

## Original Article

# Clinical and endoscopic-pathological characteristics of colorectal polyps: an analysis of 1,234 cases

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**Abstract:** Purpose: To analyze the correlation of clinical symptom and endoscopic-pathological characteristics of colorectal polyps. Methods: A retrospective study was performed on 1,234 continuous colorectal polyp patients. Their clinical, colonoscopic and pathological data were collected and analyzed. Results: In 1,234 patients, 46.0% cases were asymptomatic, and 54.0% cases were symptomatic, and the female to male ratio was 2.23:1 and 1.74:1, respectively ( $P = 0.048$ ). The mean polyp size in symptomatic group was significantly larger than asymptomatic group [ $7.6 \pm 5.1$  mm (95% CI: 7.2, 8.0) vs.  $6.3 \pm 3.7$  mm (95% CI: 6.0, 6.6),  $P < 0.001$ ]. Tubu-villous polyp and villous polyp occurred more frequently in symptomatic group, compared with asymptomatic group ( $P = 0.002$ ). In symptomatic group, 37.4% cases complained of abdominal pain and 62.6% cases complained of bowel habit alteration. The polyp number in abdominal pain group was larger than bowel habit alteration group ( $P = 0.036$ ). Three major symptoms of bowel habit alteration were diarrhea, constipation and hematochezia, with proportion of 54.2% (278/513), 27.7% (142/513) and 18.1% (93/513), respectively. The hematochezia group had larger polyp size than diarrhea group ( $P = 0.001$ ) and consisted of more villous component than the constipation patients ( $P = 0.005$ ). Conclusion: Almost half of colorectal polyp patients do not complain of bowel symptoms, especially the male. Colorectal polyp patients have bowel habit alteration more commonly than abdominal pain. Half of patients with bowel habit alteration demonstrate diarrhea. The hematochezia patients are more susceptible to advanced adenomas than the diarrhea and constipation ones.

**Keywords:** Colorectal polyps, bowel symptoms, analysis, advanced adenoma

## Introduction

Colorectal cancer (CRC), one of malignant neoplasms in digestive system, ranks the third most common malignant disorder and the 2<sup>nd</sup>-4<sup>th</sup> leading cause of cancer-related mortality in western developed countries and Southeast Asian [1, 2]. With the proposal of 'adenoma-carcinoma sequence' and 'the serrated pathway' theories [3, 4], an increasing attention has been paid to the relationship between colorectal polyps and CRC. As the most common pre-malignant disorder of the large bowel and colorectal polyps are often detected by the complaints of an arrays of bowel symptoms such as abdominal pain, diarrhea, constipation, hematochezia or general symptoms including anemia and lose weight, their detection rates range from 7.5% to 30.6% owing to

the above symptoms [5-9]. However, most patients do not have any discomfort in clinic, or even some symptoms cannot explain their states. As reported by Bafandeh et al [10], screening the asymptomatic patients is the most common manner of detecting colorectal polyps in Western countries. This study aimed to explore the association between clinical and endoscopic-pathological characteristics of colorectal polyps by analyzing their bowel symptoms, for knowing more about the predict value of bowel symptoms for diagnosing colorectal polyps.

## Materials and methods

### Subjects

This retrospective study was carried out in the Fifth Affiliated Hospital of Sun Yat-sen University

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**Table 1.** General and endoscopic-pathological characteristics of colorectal polyp patients

Index		N (%)	Remark
Gender	Male	815 (66.0)	Sex ratio: 1.95:1
	Female	419 (34.0)	
Age (years)	≤ 44	266 (21.6)	Range: 2-86 (54.4±12.4); Male: 54.8±12.5; Female: 53.6±12.3
	45-59	555 (50.0)	
	60-74	341 (27.6)	
	75-89	72 (5.8)	
Size (mm)	≤ 5	586 (47.5)	Range: 1-33 (7.0±4.5); 95 CI: 6.7, 7.2
	6-9	420 (34.0)	
	10-19	187 (15.2)	
	≥ 20	41 (3.3)	
Shape	Yamada I	812 (46.1)	
	Yamada II	605 (34.4)	
	Yamada III	208 (11.8)	
	Yamada III	208 (11.8)	
Polyp number	Single polyp	405 (32.8)	2-5 polyps: 56.5; 6-10 polyps: 24.4; ≥ 11 polyps: 11
	Multiple polyps	829 (67.2)	
Location	Left side	1447 (66.4)	
	Right side	347 (15.9)	
	Transverse side	384 (17.6)	
Histology	Hyperplastic polyp	577 (45.0)	Tubular (75.6); Tubu-villous (22.2); Villous (2.2)
	Adenomatous polyp	67 (52.7)	
	Others	30 (2.3)	

(Zhuhai, China). 1,234 continuous colorectal polyp patients who were admitted in this hospital and underwent total colonoscopy for all kinds of reasons between January 2007 and October 2013 were enrolled in this study. Patients whose bowel preparation were poor, who could not reach the distal of caecum, who was accompanied with CRC or diagnosed as colorectal polyps half a year ago due to the same symptom without treating, or who was diagnosed as hereditary colorectal polyps were excluded.

### *Data collection and grouping*

The clinical data (gender, age, and symptoms), colonoscopic data (polyp size, number, shape, location) and pathological data were collected. According to with or without symptoms, the patients were divided into asymptomatic and symptomatic groups. In symptomatic group, patients complained of abdominal pain or abdominal distention were grouped to abdominal pain, and those complained of diarrhea, constipation, hematochezia or mucous stool were grouped to bowel habit alteration.

### *Statistical analysis*

Statistical analysis was performed using SPSS 13 Statistical software (SPSS Inc., Chicago, IL, USA). The qualitative data was described by frequency and rate, and the quantitative data was expressed as mean and 95% confidence intervals (95% CI). Patient's characteristics (sex, age) and polyp characteristics (macroscopic features such as size, number and location and histological features) according to bowel symptoms were compared with the Pearson chi-square test, Fisher's exact test or Kruskal-Wallis H for qualitative variables, and with independent samples t test for quantitative variables. A two-tailed test was used for all, and significance was defined as a  $P < 0.05$ . For comparison between subgroups of the multi-group data,  $P$  value was adjusted according to the compared counts.

### **Results**

#### *Detection rate of colorectal polyps*

During the period from January 2007 to October 2013, there were 22,614 patients received

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**Table 2.** Distribution of general and endoscopic-pathological characteristics according to symptoms [n (%)]

Index		Asymptomatic (n = 568)	Symptomatic (n = 666)	P
Gender	Male	176 (31.0)	243 (36.5)	0.048
	Female	392 (69.0)	423 (63.5)	
Age (years)		54.19±11.18	54.58±13.38	0.577
Polyp size (mm, 95% CI)		6.3±3.7 (6.0,6.6)	7.6±5.1 (7.2,8.0)	< 0.001
Shape	Yamada I	392 (50.6)	420 (42.6)	< 0.001
	Yamada II	264 (34.1)	341 (34.6)	
	Yamada III	80 (10.3)	128 (13.0)	
	Yamada IV	39 (5.0)	97 (9.8)	
Polyp number	Single polyp	209 (36.8)	197 (29.6)	0.009
	Multiple polyps	359 (63.2)	469 (70.4)	
Location	Left side	664 (69.3)	764 (66.0)	0.102
	Right side	144 (15.0)	171 (14.8)	
	Transverse side	150 (15.7)	222 (19.2)	
Histology	Hyperplastic polyp	265 (47.2)	312 (43.2)	0.217
	Adenomatous polyp	287 (51.2)	389 (53.9)	
	Tubular	233 (81.2)	278 (71.5)	0.002
	Tubu-villous	52 (18.1)	98 (25.2)	
	Villous	2 (0.7)	13 (3.3)	

colonoscopy, and 6,161 colorectal polyp cases were detected, with detection rate of 27%. There were 1,295 colorectal polyp cases admitted in the hospital, from which 15 poor bowel preparation cases and 46 co-exist with CRC cases were excluded because their features such as polyp number, shape, location and size could not be described accurately. Therefore, 1,234 consecutive patients (aged 54.4±12.4 years) were included. The details of them were described in (Table 1).

### *Comparison between asymptomatic and symptomatic groups*

The distribution of general characteristics and polyp characteristics according to symptoms were summarized in Table 2. In this study, 568 patients (46.0%) were asymptomatic, and 666 patients (54.0%) were symptomatic, with sex ratio (female: male) of 2.23:1 and 1.74:1, respectively (P = 0.048). The mean polyp size in symptomatic group was significantly larger than asymptomatic group [7.6±5.1 mm (95% CI: 7.2, 8.0) vs. 6.3±3.7 mm (95% CI: 6.0, 6.6), P < 0.001]. Multiple polyps, and Yamada III and IV type shape were more common in symptomatic group. The returned pathological data showed that, the tubu-villous polyp and villous polyp occurred more frequently in symptomatic

group, compared with asymptomatic group (P = 0.002). However, no significant difference of age or lesion location between two groups (P > 0.05).

### *Comparison between abdominal pain and bowel habit alteration in symptomatic group*

In symptomatic group, 37.4% (294/786) patients complained of abdominal pain, and 62.6% (492/786) patients complained of bowel habit alteration. Except that the polyp number in abdominal pain group was larger than bowel habit alteration group (P = 0.036), no statistical difference was found in the gender, age, polyp size, shape, location or histology between two groups. The details were described in Table 3.

### *Comparison among diarrhea, constipation and hematochezia in bowel habit alteration*

Three major symptoms of bowel habit alteration were diarrhea, constipation and hematochezia, with proportion of 54.2% (278/513), 27.7% (142/513) and 18.1% (93/513), respectively. Females tended to be detected with constipation while the males tended to be detected with diarrhea or hematochezia (P = 0.019). The constipation group was elder than the other two groups (P = 0.001), while the hematochezia

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**Table 3.** Distribution of general and endoscopic-pathological characteristics according to bowel symptoms [n (%)]

Index		Abdominal pain (n = 294)	Bowel habit alteration (n = 492)	P
Gender	Male	184	190	0.737
	Female	110	302	
Age (years)	≤ 44	63 (21.4)	121 (24.6)	0.997
	45-59	129 (43.9)	191 (38.8)	
	60-74	85 (28.9)	142 (28.9)	
	75-89	17 (5.8)	38 (7.7)	
Polyp size (mm, 95% CI)	≤ 5	124 (42.2)	210 (42.7)	0.537
	6-9	111 (37.8)	163 (33.1)	
	10-19	50 (17.0)	89 (18.1)	
	≥ 20	9 (3.1)	30 (6.1)	
Shape	Yamada I	190 (42.7)	314 (43.2)	0.902
	Yamada II	158 (35.5)	244 (33.6)	
	Yamada III	55 (12.4)	96 (13.2)	
	Yamada IV	42 (9.4)	73 (10.0)	
Polyp number	Single polyp	72 (24.5)	155 (31.5)	0.036
	Multiple polyps	222 (75.5)	337 (68.5)	
Location	Left side	365 (64.8)	566 (63.7)	0.726
	Right side	88 (15.6)	153 (17.2)	
	Transverse side	110 (19.5)	169 (19.0)	
Histology	Hyperplastic polyp	147 (46.7)	219 (42.5)	0.287
	Adenomatous polyp	161 (51.1)	280 (54.4)	
	Tubular	115 (71.4)	199 (71.1)	0.946
	Tubu-villous	40 (24.8)	72 (25.7)	
	Villous	6 (3.7)	9 (3.2)	

group had more Yamada III and IV cases ( $P = 0.005$ ), with larger polyp size than diarrhea group ( $P = 0.001$ ), and consisted of much more villous component than constipation group ( $P = 0.005$ ). However, no significant difference was found among three groups with respect to polyp number, location or adenoma proportion (**Table 4**).

### Discussion

As an acknowledged premalignant disorder of CRC, the colorectal polyps have an increasing detection rate in recent years. In this study, there are 22,614 patients receiving colonoscopy, and 6,161 polyp cases are detected. The detection rate is 27%, which is higher than the results in previous study [11].

In clinic, the bowel symptoms often include abdominal pain, distension and bowel habit alteration. These symptoms often pull the clini-

cians to find further evidence for ruling out the intestine abnormality. Former study [12] shows that, CRC in the right side colon is often detected by general symptoms such as anemia while CRC in the left side is often detected by hemetochazia, diarrhea or constipation. However, when patients show these symptoms, it often means that the tumor has been at the later stage. In the past, only those adenomatous polyps are thought to have the chance to develop to malignant disorders. However, an increasing attention has been paid to the malignant potential of hyperplastic polyps in recent years, with the proposal of 'the serrated pathway' theory [3, 4]. As the most common premalignant disorder of CRC, adenomatous polyp or other polyps such as hyperplastic polyps often grow without any symptoms in their whole clinical course. Chen et al [13] report that, the detection rate of colorectal polyps in asymp-

tomatic population is 18.2%, while the adenoma detection rate reaches 25% in the average risk population as reported in Giacosa et al. study [14]. In our study, 1,234 cases are enrolled, and 46% are asymptomatic, which is higher than the reported literatures [7, 15, 16]. This phenomenon may be explained by reasons as following: Firstly, in this study we concentrate on the bowel habit and rule out those general symptoms such as anemia and lose weight. Secondly, the patients in the comparatively developed city with good medical insurance policy have high consciousness of health, and their regularly examination can detect a large proportion of polyps. Last but not least, it may remind that the colorectal polyp incidence increased with the improved living standard. The sex ratio (female: male) is 2.23: 1 for asymptomatic group and 1.74: 1 for symptomatic group, respectively ( $P = 0.048$ ). This may be explained by that females are more sensi-

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**Table 4.** Distribution of general and endoscopic-pathological characteristics according to bowel habit alteration [n (%)]

Index		Diarrhea (n = 278)	Constipation (n = 142)	Hematochezia (n = 93)	P
Gender	Male	105	68	28	0.019
	Female	173	74	65	
Age (years)	≤ 44	67 (24.1)	31 (21.8)	30 (32.3)	0.006
	45-59	119 (42.8)	40 (28.2)	33 (35.5)	0.001*
	60-74	79 (28.4)	53 (37.3)	23 (24.7)	0.001**
	75-89	13 (4.7)	18 (12.7)	7 (7.5)	0.15***
Polyp size (mm, 95% CI)	≤ 5	129 (46.4)	57 (40.1)	33 (35.5)	0.004
	6-9	95 (34.2)	51 (35.9)	23 (24.7)	0.203*
	10-19	43 (15.4)	30 (21.1)	22 (23.7)	0.031**
	≥ 20	11 (4)	4 (2.8)	15 (16.1)	0.001***
Shape	Yamada I	184 (45.8)	95 (45.9)	47 (30.7)	0.006
	Yamada II	132 (32.8)	70 (33.8)	53 (34.6)	0.982*
	Yamada III	53 (13.2)	25 (12.1)	27 (17.6)	0.005**
	Yamada IV	33 (8.2)	17 (8.2)	26 (17)	0.001***
Polyp number	Single polyp	86 (30.9)	45 (31.7)	29 (31.2)	0.887
	Multiple polyps	192 (69.1)	97 (68.3)	64 (68.8)	
Location	Left side	323 (64.7)	147 (61)	123 (66.1)	0.65
	Right side	82 (16.4)	44 (18.3)	34 (18.3)	
	Transverse side	94 (18.8)	50 (20.7)	29 (15.6)	
Histology	Hyperplastic polyp	132 (47.7)	63(42.9)	34 (33.7)	0.245
	Adenomatous polyp	145 (52.3)	82 (55.8)	56 (55.4)	0.016
	Tubular	102 (70.3)	63 (76.8)	30 (53.6)	0.29*
	Tubu-villous	38 (26.2)	17 (20.7)	24 (42.9)	0.005**
	Villous	5 (3.4)	2 (2.4)	2 (3.6)	0.032***

\*Diarrhea group vs. constipation group; \*\*Constipation group vs. hematochezia group; \*\*\*Diarrhea group vs. hematochezia group.

tive to symptoms than males, which means those symptoms are more likely to cause their attention to send for medical help. The asymptomatic polyps are smaller than the symptomatic polyps [6.3±3.7 mm (95% CI: 6.0, 6.6) vs. 7.6±5.1 mm (95% CI: 7.2, 8.0)], which means that polyps can cause clinical symptoms only when they develop to an extent size. However, those mini and small polyps can also developed to malignant polyps with a malignant rate of 1% and 3%, respectively [9]. As found by Church [17], 4% of adenomas less than 6 mm diameter and 16% of those between 6 and 10 mm have unfavorable histology. Small adenomas are still clinically significant and should not be ignored. Therefore, we should also pay attention to those asymptomatic polyps.

The bowel habit alteration includes diarrhea, constipation, hematochezia, mucous stool, and

so on. In these symptoms, the former three alterations occupy the highest proportion. As shown in this study, diarrhea is the most common symptom with a proportion of 54.2 percent (278/513). This may be explained by the fact that the majority of colorectal polyps are adenoma, in which especially the big ones can secrete a plenty of mucilage consisting of electrolytes or secrete some other substances that can cause secretory diarrhea. With respect to gender, the sex ratios for diarrhea, constipation and hematochezia group are 1.65:1, 1.09:1 and 2.32:1, respectively, which implies that the female patient tends to show constipation once they have colorectal polyps, while the male tends to complain of diarrhea or hematochezia. With respect to age, the elder patients tend to complain of constipation while the young patients tend to complain of diarrhea or hematochezia. This may be explained by that the

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young ones excise more frequently, which helps the intestine peristalsis than the elder ones.

In this study, the hematochezia polyps are larger than the diarrhea and the constipation ones. Uno and Munakata [18] mention that, the presence of fecal occult blood is found to be correlated with the surface area of colonic polyps. The area of microerosion and thin surface epithelium tends to increase as the surface area expands, which can lead to a positive fecal occult blood test result. There is no significance among these bowel habit alteration groups with the proportion of hyperplastic polyp. However, significant difference ( $P = 0.032$ ) exists with respect to the villous polyp. This may be explained by that the extent of micro-erosion and thin surface epithelium are correlated with the villous component [18]. As mentioned in previous studies [19-21], only hematochezia can imply advanced adenoma.

As shown in this study, the adenoma reaches 51.2% in the asymptomatic population, with no significance with the symptomatic group. No significance is found in their age or polyp location between symptomatic and asymptomatic group. No significance is found in their sex ratio, age, polyp size, shape, location and histology between the abdominal pain or bowel habit alteration group, and the bowel habit alteration group except that the polyp number is more in the former group. No significance of adenoma proportion is found between diarrhea and constipation group or between diarrhea and hematochezia group, which implies that the relative bowel symptom predicted values for polyp histology are not significantly different. Lower gastrointestinal symptoms are common, but they are not predictive of colorectal neoplasia [22], and bowel symptoms are also not uncommon in social community, but these symptoms are usually self-limited, and the information provided for seeking for medical help is rather rare. As a common disorder and premalignant state, colorectal polyps, especially the adenoma polyps should be paid with a great attention. Ma et al [23] report that, it costs about RMB 42,963.3 yuan to diagnose a CRC case, while it costs about 3,015 yuan for a polyp case and 4,384 yuan for an adenoma case. Therefore, if removing the adenoma can reduce half of the CRC incidence, the mean cost for reducing one CRC case is 6,384 yuan. Colonoscopy screening can reduce 90% CRC risk. There is evidence

that the rate of mortality from colorectal cancer can be reduced by screening asymptomatic persons at average risk, beginning at the age of 50 years [24].

In conclusion, colorectal polyps occur commonly in middle age, and most polyps are adenoma. Almost half patients have no bowel symptom, especially the male, and the related symptoms except hematochezia have little hint role in predicting pathology feature. It is suggested that, the colonoscopy should be incorporated in the physical examination in the relatively developed ozone.

### Disclosure of conflict of interest

None.

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### References

- [1] Sung JJ, Lau JY, Goh KL, Leung WK. Increasing incidence of colorectal cancer in Asia: implications for screening. *Lancet Oncol* 2005; 6: 871-876.
- [2] Derry MM, Raina K, Balaiya V, Jain AK, Shrotriya S, Huber KM, Serkova NJ, Agarwal R, Agarwal C. Grape seed extract efficacy against azoxymethane-induced colon tumorigenesis in A/J mice: interlinking miRNA with cytokine signaling and inflammation. *Cancer Prev Res (Phila)* 2013; 6: 625-633.
- [3] Hawkins NJ, Bariol C, Ward RL. The serrated neoplasia pathway. *Pathology* 2002; 34: 548-555.
- [4] Leggett B, Whitehall V. Role of the serrated pathway in colorectal cancer pathogenesis. *Gastroenterology* 2010; 138: 2088-2100.
- [5] Chen CF, Qiu LH. Clinical manifestations and patterns of malignant transformation of colorectal polyps of 1 884 cases. *Chin J Cancer Prev Treat* 2005; 12: 1888-1890.
- [6] Li GH, Liao WD, Xu B, Lv NH, Wang CW. Clinicopathological analysis of 2889 patients with colorectal polyps in the Nanchang area. *Chin J Clinical Cancer* 2007; 34: 1105-1108.
- [7] Du AM, Miao Y, Shi YM, Cheng CM. Analysis of clinical characteristics of colonic polyps. *Chin J Gastroenterol Hepatol* 2010; 19: 53-55.
- [8] Li J, Yue WJ, Liu Y, Dong L, Zhang ZJ, Wang L, Liu J. Endoscopic and pathologic analysis of colorectal polyps: a report of 1 239 cases. *Shanghai Med J* 2010; 33: 585-588.

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- [9] Sakamoto T, Matsuda T, Nakajima T, Saito Y. Clinicopathological features of colorectal polyps: evaluation of the predict, resect and discard' strategies. *Colorectal Dis* 2013; 15: 1295-1300.
- [10] Bafandeh Y, Khoshbaten M, Eftekhari Sadat AT, Farhang S. Clinical predictors of colorectal polyps and carcinoma in a low prevalence region: Results of a colonoscopy based study. *World J Gastroenterol* 2008; 14: 1534-1538.
- [11] Bowles CJ, Leicester R, Romaya C, Swarbrick E, Williams CB, Epstein O. A prospective study of colonoscopy practice in the UK today: are we adequately prepared for national colorectal cancer screening tomorrow? *Gut* 2004; 53: 277-283.
- [12] Kent AJ, Woolf D, Mccue J, Greeifiedld SM. The use of symptoms to predict colorectal cancer site. Can we reduce the pressure on our endoscopy services? *Colorectal Dis* 2010; 12: 114-118.
- [13] Chen CX, Ji F, Mao YS, Zhu ZW, Du J, Zhou XX. The detection rate and pathological analysis of colorectal polyps in 22,738 asymptomatic population cases. *Zhejiang Med J* 2011; 33: 688-690.
- [14] Giacosa A, Frascio F, Munizzi F. Epidemiology of colorectal polyps. *Tech Coloproctol* 2004; 2: S243-S247.
- [15] Zhang KJ, Wu BW. Clinical and histological features of colorectal polyps in elder population. *Chin Practical Med J* 2010; 26: 438-439.
- [16] Wang JF, Gao L, Liu JP. The investigation and prediction of the current incidence status of colorectal polyps. *Jilin Med J* 2010; 31: 4958-4959.
- [17] Church JM. Clinical significance of small colorectal polyps. *Dis Colon Rectum* 2004; 47: 481-485.
- [18] Uno Y, Munakata A. Endoscopic and histologic correlates of colorectal polyp bleeding. *Gastrointest Endosc* 1995; 41: 460-467.
- [19] Chaput U, Alberto SF, Terris B, Beuvon F, Audureau E, Coriat R, Roche H, Gaudric M, Prat F, Chaussade S. Risk factors for advanced adenomas amongst small and diminutive colorectal polyps: a prospective monocenter study. *Dig Liver Dis* 2011; 43: 609-612.
- [20] Lucendo AJ, Guagnozzi D, Angueira T, González-Castillo S, Fernández-Fuente M, Frigal-Ruiz AB, Tenias JM. The relationship between proximal and distal colonic adenomas: is screening sigmoidoscopy enough in the presence of a changing epidemiology? *Eur J Gastroenterol Hepatol* 2013; 25: 973-980.
- [21] Eichenseer PJ, Dhanekula R, Jakate S, Mobarhan S, Melson JE. Endoscopic mis-sizing of polyps changes colorectal cancer surveillance recommendations. *Dis Colon Rectum* 2013; 56: 315-321.
- [22] Bai Y, Xu C, Zou DW, Gao J, Li ZS. Diagnostic accuracy of features predicting lower gastrointestinal malignancy: a colonoscopy database review of 10,603 Chinese patients. *Colorectal Dis* 2011; 13: 658-662.
- [23] Ma XY, Li QL, Ma WL. Cost estimation and cost control in colorectal cancer screening. *Chin Cancer* 2011; 20: 422-424.
- [24] Lieberman DA, Weiss DG, Bond JH. Use of colonoscopy to screen asymptomatic adults for colorectal cancer. Veterans Affairs Cooperative Study Group 380. *N Engl J Med* 2000; 343: 162-168.