Utility of the Asia-Pacific colorectal screening scoring system and the presence of metabolic syndrome components in screening for sporadic colorectal cancer

Jiang-Yuan Wang, Zhen-Tao Li, Yuan-Min Zhu, Wen-Chao Wang, Yan Ma, Yu-Lan Liu

Jiang-Yuan Wang, Yuan-Min Zhu, Yu-Lan Liu, Department of Gastroenterology, Peking University People’s Hospital, Beijing 100044, China
Zhen-Tao Li, Department of Gastroenterology, People’s Hospital of Dengfeng, Dengfeng 452470, Henan Province, China
Wen-Chao Wang, People’s Hospital of Pu’er, Pu’er 665000, Yunnan Province, China
Yan Ma, People’s Hospital of Lviang, Lviang 033000, Shanxi Province, China

Author contributions: Zhu YM and Liu YL contributed to the concept and design of the study, and provided final approval of the version to be published; Wang JY performed the majority of data analysis, drafted the article and revised it for important intellectual content; Li ZT performed the collection of the clinical data; Wang WC and Ma Y participated in data collection; all the authors confirmed that they had reviewed the manuscript and approved its publication.

Supported by Capital Health Research and Development of Special, No. 2011-4022-06

Correspondence to: Yuan-Min Zhu, MD, Department of Gastroenterology, Peking University People’s Hospital, No.11 Xizhimen South Street, Beijing 100044, China. zhuyuanmin@sina.com
Telephone: +86-10-88324780 Fax: +86-10-88324780
Received: January 22, 2014 Revised: April 4, 2014
Accepted: April 30, 2014
Published online: August 28, 2014

Abstract

AIM: To determine the utility of the Asia-Pacific colorectal screening (APCS) scoring system and metabolic syndrome components in individual screening for sporadic colorectal cancer.

METHODS: The subjects were patients admitted to the Peking University People’s Hospital for colonoscopy between October 2012 and July 2013. Clinical information, including patient willingness to undergo colonoscopy, medical history, endoscopic findings, histology, and other information, was collected, and the patients were grouped according to APCS scores and the presence of metabolic syndrome components. Colorectal tumor detection rates were compared between the groups.

RESULTS: A total of 219 patients were included in the study, 108 were male and 111 were female, resulting in a male-to-female ratio of 1:1.03. The average age of the patients was 56.8 ± 13.7 years. According to APCS scores, 88 (40.2%) patients were included in the average-risk (AR) group, 113 (51.6%) patients were included in the moderate-risk (MR) group, and 18 (8.2%) patients were included in the high-risk (HR) group. Colorectal tumors were detected in 69 (31.5%) subjects, and the detection rates in the AR, MR, and HR groups were 15.9%, 36.3%, and 77.8%, respectively. The difference in the detection rates between the three groups was statistically significant (P < 0.01). The combined detection rate of colorectal tumors in the APCS MR and HR groups was 42.0%. However, patients in the MR and HR groups who presented with metabolic syndrome components, in particular obesity, exhibited a significantly higher colorectal tumor detection rate (59.5%) than those without these components (19.2%, P < 0.01) and those who underwent colonoscopy because of doctor’s recommendation (36.5%, P < 0.01).

CONCLUSION: The APCS scoring system can be used in individual screening for sporadic colorectal cancer. The combined use of APCS scores and the metabolic syndrome components, in particular obesity, will significantly improve the efficacy of individual colorectal cancer screening.

© 2014 Baishideng Publishing Group Inc. All rights reserved.
Key words: Asia-Pacific colorectal screening scoring system; Metabolic syndrome; Obesity; Colorectal cancer; Individual screening

Core tip: This study assessed the utility of the Asia-Pacific colorectal screening (APCS) scoring system and the presence of metabolic syndrome components in outpatient screening for colorectal cancer (CRC) by stratifying individuals according to these parameters. The APCS scoring system can be used in individual screening for sporadic CRC. The combined use of APCS scores and the metabolic syndrome components, in particular obesity, will significantly improve the efficacy of colorectal cancer screening.

INTRODUCTION

Colorectal cancer (CRC) is one of the most common malignant tumors worldwide. Both the incidence and associated mortality rates of CRC in China have increased because of improved standards of living and changes in eating habits. In most cases, CRC is sporadic and develops from adenomas. As effective CRC prevention methods are lacking, the best method to prevent the morbidity associated with CRC is to improve the detection rate of early-stage disease. A growing body of evidence has shown that detection and elimination of lesions at the precursor or early stage can reduce both the incidence of and mortality from CRC. The decreased incidence of CRC in the United States over the past 2 decades has been attributed by some efficient CRC screening methods.

Many studies have recommended screening programs for CRC. Among them, the Asia-Pacific colorectal screening (APCS) system, reported in 2011, uses age, gender, a family history of colorectal tumors, and smoking history as the factors to calculate scores. Individuals are categorized into 3 groups according to these scores: the average-risk (AR), moderate-risk (MR), and high-risk (HR) groups. Colonoscopy is recommended for individuals in the HR group. The APCS scoring system is simple and convenient for outpatient screening; however, it was proposed only recently, and therefore, its effectiveness requires further evaluation. Because the APCS system was established using asymptomatic individuals, whether it is useful for individual screening in symptomatic outpatients was discussed in this study.

Metabolic syndrome (MS) comprises the metabolic risk factors of cardiovascular disease and type 2 diabetes, which mainly include obesity, dyslipidemia, hypertension, hyperglycemia, and insulin resistance. Because of the adoption of Western dietary habits and lifestyle, many Asian countries have witnessed a substantial increase in the prevalence of obesity and MS over the past few decades.

A large number of epidemiological studies have shown that MS components are closely related to the occurrence of colorectal tumors. However, the APCS scoring system does not incorporate MS components. Therefore, in this study, we assessed the utility of the APCS system and the presence of MS components in outpatient screening for CRC by stratifying individuals according to these parameters.

MATERIALS AND METHODS

Subjects

We selected patients who were admitted to the Peking University People's Hospital for colonoscopy between October 2012 and July 2013. The exclusion criteria were as follows: age less than 20 years or more than 90 years; familial adenomatous polyposis or hereditary non-polypotic CRC; and inflammatory bowel disease.

The study was approved by the Ethical Committee of Peking University People's Hospital. All the patients enrolled in the study were well informed and signed the informed consent.

Methods

We collected the clinical information of patients, including gender; age; body mass index (BMI); history of hypertension, high blood glucose levels, dyslipidemia, alcohol consumption, smoking, and cancer; and the history of CRC in immediate family members. Additionally, we determined the reasons for which patients underwent colonoscopy: whether the patient volunteered to undergo these examinations or whether these examinations were recommended by their doctors.

The colonoscopy findings and tumor pathology results were reviewed. Colorectal tumors were classified as non-advanced tumors (tubular adenoma with a maximum diameter < 1 cm, without severe dysplasia) or advanced tumors (tubular adenoma with a maximum diameter ≥ 1 cm, villous or tubulovillous adenoma, adenoma with severe dysplasia, or cancer).

The subjects were divided into the AR, MR, and HR groups according to APCS scores, which were assigned as follows: age < 50 years = 0 points, 50-69 years = 1 point, ≥ 70 years = 2 points; gender: female = 0 points, male = 1 point; immediate family member with CRC: no = 0 points, yes = 1 point; and smoking status: no smoking history = 0 points, current or former smoker = 1 point. On the basis of the cumulative scores, patients were classified into the following groups: AR = 0-1, MR = 2-3, and HR = 4-7.

In this study, the MS components and related diseases that were evaluated were obesity (BMI ≥ 25 kg/m²), hyperlipidemia, hypertension, and diabetes.

Wang JY et al. APCS and MS for CRC screening
the presence of MS components and related disorders, individuals in the APCS MR and HR groups were further stratified and colorectal tumor detection rates were compared between individuals who did and those who did not have these MS components and related diseases to determine their utility in CRC screening.

**Statistical analysis**
All data were analyzed using IBM SPSS Statistics 20 software (SSPS, Inc., Chicago, IL, United States). Continuous variables with a normal distribution were presented as means ± SD. Categorical data were presented as percentages (%) and were analyzed using the \( \chi^2 \) test or Fisher’s exact test, with a significance level of \( \alpha = 0.05 \). A \( P \) value of < 0.05 was considered statistically significant.

**RESULTS**

**General characteristics**
Among the 219 enrolled patients, 108 were male and 111 were female, resulting in a male-to-female ratio of 1:1.03. The average age of the patients was 56.8 ± 13.7 years. Among the 219 patients, 52 (23.8%) had a history of colorectal polyps and 4 had a history of CRC. Colorectal tumors were detected in 69 patients (31.5%); of these, 14 (15.9%) were in the AR group, 41 (36.3%) were in the MR group, and 14 (77.8%) were in the HR group. Further, 51 patients (23.3%) had non-advanced tumors and 18 (8.2%) had advanced tumors, including 9 cases of invasive carcinoma.

**Effect of stratification according to APCS scores on the colorectal tumor detection rate**
According to the APCS criteria, of the 219 patients, 88 (40.2%) were in the AR group, 113 (51.6%) were in the MR group, and 18 (8.2%) were in the HR group. The colorectal tumor detection rates for the AR, MR, and HR groups were 15.9%, 36.3%, and 77.8%, respectively, and the differences between the groups were statistically significant (Table 1). The combined detection rate of the MR and HR groups was 42.0%.

**Effect of the presence of MS components on the colorectal tumor detection rate**
A sub-group analysis was performed on the 131 patients in the APCS MR and HR groups. Based on the presence of MS components and related diseases, these patients were divided into 3 groups: group A (control group), BMI < 25 kg/m² and no MS components; group B, BMI ≥ 25 kg/m² with 1 or no MS components; and group C, BMI ≥ 25 kg/m² with 2-3 MS components. The colorectal tumor detection rates were as follows: group A, 19.2% (10/52); group B, 56.4% (22/39); group C, 62.5% (25/40); and group B + C, 59.5% (47/79). Statistical analysis revealed that the values of groups B and C were significantly different from that of group A; however, the difference between groups B and C was not statistically significant (Table 2).

**DISCUSSION**
Researchers at the National University of Singapore...
conducted a study on tertiary hospitals in 11 Asian cities, including 2752 asymptomatic individuals who underwent screening colonoscopy. The researchers developed the APCS scoring system based on the results of multivariate logistic regression analysis of the risk factors for colorectal tumors\[9\]. In the validation group, the rates of advanced neoplasia in the AR, MR, and HR groups were 1.3%, 3.2%, and 5.2%, respectively. Patients in the MR and HR groups had a 2.6-fold (95%CI: 1.1-6.0) and 4.3-fold (95%CI: 1.8-10.3) higher rate of advanced neoplasia, respectively, than patients in the AR group. In our study, we observed colorectal tumor detection rates of 15.9%, 36.3%, and 77.8%, respectively, for the AR, MR, and HR groups, and the detection rates for advanced colorectal tumor were 2.3%, 9.7%, and 27.8% in these groups, respectively. The differences in the detection rates between the 3 groups were statistically significant, suggesting that APCS scoring system was useful in colorectal tumor screening for symptomatic outpatients, although the APCS scoring system was established using asymptomatic individuals. In addition, the APCS scoring system is simple and convenient for clinical use. In this study, the colorectal tumor detection rate was significantly higher than that in the APCS study; a possible reason for this difference is that many patients who visited the clinic had related symptoms and risk factors such as a history of colorectal polyps or CRC. Patients with a history of colorectal polyps might have recurrence rates exceeding 55.7%\[13\], and therefore, the colorectal tumor detection rate is higher in those patients than in the general population.

Numerous studies have indicated that MS components and related diseases are significantly associated with the development of colorectal tumors, and MS is a significantly independent element that influences the survival of the CRC\[14-18\]. Obesity is a key component of MS\[19\], and systematic reviews\[20,21\] revealed that obesity is a statistically significant risk factor for CRC. Therefore, we further stratified patients in the MR and HR groups according to these risk factors. When patients in the MR/HR group were stratified according to the presence of obesity, the colorectal tumor detection rate significantly increased (59.5% vs 19.2% for the MR/HR group without obesity, \(P < 0.01\)). Thus, MS components, especially obesity, are closely related to the onset of colorectal tumors.

Our previous studies\[13,14\] demonstrated that an increase in the number of MS components is related to an increased proportion of advanced colorectal tumors among all colorectal tumors. The number of MS components is also related to tumor recurrence. Patients with colorectal tumors that are not associated with any MS components have a recurrence rate of 18.42% within 1-3 years after initial treatment, whereas those with 1, 2, or \(\geq 3\) components have recurrence rates of 59.52%, 75%, and 77.78%, respectively. This finding suggests that the number of MS components is positively correlated with the risk of colorectal tumor development. This study revealed that the colorectal tumor detection rate increased as the number of MS components increased; however, this increase did not reach statistical significance, which was probably due to the small sample size.

Individual screening, also known as opportunistic screening, comprises clinical screening and a face-to-face examination. This may be performed when patients request screening from doctors or doctors prescribe screening tests on the basis of the presence of risk factors. In fact, most early CRC diagnoses in China result from individual screening recommended by doctors in hospital\[22\]; however, neither doctors nor patients have clear guidelines to follow. In China, the CRC screening program involves screening methods such as the sequential fecal occult blood initial screening method\[23\]. Even with immunoassays of fecal occult blood, the detection rate of early-stage CRC is relatively low\[23,24\]. Thus, in CRC screening programs, a survey of high-risk factors for CRC should be emphasized, so that patients in the high-risk group can undergo screening colonoscopy without delay.

According to former studies, the extent of knowledge regarding CRC that primary care doctors and the general population have greatly influences compliance with CRC screening\[25,26\]. Given the limited medical resources, we should identify high-risk patients for prior colonoscopy screening. In the clinic, doctors’ decisions are greatly influenced by personal experiences. Most doctors are not familiar with specific CRC screening principles, and many patients fear colonoscopy. This study illustrated that the combined use of the APCS score and the presence of MS components such as obesity had a significantly better effect on CRC screening than did physician advice or the patient’s willingness to undergo colonoscopy. We suggest that the effects of the APCS scores as well as those of MS components on CRC onset be advocated in doctors and among the general population. Increased compliance with CRC screening should be ensured among patients in the APCS MR/HR group, especially among those with MS components, particularly obesity, to increase the efficiency of individual CRC screening programs and promote the accumulation of experiences and data that will provide evidence for improving CRC screening in China.

**COMMENTS**

**Background**

Colorectal cancer (CRC) is one of the most common malignant tumors worldwide. The best method to prevent the morbidity associated with CRC is to improve the detection rate of early-stage disease. The Asia-Pacific colorectal screening (APCS) system uses age, gender, a family history of colorectal tumors, and smoking history as the factors to calculate the risk of colorectal tumors. However, the APCS scoring system does not incorporate metabolic syndrome, which has been proved closely related to the occurrence and development of colorectal tumors.

**Research frontiers**

There are a large number of studies aiming to reveal the risk factors of CRC, including but not limited to age, gender, smoking, a family history of colorectal tumors and metabolic syndrome. Accordingly, many screening models for CRC
have been recommended.

**Innovations and breakthroughs**

This study assessed the efficacy of APCS scoring system and the combined use of metabolic syndrome in individual screening for sporadic CRC.

**Applications**

The combined use of APCS scores and the metabolic syndrome components, in particular obesity, may significantly improve the efficacy of individual CRC screening, and has clinical significance.

**Terminology**

Individual screening, also known as opportunistic screening, is a new model based on clinical practice. It may be performed when patients request screening from doctors or doctors prescribe screening tests on the basis of the presence of risk factors.

**Peer review**

The APCS scoring system can be used in individual screening for sporadic colorectal cancer. The combined use of APCS scores and the metabolic syndrome components, in particular obesity, may significantly improve the efficacy of colorectal cancer screening. This is a potentially important study, especially in the Asian population, and has clinical significance. The manuscript is well written and clear.

**REFERENCES**

1. Kuriki K, Tajima K. The increasing incidence of colorectal cancer and the preventive strategy in Japan. *Asian Pac J Cancer Prev* 2006; 7: 495-501 [PMID: 17059355]
2. Steele CB, Rim SH, Joseph DA, King JB, Seeff LC. Colorectal cancer incidence and screening - United States, 2008 and 2010. *MMWR Surveill Summ* 2013; 62 Suppl 3: 53-60 [PMID: 24264490]
3. Altabelli E, Lattanza A, Paduano R, Varassi G, di Orso F. Colorectal cancer prevention in Europe: burden of disease and status of screening programs. *Prev Med* 2014; 62: 132-141 [PMID: 24530610 DOI: 10.1016/j.ypmed.2014.02.010]
4. Chen Q, Liu ZC, Cheng LP, Song GH, Sun XB, Zheng RS, Zhang SW, Chen WQ. An Analysis of Incidence and Mortality of Colorectal Cancer in China, 2003-2007. *Zhongguo Zhongliu* 2012; 21: 179-182
5. Sung JI, Lau JY, Goh KL, Leung WK. Increasing incidence of colorectal cancer in Asia: implications for screening. *Lancet Oncol* 2005; 6: 871-876 [PMID: 16257795 DOI: 10.1016/S1470-2045(05)70222-5]
6. Levin B, Lieberman DA, McFarland B, Andrews KS, Brooks D, Bond J, Dash C, Giardiello FM, Glick S, Johnson D, Johnson CD, Levin TR, Pickhardt P, Rex DK, Smith RA, Thorson A, Winawer SJ. Screening and surveillance for the early detection of colorectal cancer and adenomatous polyps, 2008: a joint guideline from the American Cancer Society, the US Multi-Society Task Force on Colorectal Cancer, and the American College of Radiology. *Gastroenterology* 2008; 134: 1570-1595 [PMID: 18384785 DOI: 10.1016/j.gastro.2008.02.002]
7. Ma GK, Ladabaum U. Personalizing Colorectal Cancer Screening: A Systematic Review of Models to Predict Risk of Colorectal Neoplasia. *Clin Gastroenterol Hepatol* 2014; Epub ahead of print [PMID: 24534546 DOI: 10.1016/j.cgh.2014.01.042]
8. Chinese Medical Association Of Gastroenterology. Chinese colorectal cancer screening, early detection and treatment, and comprehensive prevention consensus (Summary). *Zhonghua Xiu Fen Bing Xue Za Zhi* 2012; 29: 61-64 [DOI: 10.3760/cma.j.issn.1007-5232.2012.02.001]
9. Yeoh KG, Ho KY, Chiu HM, Zhu F, Ching JY, Wu DC, Matsuda T, Byeon JS, Lee SK, Koh KL, Sollano J, Rerknimitr R, Leong R, Tsoi K, Lin JT, Sung J. The Asia-Pacific Colorectal Screening score: a validated tool that stratifies risk for colorectal advanced neoplasia in asymptomatic Asian subjects. *Gut* 2011; 60: 1236-1241 [PMID: 21402615 DOI: 10.1136/gut.2010.221168]
10. Eckel RH, Alberti KG, Grundy SM, Zimet PZ. The metabolic syndrome. *Lancet* 2010; 375: 181-183 [PMID: 20109902 DOI: 10.1016/S0140-6736(09)61794-3]
11. Nestel P, Lyu R, Low LP, Shew WH, Nitiyanant W, Saito I, Tan CE. Metabolic syndrome: recent prevalence in East and Southeast Asian populations. *Asia Pac J Clin Nutr* 2007; 16: 362-367 [PMID: 17468095]
12. Xi B, He D, Hu Y, Zhou D. Prevalence of metabolic syndrome and its influencing factors among the Chinese adults: the China Health and Nutrition Survey in 2009. *Preo Med* 2013; 57: 867-871 [PMID: 24103567 DOI: 10.1016/j.ypmed.2013.09.023]
13. Liu CS, Hsu HS, Li CJ, Jan CI, Li TC, Lin WY, Lin T, Chen YC, Lee CC, Lin CC. Central obesity and atherogenic dyslipidemia in metabolic syndrome are associated with increased risk for colorectal adenoma in a Chinese population. *BMJ Gastroenterol* 2010; 10: 51 [PMID: 20507579 DOI: 10.1186/1471-230X-10-51]
14. Shen Z, Wang S, Ye Y, Yin M, Yang X, Jiang K, Liu Y. Clinical study on the correlation between metabolic syndrome and colorectal cancer. *ANZ J Surg* 2010; 80: 331-336 [PMID: 20579506 DOI: 10.1111/j.1445-2197.2009.05804.x]
15. Yang J, Zhu YM, Hu Y, Cao S, Tian K, Zhang NM, Liu YL. Study on Relationship between major components of metabolic syndrome and recurrence of colorectal adenomatous polyp. *Weichangxue* 2011; 16: 712-716
16. Yang J, Zhu YM, Hu Y, Zhang NM, You P, Chen DB, Jia M, Liu YL. Expression of components of metabolic syndrome and related diseases in patients with colorectal tumor at different stages. *Zhonghua Xiu Fen Bing Za Zhi* 2013; 33: 176-179
17. Zhu YM, Li HP, Li J, Liu YL. The relationship between colorectal tumors and metabolic syndrome. *Zhonggao Xiao-hua Neijing* 2007; 24: 190-193
18. Wong VW, Wong GL, Tsang SW, Fan T, Chu WC, Wong JY, Chan AW, Choi PC, Chim AM, Lau JY, Chan FK, Sung JY, Chan HL. High prevalence of colorectal neoplasm in patients with non-alcoholic steatohepatitis. *Gut* 2011; 60: 829-836 [PMID: 21392094 DOI: 10.1136/gut.2011.237974]
19. Zhou XG, Song XX, Ji LN. The components of metabolic syndrome analyzed by factor analysis. *Zhonggao Tiaoniang-bi* 2005; 13: 434-436
20. Dai Z, Xu YC, Niu L. Obesity and colorectal cancer risk: a meta-analysis of cohort studies. *World J Gastroenterol* 2007; 13: 4199-4206 [PMID: 17696248]
21. Ma Y, Yang Y, Wang F, Zhang P, Shi C, Zou Y, Qin H. Obesity and risk of colorectal cancer: a systematic review of prospective studies. *PLoS One* 2013; 8: e53916 [PMID: 23349764 DOI: 10.1371/journal.pone.0053916]
22. Han Y, Li SY, Sheng JQ. Promote the model of “Opportunistic screening” and improve the early diagnosis and treatment of colorectal cancer. *Weichangxue Gaobingxue* 2010; 19: 581-583 [DOI: 10.3969/j.issn.1006-5709.2010.07.001]
23. Liu XY, Ma XY. Randomized controlled trial of sequence mass screening program for colorectal Prospective evaluation of the application of the colorectal cancer screening program in population health. *Zhonghua Liuxingbingxue Za Zhi* 2010; 21: 430-433
24. Hernandez V, Cubiella J, Gonzalez-Mao MC, Iglesias F, Rivera C, Iglesias MB, Cid L, Castro I, de Castro L, Vega P, Herno JA, Macenlle R, Martinez-Turnes A, Martinez-Ares D, Estevez P, Cid E, Vidal MC, Lopez-Martinez A, Hijona E, Herreros-Villaneuva M, Bajanda L, Rodriguez-Prada JJ. Fe-cal immunochromatic test accuracy in average-risk colorectal cancer screening. *World J Gastroenterol* 2014; 20: 1038-1047 [PMID: 24574776 DOI: 10.3783/wjg.v20.i4.1038]
25. Sanderson PR, Weinstein N, Teufel-Shone N, Martinez ME. Assessing colorectal cancer screening knowledge at tribal
Kiviniemi MT, Bennett A, Zaiter M, Marshall JR. Individual-level factors in colorectal cancer screening: a review of the literature on the relation of individual-level health behavior constructs and screening behavior. *Psychooncology* 2011; 20: 1023-1033 [PMID: 21954045 DOI: 10.1002/pon.1865]

**P- Reviewer:** Kim JS, Salkic NN, Xie K  
**S- Editor:** Qi Y  
**L- Editor:** O’Neill M  
**E- Editor:** Wang CH
