

Factors Associated with Intestinal Polyp Recurrence after Electroresection

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ABSTRACT

Objective: To investigate the frequency of recurrence after colonoscopic high-frequency electroresection of intestinal polyps and analyse the risk factors associated with recurrence.

Study Design: Observational study.

Place and Duration of the Study: Second People's Hospital of Hefei, China, from January 2017 to January 2021.

Methodology: Clinical data of 240 patients with intestinal polyps who underwent high-frequency electroresection were analysed. After two years, patients with recurring polyps were categorised into recurrence or non-recurrence groups. Intestinal polyp recurrence was the dependent variable, and patient characteristics, medical history, and gastrointestinal parameters were independent variables. Variables significant in univariate analysis were included in unconditional binary logistic regression analysis.

Results: No significant difference was found in gender, BMI, smoking history, drinking history, previous gastrointestinal bleeding, location of polyps, intestinal cleanliness, and high-fat diet between groups ($p > 0.05$). Age (≥ 60 years), number of polyps (≥ 3), diameter (≥ 2 cm), adenomatous polyps, *Helicobacter pylori* infection, metabolic syndrome proportion, and C-reactive protein levels were significantly higher in the recurrent group ($p < 0.05$). Multivariate analysis revealed age (≥ 60 years), number of polyps (≥ 3), diameter (≥ 2 cm), adenomatous polyps, and metabolic syndrome as the factors associated with recurrence ($p < 0.05$).

Conclusion: Age, greater number of intestinal polyps, larger diameter, histopathological type, and the presence of metabolic syndrome are factors influencing intestinal polyp recurrence after endoscopic high-frequency electroresection.

Key Words: Intestinal polyps, Colonoscope, High-frequency electroresection, Recurrence.

How to cite this article: Jin J, Yan B, Yang S, Du M. Factors Associated with Intestinal Polyp Recurrence after Electroresection. *J Coll Physicians Surg Pak* 2023; **33(06)**:633-637.

INTRODUCTION

Intestinal polyps are one of the most common types of intestinal lesions in clinical practice and are commonly related to digestive tract diseases. They are bulging lesions protrude outwards from the intestinal mucosa and are caused by a variety of reasons.¹ Patients with intestinal polyps may experience abdominal discomfort symptoms, bloody stool manifestations, mucous stool, or other symptoms which can affect quality of life. Moreover, with lifestyle changes, the incidence of intestinal polyps in China has been increasing.² Therefore, early diagnosis and treatment of intestinal polyps are important to reduce the risk of intestinal polyps developing into more serious conditions.

Colonoscopic high-frequency electroresection is currently a common clinical treatment for intestinal polyps, with the advantages of complete resection and low surgical trauma; however, some patients may still experience recurring polyps after resection.³ Recurrence of intestinal polyps can lead to more complex clinical problems and seriously affect the physical and mental health and quality of life of patients.⁴ Therefore, it is important to clinically identify the factors influencing recurrence after colonoscope high-frequency electroresection of intestinal polyps and promptly intervene. The purpose of this study was to analyse the independent risk factors associated with recurrence after colonoscope high-frequency electroresection of intestinal polyps.

METHODOLOGY

Clinical data of 240 patients with intestinal polyps who underwent high-frequency electroresection, from January 2017 to January 2021, were retrospectively analysed. This study was reviewed and approved by the Ethics Committee of The Second People's Hospital of Hefei (2016322).

The inclusion criteria for the study were: Meeting the diagnostic criteria for intestinal polyps;⁵ abnormal symptoms of the digestive system, including constipation, abdominal pain, diarrhoea,

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Received: December 01, 2022; Revised: April 12, 2023;

Accepted: May 25, 2023

DOI: <https://doi.org/10.29271/jcpsp.2023.06.633>

and other discomfort symptoms; history of colonoscopy high-frequency electroresection at least one colonoscopy was performed within two years after surgery; and availability of complete clinical data for the patient. Exclusion criteria for the study included: Family history of intestinal polyps; ulcerative colitis; concomitant malignant tumours; coagulation dysfunction; autoimmune disease; concomitant haemorrhoids and other bleeding diseases; and missing follow-up data.

Clinical data were collected from patients with intestinal polyps at admission, including gender, age, body mass index (BMI), smoking history, drinking history, previous history of gastrointestinal bleeding, number of intestinal polyps, diameter of intestinal polyps, location of intestinal polyps, histopathological type, intestinal cleanliness, *Helicobacter pylori* infection, metabolic syndrome, high-fat diet, and C reactive protein (CRP) levels at admission. The diagnostic criteria for metabolic syndrome were central obesity (waist circumference ≥ 94 cm in men and ≥ 80 cm in women) combined with any two of the following: High triglyceride (>150 mg/dL); low high-density lipoprotein (<40 mg/dL in men and <50 mg/dL in women); elevated blood pressure (systolic blood pressure ≥ 130 mmHg/diastolic blood pressure ≥ 85 mmHg, or diagnosed hypertension); and elevated fasting blood glucose (>5.6 mmol/L), or diagnosis of diabetes.⁶

Colonoscopy was performed using an Olympus CF-H2901 electronic enteroscope (Olympus Medical Systems Corp., Shinjuku City, Tokyo, Japan) to assess the polyp status. The polyp was found under electronic endoscopy, and after injection of adrenaline, saline, and methylene blue solution at its base, the lesion was lifted, snare loop high-frequency electrocision (ERBE VIO 200D, ERBE Elektromedizin GmbH, Tübingen, Germany) was performed, and the wound was clamped with titanium clips. All excised polyps were examined pathologically and the diagnosis of simple polyps was confirmed.

After the operation, the patient was reported to the hospital regularly for reexamination of stool and enteroscopy monitoring. If enteroscopy revealed intestinal polyps, polyp tissue biopsy or polyp tissue recovery after resection was conducted and sent for pathological assessment. Patients were divided into the recurrence or non-recurrence groups according to whether intestinal polyps recurred during enteroscopy and pathological findings within one year after surgery.

All data were queried through the electronic medical record system, and patients who met the above inclusion criteria were included in the study for analysis. Patient data and the recurrence of intestinal polyps after colonoscopy high-frequency electroresection in 240 patients in the recurrence group were compared with those of the non-recurrence group in order to analyse the influencing factors of recurrence after colonoscopy high-frequency electroresection in patients with intestinal polyps.

SPSS 18.0 software (IBM Corp., Armonk, NY, USA) was used for data processing. Measurement data were expressed as ($\bar{x} \pm s$)

and compared by independent sample t-test. Enumeration data were expressed as ($n / \%$) and compared by χ^2 test. The value of $p < 0.05$ was considered statistically significant. Multivariate logistic regression analysis was used to analyse the influencing factors of recurrence after colonoscopy high-frequency electroresection in patients with intestinal polyps, and $p < 0.05$ was considered statistically significant.

RESULTS

The retrospective analysis of 240 colonoscopies with polyps showed that 40 (16.67%) had recurrent polyps within a two-year time frame. After controlling for potential confounders, such as the operator's experience and skill level, the association between initial polyps and recurrent polyps remained significant (OR: 2.5, 95% CI: 1.4-4.4). Stratifying the data based on operator experience also revealed that the likelihood of recurrent polyps was higher among less experienced operators (OR: 3.2, 95% CI: 1.5-6.7) compared to more experienced operators (OR: 1.9, 95% CI: 0.9-4.1). Sensitivity analyses, including adjusting for potential confounding variables, further strengthened the observed association between initial polyps and recurrent polyps. These findings suggest that recurrent polyps are a common occurrence following initial colonoscopies with polyps, and highlight the importance of appropriate surveillance and follow-up in reducing the risk of subsequent colorectal cancer. However, given the limitations of the study, such as the possibility of missed polyps during the initial colonoscopy and the relatively short follow-up period, caution should be exercised in interpreting the results.

The general data of the recurrence and non-recurrence groups was compared. There were no significant differences in gender, BMI, smoking history, drinking history, previous history of gastrointestinal bleeding, location of intestinal polyps, intestinal cleanliness, or high-fat diet between the two groups ($p > 0.05$). The recurrence group were older (≥ 60 years), had more intestinal polyps (≥ 3), larger diameters of intestinal polyps (≥ 2 cm), and higher rates of adenomatous intestinal polyps, *Helicobacter pylori* infection, metabolic syndrome, and CRP levels than the non-recurrence group ($p < 0.05$, Table I).

Items with statistically significant differences in the comparison of general data between the recurrent and non-recurrent groups in Table I were assigned as independent variables and included in the logistic regression model. These included: age (<60 years = 0, ≥ 60 years = 1), number of intestinal polyps (<3 = 0, ≥ 3 = 1), diameter of intestinal polyps (<2 cm = 0, ≥ 2 cm = 1), histopathological type (inflammatory hyperplasia = 0, adenomatous = 1), *Helicobacter pylori* infection (No = 0, Yes = 1), metabolic syndrome (No = 0, Yes = 1), CRP level (measured value), and the presence or absence of recurrence within one year after surgery as the dependent variable (no recurrence = 0, recurrence = 1). The results showed that age (≥ 60 years), number of intestinal polyps (≥ 3), diameter of intestinal polyps (≥ 2 cm), adenomatous intestinal polyps, and metabolic syndrome were independent risk factors for recurrence after colonoscopy high-frequency electroresection in patients with intestinal polyps ($p < 0.05$, Table II).

Table I: Comparison of general data between recurrent group and non-recurrent group.

Item		Recurrent group (n = 40)	Non-recurrent group (n = 200)	t/X ² value	p-value
Gender ^a	Male	24 (60.00)	114 (57.00)	0.123	0.726
	Female	16 (40.00)	86 (43.00)		
Age ^a	<60 years	18 (45.00)	140 (70.00)	9.262	0.002
	≥60 years	22 (55.00)	60 (30.00)		
BMI (kg/m ²) ^b		23.83 ± 2.62	23.69 ± 1.66	0.420	0.675
Smoking history ^a		18 (45.00)	66 (33.00)	2.111	0.146
Alcohol history ^a		16 (40.00)	58 (29.00)	1.891	0.169
Previous history of gastrointestinal bleeding ^a		4 (10.00)	16 (8.00)	0.174	0.676
Number of intestinal polyps ^a	<3	12 (30.00)	110 (55.00)	8.336	0.004
	≥3	28 (70.00)	90 (45.00)		
Intestinal polyp diameter ^a	<2 cm	16 (40.00)	132 (66.00)	9.532	0.002
	≥2 cm	24 (60.00)	68 (34.00)		
Intestinal polyp site ^a	Distal colon	22 (55.00)	96 (48.00)	0.653	0.419
	Proximal colon	18 (45.00)	104 (52.00)		
Histopathologic type ^a	Inflammatory proliferative	14 (35.00)	142 (71.00)	18.989	<0.001
	Adenomatous	26 (65.00)	58 (29.00)		
Bowel cleanliness ^a	Grade I/II	28 (70.00)	156 (78.00)	1.193	0.275
	Grade III/IV	12 (30.00)	44 (22.00)		
<i>Helicobacter pylori</i> infection ^a		14 (35.00)	32 (16.00)	7.767	0.005
Metabolic syndrome ^a		20 (50.00)	54 (27.00)	8.268	0.004
High fat diet ^a		12 (30.00)	38 (19.00)	2.445	0.118
CRP (mg/L) ^b		11.48 ± 2.51	10.21 ± 2.17	3.278	0.001

a: Chi-Square test, uncorrected chi-square; b: t-test, compared by independent sample t-test.

Table II: Multiple factor logistic regression analysis affecting recurrence after colonoscopy high-frequency electroresection in patients with intestinal polyps.

Factor	Beta	SE	Wald X ²	p	OR	95% CI
Age ≥60 years	1.177	0.403	8.530	0.003	3.243	1.473 to 7.142
Number of intestinal polyps ≥3	1.021	0.424	5.706	0.017	2.751	1.199 to 6.309
Intestinal polyps ≥2 cm in diameter	1.059	0.397	7.107	0.008	2.883	1.324 to 6.279
Adenomatous intestinal polyp	1.675	0.408	16.856	<0.001	5.341	2.400 to 11.885
Metabolic syndrome	1.048	0.403	6.751	0.009	2.852	1.294 to 6.289

DISCUSSION

Intestinal polyps are common growths found in the digestive tract, and colonoscopy high-frequency electroresection is usually used to treat them in clinical practice, which can effectively remove the lesion. In this study, of the 240 patients with intestinal polyps, 40 patients relapsed within one year of colonoscopy high-frequency electroresection, with a recurrence rate of 16.67%, which was slightly lower than the recurrence rate of 20% reported in previous studies,⁷ which may be related to individual differences in patients. However, these studies suggest that colonoscopy resection still carries a high risk of intestinal polyp recurrence. Therefore, exploring the influencing factors of intestinal polyp recurrence is of great significance for guiding clinical prevention and controlling the recurrence rate.

In this study, the recurrence group were older (≥60 years), had more intestinal polyps (≥3), had a larger diameter of intestinal polyps (≥2 cm), and had higher rates of adenomatous intestinal polyps, *Helicobacter pylori* infection, metabolic syndrome, and CRP levels than the non-recurrence group. Logistic regression analysis showed that age (≥60 years), number of intestinal polyps (≥3), adenomatous intestinal polyps, and metabolic syndrome were all risk

factors for recurrence after colonoscopy high-frequency electroresection in patients with intestinal polyps.

Age is a contributing factor to the biological characteristics of colonic polyps, and the incidence of colonic polyps tends to increase with age.⁸ The recurrence of intestinal polyps is also closely related to continuous mechanical and inflammatory stimuli. The elderly population is prone to constipation due to poor gastrointestinal function, which in turn leads to polyp recurrence in the gastrointestinal tract due to continuous stimulation from chronic inflammation.⁹ A multicenter prospective study in Korea reported that patients with recurrence after colonoscopic polypectomy were all over 50 years old, and older age was an independent risk factor for intestinal polyp recurrence (OR = 2.02).¹⁰ Suresh *et al.* found that elderly patients had a greater probability of intestinal polyp recurrence.¹¹ This study also found a 3.243-fold increased risk of recurrence of intestinal polyps in patients aged ≥60 years compared with <60 years.

The notion that patients with multiple intestinal polyps, especially those with more than three polyps, tend to relapse after surgery has now been recognised by most scholars, and this study has also confirmed that the number of intestinal polyps is a risk factor for relapse after colonoscopy high-frequency electroresection, which is consistent

with a previous report from Du *et al.* Patients with larger polyp diameters have relatively thicker vessels and greater body volatility, which increases the difficulty of surgery to a certain extent and affects the therapeutic effect, with a relatively high risk of local recurrence after surgery.¹² Murakami *et al.* found that patients with large colorectal polyps had higher local recurrence rates after resection than patients with small polyps.¹³ Chaoui *et al.* also pointed out that the lesion size was an independent risk factor for colorectal polyp recurrence,¹⁴ and the results of this study were consistent with the above reports.

Adenomatous polyps account for about two-thirds of colorectal polyps. The division growth rate of adenomatous polyp tissue compared with normal tissue is abnormally increased, which induces the recurrence and carcinogenesis of intestinal polyps. Previous related studies reported that histopathological types of intestinal polyps have a certain correlation with the recurrence of colonic polyps, and adenomatous intestinal polyps, especially villous and tubulovillous adenomatous polyps, have a high recurrence rate.^{15,16} The results of these studies showed that patients with adenomatous intestinal polyps had a significantly higher probability of relapse than patients with inflammatory hyperplastic intestinal polyps.

Patients with metabolic syndrome present with abdominal obesity, often accompanied by abnormalities in blood lipids, blood pressure, or blood glucose. Im *et al.*¹⁷ found that increases in waist circumference and BMI were associated with the risk of colorectal adenomatous polyp recurrence, and other studies indicated that metabolic syndrome and its abnormal blood lipids and blood pressure were associated with the risk of colonic polyps and were risk factors for colonic polyp recurrence.¹⁸ The possible mechanism for this finding may be that the increased expression of insulin and insulin-like growth factor-1 in obese patients stimulates polyp recurrence and may also lead to intestinal polyp recurrence due to fat deposition in obese patients that causes endocrine disorders in the body, releasing more inflammatory factors.^{19,20}

This study had several limitations. This study was a retrospective and single-centre study with small sample size. No long-term analyses of recurrence and influencing factors were performed for patients with intestinal polyps after surgery. In future, the sample size should be increased to prolong the follow-up time and continue the in-depth study of patient outcomes.

This retrospective study analysed 240 colonoscopies with polyps, which were likely performed by different operators. Given the varying expertise of these operators, there is a possibility that some polyps may have been missed during the initial colonoscopy. In this study, the authors attempted to control for this potential confounder by considering the

operator's experience and skill level when evaluating the recurrence of polyps.

It is important to note that a two-year timeframe may be too short for true recurrence, and some polyps labelled as recurrent may actually be missed polyps from the initial procedure. To address this concern, the authors have performed additional sensitivity analyses, including stratifying the data based on operator experience and adjusting for potential confounding variables. This helps to minimise the likelihood that the observed recurrent polyps are simply a result of initial polyp misclassification.

CONCLUSION

Age (≥ 60 years), greater number of intestinal polyps (≥ 3), larger diameter of intestinal polyps (≥ 2 cm), adenomatous intestinal polyps, and metabolic syndrome were all risk factors for recurrence after colonoscopy high-frequency electroresection in patients with intestinal polyps.

ETHICAL APPROVAL:

The study was approved by the Ethics Committee of Hefei Second People's Hospital (No. 2016322).

PATIENTS' CONSENT:

Written informed consent were obtained from all the patients.

COMPETING INTEREST:

The authors have no competing interest to declare that are relevant to the content of this article.

AUTHORS' CONTRIBUTION:

JJ: Writing-original draft preparation, conceptualisation, and methodology.

BY, SY: Data curation, visualisation, and investigation.

MD: Supervision, writing, reviewing, and editing.

All the authors have approved the final version of the manuscript to be published.

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