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ORIGINAL ARTICLE

Endoscopic submucosal dissection of distal intestinal tumors using grasping forceps for traction

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Abstract

Background The aim of this study was to assess the efficacy of traction device-assisted endoscopic submucosal dissection (ESD) of the rectum and the distal segment of sigmoid colon using grasping forceps.

Methods A total of 43 patients scheduled for colonic ESD at our institution were enrolled between January 2013 and June 2017. The patients were randomly allocated to receive conventional ESD (group A) or traction device-assisted ESD (group B). The procedure time, complication rate, and en-block resection rate in the two groups were compared.

Results A total of 41 patients completed the study. The procedure time, complication rate and en-block resection rate were, respectively, 104.1 ± 34.7 min, 15%, 90% in the routine group (group A) and 84.7 ± 23.5 min, 9.5%, 90.5% in traction device-assisted ESD (group B). The procedure time in group B was significantly less than that in group A ($F = 4.442$, $p < 0.05$).

Conclusions Traction device-assisted ESD using grasping forceps is safe and effective in distal colon ESD.

Keywords Colon · Grasping forceps · Traction · Endoscopic submucosal dissection

Introduction

Colorectal cancer (CRC) ranks as the fifth leading cause of cancer-related death in China, killing over 159,300 people every year [1, 2]. The economic growth and westernized lifestyle experienced in China have resulted in elevated incidence and mortality rates of CRC. It most commonly develops in the sigmoid colon or rectum. Early detection and resection of colorectal adenoma and other precancerous lesions reduce incidence and mortality rates of CRC [3]. Endoscopic submucosal dissection (ESD) is an endoscopic procedure used to treat larger (> 2 cm) mucosal neoplasms throughout the gastrointestinal tract. ESD has been proven to be less invasive and more cost-effective than to surgical resection [4–6, and is gaining acceptance for treatment of the colon and rectum [3, 7]. Compared with endoscopic mucosal resection (EMR), ESD allows for a more complete en bloc resection of superficial lesions and more accurate histologic assessment. However, ESD is associated with more complications, longer procedure time and requires more skill. Intestinal ESD remains more challenging than gastric ESD, due to the thinner wall and small angulated lumen [7, 8]. Traction-assisted techniques in ESD have been reported to be effective in achieving better vision and facilitating the procedure [7–12]. However, few reports on the traction technique of ESD in the rectum and sigmoid colon have been published. In this study, we investigated the auxiliary effect of traction grasping forceps on rectal and sigmoid ESD, so as to evaluate the clinical value of grasping forceps traction-assisted technique in distal intestinal ESD.

Materials and methods

Study population

From January 2013 to June 2017, 43 patients were enrolled in this study at the Department of Gastroenterology, the Jiangyin Clinical College of Xuzhou Medical University, China. Approval for the study was obtained from the Jiangyin People's Hospital, the Jiangyin Clinical College of

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Xuzhou Medical University, and written informed consent was obtained from all the patients. Inclusion criteria: (1) lesions located in the rectum and the distal segment of the sigmoid colon, (2) indication for endoscopic treatment, (3) no contraindications, for ESD (4) written informed consent. Exclusion criteria: (1) lesions located in the proximal segment of the sigmoid colon, (2) grasping forceps could not reach the lesions, (3) patients with shock, intestinal obstruction, digestive tract perforation, severe heart or lung disease, inability to cooperate, (4) long-term anticoagulant or antiplatelet therapy. The patients were divided into two groups: Group A (conventional ESD) and Group B (with grasping forceps traction-assisted ESD).

Equipment

We used the following equipment: Olympus Corporation CV-260HDTV host, Dual knife, IT knife (Olympus Corporation), Germany, Ireland Bo endoscopic workstation VIO200D+APC2, forceps (Olympus Corporation), injection needle, injection pump (Olympus Corporation) (Olympus Corporation), hot biopsy forceps (Olympus Corporation); PCF-Q260JI Therapeutic colonoscopy (Olympus Corporation); simethicone (Percy Berlin-Chemie AG); indigocarmine (Nanjing minimally invasive medical Polytron Technologies Inc).

Endoscopic procedure

Group A (conventional ESD): first, normal saline solution and epinephrine (1:10,000), supplemented with indigo carmine was injected into the submucosal layer. After making a circular incision around the lesion with a Dual knife or IT knife, submucosal dissection was performed using the same device until the lesion was complete removal. For bleeding or visible vessels, treatment was carried out with hot biopsy forceps or titanium clips.

Group B (with grasping forceps traction-assisted ESD) (Fig. 1): the initial steps of the procedure were similar to conventional ESD. After a circular incision with a Dual knife or IT knife, the colonoscope was retrieved outside the rectum. Then, the rest steps could be operated by one of the following two different procedures.

(1) An external grasping forceps was held by a second grasping forceps through the accessory channel of the colonoscope. The colonoscope was again inserted up to the lesion. The external grasping forceps was used to grasp the anal side of the lesion. Then, the second grasping forceps was withdrawn outside the rectum. The external grasping forceps was gently pulled to elevate the lesion, thus providing better vision of the submucosal layer.

(2) An assistant inserted a grasping forceps into the rectum, and then the colonoscope was again and the grasping forceps was grabbed by a second grasping forceps.

The rest of the steps were similar to the conventional ESD.

The histological features of the specimens were evaluated by a senior pathologist according to the classification criteria from the World Health Organization [13].

Endpoints

Endpoints were the en bloc resection rate, procedure time, and adverse events (intraoperative uncontrolled bleeding and perforation, postoperative bleeding, and perforation, postoperative infection, postoperative stenosis).

Statistical analysis

SPSS 17 statistical software was used for statistical analysis. The mean operation time was analyzed with variance analysis, and the rate comparison was analyzed with χ^2 test. When the theoretical frequency was less than 5, Fisher exact probability method was performed. A p value <0.05 was considered statistically significant.

Results

Patient characteristics

A total of 43 patients were enrolled in this study, 2 of whom withdrew from the study. A total of 41 patients were included in the statistical analysis. There were 24 males, with a mean age of 51.3 ± 16 years, and 17 females with a mean age of 56.4 ± 11.5 years. There were 30 cases of mixed adenoma, 7 cases of tubular adenoma, and 4 cases of villous adenoma. Tumor size was as follows: group A, median 3.2 cm (range 2.0–4.6 cm) vs group B, median 3.0 cm (range 1.8–4.8 cm). There was no significant difference in median tumor size between the two groups ($F=0.039$, $p>0.05$).

Procedure time

The procedure time in group B was shorter than that in group A (Table 1), and the difference between the two groups was statistically significant ($p<0.05$).

Treatment effect and complications

The en bloc resection rate of group A was 90% (18/20), mostly equal to that of group B which was 90.5% (19/21), and the difference was not statistically significant (Fisher

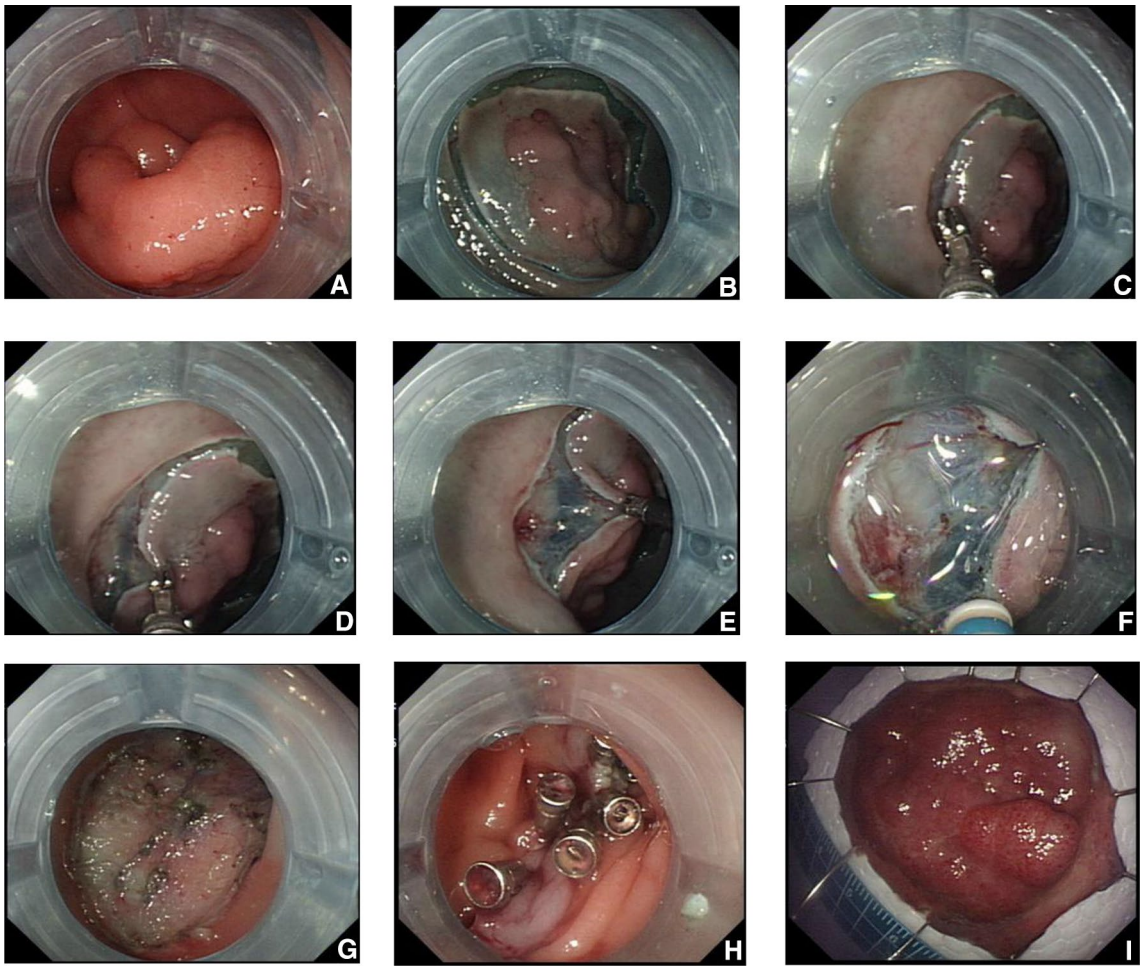

Fig. 1 **a** Sigmoid colon, 20 cm from the anus: a nodular mixed laterally spreading tumor, size about 4.0×4.0 cm. **b** Circumferential incision. **c** Grasping forceps holding the edge of the lesion. **d** Pulling traction of grasping forceps. **e** External grasping forceps positioned at the edge of the lesionfully exposing the submucosa. **f** Peeling of the submucosa with Dual knife. **g** The wound after stripping. **h** Close wound with metal clip. **i** 5.0×4.5 cm size of resected specimens

exact probability method, $p > 0.05$). 5 patients in group A and 6 patients in group B were lost to follow-up, and 30 patients had no local recurrence at follow-up lasting from 2 to 50 months after operation. In group A, one case (5%) of intraoperative bleeding occurred and was successfully managed using hot biopsy forceps, one case(5%) of perforation occurred during the dissection, clipped with titanium clips, and one case (5%) of delayed bleeding, 6 h after surgery, stopped by the combined treatment of hot biopsy forceps and titanium. In group B, there was one case (4.5%) of intraoperative bleeding stopped by hot biopsy forceps, and one case (4.5%) of delayed bleeding, 12 h after surgery, managed with hot biopsy forceps. There was no death, digestive tract stricture or other severe complications in the two groups. There was no significant difference between the cumulative incidence of all complications in group A, 15%, and group B, 9.5%, ($p > 0.05$).

Discussion

Despite the currently available methods of aggressive treatment for CRC, the 5-year survival rate remains poor because of the absence of early symptoms, late diagnosis and the rapid metastasis of cancer cells [1]. Removal of precancerous lesions such as adenomatous polyps with colonoscopy has been shown to lower the mortality rate [14, 15]. Colorectal ESD is technically difficult and is associated with a higher risk of complications [16]. The performance of ESD would be easy and practical if the mucosa could be lifted as in surgery, as we can have a better visualization of the cutting line. So researchers have been looking for refinements in colorectal ESD devices to reduce the negative factors, shorten the procedure time, and thus ensuring a higher level of safety [9, 10, 17–21].

Table 1 Comparison between group A and group B

Group	Location (cases)		Size (cm)	En bloc resection rate	Procedure time (min)	Complications					
	Rectum	Sigmoid colon				Intraoperative bleeding	Delayed bleeding	Perforation	Readmission	Death	Total
Group A	18	2	3.4 ± 0.78*	90% (18/20)	104.1 ± 34.7#	5% (1/20)	5% (1/20)	5% (1/20)	0	0	15% (3/20)Δ
Group B	19	2	3.3 ± 0.74*	90.5% (19/21)	84.7 ± 23.5#	4.5% (1/21)	4.5% (1/21)	0 (21)	0	0	9.5% (2/21)Δ

*$F = 0.039$, $p > 0.05$; #$F = 4.442$ $p = 0.042 < 0.05$; ΔFisher's exact test, $p = 0.663 > 0.05$

A number of special devices and techniques have been reported during the past few years, including the use of a clip-with-line (TAREC) technique in rectal ESD [17], a spring S–O clip-assisted ESD for large superficial colorectal tumors [18, 19], the traction with snare method [11], second endoscope [22] and the double-channel endoscope [23]. Imaeda et al. [20, 24] developed an external grasping forceps-assisted ESD for early gastric cancer and early-stage rectal cancer. This can lift the lesion and enable better vision field of the submucosal layer. But the study is single-center experience, with small number of patients involved, which was mainly applied to gastric and rectal ESD. We found that it is also useful in colorectal ESD, which has rarely been reported.

Our study showed that the procedure time of the traction device-assisted ESD group (84.7 ± 23.5 min) was shorter than that of the conventional ESD group (104.1 ± 34.7 min), and the difference was statistically significant ($p < 0.05$). There was no significant difference in the overall resection rate of the two groups ($p > 0.05$). The cumulative incidence of all complications in group A (15%) was not significantly different from that in group B (9.5%), ($p > 0.05$). A longer procedure time is the main disadvantage of ESD, especially for elder patients with a poor cardiopulmonary status. A long procedure time will also increase the risk of perforation [25]. So shortening the operative time using traction device-assisted ESD has great benefits.

This method has three advantages. First, the grasping forceps is flexible and can immobilize the lesion at the desired location. Second, this method allows pushing and pulling of the grasped lesion including some horizontal traction. Third, this method also allows release and regrasping of the tissues without colonoscope retrieval outside the rectum, which helps shorten the operative time. We also did some preliminary experiments; we tried to use dental floss and snare traction to assist ESD. We realized that traction with dental floss in the ESD of the rectum and sigmoid could only pull in one direction, and it was difficult to mount the dental floss again when the traction point needed to be changed. With a snare, we obtained traction in two directions. However, more tissues needed to be taken using the snare. The snare is soft and can only be pulled in and out on a straight line, which affects the traction effect. Floss traction and snare traction can be used for proximal sigmoid colon lesions, while traction device-assisted ESD is limited to the rectum and distal sigmoid colon, thus leading to a restricted clinical application.

Because this study is a single-center clinical study, and the small sample size was small, a prospective multi-center randomized controlled clinical trial is needed to evaluate this technique.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This study was approved by the Jiangyin People's Hospital, the Jiangyin Clinical College of Xuzhou Medical University.

Informed consent All patients in this study signed the informed consent.

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