

Will purposely seeking detect more colorectal polyps than routine performing during colonoscopy?

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Abstract

Background & Goals: We observed that the number of colorectal polyps found intraoperatively was often higher than that encountered preoperatively during elective colonoscopic polypectomy. To evaluate whether more polyps can be detected when they are purposely sought than when they are routinely examined during colonoscopy.

Materials and methods: Patients undergoing colonoscopy were randomized into groups A and B. Before colonoscopy was performed, endoscopists were instructed to seek polyps for group A purposely but not for group B. Polypectomy was electively completed. In groups A and B, the cases of elective polypectomy were named groups AR and BR, including groups AR-1 and BR-1, during the first colonoscopy and groups AR-2 and BR-2 during the second colonoscopy for polypectomy, respectively. The following data were calculated: the number of polyps detected (NPD) and the polyp detection rate (PDR) in all cases and the number of polyps missed (NPM) and partial polyp miss rate (PPMR) in the cases of colorectal polyps.

Results: A total of 419 cases were included in group A, 421 in group B, 43 in group AR, and 35 in group BR. No significant differences in PDR were found between groups A and B and in PPMR between groups AR-1 and BR-1 ($P > .05$), although PPMR in group AR-1 was higher than in group AR-2 ($P < .05$), similar results were found in PPMR between groups BR-1 and BR-2 ($P < .05$).

Conclusion: Purposely seeking for colorectal polyps did not result in more polyps detected compared with routine colonoscopy.

Abbreviations: ADR = adenoma detection rate, AI = artificial intelligence, BBPS = Boston bowel preparation scale, ICC = interval colorectal cancer, NPD = the number of polyps detection, NPM = the number of polyps missed, PDR = polyp detection rate, defined as the number of cases of colorectal polyps found in every 100 colonoscopies, PMR = polyp miss rate, defined as the number of cases of colorectal polyps missed in every 100 colonoscopies, PPMR = partial polyp miss rate, defined as the number of cases of partial polyps missed in every 100 cases of colorectal polyps, SPD = the size of polyps detection, SPM = the size of polyps missed.

Keywords: colonoscopy, partial polyp miss rate, polyp detection rate, screening colonoscopy

Editor: Muhammad Tarek Abdel Ghafar.

The authors have no conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

Project Number 2016WS0637, Study and application of potential factors to improve the detection rate of adenoma in colonoscopy, Medical and health science and Technology Development Plan of Shandong Province

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How to cite this article: Chu Y, Zhang J, Wang P, Li T, Jiang S, Zhao Q, Liu F, Gao X, Qiao X, Wang X, Song Z, Liang H, Yue J, Linghu E. Will purposely seeking detect more colorectal polyps than routine performing during colonoscopy? *Medicine* 2020;99:42(e22738).

Received: 28 December 2019 / Received in final form: 8 September 2020 / Accepted: 15 September 2020

<http://dx.doi.org/10.1097/MD.00000000000022738>

1. Introduction

Colorectal cancer usually originates from a small neoplastic polyp, which gradually increases in size and is accompanied by dysplasia and malignancy.^[1,2] Moreover, missed colorectal polyps in colonoscopy have been progressively recognized as a significant cause of interval colorectal cancer (ICC).^[3,4] Therefore, colorectal polyp detection rate (PDR) or adenoma detection rate (ADR) has gradually become an important parameter for evaluating the quality of colonoscopy.^[5-9] In the endoscopic clinical practice, obtaining the corresponding pathological data of all polyps is difficult; thus, PDR is a more practical approach compared with ADR.^[6,8,10-12] Therefore, improving PDR and decreasing polyp miss rate (PMR) have become our aims during colonoscopy. During elective colonoscopic polypectomy, we observed an interesting phenomenon: the number of colorectal polyps found intraoperatively was often higher than that encountered preoperatively. As such, we conducted the present study to determine whether more colorectal polyps can be detected by purposely seeking them compared with routine colonoscopy.

2. Materials and methods

2.1. Grouping and design

From August 9, 2016 to January 5, 2018, patients undergoing colonoscopy were randomized into groups A and B. In group A, the endoscopists were instructed to seek colorectal polyps purposely before performing colonoscopy. In group B, colonoscopy was performed without the above implications. In group A, patients with colorectal polyps for elective endoscopic removal were named as group AR, which was named as group AR-1 during the first colonoscopy. They were named as group AR-2 during the second colonoscopy for polypectomy. In accordance with the above rules, groups BR, BR -1, and BR-2 were named. This study was conducted with the approval of the Weihai Municipal Hospital Ethics Committee. Before the endoscopic procedures were initiated, every patient signed informed consent.

2.2. Inclusion and exclusion criteria

Cases involving emergency colonoscopy, inflammatory bowel disease, history of colorectal surgery, history of colorectal polyp resection, and less than 18 years of age were not enrolled. Colonoscopy cases that did not reach the ileocecal were also excluded.

2.3. Anesthesia

All explorations were performed under intravenous anesthesia with sufentanil followed by propofol. Loss of eyelash reflex indicated successful induction of anesthesia, thereby prompting the endoscopists to commence with the procedures. Colonoscopy and colonoscopic polypectomies were performed by 16 endoscopists.

2.4. Bowel preparation score

Boston bowel preparation scale (BBPS) was used to evaluate bowel preparation.^[13–15]

2.5. Parameter acquisition

The following data were prospectively collected: sex, age, weight, height, single/double operating colonoscopy, BBPS, intubation time, withdrawal time, and the number and size of polyps. The characteristics of endoscopists included colonoscopy operation period, average annual colonoscopy cases, and total colonoscopy cases. The number of polyps detected (NPD) and the polyp detection rate (PDR) in all cases and the number of polyps missed (NPM) and partial polyp miss rate (PPMR) in the cases of

colorectal polyp were calculated. PDR is defined as the number of cases of colorectal polyps found in every 100 cases of colonoscopy. PPMR is defined as the number of cases of partial polyps missed in every 100 cases of colorectal polyps. PPMR was obviously different from PMR. PMR is defined as the number of cases of colorectal polyps missed in every 100 colonoscopies. The actual total number of polyps in patients involves the number of polyps found pre-polypectomy and polypectomy intraoperatively.

2.6. Statistical analysis

Quantitative variables were expressed as mean ± standard deviation. The *t*-test was used for testing the significance between quantitative variables, and χ^2 -test was used to detect the significant differences between qualitative variables. Kolmogorov–Smirnov test was used to verify the normal distribution of quantitative data. Wilcoxon rank sum test was used for non-normally distributed data. *P*-value less than .05 was considered significant.

3. Results

3.1. General information

A total of 1390 patients met the inclusion criteria, and 550 patients were not included in the study. A total of 419 patients were enrolled in group A, 421 in group B, 43 in group AR, and 35 in group BR.

3.2. Patient features

No differences in terms of sex, age, weight, and height were found between groups A and B, groups AR-1 and BR-1, and groups AR-2 and BR-2 (*P* > .05). The above data are shown in Tables 1 and 4.

3.3. Endoscopists' characteristics

In terms of endoscopist's colonoscopy operation period, average annual colonoscopy cases, and total colonoscopy cases, no differences were found between groups A and B, AR-1 and BR-1, AR-2 and BR-2, AR-1 and AR-2, and BR-1 and BR-2 (*P* > .05, Tables 1 and 4).

3.4. Colonoscopy operation-related parameters

In terms of single/double operating colonoscopy, withdrawal time, and intubation time, no differences were observed between groups A and B, AR-1 and BR-1, AR-2 and BR-2, AR-1 and AR-2, and BR-1 and BR-2 (*P* > .05). No significant differences were

Table 1
The general characteristics of patients and endoscopists in the studied groups.

	Gender		Age	Weight	Height	ECOP (min)			EAACC (n)	ETAC (n)
	F	M				<5	5-10	≥10		
Group A	200	219	52.11	68.62	166.25	63	89	267	347	1733
Group B	192	229	52.29	67.73	166.34	54	94	273	342	1708
Group AR1	20	23	55.56	71.92	167.33	4	7	32	335	1676
Group BR1	20	15	53.26	73.86	168.83	3	5	27	383	1912
Group AR2	20	23	55.56	71.92	167.33	3	8	32	366	1828
Group BR2	20	15	53.26	73.86	168.83	2	4	29	402	2010

EAACC = endoscopist's average annual colonoscopy cases, ECOP = endoscopist's colonoscopy operation period, ETAC = endoscopist's total colonoscopy cases.

Table 2
The colonoscopy operation-related parameters in the studied groups.

	CO		BBPS (score)			IT (min)					WT (min)		
	SOC	DOC	0-3	4-6	7-9	<5	5-10	10-20	20-30	≥30	<6	6-9	≥9
Group A	128	291	27	233	159	125	194	76	18	6	146	139	134
Group B	110	311	25	203	193	129	188	84	13	7	171	128	122
Group AR1	20	23	3	24	16	14	17	7	3	2	5	24	14
Group BR1	13	22	5	18	12	6	20	8	1	0	8	15	12
Group AR2	18	25	1	9	33	13	20	8	2	0	2	7	34
Group BR2	14	21	0	7	28	10	19	5	1	0	2	8	25

BBPS=Boston bowel preparation score, CO=colonoscopy operation, DOC=double operating colonoscopy, IT=intubation time, SOC=single operating colonoscopy, WT=withdrawal time.

Table 3
The polypectomy-related parameters in the studied groups.

	PDR	NPD	SPD (cm)			PPMR	NPM	SPM (cm)		
			<0.5	0.5-1	≥1			<0.5	0.5-1	≥1
Group A	41.77%	501	157	204	140	-	-	-	-	-
Group B	42.76%	494	181	200	113	-	-	-	-	-
Group AR1	-	137	30	38	69	44.19%	73	42	27	4
Group BR1	-	66	8	50	8	57.41%	66	56	8	2
Group AR2	-	202	23	65	114	9.30%	7	4	1	2
Group BR2	-	129	23	83	21	8.57%	3	0	3	0

NPD=the number of polyps detection, NPM=the number of polyps missed, PDR=polyp detection rate, PPMR=partial polyp miss rate, SPD=the size of polyps detection, SPM=the size of polyps missed.

found in BBPS between groups A and B, AR-1 and BR-1, and AR-2 and BR-2 ($P > .05$). However, significant differences were observed between AR-1 and AR-2 and BR-1 and BR-2 ($P < .05$, Tables 2 and 4).

3.5. PDR, NPD, SPD, PPMR, NPM, and SPM

No significant differences were observed in terms of PDR, NPD, and SPD between groups A and B; PPMR, NPM, and SPM between groups AR-1 and BR-1; and PPMR, NPM, and SPM

between groups AR-2 and BR-2 ($P > .05$). PPMR in group AR-1 was higher than that in group AR-2 ($P < .05$), and similar results were found in PPMR between group BR-1 and BR-2 ($P < .05$). The differences in NPD, SPD, NPM, and SPM in AR-1 and AR-2 ($P > .05$) were not significant. However, significant differences were observed in NPD, NPM, and SPM in BR-1 and BR-2 ($P < .05$). However, no significant differences were found in SPD between groups BR-1 and BR-2 ($P > .05$). The above data are shown in Tables 3 and 4. Besides, whether the diameter of the

Table 4
Main statistical results of each group.

Variable	Groups A vs B		Groups AR-1 vs BR-1		Groups AR-2 vs BR-2		Groups AR-1 vs AR-2		Groups BR-1 a vs BR-2	
	Statistic	P	Statistic	P	Statistic	P	Statistic	P	Statistic	P
Gender	$\chi^2=0.382$	0.537	$\chi^2=0.873$	0.350	$\chi^2=0.873$	0.350	-	-	-	-
Age	$t=-0.195$	0.845	$t=0.900$	0.371	$t=0.900$	0.371	-	-	-	-
Weight	$t=1.238$	0.216	$t=-0.619$	0.538	$t=-0.619$	0.538	-	-	-	-
Height	$t=0.501$	0.616	$t=-0.807$	0.422	$t=-0.807$	0.422	-	-	-	-
CO	$\chi^2=2.021$	0.155	$\chi^2=0.694$	0.405	$\chi^2=0.028$	0.868	-	-	-	-
BBPS	$Z=-0.168$	0.866	$Z=-0.619$	0.536	$Z=-0.393$	0.695	$Z=-3.639$	<0.001	$Z=-3.988$	<0.001
IT	$Z=-0.076$	0.940	$Z=-0.593$	0.553	$Z=-0.257$	0.797	-	-	-	-
WT	$Z=-1.568$	0.117	$Z=-0.501$	0.617	$Z=-0.758$	0.448	-	-	-	-
ECOP	$Z=-0.518$	0.604	$Z=-0.268$	0.789	$Z=-0.859$	0.391	$Z=-0.062$	0.950	$Z=-0.607$	0.544
EAACC	$Z=-0.445$	0.656	$Z=-1.541$	0.123	$Z=-1.200$	0.230	$Z=-0.540$	0.589	$Z=-0.238$	0.812
ETAC	$Z=-0.445$	0.656	$Z=-1.541$	0.123	$Z=-1.200$	0.230	$Z=-0.540$	0.589	$Z=-0.238$	0.812
PDR	$\chi^2=0.084$	0.772	-	-	-	-	-	-	-	-
NPD	$Z=-0.337$	0.736	$Z=-1.295$	0.195	$Z=-0.539$	0.590	$Z=-0.672$	0.502	$Z=-2.928$	0.003
SPD	$Z=-0.004$	0.996	$Z=-0.324$	0.746	$Z=-0.560$	0.575	$Z=-0.701$	0.484	$Z=-0.008$	0.994
PPMR	-	-	$\chi^2=1.296$	0.255	$\chi^2=0.013$	0.911	$\chi^2=13.354$	<0.001	$\chi^2=18.714$	<0.001
NPM	-	-	$Z=-0.230$	0.818	$Z=-1.323$	0.186	$Z=-1.206$	0.228	$Z=-1.990$	0.047
SPM	-	-	$Z=-0.429$	0.668	$Z=-0.592$	0.554	$Z=-0.869$	0.385	$Z=-2.298$	0.022

BBPS=Boston bowel preparation score, CO=colonoscopy operation, EAACC=endoscopist's average annual colonoscopy cases, ECOP=endoscopist's colonoscopy operation period, ETAC=endoscopist's total colonoscopy cases, IT=intubation time, NPD=the number of polyps detection, NPM=the number of polyps missed, PDR=polyp detection rate, PPMR=partial polyp miss rate, SPD=the size of polyps detection, SPM=the size of polyps missed, WT=withdrawal time.

Table 5
The impact of polyp size on polypectomy-related parameters in the studied groups.

Variable	<0.5cm				≥ 0.5cm			
	Groups A vs B		Groups AR-1 vs BR-1		Groups A vs B		Groups AR-1 vs BR-1	
	Statistic	P	Statistic	P	Statistic	P	Statistic	P
NPD	Z = -1.256	0.209	Z = -0.535	0.593	Z = -0.945	0.345	Z = -1.987	0.047
PPMR	-	-	$\chi^2 = 0.582$	0.333	-	-	$\chi^2 = 0.845$	0.358
NPM	-	-	Z = -0.470	0.638	-	-	Z = -0.632	0.527
SPM	-	-	$\chi^2 = 1.000$	0.467	-	-	Z = -0.246	0.806

NPD = the number of polyps detection, NPM = the number of polyps missed, PPMR = partial polyp miss rate, defined as the number of cases of partial polyps missed in every 100 cases of colorectal polyps, SPM = the size of polyp polyps missed.

polyp was less or greater than 0.5 cm did not lead to significant differences in PDR between groups A and B in NPD and PPMR, NPM, and SPM between groups AR-1 and BR-1 ($P > .05$, Table 5).

4. Discussion

Colorectal polyps are rarely accompanied by symptoms before canceration other than occasional stool abnormalities. Therefore, current research focuses on increasing PDR and decreasing PMR during colonoscopy, thereby reducing the incidence of colorectal cancer and even ICC.^[3,7-9,16]

Many studies have been conducted on colorectal polyps. Similarly, many instruments and technological innovations, such as the advent of endocuff,^[17,18] third eye retroscope,^[19-21] high definition endoscopy,^[22-25] full-spectrum endoscopy,^[26,27] and a variety of chromoendoscopy,^[28-30] have been developed. To improve PDR, some endoscopists add a transparent cap in front of the colonoscope^[31] or use water-aided colonoscopy.^[32-34] In addition, a few reports have focused on the effects of bowel preparation on improving PDR.^[35-39] Several studies have explored the correlation between the features of colonoscopy operators, including endoscopists and nurses, and PDR.^[40-42] Besides, much research has been devoted to the control of withdrawal time.^[43-50]

The above studies explored the objective factors related to colonoscopy. The results showed that several elements, such as adequate bowel preparation and withdrawal time of more than 6 minutes, have contributed to improving PDR.^[40]

However, whether endoscopists subjectively affect PDR during colonoscopy and the different levels of focus of the operators that may cause different PDR are factors that must be considered. We often detect new polyps by chance in the second colonoscopy for polypectomy. As such, questions, such as “Was the first colonoscopy conducted carelessly?”, “Did the focus of the second colonoscopy lead to such result?”, and “Will purposely seeking colorectal polyps increase detection rate compared with routine colonoscopy?”, may arise.

Our study showed that partial data were almost consistent with our expectations. First, the interesting phenomena found in our previous clinical practices were statistically confirmed by our study. The number of polyps removed in the second colonoscopy was significantly higher than that found in the first colonoscopy. This finding was supported by the significantly higher number of NPD in BR-2 compared with BR-1. However, the differences in NPD between AR-1 and AR-2 were not significant. Unfortunately, our findings indicated that the differences in NPD between groups A and B were not significant. Purposely seeking colorectal polyps did not decrease PPMR compared with routine performance during colonoscopy. No significant differences in PPMR

and NPM were found between AR-1 and BR-1. In other words, purposely seeking colorectal polyps did not increase PDR and reduce PPMR compared with routine colonoscopy. This result is not consistent with those of other studies showing that focusing on detecting polyps may help doctors improve ADR. Madhoun et al reported that video recording may help endoscopists increase ADR.^[51]

The differences in NPD and SPM between AR-1 and AR-2 were not significant. Although no significant differences were found in SPD between BR-1 and BR-2, significant differences were observed in SPM in the two groups. However, this finding does not suggest that additional focus may result in a significant difference in sensitivity to polyps of different sizes. Further analysis indicated that a polyp diameter less than or greater than 0.5 cm had no significant effect on PDR between groups A and B in NPD, PPMR, NPM, and SPM between groups AR-1 and BR-1 (Table 5). Several polyps, which had been found in groups AR-1 and BR-1, were missed in groups AR-2 and BR-2. In other words, the polyps found in the first colonoscopy were not found in the second colonoscopy for removal. This result suggests that omission is unavoidable because “change blindness” and “inattention blindness” are common phenomena in science.^[40]

In our single-center study, PDR and reduction of the rate of polyp missed diagnosis in colonoscopy were not improved by purposely seeking polyps. The current trend in colonoscopy research is artificial intelligence (AI), and its application may serve as a promising direction. We are also conducting research on this topic. We hope that AI can help us observe more colorectal polyps and nip more cases of colorectal cancer in the bud.

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