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Endoscopic submucosal dissection of colorectal pedunculated polyps

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ABSTRACT

Background and study aims For pedunculated colon polyps, en bloc resection with inclusion of the polyp stalk is necessary to yield an accurate histologic staging. This can be challenging in cases of a large polyp and/or broad stalk using conventional snare resection. We evaluated the feasibility of endoscopic submucosal dissection (ESD) for large pedunculated polyps with broad stalks.

Patients and methods Between February 2019 and November 2021 all patients with large pedunculated polyps defined as polyp diameter ≥ 20 mm and or a broad stalk > 5 mm were enrolled in the study. All polyps were resected in ESD technique with dissection of the polyp stalk at the base after injection.

Results Twenty-five patients (male = 18, age mean: 67 years) were included. En bloc resection was achieved in 100% of the patients (25/25 polyps). Polyps were mainly located in the sigmoid (n = 19) and rectum (n = 3). Median polyp size was 30×25×17 mm. Histologic examination revealed the following results: adenoma low-grade intraepithelial neoplasia (LG-IEN): nine; high-grade intraepithelial neoplasia (HG-IEN): seven; pTis: three; adenoarcinoma: five (G1, pT1, L0, V0, Haggitt 3: 2/G2, pT1, L0, V0, Haggitt 3:2/G3, pT1, Bd3, V1, Haggitt 4: 1); other: 1.
R0 resection rate was 100% and the curative resection rate yielded 96% (24/25) without severe adverse events.

Conclusions ESD achieved high en bloc and R0 resection rates for large pedunculated polyps. In our collective, up to 32% of polyps already had adenocarcinoma, resulting in a high curative resection rate due to complete resection and subsequently accurate risk classification.

Introduction

Colorectal Cancer (CRC) is still ranked as the third highest in terms of cancer mortality [1, 2] and, therefore, an important subject in the medical field. Since the knowledge of the adenoma carcinoma sequence [3], screening colonoscopies as well as polypectomies for detected adenomas have been the gold standard of CRC prevention [4, 5]. The standard procedure for polypectomies to remove larger polyps in the colon is currently snare polypectomy or endoscopic mucosal resection (EMR) [6].

EMR of larger colonic lesions often requires resection in piecemeal technique and, thus, carries a recurrence rate of up to 20% [7].

On the other hand, endoscopic submucosal dissection (ESD) developed by eastern endoscopists, originally for en bloc resection of gastric cancers, has been gaining more prominence in treatment of colorectal lesions in recent years in Asia. Japanese data show a high en bloc rate and a low recurrence rate of 0.5% in a 5-year follow-up after ESD of broad-based colonic lesions larger than 20 mm [8]. Due to this success, this method is also increasingly being used in western countries for removal of lateral spreading colonic lesions [9]. However, snare resection remains the standard for removal of broadly pedunculated colonic polyps classified by the Paris classification system as 0-Ip lesions. 0-Ip lesions are histologically described using the Haggitt classification system. The Haggitt classification system categorizes carcinomas as low risk or high risk depending on depth of submucosal infiltration [10]. Patients with a carcinoma categorized as Haggitt level 1 to 3 are typically treated by local excision unless risk factors such as lymphatic invasion and budding dictate otherwise. However, a patient classified with Haggitt level 4 requires surgical treatment [10]. A prerequisite for proper assessment is complete evaluation of the polyp and stalk, ideally en bloc. We, therefore, retrospectively analyzed the ESD technique for resection of large or broadly pedunculated polyps concerning en bloc resection rate, histological outcome, recurrence, and adverse event (AE) rate.

Patients and methods

This was a single-center retrospective study at the University Hospital Marburg, Germany, investigating patients undergoing ESD for removal of pedunculated colonic polyps classified after the Paris classification system as a 0-Ip lesion between 2019 and 2022.

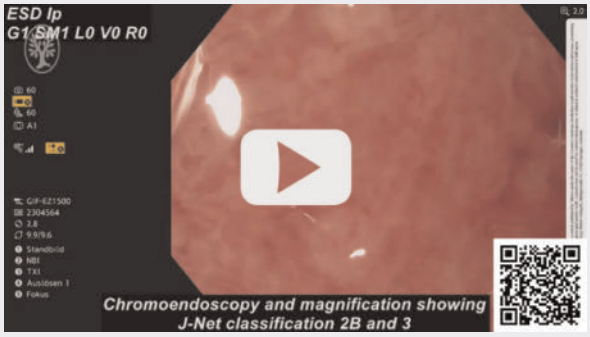
Inclusion criteria were 0-Ip lesions with a polyp diameter ≥ 20 mm and/or a broad stalk > 5 mm. Polyp and stalk diameter were estimated endoscopically in comparison with the knife and forceps diameter. All consecutive 0-Ip lesions that met the inclusion criteria were resected with ESD. All resected specimens were histologically examined and finally measured by the university's pathology institute.

Initial endoscopic follow-up was scheduled routinely 3 to 6 months after resection. In addition to endoscopic evaluation, a biopsy was taken from the former resection site or scar.

The data were analyzed for size, polyp localization, histology, en bloc resection rate, intra-procedure and postprocedural AEs, procedure time, and recurrence rate of the adenomas. Procedure time was counted starting from injection into the base until full removal of the lesion. Final polyp size, stalk diameter, and stalk length were measured on the histological preparation after formalin fixation. Statistical correlations between polyp size, stalk diameter, and malignancy or resection time were analyzed.

A regression analysis was performed and the results were calculated using a product-based biserial correlation (Pearson) and a biserial correlation (Spearman), each with a one-sided significance test. $P < 0.05$ was considered statistically significant.

VIDEO



▶ **Video 1** Chromoendoscopy and magnification showing J-NET classification 2b and 3. Submucosal injection at the basis of the polyp stalk. Incision starting on the anal side. Dissection was undertaken from anal to oral side first. Then circumferential incision of the oral side was completed in retroflexion. Vessel coagulation using swift coag mode. Clip line was attached for traction. Further dissection on the muscle surface. Prophylactic forceps coagulation of vigorous vessels in the residual stalk (soft coag mode, 60 W). Final dissection with arterial bleeding treated with a hemoclip. Final cut. Prophylactic clip closure of the resection area. Stretched resectate. Final histology: G2, pT1(sm1), L0, V0, R0, Haggit level 1.

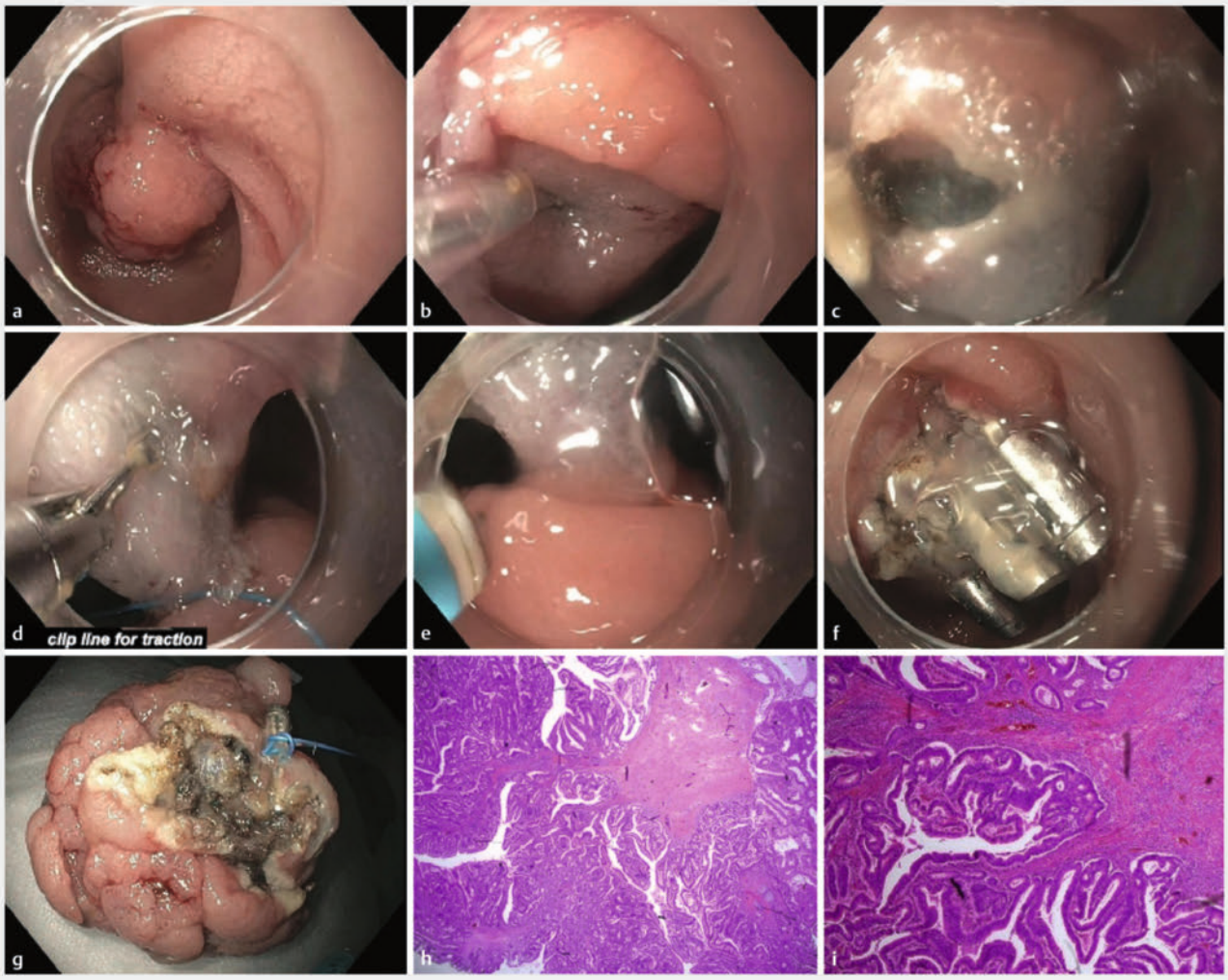
The study was approved by the local ethics committee of the Medical Faculty of the Philipps University Marburg, Germany (No. RS 22/45).

ESD technique

ESD procedures were performed with a 1.5-mm or 2.0-mm ESD knife (Dualknife, Olympus Co.), using either a therapeutic gastroscope or a colonoscope, each with a transparent spacer cap. After submucosal injection of gelofusin/indigo carmine at the base of the stalk, the stalk was dissected with ESD. For ESD, either a complete circumferential incision or, alternatively, a half circumferential incision was made on the anal side. Endoscopic dissection from the anal to the oral side of the polyp stalk was then performed. In the associated video, a visual representation of the described technique can be seen (▶ **Video 1**) as well as in ▶ **Fig. 1**, ▶ **Fig. 2**, ▶ **Fig. 3** and ▶ **Fig. 4**. If needed, the clip line method was applied for stabilization through traction during resection.

Intraprocedural bleeding was routinely stopped using a coagulation forceps (Radial Jaw 4 Hot, Boston Scientific Co), as well as adrenaline injections, as needed. Larger resection areas were closed with hemoclips in cases of suspected higher risk of postoperative bleeding for patients receiving anticoagulation medication (vitamin K antagonists and mainly direct oral anticoagulants [DOACs]). DOACs were paused 48 hours prior to ESD and were resumed within 48 to 72 hours after resection.

Patients were informed about the procedures and gave written consent. All ESDs were performed by the same experienced endoscopist.



▶ **Fig. 1** **a** Broad and short pedunculated sigmoid adenoma. **b** Injection at the base of the polyp stalk. **c** Incision starting at the anal side with dissection to oral side. **d** After two-thirds dissection, attachment of a clip line for traction. **e** Subsequent, dissection of the remaining polyp stalk. **f** Prophylactic clipping of the resection base. **g** Resectate removed en bloc. **h** Histology revealed a tubulovillous adenoma focally with HG-EIN resected R0 (1.25x, HE stain), **i** detail magnification (4x, H&E stain).

Results

The sample consisted of 25 patients (7 female and 18 male). ▶ **Table 1** shows basic demographic, procedure, and outcomes data. The median patient age was 67 years (range, 48–93 years).

ESD was mainly performed under propofol sedation and in one case under general anesthesia due to preexisting cardiopulmonary disease. Most of the 0-Ip polyps (n = 19/25, 76%) were located in the sigmoid.

All 0-Ip lesions could be resected completely en bloc using ESD, resulting in an en bloc resection rate of 100%. Median endoscopic resection time was 48 minutes (range, 19–162).

The statistical tests to determine correlation between the various parameters showed a significant correlation ($P < 0.01$) between polyp size and examination time (r = 0.694) ($P = 0.002$). However, stalk size did not seem to play a role in procedure duration (r = 0.12, $P = 0.28$).

Histological results and R0 resection rate

Median size of the resected lesions/polyps was 30 × 25 × 17 mm shown in length x width x height. Median stalk diameter was 7 mm and median stalk length was 10 mm. ▶ **Fig. 1**, ▶ **Fig. 2**, ▶ **Fig. 3** and ▶ **Fig. 4** show various examples of polyps resected in our study.

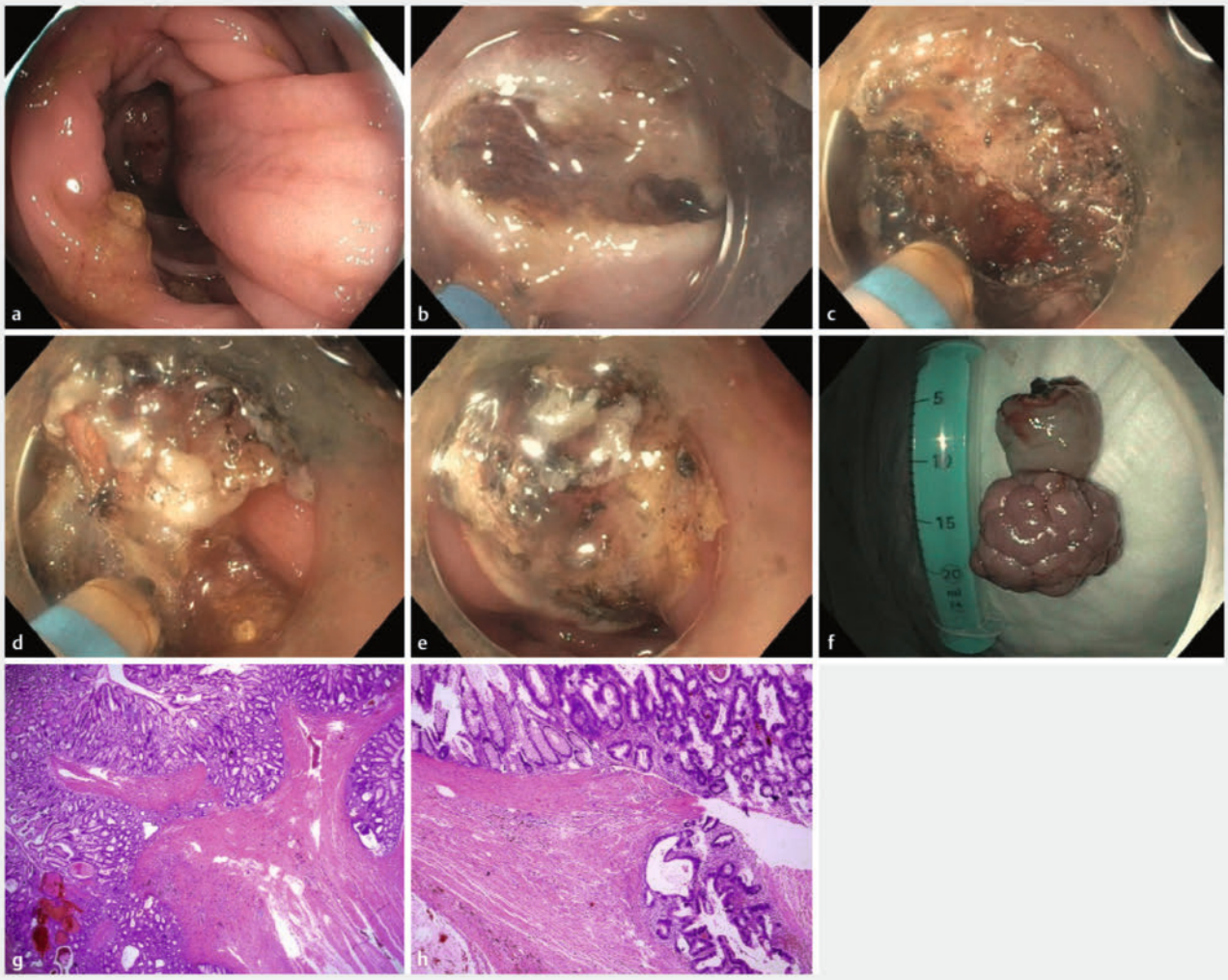
Histologic examination revealed one hyperplastic polyp and 64% adenomas (16/25), of which nine were low-grade intraepithelial neoplasia (LG-IEN) and seven were high-grade intraepithelial neoplasia (HG-IEN) as shown in ▶ **Fig. 5**. Thirty-two percent (8/25) of the removed 0-Ip lesions were carcinomas. Histological staging resulted in seven low-risk carcinomas (pTis: 3; pT1-Haggitt level 3: 4) and one high-risk carcinoma (pT1,

▶ **Fig. 2** **a** Broad pedunculated adenoma. **b** Injection of the stalk at its base. **c** Semi-circumferential incision from the anal side. **d** Endoscopic dissection from the anal to the oral side using the pocket technique. **e** Finally, application of a clip line and **f** dissection of the residual stalk under traction. **g** Resection site. **h** Stretched resectate now relatively flat. **i** Histology staining and detailed magnification showing HG-EIN with transition to adenocarcinoma in situ. Lamina muscularis mucosae is intact (1.25 x, H&E stain) **j** Detailed magnification (4x, H&E stain).

pNx, Bd3, V1, G3, Haggitt level 4), which subsequently were treated with surgery as illustrated in ▶ **Table 2**.

Statistically, there appeared to be a slight to moderate correlation between neoplastic histology (LG-IEN vs HG-IEN + cancer) and polyp size and width r = 0.286, but this correlation was not significant (P = 0.088), nor was stalk diameter with r = 0.153, also not significant (P = 0.237).

The histologic R0 resection rate was 100% with no marginal adenoma or carcinoma cells.



▶ **Fig. 3** **a** Pedunculated adenoma in the sigmoid colon. **b** Incision of the polyp stalk after injection. **c** Endoscopic submucosal dissection from anal to oral is performed. **d** In this case, with a relatively long pedicle, positioning with a spacer cap is sufficient. **e** Clean resection area. **f** Resected polyp Paris classification Ip. **g** Histology shows adenocarcinoma G1 in the polyp stalk (1.25x, H&E stain), **h** the section magnification illustrates tumor cell association in the submucosa of the polyp stalk resulting in a final tumor stage G1 pT1 Sm1 R0, L0, V0, Haggitt level 3 (4x, H&E stain).

Adverse events

Minimal intraprocedural bleeding occurred in 11 cases (44%) and was mainly treated using either the coagulation function of the ESD knife (swift coag 30 W) or coagulation forceps (soft coag 80 W).

At the end of the procedure, the resection area was clipped in 20 (80%) of 25 patients for bleeding prophylaxis. No post-procedural bleeding occurred.

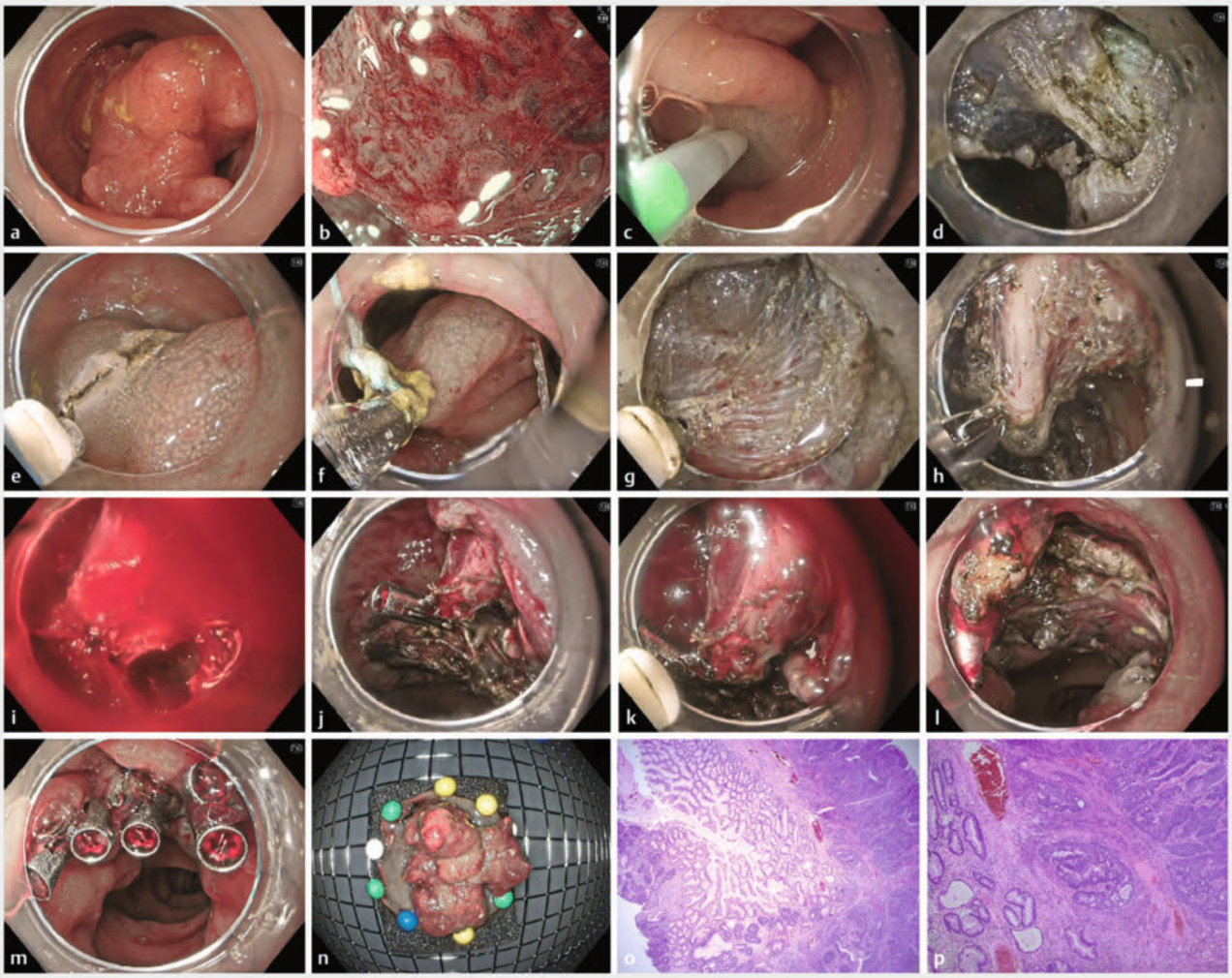
In one of the 25 patients, an incomplete perforation was suspected, showing a deep muscle defect of the sigmoid resection area without pneumoperitoneum. Successful treatment consisted of antibiotic coverage and endoscopic vacuum therapy (Endosponge, Braun) for 7 days, including one sponge exchange.

Follow up and curative resection rate

Seventeen of 25 patients returned for endoscopic follow-up, 11 of whom had adenomas and six carcinomas. Median total follow-up time was 113 days (range, 81–563). Five patients refused endoscopic follow-up due to advanced age and existing concomitant diseases, four of whom had adenomas and one carcinoma. One patient died 7 months after ESD of small cell lung cancer diagnosed at that time with multiple metastases.

The patient with a high-risk adenocarcinoma (pT1, pNx, Bd3, V1, G3, Haggitt 4) underwent surgical resection of the sigmoid colon and, therefore, dropped out of endoscopic follow up.

Endoscopic follow-up of resection sites revealed no recurrences either endoscopically or in histologic examination of the biopsies taken.



▶ **Fig. 4** **a** Broad pedunculated adenoma. **b** Chromoendoscopy and magnification showing J-NET classification 2b and 3. **c** Injection of the stalk. **d** Incision and dissection was undertaken from anal to the oral side first. **e** Then circumferential incision of the oral side was completed in retroflexion. **f** Clip line was attached for traction. **g** Further course of the endoscopic dissection. **h** Vigorous vessels at the base of the polyp stalk require prophylactic coagulation with coagulation forceps (Coag mode 60 W) prior to dissection. **i** Nevertheless, a vigorous arterial hemorrhage occurred at the end, **j** which was treated with a hemoclip **k** before the final resection. **l** Resection side. **m** Prophylactic clipping of resection side. **n** Stretched resectate. **o** Histology revealed HG-EIN with adenocarcinoma (1.25x, H&E stain), **p** the detailed magnification shows tumor cell association in the submucosa still in the polyp head (4x, H&E stain). Final tumor stage is G2, pT1(sm1), L0, V0, R0, Haggit level 1.

The follow-up group included six patients with adenocarcinoma (pTis: 2; pT1 L0, V0, G1, Haggitt 3; pT1 L0, V0, G2, Haggitt 3; pT1 L0, V0, G1, Haggitt3; pT1, L0,V0, G2, Haggitt 3) with a median follow-up of 101.5 days (range, 84–563) and no recurrence after ESD resection.

The curative resection rate was 96% (24/25).

Discussion

Our retrospective study of ESD resections of large and/or broad pedunculated polyps resulted in an en bloc and R0 resection rate of 100%. Histologically, 32% of polyps were already classified as carcinomas, including seven low-risk carcinomas in eight cases. The curative resection rate was 96% using ESD.

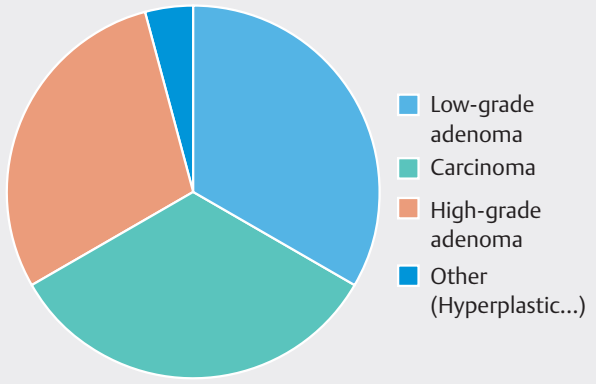
In the eight cases of carcinoma, we decided to include three cases in which the cancer was in its earliest stage, which is carcinoma in situ. That has the characteristic feature of lateral expansion within the mucosa, which is an indicator that these tumor cells have acquired invasive capacity, in contrast to HG-IEN. Therefore, we included these lesions (n = 3) in the group of cancerous lesions. It should be emphasized, however, that due to the lack of contact with lymphatic vessels, these early intramucosal invasive lesions have no metastatic capacity.

Data on ESD resection of colonic lesions primarily analyze the treatment of flat, laterally spreading lesions. In comparison, there are few data available on ESD resection of Ip lesions. Some case reports and mainly eastern retrospective multicenter studies examined feasibility for ESD on pedunculated polyps [11, 12, 13, 14, 15]. Choi et al. [11] described ESD resection of

▶ **Table 1** Patient data and initial and follow-up results.

Patient	Age	Sex	Site cm anocutaneous	Procedure time (min)	Stalk length (mm)	Stalk width (mm)	Ø polyp (max mm)	Histology	Haggit level	Resection (R0/R1)	Follow-up (d)	Recurrence
1	58	M	18	41	4	5	47	**pTis L0, V0**	0	R0	90	None
2	69	M	15	36	8	4	26	LG-IEN		R0	88	None
3	63	M	25	35	6	3	22	LG-IEN		R0		
4	83	F	22	29	12	7	28	LG-IEN		R0		
5	61	F	25	45	12	**9**	**40**	**pT1 L0, V0, G1**	3	R0	563	None
6	59	M	25	45	7	5	24	LG-IEN		R0	104	None
7	59	M	20	130	10	15	38	HG-IEN		R0	81	None
8	51	M	28	130	10	20	42	Hyperplastic Mucosa		R0		
9	77	M	15	48	14	10	25	LG-IEN		R0		
10	48	M	20	35	10	5	25	HG-IEN		R0	248	None
11	67	M	25	57	7	18	25	HG-IEN		R0	309	None
12	65	M	12	100	12	4	47	LG-IEN		R0		
13	70	M	12	34	7	**6**	**42**	**pT1 L0, V0, G2**	3	R0	113	None
14	59	F	70	96	19	3	52	HG-IEN		R0	92	None
15	82	M	10	96	6	7	51	HG-IEN		R0		
16	62	F	20	21	9	15	30	HG-IEN		R0	228	None
17	76	F	30	19	11	**11**	**23**	**pTis, L0, V0, G2**	0	R0	138	None
18	68	F	20	68	13	**5**	**40**	**pT1, Bd3, V1, G3**	4	R0		
19	73	M	20	32	9	3	27	LGIN		R0	151	None
20	67	M	50	61	9	**12**	**28**	**pT1, L0, V0, G1**	3	R0	84	None
21	93	F	8	55	12	3	**23**	**pTis, L0, V0, G2**	0	R0		
22	91	M	14	80	16	**15**	**40**	**pT1, L0, V0, G2**	3	R0	89	None
23	70	M	40	132	18	4	47	HG-EIN		R0	229	None
24	52	M	40	20	5	15	27	LG-EIN		R0	179	None
25	63	M	35	162	4	15	50	LG-EIN		R0	100	None

HG-EIN, high-grade intraepithelial neoplasia; LG-EIN, low-grade intraeplithelial neoplasia.



▶ **Fig. 5** Overview of histological results of polyps.

▶ **Table 2** Overview of histological results of carcinomas.

Histological staging	Histological grading	Haggitt level
HG-EIN- pTis, L0, V0		Haggitt 0
pTis, L0, V0	G2	Haggitt 0
pTis, L0, V0, Bd1	G2	Haggitt 0
pT1, L0, V0,	G1	Haggitt 3
pT1, L0, V0,	G2	Haggitt 3
pT1, L0, V0,	G1	Haggitt 3
pT1, L0, V0	G2	Haggitt 3
pT1, pNx, Bd3, V1	G3	Haggitt 4

23 difficult Ip lesions in 2013 as an alternative to snare resection. They achieved an en bloc resection rate of 100% with a cancer incidence of 87% in this selected group. The study of Chiba et al. [13] included a sample size (29 patients) similar to our respective study. The curative resection rate was 85.7% and the cancer incidence was 20.6% [13]. The latest retrospective study by Inagaki et al. [14] investigated 36 Ip lesions. En bloc, complete en bloc, and curative resection rates were 97%, 97% and 81%, respectively. Cancer incidence was 25% in this study. These studies did not report on any follow ups and, therefore, the possible recurrence of the lesions, an aspect we observed further.

The latest recommendation from the European Society of Gastrointestinal Endoscopy committee is use of ESD to selectively treat lesions with higher risk of submucosal invasive cancer. They identify lesions with a higher risk as mainly "nongranular lateral spreading types (LST-NGs), particularly if pseudo depressed 0-IIc; granular nodular mixed LSTs, particularly if more than 2 cm in size; especially lesions in the rectosigmoid area; and those showing an irregular pattern with CE" [16]. A meta-analysis including 48 studies, which was published in 2018, described a submucosal invasion risk in overall LST adenomas of 8.1%. Whereas they emphasize that non-granular pseudo depressed LSTs had a submucosal invasion rate of 31.6% [17]. A different multicenter study, which was published in 2020, described submucosal invasion as high as 36% in LST non-granular pseudo depressed adenomas [18].

In our study, 32% of all assessed lesions (8/25), namely large-diameter Ip polyps, were cancerous. Here our data showed a slight to moderate yet not statistically significant correlation of polyp size and stalk diameter with neoplasia (HG-IEN and cancer). The cancer risk would match the estimated risk in LST non-granular pseudo depressed adenomas. In addition to polyp size, endoscopic criteria for malignancy in pedunculated polyps may include ulceration of the polyp head and interrupted vascular pattern [19].

Endoscopic oncologic resection in these cases requires complete en bloc removal, taking the polyp stalk at the base while avoiding a marginal or incomplete resection. Only this allows for valid histopathological evaluation of submucosal infiltration depth and is vital for an accurate differentiation between low-risk and high-risk carcinomas. In our study cohort, the majority of carcinomas consisted of histologically staged low-risk carcinomas with no further indication of necessary oncologic surgical resection. It is debatable whether a certain polyp size, stalk diameter, or both, are the decisive factors in the decision to use ESD as an alternative to snare resection.

In our study we included polyps with a size ≥ 20 mm and/or broad stalk ≥ 5 mm. All Ip lesions had a final histological polyp size ≥ 20 mm (median polyp size: 30 mm), but not all had a stalk size over 5 mm (median stalk size: 7 mm). This may be due to inaccurate endoscopic size estimation with limited visibility of the stalk in cases with a big polyp head. Another point to consider may be tissue shrinkage after formalin fixation. Polyp size alone can impede visualization and snare positioning with risk of fractional resection. This may be the reason that published data on ESD resection of Ip lesions have not determined a certain stalk diameter in the indication. Choi et al. [11] included difficult Ip lesions, which were defined as polyp size ≥ 3 cm and included poor visualization of the stalk, technical difficulties in snare positioning for en bloc resection, or need for trimming of the polyp head. Chiba et al. [13] used nearly the same inclusion criteria. Inagaki et al. [14] defined inclusion criteria as the endoscopist's determination of difficult snare positioning and/or an estimated high risk for bleeding due to a thick polyp stalk without specifying numerical limits. If stricter inclusion criteria were applied to our data (polyp size ≥ 30 mm and/or polyp stalk ≥ 10 mm), 18 of 25 lesions would still have fulfilled the ESD indication.

Looking more closely at the cancerous polyps in our study, polyp size ranged between 27 and 47 mm (median polyp size: 40 mm) and polyp stalks between 5 and 15 mm (median stalk size: 7.5 mm). This is in accordance with data from Choi et al. [11], who resected 20 cancerous polyps, of which only five had a polyp stalk ≥ 10 mm. Stalk length varied between short and long. Four of six cancerous polyps resected by Chiba et al. [13] had a wide stalk between 20 and 30 mm. The study by Inagaki et al. [14] did not mention stalk width and length of Ip polyps. Their resected cancerous lesions had a polyp size between 20 and 50 mm, similar to our data.

Based on our data, it is likely that resection of difficult pedunculated polyps with ESD enables a higher en bloc rate with entrainment of the polyp stalk, which is especially crucial for cancerous polyps.

For non-pedunculated colonic adenoma, ESD has proven to result in high en bloc rates as well has low recurrence rates [20, 23, 22]. The literature reports en bloc rates as high as 91% and recurrence rates as low as 1% to 2%, whereas some studies show that EMR results in recurrence rates up to 12% to 19% [20].

Our analysis also showed en bloc resection rates as high as 100% and R0 resection rate as low as 0% using ESD. Our calculated results include 17 of 25 patients who have been assessed in the follow up. Currently, prospective randomized studies are lacking to finally clarify which Ip lesions benefit from ESD resection. The retrospective comparison of ESD and snare resection from 2013 [11] resulted in an advantage for ESD resection with an en bloc resection rate of 100% versus 90%. In this study, difficult Ip lesions with a higher proportion of short and thick polyp stalks without numerical minimum were selected for resection in the ESD group. Nevertheless, snare resection of the supposedly easier Ip lesions achieved a lower en bloc resection rate. Although prospective randomized data are lacking, this supports using ESD for en bloc resection of difficult Ip lesions.

Another important aspect when evaluating medical treatments are their AE rates. In 2005, the Munich Polypectomy study analyzed over 3000 snare polypectomies, which included treatment of 27.8% pedunculated polyps [21]. They reported an overall AE rate of 9.7%, 75% of which were classified as minor [21]. However, the authors highlighted that size, location, and configuration (sessile vs pedunculated) played an important role, with the lowest AE rate of 0.4% occurring in pedunculated left-sided polyps smaller than 2 cm. The perforation rate was reported as only 1.1% and it is not clearly stated to which kind of lesions it applied. ESD has a reported perforation rate of approximately 4.8% and is often said to be associated with higher risk of AEs than EMR [1, 22, 23]. In our case study, there were no perforations, but there was one suspected perforation which equated to 3% and matches the reported rates. Nonetheless, this AE was treated endoscopically and did not require any further interventions such as transfusions and/or surgery.

Another common AE of snare resection of broadly pedunculated polyps is bleeding from the well-vascularized polyp stalk. A randomized trial comparing prophylactic clipping of the base with prophylactic endoloop application prior to snare resection still resulted in 5% direct bleeding events on resection and 1% post-resection bleeding in both groups [24]. An advantage of ESD is that it allows slow transection of the polyp stalk with targeted coagulation of vessels using either the ESD knife or coagulation forceps. This aspect is illustrated in a current case report [12]. Published data [11, 13, 14] report no delayed bleeding using ESD, which is in accordance with our data. No postoperative bleeding occurred in our study, and minor intraprocedural bleeding was stopped with targeted vascular coagulation during resection.

There are a few limitations to our study. The main one is it that it was retrospective, single-center, and had a relatively small sample size. Also, the lack of a direct comparison between ESD and EMR is another limitation that needs to be addressed. In the future, a prospective randomized trial comparing both methods should be conducted to verify our findings. Next would be measuring the stalks. Although all of our stalks were measured by the pathology institute, some of them were not measured until after formalin treatment, which led to shrinkage. Therefore, initial assessment of stalk width was subject to examiner judgment.

In the future, for more exact evaluation, the stalks should be measured after resection, before formalin exposure, or using a standardized measurement technology, e. g., with artificial intelligence.

Conclusions

To conclude, it can be said that in our case study, ESD was an effective and safe treatment for larger colonic pedunculated lesions with en bloc resection rate and R0 resection rate both being 100% and recurrence rate being as low as 0%. Thirty-three percent of resected 0-Ip lesions were staged as adenocarcinomas. Here, complete en bloc resection allowed full pathooncological staging in all cases. Of those adenocarcinomas, more than 50% were staged as Haggitt level 3 or higher. In seven of eight carcinoma patients, ESD was curative and patients did not have to undergo any further treatment. Whenever ESD is performed, its higher technical complexity as well as longer procedure times have to be considered. Given this, our study showed a significant correlation between polyp size but not stalk diameter with ESD resection time. Prospective comparative data are the next step to analyze the increased complexity of ESD resection versus snare resection against the exact benefit in terms of increased R0 and lower recurrence rate. However, even if comparative studies defining exact eligibility criteria are lacking so far, ESD can be recommended and should be discussed when treating large pedunculated lesions due to their higher carcinoma risk.

Conflict of Interest

The authors declare that they have no conflict of interest.

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