Efficacy of Endoscopic Submucosal Dissection for Superficial Gastric Neoplasia in a Large Cohort in North America

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Abbreviations:

ASGE – American Society for Gastrointestinal Endoscopy

EGC – early gastric cancer

EGJ – gastroesophageal junction

EMR - endoscopic mucosal resection

ESD – endoscopic submucosal dissection

HGD – high-grade dysplasia

LVI – lymphovascular invasion

LGD - low-grade dysplasia

NET - neuroendocrine tumor

ABSTRACT

Background & Aims: Endoscopic submucosal dissection (ESD) is a widely accepted treatment option for superficial gastric neoplasia in Asia, but there are few data on outcomes of gastric ESD from North America. We aimed to evaluate the safety and efficacy of gastric ESD in North America.

Methods: We analyzed data from 347 patients who underwent gastric ESD at 25 centers, from 2010 through 2019. We collected data on patient demographics, lesion characteristics, procedure details and related adverse events, treatment outcomes, local recurrence, and vital status at the last follow up. For the 277 patients with available follow-up data, the median interval between initial ESD and last clinical or endoscopic evaluation was 364 days. The primary endpoint was the rate of en bloc and R0 resection. Secondary outcomes included curative resection, rates of adverse events and recurrence, and gastric cancer-related death.

Results: Ninety patients (26%) had low-grade adenomas or dysplasia, 82 patients (24%) had high-grade dysplasia, 139 patients (40%) had early gastric cancer, and 36 patients (10%) had neuroendocrine tumors. Proportions of en bloc and R0 resection for all lesions were 92%/82%, for early gastric cancers were 94%/75%, for adenomas and low-grade dysplasia were 93%/ 92%, for high-grade dysplasia were 89%/ 87%, and for neuroendocrine tumors were 92%/75%. Intraprocedural perforation occurred in 6.6% of patients; 82% of these were treated successfully with endoscopic therapy. Delayed bleeding occurred in 2.6% of patients. No delayed perforation or procedure-related deaths were observed. There were local recurrences in 3.9% of cases; all occurred after non-curative ESD resection. Metachronous lesions were identified in 14 patients (6.9%). One of 277 patients with clinical follow up died of metachronous gastric cancer that occurred 2.5 years after the initial ESD.

Conclusions: ESD is a highly effective treatment for superficial gastric neoplasia and should be considered as a viable option for patients in North America. The risk of local recurrence is low and occurs exclusively after non-curative resection. Careful endoscopic surveillance is necessary to identify and treat metachronous lesions.

KEY WORDS: EGC; stomach cancer; endoscopic resection; dysplasia

BACKGROUND:

Endoscopic resection is a minimally invasive technique for treatment of superficial gastric neoplasia with a negligible risk of lymph node metastasis and appears to be a safe alternative to radical surgery. Endoscopic mucosal resection (EMR) is a common endoscopic resection technique involving submucosal injection and/or suction and subsequent snare resection of the lesions[1]. However, EMR often results in piecemeal resection and is associated with high rates of local recurrence[2, 3]. Endoscopic submucosal dissection (ESD) was developed to overcome limitations of EMR. ESD allows en bloc resection of a superficial neoplastic lesion regardless of size, thus minimizing risk of local recurrence, and facilitates precise histological assessment of the resected specimen, and improves of curative resection[2, 4].

Numerous Asian studies, comparing ESD to surgery for EGCs fulfilling resection criteria, showed ESD has comparable outcomes in terms of overall and disease-specific survival. It is associated with a lower rate of adverse events, shorter hospital stay, lower cost, and better quality of life[5-7]. Thus, ESD is considered a safe and effective alternative to surgical resection and has become a treatment of choice for EGC and premalignant gastric lesions in Asia[8, 9].

In western countries, ESD has gained acceptance slowly, likely because of technical difficulty, time-consuming nature, steep learning curve and the lower incidence of gastric neoplasia. To date, outcomes data on gastric ESD in Western settings have been limited to small, single-center studies, with a lack of data from North America[10-16]. The 2019 American Gastroenterological Association recommends that, ESD should be considered as first-line therapy for visible, endoscopically resectable, superficial gastric neoplasia[17]. However, outcomes data for gastric ESD from US centers have not been published.

In the current study, we present a large multicenter analysis of safety, and clinical outcomes of ESD in North American population with superficial gastric neoplasia.

METHODS:

This was a retrospective analysis of consecutive patients with superficial gastric neoplasia who underwent ESD at 25 tertiary-care centers (22 in the USA and 3 in Canada). This study was approved by the institutional review board for human research at each institution.

Inclusion criteria were cases with gastric dysplasia (LGD or HGD), EGC and NET. We excluded patients with Barrett's adenocarcinoma, metastatic disease, and those who received prior chemotherapy or radiotherapy for gastric cancer.

Relevant clinical data were extracted including patient demographics, lesion characteristics, procedural details, procedure-related adverse events and treatment outcomes, presence of local recurrence, metastatic disease, and vital status at the last follow-up, when available. Well and moderately differentiated cancers were considered differentiated-type lesions, while poorly differentiated adenocarcinoma and signet-ring cell carcinoma were considered undifferentiated-type lesions. HGD is characterized by epithelium with both cytological and architectural changes. Carcinoma is diagnosed when the tumor invades into the lamina propria (intramucosal carcinoma) or through the muscularis mucosae.

ESD procedures (Figure 1).

A transparent distal cap was attached at the distal end of the endoscope. Carbon dioxide insufflation was used for all procedures. Mucosal marking was carried out circumferentially around 5-10 mm outside the lesion margins using argon plasma coagulation or an ESD knife. A submucosal injection was performed using saline or other viscous solutions. Then a mucosal incision was made outside of the marking dots, followed by submucosal dissection using an electrosurgical knife. Pathologic specimens were pinned and submitted for histopathological evaluation.

Outcomes:

Primary end points were the rates of en-bloc resection (defined as excision of the targeted lesion in a single specimen) and complete (R0) resection (defined as resection with lateral and deep margins free of gastric neoplasia on histopathology). Secondary outcomes included rates of: curative resection for EGC, adverse events, and recurrence and gastric cancer-related death.

Curative resection was achieved when all of the following conditions were fulfilled [9, 18]: an en bloc resection with negative horizontal and vertical margins and no lymphovascular invasion (LVI) and one of the following:

(a). When the lesion is <2 cm in diameter, predominantly differentiated type, pT1a, and non-ulcerated, it is considered curative resection for standard criteria.

(b). When a lesion is: (1) ≥2 cm in diameter, predominantly differentiated type, pT1a, and non-ulcerated; (2) <3 cm, predominantly differentiated type, pT1a, and ulcerated; (3) <2 cm, predominantly undifferentiated type, pT1a, and non-ulcerated; or (4) <3 cm, predominantly differentiated type, pT1b (SM1); it is considered curative resection for expanded indications.

Local recurrence was defined as the presence of endoscopic and/or histological evidence of neoplasia during follow-up endoscopy. Metachronous lesion was defined as a new gastric neoplasm in the area other than the site of the primary lesion diagnosed at least 12 months after the initial ESD.

Severe intraprocedural bleeding was defined as clinical bleeding with a drop of hemoglobin >2 g/dL and/or with the need for blood transfusion. Delayed bleeding was defined as clinical evidence of bleeding by hematemesis or melena occurring any time from the time of ESD completion to 14 days after the procedure with a drop in hemoglobin >2 g/dL and/or requiring blood transfusion and/or endoscopic treatment.

Statistical Analysis

Frequencies and percentages were calculated for categorical variables and mean, standard deviation (SD), median and interquartile range (IQR) was calculated for continuous variables. Comparative analysis using Fisher's exact test for categorical variables and the *t* test for continuous variables was performed. P values less than 0.05 were considered significant.

RESULTS:

Patients and Lesions Characteristics

Of 354 patients who were referred for gastric ESD during the study period (2010-2019), ESD was technically feasible in 347 (98%). ESD was not technically feasible in seven cases (2 due to deeply invasive cancer and 5 due to severe submucosal fibrosis from prior endoscopic

resection). In 347 gastric lesions that ESD was technically feasible, there were 90 (26%) adenomas/LGDs, 82 (24%) HGDs, 139 (40%) EGCs, and 36 (10%) NETs [**Table 1**]. Mean age was 69±12 years and 195 (56%) were males. Approximately half of the patients were Caucasian.

Most lesions were located in the antrum (167: 48%), followed by the gastric body (124: 36%), fundus (33:10%) and gastric cardia (23: 6%). The mean lesion size was 26.8 mm (SD 16) [range 3-150]. Thirty lesions (9%) had previously undergone endoscopic therapy prior to gastric ESD. Of 36 gastric NET lesions, they were type I in 22, type III in 13 and type II in one.

Of 139 EGC lesions, ulcerative findings were observed in 33 (23.7%) lesions, and 59 lesions (35.9%) had invaded to the depth of the submucosa or deeper. Most lesions (119; 85.6%) were differentiated type and LVI was detected in 29 (20.9%) of the lesions. Based on the Gastric Cancer Treatment Guidelines18, the clinical indications for ESD included absolute indications for 38 lesions (27.3%) and expanded indications for 88 lesions (63.3%) [(1) differentiated, non-ulcerated, intramucosal, >2cm in 67; (2) differentiated, ulcerated, intramucosal, ≤3cm in 11 and (3) undifferentiated, non-ulcerated, intramucosal, ≤ 2cm in 10 cases]. ESD was performed for 13 lesions (9.3%) outside of the established criteria.

In the analysis of lesion characteristics and the presence of HGD and/or EGC in the resected specimen is showed in **Supplement A (Supplementary Table 1)**. Comparison of tissue diagnosis from endoscopic biopsy and post-ESD histopathology is provided in **Supplementary A (Supplement Table 2).**

Procedural Characteristics [Table 2].

Median procedure time was 90 min (IQR 60-138). Overall, the Dual Knife (Olympus America, Center Valley, PA, USA) was the most commonly used electrosurgical ESD knife

(142; 41%). A combination of ESD knives was used in 29% of the cases. In 35% of cases (123/347), ESD was performed in an outpatient setting and 165 (47.6%) patients stayed overnight for clinical observation after ESD.

Adverse events [Table 2].

Intraprocedural perforation occurred in 6.6% (n=23). Of these, 19 were treated successfully with endoscopic therapy and four (1.1%) required surgery. Severe intraprocedural bleeding occurred in 1.2% (n=4) and all were managed endoscopically. Delayed bleeding occurred in 9 cases (2.6%). Of these, five patients underwent repeat endoscopy with successful endoscopic hemostasis and the remaining patients were managed conservatively. No delayed perforation or procedure-related deaths were observed.

Resection Outcomes

En-bloc resection rates for all lesions, EGCs, adenomas/LGD, HGD, and NETs were 92.2%, 93.5%, 93.3%, 89% and 91.7%, respectively. R0 resection rates for all lesions, EGCs, adenomas/LGD, HGD, and NET were 81.8%, 74.8%, 92.2%, 86.6% and 75%, respectively. [**Table 3**]

In the adenomas/LGD group, all cases(n=7) with non-curative resection underwent endoscopic surveillance. Of 11 patients with HGD and non-curative resection, two underwent surgery due to piecemeal resection and nine patients elected not to have surgery. For 9 patients

with non-curative ESD for NETs, 4 patients underwent surgery and 5 patients did not undergo surgery either because they were unfit for surgery or declined additional treatment.

In the EGCs subgroup, after excluding 13 lesions outside clinical criteria for resection, curative resection according to Japanese criteria was achieved in 58.7% (74/126) of all EGC lesions, including 26 EGCs fulfilling the standard criteria and 48 EGCs fulfilling the expanded criteria. Reasons for non-curative ESD were presence of LVI in the resected specimen in 29; submucosal invasive cancer > 500 μm in 17; R1 resection in 35; and piecemeal resection in 5. Of 52 cases with non-curative resection for EGCs, 22 patients underwent surgery, 2 patients await surgery and the remaining patients did not undergo surgery either because they were unfit for surgery or declined additional treatment. Of those 22 patients who underwent surgery, no residual cancer was identified at the resection site in 12 patients (55%). Pathologic T staging of these 22 patients was T1a in 4 (18%), T1b in 13 (59%) and T2 in 5 (23%). Two resection specimens (2/22, 9%) showed micrometastases in the lymph nodes and 20 (91%) were classified as pN0.

Follow-up and recurrences

A total of 203 patients who did not undergo surgery underwent follow-up endoscopy. The median total endoscopic follow-up was 239 days (IQR: 114-239) after the index gastric ESD.

Local recurrences:

Eight out of the 203 patients (3.9%) experienced a residual lesion or local recurrence, and all occurred after non-curative ESD resection. One patient with local recurrence after piecemeal resection of gastric adenoma was successfully treated by EMR. Two patients with residual

lesions after R1 resection of HGD underwent repeat endoscopic resection but it was unsuccessful. One of these two patients underwent surgery and the other patient declined surgery. One patient with local recurrence after non-R0 resection of a 2 cm intramucosal well-differentiated adenocarcinoma underwent further ESD and complete resection was achieved. One patient with local recurrence after non-R0 resection of a 2 cm intramucosal well differentiated adenocarcinoma underwent surgery. One patient with local recurrence after non-curative ESD for a 3 cm submucosally invasive poorly differentiated adenocarcinoma underwent surgery. One patient with a 3 cm submucosally invasive moderately differentiated adenocarcinoma was found to have LVI on the resected specimen and was subsequently found to have local recurrence but declined additional treatment. One patient with local recurrence after non-curative ESD for a 4 cm intramucosal moderately differentiated adenocarcinoma underwent additional EMR of the residual tumor during follow-up endoscopy, however complete resection was unsuccessful.

In the EGC group, there were 5 (7.1%) local recurrences after ESD (0% (0/43) after curative resection vs 18.5% (5/27) after non-curative resection, p=0.007).

Metachronous lesions:

Of 203 patients, including those with non-curative ESD resections, 14 (6.9%) developed metachronous lesions during follow-up endoscopy. Seven lesions were treated with EMR, 4 with surgery and 2 patients were monitored without treatment. One patient who underwent curative ESD for a 24 mm LGD developed metachronous high-grade neuroendocrine carcinoma at 2.5 years after the initial ESD.

Gastric cancer mortality:

Clinical follow-up was available in 277 of 347 patients after ESD. The median interval between initial ESD and last clinical/endoscopic follow up was 364 days (IQR 130-682). One patient died of gastric cancer (mentioned above) and nine patients died of causes other than gastric cancer.

DISCUSSION

To date, outcomes data on gastric ESD in the Western settings have been limited to small, single-center studies, with a lack of data from North America. In this study, we report on 347 superficial gastric lesions treated with ESD at 25 tertiary care centers in North America. To our knowledge, this is the largest series on gastric ESD published from Western centers. The resected 347 gastric lesions included 90 adenomas/LGDs, 82 HGDs, 139 EGCs, and 36 NETs. En-bloc resection was achieved in 92.2% and R0 resection was achieved in 81.8% of all lesions. Adverse events included a perforation rate of 6% and a postprocedural bleeding rate of 2.6%. Surgery was performed for ESD-related adverse events in 1.1% of cases. Altogether, ESD appears to be a highly effective treatment for superficial gastric lesions in a Western setting.

In the meta-analysis on resection outcomes of gastric ESD from Eastern countries involving 59,173 gastric lesions, en-bloc resection and R0 resection rates were 94% and 91%, respectively. The pooled rate for perforation was 2.6% and for bleeding was 4.2%[19]. Studies from Europe and South America reported en-bloc resection rates of 87-100%, R0 resection rates of 64-93%, perforation rates of 0-10% and bleeding rates of 1-8%[12, 13, 15, 16, 20-22]. The resection success rates of our study are slightly lower than those from Eastern studies and comparable to those of other Western studies. This may be explained by the lower incidence of gastric neoplasia in North America as compared to Asia, and the fact that ESD is not yet widely

available in the West because the procedure is technically demanding and entails a steep learning curve. Comparing to EMR, a meta-analysis of non-randomized studies showed that ESD offers considerable advantages regarding higher en-bloc resection rate (92% vs. 52%), histologically complete resection rate (82% vs. 42%), and lower local recurrence (1% vs. 6%), even for lesions smaller than 10 mm[23]. Given these results, the European guidelines recommend ESD as treatment of choice for most gastric superficial neoplastic lesions. EMR is an acceptable option for lesions smaller than 10-15mm with a very low probability of advanced histology (Paris 0-IIa)[2].

Curative resection of EGC was defined according to the Japanese Gastric Cancer Association[18]. The meta-analysis of Eastern studies reported a curative resection rate of 80%[19]. In our study, curative resection rates of 59% in the EGC group appeared lower than that of other Western series. The lower rates of curative resection in this study may be explained by differences in the types of lesions included in the analysis. One Australian study[22] reported an overall curative resection rate of 79%. However, that study combined HGD into the EGC group, while our study separated HGD from the adenocarcinoma category. In this study, we noted the rate of histologically complete resection in the HGD group was 86.6%. Thus, our curative resection rate would be higher if we combined HGD with T1a cancer. In addition, a significant proportion of the resected lesions in this study were lesions with LVI or submucosal invasive cancer > 500 µm, which could not be precisely determined prior to ESD.

Gastric adenoma and/or LGD is a precancerous lesion to gastric adenocarcinoma with an annual risk of progression to cancer of 0.77%[24]. Because lesions initially reported as gastric adenoma with LGD by endoscopic biopsy can be upgraded to invasive cancer in up to 25% of cases after total endoscopic resection, complete en-bloc resection is desirable[25, 26]. In this study,

we found that ESD is highly effective in achieving complete resection of gastric adenoma/LGD with en bloc and R0 resection rates of 93% and 92%, respectively. The risk of metachronous cancer after endoscopic resection of gastric adenoma/LGD is similar to that of EGC (14.4 cases per 1000 person-years)[26]. Thus, careful endoscopic surveillance to identify metachronous lesions after endoscopic resection should be considered for both gastric adenoma and EGC patients with the same level of intensity.

There are differences in the threshold for diagnosing HGD and early carcinoma in the West versus Japan. The lesions classified as HGD by Western pathologists are frequently diagnosed as adenocarcinoma in Japan. This is particularly important because a small fraction (6%) of lesions that would be labeled as HGD by most US pathologists on the basis of the WHO criteria show venous and/or LVI[27]. In this study, the HGD group was differentiated from EGC to further characterize ESD outcomes for this type of lesion. R0 resection for HGD was 86%, which was similar to that of the adenoma/LGD group (92%; p=0.32) but higher than the EGC group (74%, p=0.04).

In this study, with a median endoscopic follow-up of 8 months, local recurrence was low at 3.9% and occurred after non-curative resection. In a study from Germany, curative treatment was achieved with ESD in 100% of the standard criteria group and 89.7% of the expanded criteria group after a median follow-up of 51 months and 56 months, respectively. No gastric cancer-related death was observed[21]. These excellent long-term results suggested effectiveness of ESD in the Western setting.

Few reports have evaluated the efficacy of ESD for gastric NET, and all were small single center studies from Asia[8, 28, 29]. Complete resection rate ranges from 94-100% with ESD. The overall metastatic risk is low in type 1 gastric NETs and moderate in type 2, and has been

directly correlated with tumor size. Management of low risk gastric NET is controversial. 2017 ASGE guidelines suggested that EMR may be considered for types I and II gastric lesions ≤2 cm. Lesions <1 cm may not require removal; however, surgical resection is often warranted for larger lesions[30]. According to European Neuroendocrine Tumor Society, for lesions <1 cm, surveillance or endoscopic resection could be considered, while resection should be performed for tumors ≥1 cm[31]. A retrospective study suggested that ESD, as compared to EMR, was associated with a higher complete resection rate (94% vs 83%)[8]. We found ESD is effective, with high rate of complete resection for gastric NETs in a Western setting, and should be considered if expertise is available.

The main strength of this study is that it is the largest series of gastric ESD as therapy for EGCs and premalignant gastric lesions in a North American population that is derived from multiple tertiary centers, which increase the generalizability of these results. The study's limitations include its retrospective design and lack of long-term follow-up data. Lastly, almost half of the patients in this study had severe systemic disease, which could indicate selection bias toward endoscopic resection rather than surgery, and may not allow for long-term follow-up for oncologic outcomes.

In summary, this is the first multicenter study from North America on ESD in patients with EGCs and premalignant gastric lesions to demonstrate a high rate of complete resection with acceptable safety profiles. To our knowledge, this is the largest study on gastric ESD for superficial gastric neoplasia in the Western world. Based on these data, we recommend ESD should be considered as a potential treatment option for superficial gastric neoplasia. Additional prospective studies are necessary to define long-term outcomes.

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Figure 1. Gastric endoscopic submucosal dissection (ESD) of an intramucosal cancer. (A-B) White light image demonstrates a depressed lesion (Paris 0-IIc) at prepyloric antrum; (C) After marking outside the lesion margins, mucosal circumferential incision was performed; (D) Submucosal dissection; (E) ESD mucosal defect; (F) Resected specimen.

Table 1. Patient and tumor characteristics

	N = 347
Gender (male, n, %)	195 (56%)
Age (years, mean, SD)	69 (±12)
Race (n, %):	
Caucasian	161 (46%)
Asian	79 (23%)
Hispanic	28 (8%)
African American	22 (6%)
Others	8 (2%)
Unknown	49 (15%)
ASA class (n, %)	
I [normal healthy patient]	17 (5%)
II [mild systemic disease]	164 (47%)
III [severe systemic disease]	153 (44%)
Unknown	13 (4%)
Prior endoscopic treatment (n, %)	30 (9%)
Histology of the lesion (n, %)	
Early gastric cancer	139 (40%)
Well- or moderately differentiated grade	119 (34%)
Poorly differentiated or signet ring cell type	20 (6%)
Adenoma/ Low-grade dysplasia	90 (26%)

High-grade dysplasia	82 (24%)
Neuroendocrine tumor	36 (10%)
Location of tumor (n, %)	
Fundus	33 (10%)
Gastric body	124 (36%)
Antrum	167 (48%)
Cardia	23 (6%)
Tumor size, mm (mean, SD, range)	26.8 (SD: 16) [range 3-150]
≤ 20	162 (47%)
21 – 30	98 (28%)
> 30	87 (25%)
Paris classification (n, %)	
Ip	25 (7%)
Is	103 (30%)
IIa	86 (25%)
IIb	26 (7%)
IIc or IIa + IIc or IIc + IIa	85 (25%)
IIa+Is	8 (2%)
Unknown	14 (4%)
Presence of ulcer at the lesion (n, %)	54 (16%)

Table 2. Procedure data and adverse events

	N = 347
Procedure	
Type of primary knife for ESD (n, %)	
Dual knife	142 (41%)
IT-2 knife	105 (30%)
Hybrid knife	78 (22%)
Hook knife	5 (1%)
Flush knife	10 (3%)
Triangle tip knife	3 (1%)
Others	4 (1%)
Combination of ESD knives (n, %)	176 (29%)
Procedure time (minutes, median, IQR) [data available in 310 cases]	90 (IQR: 60-138)
Hospitalization following ESD (n, %)	
Outpatient procedure with discharge home	123 (35%)
Overnight observation	165 (47.6%)
Hospitalization 2 days or longer	59 (17%)
Adverse events	
Intraprocedural perforation (n, %)	23 (6.6%)
Successfully management with endoscopic closure	19
Need emergent surgery due to perforation	4

Severity of intraprocedural perforation	
Mild	17
Moderate	2
Severe	4
Severe intraprocedural bleeding (n, %)	4 (1.2%)
Severity of severe intraprocedural bleeding	
Mild	4
Delayed bleeding (n, %)	9 (2.6%)
Severity of delayed bleeding	
Mild	3
Moderate	4
Severe	2
Pulmonary embolism (n, %)	1 (0.3%)
Severity of pulmonary embolism	
Severe	1
Dyspnea (n, %)	1 (0.3%)
Severity of dyspnea	
Moderate	4
Treatment-related death	0

Table 3. Resection outcomes

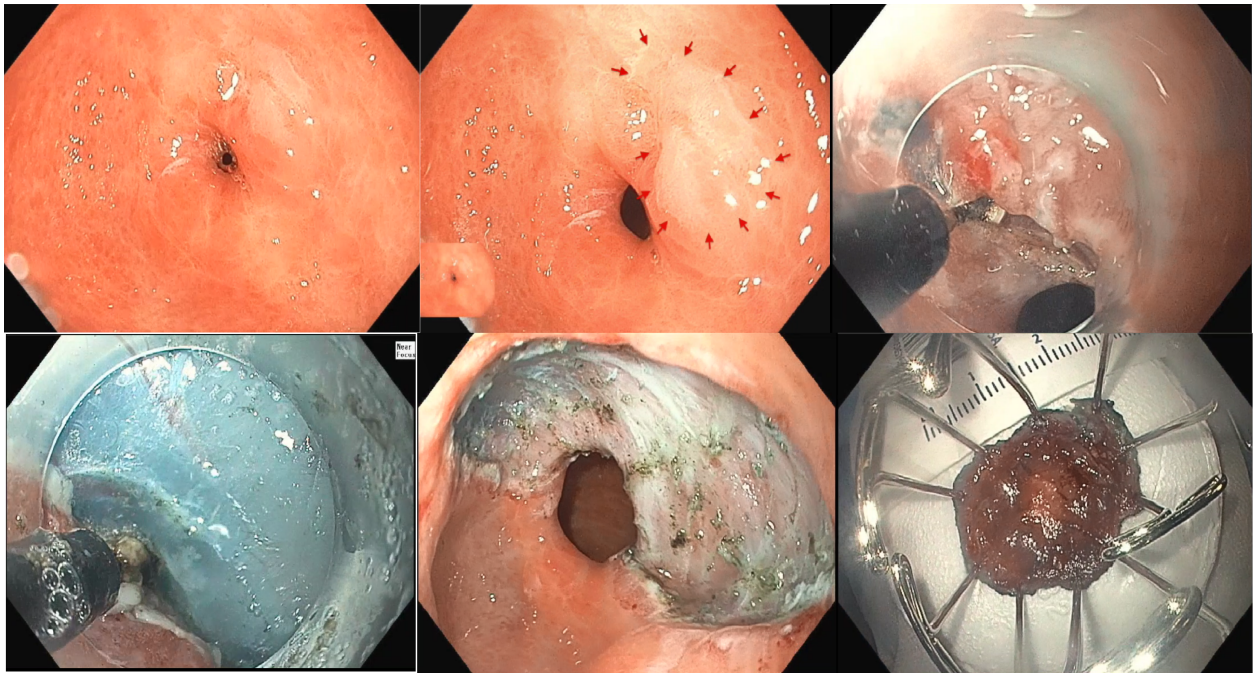
Outcomes, n (%)	**Total**	**Early gastric cancer *,#**	**Adenoma/ Low grade dysplasia**	**High grade dysplasia**	**Neuroendocrine tumor**
En bloc resection	320/347 (92.2%)	130/139 (93.5%)	84/90 (93.3%)	73/82 (89.0%)	33/36 (91.7%)
R0 resection	384/347 (81.8%)	104/139 (74.8%)	83/90 (92.2%)	71/82 (86.6%)	27/36 (75%)
Additional surgery at index ESD	28/334 (8.9%)	22/126 (17.6%)**	0/90 (0%)	2/82 (2.4%)	4/36 (11%)
Follow-up outcomes					
Residual/local recurrence	8/203 (3.9%)	5/70 (7.1%)	1/59 (1.7%)	2/57 (3.5%)	0/17 (0%)
Metachronous gastric lesions	14/203 (6.9%)	6/70 (8.6%)	2/59 (3.38)	5/57 (8.9%)	1/17 (5.9%)
Metastasis during follow-up	1/203 (0.49%)	0/70 (0%)	1/59 (1.7%)	0/56 (0%)	0/17 (0%)
Death					
Gastric	1/277 (0.4%)	0/111 (0%)	1/75 (1.3%)	0/64 (0%)	0/27 (0%)

cancer					
Non-gastric cancer	9/277 (3.2%)	8/111 (7.2%)	1/75 (1.3%)	0/64 (0%)	0/27 (0%)

*Curative resection according to Japanese criteria was 58.7% (74/126)

[#] Of 139 EGCs, the T staging was T1a in 86, T1b in 48, T2 in 2 and undetermined due to piecemeal resection in 3.

**After excluding 13 lesions outside clinical criteria for endoscopic resection



Need to Know

Background: Endoscopic submucosal dissection (ESD) is a widely accepted treatment option for superficial gastric neoplasia in Asia, but there are few data on outcomes data on gastric ESD from North America.

Findings: In an analysis of a large cohort of patients with superficial gastric neoplasia who underwent ESD at 25 centers across North America, the authors found the high rates of en bloc (92%) and R0 resection (82%), with acceptable safety profiles. The rate of local recurrence was low, and occurred only after non-curative resection.

Implications for patient care: These findings support the use of ESD for as a treatment option for superficial gastric neoplasia in North American populations.