RESEARCH ARTICLE

Metabolic Syndrome and Colorectal Cancer: A Cross-Sectional Survey

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Abstract

Introduction: There is epidemiological evidence indicating that the metabolic syndrome increases the risk of colorectal cancer. Since there is little information about this issue in Iran, the present study was conducted to evaluate prevalence of metabolic syndrome and its components in patients with colorectal cancer. Material and Methods: This cross-sectional survey involved 200 patients with a new diagnosis of colorectal cancer. Demographic information of patients was collected through the interview with them. Components of metabolic syndrome including fasting glucose serum, triglyceride, high density lipoprotein, blood pressure and waist circumference were measured for all of the patients. Results: A total of 72 colorectal cancer patients (36%) met metabolic syndrome criteria with rates of 76% for women and 24% for men. BMI in metabolic syndrome patients was higher than other colorectal cancer patients. Disease history including hypertension, diabetes and cardiovascular disease was most frequent in metabolic syndrome patients. Pathological characteristics of colorectal cancer were not significantly associated with the disease. Conclusion: The findings of present study indicated that the prevalence of metabolic syndrome in CRC patients is relatively high. Therefore, further analytical and multi centric studies are needed to better understand the role of metabolic syndrome in development of CRC in Iran. If this association is confirmed in future studies, metabolic syndrome patients should be considered in CRC screening programs.

Keywords: Colorectal cancer - metabolic syndrome - diabetes - hyperlipidemia

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Introduction

Metabolic syndrome is a complex metabolic disease characterized by central obesity, impaired glucose tolerance, hypertension and dyslipidemia (Wang et al., 2005; Chiu et al., 2007; Pelucchi et al., 2010; Siddiqui, 2011). Metabolic syndrome is a most common risk factor for cardiovascular disease and Non-Insulin Dependent Diabetes Mellitus (NIDDM) (Sturmer et al., 2006; Rigo et al., 2009; Siddiqui, 2011). Prevalence of metabolic syndrome in Western countries is rising sharply (Pais et al., 2009). In the United States, the prevalence of metabolic syndrome has been estimated at 24% and 23% in men and women, respectively (Ahmed et al., 2006). This rate have been reported between 24.6% and 30.9% in Europe countries (Pais et al., 2009). Increasing prevalence of metabolic syndrome is not only in the West but also Asian countries are faced with increasing due to changing lifestyles (Wang et al., 2005; Chiu et al., 2007).

Apart from the metabolic syndrome is a risk factor for cardiovascular disease, there is epidemiological evidence indicating that metabolic syndrome also increases the risk of colorectal cancer (CRC) (Morita et al., 2005; Chiu et al., 2007; Tsilidis et al., 2010). Various studies indicated that clinical characteristics of metabolic syndrome including body composition, hormonal factors and biological mechanisms, particularly those related to insulin resistance contribute to CRC etiology (Wang et al., 2005; Pais et al., 2009; Siddiqui, 2011). Hyperinsulinemia has been shown to increase risk of CRC through the stimulation of proliferation, decrease apoptosis and promotion of intestinal carcinogenesis (Morita et al., 2005; Sturmer et al., 2006; Safaee et al., 2009).

Abdominal obesity is considered as one of the major components of metabolic syndrome which in many cases is caused due to physical inactivity (Siddiqui, 2011). Obesity may lead to CRC development by different mechanisms (Siddiqui, 2011). Several studies have shown that body mass index ≥30 has significant association with CRC (Giovannucci, 2003; Slattery et al., 2004; Frezza et al., 2006). Other components of metabolic syndrome including total cholesterol, high density lipoprotein cholesterol (HDL-c), and triglycerides may play role in development of CRC (Tsilidis et al., 2010). Although the exact mechanism is unknown but several studies have emphasized the role of dyslipidemia on CRC development (Schoen et al., 1999; Chung et al., 2006).

Hypertension is another component of metabolic

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syndrome (Cameron et al., 2004). There is no epidemiologic evidence to suggest that hypertension is a risk factor for colon adenomas and possibly CRC and only few studies have introduced hypertension as an independent risk factor for CRC (Ahmed et al., 2006).

Despite the strong association between metabolic syndrome and CRC, there is little information about this issue in Iran. As a first step to provide further information, we decided to evaluate prevalence of metabolic syndrome and its components in patients with CRC.

Materials and Methods

The present study was designed as a cross-sectional survey to assess the frequency of metabolic syndrome in CRC patients and compare clinicopathologic characteristics of patients with and without metabolic syndrome. This study was conducted on 200 patients with new diagnosis of CRC, according to pathology report, which were referred to Imam Hossein Hospital, Tehran, Iran, from 2008-2010.

Before the onset of study, the aim of this survey was explained to all eligible individuals and requested their participation. The individuals were informed that participation in the study was not compulsory and their information will preserved confidential.

After obtaining informed consent, patients' information including demographic data, history of chronic disease, behavioral habits (such as smoking, alcohol use) and family history of disease were collected through the interview with them. Patients' waist circumference, weight and height were measured and body mass index (BMI) was calculated for all of them. Blood pressure was measured using standard sphygmomanometers, after 5 min of rest, in a sitting position. Fasting blood sample was taken for determination of high density lipoprotein (HDL), triglyceride and serum glucose.

National Cholesterol Education Program's (NCEP) is defined metabolic syndrome as the presence of 3 or more following items: waist circumference ≥102 cm in men and ≥88 cm in women, blood pressure ≥130/85 mmHg, fasting blood glucose (FBG) ≥110 mg/dl, serum triglycerides (TG) >150 mg/dl and high density lipoprotein (HDL) <40 mg/dl in men and <50mg/dl in women (2001).

According to NCEP definition, patients were divided into two categories based: CRC patients with metabolic syndrome and CRC patients without metabolic syndrome. Then clinicopathological characteristics of both groups were evaluated and were compared with each other.

Continuous variables are presented as mean±standard deviation, and other parameters as frequency and percentage. Differences between groups were determined by χ^2 test and differences between means of groups were compared by independent samples T test. Statistical analysis was performed using SPSS software (version 13.0). A P-value of 0.05 or less was considered statistically significant and all reported P values were two sided.

Results

A total of 200 CRC patients were recruited in the study, of which 115 (57.5%) and 85 (42.5%) cases were male and female, respectively. The mean age of patients was 57.1±13.9 years. Rectum was the most common site of tumor followed by descending colon, ascending colon, cecum and transverse colon. Patients' Clinicopathological features are shown in Table 1.

Fasting blood glucose was higher than 110 mg/dl in 25% of cases. Hypertension was present in 36.5% of patients. 38.5% of patients had an elevated serum TG.24% of men and 33.5% of women had a low HDL cholesterol level and abdominal obesity, based on waist circumference, were reported 46% and 6% in women and men, respectively. Table 2 demonstrates the distribution of metabolic syndrome's components.

As shown in Table 2, a total of 72 CRC patients (36%) had met to metabolic syndrome criteria that 76% were women and 24% were men. 47 patients with metabolic syndrome had at least 3 NCEP criteria and 21 and 4 of

Table 1. Clinicopathological Features of CRC Patients Under Study

		No.	%
Site of tumor	Rectum	107	53.5
	Descending colon	61	30.5
	Transverse colon	8	4.0
	Ascending colon	13	6.5
	Cecum	11	5.5
Type of lesion	Ulcerative	59	29.5
	Polyploid	66	33.0
	Infiltrative	55	27.5
	Obstructive	20	10.0
Grade of tumor	Well differentiated	103	51.5
	Moderately differentiated	76	38.0
	Poorly differentiated	21	10.5
Stage of tumor	I	24	12.0
	II	67	33.5
	III	51	25.5
	IV	58	29.0
Lymph node metastasis	Positive	119	59.5
	Negative	81	40.5
Metastasis	Local recurrence + distant metastasis		
		23	11.5
	Local recurrence	36	18.0
	Distant metastasis	20	10.0
	No metastasis	121	60.5

Table 2. Distribution of Components of Metabolic Syndrome According to Sex

	Men (n=85)	Women (n=115)	P-value
Waist circumference (mean±SD)			
	90.3±8.8	95.7±8.1	<0.0001
Abdominal obesity, n(%)	12.0 (14.1)	92.0 (80.0)	<0.0001
FBS (mean±SD)	105.2±37.7	102.4±40.1	0.62
High fasting blood glucose, n(%)			
	25.0 (29.4)	25.0 (21.7)	0.25
Blood pressure, sys/dys(mean±SD)			
	122.9±17.8/ 74.8±10.3	122.3±14.8/ 75.0±9.1	0.77
Hypertension, n(%)	33.0 (38.8)	40.0(34.8)	0.66
HDL (mean±SD)	43.0±9.2	40.7±9.0	0.07
Low HDL, n(%)	48.0 (24.0)	67.0 (33.5)	0.03
TG (mean±SD)	154.9±63.8	136.9±56.2	0.03
Hyper TG, n(%)	36.0 (42.4)	41.0 (35.7)	0.38

Table 3. Distribution of Demographic and Clinicopathological Characteristics in Patients with and Without Metabolic Syndrome

	CRC patients with metabolic syndrome*		CRC patients without metabolic syndrome**		p-value
	N	(%)	N	(%)	
Disease history					
Hypertension	29	(40.2)	16	(12.5)	<0.001
Hyperlipidemia	11	(15.3)	13	(10.2)	0.285
Diabetes	14	(19.4)	8	(6.2)	0.004
Cardiovascular disease	21	(29.2)	6	(4.7)	<0.001
Site of tumor					
Rectum	42	(58.5)	65	(51.0)	0.625
Descending colon	18	(25.0)	43	(33.5)	
Transverse colon	2	(02.7)	6	(4.5)	
Ascending colon	6	(08.3)	7	(5.5)	
Cecum	4	(05.5)	7	(5.5)	
Type of lesion					
Ulcerative	27	(37.5)	32	(25.0)	0.157
Polyploid	20	(28.0)	46	(36.0)	
Infiltrative	16	(22.0)	39	(30.5)	
Obstructive	9	(12.5)	11	(8.5)	
Grade of tumor					
Well differentiated	35	(48.5)	67	(52.5)	0.751
Moderately differentiated	28	(39.0)	48	(38.0)	
Poorly differentiated	9	(12.5)	12	(9.5)	
Stage of tumor					
I	5	(7.0)	18	(14.0)	0.165
II	23	(32.0)	44	(34.0)	
III	24	(34.0)	27	(21.0)	
IV	19	(27.0)	39	(31.0)	
Behavioral habits					
Smoking	31	(43.0)	33	(25.8)	0.012
Opium consumption	6	(8.30)	7	(5.5)	0.430

whom had 4 and 5 criteria, respectively. Mean age of metabolic syndrome patients had significantly higher than other patients (60±12 vs. 55±14, p=0.02). Also BMI in metabolic syndrome patients was higher than other CRC patients (28.0±3.8 vs.23.9±3.7, p<0.0001). Disease history including hypertension, diabetes and cardiovascular disease was most frequent in metabolic patients. Distribution of demographic and clinicopathological characteristics in CRC patients with and without metabolic syndrome is shown in Table 3.

No significant difference was observed between two groups' patients regarding lymph node metastasis and metastasis to other organs

Discussion

The present study findings indicated that considerable percentage of patients with colorectal cancer, simultaneously suffer from metabolic syndrome. These observations will reinforce the hypothesis of association between metabolic syndrome and risk of CRC.

Our results showed that about 36% of CRC patients diagnosed with metabolic syndrome. This value is similar to what is obtained in Chiu et al. (2007) study, they reported that 150 of 418 CRC patients had metabolic syndrome according to NCEP-ATP III. In another study in Korea the frequency of metabolic syndrome in CRC patients was reported 17% (Kim et al., 2007). Given that the similarity of diagnostic criteria of metabolic syndrome in these studies, differences in reported rates may be due to different demographic characteristics of population under study or various laboratory methods for determination of components of metabolic syndrome.

Although some studies (Ahmed et al., 2006; Pelucchi et al., 2010) suggested that risk of CRC in men with metabolic syndrome is higher than women, but in current study we found that metabolic syndrome in women is most common than men. This difference perhaps not be a real difference but also may be due to gender distribution in population under study in this survey.

Obesity is considered one of the major components of metabolic syndrome that is measured by different indicators including body mass index and abdominal obesity. As mentioned above, 80% of women and 14% of men had abdominal obesity according to waist circumference that is in contrast with Plucchi et al. study (Pelucchi et al., 2010). Although given that high prevalence of obesity in Iranian women (Ayatollahi and Ghoreshizadeh, 2010), the findings of current study is reasonable.

As seen in result section, prevalence of metabolic syndrome components' in our study was relatively high. Reported values in other studies (Wang et al., 2005; Chiu et al., 2007; Safaee et al., 2009) is lower than our findings. Although it should be considered that study populations' in current survey were selected from CRC patients but individuals under study in mentioned reports were selected from colonoscopy candidate that generally were healthy patients.

Pathological characteristics of patients were not associated with metabolic syndrome. But similar to other studies (Chiu et al., 2007; Safaee et al., 2009) smoking habit was most common in metabolic syndrome patients. Because of alcohol use and opium consumption is considered a taboo in Iran, obtained percentages in this study is not very reliable.

Our study has to be interpreted taking its limitations into account. First, needed information was obtained from a one referral public center that demographic characteristics of patients that refer to this center may be different from population and therefore, the generalization of results should be done with caution. Second, design of study was as a cross sectional and there was a lack of healthy control group, for this reason, causal inference is not possible.

In conclusion, our findings indicated that the prevalence of metabolic syndrome in CRC patients is relatively high. Therefore, further analytical and multicentric studies are needed to better understand the role of metabolic syndrome in development of CRC. If this association confirms in future studies, metabolic syndrome patients should be considered in CRC screening programs.

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