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Intracorporeal anastomosis in minimally invasive right hemicolectomy: a nationwide survey of the Korean Society of Coloproctology

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Purpose: We investigated the current practices and perceptions of colorectal surgeons in South Korea regarding intracorporeal ileocolic anastomosis (IIA) in minimally invasive right hemicolectomy (RHC).
Methods: Members of the Korean Society of Coloproctology (KSCP) participated in an online survey encompassing demographic information, surgical experiences, methods for IIA, and advantages, barriers, and perceptions of IIA. We performed a statistical analysis of survey results.
Results: Among the 1,074 KSCP members contacted, 178 responded to the survey. Most respondents were males aged 40–49 years with >10 years of experience who were affiliated with a tertiary healthcare facility. One hundred fifty-six respondents had performed <100 colorectal cancer surgeries annually. Fifty-nine respondents reported experiences of the IIA technique in minimally invasive RHC. Most respondents favored the isoperistaltic side-to-side (S-S) anastomosis and stapled S-S anastomosis, hand-sewn closure for the common channel, and the periumbilical area for primary specimen extraction. Respondents with IIA experience emphasized the reduction in postoperative complications as the primary reason for performing IIA, whereas respondents without IIA experience cited the lack of benefits as the main deterrent. Respondents commonly cited concerns regarding anastomotic leakage and intraabdominal contamination as the primary reasons for not performing IIA. Respondents with IIA experience demonstrated a more positive response towards attempting or transitioning to IIA than those without. Respondents with IIA experience prioritized self-sufficiency, whereas respondents without IIA experience prioritized proctorship and discussions of the initial cases.
Conclusion: Measures to standardize the IIA technique and appropriate training programs must be implemented to enhance its use in minimally invasive RHC.
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Key Words: Colon, Colectomy, Minimally invasive surgical procedure, Surgical anastomosis, Surveys and questionnaires

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INTRODUCTION

Colorectal cancer (CRC) was the third most common type of cancer, following breast and lung cancer, worldwide in 2020. CRC was the most prevalent type of cancer, following thyroid and lung cancers, in South Korea. According to the Biennial Report of the International Agency for Research on Cancer, 27,877 new cases of CRC were diagnosed in South Korea in 2020, representing a crude incidence rate of 54.3 per 100,000 individuals [1]. These statistics highlight the significant burden of CRC on public health both worldwide and in South Korea.

Minimally invasive, laparoscopically assisted surgery was first considered for patients undergoing colectomy for cancer in 1990 [2]. Since then, minimally invasive surgery has become the treatment of choice for CRC [3,4]. First reported in the United States in 1991 [5], laparoscopic right hemicolectomy (LRHC) has progressively become the most common surgical treatment for right-sided colon cancer. This may be attributed to the significantly lower mortality and morbidity rates associated with LRHC and the oncologic outcomes being comparable with those of open right hemicolectomy (ORHC) [6,7]. In addition, LRHC has provided several benefits for patients compared to ORHC, including smaller scars, less postoperative pain, rapid recovery of bowel movement, and return to normal activities after hospitalization [8].

Intracorporeal ileocolic anastomosis (IIA) and extracorporeal ileocolic anastomosis (EIA) have been performed to restore the continuity of the bowel. The anastomosis of the ileum to the colon is performed entirely within the abdominal cavity via hand-sewing, stapling, or both techniques in IIA. In contrast, in EIA, the anastomosis of the ileum to the colon is externalized by removing the intestine from the abdominal cavity via a small laparotomy. The intestine is resected subsequently, and anastomosis is achieved externally via hand-sewing, stapling, or both techniques and returned to its natural position.

A growing interest in the comparative outcomes of IIA and EIA in minimally invasive right hemicolectomy (RHC) has been observed in recent years. Several retrospective studies have compared LRHC performed using IIA and EIA and reported the postoperative outcomes [9-11]. A reduction in short-term morbidity and length of hospital stay has been reported by some studies, suggesting that IIA facilitates faster recovery than EIA. However, no significant differences were observed between IIA and EIA in terms of these outcomes in other studies. Thus, the possible clinical advantages of IIA over EIA cannot be established owing to the inconsistencies between the findings of previous studies and the lack of randomization. Two recent randomized controlled trials have demonstrated that lower postoperative pain and earlier recovery of bowel function were observed in patients who had undergone IIA; however, the duration of hospital stay was similar [12,13]. Despite these findings underscoring the feasibility and safety of IIA, it is not preferred over EIA owing to the technical challenges and increased operative time associated with this technique.

Most colorectal surgeons in South Korea perform minimally invasive right hemicolectomies; however, the attitude of colorectal surgeons toward IIA and EIA remains uncertain. Therefore, a nationwide survey was conducted within the Korean Society of Coloproctology (KSCP) by the Korean Laparoscopic Colorectal Surgery Study Group (KLCSSG) to gain insight into current practices of IIA and EIA.

METHODS

Ethical statements

This study was approved by the Institutional Review Board of Ulsan University Hospital (No. 2023-09-032) and adhered to the tenets of the Declaration of Helsinki. Vulnerable participants did not participate in the online survey. Moreover, the participants' data were anonymized, and sensitive information was not collected or recorded. Thus, this study was exempt from review, and the requirement for obtaining written informed consent was waived.

Study design and participants

An online survey was designed using LimeSurvey (https://endoscopiccolonsurgery.limesurvey.net/915979?token=Wf6clEEVuxl8i4R&lang=ko) (Supplementary Material 1). The survey comprised 12 questionnaires encompassing the following domains: demographic characteristics and profiles of the survey respondents; surgical experiences of the survey respondents; methods used for IIA as reported by the survey respondents; advantages of IIA as reported by the survey respondents; barriers to IIA as reported by the survey respondents; and perceptions of the transition to IIA as reported by the survey respondents.

After conducting an alpha test within the KLCSSG to identify and rectify potential issues or ambiguities in the questionnaire, the survey was anonymously distributed to KSCP members between February 21, 2022 and March 7, 2022. We classified the survey respondents into 2 groups based on their experiences of IIA: with or without IIA experiences group. Most analyses were performed to compare 2 groups.

Statistical analysis

All statistical analyses were performed using IBM SPSS Statistics ver. 25.0 (IBM Corp.). Categorical variables, which are presented as the number of survey respondents and percentages, were compared using the chi-square test or Fisher exact test, as appropriate. Statistical significance was set at $P < 0.05$.

RESULTS

Demographic characteristics and profiles of survey respondents

Among the questionnaires distributed to 1,074 members of the KSCP via email, 178 completed surveys (16.6%) were returned within 2 weeks of initial contact. The respondents were predominantly males (n = 158, 88.8%) aged 40–49 years (n = 89, 50.0%). The majority of respondents were colorectal surgeons with >10 years of experience (n = 96, 53.9%) who were affiliated with a tertiary healthcare facility or a university hospital (n = 126, 70.8%) (Table 1).

Surgical experiences of the survey respondents

The surgical experiences of the survey respondents were divided into 4 categories. In terms of the annual number of CRC surgeries, 156 respondents (87.6%) reported performing <200 cases, whereas 22 respondents (12.4%) reported performing ≥200 cases. A U-shaped bimodal distribution was observed for accumulated CRC surgeries, with 56 respondents (31.5%) performing <100 cases and 53 respondents (29.8%) performing >1000 cases. Eighty-three respondents (46.6%) reported performing <20 RHCs in 2021, followed by 20–50 cases, 50–100 cases, and >100 cases. Fifty-nine respondents (33.1%) reported experiences of the IIA technique in minimally invasive RHC; the remaining 119 respondents (66.9%) did not have this experience (Table 2).

Methods for intracorporeal ileocolic anastomosis as reported by the survey respondents

Among the 59 respondents who had used the IIA technique in minimally invasive RHC, 46 (78.0%) had used the IIA technique in <20% of their cases (Fig. 1A). This finding indicates that the EIA technique is favored, even among experienced individuals. Forty-seven respondents (79.7%) favored isoperistaltic side-to-side anastomosis over antiperistaltic side-to-side anastomosis in terms of IIA configuration (Fig. 1B). Fifty-seven respondents (96.6%) favored the stapled side-to-side anastomosis over the hand-sewn side-to-side anastomosis in terms of IIA technique (Fig. 1C). Notably, the respondents favored hand-sewn closure (n = 35, 59.3%) over stapled closure (n = 24, 40.7%) for the closure of the common channel in the stapled side-to-side anastomosis (Fig. 1D). The primary specimen extraction sites after IIA in minimally invasive RHC were as follows: the periumbilical area (n = 39, 66.1%), suprapubic area (n = 18, 30.5%), and other areas (n = 2, 3.4%) (Fig. 1E).

Table 1. Demographic characteristics and profiles of the survey respondents

Characteristics	Total	Group with IIA experiences	Group without IIA experiences
No. of respondents	178 (100)	59 (33.1)	119 (66.9)
Sex			
Male	158 (88.8)	53 (29.8)	105 (59.0)
Female	20 (11.2)	6 (3.4)	14 (7.9)
Age (yr)			
30–39	35 (19.7)	8 (4.5)	27 (15.2)
40–49	89 (50.0)	31 (17.4)	58 (32.6)
50–59	41 (23.0)	16 (9.0)	25 (14.0)
≥60	13 (7.3)	4 (2.2)	9 (5.1)
Professional career (yr)			
<1	5 (2.8)	2 (1.1)	3 (1.7)
1–4	35 (19.7)	6 (3.4)	29 (16.3)
5–9	42 (23.6)	13 (7.3)	29 (16.3)
≥10	96 (53.9)	38 (21.3)	58 (32.6)
Category of affiliation			
Primay healthcare facility	2 (1.1)	1 (0.6)	1 (0.6)
Secondary healthcare facility	48 (27.0)	8 (4.5)	40 (22.5)
Tertiary healthcare facility	126 (70.8)	50 (28.1)	76 (42.7)
Others	2 (1.1)	0 (0)	2 (1.1)
Bed capacity of affiliation			
<500, general hospital	42 (23.6)	9 (5.1)	33 (18.5)
≥500, general hospital	136 (76.4)	50 (28.1)	86 (48.3)

Values are presented as number (%).
IIA, intracorporeal ileocolic anastomosis.

Table 2. Surgical experiences of the survey respondents

No. of CRC surgery cases	Total (n = 178)	Group with IIA experiences (n = 59)	Group without IIA experiences (n = 119)
Annual			
<10	45 (25.3)	10 (5.6)	35 (19.7)
10–49	35 (19.7)	9 (5.1)	26 (14.6)
50–99	28 (15.7)	10 (5.6)	18 (10.1)
100–199	48 (27.0)	18 (10.1)	30 (16.9)
200–299	14 (7.9)	8 (4.5)	6 (3.4)
≥300	8 (4.5)	4 (2.2)	4 (2.2)
Accumulated			
<100	56 (31.5)	10 (5.6)	46 (25.8)
100–299	28 (15.7)	14 (7.9)	14 (7.9)
300–499	16 (9.0)	5 (2.8)	11 (6.2)
500–999	25 (14.0)	9 (5.1)	16 (9.0)
≥1,000	53 (29.8)	21 (11.8)	32 (18.0)
RHC cases in 2021			
<20	83 (46.6)	22 (12.4)	61 (34.3)
20–49	46 (25.8)	13 (7.3)	33 (18.5)
50–99	35 (19.7)	16 (9.0)	19 (10.7)
≥100	14 (7.9)	8 (4.5)	6 (3.4)

Values are presented as number (%).
IIA, intracorporeal ileocolic anastomosis; CRC, colorectal cancer; RHC, right hemicolectomy.

Advantages of intracorporeal ileocolic anastomosis as reported by the survey respondents

Comparison between the responses of the respondents with and without IIA experience revealed statistically significant differences in terms of the lack of benefits and reduction of postoperative complications. Respondents with IIA experience cited the reduction in postoperative complications as the main reason for using this technique. In contrast, respondents without IIA experience cited a lack of benefits as the primary reason for not using this technique. Reasons such as less colonic mobilization (n = 36, 61.0%) and improved cosmesis (n = 32, 54.2%) were cited frequently by respondents with IIA experience; however, statistically significant differences were not observed between the responses of respondents without IIA experience. No statistically significant differences were observed between the 2 groups in terms of other responses (Table 3).

Barriers to intracorporeal ileocolic anastomosis as reported by the survey respondents

Comparison between the responses of the respondents with and without IIA experience revealed no statistically significant differences in terms of barriers to the use of the IIA technique. Concerns regarding anastomosis leakage and intraabdominal contamination were cited predominantly by respondents with and without IIA experience as reasons for not preferring IIA, with each accounting for over half of the responses (Table 4).

Perceptions of the transition to intracorporeal ileocolic anastomosis as reported by the survey respondents

Twenty-eight and 36 respondents (47.5% and 30.3%, respectively) with and without IIA experience reported positive expectations (Table 5). Respondents with IIA experience demonstrated a more positive response (n = 36, 61.0%) towards attempting or transitioning to IIA in the future than those without IIA experience (n = 51, 42.9%) (Table 6). Regarding assistance required for attempting IIA, respondents with IIA experience prioritized "self-sufficiency," "proctorship and discussion for the initial cases," and "training programs and lectures" in descending order. In contrast, respondents without IIA experience prioritized "proctorship and discussion for the initial cases" followed by "self-sufficiency" and "training programs and lectures" (Table 7).

DISCUSSION

KLCSSG has consistently conducted surveys targeting members of the KSCP since the publication of a survey on the current status of laparoscopic colorectal surgery in South Korea by Kim et al. [14] in the *Annals of Coloproctology* in 2006 and presented the results. The present study summarizes the findings of a nationwide survey investigating the current practices and perceptions of KSCP members regarding the use of EIA and IIA during minimally invasive RHC and provides insights that may assist colorectal surgeons in making appropriate choices between EIA and IIA in various clinical

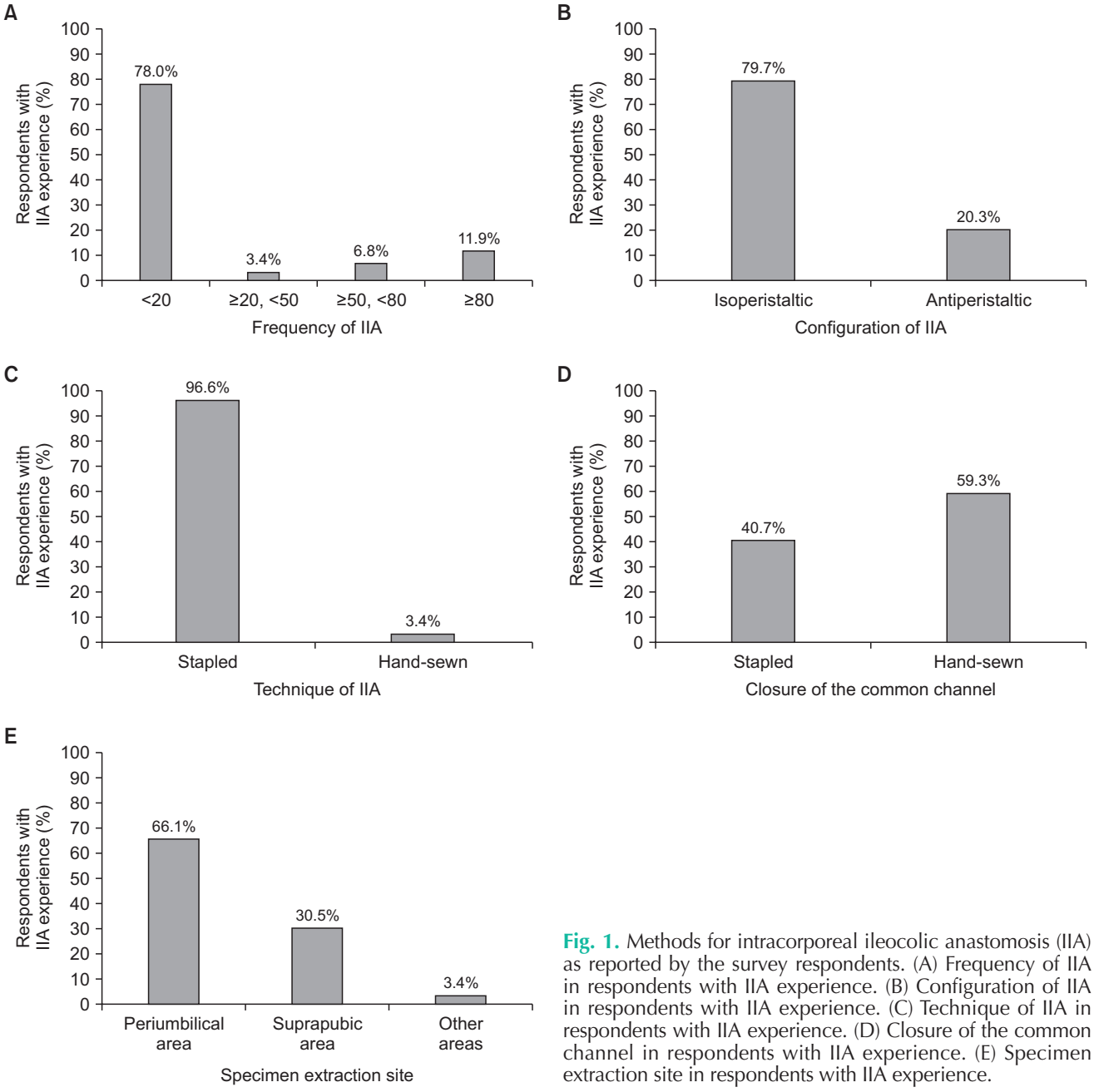

Fig. 1. Methods for intracorporeal ileocolic anastomosis (IIA) as reported by the survey respondents. (A) Frequency of IIA in respondents with IIA experience. (B) Configuration of IIA in respondents with IIA experience. (C) Technique of IIA in respondents with IIA experience. (D) Closure of the common channel in respondents with IIA experience. (E) Specimen extraction site in respondents with IIA experience.

scenarios.

Most respondents of the present study were surgical specialists aged 40–59 years (n = 130, 73.0%) who had >5 years of experience (n = 138, 77.5%). The majority of the respondents were affiliated with tertiary healthcare facilities (tertiary comprehensive hospitals), university hospitals (n = 126, 70.8%), or a general hospital with >500 beds (n = 136, 76.4%). The findings of the present study are consistent with those reported by the 7th colorectal cancer appropriateness assessment by the Health Insurance Review and Assessment Service (HIRA) in South Korea. Among the 13,903 cases evaluated for colon cancer (excluding rectal cancer) in this survey, tertiary comprehensive hospitals, general hospitals, and clinics accounted for 9,426 (67.8%), 4,138 (29.8%), and 339 cases (2.4%), respectively [15]. Thus, the domestic healthcare landscape reveals that the number of cases in tertiary comprehensive hospitals is over twice as high as the combined number of cases in general hospitals and clinics. This pattern was also observed in the results of the present survey.

The HIRA reports statistics on a 'hospital' basis rather than a 'physician' basis, which makes a direct comparison of the annual number of CRC surgeries, the accumulated number of CRC surgeries, and the annual number of RHCs performed in 2021 by respondents in the present study challenging. However,

Table 3. Advantages of IIA as reported by the survey respondents

Variable	Group with IIA experiences (n = 59)	Group without IIA experiences (n = 119)	P-value
Lack of benefit	2 (3.4)	20 (16.8)	0.014
Lesser colonic mobilization	36 (61.0)	53 (44.5)	0.056
Reduced postoperative complication	7 (11.9)	4 (3.4)	0.043
Reduced ileus	4 (6.8)	11 (9.2)	0.776
Reduced surgical site infection	6 (10.2)	16 (13.5)	0.633
Reduced pain	17 (28.8)	25 (21.0)	0.265
Shorter hospital stay	6 (10.2)	4 (3.4)	0.084
Improved cosmesis	32 (54.2)	53 (44.5)	0.265
Reduced incisional hernia	23 (39.0)	36 (30.3)	0.310

Values are presented as number (%). Multiple responses were allowed for the advantages.
IIA, intracorporeal ileocolic anastomosis.

Table 4. Barriers to IIA as reported by the survey respondents

Variable	Group with IIA experiences (n = 59)	Group without IIA experiences (n = 119)	P-value
Technical challenges	11 (18.6)	13 (10.9)	0.156
Concerns about anastomosis leakage	16 (27.1)	37 (31.1)	0.585
Concerns about intraabdominal contamination	16 (27.1)	30 (25.2)	0.784
Longer operation time	12 (20.3)	17 (14.3)	0.303
Insufficient cases to overcome the learning curve	3 (5.9)	17 (14.3)	0.067
Other reasons	1 (1.7)	5 (4.2)	0.665[a]

Values are presented as number (%). Multiple responses were allowed for the barriers, but no duplicate responses were given.
IIA, intracorporeal ileocolic anastomosis.
[a]Fisher exact test.

Table 5. Expectations regarding the increasing popularity of IIA

Variable	Group with IIA experiences (n = 59)	Group without IIA experiences (n = 119)	P-value
Strongly agree	6 (10.2)	5 (4.2)	0.170[a]
Agree	22 (37.3)	31 (26.1)	
Neutral	21 (35.6)	50 (42.0)	
Disagree	9 (15.3)	30 (25.2)	
Strongly disagree	1 (1.7)	3 (2.5)	

Values are presented as number (%).
IIA, intracorporeal ileocolic anastomosis.
[a]Fisher exact test.

Table 6. Plans to attempt or transition to IIA

Variable	Group with IIA experiences (n = 59)	Group without IIA experiences (n = 119)	P-value
Strongly agree	11 (18.6)	9 (7.6)	0.002[a]
Agree	25 (42.4)	42 (35.3)	
Neutral	16 (27.1)	36 (30.3)	
Disagree	7 (11.9)	22 (18.5)	
Strongly disagree	0 (0)	10 (8.4)	

Values are presented as number (%).
IIA, intracorporeal ileocolic anastomosis.
[a]Fisher exact test.

Table 7. Assistance needed for attempting IIA

Variable	Group with IIA experiences (n = 59)	Group without IIA experiences (n = 119)	P-value
Advanced technology	1 (1.7)	11 (9.2)	0.006[a]
Self-sufficiency	26 (44.1)	36 (30.3)	
Proctorship and discussion for the initial cases	18 (30.5)	48 (40.3)	
Training programs and lectures	14 (23.7)	23 (19.3)	
Others	0 (0)	1 (0.8)	

Values are presented as number (%).
IIA, intracorporeal ileocolic anastomosis.
[a]Fisher exact test.

according to the HIRA's 7th colorectal cancer appropriateness assessment, institutions performing >100 surgeries (n = 52, 22.4%) accounted for the majority of cases (n = 14,709, 80.4%), whereas institutions performing <10 surgeries (n = 96, 41.4%) accounted for only a small portion of cases (n = 343, 1.9%). These findings indirectly suggest that physicians from larger medical institutions perform the majority of cases, which is consistent with the results of the present study. A direct comparison with the present study is not possible as no previous study has investigated the experience of IIA. However, the ratio of IIA to EIA in a recent review was 47.7% (n = 2,123) *vs.* 52.3% (n = 2,327) [11], indirectly indicating that the respondents with IIA experience were likely to perform a relatively higher number of surgeries, considering the correlation observed in the present study (Cramér's V analysis).

The use of the IIA technique in RHC is technically challenging and time-consuming [16]. Even experienced IIA respondents showed a preference for EIA in the present study, which may be attributed to the aforementioned reasons. A preference for the isoperistaltic configuration over the antiperistaltic configuration and stapled side-to-side anastomosis over hand-sewn side-to-side anastomosis was also observed. The preference for the isoperistaltic configuration may be attributed to the familiarity of the respondents with performing an isoperistaltic configuration and stapled side-to-side anastomosis during EIA procedures [17]. The preference for hand-sewn closure in the common channel in stapled side-to-side anastomosis could be attributed to various factors [18,19], in particular, the significant contribution of barbered suture technology. The preference for the periumbilical area as the specimen extraction site following IIA in RHC may be driven by the requirement for maintaining the cosmetic benefit provided by IIA.

Compared with EIA, IIA is associated with shorter extraction site incisions, fewer postoperative complications, and lower rates of conversion to open surgery, anastomotic leakage, surgical site infection, and incisional hernia [11]. Comparisons between the reasons cited by respondents with and without IIA experience for favoring IIA were made in the present study. Respondents without IIA experience cited the lack of benefits as the primary reason for not attempting this technique, whereas those with IIA experience cited the reduction in the incidence of postoperative complications for favoring this technique, thereby justifying its implementation. However, the factors traditionally associated with the benefits of IIA, such as reduced colonic mobilization and improved cosmesis, showed no statistically significant differences among the respondents. This finding indicates that these factors had no significant influence on the decision of the respondents to adopt IIA in the present study. Comparisons between the responses of the respondents with and without IIA experience revealed no statistically significant differences in terms of reasons for not performing IIA. 'Concerns regarding anastomosis leakage' and 'concerns regarding intraabdominal contamination' accounted for more than half of the responses for not performing IIA. However, contrary to these concerns, previous studies have shown that evidence suggesting that IIA increases anastomotic leakage and intraabdominal infection is lacking or very limited [11,20,21]. Furthermore, preoperative bowel preparation may aid in avoiding these complications.

Both groups had relatively disappointing expectations in the present study, with fewer than half of the responses being positive regarding the increasing popularity of IIA in the future. However, respondents with IIA experience showed a more positive inclination toward attempting or transitioning to IIA in the future, with an increased proportion expressing willingness. Thus, these findings suggest that respondents may favor IIA over EIA in select cases, rather than all cases. Respondents with IIA experience may favor self-sufficiency, whereas respondents without IIA experience may find proctorship and discussion from experienced peers helpful in their initial cases. This finding indicates that after learning the IIA technique, surgeons can master the technique via their own development efforts.

One limitation of the present study is its reliance on the data collection methods. The reliance on the subjective opinions of the respondents may lead to biased results. Furthermore,

factors such as the recollection, preferences, and attitudes of the respondents can influence the outcomes. Another limitation of the present study is the representativeness of the sample and its generalizability. Surveys targeting specific groups or regions may not be applicable to the entire population or all clinical scenarios. Furthermore, the answers of the respondents may not be complete or accurate, which can distort the results. Lastly, the survey findings only demonstrated the observed correlations and did not confirm causality.

The survey results provide valuable insights into the current perceptions and practices related to IIA among colorectal surgeons in South Korea. These surgeons prefer IIA over EIA in select cases rather than all patients. A recent study, early outcomes from the MIRCAST (Minimally Invasive Right Colectomy Anastomosis Study), which demonstrated no difference in postoperative outcomes between IIA and EIA [22], further supports the adoption of IIA in selective cases. These findings open avenues for further research to define the optimal selection criteria to maximize the benefits of this technically and educationally demanding procedure.

SUPPLEMENTARY MATERIALS

Supplementary Material 1 can be found via https://doi.org/10.4174/astr.2024.107.2.59.

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Conflict of Interest

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

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