

## Prognostic analysis and comparison of colon cancer in Han and Hui patients

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### Abstract

**AIM:** To investigate the relevant prognostic factors and their differences between colorectal cancer (CRC) patients of Chinese Han and Hui ethnicities in the Beijing region.

**METHODS:** A retrospective analysis of 880 patients diagnosed with CRC at Xuanwu Hospital, Capital Medical University between September 2001 and September 2011 was performed. Among the 880 patients, 398 and 482 were Hui and Han, respectively. Characteristics including sex, age, diet, tumor size, primary tumor site, Dukes' stage and degree of differentiation were analyzed for their influence on prognosis. Data on dietary structures were recorded through a questionnaire survey conducted during the patient's first visit, return visit or follow-up checkups.

**RESULTS:** Among patients with colon cancer, the 5-year survival rate for patients of Hui ethnicity was lower than that for Han patients ( $P = 0.025$ ). Six risk factors (age of onset, dietary structure, tumor size,

Dukes' stage, location of cancer and degree of differentiation) in both Han and Hui patients were identified as prognostic factors ( $P < 0.05$ ). Multivariate analysis showed that age of onset ( $P = 0.002$ ), diet ( $P = 0.000$ ), Dukes' stage ( $P = 0.000$ ) and degree of differentiation ( $P = 0.000$ ) are prognostic factors affecting both ethnic groups. Comparison of prognostic factors between Han and Hui patients with CRC showed that dietary structure was a statistically significant factor, and diet varied significantly between the two ethnic groups.

**CONCLUSION:** Dietary structure has a significant influence on colon cancer prognosis among Han and Hui patients with colon cancer in Beijing, which may cause a difference in their survival rates.

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**Key words:** Colon cancer; Colorectal cancer; Han patients; Hui patients; Prognosis; Multivariate analysis

**Core tip:** Beijing is one of the cities with a high incidence rate of colorectal cancer (CRC) in China. No prior investigation has been made, based on Han and Hui ethnicities in the Beijing region. Our study compares the clinical features and prognosis of CRC patients of these two ethnicities. The results showed a difference in the 5-year survival rate between the two ethnicities, which may be contributed by various risk factors like age, sex and dietary habits. This is the first retrospective study conducted in Beijing region to investigate the clinical features and prognosis of CRC patients of two major ethnicities, Han and Hui.

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## INTRODUCTION

Colorectal cancer (CRC) is one of the most common malignant tumors of the gastrointestinal tract, representing the third and second most common cancer worldwide and in Western developed countries, respectively<sup>[1,2]</sup>. In China, the incidence rate of CRC ranks fourth in men and third in women<sup>[3]</sup>. Beijing is one of the cities with a high incidence of CRC in China, with an upward trend in both incidence rate and mortality rate<sup>[4]</sup>. Beijing has a population of diverse ethnicities including Han and Hui, which are among the most populous ethnicities. As the only Tier 3 hospital in the district with the biggest Hui community in Beijing, our hospital receives the highest number of Hui patients in Beijing, which facilitates this study on the clinical characteristics of Hui patients. There has been limited research on clinical features of Han and Hui people who exhibit significant differences in aspects such as religious practices, environment, lifestyle and dietary habits. Therefore, we collected clinical information from 398 and 482 CRC patients of Hui and Han ethnicity, respectively, in the Beijing region and performed a 10-year retrospective study of prognostic factors in Hui and Han patients.

## MATERIALS AND METHODS

### Study group

From September 2001 to September 2011, 398 Hui and 482 Han inpatients who had been histopathologically diagnosed as having CRC at Xuanwu Hospital, Capital Medical University were studied; there were 259 men and 139 women in the Hui group *vs* 302 men and 180 women in the Han group. The median age in the Hui group was 63 years with a range of 30-93 years. The median age in the Han group was 65 years with a range of 25-95 years.

### Methods

Medical records were collected, and CRC clinical characteristic forms were formulated so that patients were categorized based on their clinical characteristics, including sex, age of onset, dietary structure, tumor size, Dukes' stage, tumor location and degree of differentiation. Data on dietary structures were recorded through a questionnaire survey conducted during the patient's first visit, return visit or follow-up checkups. The prognostic factors under investigation were categorized as follows: age (three groups:  $\leq 40$ , 41-60 or  $> 60$  years); dietary structure (four groups: fat  $> 35\%$  and dietary fiber  $< 35\%$ , fat  $> 35\%$  and dietary fiber  $> 35\%$ , fat  $< 35\%$  and dietary fiber  $> 35\%$ , and fat  $< 35\%$  and dietary fiber  $< 35\%$ ); tumor size (two groups:  $\leq 5$  and  $> 5$  cm); tumor location (three groups: rectum, left-sided colon and right-sided colon); and degree of differentiation (three groups: high, medium and low). Follow-up phone calls started from the date of discharge till the date of death due to recurrence or metastasis or June 2012.

### Statistical analysis

The Kaplan-Meier statistical method was employed to determine the probability of survival and log-rank test to compare those. Cox regression was used to determine prognosis factors. All calculations were carried out with SPSS ver. 13.0 statistical software. Data were collected into Excel before statistical analysis. Skewed distribution of measurement data was described by  $M (Q_R)$ . The Kaplan-Meier statistical method was employed to calculate the survival rates which were compared by log-rank test in univariate analysis. The significant variables from univariate analysis were then assessed by stepwise methods in Cox regression which isolated the effects of other variables to determine the independent prognostic factors.  $P < 0.05$  was considered to indicate a statistically significant result for all analyses.

## RESULTS

### Follow-up result and survival rates

One hundred and sixty of the 398 Hui patients (40.2%) and 186 of the 482 Han patients (38.6%) died of CRC recurrence or metastasis. The follow-up rate was 91.7%, with 73 cases lost. The 3-, 5- and 10-year survival rates for Hui patients were 62.1%, 49.7% and 25.2%, respectively, and those for Han patients were 63.2%, 53.3% and 25.9%, respectively. Hui patients showed a significantly lower 5-year survival rate than Han patients ( $P = 0.025$ ).

### Univariate analysis of prognostic factors for CRC

For univariate analysis, we identified six risk factors (age of onset, dietary structure, tumor size, Dukes' stage, location of cancer and degree of differentiation) in both Han and Hui patients as prognostic factors ( $P < 0.05$ ) (Tables 1 and 2).

### Multivariate analysis of prognostic factors for CRC

Through running the multivariate Cox regression on the six prognostic factors from univariate analysis, we identified age of onset ( $P = 0.002$ ), dietary structure ( $P = 0.000$ ), Dukes' stage ( $P = 0.000$ ) and degree of differentiation ( $P = 0.000$ ) to be independent prognostic factors ( $P < 0.05$ ) for CRC, whereas tumor size ( $P = 0.632$ ) and location of tumor were not independent factors ( $P > 0.05$ ).

### Comparison of prognostic factors between Han and Hui patients with CRC

Student's *t* test showed that dietary structure was a statistically significant factor between Han and Hui patients, while other prognostic factors like age of onset, Dukes' stage and degree of differentiation were not.

## DISCUSSION

### Relationship of age of onset, Dukes' stage and degree of differentiation with CRC prognosis

Despite controversy over whether age could be an inde-

**Table 1 Results of univariate analysis of clinical data from Han colorectal cancer patients**

Characteristic		<i>n</i>	Average survival time	3-yr survival rate	5-yr survival rate	10-yr survival rate	<i>P</i> value
Sex	Male	302	72.81 ± 1.96 × 2.45	63.5%	52.2%	23.0%	0.954
	Female	180	74.03 ± 1.96 × 3.08	62.6%	55.0%	30.9%	
Age	≤ 40 yr	18	69.10 ± 1.96 × 8.07	56.8%	46.5%	19.3%	0.000
	41-60 yr	147	86.65 ± 1.96 × 3.30	72.8%	68.1%	33.4%	
	> 60 yr	317	65.77 ± 1.96 × 2.30	59.1%	47.0%	15.4%	
Dietary structure	Fat > 35% and dietary fiber < 35%	106	59.71 ± 1.96 × 6.05	53.7%	39.6%	23.1%	0.000
	Fat > 35% and dietary fiber > 35%	136	63.75 ± 1.96 × 2.24	60.8%	48.2%	24.0%	
	Fat < 35% and dietary fiber > 35%	80	86.79 ± 1.96 × 5.15	80.2%	66.3%	32.2%	
	Fat < 35% and dietary fiber < 35%	160	76.79 ± 1.96 × 5.15	63.7%	54.3%	25.6%	
Tumor size	≤ 5 cm	322	77.24 ± 1.96 × 2.24	66.9%	59.1%	26.9%	0.000
	> 5 cm	160	64.22 ± 1.96 × 3.65	54.8%	38.5%	23.8%	
Dukes' stage	A	82	100.60 ± 1.96 × 3.45	97.0%	90.0%	53.0%	0.000
	B	148	96.63 ± 1.96 × 3.29	87.9%	71.4%	48.9%	
	C	169	70.25 ± 1.96 × 3.37	58.9%	51.8%	25.2%	
	D	83	23.90 ± 1.96 × 0.66	4.2%			
Location of tumor	Rectal cancer	247	77.82 ± 1.96 × 2.69	68.7%	58.4%	23.8%	0.005
	Left-sided colon cancer	98	73.06 ± 1.96 × 4.14	62.5%	57.6%	27.9%	
	Right-sided colon cancer	137	65.77 ± 1.96 × 3.55	54.1%	41.5%	23.4%	
Degree of differentiation	High	83	88.96 ± 1.96 × 4.08	83.5%	69.4%	34.3%	0.000
	Medium	329	78.30 ± 1.96 × 2.42	68.4%	59.5%	28.6%	
	Low	70	35.92 ± 1.96 × 3.11	19.6%	12.8%	6.3%	

pendent risk factor for CRC in previous studies<sup>[5,6]</sup>, this study shows that age of onset is a risk factor for CRC in both ethnic groups through univariate and multivariate analyses. The data show that the survival rate of the young group is on the low side. Possible causes include ignorance of symptoms, late presentation to medical care and misdiagnosis of malignant tumors as benign in the young group of patients. Besides, young patients are often diagnosed with undifferentiated or low differentiated CRC at a relatively late Dukes' stage with a lower chance of eradication by surgery<sup>[7,8]</sup>, which leads to a lower survival rate than the middle age group. This suggests that clinicians should pay greater attention to young patients and change their traditional means of diagnosis in order to enhance the rate of early diagnosis and treatment, improving the prognosis for young CRC patients. On the other hand, the survival rate for the elderly group was also lower than that for the middle age group due to older age, lower tolerance of surgery and chemotherapy, and higher rates of complications and postoperative complications. This study also identifies Dukes' stage as an important prognostic factor for CRC in the two ethnic groups. The survival rate drops as Dukes' stage goes up, consistent with most other previous studies on Dukes' stage in CRC patients<sup>[9,10]</sup>. For each degree that Dukes' stage increases, the mortality rate rises by 2.92-fold. Therefore, Dukes' stage should be determined as early as possible in order to decide if early surgical treatment is given, because the prognosis improves as the opportunity of radical excision increases. However, the chance of undergoing radical excision decreases as Dukes' stage increases. When patients can only receive palliative surgeries or even lose the chance to receive any surgery, their prognosis is poorer. Degree of differentiation is another important prognostic factor for CRC<sup>[11,12]</sup>. Some studies show a high correlation between degree of differentia-

tion in CRC and postoperative survival. The survival rate is lower for cancer of low differentiation compared to that for cancer of medium and high differentiation<sup>[13]</sup>. The lower the degree of differentiation, the higher the malignancy and probability of metastasis. The low degree of differentiation also lowers the opportunity for radical excision and leads to poorer prognosis.

#### ***Influence of dietary structure on prognosis of CRC in the two ethnic groups***

Hui people practice the Islamic religion, one of the three major world religions along with Buddhism and Christianity. As of the end of 2009, the population of Muslims, the adherents of Islam, is 1.57 billion, accounting for 23% of the world's population, which are distributed across 204 countries<sup>[14]</sup>. Thus, research on the clinical features for this group is not without its significance. CRC results from polygenic alterations of colonic epithelium caused by multiple factors such as genetic and environmental causes. Much epidemiological research on CRC shows that it can be caused by economic development, changes in lifestyle, especially dietary structure, and other factors including environmental and hereditary factors<sup>[15,16]</sup>. The present study indicated that the 5-year survival rate of CRC patients from the Hui group was significantly lower than that of patients from the Han group, suggesting the important role that dietary structure played in determining the difference in survival between the two ethnic groups<sup>[17]</sup>. Based on survey results, the Hui people were found to have higher consumption of beef and lamb while abstaining from consumption of pork. Their daily fat intake is higher and dietary intake in each meal is lower than the Han people. Despite the fact that Hans consume a diverse range of meat types, including pork, chicken, beef and lamb, their daily intake of meat is lower while their intake of vegetable, fruits and grains is

**Table 2 Results of univariate analysis of clinical data from Hui colorectal cancer patients**

Characteristic		<i>n</i>	Average survival time	3-yr survival rate	5-yr survival rate	10-yr survival rate	<i>P</i> value
Sex	Male	259	69.70 ± 1.83 × 2.14	62.9%	48.5%	24.2%	0.836
	Female	139	71.22 ± 1.83 × 3.25	61.8%	51.2%	30.1%	
Age	≤ 40 yr	16	67.28 ± 1.83 × 7.17	55.6%	43.4%	18.9%	0.000
	41-60 yr	127	82.04 ± 1.83 × 4.45	70.2%	64.6%	34.0%	
	> 60 yr	255	66.36 ± 1.83 × 3.50	58.4%	46.8%	16.2%	
Dietary structure	Fat > 35% and dietary fiber < 35%	159	58.23 ± 1.83 × 7.12	50.6%	38.9%	22.4%	0.000
	Fat > 35% and dietary fiber > 35%	104	62.05 ± 1.83 × 3.04	59.7%	45.2%	24.9%	
	Fat < 35% and dietary fiber > 35%	51	87.66 ± 1.83 × 4.97	79.5%	65.6%	33.0%	
	Fat < 35% and dietary fiber < 35%	84	73.98 ± 1.83 × 5.77	64.2%	53.5%	25.1%	
Tumor size	≤ 5 cm	266	78.13 ± 1.83 × 2.88	67.1%	58.0%	25.8%	0.000
	> 5 cm	132	62.74 ± 1.83 × 2.96	55.3%	37.2%	22.7%	
Dukes' stage	A	69	99.96 ± 1.83 × 4.36	95.6%	86.7%	50.3%	0.000
	B	126	96.63 ± 1.83 × 3.29	86.1%	64.4%	44.1%	
	C	130	70.25 ± 1.83 × 3.37	56.3%	51.8%	23.6%	
	D	73	23.90 ± 1.83 × 0.66	4.0%			
Tumor location	Rectal cancer	199	76.29 ± 1.83 × 2.33	68.2%	56.1%	22.3%	0.015
	Left-sided colon cancer	80	72.13 ± 1.83 × 4.65	61.2%	56.4%	26.9%	
	Right-sided colon cancer	119	63.55 ± 1.83 × 3.26	53.6%	40.3%	23.6%	
Degree of differentiation	High	66	89.04 ± 1.83 × 5.07	82.4%	68.4%	32.8%	0.000
	Medium	273	76.25 ± 1.83 × 2.02	67.8%	57.9%	27.0%	
	Low	59	33.28 ± 1.83 × 2.96	20.3%	13.1%	5.1%	

higher. Americans, who have a high CRC incidence rate, consume fat, which is made up of primarily saturated fat, as 41.8% of their daily caloric intake<sup>[18-20]</sup>. Japanese who have low incidence of CRC, consume fat, which is mainly unsaturated fat, as 12.2% of daily caloric intake. Some animal studies show that high consumption of fat can increase CRC incidence, induce earlier tumor formation, exacerbate tumor malignancy, increase the rate of metastasis and shorten survival time in experimental animals. A high-fat diet can increase the incidence rate of CRC<sup>[21-23]</sup>, possibly through the following mechanisms: (1) changing the concentration of cholic acid in feces; (2) increasing intestinal bacterial enzyme activities and promoting the formation of carcinogens; and (3) incorporating a higher intake of meat which produces carcinogenic heterocyclic amine in the frying or grilling process. A high-fiber diet is negatively correlated to, and has significant dose-response relationship with, the risk of morbidity in CRC<sup>[24-26]</sup>. It possibly works through the following mechanisms: (1) increasing the bulk of the feces, diluting carcinogens, shortening the passage time through the intestinal tract, reducing the contact between colonic mucosa and the carcinogen in the feces, and thereby reducing the risk of CRC; (2) regulation of lipid metabolism by lowering the concentration of deoxy bile acid in the colon through control of reabsorption, dilution and effects of absorption and chelation; (3) changing colonic flora which influences the structure and function of colonic mucosa and colonic epithelial growth and regulation of pH of the intestinal tract; and (4) alleviation of the damage to colonic epithelium by toxic agents through strengthening protective barrier function of the colonic mucosa. Hence, we recommend a low-fat and high-fiber diet for prevention of CRC and improvement of prognosis.

In summary, this study concludes that age of onset, dietary structure, Dukes' stage and degree of differentia-

tion are the common prognostic factors for CRC in both Han and Hui patients. There are significant differences in dietary structure between the two ethnic groups, which thereby cause a difference in their survival rates. The above prognostic factors for CRC strongly emphasize the importance of early diagnosis and treatment and suggest reasonable and healthy dietary habits so as to improve the prevention and prognosis of CRC.

## COMMENTS

### Background

Colorectal cancer (CRC) is one of the most common malignant tumors of the gastrointestinal tract worldwide. It is one of the major causes of morbidity and mortality in China, and Beijing is one of the cities with a high incidence rate. Beijing has a population of diverse ethnicities including Han and Hui which are among the most populous ethnicities. Studies have shown the CRC incidence rate vary from different races and ethnic population. There has been limited research on clinical features of Han and Hui people who exhibit significant differences in aspects such as religious practices, environment, lifestyle and dietary habits.

### Research frontiers

Various studies have shown the CRC incidence and mortality vary from different races, ethnicities, age and gender. Familial and hereditary factors could be the major risk factors, while environmental factors like nutritional practices, physical activity, obesity, use of alcohol and tobacco could be the other risk factors. No prior research has been conducted regarding the differences in clinical features and prognosis of Han and Hui CRC patients in the Beijing region.

### Innovations and breakthroughs

This study investigated the different clinical features and prognosis of Han and Hui CRC patients in the Beijing region. The sample size was relatively large and reliability was strong. The study concluded that age of onset, dietary structure, Dukes' stage and degree of differentiation are the common prognostic factors for both Han and Hui CRC patients. The 5-year survival rate for patients of Hui ethnicity was lower than that for Han patients. Significant dietary differences between the two ethnic groups exist, which may cause a difference in their survival rates.

### Applications

This study strongly emphasizes the importance of early diagnosis and treatment in CRC patients and suggests reasonable and healthy dietary habits so as



to improve the prevention and prognosis of CRC. This study can act as a guide for clinical prevention and further research of CRC.

### Peer review

In the present manuscript, the authors analyzed the differential factors between colorectal cancer patients of Han and Hui ethnicities in the Beijing region. This is the first retrospective study conducted in Beijing region to investigate the clinical features and prognosis of CRC patients of two major ethnicities, Han and Hui. Overall, the manuscript is very well written.

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