Figure 1 Pre-treatment endoscopic evaluation. A: Close view of the cecum revealed a 70 mm I s +II a, LST granular type (LST-G) lesion; B: Clearly delineated margin of the LST-G lesion after 0.4% indigo-carmine dye spraying; C: Magnification view of the Is component of the I s +II a (LST-G); D: Spreading confirmation of the tumor through the ileocecal valve to the terminal ileum.

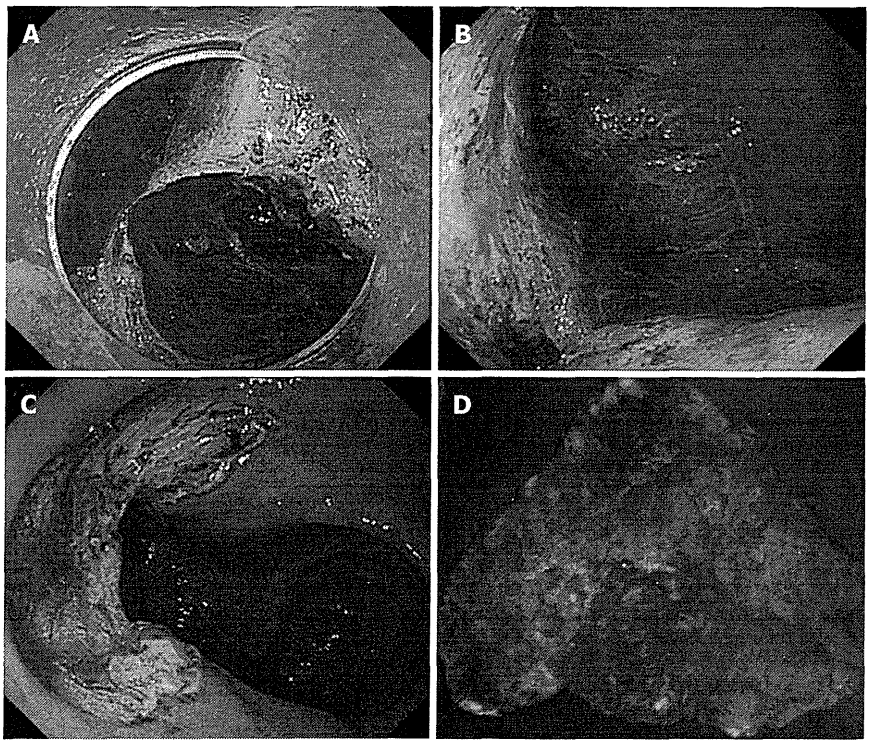

Figure 2 Procedure. A: Endoscopic view through the distal attachment showing dissection with insulation-tip knife; B: Carefully check for bleeding throughout the ileocecal region; C: The ulcer bed of ileum after *en-bloc* endoscopic submucosal dissection; D: Stereomicroscopic view presenting the resected specimen, which pathology reported as a I s+II a intramucosal cancer with tumor-free margins of 70 mm in diameter.

cecum. Conventional colonoscopy revealed a broad base, flat tumor. After 0.4% indigo-carmine dye spraying, the margin of the 70 mm-lesion was clearly delineated (Figure 1A and B). High-magnification colonoscopy (PCF-Q240ZI; Olympus Optical Co. Ltd, Tokyo, Japan) disclosed a non-invasive pit pattern[10-12] indicating an intramucosal cancer despite the lesion's large size (Figure 1C). Extension onto the terminal ileum until 1.5 cm from the ileocecal valve was also observed (Figure 1D). After diagnosing a I s+ II a, LST granular type (LST-G), we performed ESD using B-Knife and insulation-tip knife (IT-Knife) (Olympus Optical Co., Tokyo, Japan) (Figure 2A). During the procedure, we used CO_2 instead of air insufflation to reduce patient's intraoperative abdominal discomfort. This is a safe and effective technique suitable in lengthy colonic endoscopic procedures with the patient under

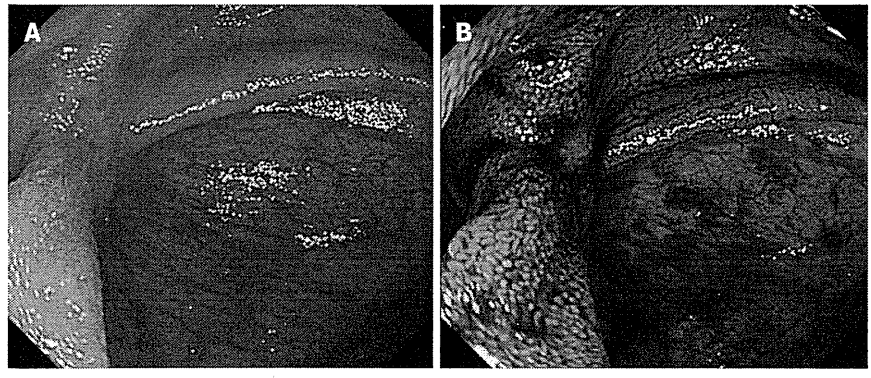

Figure 3 Post-endoscopic submucosal dissection follow-up endoscopic view of the cecum. A: After 6 mo, it shows mildly deformed ileocecal valve due to post-operative scar; B: Following indigo-carmine spraying, no recurrence can be seen.

conscious sedation[13]. Following the injection of glycerol and sodium hyaluronate solution into the sm layer[14,15], a circumferential incision was made using a B-Knife. The thickened sm layer was then dissected (oral to anal) across the ileocecal valve using both the B-Knife and IT-Knife. Finally, hemostasis was carefully checked throughout the ileocecal region (Figure 2B and C). The procedure took 150 min and neither perforation nor delayed bleeding was recognized. Hospitalization lasted four days with no further complications. Histopathology disclosed that the 70 mm resected specimen was an intramucosal cancer with tumor-free margins (Figure 2D). Although some retraction of the ileocecal valve could be observed, follow-up examinations after 6 mo revealed no residual tumor or recurrence (Figure 3A and B).

DISCUSSION

In the present report, en-bloc resection was successfully achieved by ESD using B-Knife and IT-Knife, despite the difficult location involving the ileocecal valve and terminal ileum and the large size of the lesion. IT-Knife, a developed insulation-tipped monopolar electrosurgical knife for removing large gastric lesions en-bloc, is not widely accepted in the colorectum because of its technical difficulty and the risk of complications, such as perforation and bleeding. On the other hand, a bipolar current minimizes the damage to deeper tissues. Thus, the current flow characteristics of the B-Knife reduce the vertical damage and risk of perforation demonstrating its utility for ileocecal ESDs[9,10].

Another important consideration was patient discomfort with air insufflation in long procedures. The supply of air can easily flow into the ileum causing painful distension even in EMRs for cecal lesions. In an earlier study aimed at reducing abdominal discomfort using CO_2 in colorectal ESDs, we demonstrated the advantages and safety of CO_2 compared to conventional air[14]. This factor was evident in the present case. Although a large amount of CO_2 was supplied to the ileum, only a small amount of midazolam (4 mg in both cases) was required for intra-operative sedation.

Considering the indications for colorectal ESD, we M < 40 mm[3]. In these four cases, we decided to perform ESD because of the LST-Gs large size, their location at the ileocecal valve and terminal ileum spreading, the probability of sm infiltration, and an increased likelihood of incomplete resections and recurrence.

Limitations

In our institution, we have performed colorectal ESD using a B-Knife and an IT-Knife in 500 cases. Among of these 500 ESDs, large LST involving the ileocecal valve were only 4 cases, including the presented case. Based on our experience, lesions should be limited at most to 1 or 2 cm into the ileum and not circumferential. If the extension is more than 2 cm or circumferential, ESD would be very difficult and hazardous, so laparoscopy-assisted colectomy should be recommended. The reported case extended 1.5 cm into the ileum, making the most challenging one. Compared with conventional EMR[16], however, the longer procedure time for colorectal ESDs is still a problem. Nevertheless, we are improving our learning curve and using newly developed devices to reduce the length of the procedure and associated complications in order to increase the widespread use of colorectal ESD.

In conclusion, we successfully performed ESD in large LST-G involving the ileocecal valve and terminal ileum using a B-Knife and an IT-Knife with CO_2 insufflation.

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ORIGINAL ARTICLE

How often should we perform surveillance colonoscopy after surgery for colorectal cancer?

Taku Sakamoto · Takahisa Matsuda · Takeshi Nakajima · Yutaka Saito

Accepted: 7 November 2012

Abstract
Purpose Surveillance colonoscopy is undertaken after resection of colorectal cancer to detect and treat local recurrence and metachronous lesions, with the aim of improving survival. This study aimed to clarify the current timing of surveillance colonoscopies and evaluate the rates of local recurrence and metachronous tumors.
Methods We retrospectively analyzed data from 459 patients who underwent surveillance colonoscopy at our institution after curative resection of colorectal cancer. The number and timing of surveillance colonoscopies, incidence of local recurrence and metachronous lesions, pathological findings of lesions, treatment of lesions, and outcomes were recorded.
Results The first surveillance colonoscopy was undertaken at 6–18 months after surgery in 73 % of patients. Local recurrence was detected in three cases (0.7 %), all during the first surveillance colonoscopy, which was performed >1 year after surgery. These three patients all underwent additional surgery and were alive 5 years later. Invasive metachronous cancers were detected in six patients (1.3 %) at 18–57 months after surgery, and advanced adenomas were detected in 30 patients.
Conclusion Considering the low incidence of postoperative lesions and the timing of lesion detection, reducing the number of surveillance colonoscopies after surgery for colorectal cancer may be appropriate.

Keywords Colonoscopy · Colorectal cancer · Local recurrence · Metachronous lesion

T. Sakamoto (✉) · T. Matsuda · T. Nakajima · Y. Saito
Endoscopy Division, National Cancer Center Hospital,
5-1-1 Tsukiji, Chuo-ku,
Tokyo 104-0045, Japan
e-mail: tasakamo@ncc.go.jp

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Introduction

Previous studies reported that intense surveillance after curative surgery for colorectal cancer, including colonoscopy, computed tomography, and measurement of serum carcinoembryonic antigen levels, improved overall survival and early detection of local recurrence and distant metastasis [1–7]. The important aims of colonoscopy are detection of local luminal recurrence and metachronous colorectal cancer. Early detection and endoscopic resection of polyps, which may be precursors of invasive lesions, is thought to contribute to improved mortality rates in patients with colorectal cancer. Colonoscopy is therefore considered to play a very important role in achieving curative treatment for colorectal cancer. The American Cancer Society and US Multi-Society Task Force guidelines suggest surveillance colonoscopy at 1, 4, and 9 years after surgery if all synchronous colonic lesions are treated during the preoperative or perioperative periods [8]. However, there are no established guidelines for surveillance colonoscopy in Japan, and the timing of colonoscopies is at the discretion of the attending physician. The aim of this study was to clarify the current timing of surveillance colonoscopies in Japan and evaluate the incidence of local recurrence and metachronous cancer.

Methods

We retrospectively analyzed data from 873 consecutive patients who underwent surgical resection from colorectal cancer at our institution from January 2004 to December 2005. All patients gave written informed consent for clinical examination and treatment. Patients were excluded if they had familial adenomatous polyposis, Lynch syndrome, ulcerative colitis, International Union Against Cancer-TNM stage IV disease at the time of initial treatment, serious

comorbidities (coronary artery disease, neurological disease), or distant metastasis. Of the 671 remaining patients, 459 underwent at least one colonoscopy after surgery at our institution, and the others were followed up in private care. There were no significant differences in clinical background characteristics between patients who underwent colonoscopy at our institution and those who did not (Table 1).

We collected the following information from the medical records: number of surveillance colonoscopies, timing of surveillance colonoscopies, lesions detected during surveillance colonoscopy (local recurrence or metachronous), pathological findings of lesions detected during surveillance colonoscopy, treatment, and outcomes of lesions detected during surveillance colonoscopy. Colonoscopies were classified into six periods according to the time after surgery: 6–18, 19–30, 31–42, 43–54, 55–66, or ≥67 months.

Preoperative examination

Full colonoscopy was performed in all patients prior to surgery, either at our institution or the referring institution. Neoplastic lesions, other than the main lesion, measuring >10 mm in diameter were resected endoscopically and examined to confirm that there was no invasive tumor. If it was difficult to perform, full colonoscopy due to poor bowel preparation or severe stenosis, barium enema, or CT colonography was performed instead of full colonoscopy. The timing of the first surveillance colonoscopy in patients who did not undergo full preoperative colonoscopy was decided by the attending physician.

Table 1 Background characteristics of patients

	Surveillance colonoscopy+ (n=459)	Surveillance colonoscopy− (n=212)	P value
Age (years)	62±11	62±12	
Gender (male/female)	268/191	119/93	0.582
Location (%)			0.371
Colon	310 (68)	139 (66)	
Rectum	149 (32)	73 (34)	
Dukes (%)			0.873
A, B	285 (62)	133 (63)	
C	174 (38)	79 (37)	
Full colonoscopy (%)			0.260
Yes	335 (73)	146 (69)	
No	49 (11)	32 (15)	
Unknown	75 (16)	34 (16)	
Observation period (months)	60 (12–85)	–	

Data are presented as the mean ± standard deviation, n (%), or median (range)

Results

Timing of surveillance colonoscopies

Figure 1 shows the timing of colonoscopies. Most patients (73 %) underwent their first surveillance colonoscopy at 6–18 months after surgery, and among these, the most common time period for the second surveillance colonoscopy was 55–66 months after surgery (31 % of all patients). Twenty-one percent of all patients underwent their first surveillance colonoscopy at 6–18 months after surgery and then continued radiographic and carcinoembryonic antigen surveillance without further colonoscopy.

Prevalence of postoperative lesions

Postoperative lesions detected during surveillance colonoscopy included advanced adenomas and invasive cancers, including luminal recurrences. Postoperative lesions were detected in 8.5 % of patients (95 % confidence interval, 6.1–11.4 %). The three cases (0.7 %) of luminal recurrence were all detected during the first surveillance colonoscopy, which was >1 year after surgery. Of these, the initial lesion was located in the rectum in one patient and in the colon in the other two patients. These three patients all underwent additional surgery, and were alive at 5 years after their second operation. Six invasive metachronous lesions (1.3 %) were detected. One metachronous lesion was detected during the first surveillance colonoscopy at 6–18 months after surgery, and the others were detected at 31–66 months after surgery. Curative resection was achieved by endoscopic submucosal dissection or surgery in all cases. Details of the patients with metachronous lesions are shown in Table 2. Thirty advanced adenomas were detected at various follow-up times, all of which were treated by endoscopic mucosal resection. Kaplan–Meier cumulative incidence curves for luminal recurrence, metachronous invasive cancer, and metachronous advanced adenoma are shown in Fig. 2.

Discussion

Our results show that most patients followed up at our institution did not undergo a less intensive surveillance colonoscopy program than the generally recommended guidelines. However, the incidence of postoperative lesions was low. We therefore considered the possibility of prolonging the intervals of surveillance colonoscopies.

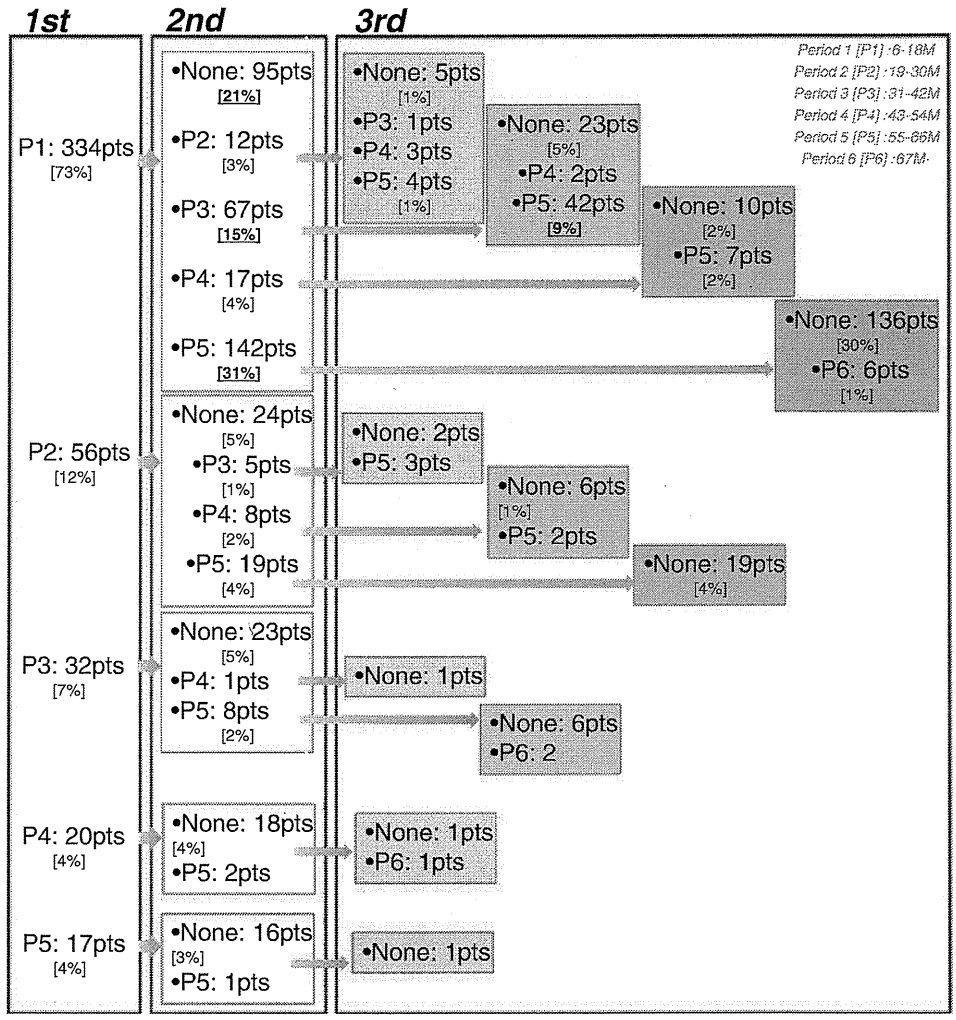

Fig. 1 Details of surveillance colonoscopy intervals

The overall local luminal recurrence rate in this study was <1 %, and recurrent lesions were all detected at >1 year after surgery. The Japanese guidelines for the treatment of colorectal cancer report a local luminal recurrence rate of 0.4 % [9]. These rates are consistent with previously reported rates. Even though the recurrence

Table 2 Clinicopathological characteristics of patients with metachronous invasive cancer

Patient		Primary lesion		Secondary lesion			
Age (years)	Gender	Site	Full CS	Site	Surveillance CS (months)	Clinical diagnosis	Treatment
64	M	S	Yes	C	55	Metachronous	ESD, surgery
70	M	S	No	A	57	Metachronous	ESD
75	F	T	No	A	45	Metachronous	Surgery
67	F	RS	–	Rb	18	Metachronous	Surgery
73	M	T	Yes	–	12	Local recurrence	Surgery
49	M	Rb	Yes	–	13	Local recurrence	Surgery
58	M	D	–	–	12	Local recurrence	Surgery
66	M	S	Yes	A	11, 37	Metachronous	Surgery
72	M	A	Yes	D	29, 41	Metachronous	Surgery

CS colonoscopy, *ESD* endoscopic submucosal dissection

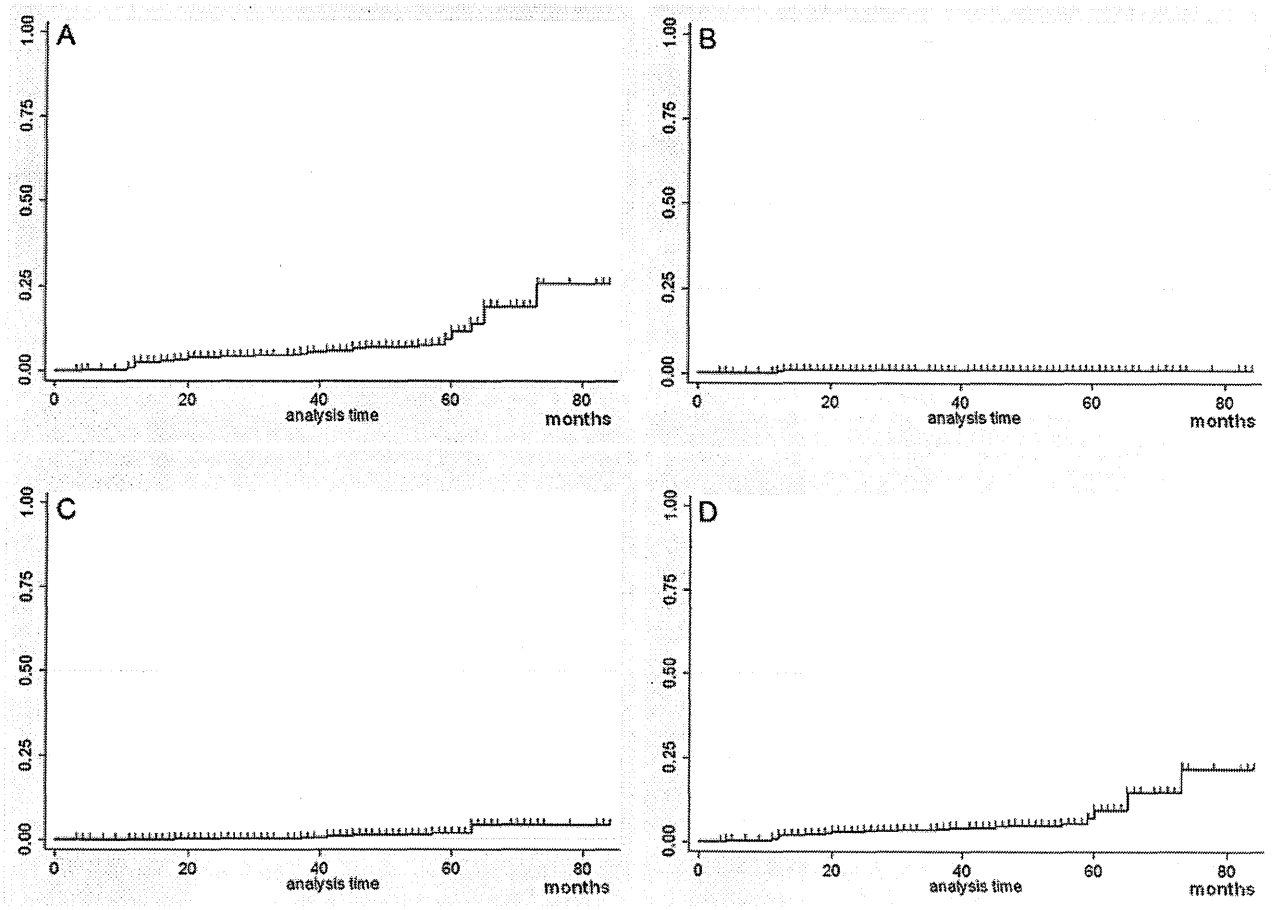

Fig. 2 Kaplan–Meier cumulative incidence curves for postoperative lesions. **a** All postoperative lesions. **b** Local luminal recurrence. **c** Metachronous invasive cancer. **d** advanced adenoma

rate is relatively low, it is important to undertake surveillance for local luminal recurrence at the anastomosis, as such recurrence may affect the patient's prognosis and the invasiveness of ongoing treatment. Surveillance colonoscopy during the first year is therefore considered to be essential.

The metachronous lesion rate (invasive and advanced adenoma) was 8 %, which was more frequent than the rate of local luminal recurrence. Detection of metachronous lesions can therefore be considered to be one of the main purposes of surveillance colonoscopy.

Previous studies have reported an improved survival rate in patients with colorectal cancer who undergo colonoscopic surveillance [10–13]. It is widely accepted that most colorectal cancers arise from an adenoma-carcinoma sequence, and screening colonoscopy is recommended for the early detection and removal of polyps. In this study, surveillance colonoscopy detected advanced adenomas in 5.4 % of patients. Invasive metachronous carcinomas were detected in 1.3 % of patients at 3–5 years after surgery. Two of the six cases of invasive cancer were detected during the second surveillance colonoscopy. One of these two invasive carcinomas was located in the descending colon near the splenic flexure and the other was in the ascending colon. These carcinomas may have been missed during the first surveillance colonoscopy. It has been reported that flat and depressed-type lesions have a relatively high malignant potential [14–18]. These types of lesions are considered difficult to detect by conventional colonoscopy with poor bowel preparation. Moreover, it may be more difficult to detect these lesions in regions of the colon which are curved and have blind areas. If precancerous lesions are detected at the preoperative or first surveillance colonoscopy, they can be treated endoscopically, and a second operation can be avoided. As some metachronous cancers were detected at 4–5 years after surgery, a second surveillance colonoscopy should be planned at 3–4 years after surgery.

Considering the timing of postoperative lesion detection, surveillance colonoscopy during the first 5 years after surgery may be sufficient for the early detection of metachronous lesions. Reducing the number of colonoscopies may

contribute to patient compliance and reduce medical costs. However, quality control of colonoscopies is essential. As discussed above, it is difficult to detect flat and depressed-type lesions with poor bowel preparation, and some lesions may be overlooked. The quality of the preoperative and first surveillance colonoscopies is therefore crucial [19, 20]. If full preoperative colonoscopy is difficult, postoperative colonoscopy should be undertaken within 1 year to detect and resect any lesions that may have been overlooked.

This study has some limitations. First, this was a single-center study, and the quality of colonoscopy and surgery may differ between institutions. A multicenter trial should therefore be conducted to further evaluate the incidence of local recurrence and metachronous lesions. Second, this study was retrospective. Some patients who underwent surgery at our institution were excluded because they were followed up at a different institution due to of their location and age. A prospective study with well-defined inclusion criteria should be undertaken to evaluate the results of colonoscopy after surgery. Third, we were unable to determine the optimal surveillance colonoscopy intervals from the results of this study and were only able to suggest that longer intervals might be appropriate. To evaluate surveillance colonoscopy intervals, the results of the current colonoscopy guidelines should be evaluated by a multicenter retrospective study, and patients who undergo colonoscopy earlier should be compared with those undergoing colonoscopy at the usual times. Fourth, this study could not evaluate the survival rate after surgery. Considering that the aim of postoperative surveillance is to improve the survival rate, this should be further investigated.

In conclusion, we emphasize that reducing the frequency of colonoscopic surveillance may be safe, even in patients who are classified as at high risk for colorectal cancer. We plan to conduct further clinical trials to evaluate this concept.

Conflict of interest The authors have no financial or other conflicts of interest to declare.

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LETTERS, TECHNIQUES AND IMAGES

Impact of endoscopic submucosal dissection knife on risk of perforation with an animal model-monopolar needle knife and with a bipolar needle knife

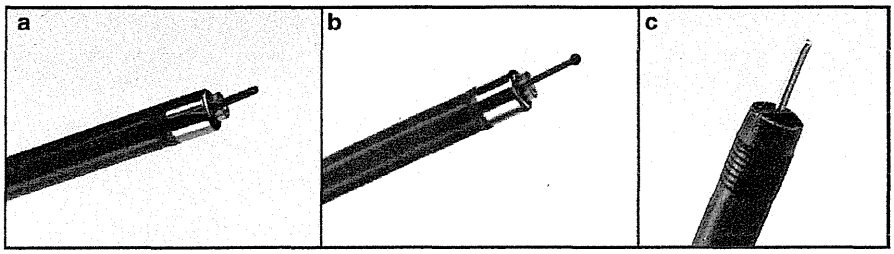

Fig. 1. (a) Bipolar needle knife (B knife). (b) Ball-tip B knife (BB knife). (c) Monopolar needle knife.

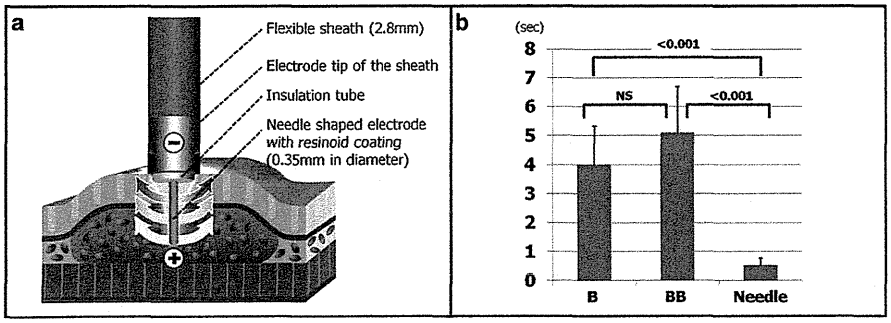

Fig. 2. (a) Schematic view showing flow route of high-frequency electric current from knife to sheath tip. (b) Results of bipolar needle knife (B knife), ball-tip B knife (BB knife) and monopolar needle knife showing time to perforation (s) on a resected porcine esophagus. NS, not significant.

The bipolar needle knife (B knife; XEMEX Co, Tokyo, Japan) was developed to reduce the risk of perforation during endoscopic submucosal dissection compared to monopolar instruments (Fig. 1a).[1] It was designed so high-frequency electricity flows from the knife to the sheath tip, reducing the amount of current sent to the muscle layer (Fig. 2a).[2] Subsequently, the ball-tip B knife (BB knife; XEMEX) was designed with a ball-shaped needle end, to further reduce the risk of perforation (Fig 1b). The objective of this animal experiment was to confirm and compare the actual risk of perforation with these different knives.

A resected porcine esophagus was cut open along the long axis to expose the lumen, which was fixed to a tray with stable tension. The end of each endoscopic submucosal dissection knife attached to a stick was designed to perpendicularly contact the mucosa. A 200 g fixed weight attached to the stick created a constant pressure for each application. A 40 W forced coagulation current (ICC200; ERBE, Tübingen, Germany) was applied with a needle knife (Olympus Optical Co., Ltd, Tokyo, Japan) (Fig. 1c), B knife and BB knife, and perforation time was measured. This procedure was repeated 10 times for each knife.

The time to perforation (mean ± SD) with the needle knife, B knife and BB knife was 0.5 ± 0.2, 4.0 ± 1.3 and 5.1 ± 1.6 s, respectively (needle *vs* B, $P < 0.001$; B *vs* BB, not significant; needle *vs* BB, $P < 0.001$) (Fig. 2b). The B and BB knives had significantly longer times to perforation than the needle knife.

Bipolar instruments are considered safer because of their perceived reduced risk of perforation, particularly the BB knife with its ball-tipped design. Our study reaffirmed that bipolar knives are better for performing endoscopic submucosal dissection of the esophagus and colorectum, which have thinner walls than the stomach.

Satoru Nonaka, Yutaka Saito, Shusei Fukunaga, Taku Sakamoto, Takeshi Nakajima and Takahisa Matsuda
Endoscopy Division, National Cancer Center Hospital, Tokyo, Japan

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Knowledge of, attitudes toward, and barriers to participation of colorectal cancer screening tests in the Asia-Pacific region: a multicenter study

Jenn Hian Koo, FRACP,[1] Rupert W.L. Leong, MD,[1] Jessica Ching, MPH,[2] Khay-Guan Yeoh, MBBS, MMed,[3] Deng-Chyang Wu, MD, PhD,[4] Abdullah Murdani, MD,[5] Quancai Cai, MD,[6] Han-Mo Chiu, MD, PhD, MD, PhD,[7] Vui Heng Chong, FRCP, FAMS, MD,[8] Rungsun Rerknimitr, MD,[9] Khean-Lee Goh, MD, PhD,[10] Ida Hilmi, MBBS, MRCP,[10] Jeong-Sik Byeon, MD, Ph,[11] Saad K. Niaz, MRCP, FRCP,[12] Arif Siddique, MRCP,[12] Kai Chun Wu, MD,[13] Takahisa Matsuda, MD, PhD,[14] Govind Makharia, MD, DM, DNB,[15] Jose Sollano, MD,[16] Sang-Kil Lee, MD,[17] Joseph J.Y. Sung, MD, PhD,[2] for the Asia Pacific Working Group in Colorectal Cancer

Sydney, New South Wales, Australia, Hong Kong (SAR), People's Republic of China, Singapore, Kaohsiung, Taipei, Taiwan, Indonesia, Shanghai, Xi'an, People's Republic of China, Bandar Seri Begawan, Brunei, Bangkok, Thailand, Kuala Lumpur, Malaysia, Seoul, Korea, Karachi, Pakistan, Tokyo, Japan, Delhi, India, Manila, Philippines

Background: The rapid increase in the incidence of colorectal cancer (CRC) in the Asia-Pacific region in the past decade has resulted in recommendations to implement mass CRC screening programs. However, the knowledge of screening and population screening behaviors between countries is largely lacking.

Objective: This multicenter, international study investigated the association of screening test participation with knowledge of, attitudes toward, and barriers to CRC and screening tests in different cultural and sociopolitical contexts.

Methods: Person-to-person interviews by using a standardized survey instrument were conducted with subjects from 14 Asia-Pacific countries/regions to assess the prevailing screening participation rates, knowledge of and attitudes toward and barriers to CRC and screening tests, intent to participate, and cues to action. Independent predictors of the primary endpoint, screening participation was determined from subanalyses performed for high-, medium-, and low-participation countries.

Results: A total of 7915 subjects (49% male, 37.8% aged 50 years and older) were recruited. Of the respondents aged 50 years and older, 809 (27%) had undergone previous CRC testing; the Philippines (69%), Australia (48%), and Japan (38%) had the highest participation rates, whereas India (1.5%), Malaysia (3%), Indonesia (3%), Pakistan (7.5%), and Brunei (13.7%) had the lowest rates. Physician recommendation and knowledge of screening tests were significant predictors of CRC test uptake. In countries with low-test participation, lower perceived access barriers and higher perceived severity were independent predictors of participation. Respondents from low-participation countries had the least knowledge of symptoms, risk factors, and tests and reported the lowest physician recommendation rates. "Intent to undergo screening" and "perceived need for screening" was positively correlated in most countries; however, this was offset by financial and access barriers.

Limitations: Ethnic heterogeneity may exist in each country that was not addressed. In addition, the participation tests and physician recommendation recalls were self-reported.

Conclusions: In the Asia-Pacific region, considerable differences were evident in the participation of CRC tests, physician recommendations, and knowledge of, attitudes toward, and barriers to CRC screening. Physician recommendation was the uniform predictor of screening behavior in all countries. Before implementing mass screening programs, improving awareness of CRC and promoting the physicians' role are necessary to increase the screening participation rates. (Gastrointest Endosc 2012;76:126-35.)

Abbreviations: CRC, colorectal cancer; FOBT, fecal occult blood test.

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Current affiliations: Faculty of Medicine (1), The University of New South Wales, Sydney, New South Wales, Australia, Department of Medicine and Therapeutics (2), The Chinese University of Hong Kong, Hong Kong (SAR), People's Republic of China, Department of Medicine (3), National University

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The past decades have seen a rapid increase in the incidence of colorectal cancer (CRC) in usually low-risk Asia-Pacific populations, with industrialized countries and regions such as Japan, China, Hong Kong, Taiwan, Korea, and Singapore reaching incidence rates comparable to those of Western nations.[1-3] This increase in incidence has been largely attributed to environmental factors including the adoption of the Western lifestyle.[1]

Population screening with fecal occult blood test (FOBT) significantly reduces CRC mortality.[4,5] Despite this, the participation rates of at-risk populations in Western and Asian countries remain low.[6-9] CRC screening is a challenging process and requires all of its components to function correctly for it to be successful. Barriers to successful CRC screening include lack of patient awareness, attitudes and acceptance, physicians' knowledge, attitudes and recommendations, multiple screening modalities with their intrinsic benefits, limitations and risks, logistic and financial considerations, timely diagnosis, and appropriate follow-up. Successful screening also requires moderate patient effort, sustained participation, and specialized health care providers with skills in colonoscopy.[10]

The Asia-Pacific Working Group in Colorectal Cancer was established in 2004 to study the epidemiology of CRC and the appropriateness and feasibility of implementing population-based CRC screening programs in the Asia-Pacific region. It recently reported consensus guidelines on screening and recommended FOBT, flexible sigmoidoscopy, and colonoscopy as suitable screening modalities in Asia, with FOBT as the preferred test in resource-limited countries.[11] Subsequent studies revealed comparable incidences of advanced CRC in Asian and Western nations, supporting the benefits of screening.[12,13] However, screening behavior in the Asia-Pacific region remains largely unknown. This comparative study involved 14 Asia-Pacific countries and used a validated structured survey based on the Health Belief Model.[14] The study investigates the prevailing participation of CRC tests, knowledge of and attitudes toward CRC and screening tests, and barriers to screening and examines possible interventional strategies to facilitate screening participation in different cultural and sociopolitical contexts. Interventional measures, including culturally and linguistically appropriate educational programs may be developed to improve the overall uptake rates of CRC tests in the Asia-Pacific region.

Take-home Message

- Considerable deficiencies existed in colorectal cancer (CRC) knowledge, attitudes, and physician recommendations, leading to poor uptake of CRC tests in the Asia-Pacific region.
- Improving awareness of CRC through mass education and increasing physicians' promotion of CRC screening are strongly recommended.

METHODS

Subjects

This multicenter, international study involved 14 countries/regions in the Asia-Pacific area: Hong Kong, Australia, Brunei, China, India, Indonesia, Japan, Korea, Malaysia, Pakistan, Philippines, Singapore, Taiwan, and Thailand. Over a 4-month period in 2007, trained researchers performed person-to-person interviews in native languages with patients and visitors of ages 30 to 65 years who were randomly recruited from outpatient clinics at the investigators' respective hospitals. To reduce selection bias, patients attending gastroenterology or related clinics (eg, inflammatory bowel disease and hepatology clinics) were excluded from the study. Participation was voluntary, and informed consent was obtained from all participants. Ethics approval was obtained from the individual centers for the collection and reporting of these data.

Questionnaire

A simplified version of questionnaire items used in a telephone survey by Hong Kong researchers in 2006 was used as measurement instruments, and the details of the questionnaire are described elsewhere.[14] In multilingual countries, the questionnaire was translated into the native languages and back-translated to ensure accuracy. The study questionnaire included measurements of key elements that were essential components of the Health Belief Model, including (1) knowledge of the CRC symptoms and risk factors, (2) knowledge of the types of CRC screening tests, (3) perceived risk of CRC, (4) risk factors for CRC, (5) previous CRC test participation and clinical indications, (6) perceived benefits of screening, (7) intent to undergo CRC screening, (8) major barriers to CRC screening, (9) perceived severity of CRC, (10) access to health care, (11) cues to action, and (12) sociodemographic information including sex, age, education, marital status, employment status, and personal and household income. To assess respondents' knowledge of CRC symptoms, risk factors, and screening tests, respondents were asked "what are the symptoms of bowel cancer" and "what are the risks of bowel cancer" and whether they had heard of each screening test (FOBT, colonoscopy, flexible sigmoidoscopy, and virtual colonoscopy). A standardized lay description of each test was presented to ensure correct comprehension and representation. Interviewers scored correct answers on a list undisclosed to the respondents.

The assessment of perception of CRC severity and the negative consequences of screening tests consisted of 9 questions and used a 5-point Likert scale. Respondents indicated the extent to which they agreed or disagreed with each item. Each response category ranged from

TABLE 1. Demographic characteristics

Characteristic	Total (N = 7915)	Australia (n = 500)	Brunei (n = 502)	China (n = 1078)	Philippines (n = 343)	Hong Kong (n = 502)	India (n = 340)
Sex, %							
Male	51.7	42.4	58.6	50.0*	53.6	45.2	87.4
Female	48.3	57.6	41.4	50	46.4	54.8	12.6
Age, ≥50 y, %	37.8	62.2	32.1	25.5	27.1	57.6	19.1
Education level, %							
Primary or no schooling	18.0	4.4	12.7	13.2	15.7	32.7	44.4
Secondary	39.0	72.2	57.6	46.8	21.9	53.4	21.2
Tertiary	43.0	23.4	29.7	40.0	62.4	13.9	34.4
Monthly household income, US$, %							
≤1000	48.0	38.4	47.1	87.8	90.7	21.0	88.9
1000-5000	40.9	48.2	45.7	10.8	8.3	66.8	2.0
≥5000	11.1	13.4	7.2	1.4	1.0	12.2	9.1
Network member had colorectal cancer, %	25.1	41.8	33.7	19.7	39.1	28.7	6.2
Health insurance, yes, %	44.5	29.4	5.8	42.4	23.9	23.5	9.7

Cont. on next page

*n = 648 available for analysis of sex.
†n = 27 available for analysis of monthly household income.

strongly agree, agree, unsure, disagree, and strongly disagree and was scored from 0 to 4. Scores were summed; higher scores indicated greater negative perception. Similarly, for perceived financial barrier, time constraints, and access barrier to testing, respondents were also asked the extent to which they agreed with these items, which were scored from 0 to 4.

To evaluate perceived susceptibility, respondents were asked whether they had any CRC risk factors. Each reported risk scored 1 point, and the total was classified as perceived risk score. A question examining the need for regular screening in an asymptomatic person aged 50 years and older was posed to determine whether respondents appreciated the rationale for screening. The responses "great need," "some need," "not sure," "little need," and "no need" were scored from 4 to 0 and categorized as the perceived testing need score.

To assess health behaviors, respondents were asked whether they had undergone previous CRC tests and if so, the type and indications for them. The indication was classified as symptomatic or asymptomatic. Intention to undergo screening was assessed with the question "Will you have a bowel cancer screening test?" The responses were "definitely yes," "yes," "no," and "definitely not." To evaluate cues to action, respondents were asked whether they had received physician recommendations to have tests, whether they recalled reading or hearing CRC information in the media, and whether they were familiar with patients with CRC.

Statistical analysis

Associations between categorical variables and outcomes were assessed by using the χ^2 test. Continuous variables were compared by using nonparametric methods. The Australian cohort was considered the reference country with which comparisons of categorical and continuous variables for each country were made. This was because CRC screening has been an accepted test in this country, where there was a high level of knowledge and acceptance.[15,16] The Kruskal-Wallis test was first used to compare 14 countries simultaneously followed by the Mann-Whitney *U* test for pairwise comparisons. Results are shown with Bonferroni adjustment for multiple comparisons. Because Kruskal-Wallis tests revealed a significant effect for all factors ($P < .001$), post hoc tests by using the Mann-Whitney *U* test with Bonferroni correction were conducted. To assess for independent predictors of CRC test uptake, a 4-level hierarchical logistic regression to variable selection was used. The first level included sociodemographic variables, the second level included knowledge factors, the third level included perception factors, and the fourth level included cues to action. At

TABLE 1. (*Continued*)

Indonesia (n = 611)	Japan (n = 388)	Korea (n = 767)	Malaysia (n = 501)	Pakistan (n = 490)	Singapore (n = 906)	Taiwan (n = 535)	Thailand (n = 452)
53.2	56.3	43.7	49.3	64.3	54.9	43.0	36.7
46.8	43.7	56.3	50.7	35.7	45.1	57.0	63.3
33.2	80.7	52.0	19.8	19.0	48.1	16.8	35.8
33.1	2.3	8.7	11.6	31.2	17.0	7.9	19.9
31.1	84.1	45.9	37.9	21.2	40.2	14.0	17.3
35.8	13.6	45.4	50.5	47.6	42.8	78.1	62.8
37.9	0.0	14.3	72.2	96.6	21.4	16.6	49.9
53.3	51.9	70.9	26.5	2.6	44.7	73.7	44.2
8.8	48.1†	14.8	1.3	0.8	33.0	9.7	5.9
17.2	9.0	33.8	15.2	19.4	22.6	25.4	27.7
57.1	47.6	73.3	61.7	26.9	50.3	64.5	70.8

each level, all variables were included, and those with a P value ≤.1 were retained and adjusted for the next level by using backward stepwise regression. In the final model, the variables were considered significant if $P < .05$ after adjusting for variables at the same level and higher. SPSS for Windows, version 17 (SPSS Inc, Chicago, Ill) was used to analyze the data.

RESULTS

Demography

During the study period, 8755 eligible subjects were invited to participate in the survey, and 7915 (90.4%) completed the survey (49% male subjects, 435 subjects [40%] missing sex data from China cohort; 37.8% of subjects were 50 years and older). The demographic characteristics are depicted in Table 1. At the time of the study, Japan, Korea, and Taiwan had population-based screening programs using FOBT.

Knowledge of CRC symptoms, risk factors, and screening tests

Considerable differences were evident in the knowledge of CRC symptoms, risk factors, and tests according to country of residence (Table 2). The most commonly recalled CRC symptoms were blood in the stool (45.1%), abdominal pain (30.5%), and diarrhea or constipation (27.8%), whereas 30% were unable to recall any symptom. The most frequently identified risk factors were consuming too much fried food (27.3%), inadequate consumption of fruits and vegetables (25.1%), and family history of CRC (23.8%), whereas 29% were unaware of any risk factor. Only 15% of all respondents and 16% of those older than 50 years of age recognized age as a risk factor. The median knowledge scores for symptom, risk factor, and tests were very low in India, Brunei, Malaysia, and Singapore; more than half of the respondents from these countries could not recall a symptom or risk factor. In contrast, respondents from the Philippines and Japan had the highest knowledge scores, with more than 90% recalling at least 1 CRC symptom and risk factor. Respondents from Thailand and Pakistan had high levels of knowledge of symptoms and risk factors, but not of tests.

Perception of CRC and screening tests

Overall, 18.4% reported having risk factors for CRC. The perception scores of respondents from each country were compared with Australia and depicted in Table 3. Respondents from Korea, China, and Taiwan had the lowest median perceived risk scores. Those from Brunei, Korea, and Taiwan had the highest perceived cancer severity scores, whereas Malaysian and Japanese respondents had lowest perceived cancer severity scores. Japan had the lowest perceived negative health consequences of testing. Respondents from Malaysia and Pakistan had the lowest scores for perceived need for testing when asymptomatic and the highest time constraints and access barriers.

TABLE 2. Knowledge of CRC and screening tests

Factor	Australia	Brunei	China	Philippines	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Pakistan	Singapore	Taiwan	Thailand
Did not know any symptom, %	31.2	45.6*	22.6*	2.0*	14.5*	61.5*	41.1†	0.3*	41.1*	50.1*	15.9*	54.4*	12.0*	3.1*
Did not know any risk factor, %	34.8	40.6	17.5*	1.2*	13.1*	71.5*	21.1*	7.2*	51.5*	58.3*	20.4*	54.0*	8.4*	1.3*
Did not know any CRC test, %	12.8	52.4*	35.8*	12.2	22.3*	87.1*	58.3*	2.4†	9.6	80.0*	58.4*	39.3*	18.9†	53.3*
Median symptom knowledge score, 0-9	2.0	1.0‡	2.0‡	4.0‡	2.0	0.00‡	1.0‡	2.0‡	1.0‡	0.0‡	3.0‡	0.00‡	3.0‡	3.0‡
Median risk factor knowledge score, 0-9	1.0	0.00‡	2.0‡	4.0‡	1.0‡	0.00‡	0.00	4.0‡	0.00‡	0.00‡	2.0‡	0.00‡	2.0‡	3.0‡
Median test knowledge score, 0-5	2.0	0.00‡	1.0‡	2.0‡	1.0‡	0.00‡	0.00‡	2.0‡	1.0§	0.00‡	0.00‡	1.0‡	2.0§	0.00‡

CRC, Colorectal cancer.
*$P < .001$ compared with Australia with χ^2 2 × 2 test ($df = 1$).
†$P < .05$ compared with Australia with χ^2 2 × 2 test ($df = 1$).
‡$P < .001$ compared with Australia with Mann-Whitney *U* test.
§$P < .05$ compared with Australia with Mann-Whitney *U* test.

TABLE 3. Perception and attitudes toward CRC and screening

Median (scores range)	Australia	Brunei	China	Philippines	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Pakistan	Singapore	Taiwan	Thailand
Median perceived risk score, 0-2	1.0	1.0*	0.00*	1.0*	0.00†	1.0*	0.00	1.0	0.00*	1.0	0.00	1.0	0.00	2.0*
Median perceived cancer severity score, 0-20‡	13.0	17.0*	13.0	15.0*	14.0	15.0*	14.0†	9.0*	15.0*	7.0*	14.0	14.0*	15.0*	14.0*
Median perceived testing need score, 0-4§	3.0	3.0*	3.0*	3.0	4.0*	2.0*	3.0*	3.0*	3.0	1.0*	1.0*	3.0	3.0*	4.0*
Median score of perceived negative health consequence of testing, 0-16‡	6.0	8.0*	9.0*	12.0*	7.0*	10.0*	8.0*	4.0	9.0*	9.0*	12.0*	6.0	10.0*	8.0*
Median score of perceived financial burden of testing, 0-4‡	2.0	3.0*	2.0	3.0*	3.0*	1.0*	3.0*	1.0*	2.0*	2.0*	3.0*	2.0*	1.0*	2.0†
Median score of perceived time constraint of test, 0-4‡	1.0	1.0*	2.0*	3.0*	1.0	1.0*	1.0*	3.0*	1.0*	3.0*	3.0*	1.0*	2.0*	1.0*
Median score of perceived access barrier to testing, 0-4‡	1.0	1.0*	2.0*	3.0*	3.0*	3.0*	3.0*	1.0	1.0*	3.0*	3.0*	1.0*	1.0*	2.0*

CRC, Colorectal cancer.
*$P < .001$ compared with Australia by using Mann-Whitney *U* test.
†$P < .05$ compared with Australia by using Mann-Whitney *U* test.
‡Higher values = greater negative perception.
§Higher values = greater perceived need.

Participation in investigations for CRC

A total of 1422 (18%) of respondents had undergone previous CRC testing (FOBT, 30.4%; colonoscopy, 61.8%; flexible sigmoidoscopy, 7.7%; CT colonography, 3.2%; and other, 17%). Of these respondents, 384 (27%) were symptomatic at the time of testing, which included rectal bleeding (35%), change in bowel habits (25%), abdominal pain or distention (20%), and anemia and weight loss (4%). Of

the asymptomatic respondents (n = 1038), 33% had undergone FOBT, 53% colonoscopy, and 9.7% flexible sigmoidoscopy. Only 31% of respondents reported undergoing testing on a regular basis.

Respondents aged 50 years and older (n = 2990)

Knowledge of CRC symptoms, risk factors, and screening tests. Respondents aged 50 years and older from Hong Kong, Indonesia, Korea, and Taiwan had poorer knowledge of symptoms and risk factors, and, to a lesser extent, screening tests compared with younger respondents (Table 4). There were no significant differences comparing both age groups in the other countries.

Participation in CRC screenings. Of the respondents aged 50 years and older, 809 (27%) had undergone previous CRC screenings, and these varied by country (Table 5). Aside from Japan and the Philippines, all other countries had significantly lower participation rates compared with Australia. Of the respondents who had undergone previous CRC testing, 549 (67.9%) were asymptomatic at the time (FOBT, 38.3%; colonoscopy, 60.1%), and this varied by country (Table 5).

Intention to undergo screening. Most respondents (70.5%) responded positively to undergo future CRC tests (responded "definitely yes" and "yes"), comparable to Australia; however, respondents from India and Malaysia had significantly more negative responses (Table 5).

Physician recommendation for CRC tests. Only 20.4% received physician recommendations to undergo CRC testing. Significantly lower rates were reported by respondents from Malaysia (1%), India (1.5%), and Brunei (3.7%) compared with the Philippines (53.8%), Australia, and Japan (both 41%) (Table 5). Despite having population-screening programs, only 12.3% and 18.9% of respondents from Korea and Taiwan, respectively, had received physician recommendations.

Predictors of uptake in investigations for CRC. To assess for predictors of uptake in CRC tests, countries were categorized into 3 groups according to their participation rates: countries with low participation (<10% participation: Brunei, India, Indonesia, Malaysia, and Pakistan), medium participation (10%-30%: China, Hong Kong, Korea, Singapore, Taiwan, and Thailand), and high participation (>30% participation: Australia, Japan, and the Philippines). Using sequential multivariate modeling with logistic regression, independent predictors of each group are depicted in Table 6. Physician recommendation and knowledge of CRC tests were the most important predictors of screening participation in all groups. In countries with low participation, lower perceived access barriers (total score of financial burden of testing, time constraints, and access to tests), and higher perceived severity were independent predictors of participation. In countries with medium participation rate, having health insurance, lower

TABLE 4. Knowledge of CRC and screening tests in 2 age groups

	Age <50 y, %	Age ≥50 y, %	*P* value
Did not know any symptom			
Hong Kong	9.4	18.3	.005
Indonesia	37.5	48.3	.01
Korea	30.4	50.9	<.001
Taiwan	9.0	26.7	<.001
Did not know any risk factor			
Hong Kong	7.5	17.3	.001
Indonesia	18.9	25.6	.05
Korea	41.3	60.9	<.001
Taiwan	4.3	28.9	<.001
Did not know any CRC test			
Hong Kong	15.5	27.3	.002
Indonesia	59.1	56.7	.57
Korea	10.9	8.5	.27
Taiwan	18.7	20.0	.76
Median symptom knowledge score			
Hong Kong	2	2	.01
Indonesia	1	0	.06
Korea	1	0	<.001
Taiwan	3	1.5	<.001
Median risk factor knowledge score			
Hong Kong	1	1	<.001
Indonesia	0	0	.79
Korea	1	0	<.001
Taiwan	3	1	<.001
Median test knowledge score			
Hong Kong	1	1	.01
Indonesia	0	0	.67
Korea	1	1	.36
Taiwan	2	2	.60

CRC, Colorectal cancer.

TABLE 5. Participation of previous screening test, intent to screen, and physician recommendations

	Australia	Brunei	China	Philippines	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Pakistan	Singapore	Taiwan	Thailand
Participation of CRC test, %	38.0	8.8*	17.3*	49.0†	18.9*	7.1*	1.5*	32.4	26.7*	1.2*	4.7*	20.3*	14.2*	18.8*
Uptake of CRC test, age ≥50 y, %	48.2	13.7*	19.6*	68.8*	18.0*	1.5*	3.0*	38.1*	40.1†	3.0*	7.5*	28.7*	30.0*	23.5†
Participation of CRC test, age ≥50 y and asymptomatic, %	40.7	27.3	94.4*	96.9*	53.8	100	66.7	97.0*	64.4*	100	85.7†	61.6†	77.8	73.7*
Screening intent, age ≥50 y: definitely yes or yes, %	83.9	65.8*	72.0*	96.8†	69.2*	27.7*	71.9†	78.3	63.7*	38.4*	63.4*	61.7*	76.7	95.1*
Physician recommendation, age ≥50 y, %	41.2	3.7*	17.1*	53.8†	14.2*	1.5*	9.9*	41.1	12.3*	1.0*	6.5*	14.0*	18.9*	32.7
Network member had colorectal cancer Yes (%)	41.8	33.7†	19.7*	2.52	28.7*	6.2*	17.2*	9.0*	33.8†	15.2*	19.4*	22.6*	25.4*	27.7*
Media exposure to testing: yes, %	57.0	10.8*	27.1*	23.2†	45.8*	5.9*	22.1*	38.6*	73.7*	14.4*	2.4*	34.4*	53.6	52.0

CRC, Colorectal cancer.
*$P < .001$ compared with Australia with χ^2 2 × 2 ($df = 1$).
†$P < .05$ compared with Australia with χ^2 2 × 2 ($df = 1$).

perceived access barrier, media exposure, and known network member were additional positive correlates.

DISCUSSION

The Asia-Pacific Working Group in Colorectal Cancer has recommended FOBT, flexible sigmoidoscopy, and colonoscopy as suitable screening modalities in Asian nations, after an evident increase in CRC incidence in the region.[11] This comparative study revealed considerable differences in the prevailing CRC test participation rates, physician recommendations, knowledge, perception, barriers, and CRC screening intent among the participating nations. Overall, it emphasized the need to develop targeted interventions in each country to address deficient areas to improve the overall uptake of CRC tests.

Physician recommendation was the most important factor associated with the uptake of CRC tests, consistent with multiple previous studies.[14-17] However, only 20% of respondents 50 years and older had received recommendations to undergo testing, and this was particularly a concern in high-incidence countries such as Singapore, Hong Kong, China, and Malaysia. Only 14% of respondents from Singapore had received recommendations and less than one third had participated. The overall knowledge of screening was also low and comparable with a local survey reported several years ago despite the recent increase in the importance of CRC.[18] Similarly, respondents from Malaysia had infrequent physician recommendations, poor knowledge, low perceived testing need, and intent. They also reported the greatest time constraint and access barriers to testing. These factors may explain the high proportion of advanced CRC at diagnosis.[19,20] Taiwan and Korea had population screening programs; however, the test participation and physician recommendations were lower compared with Australia and Japan. This finding again emphasized the importance of physicians to continually promote screening adherence and that the existence of a screening program should not diminish their important roles.

In contrast, the higher test participation rate in Japan and Australia was associated with high physician recommendations, greater knowledge of CRC and tests, and the existence of population screening programs. Notably, respondents from the Philippines had the highest test participation rate, and this was attributed to greater knowledge of respondents and high physician recommendations rates. These encouraging results may also be the results of the Philippine Cancer Control Program, established in 1988 to reduce cancer morbidity and mortality.[21]

Aside from physician recommendation, perceived access barriers to testing was a significant factor associated with participation in low- and medium-uptake countries. In these countries without a screening program, health care is often self-financed; therefore, the cost of having a CRC test is a significant financial barrier, especially in low socioeconomic communities and rural areas.[14] Financial support by health authorities to these disadvantaged groups is strongly recommended. In addition, perceived difficulty in accessing appropriate health services was an important barrier. Improving timely access to and increasing the availability of experts performing colonoscopy and health care infrastructures will be significant challenges. Even in well-resourced countries such as the United Kingdom, the number of colonoscopies and average waiting times increased considerably after the introduction of pop-

TABLE 6. Multivariate analysis with logistic regression of predictors of previous participation of CRC tests (age ≥50 years)

	Low-participation countries*		Medium-participation countries†		High-participation countries‡	
	aOR	95% CI	aOR	95% CI	aOR	95% CI
Sex						
Male					1	
Female					0.98	0.69-1.38
Monthly income, US$						
<500	1					
≥500	2.06	0.58-7.36				
Education						
Less than primary school					1	
Secondary school					0.74	0.36-1.51
Tertiary					0.51	0.22-1.17
Health insurance						
No			1		1	
Yes			1.46§	1.10-1.93	1.28	0.89-1.83
Knowledge of CRC symptoms					0.98	0.86-1.12
Knowledge of CRC risk factors					0.96	0.88-1.04
Knowledge of CRC screening test	3.10¶	2.03-4.74	1.37¶	1.20-1.57	1.60¶	1.25-2.03
Perceived risk/ susceptibility to CRC	0.57	0.29-1.09				
Perceived screening need score	1.41	0.95-2.09	1.11	0.96-1.28	1.27¶	1.09-1.48
Perceived health and psychosocial barrier						
Perceived access barrier to screening test	0.79§	0.64-0.98	0.89¶	0.83-0.94	0.98	0.88-1.10
Perceived severity score	1.35¶	1.13-1.60			1.04	0.99-1.09
Physician recommendation						
No	1		1		1	
Yes	8.36¶	2.96-23.62	3.01¶	2.16-4.18	4.55¶	3.20-6.48
Media exposure			1.64¶	1.22-2.21		
Network member had CRC			1.74¶	1.31-2.31	3.63¶	2.43-5.41

aOR, Adjusted odds ratio; *CI*, confidence interval; *CRC*, colorectal cancer.
*Malaysia, India, Indonesia, Brunei, and Pakistan.
†China, Korea, Taiwan, Hong Kong, Singapore, and Thailand.
‡Japan, Australia, and the Philippines.
§$P < .05$.
¶$P < .01$.

ulation FOBT screening.[22] The consequence of screening programs on resource-limited countries will likely be considerable and may not be cost-effective. In these countries, greater emphasis should be placed on developing educational interventions aimed at addressing modifiable risk factors and increasing opportunistic screening of high-risk individuals. Risk stratification tools such as the Asia-Pacific Colorectal Screening Score may also be used to identify high-risk subjects with advanced neoplasia for colonoscopy screening.[23]

In addition to physician recommendation and access barriers, the low participation of CRC tests in countries such as India, Pakistan, and Indonesia was attributed to low knowledge of tests. This may be an indication of the greater importance placed on communicable and infectious diseases compared with CRC, fewer known affected members, and lower incidence of CRC.[3] In these countries, greater perceived cancer severity was positively associated with test uptake. This was an interesting observation because previous studies had found an inverse association of perceived disease severity and test uptake in some Asian populations, where the anxiety and fear of receiving potentially negative results hindered participation.[14,24] Because this characteristic was not evident in this cohort, implementing mass educational programs to increase the awareness of CRC and screening may be beneficial and unlikely to have negative effects on participation.

The majority of respondents from low- and medium-participation countries aside from India responded positively to future intent. Although this may represent an encouraging result, a study revealed that positive intentions to undergo CRC screening did not automatically translate into actual uptake in Asians.[25] This inconsistency was a recognized occurrence relating to self-efficacy, ambivalence caused by conflicting objectives, and perceived behavioral control. Additional research into this challenging area is recommended. Although these challenges appear substantial, they are not insurmountable, as demonstrated by the increase in CRC screening test participation in Korea as a result of health care policies and pubic awareness campaigns.[26]

The respondents' ages differed considerably among countries and may have led to bias in the results of knowledge of CRC. Because previous studies demonstrated better knowledge in older people, the superior knowledge in countries such as Japan may have been attributable to their higher proportion of older respondents.[27,28] In contrast, respondents aged 50 years and older in this study had poorer knowledge of symptoms and risk factors compared with younger respondents, especially those from Hong Kong, Indonesia, Korea, and Taiwan. This may be attributed to older patients being less aware of this relatively recent disease. Also, younger patients in Hong Kong, Korea, and Taiwan were better educated and reported significantly greater media exposure to CRC. This finding emphasized the importance of intervention targeted at the older age group.

Several limitations are acknowledged. First, ethnic heterogeneity may exist in each country that was not addressed. For instance, ethnic differences in CRC incidence had been reported in Malaysia and Brunei, where Chinese had the highest incidence followed by Malays and Indians.[20,29] In these countries, subanalysis of data according to ethnicity was not possible. Response bias is a recognized limitation of a person-to-person interview, where the pressure to provide a socially acceptable answer may result in an overreporting of positive health behavior and intentions, instead of true intentions, and that stated intentions may not necessarily translate into actual behavior.[23,30] Furthermore, the participation of tests and physician recommendation recalls were self-reported and not verified by medical records; therefore, an element of recall bias may have existed. Because this was a cross-sectional study, reverse causality is possible, and, therefore, the association between predictors and outcomes may not necessarily reflect causality; for instance, greater knowledge of tests independently predicted undergoing them; however, it is possible that having previously undergone testing may have improved knowledge. The data were obtained from a convenience sample of hospital visitors and may not reflect those of the general community. It is possible that hospital-based respondents, especially those attending academic and cancer centers, may be more knowledgeable in medical matters, and the study may overestimate the knowledge level of the community. Also, their test participation may be greater than the community; however, this would likely represent an estimate of maximal test participation in the community. Finally, although attempts were made to ensure consistency in administering the survey among multilingual countries including multiple group discussions on the interpretation and translation of the instrument and training of interviewers, it is acknowledged that language variability could have occurred; however, this was unavoidable because the survey had to be conducted in the primary language to maximize uniformity.

CONCLUSIONS

This study clearly demonstrates considerable deficiencies in CRC knowledge, attitudes, and physician recommendations, leading to low participation of CRC tests in many Asia-Pacific countries. Heterogeneity was noted and accounted for by variable knowledge, attitudes, perceptions, cost of and prioritization of CRC screening within the health care system. Even high-incidence countries such as Japan and Australia did not necessarily have good performance characteristics, and all participating countries, in the end, had aspects of screening that could be improved. To increase CRC screening participation rates, considerable effort must be made to improve the awareness of CRC through mass education and increasing physician involvement in promoting CRC screening, even in countries with existing population screening programs. This study, importantly, provided the comparative background for Asia-Pacific countries to develop and strengthen their CRC screening strategies.

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of Singapore, Singapore, Department of Gastroenterology (4), Kaohsiung Medical University, Kaohsiung, Taiwan, Cipto Mangunkusumo Hospital (5), University of Indonesia, Jakarta, Indonesia, Department of Gastroenterology (6), Shanghai Hospital, Center for Clinical Epidemiology, Second Military Medical University, Shanghai, People's Republic of China, Department of Internal Medicine (7), National Taiwan University Hospital, Taipei, Taiwan, Raja Isteri Pengiran Anak Saleha (RIPAS) Hospital (8), Bandar Seri Begawan, Brunei, Division of Gastroenterology (9), Chulalongkorn University, Bangkok, Thailand, Department of Gastroenterology and Hepatology (10), University of Malaya, Kuala Lumpur, Malaysia, Department of Gastroenterology (11), University of Ulsan, Seoul, Korea, Patel Hospital (12), Karachi, Pakistan, Department of Gastroenterology (13), Xijing Hospital, Fourth Military Medical University, Xi'an, People's Republic of China, Endoscopy Division (14), National Cancer Center Hospital, Tokyo, Japan, Department of Gastroenterology and Human Nutrition (15), All India Institute of Medical Sciences, Delhi, India, Department of Gastroenterology (16), University of Santo Tomas, Manila, Philippines, Department of Gastroenterology (17), Yonsei University, Seoul, Korea.

Reprint requests: Jenn H. Koo, FRACP, Department of Gastroenterology, Liverpool Hospital, Locked Bag 7103, Liverpool BC, NSW 1871, Australia.

If you would like to chat with an author of this article, you may contact Dr Koo at kenjhkoo@yahoo.com.au.