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Original Research Article

Colorectal Post-polypectomy Bleeding in Outpatient versus Inpatient Treatment: Propensity Score Matching Analysis

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Abstract

Objectives: Delayed bleeding is the most frequent adverse event associated with endoscopic mucosal resection (EMR) and hot snare polypectomy (HSP) of colorectal polyps. However, whether the incidence of delayed bleeding differs between outpatient and inpatient treatment is unknown. Therefore, in this study, we aimed to evaluate delayed bleeding rates between outpatient and inpatient endoscopic treatments and clarify the safety of outpatient treatment.

Methods: We enrolled 469 patients (1077 polyps) and 420 patients (1080 polyps) in the outpatient and inpatient groups, respectively, who underwent EMR or HSP for colorectal polyps at our institution between April 2020 and May 2023. Using propensity score matching, we evaluated the delayed bleeding rates between the two groups. Delayed bleeding was defined as a hemorrhage requiring endoscopic hemostasis occurring within 14 days of the procedure.

Results: Propensity score matching created 376 (954 polyps) matched patient pairs. The median maximum diameter of polyps removed was 10 mm in both groups. Delayed bleeding rates per patients were 1.3% (5/376) in the outpatient group and 2.9% (11/376) in the inpatient group (P=0.21). In term of per polyp, early delayed bleeding (occurring within 24 hours) rates were higher in the inpatient group than outpatient group (0.2% [2/954] vs. 1.1% [10/954], respectively; P=0.04). No severe bleeding requiring a transfusion occurred in either group.

Conclusions: Outpatient endoscopic treatment did not increase delayed bleeding compared with inpatient treatment. Outpatient treatment would be safe and common for the removal of colorectal polyps.

Keywords

colorectal polyp, endoscopic mucosal resection, hot snare polypectomy, delayed bleeding, outpatient, inpatient

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Introduction

Removal of colorectal polyps reduces the incidence and mortality of colorectal cancer[1,2]. In recent years, outpatient endoscopic treatment has become more common due to the widespread use of cold polypectomy [CP], which has fewer adverse events than resection with electrocautery (e.g., endoscopic mucosal resection [EMR] and hot snare polypectomy [HSP])[3-5]. Nevertheless, limiting CP indications to lesions ≤ 10 mm and avoiding it for lesions with possible cancer is recommended, as it results in incomplete resection of the muscularis mucosa, complicating the pathological as-

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sessment of the tumor margins[6,7]. Therefore, lesions that cannot be accurately diagnosed as colorectal adenomas should be resected with electrocautery; such cases are common in practice.

The risk of delayed post-polypectomy bleeding is especially concern after resection with electrocautery; however, evidence on postoperative management is lacking. It is unclear whether inpatient management can prevent delayed bleeding. Furthermore, whether outpatient treatment is associated with a higher risk of bleeding than inpatient treatment is unknown. It is important to clarify the frequency of delayed bleeding as outpatient endoscopic treatment requires a high level of safety.

Therefore, in this study, we aimed to investigate whether outpatient resection of colorectal polyps with electrocautery is safe by comparing the incidence of delayed bleeding between outpatient and inpatient treatment using propensity score matching analysis.

Methods

Study design

This was a retrospective cohort study conducted at a single center. At our institution, all endoscopic resections of colorectal polyps with electrocautery were performed in inpatient setting before May 2021. Outpatient treatment was introduced in June 2021. Therefore, we enrolled 420 patients (1080 polyps) treated in the inpatient setting between April 2020 and May 2021 and 469 patients (1077 polyps) treated in the outpatient setting between June 2021 and May 2023 as the inpatient and outpatient groups, respectively. All patients provided written informed consent before the endoscopic treatment. The exclusion criteria were polyp size ≥ 21 mm; inflammatory bowel disease; pre-operative cases of colorectal cancer; and polyposis of the alimentary tract. This study was approved by the Ethics Review Board of Tsugaru General Hospital (No.14; December 6, 2022).

Medical records were used to collect patient clinical information and data on the excised polyps. Data on patient-related factors included age, sex, comorbidities, antithrombotic agents, number of polyps removed, and maximum diameter of excised polyps and polyp-related factors included polyp size, morphology, location, and procedures.

Procedure

Endoscopic treatment was performed using an electric video endoscope (PCF-H290ZI, CF-HQ290ZI, PCF-H290I, CF-H290I; Olympus, Tokyo, Japan), processor (CV-290; Olympus, Tokyo, Japan), and light source (CLV-290; Olympus, Tokyo, Japan), with carbon dioxide insufflation. All patients were treated with 1.0-2.0 L of polyethylene glycol solution (MoviPrep®; Ajinomoto, Tokyo, Japan) in the morning on the day of the procedure, and polyps were removed using EMR or HSP. For EMR, normal saline was injected into the submucosa before resection. The snares used in this study included Captivator II (Boston Scientific Co., Boston, MA, United States) and SnareMaster (Olympus, Tokyo, Japan). A VIO300D (ERBE Elektromedizin, Tubingen, Germany) was used for resection with electrocautery. All participating endoscopists used the same settings, procedures, and equipment in both groups. Decisions on procedures for polyps (i.e., EMR or HSP) were made by the endoscopists in charge. In all cases, clipping for the prophylaxis of bleeding after polypectomy was usually performed. Patients in the outpatient group were discharged after treatment, whereas patients in the inpatient group were admitted to the hospital on the day of treatment, fasted after the procedure, and discharged the next day if they experienced no adverse events. Both groups were instructed to report to the hospital if they experienced adverse events such as bleeding or abdominal pain. Antithrombotic agents were changed or discontinued throughout the study, based on Japanese Gastroenterological Endoscopy Society guidelines[8,9].

Outcome

The primary outcome of this study was to compare the post-polypectomy delayed bleeding rates between the outpatient and inpatient treatment groups. Delayed bleeding was defined as a hemorrhage requiring endoscopic hemostasis occurring within 14 days of the procedure. Early and late delayed bleeding were defined as bleeding within and after 24 hours of treatment, respectively. Secondary outcomes included the minor bleeding rate (defined as hemorrhage not requiring endoscopic hemostasis), severe bleeding (defined as hemorrhage requiring transfusion with or without endoscopic hemostasis) and emergency department visits. Additionally, we analyzed data on patient and polyp factors associated with delayed bleeding.

Statistical analysis

We used propensity score matching to adjust for baseline differences between the groups. Propensity scores were calculated using logistic regression to estimate the probability of a patient undergoing treatment on an outpatient or inpatient basis. The following variables were defined as potential confounders: patient variables including age, sex, comorbidity, antithrombotic agents, number of polyps removed, and maximum diameter of the excised polyp and polyp variables including size, morphology, location, resection method, prophylactic clipping, and experience of the endoscopist. One-to-one propensity score matching was performed using a 0.05 caliper, equal to 0.2 of the standard deviation of the logit of the propensity score. Patient characteristics before and after propensity score matching between the groups were examined. Continuous variables were compared using the

Table 1. Characteristics of Patients and Polyps before Propensity Score Matching.

	Outpatient (469 patients, 1077 polyps)	Inpatient (420 patients, 1080 polyps)	P-value
Patient variables			
Sex, men, n (%)	298 (64)	271 (65)	0.78
Age, year, median (IQR)	70 (63–76)	70 (63–77)	0.93
Comorbidity, n (%)			
Hypertension	272 (58)	238 (57)	0.73
Diabetes mellitus	107 (23)	71 (17)	0.03
Heart disease	57 (12)	79 (19)	<0.01
Cerebrovascular disease	37 (8)	29 (7)	0.61
Liver cirrhosis	5 (1)	2 (0.5)	0.46
Hemodialysis	2 (0.4)	3 (0.7)	0.67
Antithrombotic agents, n (%)			
Antiplatelet agents	51 (11)	57 (14)	0.26
Anticoagulants	36 (8)	57 (14)	<0.01
Number of polyps removed, mean (SD)	2.3 (1.7)	2.6 (1.7)	<0.01
Maximum diameter of excised polyp, mm, median (IQR)	10 (7–12)	10 (7–12)	0.83
Polyp and procedure variables			
Size, mm, median (IQR)	7 (6–10)	7 (5–10)	<0.01
Morphology, n (%)			0.37
0-II, Is	845 (78)	865 (80)	
0-Ip, Isp	232 (22)	215 (20)	
Location, n (%)			<0.01
Right-side colon	531 (49)	601 (56)	
Left-side colon	433 (40)	375 (35)	
Rectum	113 (11)	104 (10)	
Procedure, n (%)			
Resection method			<0.01
EMR	989 (92)	1030 (95)	
HSP	88 (8)	50 (5)	
Prophylactic clipping	1054 (98)	1075 (99)	<0.01
Experience of endoscopist, ≥10 years	335 (31)	337 (31)	0.96

EMR, Endoscopic mucosal resection; HSP, Hot snare polypectomy

Mann-Whitney U-test, and categorical variables were compared using Fisher's exact tests or chi-square test. A sample size of 376 patients and 954 polyps per group resulted in post hoc powers of 24% and 59%, respectively, to detect differences in delayed bleeding rates, using a two-group t-test with a two-side significance level of $P < 0.05$.

Logistic regression analyses were used to estimate the odds ratio (OR) of delayed bleeding in the outpatient group compared with that in the inpatient group after propensity score matching. Univariate and multivariate logistic regression analyses were performed to assess the effect of the various factors on delayed bleeding. Differences were considered statistically significant at $P < 0.05$. All statistical analyses were performed using GraphPad Prism version 8.4.3 (GraphPad Software, La Jolla, CA, USA) and EZR version 1.60, a graphical user interface for R (R Foundation for Statistical Computing, version 4.2.1)[10].

Results

Characteristics of patients and polyps

Table 1 presents the characteristics of the outpatient (469 patients, 1077 polyps) and inpatient (420 patients, 1080 polyps) groups. Sex and age did not differ significantly between the two groups. Among comorbidities, diabetes mellitus was significantly more common in the outpatient group (23% vs. 17%; P=0.03) and heart disease was significantly more common in the inpatient group (12% vs. 19%; $P < 0.01$). The use of antiplatelet agents was not significantly different in both groups; however, anticoagulants were significantly higher in the inpatient group than in the outpatient group (8% vs. 14%; $P < 0.05$). The number of polyps removed per patient was significantly higher in the inpatient group than in the outpatient group (mean, 2.3 vs. 2.6; $P < 0.01$). There were no significant differences in the maximum diameter of excised polyps between the two groups (median,

Table 2. Histology of Excised Polyps.

	Outpatient (469 patients, 1077 polyps)	Inpatient (420 patients, 1080 polyps)	P-value
Polyp retrieval rate, n (%)	1074 (99.7)	1072 (99.3)	0.23
Histology			
Adenoma with low-grade dysplasia	528 (49.0)	509 (47.1)	0.39
Adenoma with high-grade dysplasia	319 (29.6)	262 (24.3)	<0.01
Intramucosal carcinoma	98 (9.1)	162 (15.0)	<0.01
Submucosal carcinoma	16 (1.5)	9 (0.8)	0.17
Hyperplastic polyp	30 (2.8)	56 (5.2)	<0.01
Sessile serrated lesion	53 (4.9)	41 (3.8)	0.21
Traditional serrate adenoma	11 (1.0)	23 (2.1)	0.06
Others	22 (2.0)	10 (0.9)	<0.01

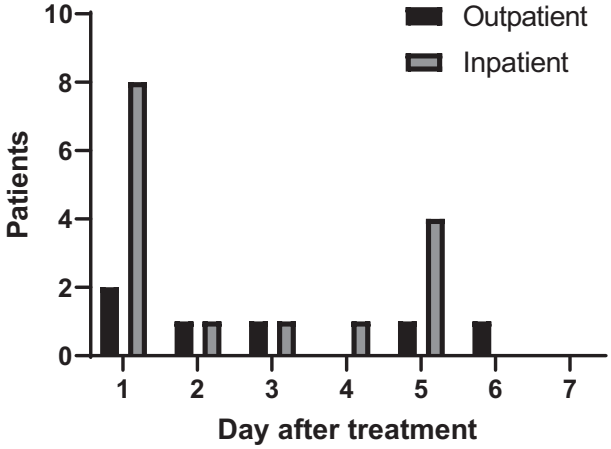

Figure 1. Time and number of patients at the occurrence of delayed bleeding.

10 mm vs. 10 mm; P=0.83).

The characteristics of the polyps and their procedures are presented in Table 1. The size of the treated polyps was significantly larger in the outpatient group than in the inpatient group (median [IQR], 7[6-10] vs. 7[5-10]; P < 0.01). Polyp morphology showed a higher proportion of sessile polyps in both groups (78% vs. 80%; P=0.37). The proportion of polyps resected using EMR was 92% (989/1077) in the outpatient group and 95% (1030/1080) in the inpatient group (P < 0.01). Polyps in the right-side of the colon were significantly more common in the inpatient group than in the outpatient group (49% vs. 56%; P < 0.01). Prophylactic clipping was performed in almost all cases. Moreover, there were no significant differences in endoscopist experience between the two groups.

The histology of polyps is summarized in Table 2. There was no significant difference in the polyp retrieval rate between the two groups (99.7% vs. 99.3%; P=0.23). The proportion of adenoma with high-grade dysplasia was significantly higher in the outpatient group (29.6% vs. 24.3%; P < 0.01) and intramucosal carcinoma was significantly higher in the inpatient group (9.1% vs. 15.0%; P < 0.01).

Incidence of delayed bleeding and time of occurrence

Figure 1 demonstrates the period of occurrence of delayed bleeding after polypectomy. A total of 21 patients developed delayed bleeding, with an average bleeding time of 2.6 days after treatment (range 1-6). Eight patients (53.3%) in the inpatient group developed bleeding within 1 day (early delayed bleeding), most of whom underwent endoscopic hemostasis while in the hospital. In five of these eight cases, patients were taking antithrombotic agents.

Comparison of delayed bleeding rates after propensity score matching

Propensity score matching created 376 patient pairs and 954 polyp pairs in each group (Table 3). After propensity score matching, the characteristics of patients and polyps were well balanced between the groups. Table 4 shows the results for each outcome in the post propensity score matching cohort. The delayed bleeding rate per patient was 1.3% in the outpatient group and 2.9% in the inpatient group (P= 0.21). Early and late delayed bleeding rates were not significantly different between both groups (P=0.69 and P=0.34, respectively). The delayed bleeding rate per polyp was 0.6% in the outpatient group and 1.8% in the inpatient group (P= 0.03). Minor bleeding rates (0.8% vs. 1.3%) and unscheduled emergency visits (1.9% vs. 1.9%) did not differ significantly between both groups (P=0.73 and P=1, respectively). No events of serious bleeding requiring transfusion and perforation were observed in both groups.

Factors related to delayed bleeding

All patients and treated polyps were divided into the delayed bleeding and non-bleeding groups. Univariate and multivariate logistic regression analyses were performed to identify factors associated with delayed bleeding (Table 5). Univariate analysis showed that the use of anticoagulants, resection of three or more polyps, and inpatient treatment

Table 3. Characteristics of Patients and Polyps after Propensity Score Matching.

	Outpatient (376 patients, 954 polyps)	Inpatient (376 patients, 954 polyps)	P-value
Patient variables			
Sex, men, n (%)	242 (64)	241 (64)	1
Age, year, median (IQR)	70 (62–76)	70 (63–77)	0.93
Comorbidity, n (%)			
Hypertension	216 (57)	211 (56)	0.77
Diabetes mellitus	70 (19)	67 (18)	0.85
Heart disease	52 (14)	53 (14)	1
Cerebrovascular disease	31 (8)	27 (7)	0.68
Liver cirrhosis	1 (0.3)	2 (0.5)	1
Hemodialysis	0	0	
Antithrombotic agents, n (%)			
Antiplatelet agents	49 (13)	43 (11)	0.58
Anticoagulants	34 (9)	34 (9)	1
Number of polyps removed, mean (SD)	2.4 (1.8)	2.5 (1.6)	0.90
Maximum diameter of excised polyp, mm, median (IQR)	10 (7–12)	10 (7–12)	0.37
Polyp and procedure variables			
Size, mm, median (IQR)	7 (6–10)	7 (5–10)	0.31
Morphology, n (%)			0.69
0-II, Is	766 (80)	758 (80)	
0-Ip, Isp	188 (20)	196 (21)	
Location, n (%)			0.47
Right-side colon	492 (52)	485 (51)	
Left-side colon	368 (39)	366 (38)	
Rectum	94 (10)	103 (11)	
Procedure, n (%)			
Resection method			0.54
EMR	899 (94)	906 (95)	
HSP	55 (6)	48 (5)	
Prophylactic clipping	950 (99)	950 (99)	1
Experience of endoscopist, ≥10 years	302 (32)	296 (31)	0.81

EMR, Endoscopic mucosal resection; HSP, hot snare polypectomy

Table 4. Delayed Bleeding in the Outpatient versus Inpatient Group after Propensity Score Matching.

	Outpatient (376 patients, 954 polyps)	Inpatient (376 patients, 954 polyps)	P-value
Per patient			
Delayed bleeding, n (%)	5/376 (1.3)	11/376 (2.9)	0.21
Early delayed bleeding, n (%)	2/376 (0.5)	4/376 (1.1)	0.69
Late delayed bleeding, n (%)	3/376 (0.8)	7/376 (1.9)	0.34
Minor bleeding, n (%)	3/376 (0.8)	5/376 (1.3)	0.73
Emergency visit, n (%)	7/376 (1.9)	7/376 (1.9)	1
Per polyp			
Delayed bleeding, n (%)	6/954 (0.6)	17/954 (1.8)	0.03
Early delayed bleeding, n (%)	2/954 (0.2)	10/954 (1.1)	0.04
Late delayed bleeding, n (%)	4/954 (0.4)	7/954 (0.7)	0.55

were significant patient factors for risk of delayed bleeding. Multivariate logistic regression analysis revealed that the use of anticoagulants (odds ratio [OR], 1.97; 95% confidence interval [CI]: 1.22-3.18; P < 0.01), polyp size ≥ 10 mm (OR, 2.89; 95% CI: 1.15-7.24; P=0.02) and inpatient treatment (polyp variable; OR, 3.12; 95% CI: 1.22-7.99; P=0.02) were

Table 5. Variables Associated with Delayed Bleeding.

	Univariate		Multivariate	
	OR (95% CI)	P-value	OR (95% CI)	P-value
Patient variables				
Age, ≥ 75	1.01 (0.38–2.70)	0.98	1.05 (0.40–2.71)	0.93
Female	0.47 (0.15–1.42)	0.18	0.67 (0.23–1.92)	0.45
Antiplatelet agents	1.96 (0.64–6.03)	0.24	1.55 (0.50–4.84)	0.45
Anticoagulants	2.31 (1.43–3.72)	<0.01	1.97 (1.22–3.18)	<0.01
Number of polyps removed, ≥ 3	3.14 (1.23–8.07)	0.02	2.41 (0.97–6.00)	0.06
Maximum diameter of excised polyp, ≥ 10 mm	1.96 (0.79–4.87)	0.15	1.86 (0.77–4.51)	0.17
Inpatient treatment	2.86 (1.10–7.44)	0.03	2.42 (0.91–6.43)	0.08
Polyp variables				
Size, ≥ 10 mm	2.24 (0.94–5.31)	0.07	2.89 (1.15–7.24)	0.02
Left-side colon	1.43 (0.62–3.27)	0.40	1.57 (0.67–3.65)	0.30
0-Ip, Isp	0.80 (0.27–2.37)	0.69	0.52 (0.16–1.68)	0.28
Experience of endoscopist, ≥10 years	0.78 (0.31–1.98)	0.60	0.75 (0.29–1.92)	0.55
Inpatient treatment	2.85 (1.12–7.27)	0.03	3.12 (1.22–7.99)	0.02

OR, odds ratio; CI, confidence interval

significant independent risk factors for delayed bleeding.

Discussion

In this study, we found that outpatient endoscopic treatment did not increase delayed bleeding compared with inpatient treatment for polyps sized approximately 10 mm. In addition, early delayed bleeding was more common in the inpatient group than in the outpatient group.

First, our study showed that outpatient endoscopic treatment did not increase delayed bleeding compared with inpatient treatment. Several studies have reported on delayed post-polypectomy bleeding rates. In a previous large questionnaire survey in Japan, the postoperative bleeding rates for colorectal EMR and HSP were 1.4% and 1.3%, respectively; however, delayed bleeding in this study was defined as the condition wherein the hemoglobin content of the blood was ≤ 2 g/dL, which differs from our study[11]. Moreover, this study did not provide information on whether treatment was provided on an outpatient or inpatient basis. Another study in a Japanese clinic reported that the frequency of post-polypectomy bleeding in outpatient endoscopic treatment was 0.2-0.4%[12], however, the mean size of polyps removed in this study was 4.3 mm, with most polyps being small. Other studies have reported delayed bleeding rates of 1.2-3.4%[13,14]; however, to our knowledge no study has compared the delayed bleeding rates between outpatient and inpatient treatment. Although Japanese guidelines state that colorectal EMR for lesions ≤ 2 cm can be performed for outpatients[15], its indication in the real world varies among different centers and doctors, and evidence on postoperative management is lacking. In this case, our results suggest the safety of outpatient endoscopic treatment, which has become more common in recent years. In addition, the advantage of outpatient treatment is its low cost. Our hospital estimates that outpatient colorectal polypectomy (for polyps ≤ 2 cm in patients < 70 years old) could reduce medical costs by 43-55% compared to inpatient treatment.

Second, we found that early delayed bleeding was more common in the inpatient group than in the outpatient group. The major difference between outpatient and inpatient management in this study was dietary restrictions on the day of treatment and symptom monitoring up to the day after treatment. However, the extent to which this difference contributes to the prevention of delayed bleeding is unclear. In addition, the delayed bleeding rates in this study tended to be higher in the inpatient group than in the outpatient group. Further, logistic regression analysis identified inpatient treatment as a risk factor for delayed bleeding, possibly due to a higher detection rate of hematochezia in the inpatient group. In other words, there were no cases of severe delayed bleeding in this study. Thus, the advantage of inpatient management is early detection of delayed bleeding and prompt treatment, potentially preventing serious bleeding. Furthermore, more than half of the case of delayed bleeding involved early delayed bleeding that occurred within 24 hours of the procedure, which is consistent with a previous study[14]. Thus, inpatient management may be considered in cases with multiple bleeding risks, such as the treatment of large polyps while on antithrombotic medication; however, its necessity and effectiveness warrant further investigation.

In our analysis of risk factors for delayed post-polypectomy bleeding, oral anticoagulants and polyp size were identified as risk factors, which is consistent with pre-

vious studies[16-18]. Conversely, other studies reported that a pedunculated polyp and right-side colon are associated with delayed bleeding risk[19], which was not observed in this study. There is no doubt that the risk of delayed bleeding increases with the size of the polyp being removed, although some studies showed the effectiveness of outpatient management for EMR or ESD of colorectal polyps ≥ 20 mm[20,21]. Japanese guidelines recommended that treatment of lesions ≥ 2 cm should be carried out in a hospital[11]; however, further research is required to evaluate the efficacy and safety of outpatient treatment of large lesions. For prophylactic clipping after polypectomy, our institution usually performs clip closure after resection with electrocautery; however, recent large studies reported no effects of prophylactic clipping on the prevention of delayed post-polypectomy bleeding[22,23]. Whether prophylactic clipping should be performed in patients at high risk of delayed bleeding, such as after resection of large lesions or on antithrombotic medication, remains controversial.

This study had several limitations. First, it was a single-center, and retrospective observational study without randomization. Therefore, the assignment of outpatient or inpatient treatments might have been biased. Propensity score matching and multivariate analysis were used to adjust for confounding factors; however, the results might have been biased because of unknown confounders. Second, the polyps included in this study were about 10 mm in size, and the frequency of delayed post-polypectomy bleeding was low. Prospective comparative studies in larger colorectal polyps would be desirable to address these issues. Third, the method of polyp resection and whether delayed bleeding required hemostasis was decided by each endoscopist, and there were no strict criteria.

In conclusion, our study shows that outpatient endoscopic treatment did not increase delayed bleeding compared with inpatient treatment for polyps sized approximately 10 mm. Outpatient treatment would be safe and common for the removal of colorectal polyps. The widespread use of appropriate outpatient treatment for colorectal polyps is expected to reduce medical costs and the burden of hospitalization for patients.

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Conflicts of Interest

There are no conflicts of interest.

Author Contributions

TM: study conception and design, acquisition, and analysis of data, drafting of manuscript; NI, RM, YM, SO, SN, TO, HK and DC: treatment of patients and acquisition of data; JS and HI: determination of treatment plan; HS: critical revision of manuscript. All authors have read and approved the final manuscript.

Approval by Institutional Review Board (IRB)

This study was approved by the institutional review board of Tsugaru General Hospital (No.14; December 6, 2022).

References

1. Winawer SJ, Zauber AG, Ho MN, et al. Prevention of colorectal cancer by colonoscopic polypectomy. The National Polyp Study Workgroup. N Engl J Med. 1993 Dec; 329(27): 1977-81.
2. Zauber AG, Winawer SJ, O'Brien MJ, et al. Colonoscopic polypectomy and long-term prevention of colorectal-cancer deaths. N Engl J Med. 2012 Feb; 366(8): 687-96.
3. Repici A, Hassan C, Vitetta E, et al. Safety of cold polypectomy for <10mm polyps at colonoscopy: a prospective multicenter study. Endoscopy. 2012 Jan; 44(1): 27-31.
4. Chang LC, Chang CY, Chen CY, et al. Cold Versus Hot Snare Polypectomy for Small Colorectal Polyps : A Pragmatic Randomized Controlled Trial. Ann Intern Med. 2023 Mar; 176(3): 311-9.
5. Schett B, Wallner J, Weingart V, et al. Efficacy and safety of cold snare resection in preventive screening colonoscopy. Endosc Int Open. 2017 Jul; 5(7): E580-6.
6. Uraoka T, Takizawa K, Tanaka S, et al. Guidelines for Colorectal Cold Polypectomy (supplement to "Guidelines for Colorectal Endoscopic Submucosal Dissection/Endoscopic Mucosal Resection"). Dig Endosc. 2022 May; 34(4): 668-75.
7. Ito A, Suga T, Ota H, et al. Resection depth and layer of cold snare polypectomy versus endoscopic mucosal resection. J Gastroenterol. 2018 Nov; 53(11): 1171-8.
8. Fujimoto K, Fujishiro M, Kato M, et al. Guidelines for gastroenterological endoscopy in patients undergoing antithrombotic treatment. Dig Endosc. 2014 Jan; 26(1): 1-14.
9. Kato M, Uedo N, Hokimoto S, et al. Guidelines for Gastroenterological Endoscopy in Patients Undergoing Antithrombotic Treatment: 2017 Appendix on Anticoagulants Including Direct Oral Anticoagulants. Dig Endosc. 2018 Jul; 30(4): 433-40.
10. Kanda Y. Investigation of the freely available easy-to-use software 'EZR' for medical statistics. Bone Marrow Transplant. 2013 Mar; 48(3): 452-8.
11. Oka S, Tanaka S, Kanao H, et al. Current status in the occurrence of postoperative bleeding, perforation and residual/local recurrence during colonoscopic treatment in Japan. Dig Endosc. 2010 Oct; 22 (4): 376-80.
12. Teruki Oki KO. THE SAFETY OF ENDOSCOPIC DAY SURGERY FOR COLORECTAL POLYPS. Dig Endosc. 2008 Mar; 20 (2): 92-5.
13. Amato A, Radaelli F, Dinelli M, et al. Early and delayed complications of polypectomy in a community setting: The SPoC prospective multicentre trial. Dig Liver Dis. 2016 Jan; 48(1): 43-8.
14. Park SK, Seo JY, Lee MG, et al. Prospective analysis of delayed colorectal post-polypectomy bleeding. Surg Endosc. 2018 Jul; 32 (7): 3282-9.
15. Tanaka S, Kashida H, Saito Y, et al. Japan Gastroenterological Endoscopy Society guidelines for colorectal endoscopic submucosal dissection/endoscopic mucosal resection. Dig Endosc. 2020 Jan; 32(2): 219-39.

16. Harada H, Miyaoka Y, Yuki T, et al. Postpolypectomy bleeding of colorectal polyps in patients with continuous warfarin and short-term interruption of direct oral anticoagulants. Gastrointest Endosc. 2021 Mar; 93(3): 691-8.

17. Jaruvongvanich V, Prasitlumkum N, Assavapongpaiboon B, et al. Risk factors for delayed colonic post-polypectomy bleeding: a systematic review and meta-analysis. Int J Colorectal Dis. 2017 Oct; 32(10): 1399-406.

18. Albéniz E, Gimeno-García AZ, Fraile M, et al. Clinical validation of risk scoring systems to predict risk of delayed bleeding after EMR of large colorectal lesions. Gastrointest Endosc. 2020 Apr; 91(4): 868-78.e3.

19. Kim JH, Lee HJ, Ahn JW, et al. Risk factors for delayed post-polypectomy hemorrhage: a case-control study. J Gastroenterol Hepatol. 2013 Apr; 28(4): 645-9.

20. Dior M, Coriat R, Tarabichi S, et al. Does endoscopic mucosal resection for large colorectal polyps allow ambulatory management? Surg Endosc. 2013 Aug; 27(8): 2775-81.

21. Ohya T, Marsk R, Pekkari K. Colorectal ESD in day surgery. Surg Endosc. 2017 Sep; 31(9): 3690-5.

22. Feagins LA, Smith AD, Kim D, et al. Efficacy of Prophylactic Hemoclips in Prevention of Delayed Post-Polypectomy Bleeding in Patients With Large Colonic Polyps. Gastroenterology. 2019 Oct; 157(4): 967-76.e1.

23. Inoue T, Ishihara R, Nishida T, et al. Prophylactic clipping not effective in preventing post-polypectomy bleeding for < 20-mm colon polyps: A multicenter, open-label, randomized controlled trial. J Gastroenterol Hepatol. 2021 Feb; 36(2): 383-90.