

A Randomised Controlled Study of Colorectal Polyps and Pathological Morphology Under Water-Injection Enteroscopy

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1. Abstract

1.1. Objective

This study aimed to use a randomised controlled trial to evaluate and compare the endoscopic morphological characteristics and pathologic types of colorectal polyps between water-immersion and air-insufflation colonoscopy.

1.2. Method

Patients were randomly divided into two groups (water-immersion colonoscopy group and air-insufflation colonoscopy group) to observe the abdominal-pain level with no anaesthesia, adenoma detection rate, slightly elevated lesions (Paris type 0-IIa) detection rate, cecal-intubation rate, bowel-preparation conditions, and period of performance.

1.3. Results

A total of 782 participants were randomly divided into 392 cases of water-immersion group and 390 cases of air-insufflation group. No significant difference in baseline, period of performance, quality of bowel preparation, and cecal-intubation rate existed between two groups ($P > 0.05$). Abdominal-pain level, adenoma detection rate, and slightly elevated lesion (Paris type 0-IIa) detection rate of water-immersion colonoscopy group were significantly higher than those of the air-insufflation group ($P = 0.028$, $P = 0.007$, and $P = 0.025$, respectively).

1.4. Conclusion

Water-immersion colonoscopy can improve the detection rate of adenoma and slightly elevated lesions and deserves to be applied in the clinical setting.

2. Introduction

With the improvement in people's health awareness, colonoscopy is gradually being considered as the important method for diagnosing colorectal cancer (CRC) and intestinal diseases. Traditional colonoscopy is performed with air insufflation, which is conducted by insufflating air into the large bowel to distend the bowel lumen and thus obtain a better view. However, excessive infusion of air could cause discomfort such as abdominal pain and abdominal distension. Consequently, some patients feel scared and refuse to undergo colonoscopy.

Numerous studies have reported on water-immersion colonoscopy, which have the advantages of shortening the period of performance and alleviating abdominal discomfort by axial shortening method. Whether or not colonoscopy could detect the colorectal lesion could judge its quality. CRC primarily originates from the canceration of benign polyp and adenoma, so early detection and resection can effectively reduce the incidence of CRC. Meanwhile, the adenoma detection rate is influenced by the quality of bowel preparation, morphology of lesion, and other factors [1]. Research shows that around 26% adenomas are missed during examination and are mostly superficial lesions [2]. According to the Paris classification, superficial digestive-tract lesions could be divided into three categories: pro-

truding (0-I), nonprotruding and nonexcavated (0-II), and excavated (0-III). In early CRC, the rates of Paris type of 0-I and 0-IIa are 50% and 44%, and the rate of other classifications is 6% [3]. Thus, elevating the adenoma detection rate and reducing the rate of missed detection could effectively decrease the incidence of CRC.

3. Materials and Methods

3.1. General Information

3.1.1. Inclusion Criteria

Patients undergoing colonoscopy with no anaesthesia in Shanghai Forth People's Hospital between June 2021 and September 2021 were prospectively selected. The inclusion criteria were (1) patients older than 18 years old, and (2) patients who agreed to undergo colonoscopy.

3.1.2. Exclusion Criteria

Exclusion criteria were patients (1) in poor health who had severe heart and lung illness, as well as low liver and kidney function; (2) who had intestinal obstruction; (3) who had undergone partial or complete colectomy; (4) who had acute alimentary tract haemorrhage; and (5) who had mental illness and other contraindications preventing them to undergo colonoscopy. All patients signed the colonoscopy and polyp-removal informed consent.

1.2. Methods

1.2.1. A total of 782 patients were randomly assigned to two groups, namely, the water-immersion colonoscopy group (A group, $n = 392$) and the air-insufflation colonoscopy group (B group, $n = 390$). All patients were single blinded.

1.2.2. Bowel preparation and Endoscopist

All patients underwent a bowel preparation with 3 L of polyethylene glycol electrolyte lavage solution until they had watery diarrhoea. Colonoscopies for the two groups were completed by one experienced

endoscopist.

1.2.3. Machine and Appliance

An OLYMPUS290 series was used. The image-capture card (SDI-40A-E) with a resolution of 1920×1080 was offered by Beijing Join-Hope Image company. The editing system was from WuHan Lianying Technology Co., Ltd.

1.2.4. Colonoscopy Procedure

The patients were placed in left lateral position. For the A group, the colonoscopy was manipulated by one endoscopist, and water was infused through the water-supply duct with the air button turned off. The colonoscopy could be advanced by shortening the shaft until it reached the cecum and insufflated air to stretch the lumen. For the B group, the colonoscopy was manipulated by the same doctor with the air button turned on until it reached the cecum. Polyps found in two groups were removed by colonoscopy and examined histopathologically.

1.2.5. Study Endpoints

(1) For the adenoma and slightly elevated lesion-detection rate, we analysed the differences in slightly elevated lesion-detection rate according to The Paris endoscopic classification and the adenoma detection rate according to pathologic outcomes (Table 1). (2) Separate calculation of cecal-intubation rate was performed for groups A and B. (3) For abdominal pain, the nurse illustrated the visual analogue scale pain-scoring system for patients before the examination (0 means no pain, 1–3 means mild pain, 4–6 means moderate pain, 7–9 means severe pain, and 10 means extremely painful). This assessment was performed during the procedure, and the nurse inquired and recorded the pain points of each colon site that patients scored by themselves. (4) Cecal intubation time was automatically calculated by the Lianying system. (5) For the quality of bowel preparation, the Boston bowel preparation scale (BBPS) was used.

Table 1: Paris endoscopic classification of neoplastic lesions of colon and rectum.

Paris endoscopic classification	Polypoid 0-I	Slightly Elevated 0-IIa	Flat 0-IIb	Slightly Depressed 0-IIc	Excavated 0-III
Colon and Rectum	50%	44%	< 1%	5%	< 1%

1.3. Statistical Analysis

We analysed the data using SPSS software. The data were compared using Chi square (χ^2) test except for the data on age and BMI, which were compared using t-test. A P-value < 0.05 was considered significant between two groups.

4. Results

4.1. Baseline Characteristics of Patients

Age, sex, BMI, history of intestinal polypectomy, and abdominal surgery showed no significant differences between the two groups ($p > 0.05$), as shown in Table 2. No surgery-related complications such as bleeding, perforation, and cardiopulmonary dysfunction occurred.

Table 2: Comparison of baselines between two groups.

Group	Sex ratio (male/female)	age/years	BMI (kg/m ²)	History of endoscopic polypectomy	History of abdominal surgery
A	1.12	54.18 ± 14.52	21.86 ± 4.32	96	18
B	0.92	55.25 ± 13.98	20.97 ± 3.59	106	15
U/t/ χ^2 value	1.43	3.84	3.21	2.70	5.23
<i>P</i>	0.294	0.322	0.225	0.383	0.470

Annotation, * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Group A, Water-immersion colonoscopy; group B, Air-insufflation colonoscopy.

4.2. Comparison of Observation Indices Between the two Groups

Results showed no significant difference between the two groups in reaching the ileocecal valve, bowel preparation, and success rate of cecal intubation ($p > 0.05$). However, group A was slightly better than group B. Compared with group B, the abdominal pain score in group A was significantly lower ($p < 0.05$), as shown in Table 3.

4.3. Statistical Analysis of Endoscopic Morphology and Pathological Biopsies

A total of 782 patients were included, namely, 370 had no abnormality in whole colon, 389 had colonic polyps (513 intestinal polyps were detected in all of them), 9 had colonic tumours, and 14 had endoscopic changes after colectomy or with inflammatory bowel disease (Table 4). The pathological specimens of 389 patients with a total of 557 colonic polyps were examined. Among them, 202 cases were 0-IIa type lesions, and 391 were adenomatous polyps, as shown in Table 5.

Table 3: Comparison of main observation indices between the two groups.

Group	Time To Insert Into Ileocecal Area	Abdominal Pain Score	Boston Bowel Prep Score	Success Rate Of Intubation
A	5 ± 0.26	3 ± 1.41	8 ± 0.84	100%
B	5 ± 0.48	7 ± 1.23	8 ± 1.12	100%
U/t/ χ^2 value	3.244	4.132	8.44	0.00
<i>P</i> value	0.211	0.028*	0.472	0.99

Annotation, * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Group A, Water-immersion colonoscopy; group B, Air-insufflation colonoscopy.

Table 4: Endoscopic diagnosis of 782 patients.

Group	No Abnormality of Whole Colon	Colonic Polyp		Colon Neoplasm	Others
		Single	Multiple		
A	122	115	91	4	8
B	148	106	77	5	6
<i>p</i> value	0.109	0.503	0.237	0.732	0.596
Total	370	221	168	9	14

Annotation, * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Group A, Water-immersion colonoscopy; group B, Air-insufflation colonoscopy.

Table 5: Statistical analysis of endoscopic morphology and pathological biopsies.

Group	Number of Lesions		Pathologic Diagnosis		
	Number of polyps	0-IIa	Non-Neoplasm	Adenoma	Carcinoma
A	297	115	78	215	4
B	260	87	79	176	5
<i>p</i> value	0.005**	0.025*	0.900	0.007**	0.732

Annotation, * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Group A, Water-immersion colonoscopy; group B, Air-insufflation colonoscopy.

5. Discussion

The preferred way to prevent CRC is screening colonoscopy [4,5], with air insufflation of the intestinal cavity as a routine method during colonoscopy to make the visual field clear. In recent years, underwater colonoscopy has been increasingly applied to clinical practice. Underwater colonoscopy was first used in the 1980s and is commonly applied in patients with colonic diverticulosis or difficult sigmoid colon intubation [6,7]. In the left hemi-colon, water-injection method can flush and straighten the distorted sigmoid colon, thereby expanding and elongating the local intestinal cavity and thus avoiding loop formation. For these reasons, underwater colonoscopy reduces the pain of colonoscopy, minimises or eliminates the usage of sedative medications, and improves patient satisfaction[8,9]. Our results also well agreed with the above conclusions by using the visual analogue scale scoring method. Results revealed that compared with conventional air-insufflation colonoscopy, underwater colonoscopy can reduce the degree of abdominal pain and improve the examination comfort of patients, and difference had striking significance ($p < 0.05$). Moreover, underwater colonoscopy can remarkably ameliorate the pain of patients with chronic constipation ($p < 0.05$) [10]. Although no significant difference was observed in the time to insert into the ileocecal section between underwater colonoscopy and air-insufflation colonoscopy ($p > 0.05$), underwater colonoscopy can slightly shorten the operation time to some extent, which may be related to the effective expansion and stretching of the intestinal cavity by water. Consequently, the endoscope itself does not easily form a loop in the intestinal cavity. Furthermore, water injection can play the role of secondary cleaning, so the satisfaction of colon cleaning of underwater colonoscopy was better than that of air-insufflation colonoscopy during the withdrawal period. The above conclusions were consistent with the findings of Martin D [11]. The reason no difference was noted between the two groups may be the rich experience of the endoscopist. The examiners participating in this study were the same endoscopist who had more than 10 years of endoscopy experience, so no significant difference existed in entry time. Great emphasis has also been placed on the good quality of bowel preparation of patients referred to the endoscopy centre of our hospital. Accordingly, the patients were instructed to take an oral laxative the day before colonoscopy through telephone follow-up by a nurse to achieve satisfactory effects. Adenoma detection rate can be an important indicator of quality control for colonoscopy screening [12]. According to research findings, the occurrence of colorectal tumours within 3–5 year interval is related to the omission of lesions owing to the poor experience of examiners [1]. Therefore, the innovation of colonoscopy should focus on how to improve the detection rate of adenomas and thus reduce the incidence of intermittent colorectal tumours [13]. Although some studies have shown that underwater colonoscopy can remove residual faeces and improve the intestinal cleanliness of patients, no extensive agreement has been reached on whether it can improve the detection rate of adenomas. Based on

existing literature, the majority of studies focus on the detection rate of adenomas, and the morphology of these lesions is not deeply studied. Thus, the current study innovatively paid attention to the difference in the detection rate of adenomas between underwater colonoscopy and traditional air-insufflation colonoscopy to detect the superficial elevated type (0-IIa). Results revealed that underwater colonoscopy was superior to air-insufflation colonoscopy in terms of adenoma-detection rate, with significant difference ($p < 0.05$). In summary, we listed the following reasons. 1. Underwater colonoscopy improved the quality of bowel preparation, making it easier to find lesions. 2. The 0-IIa lesion type is relatively flat and often easy to ignore when the intestinal cavity is dilated. Water has the effect of visual magnification, which makes type 0-IIa lesions more obvious, so it can improve the detection rate of adenomas. In conclusion, underwater colonoscopy can improve the detection rate of colorectal adenomas, especially those with a superficial elevated pattern. As reported in literature, the 5-year survival rate of early-stage CRC is more than 90%, whereas that of late-stage CTC is only 10%, so early detection is very important [14]. About 80% to 90% of CRC cases originate from colorectal adenoma, and it takes 5 years to evolve from adenoma to cancer. Therefore, the occurrence of CRC can be blocked by detecting and removing colonic adenoma through colonoscopy at this interval[15]. Screening is the best way to reduce the incidence and mortality rate of CRC, and colonoscopy is the most effective and feasible means of CRC screening. Through screening, CRC mortality can be reduced by more than 70%[16]. Our study provided a theoretical basis for reducing the incidence rate of CRC. In conclusion, the present study illustrated that underwater colonoscopy can significantly alleviate the abdominal pain of patients and improve the detection rate of adenomas, especially those with a superficial elevated pattern. Therefore, this method can also provide the necessary evidence to reduce the prevalence of CRC and can be extensively applied in clinical work.

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