



The current capacity and quality of colonoscopy in Korea

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Background/Aims: Little is known for the capacity and quality of colonoscopy, and adherence to colonoscopy surveillance guidelines in Korea. This study aimed to investigate the present and potential colonoscopic capacity, colonoscopic quality, and adherence to colonoscopy surveillance guidelines in Korea. **Methods:** We surveyed representative endoscopists of 72 endoscopy units from June to August 2015, using a 36-item questionnaire regarding colonoscopic capacity, quality, and adherence to colonoscopy surveillance guidelines of each hospitals. **Results:** Among the 62 respondents who answered the questionnaire, 51 respondents were analyzed after exclusion of 11 incomplete answers. Only 1 of 3 of endoscopy units can afford to perform additional colonoscopies in addition to current practice, and the potential maximum number of colonoscopies per week was only 42. The quality of colonoscopy was variable as reporting of quality indicators of colonoscopy were considerably variable (29.4%–94.1%) between endoscopy units. Furthermore, there are substantial gaps in the adherence to colonoscopy surveillance guidelines, as concordance rate for guideline recommendation was less than 50% in most scenarios. **Conclusions:** The potential capacity and quality of colonoscopy in Korea was suboptimal. Considering suboptimal reporting of colonoscopic quality indicators and low adherence rate for colonoscopy surveillance guidelines, quality improvement of colonoscopy should be underlined in Korea. (**Intest Res 2019;17:119-126**)

Key Words: Colonoscopy; Colorectal neoplasms; Quality; Surveys and questionnaires; Guideline

INTRODUCTION

Colorectal cancer (CRC) is a significant public health problem, as its incidence has been increasing worldwide.^{1,2} As most CRC develops from colorectal adenoma through the adenoma-carcinoma sequence, CRC screening has decreased CRC incidence and mortality through early detection and removal of colorectal adenoma.^{3,4} Several Western countries such as Australia, Germany, Poland, Switzerland, and the United States use colonoscopy as primary CRC screening.⁵ Recently, the adoption of colonoscopy as a pri-

mary CRC screening tool has been argued in Korea.

In Western countries, limited resources for colonoscopy have been an obstacle in expanding CRC screening program.⁶⁻⁸ Until now, little is known for the the present and potential colonoscopic capacity, colonoscopic quality, and adherence to colonoscopy surveillance guideline recommendations in Korea. A better understanding of these information may be the first step towards successful implementation of primary colonoscopy screening as well as identification of deficits in the current colonoscopic resources in Korea. Considering excellent accessibility of colonoscopy, low cost of colonoscopy, and the availability of experienced colonoscopists in Korea, the current Korea's data may be different from those of Western countries.

In this context, we evaluated the present and potential colonoscopic capacity, colonoscopic quality, and adherence to colonoscopy surveillance guideline recommendations in Korea.

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METHODS

1. Study Subjects

This nationwide survey was conducted between June and August 2015. The survey items were designed to investigate the current and potential colonoscopic capacity, colonoscopic quality, and adherence to colonoscopy surveillance guideline recommendations. In this survey, representative endoscopists of 72 hospitals nationwide were selected as potential respondents. Representative endoscopists were directors of endoscopy units or executive members of the Korean Association for the Study of Intestinal Disease (KASID). If the respondents' e-mail addresses were not valid, they were excluded from the study. Respondents who did not complete the questionnaire were also excluded from the analysis. This study was approved by the Institutional Review Board at the Kyung Hee University Hospital at Gangdong (KHNMC IRB 2015-07-003). Informed consent was waived for this survey study.

2. Questionnaire

A 36-item survey was developed based on literature review^{9,10} and semi-structured discussions with academic gastroenterologists and the governing board of KASID. The survey instrument included questions about (1) characterization of respondents and endoscopy units, (2) capacity for colonoscopy in the endoscopy unit, (3) sedation and reprocessing for colonoscopy, and (4) adherence to the colonoscopy surveillance guidelines by the US Multi-Society Task Force (USMSTF).¹¹ We did a pilot test on 4 gastroenterology fellows at the Kyung Hee University Hospital at Gangdong, and answers from this group were used to revise the survey questionnaire. Reported completion times ranged from 15 to 20 minutes. A web link using the host SurveyMonkey (<http://www.surveymonkey.com>) was e-mailed to all potential respondents, and all responses were anonymous. There were no incentives and all respondents voluntarily participated. The survey was designed not to move to the next item if the respondents failed to answer the previous item, in order to increase the completeness of the survey. We sent invitation e-mails to potential respondents once a week for three times. The survey website was closed after 8 weeks.

3. Definition of Terminology Used

The USMSTF guidelines' recommended surveillance interval based on index colonoscopy findings are: 10-year intervals for no polyps or small hyperplastic polyps in the rectum

or sigmoid colon; 5-year intervals for 1 to 2 tubular adenomas <10 mm; and 3-year intervals for high-risk adenomas, defined as adenoma with villous histology, high-grade dysplasia, ≥ 10 mm, or 3 or more adenomas.¹¹ For the self-reported adherence rate to CRC surveillance guideline recommendations, this guideline was used with the assumption that the baseline colonoscopy was complete and adequate and that all visible polyps were completely removed.

Indications for colonoscopy were divided into 3 groups: screening, surveillance, or diagnostic. "Screening colonoscopy" refers to the routine use of the procedure in order to detect a precursor lesion or early CRC in asymptomatic individuals. "Surveillance colonoscopy" refers to planned colonoscopy for patients previously diagnosed with colorectal polyp or CRC. "Diagnostic colonoscopy" is colonoscopy for patients with lower GI symptoms (such as abdominal pain, change in bowel habits, anemia, bleeding, tumor, intestinal obstruction, or weight loss) or a positive test result (such as fecal occult blood test, sigmoidoscopy, or double contrast barium enema).

4. Statistical Analyses

Descriptive statistics were used to summarize socio-demographic characteristics. Categorical data were expressed as number (percentage), whereas continuous data were expressed as mean \pm SD. Statistical analyses were performed using the SPSS version 18.0 for Windows (SPSS Inc., Chicago, IL, USA).

RESULTS

We sent a web link e-mail to 72 representative physicians in hospitals nationwide, and 62 of them answered with a response rate of 86%. Overall, survey results from 51 of the total 62 respondents were analyzed after exclusion of 11 surveys with incomplete answers. The complete overall response rate was 71.0%.

1. Characteristics of Respondents And Endoscopy Units

The respondents included 39 men (76.5%) and 12 women (23.5%), with a mean age of 42.3 \pm 5.0 years (Table 1). All respondents were representative gastroenterologists performing colonoscopy at each endoscopy units. Fellowship period for colonoscopy training was 1.9 \pm 0.8 years, and 88.2% of respondents performed more than 30 colonoscopies per month. The endoscopy units were mostly in tertiary or training hospitals (82.4%) and the median number of examina-

tion rooms in the endoscopy unit was 6. The main specialty of working colonoscopists in each endoscopy units was gastroenterology (66.7%, 95% CI, 60.5%–72.9%).

We also investigated the characteristics of sedation used for colonoscopy. The most commonly used sedative agent was a benzodiazepine alone (51.0%), followed by a combination of benzodiazepine and propofol (45.1%) or other agents (4.0%). During conscious sedation, the staffs who were working in each examination room (62.7% were nursing staff and 29.4% were colonoscopists) directly monitored patients without other assistance. In only 1 endoscopy unit,

an anesthesiologist monitored patients (1%).

2. Colonoscopic Capacity

Table 2 shows the current and potential colonoscopic capacity that could be performed under current existing resources. There was a wide range of difference between each endoscopy unit's capacity. The indications for colonoscopies were composed of screening (32.9%, 95% CI, 26.3%–35.9%), surveillance (33.0%, 95% CI, 28.3%–35.7%) and diagnostic (37.6%, 95% CI, 32.3%–41.5%). Under the present colonoscopic capacity, 84.4% of endoscopy units provided screening or surveillance colonoscopy within 1 month and 95.6% of endoscopy units provided diagnostic colonoscopy within 1 month.

Respondents estimated the potential maximum number of colonoscopies that could be performed at their endoscopy units in addition to those in current practice with the available resources (potential colonoscopic capacity). Only 1 of 3 of endoscopy units were able to perform more colonoscopies, and the potential maximum number of colonoscopies per week was only 42.0 cases (8 cases per working day). Three major limiting factors in the performance of more colonoscopies were insufficient nursing staff, insufficient procedure rooms and recovery areas, and insufficient number of physicians. In a separate survey question about the main strategies that would be considered in order to accommodate an increase in endoscopic demand, respondents were likely to recruit more physician staff (23.5%) or establish more procedure rooms and recovery areas (17.5%). However, 23.5% of respondents answered that they would not consider performing more colonoscopies.

3. Colonoscopy Quality

For quality indicators monitored in daily practice, cecal intubation rate, withdrawal time more than 6 minutes, polyp detection rate (PDR) or adenoma detection rate (ADR), bowel preparation, procedure-related complications and patient compliance were surveyed (Table 3). The most frequently monitored indicator was cecal intubation rate (94.1%), followed by withdrawal time more than 6 minutes (76.5%), procedure-related complications (76.5%), bowel preparation (66.7%), PDR/ADR (56.9%), and patient satisfaction (29.4%). The reporting rate of quality indicators was considerably variable, ranging from 29.4% to 94.1% between endoscopy units. Three main causes of incomplete colonoscopies were poor bowel preparation (86.3%), technical difficulties (9.8%), and patient discomfort or pain (3.9%).

Table 1. Characteristics of Respondents and Endoscopy Units

Characteristic	Data
Respondent	
Age (yr)	42.3±5.0
Male sex	39 (76.5)
Fellowship period for colonoscopy (yr)	1.9±0.8
Working years after fellowship (yr)	7.0 (1–30)
Current colonoscopy volume ≥30 cases/mon	45 (88.2)
Endoscopy units	
Clinical practice site	
Tertiary or training hospital	42 (82.4)
Secondary hospital	5 (9.8)
Military or Veteran's hospital	4 (7.8)
No. of examination rooms	6 (1–20)
Specialty of working colonoscopists, mean % (95% CI)	
Gastroenterology	66.7 (60.5–72.9)
Internal medicine (excluding gastroenterology)	26.7 (21.1–32.3)
Others	6.6 (2.1–11.1)
Sedative colonoscopy	
Sedative agents	
Benzodiazepine alone	26 (51.0)
Combination of benzodiazepine/propofol	23 (45.1)
Propofol alone or etomidate alone	0
Others	2 (4.0)
Monitoring staff during conscious sedation	
Nursing staff	32 (62.7)
Colonoscopists	15 (29.4)
Anesthesiologists	1 (2.0)
Others	3 (5.9)

Values are presented as mean±SD, number (%), or median (range).

Table 2. Current and Potential Colonoscopic Capacity of Endoscopy Units

Endoscopic capacity	Data
Current colonoscopic capacity	
Current colonoscopy volume	
No. of colonoscopies per week	100 (7–600)
No. of colonoscopies per month	400 (25–2,000)
Proportion of colonoscopy by indications, mean % (95% CI) ^a	
Screening colonoscopy	32.9 (26.3–35.9)
Surveillance colonoscopy	33.0 (28.3–35.7)
Diagnostic colonoscopy	37.6 (32.3–41.5)
Endoscopy units with waiting time ≤1 mon ^a	
For screening colonoscopy	38 (84.4)
For surveillance colonoscopy	38 (84.4)
For diagnostic colonoscopy	43 (95.6)
Potential colonoscopic capacity ^b	
Endoscopy units with potential capacity	17 (33.3)
No. of potential capacity per week	42.0±50.5
Three major limiting factors to perform more colonoscopies	
Insufficient nursing staff	17 (33.3)
Insufficient procedure rooms and recovery areas	10 (19.6)
Insufficient physicians	7 (13.7)
Major strategies taken to meet the increased demand	
Increase physician staff	12 (23.5)
Not planning to perform more colonoscopies	12 (23.5)
Establish more procedure rooms and recovery areas	9 (17.5)

Values are median (range), number (%), or mean±SD.

^aSix respondents did not answer this item.

^bPotential colonoscopic capacity means potential maximum number of colonoscopies that could be performed at their endoscopy units in addition to those in current practice with the current available resources.

4. Adherence to Surveillance Guideline

Table 4 shows the self-reported adherence rate for surveillance guideline recommendations.^{11,12} In most scenarios, there is a big gap between respondents' answers and guideline recommendations on surveillance intervals. Concordance rate for guideline recommendation was less than 50% in most scenarios. Most colonoscopists favored shorter sur-

Table 3. Colonoscopy Quality in Endoscopy Units (n=51)

Quality of endoscopy units	Data
Endoscopy units monitoring quality indicators	
Cecal intubation rate	48 (94.1)
Colonoscopy withdrawal time (>6 min)	39 (76.5)
Polyp detection rate or adenoma detection rate	29 (56.9)
Adequate bowel preparation	34 (66.7)
Procedure-related complications (bleeding or perforation)	39 (76.5)
Patient satisfaction	15 (29.4)
Reasons of incomplete colonoscopies	
Poor preparation	44 (86.3)
Technical difficulties	5 (9.8)
Patient pain or discomfort	2 (3.9)

Values are presented as number (%).

veillance interval than recommended surveillance interval from guideline.

5. Attitude and Opinions on the Surveillance Guidelines

Table 5 shows the attitude and opinions on the surveillance guidelines. Only 54.9% of respondents were familiar with "colonoscopy surveillance guidelines." With regard to the attitude toward the guidelines, 23.5% of respondents worried about the risk of a missed CRC from guideline adherence and 43.1% of them were exaggerating the benefit of repeat colonoscopy. Only few colonoscopists were either not familiar with the guidelines or did not know the guidelines well. However, 31.4% of respondents disagree with the guidelines and 41.2% of respondents complained of difficulty to keep guidelines.

DISCUSSION

This is the first study evaluating the colonoscopic capacity, colonoscopic quality, and adherence to colonoscopy surveillance guideline recommendations in Korea. For the potential colonoscopic capacity, only 1 of 3 of endoscopy units can afford to perform additional colonoscopies, and only 8 cases of colonoscopies per working day might be performed in addition to the current practice. Despite recent issues of qualified colonoscopy in Korea, monitoring and reporting of quality indicators of colonoscopy were suboptimal and considerably variable (29.4%–94.1%) between endoscopy units. Furthermore, there are substantial gaps in the adher-

Table 4. Self-Reported Adherence Rate for Guideline Recommendations^a

Scenario	Guideline concordance rate	Favor shorter interval FU	Favor longer interval FU
No. of polyps	6 (11.8)	45 (88.2) ^b	0
Small (<10 mm) hyperplastic polyps in rectum or sigmoid colon	6 (11.8)	45 (88.2) ^b	0
1–2 Small (<10 mm) TAs	27 (52.9)	24 (47.1)	0
3–10 TAs	7 (13.7)	44 (86.3)	0
One or more TAs ≥10 mm	24 (47.1)	27 (52.9)	0
One or more villous adenomas	25 (49.0)	26 (51.0)	0
Adenoma with high-grade dysplasia	19 (37.3)	32 (62.7)	0
SSP(s) <10 mm with no dysplasia	13 (25.5)	37 (72.5)	1 (2)
SSP(s) ≥10 mm	19 (37.3)	32 (62.7)	0
Traditional serrated adenoma	25 (49.0)	25 (49.0)	1 (2)

Values are presented as number (%).

^aGuideline recommendations were based on the 2012 guideline for post-polypectomy surveillance that was updated by the U.S. Multi-Society Task Force on Colorectal Cancer.

^bKorean guidelines¹² recommend 5-year (not 10-year) interval for these scenarios, which may justify a high rate of shorter intervals for these lesions. In addition, Korean guidelines did not mentioned surveillance intervals for >10 adenomas, sessile serrated polyps <10 mm with no dysplasia and traditional serrated adenoma.

FU, follow-up; TA, tubular adenoma; SSP, sessile serrated polyp.

Table 5. Familiarity and Attitude on the Colonoscopy Surveillance Guidelines

Familiarity and attitude	Agreement rate
Familiarity with "colonoscopy surveillance guidelines"	
Very familiar or familiar	5 (9.8)
Unfamiliar or very unfamiliar	33 (54.9)
Attitude for the "colonoscopy surveillance guidelines"	
It is a convenient source of advice.	32 (62.7)
Current research justifies for surveillance intervals.	25 (49.0)
It increases the risk of a missed colorectal cancer.	12 (23.5)
There are benefits of repeat colonoscopy not captured by it.	22 (43.1)
It is likely to be used in physician discipline.	30 (58.8)
Opinion about difference between real practice and guidelines	
Physician does not know guidelines well.	2 (3.9)
Physician is not familiar with guidelines.	5 (9.8)
Physician disagrees with guidelines.	16 (31.4)
Physician has difficulty to keep guidelines.	21 (41.2)
Physician does not have motivation to keep guidelines.	7 (13.7)

Values are presented as number (%).

ence to guideline recommendations for surveillance colonoscopy as concordance rate for guideline recommendation

was less than 50% in most scenarios.

During sedative colonoscopy in Korea, a benzodiazepine is most commonly used under monitoring by the staffs who were working in each examination room. Our finding was contrasted those of European studies,¹³⁻¹⁵ in which propofol were preferred to benzodiazepines. The major concerns regarding the risks of adverse events¹⁶ with propofol use may prohibit its widespread use in Korea. Characteristics of sedation and monitoring during colonoscopy may be influenced by the safety concerns of patients and colonoscopists, reimbursement policies, and the variable health care systems of each country; therefore, further studies to optimize sedation and monitoring for colonoscopy are warranted in each country.

For the potential colonoscopic capacity, we assumed that many endoscopy units can afford to more colonoscopies in addition to current practice. It was surprising that only 1 of 3 of endoscopy units can afford to perform additional colonoscopies in addition to the current practice. Our survey results suggest that the potential colonoscopic capacity may not be able to adequately respond to the increasing demand of colonoscopy in Korea. Even though our survey results are subject to bias associated with self-reported data, it may suggest areas for further investigation as the colonoscopic capacity appropriate to meet the increasing demand of colonoscopy screening in Korea has not been fully established. In the United States, colonoscopic capacity limitation have

been an obstacle in expanding colonoscopic procedures.¹⁷ In the U.S. survey,¹⁸ only 63% of the volume of colonoscopies could be performed with their available resources in 2002. Considering only certain specialists are trained to perform colonoscopy and all positive CRC screening tests are typically followed by a colonoscopy, issues of colonoscopic capacity must be underlined in Korea.

To provide adequate colonoscopy screening, the issue of quality must be addressed. In our study, monitoring and reporting of quality indicators of colonoscopy were suboptimal and considerably variable between endoscopy units. In the United States and Europe, rates of reporting of colonoscopy quality indicators were likewise variable and suboptimal, either.^{19,20} These common findings demonstrate the need for regular and efficient assessment of colonoscopic quality in clinical practice. In our survey, the most frequently monitored indicators are cecal intubation rate, followed by withdrawal time more than 6 minutes, procedure-related complications, bowel preparation, PDR/ADR, and patient satisfaction. Provider-oriented indicators, such as cecal intubation rate or withdrawal time, were relatively well monitored. However, patient-oriented indicators, such as patient satisfaction, was insufficiently monitored. Therefore, implementation of quality reporting in colonoscopy, especially for patient-oriented indicators, should be emphasized.

Our survey results show that there are substantial gaps in the adherence to guideline recommendations for surveillance colonoscopy in Korea, which was consistent with previous studies.^{21,22} In our survey, most of the respondents favored shorter surveillance intervals than guideline recommendations in most scenarios, though overuse of surveillance colonoscopy leads to unnecessary costs and risks associated with unnecessary colonoscopy.²³ Over-recommendation of surveillance colonoscopy may be due to their concern about interval CRCs,^{24,25} lower colonoscopy costs, or lack of confidence in the guidelines.^{9,26,27} In our study, the adherence rate was less for sessile serrated polyps, which were recently included in guideline recommendations. Therefore, efforts to increase the colonoscopist's awareness and knowledge about the guidelines may be necessary. Because the potential barriers to guideline adherence were physician awareness, familiarity, and agreement,²⁸ only 54.9% of familiarity for the guidelines and 68.6% of agreement rate with the guidelines should be improved for optimal guideline adherence. Although 62.7% of respondents thought that a guideline is a convenient source of advice, they had difficulty to keep that guidelines in their clinical practice because of many reasons, including a legal issue.

Our study has several strengths. First, we surveyed the nationwide endoscopy units and the overall response rate was high as 86%. Our high response rate was possible because representative physicians were all members of KASID, and contact information was provided by KASID. Furthermore, survey responses were monitored, and follow-up e-mails were sent weekly to non-participating respondents. Second, our survey results represent the current state of colonoscopies in Korea because respondents were the representative physicians of endoscopy units nationwide. Finally, the questionnaire was developed by academic and community gastroenterologists, and covered the topics of colonoscopic capacity, colonoscopic quality, and guideline adherence. Our study results also need to be interpreted in the context of potential limitations. First, the generalization of this study may be limited due to selection bias because survey respondents were highly experienced gastroenterologists working at hospitals. In addition, the respondents' answers may differ from that of non-respondents. Second, there may be a selection bias as all study respondents were gastroenterologists, however, they surveyed as a representative physician of endoscopy units, including non-gastroenterologists who perform colonoscopy. A larger survey including non-gastroenterologists and variable endoscopy settings may be warranted to overcome these limitations. Third, similar to most survey studies, this survey relied wholly on the knowledge and the answer of the respondents. Fourth, the definition of colonoscopic capacity is relatively subjective and may be compromised with the waiting time, however, we failed to find any objective definition. Finally, the respondents' size was small. However, our respondents were representative physicians and were not selected by random methods. Therefore, our findings could be interpreted as nationwide Korean data, despite a small sample size.

In conclusion, the potential capacity and quality of colonoscopy in Korea was suboptimal. Considering suboptimal reporting of colonoscopic quality indicators and low adherence rate for colonoscopy surveillance guidelines, quality improvement of colonoscopy and a better adherence of colonoscopy surveillance guideline should be underlined in Korea.

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CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

AUTHOR CONTRIBUTION

Choi JH, conceptualization; Choi JH and Cha JM, writing-original draft; Yoon JY, formal analysis and project administration; Kwak MS, Jeon JW, Shin HP, writing-review and editing. All authors approved the final version of the manuscript.

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