW, Steele B, Ruiz B, Fulton J, Liu L, et al. Subsite-specific incidence rate and stage of disease in colorectal cancer by race, gender, and age group in the United States, 1992–1997. *Cancer* 2001;92:2547–54.
13. Nelson RL, Doller T, Freels D, Persky V. The relation of age, race, and gender to subsite location of colorectal carcinoma. *Cancer* 1997;80:193–7.
14. Butcher D, Hassanein K, Dudgeon M, Rhodes J, Holmes FF. Female gender is a majority determinant of changing subsite distribution of colorectal cancer with age. *Cancer* 1985;56:714–6.
15. Yamaji Y, Mitsushima T, Ikuma H, Watanabe H, Okamoto M, Yoshida H, et al. Right-side shift of colorectal adenomas with aging. *Gastrointest Endosc* 2006;63:459–60.
16. Wakai K, Hayakawa N, Kojima M, Tamakoshi K, Watanabe Y, Suzuki K, et al. Smoking and colorectal cancer in a non-Western population: a prospective cohort study in Japan. *J Epidemiol* 2003;13:323–32.
17. Otani T, Iwasaki M, Inoue M, Tsugane S. Body mass index, body height, and subsequent risk of colorectal cancer in middle-aged and elderly Japanese men and women: Japan Public Health Center-based Prospective Study. *Cancer Cause and Control* 2005;16:839–50.
18. Otani T, Iwasaki M, Yamamoto S, Sobue T, Hanaoka T, Inoue M, et al. Alcohol consumption, smoking and subsequent risk of colorectal cancer in middle-aged and elderly Japanese men and women: Japan Public Health Center-based Prospective Study. *Cancer Epidemiol Biomark Prev* 2003;21:1492–500.
19. Kim MK, Sasaki S, Otani T, Tsugane S. Dietary patterns and subsequent colorectal cancer risk by subsite: A prospective cohort study. *Int J Cancer* 2005;115:790–8.
20. Lee KJ, Inoue M, Otani T, Iwasaki M, Sasazuki S, Tsugane S. Physical activity and risk of colorectal cancer in Japanese men and women: the Japan Public Health Center-based prospective Study. *Cancer Causes Control* 2007;18:199–209.
21. Curado MP, Edwards B, Shin HR, Storm H, Ferlay J, Heanue M, et al. Cancer Incidence in Five Continents, Vol. IX, IARC Scientific Publications No. 160. Lyon, IARC 2007. Available from http://www-dep.iarc.fr/CI5-IX/PDF/INDICES/I_03.pdf.