Current Problems in Quality Colonoscopy of Korea and Their Solutions

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Introduction

Colonoscopy is accepted as the most effective method of screening the colon for neoplasia in patients over the age of 50 years and in younger patients at increased risk. The effectiveness of colonoscopy in reducing colon cancer incidence depends on adequate visualization of entire colon. To maximize this preventive effect, endoscopists should perform a careful examination to detect more adenomas and remove all cleanly during colonoscopy. Careful examination means a complete colonoscopy with detailed observation based on cecal intubation, longer withdrawal time, adequate preparation and skillful colonoscopy technique. These quality indicators have become a topic of increased interest for the same reason that quality has become important throughout healthcare. Quality indicators for colonoscopy include the adenoma detection rate, adenoma miss rate, cecal intubation rate, bowel preparation, and withdrawal time. By the control of quality indicators of colonoscopy, we can reduce the adenoma miss rate, a main reason for occurrence of interval cancer, and maintain the appropriate surveillance interval after polypectomy.

There are some concerns about the status of colonoscopy quality in Korea. First, there is little evidence and few statistical reports properly reflecting colonoscopy quality. Second, it is not easy to assess the colonoscopy quality of medical institutions which perform colonoscopy, because there are so many institutions performing colonoscopy in Korea with no standard quality guidelines. Although institutions which perform endoscopy with the national cancer surveillance program undergo endoscopic quality rating scale (EQRS) regularly, and the ‘Qualified endoscopy unit accreditation’ program, a kind of endoscopy quality control program led by ‘The gastrointestinal endoscopy research foundation of Korea’ are now available, these have limitations in controlling the quality of all endoscopy performing facilities. In this article, I hope that we have a chance to think about current problems in quality colonoscopy in Korea and how can we rectify them.

Assessment of colonoscopy quality in Korea

Recently, many concerns about colonoscopy quality have been arisen and quite a number of studies have been reported with focus on the colonoscopy quality. However, these studies are still inadequate to understand the totality of colonoscopy quality in Korea, especially the quality of colonoscopy performed in private clinics or primary or secondary hospital. For the evaluation of domestic references for colonoscopy quality in this article, I assessed recent domestic investigations about quality of colonoscopy, such as colonoscopy withdrawal time, bowel preparation and adenoma detection rate. Furthermore, I reviewed the endoscopy quality rating scale (EQRS) of national cancer surveillance program (NCSP) and ‘Qualified endoscopy unit accreditation’ program of ‘The gastrointestinal endoscopy research foundation of Korea’. EQRS is a quality improvement and assessment tool for gastrointestinal endoscopy in Korea by a task force team of NCSP. Because institutions which participate in NCSP are composed of not tertiary academic hospitals but also private clinics and health promotion centers in secondary hospitals, EQRS may give us insight to colonoscopy quality control in primary and secondary clinics.
Missed lesions

Interval cancer results from three primary reasons: lesion missed during colonoscopy, incomplete polypectomy, and rapidly growing lesion after polypectomy. Missing lesions during colonoscopy is the main reason for the interval cancers. Missed lesions may account for 70~80% of interval cancers. The most reliable method for assessing the adenoma miss rate is “tandem” or “back-to-back” colonoscopy, a method in which two same-day colonoscopies are performed in each patient. Several studies have evaluated the adenoma miss rates of colonoscopy by performing ‘back-to-back colonoscopy’. The overall miss rates for adenomas and advanced adenoma ranged from 15~24% and 11% in previous back-to-back colonoscopy studies.

Four prospective controlled back-to-back colonoscopy studies have been reported in Korea. In these studies, the adenoma miss rate ranged from 8.3~33.3%, and lesions over 1 cm size were missed at 0~5.8% (Table 1). One study mentioned advanced adenoma miss rates at 5.4%. These miss rates in Korea were similar to those of foreign studies. However, all reference data were designed prospectively and performed by established endoscopy units, and therefore are not reflective of the total situation around endoscopy.

Table 1. Adenoma Miss Rate from Recent Prospective Tandem Colonoscopy Studies in Korea

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Enrolled number</th>
<th>Adenoma miss rate (%)</th>
<th>&gt;1 cm lesion miss rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong, et al</td>
<td>2012</td>
<td>119</td>
<td>22.9</td>
<td>Not mentioned</td>
</tr>
<tr>
<td>Ahn, et al</td>
<td>2012</td>
<td>149</td>
<td>17</td>
<td>5.8</td>
</tr>
<tr>
<td>Han, et al</td>
<td>2011</td>
<td>62</td>
<td>33.3</td>
<td>1</td>
</tr>
<tr>
<td>Chung, et al</td>
<td>2010</td>
<td>359</td>
<td>8.3</td>
<td>0</td>
</tr>
</tbody>
</table>

Adenoma detection rate (ADR), polyp detection rate (PDR): Can we calculate ADR in real practice?

ADR is an independent predictor of the risk of interval colorectal cancer after screening colonoscopy. In one study with 186 colonoscopists, only 14% of colonoscopists averaged over 20% in adenoma detection and the colonoscopists who detected adenoma at less than 20% had a hazard ratio for interval cancer of about 10 to 12. ‘American Society for Gastrointestinal Endoscopy (ASGE)/American College of Gastroenterology (ACG) Taskforce (TF) on Quality in Endoscopy’ has recommended that adenoma should be detected in ≥25% of men and ≥15% women more than 50 years old among healthy asymptomatic patients undergoing colonoscopy. There are very limited studies about ADR or PDR in Korea. Recently, one multicenter prospective study showed that endoscopy nurse participation may increase the PDR. In this study, ADR and PDR were estimated at 43.2% and 48.2%. Including this study, several domestic study recently showed the ADR ranged as 22.3~48.2% and PDR ranged as 33.2~58%. These proportions were based upon well constructed domestic studies were similar or superior to foreign studies which reported ADR as 25~40%. However, the studies which reflect ADR or PDR in a real clinical practice including primary or secondary hospital were limited and we have no data on the mean range of ADR and PDR of colonoscopy performing facilities. We also do not know the real
differences of ADR and PDR between private clinic or general hospital, between primary clinics or secondary hospitals and tertiary academic hospitals, between colonoscopy specialist and nonprofessional.

**Bowel preparation status**

Preparation status is the most important quality indicator of colonoscopy. Poor preparation prolongs cecal intubation time and withdrawal time and reduces detection of both small and large polyps. Large scaled multicenter European study showed that colonoscopy completion was relatively low in low cleansing quality compared to intermediate to high cleansing quality.\(^\text{18}\) Besides, the lesion miss rate was 1.2 times higher in inadequate preparation status group than adequate preparation.\(^\text{19}\) Consequently, incomplete examination of colonoscopy due to inadequate preparation may contribute to the occurrence of interval cancer arisen from missed lesion during colonoscopy. To assess the preparation state, several preparation scales have been developed and generally have used as preparation status in preparation comparative study.\(^\text{20-22}\) Ottawa scale and Boston bowel preparation scale (BBPS) are validated and useful preparation scales to estimate the preparation status in bowel preparation study, but relatively complex and time consuming.\(^\text{21-22}\) For the convenience of estimation for preparation status, simple independent preparation scales have been used in real clinical practice.\(^\text{2,23}\) Although there is little research of inadequate cleansing in randomized trials, inadequate preparation rates range from 10~23% in recent Western multicenter large scaled studies.\(^\text{18-19}\)

Among quality indicator of colonoscopy, bowel preparation has been of most concern in Korea with many studies about bowel preparation comparison. In recent domestic preparation studies, the proportion of inadequate preparation by standard 4L polyethylene glycol (PEG) ranged from 18.4~38.6%.\(^\text{23-27}\) All of these studies were performed in tertiary academic hospitals in prospective randomized settings. However, the proportion of inadequate preparation was higher than in Western multicenter studies. There can be many reasons for the low proportion of adequate preparation of domestic studies. Probably the diet pattern which most Koreans usually enjoy is a mostly vegetarian diet, and educational methods for colonoscopy preparation are problematic. For example, a domestic comparative study with prokinetics combined with low dose PEG showed a relatively high rate (20.3%) of inadequate preparation compared to foreign studies (6.8%).\(^\text{28-29}\) Bowel movement enhancement by prokinetics is less effective for Koreans because of much fibrous material and feces due to vegetarian diet. In the aspect of preparation education before colonoscopy, education method may be difficult to understand or the time required for education may be not enough to understand the method. A recent interesting domestic study using a cartoon method showed that perceptible easy cartoon education effectively improved bowel preparation for colonoscopy.\(^\text{25}\) The reason why colonoscopy examinee usually does not easily understand the preparation method may be related to the brief education practice for saving time and with colonoscopy cost strategy of low-price-high volume of colonoscopy in Korea. Furthermore, we do not know the preparation quality of the private clinic offices including primary and secondary hospitals and have no way to estimate. ASGE/ACG TF quality on endoscopy demonstrate that the colonoscopist should document the quality of the bowel preparation in the colonoscopy report format.\(^\text{2}\) However, many of colonoscopy report forms used in clinical practice in Korea does not have recording item for preparation quality. EQRS of

| Table 3. Inadequate Preparation Rate with Standard 4L PEG Preparation in Domestic Studies |
|---|---|---|---|---|
| Authors | Year | Sample size (n) | Estimation scale | Inadequate preparation (%) |
| Kim, et al\(^\text{24}\) | 2012 | 162 | Ottawa | 27.6 |
| Tae, et al\(^\text{25}\) | 2012 | 205 | BBPS | 18.4 |
| Seo, et al\(^\text{26}\) | 2012 | 366 | Ottawa | 38.6 |
| Park, et al\(^\text{27}\) | 2010 | 232 | Aronchick | 24 |
NCSP and ‘Qualified endoscopy unit accreditation’ program of ‘The gastrointestinal endoscopy research foundation of Korea’ defined that all colonoscopy unit should document the preparation quality on the colonoscopy report form.

Withdrawal time

Several studies have demonstrated increased detection of significant neoplastic lesions in colonoscopic examinations where the withdrawal time is 6 minutes or more.\textsuperscript{30,31} ASGE/ACG TF quality on endoscopy demonstrated that mean withdrawal time should be $\geq 6$ minutes in colonoscopies with normal results performed in patients with intact colons.\textsuperscript{2} Interestingly, a recent Norwegian multicenter large scaled study (n=4429) suggested that ‘6-minute withdrawal time’ should not be used as a quality indicator or surrogate end point for adenoma detection rate in colonoscopy.\textsuperscript{32} In their study, there were no differences of colonoscopies with polyps $\geq 5$mm between withdrawal time $<6$min and $\geq 6$ min.\textsuperscript{32} The remarkable thing of this study is its design of recruitment from a routine clinical setting in several hospitals reporting to a national quality register. In one domestic study, the polyp miss rate was high even in longer withdrawal time; 24.7\% of polyp was missed in 12.75 minutes of withdrawal time and 27.6\% in 18.27 minutes of withdrawal time.\textsuperscript{33} It is still debatable whether $\geq 6$ min withdrawal time is an absolute criterion to detect more polyp or adenoma. More recent studies have not found any association between withdrawal time and adenoma detection of the risk of CRC after screening.\textsuperscript{34-35} However, it is well established based on several powerful studies that careful and longer inspection definitely helpful for the detection of adenoma and decreased miss rate.\textsuperscript{17,30,36}

Several domestic studies of adenoma detection rate have mentioned colonoscopy withdrawal time in their studies and most of them noted a withdrawal time over 6 minutes.\textsuperscript{10,15,37-38} But all these were from prospective study and performed in endoscopy training hospitals. In one retrospective study, withdrawal time was distributed with wide range as 3.6 to 7.1 minutes.\textsuperscript{39} In real clinical practice or retrospective setting study, we can easily find withdrawal times less than 6 minutes. Actually it may difficult to maintain the withdrawal time over 6 minutes in institutions where many examinations of colonoscopy were routinely performed. EQRS of NCSP and ‘Qualified endoscopy unit accreditation’ program of ‘The gastrointestinal endoscopy research foundation of Korea’ defined that colonoscopy withdrawal time should be maintained over 6 minutes.

\begin{table}[h]
\centering
\caption{Colonoscopy Withdrawal Time Mentioned in Domestic Studies}
\begin{tabular}{lccc}
\hline
Author & Year & Sample size (n) & Mean withdrawal time (min) \\
\hline
Hong, et al\textsuperscript{10} & 2012 & 119/115/118 & 7.8/7.8/8.4 \\
Kim, et al\textsuperscript{37} & 2012 & 191/192 & 8.8/8.8 \\
Sinn, et al\textsuperscript{38} & 2011 & 709 & 6.5 \\
Lee, et al\textsuperscript{15} & 2011 & 384/407 & 9.7/10.2 \\
Cha, et al\textsuperscript{40} & 2010 & 63/65 & 5.7/5.5 \\
Ahn, et al\textsuperscript{39} & 2009 & 1515 & 3.6~7.1 \\
\hline
\end{tabular}
\end{table}

Colonoscopy report form

The colonoscopy report form is a basic step to maintain quality of colonoscopy. All units performing colonoscopy should prepare a colonoscopy report and record the examination result on the report form. But the contents which should be recorded on the report form are not standardized and the record forms are individualized by each institution with various style. ASGE/ACG TF quality on endoscopy recommended the use of computerized endoscopic reporting systems which should contain the following elements(2, 41): date of procedure, patient identification data, endoscopists, assis-
tants, documentation of relevant patient history and physical examination, indication of informed consent, preparation status, endoscopic procedure, indications, type of endoscopic instrument, medication (anesthesia, analgesia, sedation), anatomic extent of examination (photodocumentation of cecum), limitations of examination, tissue or fluid samples obtained, findings, diagnostic impression, results of therapeutic intervention, complications, disposition, recommendations for subsequent care. Korean Society of Gastrointestinal Endoscopy (KSGE) has provided an example of a colonoscopy report form for colonoscopists. It is uncomplicated but contains effective elements and may help to maintain the quality of colonoscopy.

Quality of primary or secondary medical institutions in Korea

As I previously noted, quality indicators of colonoscopy via domestic studies review look similar to those of foreign studies. Although the degree of bowel preparation may be lower than in other countries, ADR and adenoma miss rate, colonoscopy withdrawal time are reported as similar to those of foreign data. However, all these data are based on literature from tertiary academic hospital settings with endoscopist specialist training. There were extremely limited data of colonoscopy quality in primary or secondary hospitals and no data about private clinics. For the evaluation of colonoscopy quality in primary or secondary hospitals and private clinics, I and my colleagues analyzed the computerized photo-documentation file of patients who were transferred from other medical institutions not including tertiary hospital. The photo-documented data of 198 patients transferred to our hospital during previous 10 months were analyzed. Cecal intubation rate was 91.4% (181/198) and appendiceal orifice photo-documentation rate was 84.3% (167/198). Ileocecal valve photo-documentation rate was 71.7% (142/198) and cecum with lower fold photo-documentation rate was 76.3% (151/198). Withdrawal time could be estimated at 94.4% (187/198) of cases and mean withdrawal time was 10.8±8.1 minutes. However, the rate of cases which withdrawal time was less than 6 minutes was 25.3% (50/198). Insertion time estimation rate was 26.3% (52/198) and mean insertion time was 7.1±4.9 minutes. Bowel preparation was assessed by photo review of objective data. Adequate bowel preparation was seen in 83.3% of cases (165/198, excellent level was 52% (103/198) and good level was 31.3% (62/198)).

Although these sparse data cannot represent domestic colonoscopy quality of primary or secondary medical institutions including private clinics, some indicators find cecal intubation comparatively adequate to recommendations of ASGE/ACG TF quality on endoscopy. In the aspect of withdrawal time and cecal photo-documentation, one-fourth of colonoscopists usually do have not enough time to inspect the colon and 20~30% of colonoscopists may not examine the cecum appropriately. Careful right colon inspection and longer withdrawal time can improve the adenoma missing rate or ADR directly. It is important that all colonoscopists concentrate on ADR for the prevention of colorectal cancer, the prime goal of colonoscopy and perception about maintaining quality.

What is the solution to control the quality of colonoscopy in Korea?

NCPS has been conducted for the nation over 40 years of age, and the number of colonoscopy examinations has greatly increased and is expected to grow continuously. With this increase, the medical institutions which perform colonoscopy have been also continuously increased irrespective of physician’s specialty. In one study about endoscopy specialty based on EQRS data, the proportion of colonoscopy units where endoscopy subspecialists perform the colonoscopy was only 54.4% of all participating units and EQRS scores were significantly higher in subspecialist’s unit than non-subspecialist’s unit.(42) Although EQRS and ‘Qualified endoscopy unit accreditation’ program have included the endoscopist specialty as the estimation criteria, there is no forceful guideline about endoscopist specialty or no differentiation of medical in-
surance cost according to the presence of specialty.

Besides, the pricing for colonoscopy in Korea is relatively low compared to other countries because the whole nation has the advantage of public medical insurance by the medical policy of the government. However, this low-cost-high volume strategy of colonoscopy negatively impacts quality. In other words, ‘more number of colonoscopy with rapid examination’ is a prevalent practice in facilities performing colonoscopy. Although EQRS of NCSP and ‘Qualified endoscopy unit accreditation’ program of ‘the gastrointestinal endoscopy research foundation of Korea’ helps the quality control of colonoscopy, EQRS of NCSP can be applied only to the medical institutions which perform NCSP by the designation of the Ministry of Health and Welfare and ‘Qualified endoscopy unit accreditation’ program also can only be applied to the voluntarily requesting institutions. Therefore these programs could not guarantee the quality of all institutions which perform colonoscopy.

To improve and maintain the quality of colonoscopy, there should be standardized guidelines of colonoscopy quality including cecal intubation rate, adenoma detection rate, bowel preparation status assessment and colonoscopy report format set up by the expert group based on multi-academic society. Second, it is necessary to give acceptable benefits such as differential medical cost for colonoscopy or certificate of qualified colonoscopy unit or other possible reimbursement to the institutions which voluntarily participate in the quality control program like ‘Qualified endoscopy unit accreditation’ program. Finally, the medical insurance cost for colonoscopy should be raised to maintain the quality of colonoscopy. For instance, in 2012, the cost for colonoscopy was 3000 US dollars in USA, 350 US dollars in Canada, 70 US dollars in primary clinic in Korea, approximately (data from national health insurance corporation, NHIC). Appropriate economic compensation is essential factor to invest the concern and money in the quality control.

Conclusions

This article reviewed current evidence of domestic studies for colonoscopy quality to define the current problems in colonoscopy quality. It is very difficult to assess the current problems in quality colonoscopy of Korea and recognize their solutions. The importance of quality has emerged as a priority for colonoscopy practice. In Korea, colonoscopy examination can be easily accessed and the colonoscopy practice will grow more and more hereafter. However, there are limited data about colonoscopy practice of medical institutions which perform colonoscopy except endoscopist training hospital. There are no standardized guidelines or recommendations of colonoscopy practice and quality control based on multi-academic society. Above all things, all parties including endoscopists and all concerned in the government should pay attention to quality improvement of colonoscopy. The concerned group within government should invest budget in making a working environment and raising colonoscopy insurance cost. All medical facilities which perform colonoscopy should take an interest in control of colonoscopy quality and select the subset most appropriate to their individual needs.

References