

Perspectives on endoscopic submucosal dissection training in the United States: a survey analysis



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ABSTRACT

Background and study aims Endoscopic submucosal dissection (ESD) is a widely accepted method for en-bloc resection of dysplastic lesions and early cancer in Asia and

Europe. A limiting factor in adoption of ESD in the United States is perceived lack of training opportunities. The aims of this study were to: (1) evaluate ESD experience of attendees at a University-sponsored ESD training course; (2) characterize effectiveness of the current ESD training regimen and its impact on ESD adoption in the United States; and (3) gauge trainees' attitude towards ESD.

Patients and methods An electronic anonymous survey was distributed to the 86 physicians who participated in the University of Florida's annual ESD course from 2014 to 2016. Main outcomes included participants' practice setting, prior training, current ESD techniques, and planned training.

Results A total of 34 participants (40%) completed the survey. Most of the respondents routinely use one or more endoscopic mucosal resection (EMR) techniques (97.1%) in their practice. Most respondents (79%) had no experience with ESD on humans prior to the ESD course. Following completion of course training, more participants reported ongoing hands-on ESD exposure, with 15/34 (44%) having performed ESD in humans. Most participants identified potential hurdles for adoption of ESD.

Conclusion A dedicated ESD training course with hands-on experience, under the guidance of experts, notably increased use of ESD among participants. Limited availability of structured training opportunities, concerns over procedural length, lack of adequate number of lesions, and potential for serious adverse events (AEs) were identified as the main factors slowing adoption of ESD in the United States.

Introduction

EMR is an established technique for both diagnostic and therapeutic intervention of superficial dysplastic lesions throughout the gastrointestinal tract. While EMR has greatly expanded the role of endoscopy in management of such lesions, en-bloc resection is typically not feasible for lesions larger than 20mm, which often require piecemeal resection. That, in turn, hinders accurate histopathological assessment and increases risk of recurrence, need for additional ablative therapy, and [1] repeat procedures. ESD is a technique commonly used in Asia and Eur-

ope for endoscopic resection of selected dysplastic lesions and early neoplasia. Several studies have shown it to be superior to EMR [2–5] in achieving en-bloc and curative resection rates, which in turn translates to a lower risk of recurrence [2,6]. However, widespread adoption of ESD in the United States has been curtailed by several factors, including, but not limited to, perceived increased technical demand, longer procedural times, higher AE rates, and lack of reimbursement when compared to EMR. Furthermore, endoscopists seeking to learn and perform ESD in the United States face challenges in acquiring their hospitals' support, locating start-up funding for ESD train-

ing and equipment, establishing a referral base, and devising appropriate billing codes and insurance coverage. While these challenges alone may discourage many endoscopists, the major constraint may be limited access to ESD experts who can provide mentorship and practical training, either locally or in a foreign high-volume center. We believe that a dedicated hands-on training course with ESD experts, including those from Japan and Europe, would promote greater acceptance and application of ESD techniques in the United States. The aims of this survey study were to: (1) evaluate pre-course and post-course ESD training status of attendees at a University-sponsored ESD training course held by experts in ESD; (2) assess the effectiveness of the current ESD training regimen and its impact on ESD utilization in the United States; and (3) gauge trainees' attitude towards ESD.

Methods

The study was approved by the University of Florida Institutional Review Board. An electronic questionnaire was sent to all participants who attended the University of Florida annual ESD training course in 2014, 2015 or 2016. These course participants were contacted through email between April and June 2016 via the University of Florida secure Research Electronic Data Capture (REDCap) Web-based software and invited to complete the voluntary anonymous electronic survey questionnaire. Study data were collected and managed using REDCap hosted at University of Florida Academic Health Center. The survey tool was designed to be completed in approximately 10 minutes. Reminder emails requesting participation were automatically sent every 3 weeks to subjects who had not completed the survey (a total of no more than 2 reminder emails were sent over the course of 6 weeks).

The 40-question survey included items related to the subjects' demographics, advanced endoscopic training, practice setting, and pre-course as well as post-course ESD experience (didactics, hands-on training with ex-vivo, live animal models, and human case experience). The survey also measured participants' preferred location of lesion removal and understanding of proper ESD use. A copy of the electronic survey questionnaire is included as **Supplement 1**. All survey participants attended at least one University of Florida ESD training course in 2014, 2015 and/or 2016 without specifying repeat attendance. The course was conducted over two 8-hour days. A combination of didactic lectures and ex-vivo hands-on sessions were alternated during the course. For the hands-on portion of the course, there were five stations: management of complications, electrocautery, insulated tip knife, needle knife with injection capabilities, and needle knife without injection capabilities. The participants were divided into groups of five and each group spent 90 minutes at their designated station. Over the course of the 2 days, each group rotated through all five stations.

Results

Participant Baseline Characteristics

The electronic survey (Supplement 1) was sent to the 86 physicians who attended the University of Florida's annual ESD courses in 2014, 2015, and 2016. A total of 34 (40%) responded including one incomplete survey, reducing the total to 33 responses for some questions. About two-thirds (67.6%) reported being affiliated with academic medical centers, as opposed to community (23.5%) or Veterans Affairs (8.8%) hospitals. Most respondents (70.6%) had completed a fourth-year fellowship in advanced endoscopy. Most of these physicians reported performing endoscopic retrograde cholangiopancreatography (ERCP) (82.4%) and endoscopic ultrasound (EUS) (76.5%) in their practices. Survey participants were primarily male (94.1%), between aged 36 to 50 (67.7%), and slightly more than half (54.5%) were foreign medical graduates (► **Table 1**).

Participant EMR/ESD background

Virtually all surveyed participants (97.1%) reported experience with various EMR techniques, most notably snare and piecemeal polypectomy of large lesions, distal cap-assisted EMR, and band-ligation EMR, prior to attending our course (► **Table 2**). Participants' exposure to and experience with ESD before the course varied, but overall it was very limited. More than a quarter of participants mentioned no prior exposure (26.5%), whereas 47.1% had didactic ESD experience from other courses or videos. A minority of respondents reported prior experience with explant (41.2%) or live (26.5%) animal model ESD training. Only two participants had actually performed ESD in humans as lead endoscopists (5.9%) prior to this course (► **Table 2**).

► **Table 1** Demographics of survey respondents: number (%).

| | |
|---|------------|
| Males | 32 (94.1%) |
| Females | 2 (5.9%) |
| Age ≤ 50 | 24 (70.6%) |
| Age > 50 | 10 (29.4%) |
| Gastroenterologists | 33 (97.1%) |
| Surgeon | 1 (2.9%) |
| Foreign medical training | 19 (55.9%) |
| US medical training | 15 (44.1%) |
| Academic medical centers | 23 (67.6%) |
| Community hospitals / practice | 8 (23.5%) |
| Veterans Administration Hospitals | 3 (8.8%) |
| Fourth-year advanced endoscopy trained | 24 (70.6%) |
| Performing ERCP | 28 (82.4%) |
| Performing EUS | 26 (76.5%) |
| ERCP, endoscopic retrograde cholangiopancreatography; EUS, endoscopic ultrasound. | |

► **Table 2** Pre-attendance motivational factors, training, and experience.

| Question | Survey answer | Number (%) |
|--|--|------------|
| What was your primary motivation to attend the University of Florida ESD course? | “To get exposure” to ESD in order to decide whether to pursue further training | 13 (39.4) |
| | Already committed to learning ESD and want to improve personal technique | 20 (60.6) |
| What was your motivation for attending the UF ESD course? Select all that apply. | Participation of foreign expert faculty attendance. | 9 (28.1) |
| | Format of the course | 11 (36.7) |
| | Format of the hands-on training sessions | 11 (35.6) |
| | ASGE endorsement | 2 (6.0) |
| | Timing of the year for the course | 1 (3.0) |
| | CME credit | 1 (3.0) |
| Prior to the UF ESD course what courses have you attended? Select all that apply. | ASGE ESD course | 9 (69.2) |
| | Non-ASGE weekend course | 6 (46.2) |
| | Olympus Masters course | 7 (53.8) |
| Prior to the UF ESD course what EMR techniques were part of your practice? Select all that apply. [33 responded] | Routine use of snare polypectomy | 32 (97) |
| | Piecemeal polypectomy / EMR | 32 (93.9) |
| | Accessories such as cap assisted EMR | 25 (75.8) |
| | Band ligation EMR | 29 (87.9) |
| | Underwater EMR | 12 (34.4) |
| Prior to the UF ESD course what was your level of experience with ESD? Select all that apply. | General gastroenterology / surgical conferences | 12 (36.4) |
| | Dedicated mucosal resection techniques courses (e. g. EMR and ESD) | 10 (30.3) |
| | ESD course | 13 (39.4) |
| | Self-directed study; videos and/or didactics | 15 (45.5) |
| | Live animal self-directed training | 8 (24.2) |
| | Explant animal model self-directed training | 13 (39.4) |
| | Traveled to high volume ESD medical center to observe live human cases | 4 (12.1) |
| | Performed ESD in a human under supervision of an expert | 2 (5.9) |
| | Lead physician for their ESD procedures | 2 (5.9) |
| The number of lesions removed by ESD in a live animal as well as explant models. | Live animal lesions removed by ESD (total) | |
| | 1 to 5 lesions | 3 (37.5) |
| | 6-to-10 lesions | 5 (62.5) |
| | Explant model lesions removed by ESD (total) | |
| | 1 to 5 lesions | 3 (23.1) |
| | 6 to 10 lesions | 3 (23.1) |
| | 11 to 15 lesions | 5 (62.5) |
| | > 16 lesions | 2 (15.4) |

UF, University of Florida; ESD, endoscopic submucosal dissection; ASGE, American Society for Gastrointestinal Endoscopy; CME, continuing medical education; EMR, endoscopic mucosal resection.

Perceptions on ESD in the United States

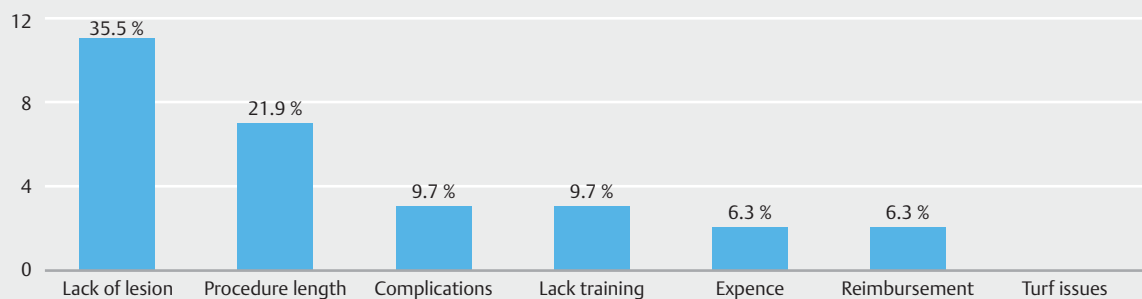
Approximately one-third of survey participants reported that ESD is gaining acceptance as a “standard-of-care” procedure. On the other hand, two-thirds responded that ESD is not gain-

ing acceptance or were unsure of the future of ESD in the United States (► **Table 3**). Participants most commonly identified need for more training opportunities in the diagnostic evaluation of lesions for ESD and familiarity with technical aspects of ESD as two of the most important factors for ESD development

► **Table 3** Post-attendance perception of the future of ESD.

| Question | Survey answer | Number (%) |
|--|--|---|
| What is your opinion on the future of ESD in the US? (%) | It will not gain acceptance as a routinely performed "standard of care" procedure | 10 (30.3) |
| | It will become a routinely performed "standard of care" procedure. | 13 (39.4) |
| | Not sure as to the future of ESD in the US | 10 (30.3) |
| Please rank the issues by most important to least important (Most important graphed) | More training opportunities on the methods for visual diagnosis of precancerous/cancerous lesions are required | 6 (18.2) |
| | More training opportunities on the technical aspects of ESD are required. | 8 (24.2) |
| | New – easier to use and safer devices are required | 8 (24.2) |
| | Incorporation of ESD training into advanced GI training fellowship | 3 (9.1) |
| | Available dedicated ESD billing code | 5 (14.7) |
| | Educating the community on ESD for referral. | 3 (8.8) |
| | Participant ranking of obstacles for establishing ESD in their practice (%) | 1. Lack of adequate number of lesions appropriate for ESD |
| 2. Length of the procedure | | 7 (21.9) |
| 3. Fear of complications | | 3 (9.7) |
| 4. Lack of structured training | | 3 (9.7) |
| 5. Expense associated with devices | | 2 (6.3) |
| 6. Lack of reimbursement | | 2 (6.3) |
| 7. "Turf" issues with surgical colleagues | | 0 (0) |

ESD, endoscopic submucosal dissection.

► **Fig. 1** Barriers to ESD.

in the United States (► **Table 3**). When asked about indications for ESD in the gastrointestinal tract, most survey participants responded that intramucosal lesions and lesions with superficial submucosal invasion in the esophagus, stomach, or rectum would be appropriate for ESD. While most respondents agreed that ESD would be indicated for precancerous adenomatous lesions and intramucosal colon cancer, a large majority would not recommend ESD for colon cancer with superficial submucosal invasion (**Supplement 2**).

Several factors were identified as potential barriers to establishment of an ESD practice in the United States. Lack of an adequate number of lesions appropriate for ESD was the most commonly identified limiting factor (11/34 or 35.5%). Other perceived hurdles for adoption of ESD included concerns re-

garding ESD procedure length, lack of structured training and fear of complications. In addition, costs associated with equipment or devices, reimbursement, or "turf wars" with surgical colleagues were commonly cited as factors that would impede start-up of individual programs (► **Table 3**, ► **Fig. 1**).

ESD training following course attendance

Survey participants reported a desire to "to get exposure to ESD" (13/34 or 39.4%) and "to improve ESD technique" (20/34 or 60.6%) as the main reasons for attending the UF ESD course. Only a minority of respondents indicated no further desire to pursue ESD training/practice (5/34 or 14.7%) after course completion, while most of the remaining participants reported continued ESD training with self-directed study of videos/didactics

► **Table 4** Post-attendance training preferences and usage of ESD.

| Question | Survey answer | Number (%) |
|---|--|------------|
| Since completing the UF ESD course what additional training do you plan on pursuing? Select all that apply. | ASGE ESD course | 8 (23.5) |
| | Non ASGE weekend course | 9 (26.5) |
| | Olympus ESD masters course | 13 (38.2) |
| | Attend the University of Florida ESD course again | 7 (20.6) |
| | None | 9 (26.5) |
| Which of the following have you already done since completing the UF ESD course? Select all that apply | Decided not to pursue further ESD training/practice | 5 (14.7) |
| | Self-directed study of videos/didactics | 20 (58.8) |
| | Continued to attend ESD courses | 16 (47.1) |
| | Live animal self-directed training | 8 (23.5) |
| | Explant animal model self-directed training | 11 (32.4) |
| | Traveled to a high-volume ESD center to observe live cases | 3 (8.8) |
| | Performed ESD in humans under supervision | 4 (11.8) |
| Are you currently doing ESD in humans? | Yes | 15 (45.5) |
| | No | 18 (54.5) |
| How many total ESD have you done? | ≤ 5 | 4 (26.7) |
| | 6 – 10 | 0 (0) |
| | 11 – 15 | 7 (46.7) |
| | 16 – 20 | 1 (6.7) |
| | 21 – 25 | 2 (13.3) |
| | 26 – 30 | 1 (6.7) |
| | Over the last year how many ESD have you performed? | None |
| | ≤ 5 | 5 (33) |
| | 6 – 10 | 4 (26.7) |
| | 11 – 15 | 2 (13.3) |
| | 16 – 20 | 1 (6.7) |
| | 21 – 25 | 1 (6.7) |
| | 26 – 30 | 1 (6.7) |
| What is your preferred knife for performing ESD? | Dual knife | 10 (30.3) |
| | Hybrid knife | 4 (12.1) |
| | IT knife | 4 (12.1) |
| | No favorite knife | 4 (12.1) |
| | I don't perform ESD | 13 (39.4) |

UF, University of Florida; ASGE, American Society for Gastrointestinal Endoscopy; IT, insulated tip.

(20/34 or 58.8%) and/or attendance at additional ESD courses (16/34 or 47.1%). Some also reported ongoing hands-on training with explant (11/34 or 32.4%) and live animal models (8/34 or 23.5%). Furthermore, three (8.8%) of the survey participants reported additional training by visiting high-volume centers for ESD in humans for either observation or supervision (► **Table 3**). In aggregate, nearly half (15/34 or 44%) of the respondents reported performing ESD in humans after completing the UF course. Most of the participants indicated the esophagus,

stomach and rectum as the starting locations for their ESD training, whereas some endoscopists indicated having performed ESD in the colon as well. These individuals reported overlapping continued ESD education that included self-directed study with videos, didactic learning, additional ESD courses as well as explant and live animal model hands-on training. A few (3/34 or 8.8%) traveled to high-volume ESD centers to observe live human cases and four (11.8%) individuals had supervision while performing ESD in humans (► **Table 4**).

Discussion

EMR has been the endoscopic resection technique of choice for removal of superficial dysplastic gastrointestinal lesions. Recently, there has been increased interest in the role of ESD, given its associated higher en-bloc and curative resection rates for superficial gastrointestinal neoplasia when compared to EMR [2, 3, 7–11]. Widespread adoption of ESD in the United States has been slow, with lack of structured training opportunities as a major limiting obstacle. While a traditional master-apprentice relationship has been the training model in Asia where ESD is a common practice, this approach is not applicable in the United States due to the scant number of ESD experts available. Hence, dedicated training courses have been suggested as one of the main ESD training tools [10, 12, 13]. To date, data are scarce on background training of ESD course attendees, their perceptions on the state of ESD in the United States and their level of involvement with ESD following course completion. Therefore, we conducted this study to gain further insight into what is currently the available and accepted ESD training model in the United States.

Our study suggests that although endoscopists attending an ESD dedicated course are already well trained in advanced endoscopic procedures, including various EMR techniques, the extent and nature of their pre-course experience in ESD varies widely. In this survey study, respondents' ESD experience prior to the course primarily involved didactic training with limited hands-on experience with either animal models or human cases. Among the 34 respondents, only four (11.8%) had travelled to a high-volume ESD center for intensive training in human cases and only two (5.9%) had performed ESD as lead endoscopists before attending our course.

The results of our study suggest that a dedicated ESD course with hands-on training notably increased utilization of ESD following course attendance. Overall, the number of survey respondents performing ESD in humans increased from 2 to 15 after our course. While this represents a notable increase, it is important to highlight that most of these physicians still reported performing fewer than 10 ESD cases per year. Certainly, attending a dedicated ESD course alone is insufficient for a physician to "hit the ground running" with ESD in his or her practice, reinforcing the need for structured tier-level training opportunities to attain proficiency. Furthermore, the relatively low number of cases performed by endoscopists may also be due to lack of lesions identified as appropriate for ESD, which was a commonly cited barrier for ESD in this survey study. Other potential factors slowing ESD dissemination may include concerns regarding the need for structural training, longer procedural times, and fear of severe complications.

Our study had several strengths. The study participants consisted of three consecutive-years' worth of attendees at a university-sponsored, expert-led ESD training course which should offer a good representation of the US endoscopists interested in ESD. An incomplete response rate is one of the inherent limitations of any survey type of study because it creates potential for selection bias. Although the response rate in our study was relatively good (40%), a limiting factor is the overall low num-

ber of study participants. In addition, this study provides data in an area that has not been studied to date. Using this type of survey study to identify course attendees' areas of concern can help ESD course providers improve the effectiveness of future courses.

The principal limitation of our study is that, while the response rate was good, the actual number of respondents was only 34, which is admittedly low, making extrapolation of the study results to a broader population less reliable. However, because at this time only a limited number of endoscopists are considering pursuing ESD training, we believe that our data still represent an accurate sample of the current status of ESD in the United States.

Masters of ESD training suggest a multistep process for practitioners to learn ESD. Based on this survey study, our ESD training course, which includes both didactic as well as hands-on learning with explant models and utilizing direct expert instruction, appears to be effective at helping practitioners get started in using ESD. Repeated practice with live pigs can provide an effective next step toward mastering ESD. Indeed, as the 2016 by Jacques demonstrated, extensive ESD training with live pigs can permit a practitioner to achieve safety and efficacy outcomes similar to outcomes by Japanese experts on human cases [13]. Completing courses such as our university-sponsored ESD training course and then moving on to a training program using live pig models should enable practitioners to incorporate ESD safely and effectively into their practices [10, 12]. It should be emphasized that attending a course is expected to increase endoscopists' cognitive and manual skills, yet the adequacy of training is typically not evaluated at completion of these courses, including ours. Therefore, competency cannot be assumed and participants should consider such courses as only one of the many components that are needed to safely incorporate ESD in their practices. It has been shown that taking the further steps of observing and then assisting experts performing ESD over a period of time at a high-volume center can significantly enhance a training physician's ESD skills [6, 9, 11]. Indeed, the diagnostic and endoscopic skills necessary to master ESD are best honed under such direct mentorship, which explains why a panel of Japanese experts has recommended that ESD training include observing a minimum of 20 ESD cases and assisting in five cases [14].

Conclusion

There is increasing interest in the role of ESD in the United States, although widespread adoption has been slow in part due to the limited structured training opportunities currently available. Our survey study suggests that a dedicated ESD course can greatly promote introduction of ESD into clinical practice. Nevertheless, ESD training courses are only one of the many components in establishing ESD program, and a multipronged approach is warranted. This survey study helped identify specific obstacles to introduction of ESD in US clinical practice that were perceived by course attendees and those findings can be used as a guide to seek and address deficiencies in ESD training.

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Competing interests

Dr. Draganov is a consultant for Boston Scientific, Cook Medical, Olympus America, and Conmed. Dr. Yang is a consultant for US Endoscopy.

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Supplement 1 Endoscopic Submucosal Dissection (ESD) questionnaire

The aim of this questionnaire is to gain insight into the past, present and future training patterns of Gastroenterologists performing ESD. The questionnaire has been sent to you with the full approval of the IRB (Institutional Review Board) at The University of Florida. **Your answers are anonymous.**

Background Information

1. What is your background? *Allow only one answer*
 - a) Gastroenterologist
 - b) Surgeon
 - c) Currently in residency/fellowship training
2. Sex *Allow only one answer*
 - a) Male
 - b) Female
3. Your age *Allow only one answer*
 - a) Less than 35
 - b) 36–40
 - c) 41–45
 - d) 46–50
 - e) 51–55
 - f) 56–60
 - g) More than 60
4. Are you a foreign medical graduate? *Allow only one answer*
 - a) Yes
 - b) No
5. Have you completed a gastroenterology fellowship or surgical residency training? *Allow only one answer*
 - a) Yes
 - b) No
6. Year of completion: _____ *This should be available only to people that have answered yes to question 5*
7. Have you completed a 4th year advanced endoscopy fellowship? *Allow only one answer*
 - a) Yes
 - b) No
 - c) Currently an advanced fellow
8. Year of completion: _____ *This should be available only to people that have answered yes to question 7*
9. Are you currently performing ERCP? *Allow only one answer*
 - a) Yes
 - b) No

10. Are you currently performing EUS? *Allow only one answer*
 - a) Yes
 - b) No

11. Your practice is primarily based at: *Allow only one answer*
 - a) Community Hospital/Practice
 - b) Academic Medical Center
 - c) Veterans Administration Hospital

Prior to the University of Florida ESD Course

12. Prior to the University of Florida course, what was your experience with **endoscopic mucosal resection (EMR)?** (mark all that apply): *May choose more than one*
 - a) None
 - b) Snare polypectomy
 - c) Piecemeal large area (> 2 cm) EMR
 - d) Cap-assisted EMR
 - e) Band-ligation EMR
 - f) Underwater EMR
13. Prior to the University of Florida course, what was your level of experience with **endoscopic submucosal dissection (ESD)?** (mark all that apply): *May choose more than one*
 - a) None
 - b) Exposure at general GI/Surgical conferences
 - c) Dedicated mucosal resection technique (e.g. EMR **and** ESD) course
 - d) Dedicated ESD course
 - I. ASGE ESD course
 - II. Non-ASGE weekend course
 - III. Olympus ESD masters course
 - e) Self-directed study of videos/didactics
 - f) **Live animal** self-directed training
 - I. Number of lesions removed by ESD in live animals:
 1. 1–5
 2. 6–10
 3. 11–15
 4. 16–20
 5. 21–25
 6. More than 25
 - g) **Explant animal** model self-directed training
 - I. Number of lesions removed by ESD in explant models:
 1. 1–5
 2. 6–10
 3. 11–15
 4. 16–20
 5. 21–25
 6. More than 25
 - h) Traveled to high volume ESD center to observe live human cases
 - I. Specify country: _____
 - II. Duration
 1. 1–2 weeks
 2. 2–4 weeks
 3. 4–6 weeks
 4. 6–8 weeks

5. More than 8 weeks

- i) Performed ESD in humans under supervision
- j) Performed ESD in humans as leading endoscopist

14. What was your primary motivation to attend the University of Florida course? *Allow only one answer*

- a) Get exposure to ESD in order to decide whether to pursue further training.
- b) Already committed to learn ESD and want to improve own technique.

The University of Florida course

15. When did you attend your first University of Florida ESD course? *Allow only one answer*

- a) 2014
- b) 2015
- c) 2016

16. **Before attending** the University of Florida course, how much did each of the following factors contribute to your decision to participate in the course, on a scale from 1 to 7 (1 most important – 7 least important)? *Allow only an answer from 1 to 7 on each*

- a) Recommendation from colleague _____
- b) ASGE endorsement _____
- c) Participation of foreign expert faculty _____
- d) Format of the course _____
- e) Location _____
- f) Timing of the year _____
- g) CME credit _____

17. **After attending** the University of Florida course, what is your opinion on the value of each of the following components on a scale from 1 to 6 (1 most valuable – 6 least valuable)? *Allow only an answer from 1 to 6 on each*

- a) Participation of foreign expert faculty _____
- b) Format of the course (lecture/videos) _____
- c) Format of the hands-on training stations _____
- d) Location _____
- e) Timing of the year _____
- f) CME credit _____

18. How can we improve the University of Florida ESD course? (mark all that apply): *May choose more than one*

- a) Good as it is, no changes necessary
- b) Increase the time allocated to hands-on ESD training
- c) Increase the number of different hands-on ESD training stations
- d) Decrease the size of the groups per hands-on station
- e) Add more expert-guided lectures and video discussions
- f) Add lectures/hands-on training on per-oral endoscopic myotomy (POEM)
- g) Expand format to 3-day course
- h) Expand format to 4-day course
- i) Other _____

After the University of Florida ESD course

19. What is your opinion on the future of ESD in the US? *Allow only one answer*

- a) It **will not** gain acceptance as routinely performed “standard of care” procedure
- b) It **will** become routinely performed “standard of care” procedure.
- c) Not sure

20. What are the important factors to encourage further ESD training in the US on a scale from 1 to 5 (1 most important – 5 least important)? *Allow each number from 1 to 5 to be used only once*

- a) More training opportunities on the methods for **visual diagnosis** of precancerous/cancerous lesions
- b) More training opportunities on the **technical aspects** of ESD
- c) New easier to use and safer devices
- d) Incorporation of ESD training into advanced fellowship
- e) Available dedicated ESD billing code
- f) Education of community gastroenterologist/surgeons on the value of ESD in order to stimulate referral of suitable lesions.

21. Would you **currently** consider ESD appropriate in the US in the following situations (yes/no)? *Allow a choice of yes/no after each answer*

- a) Esophagus: squamous cell cancer
- b) Esophagus: Large area of nodular Barrett’s with HGD
- c) Esophagus: Barrett’s with early cancer (intramucosal)
- d) Esophagus: Barrett’s with early cancer (superficial submucosal invasion)
- e) Stomach: Early gastric cancer
- f) Rectum: Large adenoma
- g) Rectum: Early rectal cancer (intramucosal)
- h) Rectum: Early rectal cancer (superficial submucosal invasion)
- i) Colon: Large adenoma
- j) Colon: Early colon cancer (intramucosal)
- k) Colon: Early colon cancer (superficial submucosal invasion)

22. If you perform ESD, what is your most commonly utilized knife? *Allow only one answer*

- a) No favorite knife
- b) IT knife
- c) Dual knife
- d) Hybrid knife
- e) I don’t perform ESD
- f) Other

23. Which of the following have you **already done** since completing the University of Florida ESD course (mark all that apply)? *May choose more than one*

- a) Decided not to pursue further ESD training/practice
- b) Self-directed study of videos/didactics
- c) Live animal self-directed training
- d) Explant animal model self-directed training
- e) Traveled to high volume ESD center to observe live cases

- I. What country_____
- II. Duration
1. 1–2 weeks
 2. 2–4 weeks
 3. 4–6 weeks
 4. 6–8 weeks
 5. More than 8 weeks
- f) Attended ESD courses
- I. ASGE ESD course
 - II. Non ASGE weekend course
 - III. Olympus ESD masters course
 - IV. Attended again the University of Florida ESD course
- g) Performed ESD in humans under supervision
- h) Performed ESD in humans as leading endoscopist
24. Since completing the University of Florida course, what additional ESD training do you **plan on pursuing?** (mark all that apply) *May choose more than one*
- a) None
 - b) Self-directed study of videos/didactics
 - c) Live animal self-directed training
 - d) Explant animal model self-directed training
 - e) Travel to high volume ESD center to observe live cases
 - f) Attended ESD courses
 - I. ASGE ESD course
 - II. Non ASGE weekend course
 - III. Olympus ESD masters course
 - IV. Attend the University of Florida ESD course again
25. Which are the biggest obstacles in adopting ESD into **your current practice?** Please specify on a scale from 1 to 9 (1 being the biggest obstacle and 8 being the least) *Allow each number from 1 to 9 to be used only once*
- a) Lack of structured training _____
 - b) Lack of adequate number of lesions appropriate for ESD _____
 - c) Expensive devices _____
 - d) Lack of reimbursement _____
 - e) "Turf" issues with surgery _____
 - f) Long procedure duration _____
 - g) Fear of complications _____
 - h) Lack of support from hospital _____
 - i) Unable to get credentialed _____
 - j) May want to add an "other" answer _____
26. Are you **currently** doing ESD in humans? *Allow only one answer*
- a) Yes
 - b) No (if the answer is "no" question 27 to 30 should not be available for answer in RedCap)
27. How many **total** ESD have you done? *Allow only one answer*
- a) Less than 5
 - b) 6–10
 - c) 11–15
 - d) 16–20
 - e) 21–25
 - f) 26–30
 - g) 31–35
 - h) 36–40
 - i) 41–45
 - j) 46–55
 - k) More than 56
28. Over the **last year** how many ESDs have you performed? *Allow only one answer*
- a) None
 - b) 1–5
 - c) 6–10
 - d) 11–15
 - e) 16–20
 - f) 21–25
 - g) 26–30
 - h) 31–35
 - i) 36–40
 - j) More than 40
29. What is the % of lesion anatomic location of the ESDs that you have done (should add to 100%)?
- a) Esophagus___%
 - b) Stomach___%
 - c) Rectum___%
 - d) Colon___%
30. Please rank the sources of referrals to your ESD practice on a scale from 1 to 6 (1 most common – 5 least common) *Allow each number from 1 to 6 to be used only once*
- a) Gastroenterologist from your group/hospital _____
 - b) Surgeons from your group/hospital _____
 - c) Gastroenterologist from outside your practice _____
 - d) Surgeons from outside your practice _____
 - e) Medical or radiation oncologist _____
 - f) Primary care or other subspecialties _____
- Please provide us with any comments on ESD training that you consider important:**

Supplement 2

| Question | Survey answer | Number (%) |
|---|----------------------|------------|
| More training opportunities on the methods for visual diagnosis of precancerous/cancerous lesions. (Rank importance) | Most Important 1 | 6 (18.2%) |
| | 2 | 3 (9.1%) |
| | 3 | 6 (18.2%) |
| | 4 | 8 (24.2%) |
| | 5 | 5 (15.2%) |
| | Least Important 6 | 5 (15.2%) |
| The responses to current appropriate ESD use in the US for specific anatomical lesions included: | | |
| Esophagus | Yes | No |
| Squamous cell cancer | 25 (73.5%) | 9 (26.5%) |
| Large area of nodular Barrett's esophagus with high-grade dysplasia | 29 (85.3%) | 5 (14.7%) |
| Barrett's esophagus with early cancer, intramural | 30 (88.2%) | 4 (11.8%) |
| Barrett's esophagus with early cancer, superficial submucosal invasive | 22 (66.7%) | 11 (33.3%) |
| Stomach | Yes No | |
| Early gastric cancer | 33 (97.1%) | 1 (2.9%) |
| Rectum | Yes | No |
| Large adenoma | 30 (88.2%) | 4 (11.8%) |
| Early rectal cancer, intramucosal | 31 (91.2%) | 3 (8.8%) |
| Early rectal cancer, superficial submucosal invasion | 23 (67.6%) | 11 (32.4%) |
| Colon | Yes | No |
| Large adenoma | 27 (79.4%) | 7 (20.6%) |
| Early colon cancer superficial submucosal invasion | 16 (47.1%) | 18 (52.9%) |
| If you perform ESD, what is your most commonly utilized knife? | | |
| | Dual knife | 10 (30.3%) |
| | Hybrid knife | 4 (12.1%) |
| | IT knife | 4 (12.1%) |
| | No favorite knife | 2 (6.1%) |
| | I don't perform ESD | 13 (39.4%) |
| ESD, endoscopic submucosal dissection; IT, insulated tip. | | |