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

An-Gao Xu, Zhi-Jin Yu, Bo Jiang, Xin-Ying Wang, Xu-Hui Zhong, Ji-Hong Liu, Qiu-Yun Lou, Ai-Hua Gan

An-Gao Xu, Zhi-Jin Yu, Xu-Hui Zhong, Ji-Hong Liu, Qiu-Yun Lou, Ai-Hua Gan, Department of Gastroenterology, Huizhou Municipal Central Hospital, Huizhou 516001, Guangdong Province, China
Bo Jiang, Xin-Ying Wang, Department of Gastroenterology, Nanfang Hospital, Southern Medical University, Guangzhou 510515, Guangdong Province, China

Author contributions: Xu AG and Yu ZJ provided vital reagents, designed the study and finished all the statistics analysis; Jiang B and Wang XY collected the data of patients in Nanfang Hospital and wrote the manuscript; Zhong XH collected the data of patients in Meizhou People's Hospital; Liu JH collected the data of patients in North-Guangdong People's Hospital of Shaoguan; Lou QY collected the information of patients in Huizhou Central People's Hospital; Gan AH collected the information of patients in the Affiliated Hospital of Guangdong Medical College.

Correspondence to: Dr. An-Gao Xu, Department of Gastroenterology, Huizhou Municipal Central Hospital, Huizhou 516001, Guangdong Province, China. angao62@21cn.com
Telephone: +86-752-2288288 Fax: +86-752-2288288
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 patients, 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.

© 2010 Baishideng. All rights reserved.

Key words: Colorectal cancer; Survey; Characteristics; Differentiation

Peer reviewer: Dr. Charles P Heise, MD, Associate Professor, Department of Surgery, University of Wisconsin School of Medicine, 600 Highland Avenue, Madison, WI 53792, United States
Xu AG, Yu ZJ, Jiang B, Wang XY, Zhong XH, Liu JH, Lou QY, Gan AH. Colorectal cancer in Guangdong Province of China: A demographic and anatomic survey. World J Gastroenterol 2010; 16(8): 960-965 Available from: URL: http://www.wjgnet.com/1007-9327/full/v16/i8/960.htm DOI: http://dx.doi.org/10.3748/wjg.v16.i8.960

INTRODUCTION

Colorectal cancer (CRC) is one of the most common gastrointestinal tumors and ranks as the third most com-
mon cancer in the world\cite{1}. CRC has been thought to be less common in Asian compared with Western countries\cite{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\cite{4-6}. Previous studies implicated that cause of CRC was more closely related to dietary habits and geography than race\cite{7-9}. The incidence of CRC in China was lower than that in the West, but has increased in recent years\cite{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\cite{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 under-developed 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 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 \( \chi^2 \) 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 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 (\( \leq 30 \) years) decreased from 7.2% to 5.2%.
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 ($\chi^2 = 154.700, P = 0.000$).

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 ($\leq 30$ 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 ($\chi^2 = 232.823, P < 0.001$). In comparison of years 1986-1988 and 2004-2006, the proportion of well- and moderately differentiated tumors increased from 60.5% to 74.7%, while that of poorly-differentiated decreased from 39.5% to 25.3%. The difference was statistically significant ($\chi^2 = 128.505, P < 0.001$).

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 ($\chi^2 = 459.561, P < 0.001$) and degree
of differentiation ($\chi^2 = 409.296$, $P = 0.000$) in the four areas is shown in Table 5, there were significant differences in the four geographic areas.

### DISCUSSION

China has experienced dramatic change in economy and lifestyle over the past two decades and this has lead to substantial increase in the incidence of CRC\cite{23,24}, 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\cite{16}. Previous studies suggested that the epidemiology of CRC is based on three main characteristics in China\cite{27}. 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 elderly CRC patients ($\geq$ 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\cite{22}. One possible explanation for the role of gender may be the effect of female hormones\cite{25}. Recently there have been suggestions that hormonal replacement therapy may decrease the incidence of CRC in female\cite{26}. 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\cite{26}. It is controversial about the anatomic distribution of tumors, particularly about the changes observed with time\cite{27}. Previous studies showed the ratio of rectum cancer to colon cancer was 1.5:1, and a left to right sided shift of tumors was reported in China\cite{13}. Other studies have shown that Asians and Pacific Islanders

---

**Table 4 Mean age and year group in different areas**

| Yr          | $n$ | mean age (yr) | $\leq$ 30 yr | 31-40 yr | 41-50 yr | 51-60 yr | 61-70 yr | $\geq$ 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       |

---

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

| Areas       | Recum   | Left sided | Right sided | Total | Tubular adenocarcinoma | Papillary adenocarcinoma | Other adenocarcinoma | Total | Well-and moderately-differentiated | Poorly-differentiated | Total |
|-------------|---------|------------|-------------|-------|------------------------|-------------------------|-----------------------|-------|-----------------------------------|----------------------|-------|
| Pearl Triangle area | 2349 (54.3) | 1039 (24.0) | 939 (21.7) | 4327 (100.0) | 346 (7.9) | 528 (1.2) | 1187 (27.3) | 3427 (100.0) | 2914 (81.6) | 582 (16.0) | 3427 (100.0) |
| East area   | 901 (56.9) | 363 (22.9) | 391 (23.2) | 1655 (100.0) | 1165 (71.3) | 147 (8.6) | 271 (17.1) | 1583 (100.0) | 878 (56.1) | 326 (21.1) | 1583 (100.0) |
| North area  | 415 (53.3) | 173 (22.1) | 194 (24.8) | 782 (100.0) | 484 (61.9) | 114 (14.6) | 124 (15.9) | 782 (100.0) | 299 (38.4) | 336 (43.2) | 782 (100.0) |
| West area   | 769 (52.0) | 355 (24.0) | 336 (24.0) | 1450 (100.0) | 1097 (74.1) | 15 (1.0) | 368 (2.6) | 1480 (100.0) | 829 (56.6) | 474 (32.4) | 1480 (100.0) |
| Total       | 4434 (54.3) | 1930 (23.6) | 1808 (22.1) | 8172 (100.0) | 6182 (75.6) | 773 (9.5) | 1217 (2.9) | 8172 (100.0) | 4920 (74.8) | 1718 (25.2) | 8172 (100.0) |

---

1. Increasing fold; 2. Increasing years of mean age; $\chi^2 = 12.703$, $P = 0.013$, the difference was significant.
have a higher incidence of distal lesions in older patients (≥ 70 years), compared with proximal cancers. 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 because of their embryologic origin, genetic factors and biologic identity. The shift of tumors could be attributed to the change of lifestyle, environmental factors and the increase of the elderly group. 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.

REFERENCES

1. Petro J. Cancer epidemiology in the last century and the next decade. Nature 2001; 411: 390-395
2. Parkin DM, Bray F, Ferlay J, Pisani P. Global cancer statistics. 2002. CA Cancer J Clin 2005; 55: 74-108
3. Center MM, Jemal A, Smith RA, Ward E. Worldwide variations in colorectal cancer. CA Cancer J Clin 2009; 59: 366-378
4. Wilmink AB. Overview of the epidemiology of colorectal cancer. Dis Colon Rectum 1997; 40: 483-493
5. Yuen ST, Chung LP, Leung SY, Luk IS, Chan SY, Ho JC, Ho JW, Wyllie AH. Colorectal carcinoma in Hong Kong: epidemiology and genetic mutations. Br J Cancer 1997; 76: 1610-1616
6. Jung KW, Won YJ, Park S, Kong HJ, Sung J, Shin HR, Park EC, Lee JS. Cancer statistics in Korea: incidence, mortality and survival in 2005. J Korean Med Sci 2009; 24: 995-1003
7. Gonzalez EC, Roetzheim RG, Ferrante JM, Campbell R. Predictors of proximal vs. distal colorectal cancers. Dis Colon Rectum 2001; 44: 251-258
8. Purnell JQ, Katz ML, Andersen BL, Palesh O, Figueroa-Moseley C, Jean-Pierre P, Bennett N. Social and cultural factors are related to perceived colorectal cancer screening benefits and intentions in African Americans. J Behav Med 2010; 33: 24-34
9. Chao A, Thun MJ, Connell CJ, McCullough ML, Jacobs EJ, Flanders WD, Rodriguez C, Sinha R, Calle EE. Meat consumption and risk of colorectal cancer. JAMA 2005; 293: 172-182
10. Jemal A, Siegel R, Ward E, Murray T, Xu J, Smigal C, Thun MJ. Cancer statistics, 2006. CA Cancer J Clin 2006; 56: 106-130
11. Cao KJ, Ma GS, Liu YL, Wan DS. [Incidence of colorectal cancer in Guangzhou City from 2000 to 2002.] Chin J Cancer 2009; 28: 441-444
12. Zhang S, Cui Y, Weng Z, Gong X, Chen M, Zhong B. Changes on the disease pattern of primary colorectal cancers in Southern China: a retrospective study of 20 years. Int J Colorectal Dis 2009; 24: 943-949
13. Jiang SX, Wang XS, Geng CH, Wang GY. Altering trend of colorectal cancer: a report of 3,607 cases. Chin J Cancer 2009; 28: 54-56
14. Cai SR, Zhang SZ, Zhu HH, Zheng S. Barriers to colorectal cancer screening: a case-control study. World J Gastroenterol 2009; 15: 2531-2536
15. Song F, He M, Li H, Qian B, Wei Q, Zhang W, Chen K, Hao X. A cancer incidence survey in Tianjin: the third largest city in China between 1981 and 2000. Cancer Causes Control 2008; 19: 443-450
16. Wei YS, Lu JC, Wang L, Lan P, Zhao HJ, Pan ZZ, Huang J, Wang JP. Risk factors for sporadic colorectal cancer in southern Chinese. World J Gastroenterol 2009; 15: 2526-2530
17. Jiao XY, Ren JL, editors. Xiaohuaixi Zhongliuxue: Xinliun Xinguandian Xinjishu. Beijing: People’s Military Medical Press, 2004: 175-190
18. Wang D, Chen G, Pan ZH. Dynamic analysis of hospitalized colorectal cancer in China over a period of 20 years.
colorectal cancer patients in 35 years. *Guangdong Yixue* 2001; 22: 557-558

19 Minardi AJ Jr, Sittig KM, Zibari GB, McDonald JC. Colorectal cancer in the young patient. *Am Surg* 1998; 64: 849-853

20 Soliman AS, Bondy ML, Levin B, Hamza MR, Ismail K, Ismail S, Hammam HM, el-Hattab OH, Kamal SM, Soliman AG, Dorpham LA, McPherson RS, Beasley RP. Colorectal cancer in Egyptian patients under 40 years of age. *Int J Cancer* 1997; 71: 26-30

21 Fairley TL, Cardinez CJ, Martin J, Alley L, Friedman C, Edwards B, Jamison P. Colorectal cancer in U.S. adults younger than 50 years of age, 1998-2001. *Cancer* 2006; 107: 1153-1161

22 Chiang JM, Chen MC, Changchien CR, Chen JS, Tang R, Wang YJ, Yeh CY, Fan CW, Tsai WS. Favorable influence of age on tumor characteristics of sporadic colorectal adenocarcinoma: patients 30 years of age or younger may be a distinct patient group. *Dis Colon Rectum* 2003; 46: 904-910

23 Hébert-Croteau N. A meta-analysis of hormone replacement therapy and colon cancer in women. *Cancer Epidemiol Biomarkers Prev* 1998; 7: 653-659

24 Roy HK, Bianchi LK. Differences in colon adenomas and carcinomas among women and men: potential clinical implications. *JAMA* 2009; 302: 1696-1697

25 Koo JH, Leong RW. Sex differences in epidemiological, clinical and pathological characteristics of colorectal cancer. *J Gastroenterol Hepatol* 2010; 25: 33-42

26 Distler P, Holt PR. Are right- and left-sided colon neoplasms distinct tumors? *Dig Dis* 1997; 15: 302-311

27 Axtell LM, Chiazeze I Jr. Changing relative frequency of cancers of the colon and rectum in the United States. *Cancer* 1986; 19: 750-754

28 Okamoto M, Shiratori Y, Yamaji Y, Kato J, Ikenoue T, Togo G, Yoshida H, Kawabe T, Omata M. Relationship between age and site of colorectal cancer based on colonoscopy findings. *Gastrointest Endosc* 2002; 55: 548-551

29 Goldacre MJ. Demography of aging and the epidemiology of gastrointestinal disorders in the elderly. *Best Pract Res Clin Gastroenterol* 2009; 23: 793-804

30 Béjar L, Gili M, Díaz V, Ramírez G, López J, Cabanillas JL, Cayuela A. Incidence and mortality by colorectal cancer in Spain during 1951-2006 and its relationship with behavioural factors. *Eur J Cancer Prev* 2009; Epub ahead of print

S-Editor Wang YR  L-Editor Ma JY  E-Editor Ma WH