The relationship between withdrawal time and adenoma detection rate in a screening colonoscopy for medical check-up

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ABSTRACT

Objective: The purpose of this study was to determine the relationship between withdrawal time (WT) and quality indicators (Polyp Detection Rate (PDR), Adenomatous polyp Detection Rate (ADR), Mean number of Polyps found per Patient (MPP), and Mean Adenomatous polyp found per Patient (MAP)) in a screening colonoscopy for medical check-up.

Methods: Endoscopic and pathological results were retrospectively reviewed for 840 colonoscopies performed by nine endoscopists at our facility between August and November 2018. ADR, PDR, MAP, and MPP were calculated and analyzed with WT at polyp identification (WT with polyp) or WT at polyp non-identification (WT without polyp).

Results: The mean WT without polyp was 6.56 minutes, the mean WT with polyp was 13.6 minutes, ADR was 23.9%, PDR was 29.3%, MAP was 0.35, MPP was 0.43, and the rate of early cancer (T1a) detection was 0.32%. Regression analysis revealed a high correlation between WT without polyp and ADR, PDR, MAP, and MPP (R²=0.88, 0.92, and 0.92, respectively). Regression analysis with WT without polyp as explanatory variables found each index to be significantly predictive (ADR (P=0.0101), PDR (P=0.0005), MAP (P=0.0016), and MPP (P=0.0004)). Each index was found to be significantly improved when the cutoff value was 6 minutes of extraction time at polyp non-identification (ADR (35% vs 13.1%, P=0.0005), PDR (43% vs 15.7%, P=0.004), MAP (0.58 vs 0.17, P=0.006), and MPP (0.73 vs 0.2, P=0.001)).

Conclusions: It was suggested that spending more than 6.5 minutes on whole colon observation may improve the rate of polyp detection.

Key words withdrawal time, adenoma detection rate, polyp detection rate, colonoscopy

Introduction

The results of the National Polyp Study have led to widespread use of colonoscopy for surveillance after resection of colorectal polyps. Recent large-scale studies have shown that endoscopic resection of high-risk adenomas reduces mortality from colorectal cancer. High quality endoscopy is required to avoid missing high-risk adenomas and early-stage colorectal cancer, and quality indicators (QIs) are important to ensure the quality of testing. The Adenoma Detection Rate (ADR) was first reported as a QI, and ADR < 20% was shown to be an interval cancer risk. On the other hand, because ADR is calculated based on the results of pathological diagnosis, its real-time performance is inferior, and the calculation is complicated, especially in Europe and the United States, where pathological diagnosis of all resected lesions is not made. The effectiveness of the Polyp Detection Rate (PDR) as an alternative QI to ADR has been verified. In addition, it has been shown that total colorectal extraction time (withdrawal time; WT) is effective as an indirect QI to estimate ADR and PDR easily. In these reports, it has been shown that WT of more than 7 minutes can improve ADR to more than 30%, and the interval cancer detection rate is significantly different between WT of more than 6 minutes and less than 6 minutes. All previous reports have included colonoscopy subjected surveillance or screening for high-risk patients. A study of colonoscopy for screening asymptomatic patients in medical check-up has not been conducted. In this study, we analyzed whether there is an association between WT and ADR in colonoscopy for medical check-up, and examined whether the feedback of WT is effective as individual education for endoscopists in the future.

Methods

Study design

This was a retrospective observational study approved by the institutional ethics review committee at the Shinjuku Tsurukame Clinic from August to November 2018 (approval number: 1901). The results of colonoscopies performed by 16 examiners during the study period were reviewed retrospectively. The study included both people who had previously underwent endoscopy and those who had not. The result of fecal occult blood test was not considered for enrolment. Patients with a history of surgical colorectal resection, patients with inflammatory bowel disease, and patients with familial adenomatous polyposis were excluded from the subjects. The endoscopist in charge of the examination is an endoscopist certified by the Japanese Society of Gastrointestinal Endoscopy, who has been educated in endoscopic inser-

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tion and diagnosis at a colonoscopy facility for more than 9 years. Using the database from April to July 2018 at our institution, we calculated the number of samples required for interval estimation of the mother mean using the standard deviation of ADR by examining physician as 12%, error as 5%, and confidence as 95%, and found that there were 25 cases. Therefore, examining physicians with fewer than 25 total examinations in the period were excluded from the analysis. WT at polyp identification (WT with polyp), WT at a polyp non-identification (WT without polyp), polyps identified during colonoscopy and the presence of treatment were reviewed for each eligible endoscopist, and ADR, PDR, Mean number of Adenomatous polyps per Patient (MAP) and Mean number of Polyps per Patient (MPP) were calculated. Sessile Serrated Lesion (SSL) was included in the calculation of PDR and MPP.

**Procedures**

Bowel preparation was performed by taking 1 g of Senna-containing laxative (Arozen®) on the day before the examination, followed by 2 L of polyethylene glycol formulation (Niflec®) on the day of the examination. If bowel preparation was inadequate, administration of polyethylene glycol was added as appropriate. As soon as the endoscopy began, the nurse in charge of the examination began measuring the examination time with a stopwatch, measuring the time to reach the cecum and the time to extract from the cecum to the rectum. Patients were sedated with either propofol, pethidine hydrochloride, or midazolam, or a combination of the two, as appropriate. Butyl scopolamine or glucagon was used to reduce spasm. The endoscopic instruments used for the examination were CF-HQ290ZI, PCF-H290ZI, and CF-Q260AZI (Olympus, Tokyo, Japan). The endoscopist was used for the examination were CF-HQ290ZI, PCF-H290ZI, and CF-Q260AZI (Olympus, Tokyo, Japan). The endoscopist was pre-educated to report all identified colorectal polyps, including serrated lesions, and all polyps that could be endoscopically diagnosed as adenomatous polyps were endoscopically resected. Depending on the size and morphology of the polyps, either cold snare polypectomy (SnareMaster Plus, Olympus), cold forceps polypectomy (Radial Jaw 4 Jumbo Cold Polypectomy Forceps, Boston Scientific), or endoscopic mucosal resection (SnareMaster Plus, Olympus) was selected by the endoscopists according to the size and morphology of the polyps. The level of bowel preparation was evaluated by the Boston Bowel Preparation Scale (BBPS) score\(^1\).

**Statistical analyses**

The calculation of the required sample size, analysis of variance, Student’s t-test, Pearson’s correlation analysis, and single regression analysis were all performed using the statistical analysis software R (3.3.3)\(^1\). One-way analysis of variance was used for the analysis of background factors by endoscopists. Student’s t-test was used for comparisons between the two groups. Pearson’s correlation analysis was applied to the correlation analysis of ADR, PDR, MAP, MPP, accuracy rate, early cancer detection rate and WT. As a multivariate analysis to predict ADR, PDR, MAP, and MPP for each physician, single regression analysis was applied after setting WT as an explanatory variable. \(P < 0.05\) was used as the significance level.

**Results**

**Patients’ background characteristics per endoscopists**

The number of colonoscopies performed for medical examinations during the study period was 1,099. Of these, we examined the number of endoscopies by physician in 1,092 cases, excluding 5 cases of previous surgical colorectal resection and 2 cases of inflammatory bowel disease. 7 endoscopists had fewer than 25 endoscopies during the period, and after excluding endoscopies performed by these endoscopists, 840 endoscopies performed by 9 endoscopists were included in the final analysis. 840 endoscopies were analyzed for background factors by endoscopists. Although the number of cases varied from 25 to 223 among the nine endoscopists, there were no significant differences in case background, such as age, gender, experience of past endoscopy within 5 years, percentage of smokers, percentage of sedation use and BBPS score (Table 1).

**Results by endoscopists**

The results of calculating the WT, agreement rate between endoscopic diagnosis and pathological diagnosis (accuracy rate), ADR, PDR, MAP, MPP, and early cancer detection rate for each endoscopists were shown in Table 2. WT was calculated by

### Table 1  Patients’ background characteristics per endoscopist

| Endoscopist | A | B | C | D | E | F | G | H | I |
|-------------|---|---|---|---|---|---|---|---|---|
| Experience (year) | 10 | 14 | 12 | 10 | 12 | 10 | 18 | 12 | 20 |
| Number of case | 79 | 223 | 145 | 34 | 111 | 84 | 99 | 40 | 25 |
| Age | 53.0 ± 4.5 | 51.2 ± 6.1 | 48.3 ± 5.5 | 49.2 ± 4.9 | 53.6 ± 6.2 | 45.8 ± 5.6 | 47.2 ± 4.4 | 50.1 ± 3.2 | 52.2 ± 4.3 |
| Sex (Male : Female) | 2.4 : 1 | 2.2 : 1 | 1.8 : 1 | 2.2 : 1 | 1.9 : 1 | 2.5 : 1 | 2.3 : 1 | 1.8 : 1 | 2.5 : 1 |
| Experience of past endoscopy within 5 years (%) | 45 (57.0%) | 103 (46.1%) | 78 (53.8%) | 16 (47.1%) | 62 (55.9%) | 61 (60.7%) | 53 (53.5%) | 23 (57.5%) | 15 (60.0%) |
| Smoking (%) | 6 (7.6%) | 18 (8.1%) | 11 (7.6%) | 4 (11.8%) | 9 (8.1%) | 5 (5.9%) | 8 (8.1%) | 3 (7.5%) | 3 (12%) |
| Use of Sedative agent (%) | 62 (78.5%) | 191 (85.7%) | 121 (83.4%) | 27 (79.4%) | 83 (74.8%) | 83 (83.3%) | 82 (82.2%) | 31 (77.5%) | 20 (80.0%) |
| BBPS | 7.8 ± 0.6 | 8.0 ± 0.3 | 7.9 ± 0.5 | 7.4 ± 0.6 | 7.7 ± 0.5 | 7.8 ± 0.4 | 7.7 ± 0.6 | 7.4 ± 0.6 | 7.8 ± 0.6 |

HEP Vol.47, No.4, 2020
dividing the cases in which colorectal polyps were identified (WT with polyp) and those in which no polyps were identified (WT without polyp). WT without polyp was found to be variable, with the longest being 8.2 minutes and the shortest being 4.4 minutes, while the mean for all examining physicians was 6.6 minutes. On the other hand, WT without polyp was extended among all endoscopists due to observation and procedure time for polypectomy, but there was less variability among endoscopists than that with polyp. We further analyzed the relationship between the experience and each indicators of polyp detection by using multivariable analysis, however any significant differences were found.

We compared each index in two groups: endoscopists A to E, who had an extraction time of more than 6.5 minutes at polyp non-identification, and endoscopists F to I, who had an extraction time of less than 6.5 minutes. There was no significant difference in accuracy rate (P=0.1302), but the rates of ADR, PDR, MAP, MPP, and early cancer detection were significantly higher for endoscopists A to E (P=0.01185, P=0.01026, P=0.02159, P=0.01279).

Correlation analysis was performed to determine if there was a correlation between extraction time and each index (accuracy rate, ADR, PDR, MAP, and early cancer identification rate). There was no correlation between WT with polyp and each index, but there was a high correlation between WT without polyp and ADR, PDR, MAP, and MPP (Table 3). Single regression analysis of WT without polyp using the explanatory variables, ADR, PDR, MAP, and MPP as objective variables, showed that WT without polyp was an independent predictor for all of the indicators (Table 4).

Discussion

It has been reported that ADR can be improved by spending a certain amount of time for removal of the scope in screening colonoscopy. The primary objective of this study was to follow-up the previously reported results on the cohort of medical checkup colonoscopies in Japan. The results showed that WT without polyp correlated with ADR and could be a predictor of the physician’s ADR. On the other hand, WT with polyp did not correlate with ADR. Because this was a retrospective observational study and the endoscopists was not aware of the purpose of this study, it can be said that the data accurately reflects the time spent unconsciously removing the scope when performing endoscopy for screening purposes. It has been shown that it is important to spend a certain amount of time on withdrawal of scope, especially more than 6.5 minutes, during colonoscopy for medical check-up.

PDR, MAP, and MPP have been reported as alternative QIs to ADR. The second objective of this study was to verify whether these QIs also have a correlation with WT. The results showed that WT without polyp correlated with PDR and could be a predictor of the physician’s PDR. On the other hand, WT with polyp did not correlate with PDR. Because this was a retrospective observational study and the endoscopists was not aware of the purpose of this study, it can be said that the data accurately reflects the time spent unconsciously removing the scope when performing endoscopy for screening purposes. It has been shown that it is important to spend a certain amount of time on withdrawal of scope, especially more than 6.5 minutes, during colonoscopy for screening purposes in medical check-up.

PDR, MAP, and MPP require a definitive diagnosis of adenomatous polyps on resected pathological specimens for calculation, PDR and MPP can be calculated if serrated and adenomatous lesions can be diagnosed on endoscopic examination. In this regard, to the extent that the Resect and discard strategy is applied, PDR and MPP, rather than ADR and MAP, should be set as the QI of the examiner. In colonoscopy for screening purposes in medical check-up, it was suggested that

### Table 2

| Endoscopist | A | B | C | D | E | F | G | H | I | Average |
|-------------|---|---|---|---|---|---|---|---|---|---------|
| WT without polyp (min) | 8.2 ± 0.9 | 8.0 ± 0.6 | 7.8 ± 0.7 | 7.5 ± 1.0 | 6.5 ± 0.4 | 6.2 ± 0.8 | 6.0 ± 1.1 | 4.5 ± 0.4 | 4.4 ± 0.8 | 6.6 |
| WT with polyp (min) | 12.4 ± 1.8 | 14.9 ± 2.5 | 14.7 ± 3.1 | 15.1 ± 3.4 | 12.2 ± 2.2 | 15.4 ± 3.9 | 16.6 ± 3.7 | 11.2 ± 2.0 | 10.0 ± 2.5 | 13.6 |
| Accuracy rate (%) | 78.8 | 84 | 62.8 | 85.7 | 79.2 | 90 | 100 | 85.7 | 82.1 | 83.1 |
| ADR (%) | 42.9 | 37.7 | 25.7 | 26.4 | 30.2 | 16.7 | 11 | 12.5 | 12 | 23.9 |
| PDR (%) | 58.4 | 41.7 | 39.6 | 29.4 | 32.1 | 22.6 | 13 | 15 | 15 | 29.6 |
| MAP | 0.857 | 0.812 | 0.542 | 0.38 | 0.45 | 0.29 | 0.15 | 0.18 | 0.12 | 0.42 |
| MPP | 0.857 | 0.812 | 0.542 | 0.38 | 0.45 | 0.29 | 0.15 | 0.18 | 0.12 | 0.42 |

### Table 3

| Accuracy rate | ADR | PDR | MAP | MPP | Rate of T1a cancer detection |
|---------------|-----|-----|-----|-----|-----------------------------|
| **WT without polyp** | R² | 0.61 | 0.883 | 0.918 | 0.883 | 0.924 | 0.653 |
| P-value | 0.0814 | 0.0014 | 0.0005 | 0.0016 | 0.0004 | 0.0567 |
| **WT with polyp** | R² | 0.405 | 0.193 | 0.24 | 0.362 | 0.38 | 0.0013 |
| P-value | 0.279 | 0.619 | 0.534 | 0.338 | 0.313 | 0.997 |

### Table 4

| ADR | PDR | MAP | MPP |
|-----|-----|-----|-----|
| P-value | 0.0101 | 0.0005 | 0.0016 | 0.0004 |
| Adjusted R-Squared | 0.914 | 0.951 | 0.749 | 0.834 |
taking more than 6.5 minutes to remove the scope could provide quality control of endoscopy by PDR and MPP, even if the Resect and discard strategy is applied.

Limitations of the present study include, first, that it is a retrospective observational study and the detection of polyps may be underestimated. Particularly for serrated lesions, there is a concern that there may be lesions that were actually found at the time of the examination but were not described by the examining physician in the examination report. On the other hand, the mean ADR and PDR of all endoscopists in this study were 23.9% and 29.6%, respectively, and we believe that the power of this study is comparable to the results of a large cohort of colonoscopically examined physicians from other facilities (ADR 26.45%)18). Second, the study was conducted over a limited period of 3 months, and the number of cases handled by each endoscopist was small. In estimating the number of cases needed in advance, we estimated that 25 endoscopies per endoscopists could be included in the analysis to estimate the mother average, but a larger number of cases could provide more reliable results. Third, we did not analyze each indicator for polyp detection according to the polyp size because our registry found that most polyps were diminutive; 80.6% of adenomatous polyps were less than 6 mm.

In conclusion, this study suggested that the QI of not only ADR but also PDR, MAP, MPP can be improved in colonoscopy for medical check-up by spending enough time on extraction. In particular, it was shown that it is important to spend more than 6.5 minutes on WT.

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