

Clinical, endoscopic and pathological characteristics of colorectal polyps in elderly patients: Single-center experience

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Abstract. Increasing age is a risk factor for the development of colorectal adenomas and advanced adenomas. However, few studies have been published on the features of colorectal polyps in the elderly. The present study aimed to investigate the clinical, enteroscopic and pathological characteristics of colorectal polyps in Chinese elderly patients in a single center (The Central Hospital of Wuhan, Hubei, China). The endoscopic and pathological reports of colonoscopies performed in our center were retrospectively analyzed. A total of 7,795 consecutive patients referred for colonoscopy were evaluated between January 2013 and December 2014. Of the 297 who met the inclusion criteria, 279 polyps were observed in men and 230 in women. Of all the polyps, 263 were non-adenomatous polyps, 104 were non-advanced adenomas and 142 were advanced adenomas. 336 polyps were left-sided and 173 were right-sided. Polyps ≥ 10 mm were more likely to exhibit an adenomatous component and advanced features, and these findings continued to hold true when the size cut-off was set at 5 mm. The data shown in the present study have revealed that a significant number of polyps lie proximal to the splenic flexure. Thus, evaluation of the whole bowel is particularly important in elderly patients who are undergoing colonoscopy. In addition, the polyp size was associated with the presence of adenoma, and advanced component, diminutive and small polyps should not be ignored in elderly patients.

Introduction

Colorectal cancer (CRC) is the third most commonly diagnosed cancer in males and the second most commonly diagnosed

cancer in females, with over 1.3 million new cancer cases, and 693,900 mortalities, estimated to have occurred in 2012 (1). China, similarly to several other developing countries in Asia, has been experiencing a significant rise in the incidence of CRC over the recent decades (2-4).

It is widely accepted that the adenoma-carcinoma sequence represents the process by which most cases of CRC arise (5). Several studies have revealed that age is one of the most important influential factors for colorectal adenoma: An older age (≥ 65 years) is associated with a higher prevalence of adenoma and advanced adenoma (6,7). In addition, the prevalence of adenoma and advanced adenoma in persons 76-80 years of age is more than double that of persons aged 40-49 years (8). The comparatively high rate of incidence of adenomatous and advanced adenomatous polyps in the older population makes this group an important CRC screening target.

Features of polyps in the colorectum may affect the selection of screening and surveillance modalities for CRC (9). However, few studies have been published on the features of colorectal polyps in elderly. Therefore, the aim of the present study was to investigate the clinical, enteroscopic and pathological characteristics of colorectal polyps in Chinese elderly patients in a single center (The Central Hospital of Wuhan, Hubei, China).

Patients and methods

Study design and patients. The present retrospective study was based on the colonoscopic database information from all colonoscopic examinations performed at the Central Hospital of Wuhan, Hubei, China between January 2013 and December 2014. The study protocol was reviewed and approved by the Ethics and Research Committee of the Central Hospital of Wuhan.

For the analysis of the features of colorectal polyps in elderly patients, the following inclusion criteria were used: (1) the patient was ≥ 65 years of age; (2) the patient had received an endoscopic resection of colorectal polyps; (3) complete medical records were available. Exclusion criteria were as follows: i) the patient was < 65 years; ii) there was an absence of polyps; iii) the polyps were unresected (due to taking anticoagulant drugs, multiple comorbid conditions, income inadequacy or low social support), or the polyps were observed, but not

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retrieved (by reason of small, sessile, and proximal colon polyps); iv) the patients were suffering from melanosis coli, colorectal cancer, inflammatory bowel disease, active gastrointestinal bleeding or familial adenomatous polyposis; v) there was a history of colectomy or resection; vi) the colonoscopy did not reach the cecum; and vii) the bowel preparation was poor (semi-solid stool that could not be suctioned or washed away, and <90% of mucosal visualization) (10).

Procedures and definitions. Procedures were performed by 14 colonoscopists: Seven experienced colonoscopists, each of whom had performed in excess of 2,000 colonoscopies and had been in colonoscopy practice for >10 years, and seven less experienced colonoscopists, who had had 3-5 years of colonoscopy practice, during which each had performed between 300 and 500 colonoscopies. Our center used polyethylene glycol-electrolyte powder (PEG-ELP; WanHe Pharmaceutical Co., Ltd., Shenzhen, China) as a purgative for all patients who underwent a colonoscopy. Colonoscopies were performed following bowel preparation with 3 l PEG-ELP.

The colonoscopes used in the present study [an OLYMPUS GIF-XQ240 (Pro Scope Systems, Blue Ash, OH, USA) and a PENTAX EC-3890Fi (PENTAX Medical Co., Montvale, NJ, USA)] are both utilized in standard electronic colonoscopies. Additional technologies, including narrow band imaging and i-Scan, were not regularly used. Polypectomies were performed using standard biopsy forceps (for polyps <5 mm) or polypectomy snares for larger polyps (>5 mm). Polyp size was estimated by comparing a polyp to the fully opened biopsy forceps (7 mm in length; JHY-FB-23-180-O-O; Changzhou Jiahong Medical Instrument Co., Ltd., Changzhou, China) or polypectomy snares (15 mm in diameter; NOE342214-C; Endo-Flex GmbH, Voerde, Germany).

Precise characteristics of the colorectal polyps (i.e., number, size, form, and location) were documented in the colonoscopy reports by endoscopists.

Following polypectomy, the samples were sent to the pathology department of the Central Hospital of Wuhan, and processed for routine histological examination. Two experienced gastrointestinal pathologists evaluated the histopathology of the samples, and entered details of the histological features of polyps in the pathology reports.

All the demographic data, including the age and sex of the patients and information regarding the colorectal polyps, were collected from the endoscopy and pathology databases of our center. The indications for colonoscopy were reviewed manually from the medical files.

For the purpose of the present analysis, colorectal polyps were divided into two groups: The right-sided and left-sided lesions. Polyps located proximal to the splenic flexure were considered right-sided (including the cecum, ascending colon and transverse colon), whereas those that were distal to the splenic flexure were considered left-sided (including the descending colon, sigmoid colon and rectum).

In the present study, colorectal polyps were divided into two types based on their histological findings: Non-adenomatous polyps (NAPs; benign mucosa, inflammatory, hyperplastic, lymphoid, lipomatous, and so forth) and adenomatous polyps (APs; tubular, villous, tubulovillous, and serrated adenoma). APs were further grouped as non-advanced adenomas (NAAs)

and advanced adenomas (AAs). AAs were those possessing the following features: ≥ 10 mm in diameter, having villous or tubulovillous histology, having high-grade dysplasia (HGD), or any combination of these features (11).

The morphology of the colorectal polyps was determined according to the Paris classification, being classified into protruding lesions [elevated by >2.5 mm above the mucosal layer: Pedunculated (0-Ip), sessile (0-Is) or semipedunculated (0-Isp)], superficial lesions [slightly elevated by <2.5 mm (0-IIa), flat (0-IIb) or slightly depressed (0-IIc)], and laterally spreading tumors (LSTs) (12). The colorectal polyps were classified according to their size as follows: ≤ 5 mm, 6-9 mm, 10-20 mm and >20 mm.

Statistical analysis. All statistical analyses were performed using SPSS version 17.0 software (SPSS, Inc., Chicago, IL, USA) and GraphPad Prism version 5.0 (GraphPad Software Inc., San Diego, CA, USA). Fisher's exact test was used for between-group comparisons. $P < 0.05$ was considered to indicate a statistically significant difference.

Results

Between January 2013 and December 2014, a total of 7,795 consecutive patients undergoing colonoscopy at our center (The Central Hospital of Wuhan, Hubei, China) were retrospectively analyzed. A total of 7,498 patients were excluded who met the exclusion criteria, and therefore 297 patients were included in the present study (Fig. 1). The general characteristics of these patients are summarized in Table I. The mean age was 71.4 ± 5.2 years (range, 65-87 years); 149 (50.2%) of the patients were male and 148 (49.8%) were female, and 161 patients (54.2%) were aged 70 years or older.

The indications for colonoscopy examination included a change in bowel habit (24.2%), abdominal pain (19.5%), constipation (14.1%), rectal bleeding or hematochezia (10.1%), positive fecal occult blood (7.4%), regular health examination (7.1%), diarrhea (6.7%), abdominal distention (5.4%), and other less common indications, including melena, anus bulge, weight loss, anemia, an abdominal mass or anus fistula (Table II).

Altogether, a total of 509 colorectal polyps were resected from 297 patients. The histological findings are shown in Table III. Of all polyps, 263 (51.7%) were NAPs and 246 (48.3%) were APs. Of all the NAPs, 227 (44.6%) were inflammatory polyps, 24 (4.7%) were hyperplastic polyps, 6 (1.2%) were normal mucosa and 6 (1.2%) were others. Of all the APs, 104 (20.4%) were NAAs, and 142 (27.9%) were AAs. The histological finding of NAAs was tubular adenoma. The 142 AAs comprised 11 (2.2%) tubular adenomas, 14 (2.7%) villous adenomas, 115 (22.6%) tubulovillous adenomas and 2 (0.4%) serrated adenomas. Among the AAs, 9 (1.8%) polyps were noted to have HGD.

In men, 279 (54.8%) polyps were noted, of which 150 (29.5%) were NAPs, 52 (10.2%) were NAAs and 77 (15.1%) were AAs. In women, 230 (45.2%) polyps were noted, of which 113 (22.2%) were NAPs, 52 (10.2%) were NAAs and 65 (12.8%) were AAs. The number of colorectal polyps according to sex is shown in Fig. 2A. No association was identified between sex and the histological finding of colorectal polyps ($P > 0.05$; Fig. 2A).

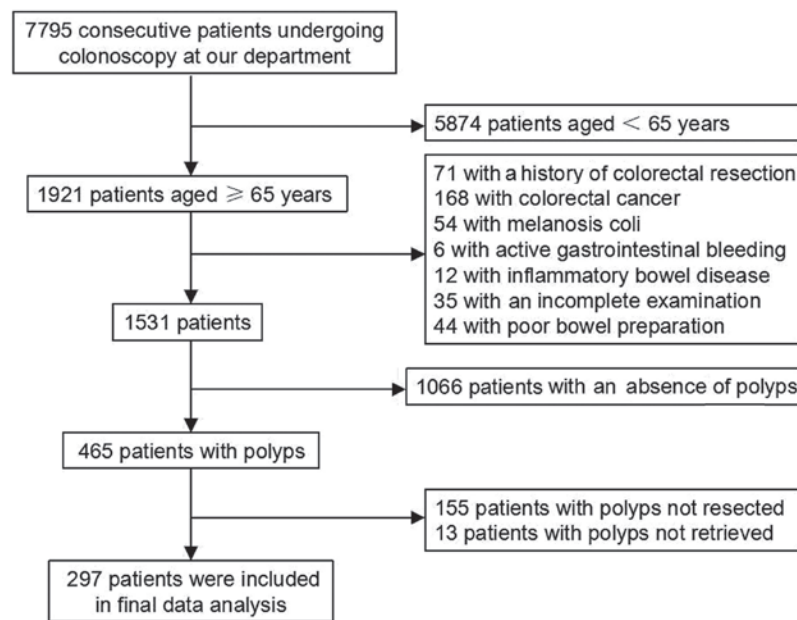


Figure 1. Flow diagram of the present study.

Of all the polyps, 242 (47.5%), 141 (27.7%), 84 (16.5%) and 42 (8.3%) were identified in patients of 65-69, 70-74, 75-79, and ≥ 80 years of age, respectively. A comparison of the polyps according to age, using 75 years as a cut-off, revealed that 36.5% (46/126) of the polyps in patients ≥ 75 years of age had an advanced feature compared with 25.1% (96/383) of those in patients aged 65-74 years ($P < 0.05$; Fig. 2B and Table IV), although there were no between-group differences in the frequency of NAPs and APs ($P > 0.05$; Fig. 2B and Table IV).

In the right-sided colon, 173 (34.0%) polyps were identified, of which 91 (17.9%) were NAPs, 39 (7.7%) were NAAs and 43 (8.4%) were AAs. In the left-sided colon, 336 (66.0%) polyps were identified, of which 172 (33.8%) were NAPs, 65 (12.8%) were NAAs and 99 (19.4%) were AAs. The number of colorectal polyps according to distribution is shown in Fig. 3. There was no association between distribution and the histological findings of colorectal polyps ($P > 0.05$; Fig. 3A). It is worth noting that the sigmoid colon was the most frequent site for the three different types of polyps, and the rectum, ascending colon and rectum were the second most frequent site for NAPs, NAAs, and AAs, respectively (Fig. 3B).

In terms of morphology, the colorectal polyps could be classified as follows: 27 (5.3%) were type 0-Ip, 49 (9.6%) were type 0-Isp, 327 (64.2%) were type 0-Is, 96 (18.9%) were type 0-IIa, and 10 (2.0%) were LSTs. No completely flat or depressed lesions (type 0-IIb or 0-IIc) were noted. The morphological appearance of polyps according to the Paris classification is shown in Fig. 4A. It was identified that the sessile type (0-Is) appeared the most frequently for the three different histological features of polyps (Fig. 4A).

Regarding the polyps' size, 330 (64.8%) were ≤ 5 mm in terms of their greatest dimension, 108 (21.2%) were 6-9 mm, 60 (11.8%) were 10-20 mm, and 11 (2.2%) were > 20 mm. The size of the polyps according to the histopathological findings is described in Fig. 4B. A comparison of polyps by size, using 10 mm as a cut-off, revealed that larger polyps were more likely to exhibit an adenomatous component, and tended to be advanced.

Approximately 40.9% (179/438) of the polyps < 10 mm in size had an adenomatous component, compared with 94.4% (67/71) of those ≥ 10 mm ($P < 0.0001$; Fig. 4B and Table V). In addition, only 17.1% (75/438) of the polyps that were < 10 mm in size had an advanced feature, compared with 94.4% (67/71) of those ≥ 10 mm ($P < 0.0001$; Fig. 4B and Table V). Similar findings were also observed when the size cut-off was set at 5 mm. Only 33.0% (109/330) of the polyps ≤ 5 mm in size had an adenomatous component, compared with 76.5% (137/179) of those 6 mm or larger ($P < 0.0001$; Fig. 4B and Table V). Furthermore, only 14.8% (49/330) of the polyps ≤ 5 mm in size had an advanced feature, compared with 52.0% (93/179) of those 6 mm or larger ($P < 0.0001$; Fig. 4B and Table V).

Discussion

The present study has retrospectively analyzed the clinical, endoscopic and pathological characteristics of colorectal polyps in Chinese elderly patients over a period of two years through the analysis of endoscopic and pathology reports in a single center (The Central Hospital of Wuhan, Hubei, China).

In the present study, it was observed that there were no specific clinical symptoms in older patients with colorectal polyps, and the majority of patients presented with changes in bowel habit or other symptoms, including abdominal pain, constipation, rectal bleeding or hematochezia, and positive fecal occult blood, which was similar to findings reported in other retrospective studies (13,14).

An advancing age is an independent risk factor for developing colorectal adenomas, which may lead to higher rates of colorectal cancer in the elderly (7). In one study, the prevalence of colorectal adenomas increased markedly with age among participants aged 20-79 years, although the increase was more marked for AAs (15). In the present study, the AAs were more common in patients ≥ 75 years of age, compared with patients who were 65-74 years of age, but the incidence of APs was

Table I. General characteristics of the elderly patients studied.

Characteristic	Results
Number of patients	297
Sex	
Male	149
Female	148
Age (years)	
65-69	136
70-74	83
75-79	51
≥80	27
Age range (years)	65-87
Mean age (years)	71.4±5.2 ^a

^aData are shown as the mean ± standard deviation of the mean.

Table II. Indications for colonoscopy examinations.

Indication	Number of patients
Rectal bleeding or hematochezia	30
Positive fecal occult blood	22
Constipation	42
Diarrhea	20
Abdominal pain	58
Abdominal distention	16
Change in bowel habit	72
Melena	6
Anus bulge	3
Weight loss	3
Anemia	2
Abdominal mass	1
Anus fistula	1
Regular health examination	21
Total	297

not significantly associated with age, perhaps due to a more selective and smaller sample size, or other biases.

Data published in recent studies have revealed that males had a greater likelihood of developing a larger number of APs and AAs compared with females (15,16), whereas in the present study, no significant differences were observed between the sexes. The findings of the present study are similar to those reported in a previous study by Yamaji *et al* (17), who reported that sex was not to be considered as an independent risk factor for the development of advanced colorectal adenomas (17). This may be due to the small sample size in the present study, or an increasing risk in women as they grow older.

The present study has shown that left-sided colorectal polyps were more prevalent than right-sided ones, a finding that is in agreement with previous studies (18,19). In the present study, APs and AAs were detected predominantly in

Table III. Histopathological features of the 509 colorectal polyps.

Histopathology of resected polyps	Result (%)
Non-adenomatous polyps	263 (51.7)
Inflammatory polyp	227 (44.6)
Hyperplastic polyp	24 (4.7)
Normal mucosa	6 (1.2)
Other	6 (1.2)
Adenomatous polyps	246 (48.3)
Non-advanced adenomas	104 (20.4)
Tubular adenoma	
Size <10 mm with LGD	104 (20.4)
Advanced adenomas	142 (27.9)
Tubular adenoma	11 (2.2)
Size <10 mm with HGD	1 (0.2)
Size ≥10 mm with LGD	10 (2.0)
Villous adenoma	14 (2.7)
Tubulovillous adenoma	115 (22.6)
With LGD	107 (21.0)
With HGD	8 (1.6)
Serrated adenoma	
Size ≥10 mm with LGD	2 (0.4)
Total	509 (100)

LGD, low-grade dysplasia; HGD, high-grade dysplasia.

Table IV. Histopathological features of 509 polyps according to the patients' age.

Histopathology	Patient age		P-value
	65-74 years N (%)	≥75 years N (%)	
NAPs	196 (38.5)	67 (13.2)	>0.05
APs	187 (36.7)	59 (11.6)	
NAAAs	91 (17.8)	13 (2.6)	<0.05
AAs	96 (18.9)	46 (9.0)	

NAPs, non-adenomatous polyps; NAAAs, non-advanced adenomas; AAs, advanced adenomas.

the sigmoid colon, although there was also a significant number of colon polyps and adenomas lying proximal to the splenic flexure. Flexible sigmoidoscopy is recommended as a possible alternative to colonoscopy (20), in which the distal 40-60 cm of the colon (up to the splenic flexure) may be inspected. It is anticipated that examination of the colon limited to the splenic flexure would have 'missed' 34% of the proximal polyps in our subjects. The incidence of adenomatous polyps in the proximal colon, as well as AAs, has increased in the last few years (16). In addition, Patel *et al* (18) reported that there

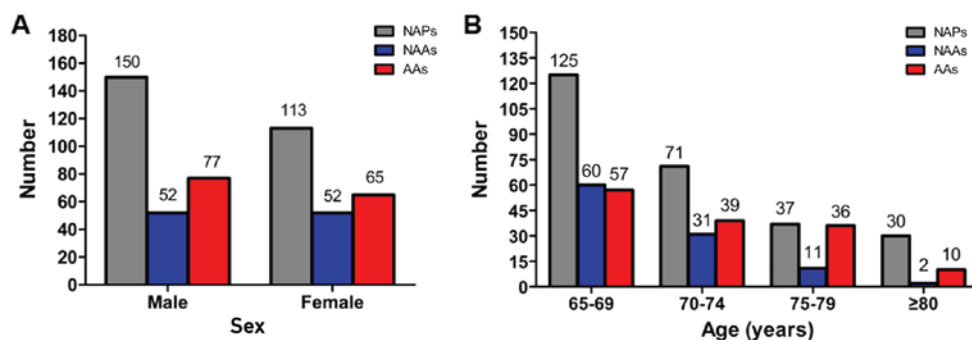


Figure 2. Bar diagram showing the frequency of resected polyps by sex and age. (A) Frequency of colorectal polyps according to the patient's sex. (B) Frequency of colorectal polyps according to the patient age. NAPs, non-adenomatous polyps; NAAs, non-advanced adenomas; AAs, advanced adenomas.

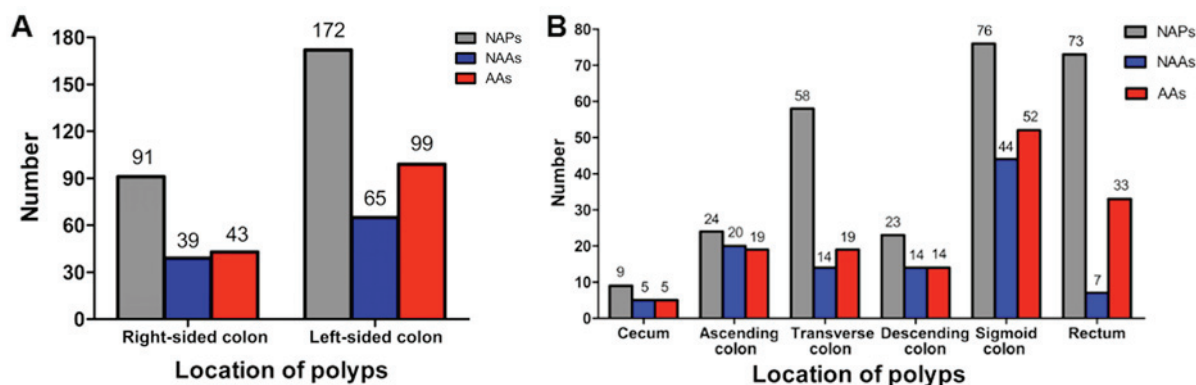


Figure 3. Bar diagram showing the frequency of resected polyps according to their location. (A) Frequency of colorectal polyps in the right-sided and left-sided colon. (B) Frequency of colorectal polyps by anatomical distribution. NAPs, non-adenomatous polyps; NAAs, non-advanced adenomas; AAs, advanced adenomas.

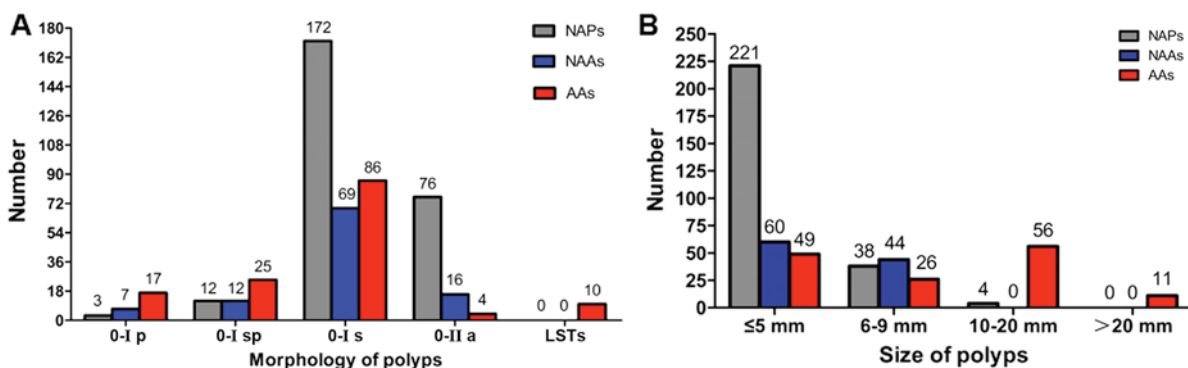


Figure 4. Bar diagram showing the frequency of resected polyps by morphology and size. (A) Frequency of colorectal polyps according to morphological appearance. (B) Frequency of colorectal polyps according to size. NAPs, non-adenomatous polyps; NAAs, non-advanced adenomas; AAs, advanced adenomas.

was an increased right-sided prevalence of adenoma or carcinoma with age. It is clear that evaluation of the whole bowel is particularly important in older patients. However, during daily practice, increasing adverse complications, poorer bowel preparation and more incomplete examinations are observed in older patients undergoing colonoscopy for diagnostic, screening and surveillance purposes (21). In this case, the colonoscopy test for the elderly should be addressed to the whole colon, in preference to methods that evaluate only a part of the colon according to specific factors, such as an elderly patient's comorbid medical conditions, cognitive ability and mobility.

In the present study, sessile type (0-Is) appeared the most frequently for the three different histological features of polyps. No flat and depressed lesions (0-IIb and 0-IIc) were identified in the present study. The possible reasons for this were poorer bowel preparation, and a less frequent use of dye-chromoendoscopy, such as indigo carmine, or electronic chromoendoscopy, such as the i-Scan procedure (22-24).

Diminutive (1-5 mm in size) and small (6-9 mm in size) colorectal polyps represent the majority of polyps that are identifiable during colonoscopy (25,26). A study from Taiwan revealed that 1.3% of the diminutive polyps had an advanced histology (25). Chaput *et al* (27) demonstrated an advanced

Table V. Histopathological features of the 509 polyps according to polyp size.

Histopathology	Polyp size (N, %) ^a		P-value	Polyp size (N, %) ^b		P-value
	0-9 mm	≥10 mm		0-5 mm	≥6 mm	
NAPs	259 (50.9)	4 (0.8)	<0.0001	221 (43.4)	42 (8.3)	<0.0001
APs	179 (35.1)	67 (13.2)		109 (21.4)	137 (26.9)	
NAAs	104 (20.4)	0 (0)	<0.0001	60 (11.8)	44 (8.6)	<0.0001
AAs	75 (14.7)	67 (13.2)		49 (9.6)	93 (18.3)	

^aSize cut-off set as 10 mm; ^bsize cut-off set as 5 mm. NAPs, non-adenomatous polyps; APs, adenomatous polyps; NAAs, non-advanced adenomas; AAs, advanced adenomas.

histology in 4.7% of the diminutive, and 35.2% of the small polyps, mainly due to presence of a villous component (27). Shapiro *et al* (28) determined that 4.1% of the diminutive polyps contained a villous component, and the rate of advanced histology for small polyps was >15% (28). In a systematic review by Hassan *et al* (29), AAs were identified in 4.6% of diminutive polyps, 7.9% of small polyps, and 12.5% of sub-centimetre (<10 mm) polyps. The observations in the present study revealed that 14.8% of the diminutive polyps, 24.1% of the small polyps, and 17.1% (75/438) of sub-centimetre polyps had an advanced histology, findings that were similar to those previously reported by Tsai *et al* (30). In that study, which included patients aged 40-89 years, the prevalence of AAs was 10% in polyps ≤5 mm, and 27% in polyps 6-9 mm in size (30). The prevalence of an advanced histology in diminutive and small colorectal polyps may vary widely in different studies, and it was suspected by the present authors that the contributing factors would possibly include sample size, the demographics of the screened population, the geographic environment, and dietary habits. In the present study, it was important to note that an increasing polyp size was associated with an increased likelihood of adenoma and advanced histology when the size cut-off for polyps was set at 5 mm or 10 mm. Therefore, one may conclude that diminutive and small colorectal polyps should not be ignored in older people, and for patients with multiple medical comorbidities, a failure to remove those polyps may place the elderly at risk of progression to advanced lesions and CRC.

A histopathological examination is considered as a gold standard for polyp characterization, and it is essential to recommend a surveillance interval following colonoscopy screening and polypectomy (31). However, the requirement for a post-polypectomy histological assessment leads to a substantial exploitation of medical and economic resources (32). In recent years, a 'resect and discard' strategy based on the findings of image-enhanced endoscopy (e.g., high-definition endoscopy, magnifying endoscopy and chromoendoscopy) for diminutive colorectal polyps has been proposed to save both the time and cost of histopathology (33-36). However, there are several barriers to applying this strategy in the clinical practice of the present authors. First, as the cost for a pathology examination (\$31 per specimen) is relatively inexpensive in Wuhan, according to the regulation of Medicare payment system, there would be no substantial economic benefit compared with

Europe and America. Secondly, current medical legal regulation in China does not allow such management in clinical practice. The standard of medical care remains to submit resected polyps for pathological assessment according to the corresponding expert consensus (37). Thirdly, high-definition endoscopy, magnifying endoscopy, dye-chromoendoscopy and electronic chromoendoscopy [e.g., narrow band imaging (NBI) and i-Scan] have not been used routinely in the clinical practice of the present authors. Considering the development and widespread use of available modern image-enhanced endoscopy, it is anticipated that the 'resect and discard' strategy may be used only by our endoscopists trained with an appropriate diagnostic method in the near future.

There are certain limitations associated with the present study. First, since a single-center retrospective study was performed, as the study subjects did not include adequate numbers of patients from other regions, any generalization of the results was limited by the small sample size and certain bias. The effect of possible confounding factors, such as geographic distribution, diet, physical activity, socioeconomic status and comorbid medical conditions, should be considered. In addition, image-enhanced endoscopy (e.g. high-definition colonoscopy, dye-chromoendoscopy and electronic chromoendoscopy) might have markedly increased the detection of small and flat polyps (22-24); small or flat lesions may occasionally also have been missed due to insufficient technical imaging methods in the present study. Therefore, the study requires replication in other centers, and with multiple technical imaging methods by experienced users.

In conclusion, the present study has revealed that a significant number of colorectal polyps lie proximal to the splenic flexure. Therefore, an evaluation of the whole bowel is particularly important in colonoscopy for the elderly. In addition, since polyp size was associated with the presence of adenoma and an advanced component, the present authors consider that diminutive and small colorectal polyps should not be ignored in elderly patients, in order to decrease the prevalence of advanced lesions and CRC.

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