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## Transanal Endoscopic Cooperative Surgery as a less invasive resection technique for anorectal tumors extending beyond the dentate line: A case series

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### Abstract:

Endoscopic submucosal dissection (ESD) and surgical local excision pose particular challenges for anorectal tumors extending beyond the dentate line, making technique selection difficult. We hypothesized that combining ESD and local excision (transanal endoscopy cooperative surgery; TaECS) can effectively resect such tumors. TaECS was performed for three patients with anorectal tumors extending beyond the dentate line between January and December 2022. TaECS was indicated for the local resection of tumors extending beyond the dentate line with a low risk of lymph node metastases. TaECS was performed in an operating room after ensuring adequate bowel preparation. Oral side of the tumor was dissected endoscopically with resection margins precisely evaluated using magnifying endoscopy. Anal side was surgically dissected above the internal anal sphincter. The defect was repaired by bilateral V-Y advancement flap reconstruction. All three tumors were successfully resected in en bloc fashion without intraprocedural adverse events. No postoperative stricture and bleeding occurred. A postoperative abscess around the anastomosis was observed in one case. The anal sphincter was preserved in all cases. No recurrences were recorded at the 17- to 27-month follow-up. TaECS may be a viable treatment for minimally invasive local resection of anorectal tumors extending beyond the dentate line.

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## 1 **Introduction**

2 Endoscopic submucosal dissection (ESD) is indicated for early-stage colorectal tumors;  
3 however, the complete resection rate is unsatisfactory (53.3%) for rectal tumors extending  
4 beyond the dentate line. [1] Moreover, tumors that require skin excision cannot be  
5 resected by ESD alone. Meanwhile, surgical local excision (LE) is indicated for  
6 noninvasive tumors located between the external anal canal and lower rectum extending  
7 to an anal verge (AV) <8 cm. However, among LE techniques, transanal excision (TAE)  
8 has a higher local recurrence rate for lesions extending to the lower rectum because of  
9 poor visualization of the lesion margin. [2] Moreover, transanal endoscopic microsurgery  
10 (TEM) can help confirm resection margins of rectal tumors endoscopically; however, the  
11 removal of lesions close to the AV is technically challenging because of the scope fixation  
12 to the anal canal. [3]

13 Therefore, optimal resection strategy for tumors broadly extending beyond the dentate  
14 line is not well-established. An advantage of ESD is its precise incision of a tumor margin  
15 under endoscopic view, and an advantage of LE is its ability to excise skin beyond the  
16 dentate line. Thus, we hypothesized that combining ESD and LE could be effective for  
17 excising tumors broadly extending beyond the dentate line. We dubbed this combination  
18 therapy as transanal endoscopy cooperative surgery (TaECS) and examined its usefulness  
19 in this study.

20

## 21 **Methods**

### 22 ***Study design***

23 In this case series, consecutive patients who had undergone TaECS at a Japanese tertiary  
24 cancer center between January and December 2022 were enrolled. We evaluated lesion

1 characteristics and clinical outcomes based on data obtained from medical records and the  
2 patient database.

3 This study was approved by the Ethics Committee of Shizuoka Cancer Center  
4 Institutional Review Board, Shizuoka, Japan (No. J2023-175-2023-1) and was performed  
5 according to the 1964 Helsinki Declaration and its subsequent amendments. Written  
6 informed consent for interventions was obtained from all participants before undergoing  
7 treatment.

### 8 9 ***Indication for TaECS***

10 TECS was indicated for the local resection of tumors extending beyond the dentate line  
11 with a low risk of lymph node metastases (LNM), which could not be resected by ESD  
12 alone due to the requirement of skin excision or by surgical LE alone due to the  
13 indeterminate lesion extent of the oral side under direct observation. The preoperative  
14 examination was performed using a high-resolution endoscope with a magnification  
15 function (CF-HQ290ZI, PCF-H290ZI; Olympus Co., Ltd., Tokyo, Japan). The  
16 preoperative diagnosis was based on magnifying endoscopy with narrow-band imaging  
17 (ME-NBI) and chromoendoscopy findings. To confirm the extent of a tumor in the  
18 horizontal axis, tumor margins were carefully evaluated, and biopsies were taken from  
19 outside the lesion to ensure the resection margin in cases where the lesion extent was  
20 indeterminate. Furthermore, we estimated the depth of lesions using contrast-enhanced  
21 computed tomography (CT) and/or magnetic resonance imaging (MRI) to confirm the  
22 absence of LNM and distant metastases. In all cases, a consensus was reached prior to  
23 performing a procedure at a cancer board conference attended by endoscopists,  
24 gastrointestinal surgeons, gynecologists, dermatologists, and oncologists.

1

## 2 ***Set-up for TaECS***

3 TaECS was performed in an operating room after ensuring adequate bowel preparation.

4 TaECS was initiated by endoscopic procedure with left lateral decubitus under

5 intravenously administered anesthesia. Subsequently, surgical procedure was performed

6 via lithotomy or jack-knife position in general anesthesia.

7

## 8 ***Endoscopic procedure***

9 Endoscopic procedure was performed using a colonoscope with a water-jet system (PCF-

10 H290T; Olympus Co, Ltd.) fitted with a clear distal attachment, a standard electrosurgical

11 generator (VIO300D; Erbe Elektromedizin GmbH, Tuebingen, Germany), and carbon

12 dioxide insufflation. Prior to the resection, tumor margins were confirmed by the

13 endoscopic view or the biopsy scar, and markings were made by cauterization. The

14 endoscopic procedure was performed similarly to ESD. A mucosal incision was made on

15 the oral side, and submucosal dissection was performed as far as possible toward the

16 dentate line.

17

## 18 ***Surgical procedure***

19 The resection line on the anal side was marked under direct vision. A perianal skin

20 incision was made with a negative margin of at least 1 cm to avoid burning effect to the

21 tumor. The tumor was dissected toward the oral side above the external anal sphincter

22 muscle using the 20W pure-cut mode and coagulation of 20W FULGRATE, an

23 electrosurgical unit (Force Fx-CS; Valleylab, Medtronic plc, Dublin, Ireland). Further

24 dissection was extended into the anal canal on the oral side, where dissection had been

1

2

1 performed endoscopically. In cases involving extensive skin excision surrounding the  
2 perianal area, the defect was repaired with a skin flap by bilateral V-Y advancement flaps  
3 reconstruction to prevent anal canal stricture. The V-Y technique was used to advance  
4 flaps as superomedially as possible, and donor sites were closed. Furthermore, flaps were  
5 slid toward the anal canal and sutured to the distal end of the rectal mucosal flap.  
6 Additionally, when the defect involved the vagina or urethra, the flaps were sutured to the  
7 mucosa (Video).

#### 8 9 *Postoperative management for TaECS*

10 Broad-spectrum antimicrobials were administered for 1–5 days routinely and oral intake  
11 was initiated by fasting for 3–5 days postoperatively. Moreover, a urethral catheter was  
12 placed in lesions where the reconstructed area extended to the vulva.

#### 13 14 ***Pathological assessment***

15 Resected specimens were extended on a panel using pins, fixed in 10% buffered formalin,  
16 cut into 3 to 5 mm sections, embedded in paraffin, and sliced at a 3 µm thickness. All  
17 samples were histologically assessed by more than two experienced pathologists  
18 according to the Japanese Classification of Colorectal Appendiceal, and Anal Carcinoma  
19 (July 2018, Ninth Edition) or the International Federation of Gynecology and Obstetrics  
20 staging for carcinoma of the vulva (2021).

#### 21 22 ***Clinical outcomes of TaECS***

23 TaECS was performed in three cases, as demonstrated in Figure 1. Patient and lesion  
24 characteristics and clinical outcomes are summarized in Table 1. In all cases, en bloc

1 resection was achieved. The horizontal margin was indeterminate in one case. No  
2 postoperative stricture, delayed bleeding, or anorectal functional disorder was observed.

3

#### 4 **Case 1**

5 A 74-year-old man presented with a rectal tumor that had been repeatedly prolapsing out  
6 of the anus. A colonoscopy showed a 70 mm villous tumor in the lower rectum (Figure  
7 2A). The tumor was in the anal canal with a flat elevated area extending to the rectum.  
8 NBI revealed irregular surface pattern, which was classified as Japan NBI Expert Term  
9 Classification (JNET) Type 2B (Figure 2B). CT revealed that the tumor filled in the  
10 rectum without LNM or distant metastases. Endoscopic resection of anal side of the tumor  
11 that prolapsed out of the anus was deemed difficult (Figure 2C), as was recognizing the  
12 flat elevated area in the rectum side by LE alone due to its large volume.  
13 Abdominoperineal resection (APR) could ensure complete removal of the tumor but was  
14 considered too invasive for the early-stage malignancy. Therefore, TaECS was indicated  
15 (Figure 2D). The procedure time was 287 minutes (ESD: 221 minutes; LE: 68 minutes).  
16 Histological examination revealed a well-differentiated intramucosal tubular  
17 adenocarcinoma without lymphovascular invasion (LVI) (Figure 2E, F). The horizontal  
18 margin on the anal side was not visualized because of the burning effect, and vertical  
19 margins were negative. No recurrence or metastasis was observed at the 17-month follow-  
20 up (Figure 2G).

21

#### 22 **Case 2**

23 A 58-year-old man with complaints of anal pain was referred to our institution. A 20 mm  
24 tumor extending into the anal canal with reddish skin were observed (Figure 3A, B).

1  
2

1 Colonoscopy showed no visible lesion in the rectum (Figure 3C). However, ME-NBI  
2 revealed a circumferentially irregular surface pattern extending continuously from the  
3 perianal tumor (Figure 3D). The biopsy confirmed a diagnosis of adenocarcinoma with  
4 pagetoid cells. The area with the irregular surface on NBI was diagnosed as a pagetoid  
5 spread. CT and MRI revealed a 20 mm intraepithelial tumor without LNM and distant  
6 metastases. Thus, local resection was indicated for the tumor. The pagetoid spread was  
7 difficult to detect macroscopically on the rectum side. Therefore, determining the  
8 resection margin by LE alone was considered difficult. Therefore, TaECS was performed  
9 to ensure negative margins on the oral side. The defect was repaired with a skin flap. The  
10 procedure time was 341 minutes (ESD: 87 minutes; LE and reconstruction: 254 minutes).  
11 Gross examination showed a flat elevated 20 mm tumor (Figure 3E). The histological  
12 assessment confirmed mucinous adenocarcinoma that was invasive to just above the  
13 internal anal sphincter (pathological T1) without LVI. The pagetoid spread was observed  
14 broadly around the tumor (Figure 3F, G). No recurrence or metastasis was observed at the  
15 27-month follow-up.

### 17 **Case 3**

18 A 73-year-old woman with irregular genital bleeding was referred to our institution. A  
19 reddish tumor was observed on the vulva, extending into the anal canal (Figure 4A). The  
20 lesion had irregular dilated vessels spread toward the anal canal on ME-NBI (Figure 4B,  
21 C). The biopsies revealed of vulvar squamous cell carcinoma (SCC) arising from lichen  
22 sclerosis. CT and MRI revealed that the tumor did not extend to adjacent perineal  
23 structures and no metastases were detected. Thus, radical vulvectomy was indicated for  
24 the tumor. Considering the risk factor for developing SCC among women with lichen



1 sclerosis [4], a complete resection of the area of lichen sclerosis was required. However,  
2 margins of the lichen sclerosis could not be determined, even on ME-NBI (Figure 4D);  
3 thus, biopsies of oral side of the lesion in the rectum were performed to confirm a negative  
4 margin. The biopsy scar was difficult to observe macroscopically. Therefore, we  
5 performed TaECS to ensure negative resection margins. The defect was repaired using  
6 bilateral V-Y advancement flaps. The procedure time was 469 minutes (ESD: 61 minutes;  
7 radical vulvectomy and reconstruction: 408 minutes). A postsurgical abscess around the  
8 anastomosis in the vaginal area was observed, requiring intravenous antimicrobial  
9 therapy for a month. Histological examination confirmed 50 and 10 mm early-stage  
10 vulvar carcinomas without LVI. Lichen sclerosis was mostly observed around the tumor  
11 within the resection margins (Figure 4E, F, G). No additional treatment was applied  
12 because all sentinel node biopsies were negative. No recurrence or metastasis was  
13 observed at the 26-month follow-up.

## 15 **Discussion**

16 We demonstrated that the combination of ESD and LE techniques, collectively referred  
17 to as TaECS, enables the removal of tumors broadly extending beyond the dentate line.  
18 TaECS has several advantages over other techniques. First, TaECS can preserve the  
19 internal anal sphincter by performing a dissection above it. Although APR is a standard  
20 treatment for perianal or lower rectal tumors, it would be overkill for non-invasive lesions  
21 due to the resulting loss of function. Conversely, TaECS can preserve the nerves in the  
22 intersphincteric space, thereby preserving anal function postoperatively [5], which is  
23 important in maintaining quality of life. Second, TaECS enables the precise evaluation of  
24 resection margins through endoscopic view. TEM and transanal minimally invasive



1 surgery (TAMIS) can provide precise detection of the extent of lesion distribution.  
2 However, TEM and TAMIS cannot be adopted for tumors extending into the anal canal  
3 due to the scope fixation on the anal canal. [3, 6] Moreover, patients who had undergone  
4 initial resection for perianal Paget's disease had a high positive margin rate of 32%–42%  
5 and required additional resection to attain complete tumor clearance. [7] In contrast, ESD  
6 allows precise resection with accurate confirmation of the extent of the lesion. However,  
7 tumors that require skin excision cannot be resected by ESD alone. Furthermore, TaECS  
8 can accurately dissect the tumor margin using ESD and excise skin beyond the dentate  
9 line. Therefore, this combined endoscopic and surgical procedure may ameliorate the  
10 technical and functional disadvantages of ESD, TAE, TEM, and TAMIS. However, in  
11 Case 1, the horizontal margin on the anal side was indeterminate. Coagulation may have  
12 occurred during surgical dissection. This can be avoided by securing a wider resection  
13 margin.

14 This case series has some limitations. First, it was a single-center retrospective study  
15 with only three cases. A conclusive evaluation of the feasibility of TaECS requires a  
16 prospective multicenter study. However, the rarity of the eligible tumors and the need for  
17 a precise indication for TaECS may limit the number of eligible patients. Previous reports  
18 have demonstrated a high incidence (17%–37%) of LNM in cases of invasive  
19 extramammary Paget's disease. [8, 9] Furthermore, APR or chemotherapy was required  
20 for recurrent cases. [6] Therefore, indication for TaECS should be carefully determined  
21 via a preoperative examination. Second, long-term outcomes after TaECS remain unclear  
22 due to the relatively short follow-up period of 17–27 months. Although no recurrence was  
23 observed, our follow-up period would be insufficient for perianal Paget's disease and  
24 vulvar SCC with lichen sclerosis. [4, 7, 10] Third, Third, TaECS was performed by highly

1 experienced endoscopists and surgeons. For example, ESD for lesions extending into the  
2 anal canal is technically difficult. [1] This technical difficulty may be reduced by omitting  
3 submucosal dissection phase and instead making a mucosal incision on the oral side by  
4 endoscopy while surgically resecting the remaining area.

5 In conclusion, TaECS may be a viable treatment for minimally invasive local resection of  
6 tumors extending beyond the dentate line.

7

8



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12

1 **Table 1. Patients and lesions characteristics**

	Age (years)	Sex	Location	Size* (mm)	En bloc resection	Procedure time (minutes)	AEs	Resection margin	Pathology	p-Stage	Recurrence**
Case 1	74	Male	Rb	70 mm	Yes	287	No	Horizontal margin indeterminate	Adenocarcinoma	pTisN0M0	None at 17 months
Case 2	58	Male	Anal	20 mm	Yes	341	No	Free	Adenocarcinoma with pagetoid spread	pT1N0M0	None at 27 months
Case 3	73	Female	Vulva	42 mm	Yes	469	Abscess	Free	SCC with lichen sclerosis	pT1bN0M0	None at 26 months

2 AE, adverse event; SCC, squamous cell carcinoma; p-Stage, pathological stage

3 \* Preoperative lesion size, \*\* Recurrence was evaluated in the latest surveillance.

1 **Figures:**

2 Figure 1: Scheme of Trans-anal Endoscopy Cooperative Surgery (TaECS)

3

4 Figure 2: Case 1. (A) A 70 mm sessile rectal tumor extending into the anal canal. (B)  
5 Magnifying endoscopy with narrow-band imaging (NBI) showing irregular villous  
6 structures on the top part of the lesion, corresponding to the Japan NBI Expert Team  
7 (JNET) classification type 2B. (C) The tumor prolapsing out of the anus. (D) The defect  
8 after the resection with no residual lesion. (E) Macroscopic view of the specimen before  
9 fixation with formalin. The blue line indicates well-differentiated intramucosal tubular  
10 adenocarcinoma. (F) Histological examination confirming the diagnosis of well-  
11 differentiated tubular adenocarcinoma that was entirely intramucosal. (G) Endoscopic  
12 view of the scar 17 months after the treatment.

13

14 Figure 3: Case 2. (A) Endoscopic view of the perianal skin. A flat elevated tumor tinged  
15 with white and pink was observed under the perianal skin and extending into the anal  
16 canal. (B) Narrow-band imaging showing dilated crypt openings on the lesion (red  
17 arrowhead). (C) Retroflex endoscopic view with white light imaging showing no visible  
18 lesions in the rectum. (D) Magnifying narrow-band imaging revealing dilated crypt  
19 openings and irregular surface pattern (red arrowhead). (E) Gross examination of the  
20 specimen revealing a flat elevated tumor with no visible pagetoid spread. (F) Macroscopic  
21 view of the specimen after fixation with formalin with tumor mapping of the lesion  
22 confirming the diagnosis of mucinous adenocarcinoma (red line) and pagetoid spread  
23 (green line). (G) Histological examination indicative of 20-mm mucinous  
24 adenocarcinoma with pagetoid spread (blue box; pagetoid cells).

1  
2

1 Figure 4: Case 3. (A) Perineal examination showing a reddish 50-mm tumor (red  
2 arrowhead) with a 10-mm nodule (yellow arrowhead) and sclerotic and erythematous skin  
3 surrounding the lesions. (B) Endoscopic view of perianal skin showing sclerotic,  
4 erythematous skin extending into the anal canal. (C) Narrow-band imaging showing  
5 irregular dilated vessels on the erythematous skin. (D) Endoscopic view revealing no  
6 visible lesions in the rectum. (E) Macroscopic view of the specimen after fixation with  
7 formalin showing two lesions with sclerotic skin. (F) Tumor mapping of the lesion  
8 showing squamous cell carcinoma (SCC) (red line) and lichen sclerosis (green line). (G)  
9 Histological examination confirming the diagnosis of SCC.

#### 10 11 **Supplemental Figure Legend**

12 Supplemental Figure 1: Views of the transanal endoscopy cooperative surgery procedure  
13 for Case 2. (A) Marking the oral side of the tumor in the rectum. (B) Mucosal incision into  
14 the oral side and submucosal dissection. (C) Making a mucosal flap in the normal rectum  
15 mucosa (white arrowhead) to join it to the skin flap from the perianal skin. (D)  
16 Endoscopic view after submucosal dissection. (E) Marking of the resection line on the  
17 anal side. (F) Dissection of the perianal skin and anal canal toward the oral side. (G) The  
18 defect after lesion resection and marking for the bilateral V-Y advancement flaps. (H)  
19 Reconstruction using bilateral V-Y flaps.

20



1 **Video Legend**

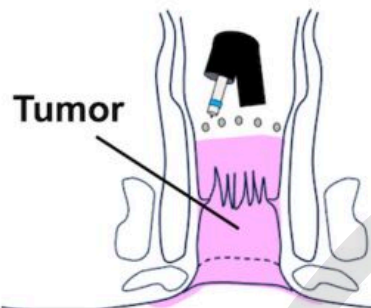
2 Trans-anal endoscopic cooperative surgery (TaECS); less invasive resection technique  
3 for a tumor extending beyond the dentate line (Case 2)

4

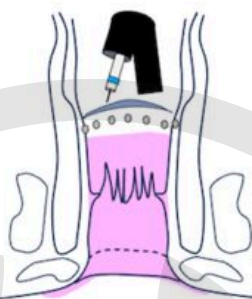
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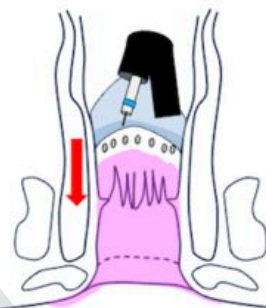
① Marking the oral side



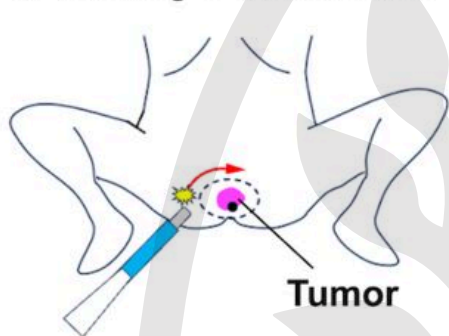
② Mucosal incision



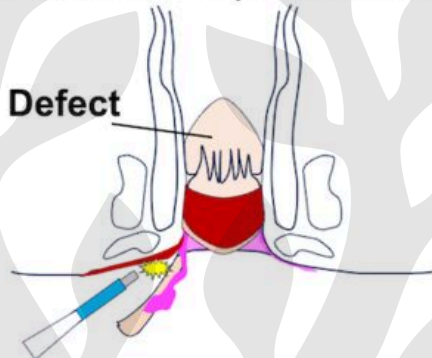
③ Dissection to dentate line



④ Marking & skin incision



⑤ Dissection of perianal skin



⑥ Dissection of anal canal

