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Improving the management and outcomes of complex non-pedunculated colorectal polyps at a regional hospital in British Columbia

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Abstract

Background Colorectal cancer arises from precancerous lesions, primarily adenomatous and serrated polyps. Some polyps pose significant technical endoscopic challenges due to their size, location, and/or morphology. A standardized protocol for documentation and management of these polyps can optimize clinical outcomes.

Methods A Quality Improvement project compared patients with a complex polyp (non-pedunculated, > 2 cm), for 12 months prior and 12 months after protocol introduction. Documentation and polyp management details were compared pre- and post-implementation using the Chi-square test.

Results 69 patients were diagnosed with complex polyps prior to the protocol introduction and 72 after. 79% (112/141) of patients underwent endoscopic mucosal resections (EMR) locally, and 14.9% (21/141) underwent surgery locally. After protocol introduction, there was significant improvement in documentation of suspicious appearing polyps (21.7% to 47.2%, $P = 0.001$), luminal circumference (14.5% to 34.7%, $P = 0.005$), and management plans (87.0% to 97.2%, $P = 0.023$); other elements of documentation were similar. The number of patients reviewed at multidisciplinary conference (MDC) increased from 1 to 61% ($P < 0.005$). Patients rebooked in a 1 h endoscopy time slot increased from 19 to 58% ($P < 0.005$), as did specific consent for EMR from 22 to 57% ($P < 0.005$). Among patients with polyps 3 cm or greater (23 pre, 36 post), MDC review increased from 4 to 67% ($P < 0.005$), primary polypectomy decreased from 72 to 23% ($P = 0.001$), patients rebooked in a double endoscopy slot increased from 33 to 75% ($P = 0.005$), and specific consent increased from 39 to 75% ($P = 0.014$). There were less polyp recurrences (12/42 pre and 1/50 post) among the post-protocol cohort ($P < 0.001$).

Conclusions The introduction of a formalized protocol for complex polyp adjudication and management has led to improved documentation, multidisciplinary discussion, and optimal complex polyp management with dedicated time for EMR, particularly for polyps over 3 cm. There is room for improvement, and this can be approached in a collaborative manner.

Keywords General surgery · Community surgery · Endoscopy · Complex polyp · Polypectomy

In 2022, it is estimated that 24,300 Canadians will be diagnosed with colorectal cancer, and 9400 of these people will die from the disease; this represents 11% of all cancer-related deaths in the country [1]. Given this, screening recommendations by the Canadian Task Force on Preventive Health Care aim to reduce deaths from colorectal cancer by disrupting the adenoma-carcinoma sequence by detecting and removing polyps and/or early stage cancers [2]. Colorectal cancer generally arises from precancerous lesions, primarily adenomatous and serrated polyps that can be directly visualized and removed via colonoscopy [3]. However, the effectiveness of screening is largely dependent on the ability to carry out polypectomy. While the majority are easily and safely removed, some polyps pose significant technical challenges due to their size, location, and/or morphology [3]. Waye describes advanced polypectomy to include not only large polyps (defined as those 20 mm or above), but those

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that are difficult to access and require special maneuvers for removal, including sessile polyps [4]. Gallegos-Orozco and Gurudu describe that 10–15% of polyps can be described as "difficult", and that up to 10–15% of large polyps harbor invasive carcinoma [5]. They describe that an endoscopist should reflect on the following two questions when identifying a large polyp: "Is the polyp benign?" and, if so, "Is the polyp amenable to endoscopic removal?" It is recommended that any doubt regarding the benign nature of the polyp or ability to safely resect it endoscopically should prompt the endoscopist to abort the procedure. The British Society of Gastroenterology/Association of Coloproctologists of Great Britain and Ireland recommend thorough lesion assessment and multidisciplinary review of all complex polyps [6]. Given this, our objective is to review the management and outcomes of complex non-pedunculated colorectal polyps before and after the implementation of a protocol for these polyps at our hospital.

Materials and methods

This Quality Improvement project took place at Vernon Jubilee Hospital, a community hospital with 196 inpatient beds in Vernon, British Columbia, Canada. VJH receives referrals from the North Okanagan region. The project was screened for ethics by our local health authority with the ARECCI tool [7, 8], and it was deemed that a formal ethics review was not required given its low-risk nature. A formal standardized protocol for the management of complex non-pedunculated colorectal polyps was initiated at our hospital in October 2021, based on the Cancer Care Ontario Regional-Level Guidance on the Management of Complex Polyps [9]. This entails multidisciplinary review for every complex polyp and standardized documentation and removal guidelines. The Cancer Care Ontario guidelines were developed by expert therapeutic endoscopists and colorectal surgeons across Ontario. The protocol recommends documentation of the following datapoints: demographics, polyp size, polyp location, polyp morphology, suspicious appearance, circumference of bowel lumen involved, whether or not a photo was taken, whether or not a biopsy was performed and, if so, the pathology result, tattoo application and location, date of multidisciplinary discussion, and management plan. Six general surgeons and one gastroenterologist performed all of the colonoscopies at our centre.

Patients with complex polyps were reviewed for 12 months prior to the introduction of the protocol in October 2021 and 12 months after. We defined a complex polyp as any sessile polyp greater than or equal to 2 cm. Recurrent and pedunculated polyps were excluded from the study. All patients had adenomatous polyps, and all cancers were excluded. The charts for these patients were reviewed and the following information was collected: sex; age; date of index colonoscopy; primary or recurrent polyp; polyp location; size; morphology (according to the Paris classification [9]); suspicious appearance; circumference of bowel lumen involved; whether or not a photo was taken; whether or not a biopsy was performed and, if so, the pathology result; tattoo application and location; date of multidisciplinary discussion; and management plan. In terms of management plan, the following outcomes were recorded: if the polyp was removed at the index colonoscopy; if a MDC discussion was convened; if an endoscopic mucosal resection (EMR) was rebooked in a double endoscopy slot; or if a specific consent for EMR was obtained. Details on the EMR technique or surgery were also captured.

The multidisciplinary team, met once weekly to discuss complex polyps, consisting of general surgeons, a gastroenterologist, and a pathologist. When needed, a radiologist and medical oncologist attended the meeting. Endoscopists were encouraged to present every patient with a complex polyp to determine the most appropriate disposition: proceed with endoscopic mucosal resection locally, refer to tertiary center for endoscopic mucosal resection, perform surgery locally, or refer to tertiary center for surgery.

Statistical analysis

All statistical analyses were performed using Excel v16.66.1 and Stata 17.0. Polyp documentation and management details were summarized and compared between pre- and post-protocol implementation groups using the Chi-square test and student *t* tests where applicable.

Results

Before implementation of the protocol, out of a total of 3508 colonoscopies between October 2020 and September 2021, there were 1985 that had polypectomy. Out of these, 69 patients had a complex polyp that met the criteria for inclusion. After implementation of the protocol, a total of 4033 colonoscopies were performed between October 2021 and September 2022 with 2275 polypectomies. In the post-protocol period, 72 patients met the criteria. In the pre-protocol group, 36 of 69 (52.2%) patients were female and the average age was 68 years old. In the post-protocol group, 35 of 72 (48.6%) patients were female and the average age was 70 years old. Of the 69 pre-protocol patients, 57 underwent EMR, 10 had surgical resection and 2 were referred to a regional expert. Of the 72 post-protocol patients, 55 underwent EMR, 11 had surgical resection, 4 were referred to a regional expert, and 2 were observed (Fig. 1).

Most patients (43%) had polyps between 2–3 cm and 26% were 3–4 cm (Fig. 2). Most polyps are located in the cecum

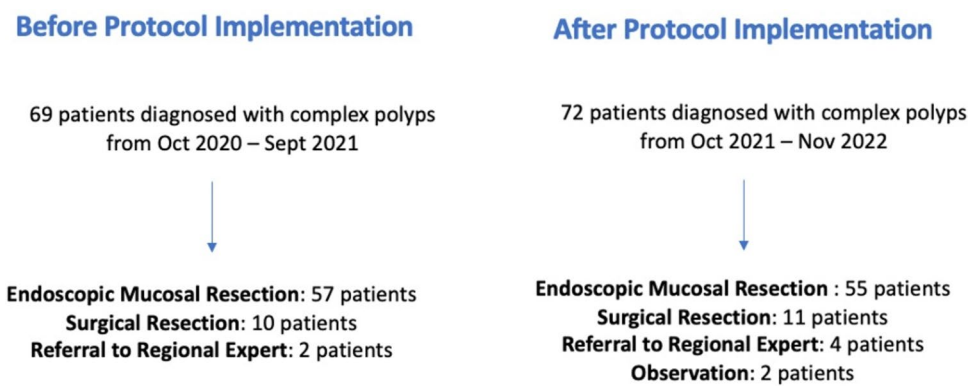

Fig. 1 Patient management before and after implementation of polyp adjudication protocol

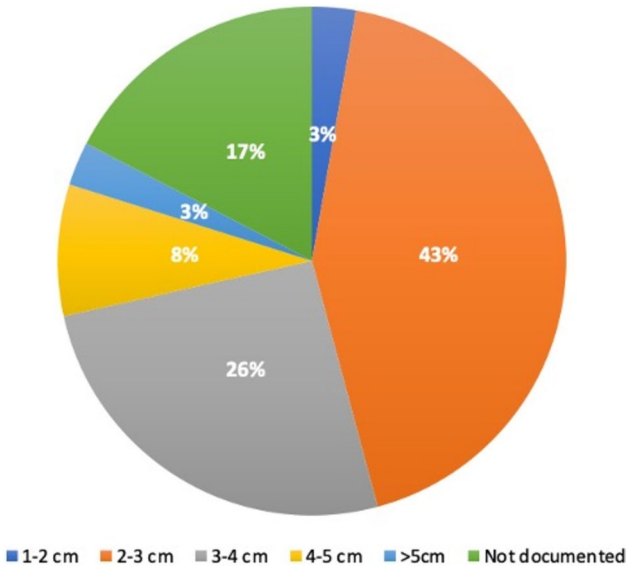

Fig. 2 Distribution of polyp sizes among entire cohort ($n=141$)

(26%) and ascending colon (35%) (Fig. 3). The 69 pre-protocol patients had polyps in the following locations: 21 cecum, 22 ascending colon, 6 transverse colon, 10 descending colon, 10 rectum. Their polyps ranged from 2 to 5 cm. The 72 post-protocol patients had polyps in the following locations: 22 cecum, 19 ascending colon, 16 transverse colon, 5 descending colon, 10 rectum. Their polyps ranged from 2 to 7 cm.

After the protocol was introduced, there was a significant improvement in documentation of suspicious appearance of polyps (21.7% to 47.2%, $P=0.001$), luminal circumference (14.5% to 34.7%, $P=0.005$), and management plans (87.0% to 97.2%, $P=0.023$). Other elements of documentation including primary versus recurrent polyp, location, photograph taken, polyp size, biopsy taken, tattoo applied, and morphology were similar pre- and post-protocol (Table 1).

The number of patients reviewed at multidisciplinary conference (MDC) increased from 1 to 61% ($P<0.005$). Polypectomies performed at the index colonoscopy decreased post-protocol from 84 to 39% ($P<0.005$). Patients rebooked for EMR in a 1 h double endoscopy time slot increased from 19 to 58% ($p<0.005$) and those giving a specific consent for EMR improved from 22 to 57% ($P<0.005$) (Table 2). Among patients with polyps 3 cm or greater (23 pre, 36 post), MDC review increased from 4 to 67% ($P<0.005$), primary polypectomy decreased from 72 to 23% ($P=0.001$), patients rebooked in a double endoscopy slot increased from 33 to 75% ($P=0.005$), and specific consent increased from 39 to 73% ($P=0.014$) (Table 3). Although not statistically significant, there was a reduction in the number of patients with polyps over 3 cm requiring surgery after the protocol, from 26 to 16% ($P=0.381$) (Table 3).

For patients who underwent dedicated EMR at a second colonoscopy, there were no significant differences in average procedure time, complete removal or complication rate (zero in both groups) and from a technical perspective we found an increase in the use of cold avulsion (11.1% to 60.6%, $P=0.008$) (Table 4). For patients who underwent primary polypectomy at the index colonoscopy, there was a significant increase in use of Eleview from 62.5 to 86.3% ($P=0.043$), use of clips (27.1% to 72.7%, $P=0.001$), cold avulsion (4.2% to 27.2%, $P=0.005$) and use of purastat (2.1% to 22.7%, $P=0.004$). There was no significant difference in average procedure time, special consent obtained for EMR, complete removal, or complication rate (zero in both groups) (Table 5). Follow-up colonoscopies were formed in 42 of the 69 (60.9%) pre-protocol patients and 50 of the 72 (69.4%) post-protocol patients. The 27 patients in the pre-protocol group 22 patients in the post-protocol group who did not have a follow-up colonoscopy either declined, have a follow-up colonoscopy planned in 3 years, or had surgery for their polyp, and thus will have a follow-up scope later. There were 16 of 42 (38.1%) polyp recurrences in the pre-protocol cohort, and of these 4 of the polyps were small and completely excised at the time of the follow-up colonoscopy. In the post-protocol cohort, 15 of 50 (30%) patients had polyp recurrences and 14 of these polyps were small and completely excised at the time of the follow-up colonoscopy. When excluding

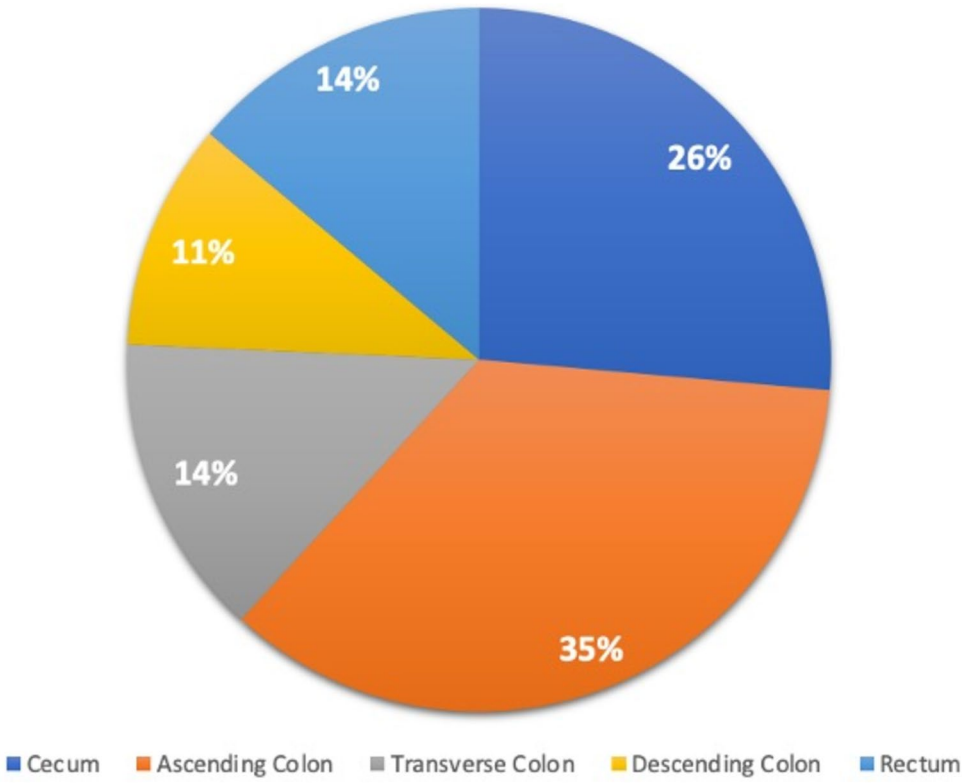

Fig. 3 Distribution of polyp locations among entire cohort ($n=141$)

Table 1 Polyp documentation before and after protocol implementation

	Pre-protocol ($n=69$)	Post-protocol ($n=72$)	*P* value
Primary vs. recurrent	100% (69)	100% (72)	1.000
Polyp location	100% (69)	100% (72)	1.000
Photograph taken	88.4% (61)	91.7% (66)	0.517
Polyp size	76.8% (53)	87.5% (63)	0.097
Biopsy taken	33.3% (23)	45.7% (32)	0.176
Tattoo applied	52.2% (36)	41.7% (30)	0.211
Suspicious appearance	21.7% (15)	47.2% (34)	**0.001**
Circumference	14.5% (10)	34.7% (25)	**0.005**
Morphology	82.6% (57)	80.6% (58)	0.753
Management plan	87.0% (60)	97.2% (70)	**0.023**

Bold value indicates statistical significance

small, completely excised recurrent polyps, there is a significant difference in recurrence rates between the pre- and post-protocol groups ($P<0.001$) (Table 6).

Patients who underwent surgical resection either had polyps not amenable to endoscopic resection or had multiple other polyps in addition to the complex polyp. In the pre-protocol group, 10 patients underwent surgical resection (5 transanal minimally invasive surgery, 1 ileocolic resection, 3 right hemicolectomies, 1 low anterior resection). In the post-protocol group, 11 had surgical resection (5 transanal minimally invasive surgery, 1 transanal endoscopic microsurgery, 2 ileocolic resections, 3 right hemicolectomies).

Discussion

With increasing colorectal cancer screening, the detection of complex polyps, defined in our study as any sessile polyp greater than or equal to 2 cm, will likely increase. With this, advanced endoscopic techniques are allowing endoscopists to push the limits for resection. While this is certainly beneficial for patients who can then avoid surgery, safety must be a priority. In order to provide safe and effective care for patients with complex polyps, our group implemented a formal standardized protocol for the management of complex non-pedunculated colorectal polyps in October 2021, based on the Cancer Care Ontario Regional-Level Guidance on the Management of Complex Polyps [9]. There are several techniques for endoscopic mucosal resection (EMR) including injection-assisted EMR, cap-assisted EMR, ligation-assisted EMR and underwater EMR [10]. Of these, injection-assisted is the most commonly used, which entails injection of a lifting solution (such as Eleview) into the submucosal space [10]. These techniques can be used for en-bloc (completely removing the polyp in one piece) or piecemeal (removing parts of the polyp piece by piece until it is completely removed) resections. At our center, piecemeal injection-assisted EMR (with Eleview) is the

Table 2 Polyp management before and after protocol implementation

	Pre-protocol ($n=69$)	Post-protocol ($n=72$)	*P* value
Multidisciplinary conference review	1% (1)	61% (45)	**< 0.005**
Endoscopic mucosal resection	84% (48/57)	39% (22/55)	**< 0.005**
Rebooked in 1-h slot	19% (11/57)	58% (33/55)	**< 0.005**
Specific consent for EMR	22% (12/57)	57% (32/55)	**< 0.005**
Surgery	14% (10)	15% (11)	0.896
Referred to regional expert	3% (2)	6% (4)	0.435
Observation	0	3% (2)	0.163

Bold value indicates statistical significance

Table 3 Polyps over 3 cm, before and after protocol implementation

	Pre-protocol ($n=23$)	Post-protocol ($n=36$)	*P* value
Multidisciplinary conference review	4% (1)	67% (24)	**< 0.005**
Endoscopic mucosal resection	72% (13/18)	23% (6/28)	**0.001**
Rebooked in 1-h slot	33% (6/18)	75% (21/28)	**0.005**
Specific consent for EMR	39% (7/18)	75% (21/28)	**0.014**
Surgery	26% (6/23)	16% (6/36)	0.381
Referred to regional expert	9% (2/23)	3% (1/36)	0.313
Observation	0	3% (1/36)	–

Bold value indicates statistical significance

Table 4 Outcomes of dedicated EMR, before and after protocol implementation

	Pre-protocol ($n=9$)	Post-protocol ($n=33$)	*P* value
Average procedure time (min)	37.6	44	0.855
Special consent for EMR	100% (9/9)	100% (33/33)	1.000
Clear cap	44.4% (4/9)	42.4% (14/33)	0.914
Eleview	88.9% (8/9)	97.0% (32/33)	0.313
Cold snare	55.6% (5/9)	70.0% (23/33)	0.425
Hot snare	55.6% (5/9)	48.4% (16/33)	0.707
Cold avulsion	11.1% (1/9)	60.6% (20/33)	**0.008**
Soft coagulation	0% (0/9)	12.1% (4/33)	0.272
Argon plasma coagulation	0% (0/9)	0% (0/33)	–
Purastat	9% (2/9)	24.2% (8/33)	0.900
Hemospray	0% (0/9)	0% (0/33)	–
Clips	55.6% (5/9)	70.0% (23/33)	0.425
Complete removal	100% (9/9)	93.9% (31/33)	0.449
Complication	0% (0/11)	0% (0/30)	–

Bold value indicates statistical significance

Table 5 Outcomes of primary polypectomy, before and after protocol implementation

	Pre-protocol ($n=48$)	Post-protocol ($n=22$)	*P* value
Average procedure time (min)	34.5	37.7	0.815
Special consent for EMR	6.3% (3/48)	0% (0/22)	0.231
Clear cap	2.1% (1/48)	0% (0/22)	0.495
Eleview	62.5% (30/48)	86.3% (19/22)	**0.043**
Cold snare	25% (12/48)	36.3% (8/22)	0.329
Hot snare	75% (36/48)	72.7% (16/22)	0.658
Cold avulsion	4.2% (2/48)	27.2% (6/22)	**0.005**
Soft coagulation	2.1% (1/48)	4.5% (1/22)	0.566
Argon plasma coagulation	6.3% (3/48)	0% (0/22)	0.231
Purastat	2.1% (1/48)	22.7% (5/22)	**0.004**
Hemospray	0% (0/48)	0% (0/22)	–
Clips	27.1% (13/48)	72.7% (16/22)	**0.001**
Complete removal	93.8% (45/48)	100% (22/22)	0.231
Complication	0% (0/48)	0% (0/22)	–

Bold value indicates statistical significance

most commonly used technique. We found no complications among our study cohort; thus, this technique is safe at our community hospital.

After the protocol was introduced, there was a significant improvement in documentation of suspicious appearance of polyps, luminal circumference, and management plans. In addition, the number of patients reviewed at multidisciplinary conference increased significantly, which in turn led to a decrease in the number of complex polypectomies preformed at the index colonoscopy. It has been well

Table 6 Post-polypectomy recurrences, before and after protocol implementation

	Pre-protocol ($n=42$)	Post-protocol ($n=50$)	P value
Total polyp recurrence	16/42 (38.1%)	15/50 (30%)	0.608
Polyp recurrence excluding small completely excised polyps at follow-up scope	12/42 (28.6%)	1/50 (2%)	**< 0.001**

Bold value indicates statistical significance

established in surgical disciplines that oncologic patients significantly benefit from multidisciplinary review, as it can lead to drastic changes in their management and also confer a survival benefit [11, 12]. Our results show that multidisciplinary review of patients with complex polyps similarly lead to changes in their management. Management plans for our patients often changed based on multidisciplinary discussion though the frequency of this was not captured by this study. This was one of the most significant changes in patient care following implementation of the protocol. Patients were rebooked in a 1-h time slot and special informed consent was obtained prior to polypectomy. This allows time for the endoscopist to ensure a complete resection and gives patients the opportunity to ask questions about a procedure that has a higher risk than "standard" colonoscopy [13]. The number of patients with polyps over 3 cm needing surgery decreased from 26 to 16%, though this was not statistically significant, likely owing to small sample size. This is clinically significant and highlights the advantages of EMR pushing boundaries.

For patients who underwent dedicated EMR and primary polypectomy, we found increase in the use of cold avulsion in both groups, and increased use of Eleview, clips, and purastat in the primary polypectomy group. There was otherwise no significant difference in average procedure time, complete removal or complication rate. The polyp recurrence data is incomplete given the timing of follow-up colonoscopies and our analysis; however, we found a significant difference in recurrences of polyps pre- and post-protocol after excluding small recurrent polyps that were completely excised at the time of follow-up colonoscopy. This is critical since it shows that this protocol led to improved patient outcomes, rather than solely improved adherence to a protocol.

All endoscopists were given their individual results before and after protocol implementation to reflect on. Limitations of this study include the observational and retrospective nature of the study, small sample size, incomplete recurrence data, and individual differences in endoscopist documentation and practices. Future directions include an audit to ensure that documentation and management continue to improve. Also, we plan to conduct a follow-up project to include polyp pit pattern description (according to the NICE and JNET classification systems) [14, 15] into colonoscopy reporting and management.

Conclusion

The introduction of a formalized protocol for complex polyp adjudication and management at our regional hospital has led to improved documentation, multidisciplinary discussion, and optimal management of complex polyps with dedicated appropriate time for endoscopic mucosal resection, particularly for polyps over 3 cm. Outcomes suggest that this technique is safe in the community setting in appropriately selected patients. This protocol has led to improved patient outcomes, with less polyp recurrences after protocol implementation. There is still room for improvement, especially with documentation, and this can be approached in a collaborative manner with the endoscopist group.

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Data availability The data for this study is available upon request from the corresponding author.

Declarations

Disclosures Lina Cadili, Michael Horkoff, Scott Ainslie, Brian Chai, Jeffrey S. Demetrick, Karl Langer, Kevin Wiseman and Hamish Hwang have no conflicts of interest or financial ties to disclose.

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