Retrospective Study

Analysis of 234 cases of colorectal polyps treated by endoscopic mucosal resection

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Abstract

BACKGROUND
Colorectal polyps refer to all neoplasms that protrude into the intestinal cavity. Researchers believe that 50%-70% of colorectal cancers originate from adenomatous polyps.

AIM
To investigate the endoscopic morphologic features, pathologic types, and clinical situation; evaluate the efficacy and safety of endoscopic mucosal resection (EMR); and guide clinicians in their daily practice.

METHODS
Two hundred thirty-four patients who underwent EMR in our hospital from January 1, 2018 to December 31, 2019 were recruited. Data including sex, age, endoscopic morphology of the polyps, and pathological characteristics were analyzed among groups.

RESULTS
A total of 295 polyps were resected from the 234 subjects enrolled in the study, of which 4 (1.36%) were Yamada type I. There were 75 (25.42%) type II, 101 (34.24%) type III, and 115 (38.98%) type IV adenomas. Among them, 41 were non-adenomas, 110 were low-risk adenomas, 139 were high-risk adenomas, and 5 were carcinomas. The differences in distribution were not statistically significant, with P values greater than 0.05. The risk of cancer significantly increased for polyps ≥ 1 cm in diameter ($c^2 = 199.825, P = 0.00$). Regarding the endoscopic morphologic features, congestion, erosion, and lobulation were more common on the surface morphology of high-risk adenomas and cancerous polyps ($c^2 = 75.257, P = 0.00$), and most of them were Yamada types III and IV. In all, 6 of the
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295 polyps could not be removed completely, with a one-time resection rate of 97.97%. There were two cases of postoperative bleeding and no cases of perforation, with an overall complication rate of 0.09%.

CONCLUSION
Colorectal polyps ranging from non-adenomatous polyps, low-risk adenomas, and high-risk adenomas to adenocarcinomas each have their own endoscopic features, while EMR, as a mature intervention, has good safety and operability and should be promoted clinically, especially at the primary care level.

Key Words: Colorectal polyp; Endoscopic mucosal resection; High-risk adenoma; Risk factors; Adenocarcinomas; 1,4-bis (diphenylphosphino) butane

INTRODUCTION
Colorectal polyps refer to all neoplasms that protrude into the intestinal cavity. Researchers believe that 50%-70% of colorectal cancers originate from adenomatous polyps[1]. The development process of colorectal cancer is normal mucosa, to epithelial cell hyperplasia, to tubular adenoma, to villous adenoma, to early cancer and finally to invasive carcinoma, and this evolution process takes approximately 8-15 years[2]. The early detection and treatment of colorectal polyps, especially endoscopic treatment of high-risk adenomas, can effectively reduce the incidence of colorectal cancer. Endoscopic mucosal resection (EMR) refers to the operation for complete removal of the diseased mucosa under endoscopy. It is a treatment method developed by combining endoscopic polypectomy and endoscopic submucosal injection[3]. Endoscopy is an optional diagnostic tool. Radical surgery can also be considered. Surgery aims to diagnose and treat mucosal lesions through mass excision of part of the mucosa (up to the depth of the submucosal tissue). Since its introduction in 1973, EMR has been developed for decades and is currently a safe and effective method for treating polyps in the large intestine[4].

This article will retrospectively analyze the sex, age, endoscopic morphological characteristics, pathological types, and clinical conditions of 234 patients treated with EMR admitted to the hospital from January 2018 to December 2019, to understand the clinical characteristics of different types of colorectal polyps and the safety and efficacy of EMR treatment.

MATERIALS AND METHODS

Basic information
We selected 234 patients undergoing EMR treatment from January 2018 to December 2019 in our hospital. Of the 234 subjects enrolled in the study, 171 were male, with a mean age of 62.2 ± 11.9 years, and 63 were female, with a mean age of 60.9 ± 10.6 years. A total of 295 polyps were removed. Clinical data such as sex, age, polyp size, location,
morphology, and pathological type were collected for retrospective analysis.

Research method
Patients confirmed with polyps under endoscopic and successful EMR treatment with complete clinical data, such as endoscopic and pathological reports were included. Patients with intestinal obstruction, familial hereditary polyposis, intestinal tuberculosis, or inflammatory bowel disease and those with incomplete clinical data were excluded.

Grouping method
The selected research subjects were divided into non-adenomatous polyps, low-risk adenoma, high-risk adenoma, and adenoma canceration groups according to the Chinese colorectal cancer screening, early diagnosis and treatment, and comprehensive prevention consensus. Those with one of the following three items were considered to have high-risk adenoma: Polyps or lesions ≥ 1.0 cm in diameter; Villous adenoma or mixed adenoma with villous structures exceeding 25.00%, and high-grade epithelium. Statistical analysis was conducted for variables such as sex, age, and endoscopic and pathological features of polyps.

Devices and medicines
Equipment: OLYMPUS CV-290 electronic colonoscope, OLYMPUS ESG-100 high-frequency electric transmitter, COOK ASM-1-S snare, Nanjing minimally invasive disposable endoscope injection needle, Nanjing minimally invasive ROCC-D-26-195 Titanium clip. Intestinal medicine: Compound polyethylene glycol electrolyte powder (Sutaiqing).

Treatment method
The patients were asked to discontinue anticoagulant and antiplatelet medications 1 wk before surgery, start a low residue or no residue diet 3 d before surgery, and take one box of Sutex the night before surgery and 750 mL warm water. Three packs of Sutaiqing and 2250 mL warm water were taken orally on the morning of the examination, followed by water fasting. Signed informed consent was obtained. The leads were smoothly inserted to reach the ileocecal region, and then the lens was withdrawn to observe the ileocecal region, ascending colon, transverse colon, sigmoid colon, and rectum to determine the endoscopic features of the polyps treated with EMR and to administer 1:10000 epinephrine submucosal injections at the base of the polyps. A sodium chloride solution was administered, good lifting was observed, a loop device was used to encircle the polyp, and then high-frequency electricity was used to completely remove the polyp. The wound was closed as appropriate with titanium clips. Clamping or high-frequency electrocautery were applied. Postoperatively, the patients were instructed to stay in bed, initiate a liquid diet, eat a residue-free diet for 1 wk after surgery, and abstain from strenuous exercise.

RESULTS

Clinical and endoscopic characteristics of the study subjects
A total of 295 polyps were resected, of which 219 (74.24%) were from males and 76 (25.76%) polyps were from females. The lesions were classified as follows: Type I: 4 (1.36%); Type II: 75 (25.42%); Type III: 101 (34.24%); Type IV: 115 (38.98%). Under endoscopy, Yamada classified the raised lesions in the stomach into four types according to their morphology, regardless of their nature: Type I: Mound-shaped, and the raised part is smooth without a clear boundary; Type II: Hemispherical shape, with a definite boundary in the uplifting part; Type III: The uplift is slightly smaller, forming Yati; and Type IV: The uplift has an obvious pedicle. All 295 polyps were divided into four groups according to Yamada type for analysis: The age differences and distributions of polyps were not statistically significant among groups (P > 0.05). Type I and type II polyps more commonly had a diameter of 0.5-0.9 cm, while the number of type III and type IV polyps with diameter > 1.0 cm increased gradually ($\chi^2 = 463.381, P = 0.000$). Type III and Type IV polyps had significantly more congestion, erosion, roughness, and lobulation on the surface morphology than type I and II lesions ($\chi^2 = 46.935, P = 0.000$, Table 1).
Table 1 Comparison of clinical characteristics and endoscopic features

| Item                              | Yamada type |       |       |       | Total |
|-----------------------------------|-------------|-------|-------|-------|-------|
|                                   | I           | II    | III   | IV    |       |
| Number of polyps, examples        | 4           | 75    | 101   | 115   | 295   |
| Sex                               |             |       |       |       |       |
| Male                              | 4           | 57    | 61    | 97    | 219   |
| Female                            | 0           | 18    | 40    | 18    | 76    |
| Age                               |             |       |       |       |       |
| < 60                              | 0           | 31    | 50    | 61    | 149   |
| ≥ 60                              | 4           | 44    | 51    | 54    | 146   |
| Polyp size in cm                  |             |       |       |       |       |
| 0.5-0.9                           | 1           | 55    | 58    | 31    | 145   |
| ≥ 1                               | 3           | 20    | 43    | 84    | 150   |
| Surface morphology of polyps, examples |     |       |       |       |       |
| Bloody and red                    | 0           | 29    | 45    | 83    | 157   |
| Smooth                            | 3           | 36    | 31    | 22    | 92    |
| Rough and unkempt                 | 1           | 26    | 46    | 41    | 114   |
| Lobular                           | 0           | 10    | 22    | 45    | 77    |
| Dissipated                        | 1           | 5     | 3     | 11    | 20    |
| Polyp site, examples              |             |       |       |       |       |
| Left hemicolon, including rectum  | 0           | 46    | 58    | 67    | 171   |
| Right hemicolon, including ileocecum | 4     | 29    | 43    | 48    | 124   |

**Risk factor analysis for colorectal polyps**

A total of 295 polyps comprising 41 non-adenomas, 110 low-risk adenomas, 139 high-risk adenomas, and 5 carcinomas were classified by sex, age, polyp size, and distribution in the large intestine. There were no statistically significant differences in gender, age and distribution in the large intestine, and the P values were greater than 0.05. The risk of polyps ≥ 1 cm in diameter was significantly elevated ($\chi^2 = 199.825$). All five cancerous polyps in the study subjects were polyps ≥ 1 cm in diameter, the largest being approximately 3 cm in diameter. The smallest one was approximately 1 cm in diameter. A total of 128 polyps ≥ 1 cm were found among the high-risk adenomas, accounting for 92.09% of all high-risk adenomas, while the smallest polyp was approximately 1 cm in diameter. There were only 5 polyps ≥ 1 cm among the low-risk adenomas, accounting for 4.55% of all low-risk adenomas (Table 2).

Comparing endoscopic morphological features, congestion, erosion, and lobulation were more common on the surface morphology of high-risk adenomas and cancerous polyps ($\chi^2 = 75.257, P = 0.00$) and mostly Yamada types III and IV than on other polyps (Table 3).

**EMR efficacy and complications**

In all, 6 of the 295 polyps were incompletely excised, with remnants of adenomatous or cancerous tissue in the incision, and margin 2.03% of the total. Five of them were Yamada type II, one was Yamada type III, two were less than 1 cm in diameter, four were ≥ 1 cm in diameter, and the largest one was 2 cm in diameter. If the pathology was adenoma, the patient underwent secondary endoscopic argonplasma coagulation or high-frequency electrosurgery; if the cancerous tissue remained, additional surgical treatment was provided after surgery. During follow-up, there were two cases of postoperative hemorrhage. Both of these cases occurred in males with high-risk adenomas, one with a Yamada type II polyp and one with a Yamada type IV polyp, with diameters of 2 cm and 4 cm, respectively. Endoscopic hemostasis was successfully performed. There were no cases of perforation or infection in any of the enrolled subjects.
Table 2 Comparison of general clinical conditions of each group

| Group               | Sex | Age | Size of the polyp in cm | Site of the polyp in cm |
|---------------------|-----|-----|-------------------------|-------------------------|
|                     | Female | Male | < 60 | ≥ 60 | 0.5-0.9 | ≥ 1 | Left colon, including the rectum | Right colon, including the ileocecal region |
| Non-adenoma         | 28 | 13 | 20 | 21 | 28 | 13 | 21 | 20 |
| Low-risk adenoma    | 81 | 29 | 52 | 58 | 105 | 5 | 58 | 52 |
| High-risk adenoma   | 106 | 33 | 64 | 75 | 11 | 128 | 89 | 50 |
| Carcinogenesis      | 4 | 1 | 1 | 4 | 0 | 5 | 3 | 2 |
| χ² value            | 1.162 | 1.535 | 199.825 | 5.416 |
| P value             | 0.762 | 0.674 | 0 | 0.144 |

Table 3 Comparison of morphological characteristics of each group under endoscopy

| Groups               | Polyp pattern | Yamada type |
|----------------------|---------------|-------------|
|                      | Bloody, red  | Smooth      | Coarse, not smooth | Leaflets | Eroded | I | II | III | IV |
| Non-adenoma          | 15 | 25 | 8 | 5 | 4 | 2 | 12 | 14 | 13 |
| Low-risk adenoma     | 53 | 44 | 53 | 11 | 5 | 0 | 43 | 39 | 28 |
| High-risk adenoma    | 88 | 23 | 52 | 59 | 10 | 1 | 19 | 48 | 71 |
| Carcinogenesis       | 0 | 0 | 5 | 2 | 1 | 1 | 1 | 0 | 3 |
| χ² value             | 75.257 | 47.676 |
| P value              | 0 | 0.00 |

**DISCUSSION**

Colorectal polyp is a generic term for all superfluous growths, both tumorous and non-tumorous, that protrude into the intestinal cavity. The former are closely related to carcinogenesis and are precancerous lesions, accounting for 70%-80% of colorectal polyps, with a cancer rate of 1.4%-9.2%[9]. The timely resection of colorectal polyps, especially high-risk adenomas, can effectively halt the polyp carcinogenesis process.

A total of 295 polyps were removed from 234 patients in this study, of which 139 high-risk adenomas were removed, accounting for approximately 47.12% of all polyps. Among them, 128 polyps ≥ 1 cm were found, accounting for 92.09% of all high-risk adenomas, higher than similar reports in which high-risk adenomas accounted for 17.08% of the total samples[10,11], which is associated with the use of argon and high-frequency electrotherapy for polyps less than 1.0 cm in diameter in this center. There were no significant differences in gender, age, or polyp distribution among the four groups studied, but another study[12] showed that in the left half of the large intestine, the incidence of high-grade neoplasia and early cancer was higher than that in the right colon, and further studies and discussions are still needed. All five cancerous polyps in the study subjects were polyps ≥ 1 cm in diameter, with the largest being approximately 3 cm in diameter and the smallest being approximately 1 cm in diameter. The number of polyps ≥ 1 cm among high-risk adenomas was 128, accounting for 92.09% of all high-risk adenomas. There were only five polyps ≥ 1 cm among low-risk adenomas, accounting for 4.55% of the total number of low-risk adenomas. High-risk adenomas and cancerous polyps more commonly showed congestion, erosion, and lobulation on the superficial morphology ($\chi^2 = 75.257, P = 0.00$), and most of them were Yamada types III and IV[13]. This is similar to the report from Fukami et al[12]. Type III and type IV colorectal polyps with a diameter of ≥ 1 cm and superficial congestion, erosion, and lobulation can be considered to have a higher risk of cancer than other types of polyps. For polyps smaller than 1 cm, endoscopic white light + blue light imaging of the three basic areas (surface/pits/vessels) of each description and polyp grading showed good accuracy and confidence[14].

Perforation of the gastrointestinal tract, infection and bleeding are the three most
common complications of colorectal polyp treatment\[^{15}\]. Bleeding was divided into intraoperative and delayed postpolypectomy [bleeding during surgery and bleeding after surgery, 1,4-bis (diphenylphosphino) butane] bleeding\[^{16}\]. There were no cases of perforation or infection in this study, and there were two cases of postoperative bleeding, with an overall complication rate of 0.09%, which is lower than that in similar reports\[^{11}\]. The two patients who developed 1,4-bis (diphenylphosphino) butane were both male and had high-risk adenomas, and bleeding occurred on the 2nd postoperative day. They had endoscopic Yamada classifications of type II. The polyps had diameters of 2 cm and 4 cm and endoscopic hemostasis was achieved. Some studies have shown that polyps with diameters > 10 mm\[^{17}\], polyps with a clitoris, adenomatous polyps and intraoperative bleeding are the most common causes of bleeding after endoscopic resection of colorectal polyps and should be considered risk factors for delayed bleeding\[^{18}\]. In contrast, other studies have shown that sex is an independent risk factor for bleeding from colorectal polyps, with men being more prone to bleeding than women\[^{19}\]. Patients with a history of hypertension, polyps ≥ 10 mm in diameter, and polyps located in the right hemicolon are prone to delayed bleeding after endoscopic resection. Endoscopists should be more vigilant when treating such patients and should routinely use titanium clips to close the wound during surgery and observe the patient’s stool after surgery. Changes in vital signs such as heart rate, abdominal signs and blood pressure should be noted in cases of postoperative bleeding. If abnormal, endoscopic titanium clip to stop bleeding or spray or inject to stop bleeding\[^{20}\]. A total of 6 of the 295 polyps were incompletely excised, with residual adenomatous or carcinomatous tissue in the incision margin (2.03% of all polyps). The rate of single resection was 97.97%, which is similar to that in relevant reports\[^{21}\]. Failed endoscopic resection of colorectal polyps is related to a number of factors, which can be summarized as follows: 1) operator skill—those who have a preliminary mastery of EMR fail to perform endoscopic resection proficiently; 2) inadequate exposure of the endoscopic polyps—a variety of factors such as overly large polyps, inadequate intestinal preparation, and poor polyp location can lead to inadequate exposure of endoscopic polyps and a limited field of view; and 3) underestimation of the submucosal depth of the polyps, especially for polyps > 2 cm in diameter and Yamada type II and lateral growth polyps, whose histology can invade the muscle and even the plasma membrane layer, rendering EMR impossible\[^{22}\]. Polyps should be evaluated by ultrasound endoscopy before surgery\[^{23}\].

CONCLUSION

In summary, colorectal polyps range from non-adenomatous polyps, low-risk adenomas, high-risk adenomas to adenocarcinomas, and each type has its own endoscopic characteristics. EMR is a mature intervention that has good safety and operability and is worth promoting clinically, especially at the primary care level.

ARTICLE HIGHLIGHTS

Research background

The early detection and treatment of colorectal polyps, especially endoscopic treatment of high-risk adenoma, can effectively reduce the incidence of colorectal cancer. Endoscopic mucosal resection (EMR) refers to the operation for complete removal of the diseased mucosa under endoscopy.

Research motivation

Endoscopy is an optional diagnostic tool. Radical surgery can also be considered. Surgery aims to diagnose and treat mucosal lesions through mass excision of part of the mucosa (up to the depth of the submucosal tissue).

Research objectives

Investigate the endoscopic morphologic features, pathologic types and clinical situation, evaluate the efficacy and safety of endoscopic mucosal resection EMR \(^\%\), and guide clinicians in their daily practice.
Research methods
In total, 234 patients who underwent EMR in our hospital from January 1, 2018 to December 31, 2019 were recruited. Data including sex, age, endoscopic morphology of the polyps, and pathological characteristics were analyzed among groups.

Research results
A total of 295 polyps were resected from the 234 subjects enrolled in the study, of which 4 (1.36%) were Yamada type I. There were 75 (25.42%) type II, 101 (34.24%) type III, and 115 (38.98%) type IV adenomas. Among them, 41 were non-adenomas, 110 were low-risk adenomas, 139 were high-risk adenomas, and 5 were carcinomas. The differences in distribution were not statistically significant, with P values greater than 0.05. The risk of cancer increased significantly for polyps ≥ 1 cm in diameter (c^2 = 199.825, P = 0.00). Regarding the endoscopic morphological features, congestion, erosion, and lobulation were more common on the surface morphology of high-risk adenomas and cancerous polyps (c^2 = 75.257, P = 0.00), and most of them were Yamada types III and IV. In all, 6 of the 295 polyps could not be removed completely, with a one-time resection rate of 97.97%. There were two cases of postoperative bleeding and no cases of perforation, with an overall complication rate of 0.09%.

Research conclusions
Colorectal polyps ranging from non-adenomatous polyps, low-risk adenomas, and high-risk adenomas to adenocarcinomas each have their own endoscopic features, while EMR, as a mature intervention, has good safety and operability and should be promoted clinically, especially at the primary care level.

Research perspectives
Endoscopic mucosal resection is becoming the preferred method of polyp treatment.

REFERENCES

1. Moazzen S, van der Sloot KJW, Bock GH, Alizadeh BZ. Systematic review and meta-analysis of diet quality and colorectal cancer risk: Is the evidence of sufficient quality to develop recommendations? Crit Rev Food Sci Nutr 2020; 1-10 [PMID: 32631345 DOI: 10.1080/10408398.2020.1763535]

2. Hollestein LM, van Herk-Sukel MP, Ruiter R, de Vries E, Mathijsen RH, Wiemers EA, Stijnen T, Coebergh JW, Lemmens VE, Herings RM, Stricker BH, Nijsten T. Incident cancer risk after the start of aspirin use: results from a Dutch population-based cohort study of low dose aspirin users. Int J Cancer 2014; 135: 157-165 [PMID: 24285345 DOI: 10.1002/ijc.28634]

3. Moon N, Aryan M, Khan W, Jiang P, Madhok I, Wilson J, Ruiz N, Ponniah SA, Westerveld DR, Gupta A, Pooran N, Qumseya B, Foroozesh CE, Draganoan PV, Yang D. Effect of referral pattern and histopathology grade on surgery for nonmalignant colorectal polyps. Gastrointest Endosc 2020; 92: 702-711. e2 [PMID: 32334014 DOI: 10.1016/j.gie.2020.04.041]

4. Fujiya M, Tanaka K, Dokoshi T, Tominaga M, Ueno N, Inaba Y, Ito T, Morichi K, Kohgo Y. Efficacy and adverse events of EMR and endoscopic submucosal dissection for the treatment of colon neoplasms: a meta-analysis of studies comparing EMR and endoscopic submucosal dissection. Gastrointest Endosc 2015; 81: 583-595 [PMID: 25592748 DOI: 10.1016/j.gie.2014.07.034]

5. Wang J, Zhang XH, Ge J, Yang CM, Liu JY, Zhao SL. Endoscopic submucosal dissection vs endoscopic mucosal resection for colorectal tumors: a meta-analysis. World J Gastroenterol 2014; 20: 8282-8287 [PMID: 25099404 DOI: 10.3748/wjg.v20.i25.8282]

6. Žlajpah M, Marjancic M, Gajic J, Gajic B, Predani J. Differential expression of extracellular matrix-related genes DCN, EPH4, FN1, SPARC, SPON2 and SPPI in colorectal carcinogenesis. Oncol Rep 2019 [PMID: 31523274 DOI: 10.3892/or.2019.7271]

7. Di Nicolantonio F, Martini M, Molinari F, Sarti-Bianchi A, Arena S, Saletti P, De Doss S, Mazzucchelli L, Frattini M, Siena S, Bardelli A. Wild-type BRAF is required for response to panitumumab or cetuximab in metastatic colorectal cancer. J Clin Oncol 2008; 26: 5705-5712 [PMID: 19010320 DOI: 10.1200/JCO.2008.10.0786]

8. Kjølhede T, Olholm AM, Kaalby L, Kidholm K, Qvist N, Baatrup G. Diagnostic accuracy of capsule endoscopy compared to colonoscopy for polyp detection: systematic review and meta-analyses. Endoscopy 2020 [PMID: 32858753 DOI: 10.1055/a-1249-3938]

9. Rassak R, Gaspar F, Grillo F, Basso L, Segalbera D, Paglisi A, Boscio MC, Mastracci L, Neumailer CE, Varesio L, Eva A. Characterization of high- and low-risk hepatocellular adenomas by magnetic resonance imaging in an animal model of glycogen storage disease type 1A. Dis Model Mech 2019; 12 [PMID: 30899869 DOI: 10.1242/dmm.038026]

10. Fang JY, Zheng S, Jiang B, Lai MD, Fang DC, Han Y, Sheng QJ, Li JN, Chen YX, Gao QY. Consensus on the Prevention, Screening, Early Diagnosis and Treatment of Colorectal Tumors in China: Chinese Society of Gastroenterology, October 14-15, 2011, Shanghai, China. Gastrointest Tumors 2014; 1: 53-75 [PMID: 26672726 DOI: 10.1159/000362385]

11. Asadzadeh Aghdaei H, Nazemalhosseini Mojarad E, Ashtari S, Pourhoseingholi MA, Chaleshi V, Anaraki
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F, Haghazali M, Zali MR. Polyp detection rate and pathological features in patients undergoing a comprehensive colonoscopy screening. *World J Gastrointest Pathophysiol* 2017; 8: 3-10 [PMID: 28251034 DOI: 10.4291/wjgp.v8.i1.3]

Fukami N. Surgery versus Endoscopic Mucosal Resection Versus Endoscopic Submucosal Dissection for Large Polyps: Making Sense of When to Use Which Approach. *Gastroint Endosc Clin N Am* 2019; 29: 675-685 [PMID: 31445690 DOI: 10.1016/j.giec.2019.06.007]

Church JM. Experience in the endoscopic management of large colonic polyps. *ANZ J Surg* 2003; 73: 988-995 [PMID: 14628888 DOI: 10.1046/j.1445-2197.2003.01-23.x]

Wolfe WI, Shinya H. Endoscopic polypectomy. Therapeutic and clinicopathologic aspects. *Cancer* 1975; 36: 683-690 [PMID: 1157028 DOI: 10.1002/1097-0142(197508)36:2+<683::aid-cncr2820360811>3.0.co;2-c]

F, Haghazali M, Zali MR. Polyp detection rate and pathological features in patients undergoing a comprehensive colonoscopy screening. *World J Gastrointest Pathophysiol* 2017; 8: 3-10 [PMID: 28251034 DOI: 10.4291/wjgp.v8.i1.3]

Wolfe WI, Shinya H. Endoscopic polypectomy. Therapeutic and clinicopathologic aspects. *Cancer* 1975; 36: 683-690 [PMID: 1157028 DOI: 10.1002/1097-0142(197508)36:2+<683::aid-cncr2820360811>3.0.co;2-c]

Li D, Wang W, Xie J, Liu G, Wang R, Jiang C, Ye Z, Xu B, He X, Hong D. Efficacy and safety of three different endoscopic methods in treatment of 6-20 mm colorectal polyps. *Scand J Gastroenterol* 2020; 55: 362-370 [PMID: 32150478 DOI: 10.1080/00365521.2020.1732456]

Wu XR, Church JM, Jarrar A, Liang J, Kalady MF. Risk factors for delayed postpolypectomy bleeding: how to minimize your patients' risk. *Int J Colorectal Dis* 2013; 28: 1127-1134 [PMID: 23440363 DOI: 10.1007/s00384-013-1661-5]

Sarkut P, Kilicturgay S, Ozer A, Ozturk E, Yilmazlar T. Gallbladder polyps: factors affecting surgical decision. *World J Gastroenterol* 2013; 19: 4526-4530 [PMID: 23901228 DOI: 10.3748/wig.v19.i28.4526]

Yao Y, Suo T, Andersson R, Cao Y, Wang C, Lu J, Chui E. Dietary fibre for the prevention of recurrent colorectal adenomas and carcinomas. *Cochrane Database Syst Rev* 2017; 1: CD003430 [PMID: 28064440 DOI: 10.1002/14651858.CD003430.pub2]

Park SK, Seo JY, Lee MG, Yang HJ, Jung YS, Choi KY, Kim H, Kim HO, Jung KU, Chun HK, Park DI. Prospective analysis of delayed colorectal post-polypectomy bleeding. *Surg Endosc* 2018; 32: 3282-3289 [PMID: 29344790 DOI: 10.1007/s00464-018-6048-9]

Choung BS, Kim SH, Ahn DS, Kwon DH, Koh KH, Sohn JY, Park WS, Kim JH, Lee SO, Lee ST, Kim SW. Incidence and risk factors of delayed postpolypectomy bleeding: a retrospective cohort study. *J Clin Gastroenterol* 2014; 48: 784-789 [PMID: 24231934 DOI: 10.1097/MCG.0000000000000027]

Inoue I, Kato J, Yoshimura N, Maeda Y, Moribata K, Shingaki N, Deguchi H, Enomoto S, Maekita T, Ueda K, Iguchi M, Tamai H, Fujishiro M, Yamamichi N, Takeshita T, Ichinose M. Elevated risk of recurrent colorectal neoplasia with *Helicobacter pylori*-associated chronic atrophic gastritis: A follow-up study of patients with endoscopically resected colorectal neoplasia. *Mol Clin Oncol* 2015; 1: 79-82 [PMID: 25494126 DOI: 10.3892/mco.2012.22]

Von Renteln D, Bouin M, Barkun AN. Current standards and new developments of colorectal polyp management and resection techniques. *Expert Rev Gastroenterol Hepatol* 2017; 11: 835-842 [PMID: 28319429 DOI: 10.1080/17474124.2017.1309279]

Parent P, Cohen R, Rassy E, Srvcuk M, Taieb J, André T, Turpin A. A comprehensive overview of promising biomarkers in stage II colorectal cancer. *Cancer Treat Rev* 2020; 88: 102059 [PMID: 32622273 DOI: 10.1016/j.ctrv.2020.102059]
