

Preoperative indicators of failure of en bloc resection or perforation in colorectal endoscopic submucosal dissection: implications for lesion stratification by technical difficulties during stepwise training

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Background and Aims: The technical difficulties inherent in endoscopic submucosal dissection (ESD) for colorectal neoplasms may result in the failure of en bloc resection or perforation. The aim of this retrospective study was to assess the predictors of en bloc resection failure or perforation by using preoperatively available factors.

Methods: Between September 2002 and March 2013, 716 colorectal ESDs in 673 consecutive patients were performed at a tertiary cancer center. Patient characteristics, tumor location, tumor type, colonoscopy-related factors, and endoscopist experience were assessed based on a prospectively recorded institutional ESD database. Logistic regression analysis was performed to identify predictors of failure of en bloc resection or perforations, with subgroup analyses of ESDs performed by endoscopists less experienced in colorectal ESD (<40 cases) and for colonic lesions only.

Results: On multivariate analysis, independent predictors of failure of en bloc resection or perforations were the presence of fold convergence (odds ratio [OR] 4.4; 95% confidence interval [95% CI], 1.9-9.9), protruding type (OR 3.6; 95% CI, 1.8-7.1), poor endoscope operability (OR 3.5; 95% CI, 1.8-6.9), right-sided colonic lesions (OR 3.0; 95% CI, 1.5-6.3 vs rectal lesions), left-sided colonic lesions (OR 3.2; 95% CI, 1.7-6.3, vs rectal lesions), the presence of an underlying semilunar fold (OR 2.1; 95% CI, 1.3-3.6), and a less-experienced endoscopist (OR 2.1; 95% CI, 1.3-3.6). Among less-experienced endoscopists, colonic lesions were independent predictors (right-sided colonic lesions 8.1; 95% CI, 2.9-25.1; left-sided colonic lesions 8.1; 95% CI, 2.5-28.3 vs rectal lesions). For colonic lesions, the presence of fold convergence (OR 3.7; 95% CI, 1.6-8.6), poor endoscope operability (OR 3.6; 95% CI, 1.8-7.2), a less-experienced endoscopist (OR 3.0; 95% CI, 1.7-1.8), and the presence of an underlying semilunar fold (OR 2.7; 95% CI, 1.5-4.7) were identified predictors.

Conclusion: This study successfully identified predictors of en bloc resection failure or perforation. Understanding these indicators could help to accurately stratify lesions according to technical difficulty and to appropriately select endoscopists. (*Gastrointest Endosc* 2016;83:954-62.)

Abbreviations: CI, confidence interval; LST, laterally spreading tumor; OR, odds ratio.

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Endoscopic resections are performed predominantly in the colorectum to remove premalignant precursor lesions with the goal of reducing the incidence and mortality of colorectal cancer.^{1,2} EMR has become widely used for large mucosal lesions. However, EMR fundamentally has limited ability to resect larger lesions (>2 cm) en bloc. Piecemeal EMR for larger polyps (>2 cm) was associated with a moderate rate of residual neoplasia of 11% to 26%.³⁻⁵ In addition, larger lesions have a high prevalence of cancer and an increased risk of invasion.⁵⁻⁷

Endoscopic submucosal dissection (ESD) is a promising technique that allows en bloc resection of premalignant and early malignant lesions larger than 20 mm.⁸ En bloc resection reduces the risk of recurrence and improves

histological assessment of R0 resection and staging of the risk of lymph-node metastasis.⁹ The application of ESD minimizes endoscopic surveillance, repeated interventions for recurrences, overuse of surgery, and redundant costs.^{10,11}

Although successful en bloc resection without perforation is expected, ESD sometimes results in unfavorable outcomes. The performance of colorectal ESD was affected by endoscopists' experience, institutional case volume, and technical difficulties.¹²⁻¹⁴ Although the endoscopist or institution could be modified, technical difficulties are yet to be easily resolved because these were caused by certain anatomic features of the organ, such as a thin colonic wall, the long shape of the colon, peristalsis, or the presence of semilunar folds.¹⁵ Therefore, appropriate selection of the endoscopist or institution according to technical difficulty of lesions would improve the outcomes of colorectal ESD. Recently, several articles focusing on the technical difficulties of colorectal ESD have been published.^{13,16,17} However, the variables studied cannot be known preoperatively. Furthermore, these studies analyzed predictors of long procedure time; however, this parameter may not appropriately affect technical difficulty because procedure time was strongly associated with tumor size.^{13,17} Therefore, preoperative indicators of clinically significant undesired outcomes are still lacking. Furthermore, limited information is available on lesions appropriate for beginner endoscopists on the learning curve of colorectal ESD.

The aim of this study was to identify the preoperative indicators of failure of en bloc resection or perforation in ESD for colorectal neoplasm.

METHODS

Patients

Between September 2002 and March 2013, 673 consecutive patients with 716 colorectal neoplasms who underwent ESD for colorectal neoplasm at a tertiary cancer center were enrolled in this retrospective study. At our institution, an ESD database includes data on patient and lesion characteristics, procedure outcomes, pathology results, and postoperative clinical course; all data were prospectively recorded by the endoscopist who performed the ESD.

Written informed consent was obtained from all patients. All patients were informed of the risks and benefits of treatment before they underwent the procedure. The Institutional Review Board of the Shizuoka Cancer Center approved this study (Institutional ID: 26-J36-26-1-2).

Indications for colorectal ESD

The indications for colorectal ESD at our center were (1) intraepithelial neoplasms larger than 20 mm, (2) intraepithelial neoplasms with scars due to previous endo-

scopic treatments or biopsies, and (3) invasive carcinoma endoscopically diagnosed within a slight submucosal invasion (<1000 μ m from the muscularis mucosa). These indications are based on criteria for colorectal ESD proposed by the Colorectal ESD Standardization Implementation Working Group.¹⁸ Patients with carcinoid tumors who underwent ESD during this period were excluded from our analysis because the biological behavior of these tumors differs from that of other colorectal neoplasms.

Preoperative endoscopic diagnosis and data collection

To determine whether an indication for ESD was present, all participants underwent diagnostic colonoscopies in which a high-resolution video endoscope equipped with a magnification function (PCF-Q240Z, CF-H260AZI, or PCF-Q260AZI; Olympus, Tokyo, Japan) was used. To assess invasion depth, the endoscopists examined the morphology of the lesion for the presence of large nodules and a depressed area. When magnified endoscopy showed a severely irregular pit pattern in a demarcated area (invasive pattern), lesions were diagnosed as a deep submucosal invasive cancer (\geq 1000 μ m from the muscularis mucosa) with a risk of lymph node metastasis.¹⁹ Tumor locations were divided into the right side of the colon (cecum and ascending and transverse colon), the left side of the colon (descending and sigmoid colon), and the rectum based on the Japanese Classification of Colorectal Carcinoma.²⁰ The macroscopic type of the tumor was classified according to the Paris classification as protruding (type 0-I) (Fig. 1A), depressed (type 0-IIc) (Fig. 1B), 2 subtypes of laterally spreading tumor (LST) according to Kudo's classification (LST-G [granular] and LST-NG [nongranular]) (Figs. 1C and 1D), or scar, which was defined as an intraepithelial tumor with submucosal fibrosis showing nonlifting signs caused by previous endoscopic treatment or biopsy (Fig. 1E).^{21,22}

They also measured the fold convergence and fixed shape after carbon dioxide insufflation (CO2 Regulation Unit; Olympus). An underlying semilunar fold was considered present when the lesion margin at the oral side was difficult to detect in the forward view (Fig. 2A). Fold convergence was considered present when more than 3 concentrating folds were visible after substantial distention of the colonic wall (Fig. 2B).

Endoscope operability was also assessed preoperatively. Poor endoscope operability occurred when paradoxical movement was present or when significant gravity force toward the opposite to the lesion could not be confirmed after changes in patient position.

Previously, the adverse event rate was shown to significantly decrease after colorectal ESD experience with 40 cases.¹² Accordingly, here an endoscopist was considered less experienced with fewer than 40 cases of colorectal ESD.

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