World Journal of Gastroenterology

ORIGINAL ARTICLE

Colorectal cancer in Guangdong Province of China: A demographic and anatomic survey

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Received: November 3, 2009 Revised: December 7, 2009
Accepted: December 14, 2009
Published online: February 28, 2010

Abstract

AIM: To determine the basic demographic features of colorectal cancer (CRC) in five hospitals located in four different areas of Guangdong Province, China.

METHODS: A review of patient records from 1986 to 2006 from five hospitals was conducted. Patient data was obtained, including age, gender, location of lesions, staging and histological type of CRC. The Chi-square test was used to assess differences in rates and a significance level of 0.05 was used. Univariate comparisons were made *via* Fisher's exact tests.

RESULTS: Analysis was carried out on 8172 CRC patents, 6.1% (499/8172) of the patients were aged ⩽ 30 years. The peak incidence was between the ages 61-70 years (27.8%). The mean age at CRC diagnosis increased from 52 years (1986-1988) to 60 years (2004-2006) and the proportion of young CRC patients decreased from 8.0% to 5.9% over the same period. Of 8172 lesions, 4434 (54.3%) were located in rectum and 3738 (45.7%) in colon. The incidence of rectal cancer decreased significantly from 59.4% (1989-1991) to 51.8% (2004-2006) and right sided colon cancer increased from 40.6% to 48.2%. The mean age, anatomic distribution, histological type and differentiation degree were significantly different among the four geographical areas ($P < 0.05$).

CONCLUSION: The hospitalization rate for CRC has increased in Guangdong in recent years. The characteristics of CRC from the five hospitals located in the four different areas of Guangdong Province are also different. Further studies are needed to assess more recent trend in the incidence and prevalence of CRC as well as the respective roles of genetic and environmental factors in CRC.

INTRODUCTION

Colorectal cancer (CRC) is one of the most common gastrointestinal tumors and ranks as the third most com-

mon cancer in the world[1]. CRC has been thought to be less common in Asian compared with Western countries[2,3]. However, recent studies from Japan, Korea and Hong Kong have shown that CRC has not only high incidence rates but also an increasing trend in the population[4-6]. Previous studies implicated that cause of CRC was more closely related to dietary habits and geography than race[7-9]. The incidence of CRC in China was lower than that in the West, but has increased in recent years[10,11] and has become a substantial cancer burden in China, particularly in the more developed provinces. Some studies have reported changes in the characteristics of colorectal cancers in China[12,13]. However, due to a lack of an effective nation-wide colorectal cancer surveillance system, there has been little information available on the relationship between colorectal cancer and geographical environment and economic status in China. The basic demographic characteristics of CRC have changed with the changing of lifestyle in Guangdong. The regional characteristics of CRC in Guangdong need to be better defined.

Guangdong Province is divided into four regions according to geographical location, which include: Triangle area, North area, West area and East area, each area is different in economic status and dietary habits. Therefore, to determine the basic demographic features of patients with CRC in different regions in Guangdong and the trends in different year group, five hospitals were selected from these four areas and 8172 patient records were reviewed. Age, gender, anatomic distribution and histological type were characterized and compared in different areas and year group. The aim of this study was to gain a broader picture of CRC in Guangdong Province and provide important information on the changing epidemiology of this disease over a period of 20 years.

MATERIALS AND METHODS

We developed a registration form to assist in obtaining the clinical characteristics of 8172 CRC cases in the five hospitals [Nanfang Hospital and Huizhou Central People's Hospital (Pearl River Triangle area in Guangdong, highly developed region), North-Guangdong People's Hospital of Shaoguan (North area of Guangdong, a developed region), the Affiliated Hospital of Guangdong Medical College (West area of Guangdong, an underdeveloped area) and Meizhou People's Hospital (East area of Guangdong, an under-developed area)]. All cases in this study were identified using a series of unified Code for the following review. The data was collected retrospectively over a 20-year period from January 1986 to December 2006. Patient basic demographic data including age and gender were recorded. The location of the tumor was recorded and classified as right sided (caecum, ascending colon, hepatic flexure and transverse colon) or left sided (splenic flexure, descending colon, sigmoid colon and rectum). Staging of the tumor was graded according to Duke's classification and histological

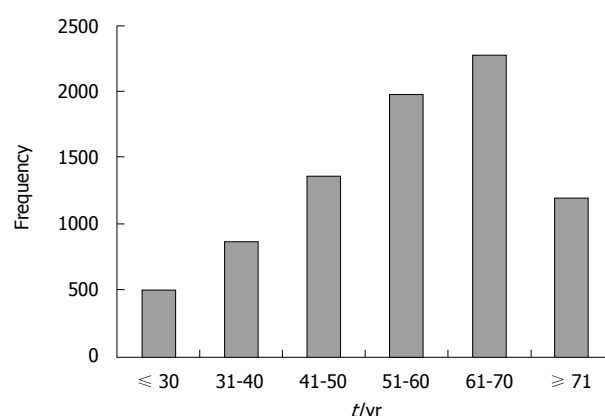| Table 1 Basic demography of study population (*n* = 8172)	
Gender	
Male:female	4841:3331
Mean age (yr)	56
Area	
Pear River Triangle area	4327
East area	1583
West area	1480
North area	782

Figure 1 Frequency of colorectal cancer (CRC) cases by age (*n* = 8172).

types were also recorded. The histological type of CRC was determined by two experienced pathologists. The study protocol was approved by the Ethics Committee of Nanfang Hospital.

Statistical analysis

According to the clinical data, we analysed the clinical characteristics of age, gender and location of tumor, and put all information to a computer. A database was established using EpiData 3.1. The χ^2 test was used to assess differences in rates, and a significance level of 0.05 was used. Univariate comparisons were made *via* Fisher's exact test.

RESULTS

Age and gender

The hospitalization rate for CRC in 2004-2006 was approximately 3.1-fold higher than that in 1986-1988. From 1986 to 2006, 8172 patients aged 5-91 years were investigated and the mean age was 56 years (Table 1). Of the 8172 patients, 4841 (59.2%) were male and 3331 (40.8%) were female, with a male to female ratio of 1.5:1. The highest hospitalization rate for CRC occurred in the Triangle area. Increasing age was associated with a change in the male to female ratio from 1.1:1 to 1.7:1. The overall peak incidence of age was between 61-70 years (Figure 1). Mean age of patients in 2004-2006 increased by 8 years compared with that of patients in 1986-1988 and the ratio of young CRC patients ($\leqslant$ 30 years) decreased from 7.2% to 5.2%.
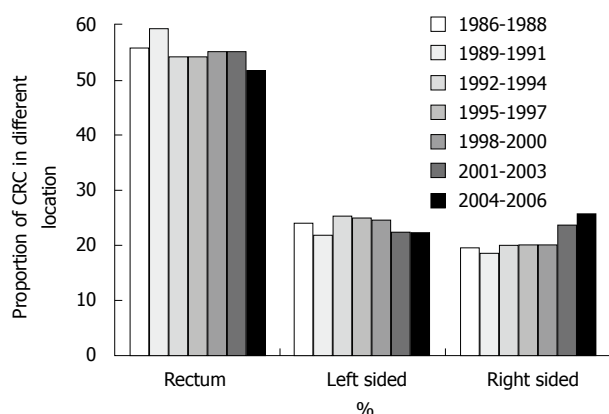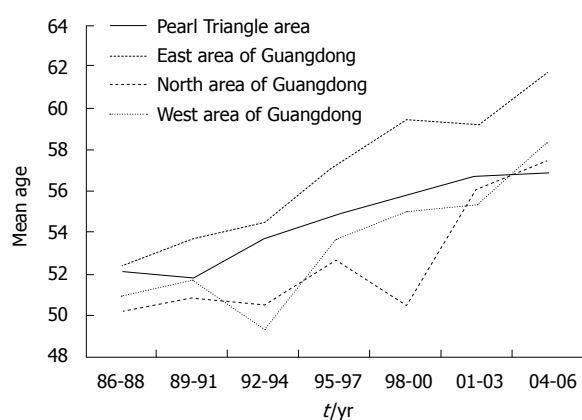
Figure 2 Year group and location of CRC.

Figure 3 Mean age in different areas in different year group.

Table 2 Anatomic distribution of CRC (*n* = 8172)

	n	%
Rectum	4434	54.3
Sigmoid	1505	18.4
Descending	292	3.6
Splenic flexure	113	1.4
Transverse	485	5.9
Hepatic flexure	365	4.5
Ascending	703	8.6
Caecum	275	3.4
Total	8172	100

CRC: Colorectal cancer.

Table 3 Age group and location of CRC *n* (%)

Age group (yr)	Rectum	Left sided	Right sided	Total
≤ 30	301 (60.3)	102 (20.4)	96 (19.3)	499 (100.0)
31-40	496 (57.0)	194 (22.3)	179 (20.6)	869 (100.0)
41-50	786 (57.8)	297 (21.8)	278 (20.4)	1361 (100.0)
51-60	1067 (54.0)	499 (25.2)	411 (20.8)	1977 (100.0)
61-70	1201 (52.9)	534 (23.5)	536 (23.6)	2271 (100.0)
> 71	583 (48.8)	304 (25.4)	308 (25.8)	1195 (100.0)
Total	4434 (54.3)	1930 (23.6)	1808 (22.1)	8172 (100.0)

Significance was determined using Chi-squared tests (χ^2 = 39.223, *P* = 0.000).

Staging of colorectal cancer

Of 8172 lesions, 5670 lesions could be staged by Duke's staging: Duke's A stage 346 (6.1%), Duke's B stage 2829 (49.9%), Duke's C stage 1922 (33.9%), and Duke's D stage 573 (10.1%). The percentage of Duke's A stage increased from 4.5% to 7.7% and Duke's D stage decreased from 13.4% to 10.0%. The difference was significant (χ^2 = 154.700, *P* = 0.000).

Anatomic distribution of tumors

Of 8172 lesions, 4434 (54.3 %) were located in the rectum and 3738 (45.7%) in the colon, the ratio of rectum cancer to colon cancer was 1.2:1. The anatomic distribution of the tumors is shown in Table 2 and the distribution between age groups and classification as rectum cancer, right sided or left sided are shown in Table 3. The proportion of right-sided lesions increased, but the difference was not statistically significant (*P* > 0.05). The proportion of CRC in the rectum decreased but that of right sided cancer increased (*P* < 0.05). The relationship between distribution and year group was analyzed in Figure 2. The proportion of each distribution group has no change.

Histological type

The CRC was classified as well, or moderately differentiated and poorly-differentiated carcinoma. Of 6638 lesions,

the histological type was classified as: tubular adenocarcinoma 4913 (75.6%), polypoid adenocarcinoma 578 (8.9%), mucinous adenocarcinoma 800 (12.3%), signet ring cell carcinoma 51 (0.8%), undifferentiated carcinoma 12 (0.2%), carcinoid 22 (0.3%), squamous carcinoma 21 (0.3%), adenosquamous carcinoma 9 (0.1%), and other types 95 (1.46%). In the young CRC patient group (≤ 30 years), the proportion of undifferentiated cancer was 50.1%, while only 27.0% in the group over 40 years of age. There was a significant difference in the different histological groups (χ^2 = 232.823, *P* < 0.001). In comparison of years 1986-1988 and 2004-2006, the proportion of well- and moderately differentiated tumors in increased from 60.5% to 74.7%, while that of poorly-differentiated decreased from 39.5% to 25.3%. The difference was statistically significant (χ^2 = 128.505, *P* < 0.001).

CRC patients in different areas of Guangdong

As shown in Figure 3 and Table 4, the mean age of CRC in the four geographic areas increased, of which the lowest mean age was found in North Guangdong, and the highest mean age in East Guangdong. There was no significant difference in gender distribution (data not shown). Anatomic distribution in the four different geographic areas is shown in Table 5, with rectal cancer representing the largest proportion of cases, followed by left-sided and right-sided CRC. There was a statistically significant difference in the anatomic distribution among the four geographic regions (*P* < 0.05). Comparison of histological type (χ^2 = 459.561, *P* < 0.001) and degree

Table 4 Mean age and year group in different areas

Yr	*n*	mean age (yr)	≤ 30 yr	31-40 yr	41-50 yr	51-60 yr	61-70 yr	≥ 71 yr	Male:female
1986-1988	462	52	37	62	101	153	82	47	1.7:1
1989-1991	532	55	41	69	104	159	125	34	1.7:1
1992-1994	866	56	56	116	158	251	208	77	1.6:1
1995-1997	1103	58	68	133	183	270	341	108	1.3:1
1998-2000	1523	59	85	138	267	358	447	228	1.5:1
2001-2003	1793	60	99	174	275	379	520	346	1.4:1
2004-2006	1893	60	113	177	273	407	548	375	1.5:1
	3.1[1]	8[2]	2.1[1]	2.9[1]	1.7[1]	1.7[1]	5.7[1]	7.0[1]	[3]

[1]Increasing fold; [2]Increasing years of mean age; [3]$\chi^2 = 12.703$, $P = 0.013$, the difference was significant.

Table 5 Anatomic distribution, histology type, differentiation degree of CRC in different areas *n* (%)

Areas	Rectum	Left sided	Right sided	Total	Tubular adenocarci-noma	Papillary adenocarci-noma	Other adenocarci-noma	Total	Well-and moderately-differentiated	Poorly-differen-tiated	Total
Pearl Triangle area	2349 (54.3)	1039 (24.0)	939 (21.7)	4327 (100.0)	3436 (79.4)	363 (8.4)	528 (1.4)	4327 (100.0)	2914 (81.6)	627 (18.4)	3571 (100.0)
East area	901 (56.9)	363 (22.9)	319 (20.2)	1583 (100.0)	1165 (73.6)	271 (17.1)	147 (1.6)	1583 (100.0)	878 (77.1)	261 (22.9)	1139 (100.0)
North area	415 (53.1)	173 (22.1)	194 (24.8)	782 (100.0)	484 (61.9)	124 (15.9)	174 (0.9)	782 (100.0)	299 (47.8)	326 (52.2)	625 (100.0)
West area	769 (52.0)	355 (24.0)	356 (24.0)	1480 (100.0)	1097 (74.1)	15 (10.1)	368 (4.7)	1480 (100.0)	829 (63.6)	474 (36.4)	1303 (100.0)
Total	4434 (54.3)	1930 (23.6)	1808 (22.1)	8172 (100.0)[1]	6182 (75.6)	773 (9.5)	1217 (2.0)	8172 (100.0)[2]	4920 (74.8)	1718 (25.2)	6638 (100.0)[3]

[1]$\chi^2 = 13.307$, $P = 0.038$; [2]$\chi^2 = 459.561$, $P = 0.000$; [3]$\chi^2 = 409.296$, $P = 0.000$.

of differentiation ($\chi^2 = 409.296$, $P < 0.001$) in the four areas is shown in Table 5, there were significant differences in the four geographic areas.

DISCUSSION

China has experienced adramatic change in economy and lifestyle over the past two decades and this has lead to substantial increase in the incidence of CRC[14,15], especially in Guangdong Province. It is important to understand the epidemiological characteristics of CRC in Guangdong. Data from the five hospitals in four representative areas of Guangdong were selected as a representative sample of CRC characteristics in Guangdong Province.

Although the hospitalization rate was not equal to the incidence rate, the increasing hospitalization rate in our study provided some information about the characteristics of CRC in recent years. Multiple risk factors increasing the incidence of colorectal cancer include: age, dietary habit, economics status and geographic location[16]. Previous studies suggested that the epidemiology of CRC is based on three main characteristics in China[17]. First, the peak age of CRC in China was lower than that in Western Countries, and the mean age was 45 years. Second, a high proportion of rectal cancer to colon cancer (1.5:1), and finally, a higher proportion of young CRC patients (10%-19%). Our data showed that the mean age was 56 years and this trend could be found in all the four areas, which was much higher than that in the previous studies. An important attribute of this trend was the increasing proportions of the elderly patients[6,18].

A high proportion of young CRC patients shown by previous studies has been an important characteristic of CRC in China, but it was difficult to compare data regarding age[19-21]. Compared with the elderly CRC patients, the young CRC patients had the following characteristics: a low ratio of male to female; a high proportion of rectum cancer; a high proportion of poorly differentiated carcinomas; and a low proportion of right sided lesions. In a recent study, we defined young age as 30 years[22], and using this definition, the proportion of young CRC patients decreased while that of elderly CRC patients (≥ 60 years) increased. But the number of patients hospitalized for CRC was similar, suggesting that the decreasing number of young CRC patients was associated with the increase of elderly CRC patients.

Previous studies have shown that the proportion of female CRC patients has increased in recent years[23,24]. One possible explanation for the role of gender may be the effect of female hormones[25]. Recently there have been suggestions that hormonal replacement therapy may decrease the incidence of CRC in female[20]. However, our data is not in agreement with this trend, but the ratio of male to female increased with age. However, this requires further research.

The prevalence of cancer in the left or right colon was different based on the age, gender, as well as high-and low-incidence nations[26]. It is controversial about the anatomic distribution of tumors, particularly about the changes observed with time[27]. Previous studies showed the ratio of rectum cancer to colon caner was 1.5:1, and a left to right sided shift of tumors was reported in China[13]. Other studies have shown that Asians and Pacific Islanders

have a higher incidence of distal lesions in older patients (≥ 70 years), compared with proximal cancers[28]. Our data clearly showed a decrease of rectal cancer and an increase of right sided lesions, but no significant difference between different age groups. Cancers of proximal and distal colon are different s because of their embryologic origin, genetic factors and biologic identity[27]. The shift of tumors could be attributed to the change of life style, environmental factors and the increase of the elderly group[29,30]. Our results also suggested that the flexible sigmoidoscopy is not the first choice for CRC screening, even though it is more cost-effective compared with screening colonoscopy. Colonoscopy may be the preferred initial screening test. Most of CRC in present study is tubular adenocarcinoma and the proportion of tubular adenocarcinoma decreased from 79.3% to 67.7% with the shift from rectum to right colon. The proportion of mucinous carcinoma and signet-ring cell carcinoma increased from 9.3% to 19.0% and similar results were reported previously by other studies. This result may be related to different genetic background and different location of tumors.

In the present study, we report the characteristics of CRC between five hospitals located in four different areas in Guangdong. The mean age of CRC in the four areas increased, the lowest mean age was seen in North Guangdong and the highest mean age in East Guangdong. There is also a significant difference in anatomic distribution, histological type and differentiation type in the four areas. The data suggests that the hospitalization rate for CRC has increased over the past 20 years in Guangdong. The characteristics of CRC are different in the five hospitals located in the four different geographic areas. Further studies are needed to assess more recent trends in the incidence and prevalence of CRC as well as the respective roles of genetic and environmental factors of CRC in China.

ACKNOWLEDGMENTS

We thank the Affiliated Hospital of Guangdong Medical College, Meizhou People's Hospital, North-Guangdong People's Hospital of Shaoguan for their help in this work.

COMMENTS

Background
The incidence of colorectal cancer (CRC) in China is lower than that in the west countries, but has increased in recent years and become a substantial cancer burden in China, particularly in the more developed areas. Some studies have reported changes in the characteristics of CRC in China. However, due to a lack of an effective nation-wide surveillance system, there has been little information available on the relationship between CRC and geographical environment and economic status in China.

Research frontiers
In the present study, the authors report a large scale of survey on the characteristics of CRC in five hospitals located in four different areas in Guangdong, China. Their data will benefit the study on prevention and treatment of CRC.

Innovations and breakthroughs
This study has gained a broader picture of CRC in Guangdong Province and provide important information on the changing epidemiology of this disease over a period of 20 years.

Applications
Further studies are needed to assess more recent trends in the incidence and prevalence of CRC as well as the respective roles of genetic and environmental factors of CRC in China based on the present study.

Peer review
The authors present an analysis of colorectal cancer within 4 regions of Guangdong Province of China over a 20-year period. Their case analysis suggests an overall increase in cancer cases as well as a rising mean age at presentation. Rectal cancer was found to be more common than colon cancer though the incidence of rectal cancer appears to have decreased while right-sided colon cancers have increased.

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