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ORIGINAL ARTICLE

Changing from two- to one-operator colonoscopy insertion technique is feasible with similar quality outcomes

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Abstract

Background and Aim: Colonoscopy can be performed with two-operator (2OP) or one-operator (1OP) methods. This study aimed to investigate the feasibility and colonoscopy quality outcomes for the two different colonoscopy insertion techniques.
Methods: One colonoscopist from Changhua Christian Hospital learned and changed the colonoscopy insertion technique from 2OP to 1OP during 2013. Real-life results of screening colonoscopies performed by this colonoscopist between these two insertion techniques (year 2012: 2OP vs year 2014: 1OP) were retrospectively reviewed and compared.
Results: In total, 219 screening colonoscopies were reviewed (2OP group, n = 103 vs 1OP group, n = 116). No differences were noted between both groups in terms of patient age, gender, weight, and height. The overall cecum intubation was 98.2%, adenoma detection rate (ADR) was 29.7%, and colonoscopy withdrawal time was 518.58 ± 972.04 s. On comparing colonoscopy quality outcomes between both methods, no differences were observed in cecal intubation rates (2OP vs 1OP: 100 vs 96.6%, P = 0.1626), ADR (28 vs 31%, P = 0.7401), and colonoscopy withdrawal time (454.88 ± 178.21 vs 576.92 ± 1325.01 s, P = 0.355). However, the 1OP group demonstrated significantly shorter colonoscopy insertion time (2OP vs 1OP: 298.28 ± 202.95 vs 216.21 ± 121.99 s, P = 0.003).
Conclusion: Colonoscopy quality outcomes were not impaired when one endoscopist changed the colonoscopy practice pattern from 2OP to 1OP. However, 1OP significantly shortened the colonoscopy insertion time.

Introduction

Colorectal cancer (CRC) is the most common malignancy in several American and European nations, and its incidence appears to be increasing in Asian countries, including Taiwan.[1–5] In Taiwan, the incidence of CRC exceeds that of liver cancer, making it the second common malignancy since 2008.[4] Therefore, the performance and quality of colonoscopy have become important issues for the effective detection and treatment of CRC. Since its introduction in 1969, colonoscopy has become a widely utilized tool for screening and diagnosis of colonic disease. In early days, colonoscopes were long and rigid, and two operators (two-operator method [2OP]) were required to control the scope. With improvements in colonoscope design, colonoscopy is increasingly performed by a single endoscopist (one-operator method [1OP]), who holds and adjusts the colonoscope using right–left and up-down knobs to control shifting during the entire procedure.[6–8] Although 1OP is the standard practice in the United States and Japan, 2OP is still commonly used in other parts of the world.[7,9–11]

Approximately half of colonoscopy procedures are performed using 2OP in a recent Italian survey;[12] 20% from the Norway GastroNet survey;[9] and 7%[7] to 21%[13] from Taiwan and China, respectively. Although use of 1OP can save manpower required for endoscopy and improve patient discomfort,[7,14] few studies have compared these two methods and published controversial findings on the use and effects of 1OP or 2OP on colonoscopy quality outcomes.[9,11] Learning to perform colonoscopy usually begins with observation, followed by colonoscopy simulators or practice under supervision with a senior endoscopist to obtain appropriate professionality.[3,8] Colonoscopists who start with either 1OP or 2OP usually maintain the same practice patterns in their future career, which explains why 2OP is still commonly used by endoscopists who were trained with 2OP in the 20th century.[11] Whether or not changing an endoscopist's practice pattern from 2OP to 1OP would be feasible, along with possible clinical impact of such a change, remains unclear. The present study is a retrospective study conducted to evaluate outcomes of changing from 2OP to 1OP in terms of feasibility of colonoscopy and quality indicator

of colonoscopy, that is, adenoma detection rate (ADR) from a single operator.

Methods

At the endoscopy center in Changhua Christian Hospital, approximately 6000 colonoscopies are performed per year by 12 endoscopists. The 2OP insertion technique was the standard method taught and performed in this unit by all endoscopists, with one nurse assistant to hold and insert the colonoscope for both insertion and withdrawal of the colonoscope. The author (Hsu-Heng Yen) began performing colonoscopy since 2004 using 2OP. The author (Hsu-Heng Yen) learned 1OP technique from Dr Hiroaki Ikematsu at the National Cancer Center Hospital East, Chiba, Japan, in 2013, to improve the technique used for advanced endoscopic therapy, that is, endoscopic submucosal dissection.[15] The author (Hsu-Heng Yen) began to change the practice pattern of colonoscopy insertion from 2OP to 1OP after 2013. Screening colonoscopy performed by Hsu-Heng Yen between January and December of 2012 (2OP insertion period) and 2014 (1OP insertion period) for physical examinations was retrospectively reviewed. The study was approved by our Institutional Review Board (CCH IRB no: 141111). Patients were excluded if they had (i) previous history of CRC; (ii) previous history of inflammatory bowel disease; (iii) previous history of colonic resection; and (iv) refused endoscopic biopsy and/or had undergone polypectomy so colonoscopic pathology could not be assessed.

The study was approved by Changhua Christian Hospital Review Board No 141111.

Colonoscopy procedures. The endoscopy center used the endoscope processor system with the Fujinon EPX-4400HD Processor and Light Source VP-4400HD XL-4400, and Fujinon EC-450WL5 video colonoscope with a scope length of 160 cm was used for all procedures. Patients received oral bowel preparation with 90 mL of sodium phosphate or 2 L of polyethylene glycol in split doses. All patients were administered analgesia with propofol and fentanyl, monitored by anesthesiologists. CO_2 is routinely used during the endoscopic procedure. In addition, endoscopic biopsy was performed if a diminutive polyp was discovered during the procedure. For lesions that required polypectomy, another appointment of colonoscopy for polypectomy was arranged. For 2OP, the endoscopist performed colonoscopy with one endoscopy assistant who held the scope to facilitate insertion and withdrawal of the scope and another assistant as a standby for endoscopic treatment, that is, biopsy. For 1OP, the endoscopist performed colonoscopy without an endoscopist assistant to handle the scope, and the endoscopist assistant was only a standby if endoscopic treatment was required.[11] The locations of polyps were defined as proximal (including cecum, ascending colon, transverse colon, and hepatic flexure) and distal (including rectum, sigmoid colon, descending colon, and splenic flexure).

Assessment of colonoscopy quality outcomes. We retrospectively reviewed colonoscopy-related parameters, including scope insertion time, withdrawal time, cecal intubation rate, examination findings, and complications from the medical chart review. In addition, patient data, including age, gender, weight, and abdominal girth, were analyzed. Moreover, pathological findings of biopsied and/or polypectomy tissues were retrospectively reviewed.

Statistical analyses. Continuous variables were compared using the Student's *t*-test or Mann–Whitney *U* test as appropriate. Categorical variables were evaluated using the χ^2 test. Differences between the two groups were considered significant when *P* values were <0.05. Statistical analyses were performed using MedCalc software version 11.5 (MedCalc Software bvba, Broekstraat 52, 9030 Mariakerke, Belgium).

Results

In total, 219 procedures were retrospectively reviewed (Table 1), with male predominance (63.5%) and median patient age of 50.55 ± 11.18 years. The cecum could be intubated for 98.2% of procedures, and only 6.8% of patients exhibited poor bowel preparation. Colonic polyps were detected among 63% of patients, while adenomatous polyps were detected in 29.7% of patients. The mean insertion and withdrawal time was 254.81 ± 169.73 and 518.58 ± 972.04 s, respectively.

On comparing the two insertion methods, no differences were observed in terms of baseline patient demographic data, including gender, age, body weight, or abdominal preparation (Table 2). Regarding colonoscopy quality parameters, no differences were noted between the two methods in terms of cecal intubation rate (1OP vs 2OP: 96 vs 100%, $P = 0.1626$), any polyp detection rate (59.5 vs 67.0%, $P = 0.31766$), adenomatous polyp detection rate (31.0 vs 28.0%, $P = 0.7401$), any polyp detection rate in the proximal colon (26.7 vs 33.0%, $P = 0.3854$), adenomatous polyp detection rate in the proximal colon (14.7 vs 14.6%, $P = 0.8631$), any polyp detection rate in the distal colon (46.6 vs 44.7%, $P = 0.8850$), and adenomatous polyp detection rate in the distal colon (21.6 vs 15.5%, $P = 0.3341$). The colonoscopy withdrawal time (1OP vs 2OP: 576.92 ± 1325.01 vs 454.88 ± 178.21 s, $P = 0.355$) was similar in both groups. However, the colonoscopy insertion time was significantly shorter in the 1OP group than in the 2OP group (1OP vs 2OP: 216.21 ± 121.99 vs 298.28 ± 202.95 s, $P = 0.003$).

Table 1 Overall performance of colonoscopy

Item	Data
Age (year) (mean ± SD)	50.55 ± 11.18
Gender (male/female)	139/80 (63.5%/36.5%)
Body weight (kg) (mean ± SD)	66.61 ± 10.90
Body height (cm) (mean ± SD)	165.05 ± 7.80
Abdominal girth (cm) (mean ± SD)	82.28 ± 8.79
Bowel preparation (good/fair/poor)	183/21/15 (83.6%/9.6%/6.8%)
Cecal intubation rate (*n*, %)	215 (98.2)
Polyp detection rate (%)	63.0
Adenoma detection rate (%)	29.7
Insertion time (s) (mean ± SD)	254.81 ± 169.73
Withdraw time (s) (mean ± SD)	518.58 ± 972.04
Method (1OP/2OP)	116/103 (53.0%/47.0%)

SD, standard deviation.

Table 2 Comparison of one- versus two-operator method

Item	One-operator (n = 116)	Two-operator (n = 103)	P
Age (year) (mean ± SD)	49.81 ± 11.07	51.38 ± 11.31	0.301
Gender (male/female)	78/38	61/42	0.2198
Body weight (kg) (mean ± SD)	67.89 ± 10.77	64.93 ± 10.89	0.054
Body height (cm) (mean ± SD)	165.61 ± 7.48	164.33 ± 8.17	0.249
Abdominal girth (cm) (mean ± SD)	83.41 ± 8.54	80.77 ± 8.93	0.034*
Bowel preparation (good/fair/poor)	84/12/10	89/9/5	0.4806
Cecal intubation rate (%)	96.6	100.0	0.1626
Polyp detection rate (%)	59.5	67.0	0.3176
Adenoma detection rate (%)	31.0	28.0	0.7401
Insertion time (s) (mean ± SD)	216.21 ± 121.99	298.28 ± 202.95	0.0003*
Withdraw time (s) (mean ± SD)	576.92 ± 1325.01	452.88 ± 178.21	0.3471
Proximal-adenoma (%)	14.7	14.6	0.8631
Distal-adenoma (%)	21.6	15.5	0.3341
Proximal-polyp (%)	26.7	33.0	0.3854
Distal-polyp (%)	46.6	44.7	0.8850

SD, standard deviation.

Discussion

With increasing incidence of CRC in Asia,[4,16] surveillance of high-risk patients with colonoscopy and subsequent endoscopic resection of precancerous lesions is an effective method to reduce future occurrence of CRC.[17–19] Thus, high-quality colonoscopy is mandatory to reduce the incidence of interval cancer.[10,17,18] However, colonoscopy requires team work, including endoscopists, assistants, and/or anesthesiologists. Although colonoscopy can be performed using 1OP or 2OP, 1OP is now a preferred method owing to less manpower requirement[14] and is associated with shorter procedure time or patient discomfort.[7] The present study demonstrated that an endoscopist who was trained with 2OP can be retrained to 1OP with improved insertion efficiency and without compromising quality outcomes.

Colonoscopy is the most commonly used tool for screening colon cancers.[16] However, new colon cancers can develop after an index colonoscopy, with the risk ranging from 1.14 to 2.24[17,20] per 1000-person-year, and such types of "interval cancer" may offset the beneficial role of colonoscopy. Among quality indicators proposed by American Society for Gastrointestinal Endoscopy,[21] a cecal intubation rate of ≥95% and an ADR of ≥25% during screening colonoscopy are two priority performance indicators that are strongly associated with a reduced incidence of interval colon cancer. For individual endoscopists, little is known regarding the effects of endoscopist factors (i.e. training background, age, gender, experience of colonoscopy, previous education, or training or insertion techniques learned) on the aforementioned colonoscopy performance indicators (i.e. ADR and cecal intubation rate).

Bressler *et al.*[22] suggested that colonoscopy performed by an internist or family physician was an independent risk factor for interval colon cancer. Jover *et al.*[23] analyzed 48 endoscopists who had performed 3838 colonoscopy procedures and found that the experience of the endoscopist and exclusive dedication to endoscopy practice were associated with better colonoscopy quality outcomes; however, the insertion technique used by individual endoscopists was not analyzed in this study. In the Norway GastroNet survey[9] of 75 endoscopists with 9368 colonoscopy procedures, the cecal intubation rate was higher with 2OP than with 1OP (96 vs 92%, $P < 0.001$), while the polyp detection rate was similar for both techniques. In the present study, we found similar cecal intubation rates and ADRs between the 1OP and 2OP groups. Our findings suggest that the colonoscopy insertion method may not affect colonoscopy quality outcomes, which is consistent with previous studies.[11,13] Adequate withdrawal time rather than insertion method is more important to ensure favorable colonoscopy quality outcomes.[9]

In this study, the intubation time with 1OP was shorter than with 2OP (216.21 vs 298.28 s, $P = 0.0003$), suggesting that 1OP could be preferred to save procedural time and manpower. However, this finding was different from findings of the Norway GastroNet survey[9] (1OP vs 2OP: 13.6 vs 9.5 min, $P < 0.001$) and Paggi *et al.*[11] (8 vs 8.13 min, $P = 0.87$). The average insertion time of 4.25 min in our study was shorter than that reported in previous Western[9,11] studies, which may be attributed to varying patient features, that is, small stature and less abdominal girth[24] in Asian patients, which may have made colonoscopy intubation easier compared with Western patients. Considering the rapid increase of colon cancer in Asia,[4,5] the need for endoscopists is expected to increase as well. Our findings suggest that 2OP colonoscopists could be encouraged to change their practice pattern to 1OP in order to increase their colonoscopy capacity without compromising quality.

This study has several limitations. First, the study was limited to a single operator's experience. Hence, our observations may not be applicable to different endoscopists and different institutions. Because 1OP endoscopists are not likely to perform 2OP, and 2OP endoscopists may maintain their familiar practice patterns for patient safety,[9] a comparison of such changes in practice patterns by using a randomized controlled study is not feasible. In this study, colonoscopy quality outcomes were not compromised with different insertion methods when performed by a single operator in the real world; this finding suggests that the performance of the endoscopist is a key factor in the insertion method to achieve a high-quality colonoscopy.[9,12,13] Second, the study is retrospective in nature, and all patients received analgesia for colonoscopy; hence, information regarding patient

discomfort during the procedure was not recorded, and we were unable to analyze the impact of different insertion methods on patient discomfort.[7,8] Third, the study did not aim to evaluate the learning curve of changing from 2OP to 1OP. In fact, during 2013, the author (Hsu-Heng Yen) began to practice 1OP with insertion using 2OP technique and withdrawal using 1OP technique. After gaining familiarity with 1OP, the author could achieve both insertion and withdrawal of colonoscopy in late 2013. Approximately 50 colonoscopies were performed using this mixed insertion method during this period. Furthermore, in this study, we suggested that an "old" endoscopist using 2OP can be retrained to "new" endoscopist using 1OP with a smaller learning curve[3,4] than a "naïve" endoscopist; this finding may encourage endoscopists that changing currently familiar practice patterns may not be difficult and that such a change may improve examination efficiency.

Conclusion

This single-operator experience suggests that 2OP colonoscopists can change their practice pattern to 1OP insertion technique with improved efficiency and without compromising colonoscopy quality.

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