Endoscopic intermuscular dissection with intermuscular tunneling for local resection of rectal cancer with deep submucosal invasion

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INTRODUCTION

The introduction of population-based screening has resulted in an increased incidence of early-invasive (T1) rectal cancer.[1] For these tumors, local treatment is considered curative when the resection margins are negative (R0) and histological high-risk factors for lymph node metastasis (LNM) are absent. Although deep submucosal invasion has long been considered a high-risk factor,[2] recent reports showed that Kikuchi level (Sm) 2 to 3 lesions without other high-risk factors are associated with a negligible LNM risk (<2%).[3-7] In addition, a recent meta-analysis suggested that the risk of future metastatic disease is unlikely to exceed the baseline risk of synchronous LNM considerably, as the overall risk of any distance recurrence for deeply invasive T1CRCs, with or without other histological risk factors, was 3.3%.[8] This implies that it is important to maximize the chance of achieving complete R0 resection for deeply invasive T1 rectal cancers because this could be considered curative in some cases.

Endoscopists usually perform dissection in the submucosal space (endoscopic submucosal dissection [ESD]), but a major disadvantage is that the vertical resection margin is more likely to become positive upon deeper invasion into the submucosa.[9] A more suitable alternative would be endoscopic intermuscular dissection (EID), a novel resection technique that involves dissection in the intermuscular plane, the plane between the longitudinal (external) and circular (internal) muscle layer. EID was described for the first time by Rahni et al,[10] who used this technique to remove rectal lesions with extensive fibrosis.[11] More recently, this resection technique has also been used to resect rectal cancers with suspected >Sm1 invasion.[12] The results from this prospective series of 67 patients suggest that EID is safe (no surgery for EID-related adverse events, 12% minor adverse events) and feasible (technical success rate 96%). Here, we present a step-by-step video explanation of the EID technique, which was used to resect a rectal lesion with a small focus of suspected deep submucosal invasion (Video 1, available online at www.giejournal.org).

CASE PRESENTATION

A 70-year-old man underwent a screening colonoscopy after a positive fecal occult blood test. Colonoscopy revealed a 25-mm rectal tumor, located 2 cm above the dentate line (Fig. 1). Virtual chromoendoscopy of the depressed area showed nonstructured amorphous pits and nearly avascular and loose microcapillary vessels (Fig. 2). Magnetic resonance imaging staging showed a cT1-2N0M0 rectal lesion in the anterior wall of the rectum, 3 cm above the anal verge. After discussion in a multidisciplinary team meeting, the patient was referred to our department for local endoscopic resection. Two expert

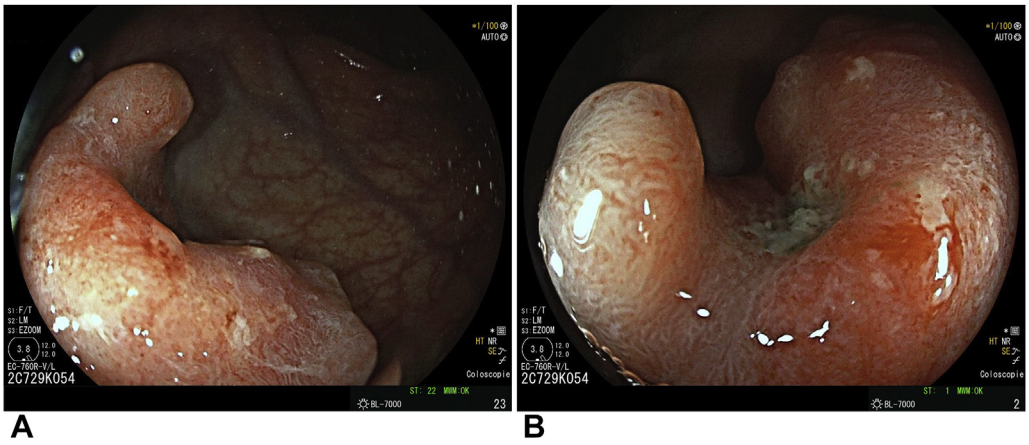

Figure 1. A, White-light image of the tumor and **B,** the central depression.

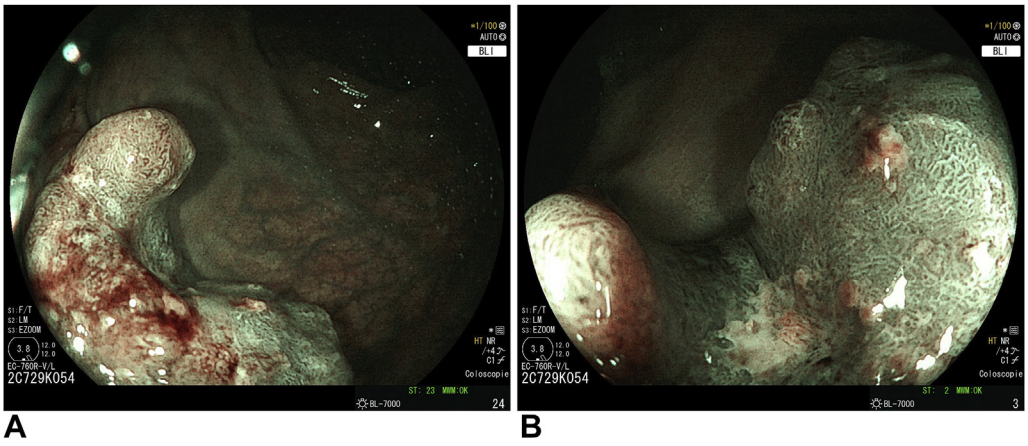

Figure 2. A, Advanced imaging of the tumor and **B,** the central depression.

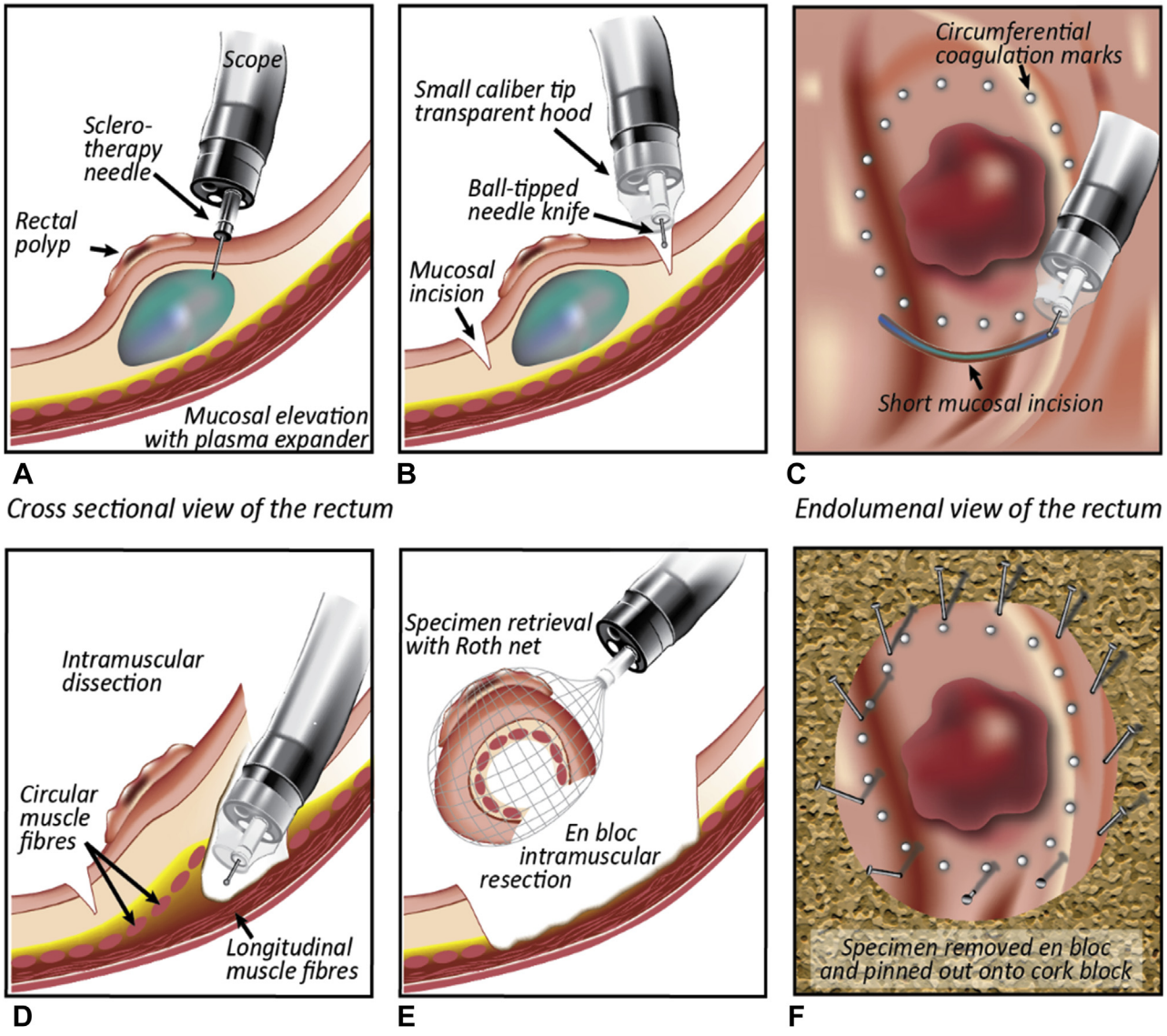

Figure 3. Schematic representation of endoscopic intermuscular dissection. **A,** Injection of a viscous fluid. **B,** Mucosal incisions at the oral and anal side of the lesion. **C,** Endoluminal view on the mucosal incision. **D,** Intermuscular dissection. **E,** Retrieval of the resection specimen. **F,** Fixation of the resection specimen.

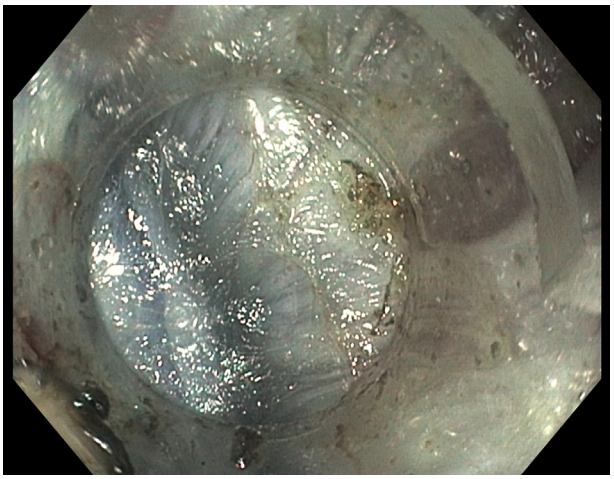

Figure 4. Overview of the layers during intermuscular dissection.

endoscopists reevaluated the endoscopic images and deemed the lesion not suitable for ESD because of optical findings strongly suggestive of deep submucosal invasion (Fig. 2). Considering the size and optical diagnosis of the lesion, EID was selected (with informed consent from the patient).

ENDOSCOPIC INTERMUSCULAR DISSECTION

EID (Fig. 3) was performed with the patient under propofol sedation. A standard therapeutic gastroscope (Olympus GIF-1TH190, Olympus, Tokyo, Japan) with a transparent tapered hood (DH-30CR; Fujifilm, Tokyo, Japan) was introduced. A 1.5-mm BT Flush Knife (Fujifilm) was used with the Endocut mode of the ERBE VIO 300D (ERBE Elektromedizin, Tübingen, Germany). First, the perimeter of the lesion was marked using soft tip coagulation. Submucosal lifting was performed with a mixture of hydroxyethyl starch, indigo carmine, and adrenaline. A submucosal incision was created at the oral side and then at the anal side of the lesion. The entrance of the tunnel was created at the anal side using submucosal dissection. After 1 cm, the inner circular muscle was incised between 2 muscular bundles, thereby exposing the outer longitudinal muscle layer. The direction of the fibers was clearly visible, but the intermuscular space is quite narrow. To facilitate safe intermuscular dissection, optimal countertraction was obtained using gravity and the transparent hood (Fig. 4). After 2 to 3 cm of intermuscular tunneling under the lesion, the submucosal space was reentered and the oral incision was reached. The lateral margins were then incised to complete the dissection. En bloc resection was achieved. The total procedure time was 90 minutes. The resection site was left open (Fig. 5). After the procedure, the patient was discharged the same day and received oral antibiotics for 5 days.

The pathology report showed a pT1Sm3 adenocarcinoma with negative lateral and vertical resection margins (both >1-mm margin), moderate differentiation, and low-grade tumor budding (Fig. 6). However, lymphovascular invasion was present, and additional treatment was recommended after discussion in the multidisciplinary team meeting. After shared decision-making, the patient agreed to participate in the TESAR trial[13] and was randomized for additional chemoradiotherapy. Three months after completion of chemoradiotherapy, restaging with magnetic resonance imaging and rectoscopy showed no signs of residual tumor tissue (Fig. 7).

CONCLUSIONS

In this video report, we provided a step-by-step explanation of EID with intermuscular tunneling. The EID technique may be particularly useful for local treatment of

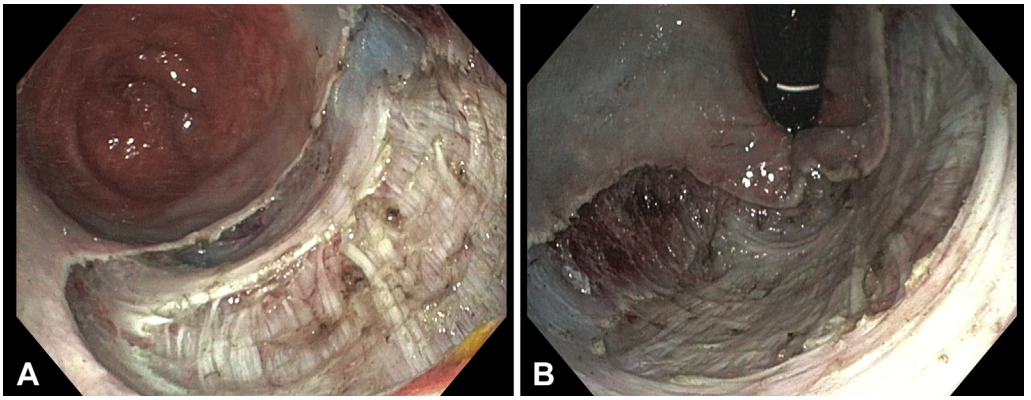

Figure 5. Resection site after completion of endoscopic intermuscular dissection, in anteversion **(A)** and retroversion **(B)**.

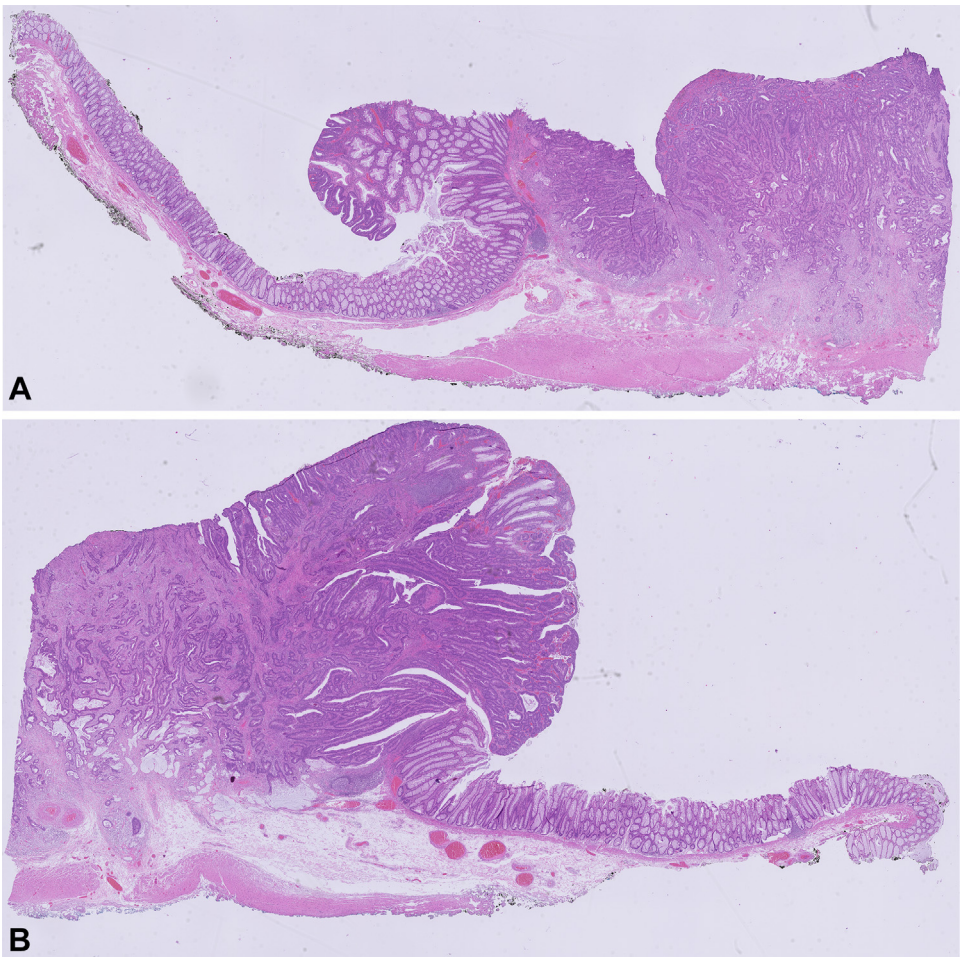

Figure 6. Histology of the resected specimen, left **(A)** and right half **(B)**. H&E, orig. mag. ×2.

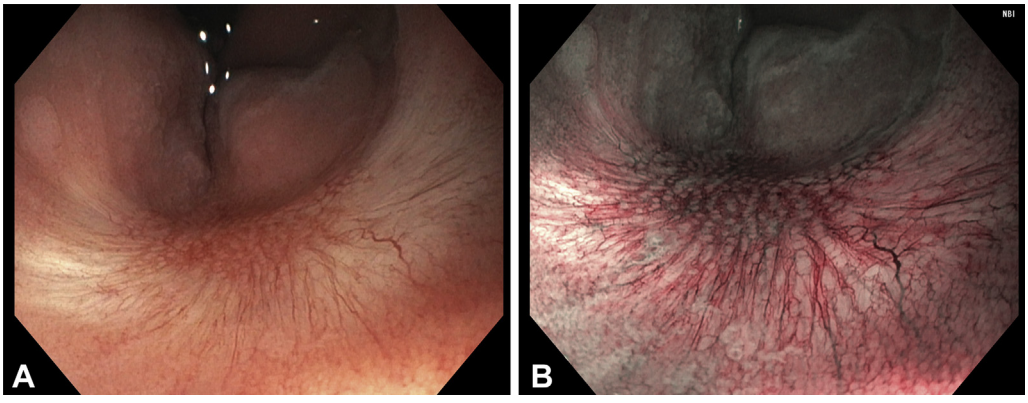

Figure 7. Post–endoscopic intermuscular dissection resection scar after 3 months of follow-up, visualized using white-light **(A)** and advanced imaging **(B)**.

T1 rectal cancers with deep submucosal invasion because it enables complete R0 resection of these tumors with minimal interference with the total mesorectal excision plane.

DISCLOSURE

Dr Boonstra is a consultant for Boston Scientific. All other authors disclosed no financial relationships.

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Abbreviations: EID, endoscopic intermuscular dissection; ESD, endoscopic submucosal dissection; R0, resection margins are negative; Sm, Kikuchi level.

REFERENCES

1. Toes-Zoutendijk E, Kooyker AI, Elferink MA, et al. Stage distribution of screen-detected colorectal cancers in the Netherlands. Gut 2018;67:1745-6.
2. Kitajima K, Fujimori T, Fujii S, et al. Correlations between lymph node metastasis and depth of submucosal invasion in submucosal invasive colorectal carcinoma: a Japanese collaborative study. J Gastroenterol 2004;39:534-43.
3. Naito A, Iwamoto K, Ohtsuka M, et al. Risk factors for lymph node metastasis in pathological T1b colorectal cancer. In Vivo 2021;35:987-91.
4. Yasue C, Chino A, Takamatsu M, et al. Pathological risk factors and predictive endoscopic factors for lymph node metastasis of T1 colorectal cancer: a single-center study of 846 lesions. J Gastroenterol 2019;54:708-17.
5. Kouyama Y, Kudo SE, Miyachi H, et al. Practical problems of measuring depth of submucosal invasion in T1 colorectal carcinomas. Int J Colorectal Dis 2016;31:137-46.
6. Ichimasa K, Kudo SE, Miyachi H, et al. Current problems and perspectives of pathological risk factors for lymph node metastasis in T1 colorectal cancer: systematic review. Dig Endosc. Epub 2021 Dec 23.
7. Rönnow CF, Arthursson V, Toth E, et al. Lymphovascular infiltration, not depth of invasion, is the critical risk factor of metastases in early colorectal cancer: retrospective population-based cohort study on prospectively collected data, including validation. Ann Surg 2022;275:e148-54.
8. Dang H, Dekkers N, le Cessie S, et al. Risk and time pattern of recurrences after local endoscopic resection of T1 colorectal cancer: a meta-analysis. Clin Gastroenterol Hepatol 2022;20:e298-314.
9. Watanabe D, Toyonaga T, Ooi M, et al. Clinical outcomes of deep invasive submucosal colorectal cancer after ESD. Surg Endosc 2018;32:2123-30.
10. Rahni DO, Toyonaga T, Ohara Y, et al. First reported case of per anal endoscopic myectomy (PAEM): a novel endoscopic technique for resection of lesions with severe fibrosis in the rectum. Endosc Int Open 2017;5:E146-50.
11. Toyonaga T, Ohara Y, Baba S, et al. Peranal endoscopic myectomy (PAEM) for rectal lesions with severe fibrosis and exhibiting the muscle-retracting sign. Endoscopy 2018;50:813-7.
12. Moons LM, Bastiaansen B, Richir M, et al. Endoscopic intermuscular dissection (EID) for deep submucosal invasive cancer in the rectum-a new endoscopic approach. Endoscopy. Epub 2022 Jan 24.
13. Borstlap WA, Tanis PJ, Koedam TW, et al. A multi-centred randomised trial of radical surgery versus adjuvant chemoradiotherapy after local excision for early rectal cancer. BMC Cancer 2016;16:513.

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