Original Article

External Validation of the Screening Score to Predict Advanced Colorectal Neoplasia in the Thai Population of the Colorectal Cancer Screening Project at Chulabhorn Hospital

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Objective: The present study validated four screening score models to predict advanced colorectal neoplasia, including the Asia-Pacific colorectal score (APCS), Korean colorectal screening score (KCS), Asia-Pacific colorectal score with body mass index (APCS+BMI), and colorectal screening scores of the Chinese population (CCS) in an asymptomatic Thai population participating in a colorectal cancer screening project.

Materials and Methods: A total of 1,404 Thai individuals participated in the Royal Charity Project of colorectal cancer screening during July 2009. The participants were asked to complete questionnaires about their risk factors of CRC. To validate a four-screening score model, a receiver operating characteristic (ROC) curve was used. The area under the ROC curve (AuROC) was also reported with 95% confidence intervals (CIs).

Results: A total of 1,349 asymptomatic Thai subjects were asked to complete a questionnaire regarding their risk factors in the risk score model and colonoscopy results. The mean age was 56.89±4.19 years and 69.8% were females. Advanced colorectal neoplasia was found in 53 subjects (3.93%). AuROC for advanced colorectal neoplasia were as follows: APCS, 0.65; 95% CI: 0.57 to 0.74), KCS, 0.66; 95% CI: 0.57 to 0.74), APCS+BMI, 0.67; 95% CI: 0.60 to 0.75, and CCS, 0.66; 95% CI: 0.58 to 0.74). All four screening score models yielded sufficient diagnostic accuracy (AuROC, 0.6 to 0.7), which is not statistically significant (p=0.683). Although no statistical significance was found in the predict advanced colorectal neoplasia, these APCS+BMI had a higher AuROC.

Conclusion: APCS+BMI provides better screening results and is recommend for Thai people. Nonetheless, future studies should be conducted for screening score development in the asymptomatic Thai population, which has high accuracy, and to determine who are most likely to benefit from colonoscopy.

Keywords: Advanced colorectal neoplasia, Screening score, Colorectal cancer screening

Cancer is the second leading cause of death globally. Colorectal cancer (CRC) accounted for 1.8 million deaths in 2018[1]. In Thailand, CRC had between the first and third highest incidences among cancers during the past 5 years in accordance with the statistics of the National Cancer Institute. In 2018, the incidence of colorectal cancer in men was ranked first, whereas the incidence in women was ranked third[2].

As part of the Royal Charity Project of colorectal cancer screening performed during 2009, 1,404 participants

aged 50 to 65 years underwent a colonoscopy and 256 cases (18.23%) of adenoma or adenomatous polyp were identified[3]. Tubular, tubulovillous, and villous adenomas have less than 5%, 20% to 25%, and 35% to 40% chances of a malignancy, respectively[4].

A previous study used screening score models to predict advanced colorectal neoplasia including the Asia-Pacific colorectal score (APCS), Korean colorectal screening score (KCS), Asia-Pacific colorectal score with body mass index (APCS+BMI), and colorectal screening scores of the Chinese population (CCS). Therefore, the present study aimed to validate the four screening scores for the Thai population that participated in the colorectal cancer screening project.

Materials and Methods

The present study was approved by the Ethics Committee of Human Research, Chulabhorn Research Institute (EC No. 062/2560). The retrospective study was conducted using individuals aged 50 to 65 years, who participated in the Royal Charity Project of colorectal cancer screening during 2009. A total of 1,349 participants were asked to sign an informed consent and complete questionnaires

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designed to validate the four-screening score model to predict advanced colorectal neoplasia.

The screening score model to predict advanced colorectal neoplasia included the following.

Variables in APCS along with its risk score were male (1), female (0), <50 years of age (0), 50 to 69 years of age (2), ≥70 years of age (3), family history of CRC in first-degree relatives absent (0) or present (2), non-smoker (0), and current or ex-smoker (1). Scores of 0 to 1, 2 to 3, and 4 to 7 were designated as average, moderate, and high risks, respectively[5].

Variables in the Korean colorectal screening score (KCS) along with its risk score were male (1), female (0), <50 years of age (0), 50 to 69 years of age (2), ≥70 years (4), family history of CRC in first-degree relatives absent (0) or present (2), non-smoker (0), current or ex-smoker (1), and body mass index (BMI) <25 kg/m^2 (0) or ≥25 kg/m^2 (1). Scores of 0 to 1, 2 to 3, and 4 to 6 were designated as average, moderate, and high risks, respectively[6].

Variables in the Asia-Pacific colorectal score with body mass index (APCS+BMI) along with its risk score were male (2), female (0), 50 to 54 years of age (0), 50 to 64 years of age (2), 65 to 70 years of age (2), family history of CRC in first-degree relatives absent (0) or present (2), non-smoker (0), current or ex-smoker (1), and body mass index (BMI) <23 kg/m^2 (0) or ≥23 kg/m^2 (1). Scores of 0 to 1, 2 to 3, and 3 to 6 were designated as average, moderate, and high risks, respectively[7].

Variables in the Chinese population (CCS) score with body mass index (APCS+BMI) along with its risk score were male (1), female (0), 50 to 55 years of age (0), 56 to 70 years of age (2), family history of CRC in first-degree relatives absent (0) or present (2), non-smoker (0), current or ex-smoker (1), body mass index (BMI) <25 kg/m^2 (0) or ≥25 kg/m^2 (1), and diabetes mellitus (1) or non-diabetes mellitus (0). Scores of 0 to 2 and 3 to 6 were designated as average and high risks, respectively[8].

Age, sex, alcohol consumption, smoking, and history of first-degree relatives with CRC were obtained.

Advanced colorectal neoplasia was defined as an adenoma that was ≥1 cm in size, villous or tubulovillous adenoma, or high grade dysplasia or adenocarcinoma[5].

Demographic data were analyzed using descriptive statistics. To validate APCS, KCS, APCS+BMI, and CCS screening score models of advanced colorectal neoplasia, a receiver operating characteristic (ROC) curve was used. The area under the ROC curve (AuROC) also calculated with 95% confidence intervals (CI) and compared the by Chi-squared test. The analysis was conducted using Stata/SE version 12 software (StataCorp LP, College Station, TX, USA). Significance was defined as a two-sided p-value of <0.05.

Results

The 1,349 participants included 407 men and 942 women with a mean age of 56.89±4.19 years, current and ex-smokers (14.7%), family history of CRC in a first-degree relative (8.8%), and body mass indexes of 25 to 29.9 kg/m^2 (34.7%), <23 kg/m^2 (32.2%), and 23 to 24.9 kg/m^2 (21.3%). Colonoscopies showed normal findings in 957 participants (71%, adenoma polyps in 243 participants (18%), hyperplastic polyps and others in 134 participants (9.9%), and colorectal cancer in 15 participants (1.1%) (Table 1).

Numbers and percentages of advanced colorectal neoplasias in each screening model are shown in Table 2. The APCS model indicated a moderate risk in 34/53 cases and high risk in 19/53 cases. The KCS model indicated a moderate risk in 22/53 cases and high risk in 31/53 cases. The APCS+BMI model indicated an average risk in 3/53 cases, moderate risk in 17/53 cases, and high risk in 33/53 cases. The CCS model indicated an average risk in 26/53 cases and high risk in 27/53 cases.
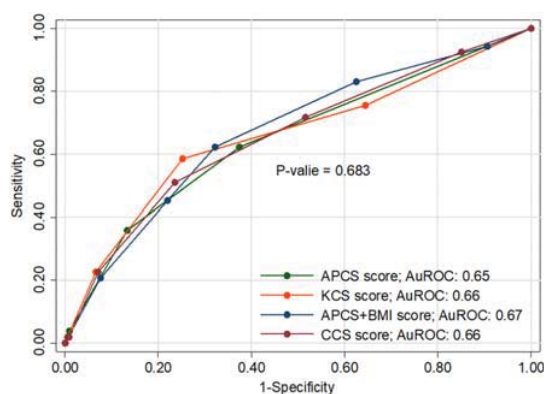
The AuROC for advanced colorectal neoplasia were as follows. APCS model: 0.65 (95% CI: 0.57 to 0.74); KCS model: 0.66 (95% CI: 0.57 to 0.74); APCS+BMI model: 0.67 (95% CI: 0.60 to 0.75); CCS model: 0.66 (95% CI: 0.58 to 0.74) (Figure 1). The four-screening model had no significance of the AuROC for advanced colorectal neoplasia.

Table 1. Demographic data and colonoscopy findings

Variable	Number	Percent
Sex		
Male	407	30.2
Female	942	69.8
Age (years)	56.89±4.19	
50 to 54	455	33.7
55 to 59	492	36.5
60 to 65	402	29.8
Smoking		
Never	1,151	85.3
Current and ex-smoker	198	14.7
Family history of CRC in a first-degree relative		
Absent	1,230	91.2
Present	119	8.8
BMI (kg/m^2)		
<23	448	33.2
23 to 24.9	287	21.3
25 to 29.9	468	34.7
≥30	146	10.8
Colonoscopy		
Normal colonoscopy	957	71.0
Hyperplastic polyps and others	134	9.9
Adenoma polyps	243	18.0
Colorectal cancer	15	1.1

Table 2. Number and percentage of advanced colorectal neoplasias in each screening model

Screening model	Group risk level	n (%)	Advanced colorectal neoplasia
APCS	Average risk (0 to 1 score)	0 (0.0)	0 (0.0)
	Moderate risk (2 to 3 score)	1,157 (85.8)	34 (3.9)
	High risk (4 to 7 score)	192 (14.2)	19 (9.9)
KCS	Average risk (0 to 1 score)	0 (0.00)	0 (0.0)
	Moderate risk (2 to 3 score)	991 (73.5)	22 (2.2)
	High risk (4 to 8 score)	358 (26.5)	31 (8.7)
APCS+BMI	Average risk (0 score)	125 (9.3)	3 (2.4)
	Moderate risk (1 to 2 score)	774 (57.4)	17 (2.2)
	High risk (3 to 6 score)	450 (33.3)	33 (7.3)
CCS	Average risk (0 to 2 score)	1,017 (75.4)	26 (2.6)
	High risk (3 to 6 score)	332 (24.6)	27 (8.1)

Figure 1. Receiver operating characteristic (ROC) curve of the four screening score models.

Discussion

The present study focused on screening models to predict advanced colorectal neoplasia, including the Asia-Pacific colorectal score (APCS), Korean colorectal screening score (KCS), Asia-Pacific colorectal score with body mass index (APCS+BMI), and colorectal screening scores of the Chinese population (CCS). The four screening score models all yielded sufficient diagnostic accuracy (AuROC, 0.65 to 0.67)[9].

Similar to a previous study, APCS, KCS, APCS+BMI, and CCS models had c-statistics (equivalent to the area under the receiver operating characteristic curve) for the advanced colorectal neoplasia risk score in validation of 0.64±0.04[5], 0.68 (0.61 to 0.76)[6], 0.65 (0.61 to 0.69)[7], and 0.62±0.01[8], respectively. All models have sufficient diagnostic accuracy. The risk score has validations such as age, sex, BMI, family history of CRC in a first-degree relative,

smoking, and diabetes mellitus. Additionally, the risk score may be more cost-effective by CRC screening such as the fecal occult blood test (FOBT)[10]. A meta-analysis study showed the high sensitivity of the FOBT in CRC screening and moderate accuracy to predict advanced colorectal neoplasia[11].

The results of this study showed that the four-screening score model yielded sufficient diagnostic accuracies in an asymptomatic Thai population.

Conclusion

In our study, APCS+BMI provided the best screening results and is recommend for Thai people. The four screening score models have sufficient diagnostic accuracy. Hence, the screening score model should be development in an asymptomatic Thai population, which has high accuracy who are most likely to benefit from a colonoscopy.

What is already known on this topic?

Previous studies have examined the screening score and validation score model, and, risk scores such as age, sex, BMI, family history of CRC in a first-degree relative, smoking, and diabetes mellitus in the development and validation model. The four screening scores all have sufficient diagnostic accuracy.

What this study adds?

This study examined an external validation CRC screening model in asymptomatic Thai population. The diagnostic accuracies of the four screening scores were 0.65 to 0.67.

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