

Curriculum for Endoscopic Submucosal Dissection practice in Europe: Position Statement of the European Society of Gastrointestinal Endoscopy (ESGE)

Running title: ESD Curriculum

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ABSTRACT/MAIN RECOMMENDATIONS

There is a need for well-organized comprehensive strategies to get well trained in ESD. In this context the ESGE aimed to develop a European core Curriculum for ESD practice across Europe that result in high quality of ESD training. Advanced Endoscopy diagnosis practice is advised before initiating ESD training. Proficiency in EMR and adverse events management is recommended before starting ESD training. ESGE discourages to start initial ESD training in humans. Animal models or/and ex-vivo models practice are useful to get the basic ESD skills. ESGE recommends at least 20 ESD cases in these models before human practice with the goal of at least 8 *en bloc* complete resections in the last 10 training cases, with no perforation. ESGE recommends observation of experts performing ESD in tertiary referral centers. Performance of ESD in humans should start on carefully selected lesions, ideally small (< 30 mm), located in the antrum or in the rectum for the first 20 cases. Beginning human practice in the colon is not recommended. ESGE recommends that at least the first 10 human cases should be done under supervision by ESD proficient endoscopist. Endoscopists performing ESD should be able to correctly estimate the probability to perform a curative resection based on the characteristics of the lesion and they should know the benefit/risk relation of ESD when comparing to other therapeutic alternatives. Endoscopists performing ESD should know how to interpret the histopathology findings of the ESD specimen, namely the criteria for low-risk resection (“curative”), local-risk resection and high-risk resection (“non-curative”) as well as its implications. ESD should only be performed in a setting where early and delayed complications can be managed adequately, namely, with the possibility to admit patients to a ward, and access to emergency surgery for the organ treated with ESD.

1. INTRODUCTION

Endoscopic submucosal dissection (ESD) appeared more than one decade ago in Japan as a new method to achieve *en bloc* resection of superficial neoplasms without any size limit. Since then, this technique has evolved greatly, shifted from the stomach to the esophagus and the colon. It expanded to Eastern Asia, and then to Europe and the rest of the world [1].

The advantage of ESD over endoscopic mucosal resection (EMR) lies in its ability to achieve *en bloc* resection of lesions regardless of tumour size or fibrosis, avoiding piecemeal resection and consequently local recurrence. However, this comes with the drawback of longer procedure time as well as an increased risk of bleeding and perforation [2]. For these reasons, the Western world remained cautious to implement ESD for several years. One of the most important limitations for the spread of this technique outside Asia was the lack of local experts. Strategies to overcome this limitation have come mostly from Western endoscopists who individually visited Japanese expert centers, and observed ESD on real cases [3]. However, going to Eastern countries to learn this technique is not feasible for most Western endoscopists. Moreover, hands-on training on patients for foreign physicians is not easily nor legally allowed neither in Japan nor in other parts of the world.

Therefore, there is a clear need for well-organized comprehensive strategies to get well trained in ESD. In this context the ESGE initiated the development of this ESD curriculum for postgraduate training to improve and safeguard ESD practice in Europe. The recommendations presented in this curriculum are based on the consensus of endoscopists considered as ESD experts who are involved in ESD training and training courses in Europe.

2. AIMS

The primary aims of this Curriculum are:

- To develop a European core Curriculum for ESD practice across Europe that result in high quality of ESD training, independently of the centre, hospital, location and endoscopist, through the setting of minimum standards for the practice of the technique;
- To define the skills and competence that an endoscopist should have before considering ESD training;
- To define a training program for an endoscopist that wants to start ESD practice in his centre;

The secondary aims are:

- To increase the awareness of the skills, knowledge and difficulties inherent to the practice of ESD;
- To support individual endoscopic departments, national societies and official bodies in developing local or national recommendations for ESD training and practice;
- To define the knowledge and minimal case load that an endoscopist should have to maintain proficiency in ESD technique.

3. METHODS

The development of this curriculum is based on the consensus of experts practitioners of ESD who are involved in ESD training and training courses in Europe [4]. On behalf of ESGE Curricula working group initiative, RB, ESGE curriculum working group chair, invited PPN to become ESGE curriculum ESD section chair. A call for participants opened in July 2017 and RB and PPN analyzed all the applications. Based on their curriculum, ESD experience and publications as well as motivation, in December 2017, the authors of this document were selected to become members of the ESD curriculum working group. In February 2018 all the group members had a meeting in Dusseldorf, Germany. In this meeting the methodology to be applied was discussed and different tasks were divided between the group members.

Three different tasks were decided:

1. What are the skills and competency requirements prior to starting ESD?
2. What are the training requirements?
3. What should be the knowledge and experience to maintain competence?

Different PICO questions were defined for each of these questions. The evidence-based Delphi process developed consensus statements. Literature search was done using PUBMED/Medline and preliminary sentences were proposed based on the available literature and expert opinion. In April 2018 in Budapest the group members met again, discussed the proposed sentences and agreed on standard terminology, need for auditable quality indicators, and formulation of the ESD training curriculum for trainees under expert supervision during initial learning curve for clinical ESD.

Based in all commentaries and suggestions, PPN and MP, evaluated and grouped every statement and evidence in a document with all the necessary bibliography, elaborating a first draft of the curriculum that circulated between the group members in October 2018. Sentences were voted online by all the group members. Discussion and initial decision on the recommendations took place in a face to face meeting in October 2018 in Vienna, Austria. At this stage, changes were made if necessary and sentences with less than 75% of agreement were excluded from this guideline. Sentences were voted online again by all the group members and external elements until a consensus was reached.

4. RESULTS

4.1 SKILLS/COMPETENCE TO START ESD

1. **Advanced Endoscopy diagnosis practice is advised before initiating ESD training. (95% agreement)**

As recommended in 2015 by ESGE guidelines [5], lesion assessment by an experienced endoscopist, using advanced diagnostic technique (virtual or dye based chromoendoscopy with or without magnification) is an essential prerequisite to ESD resections. In fact, ESD with curative intent is only justified in the different ESGE guidelines when lesions are clearly neoplastic and do not feature with deep invasive aspects [5-7]. So, mastering classifications like Paris [8], Inoue IPCL [9,10], and Sano's [11] for esophageal lesions, simplified NBI [12,13], vessel plus surface [14,15] and depth-predicting scores for superficial gastric lesions [16], and Kudo's [17], NICE [18] and/or JNET [19,20] for colonic lesions is pivotal in the decision making for the indication of ESD for appropriate lesions and to correctly define the margins of the lesions. The endoscopic report of ESD trainees on any gastrointestinal neoplasia must contain: - macroscopic type and characteristics; - microvascular and microsurface structure; - endoscopic diagnosis of predicted tumour category; - and the indication for recommended resection technique. Thus, advanced endoscopic diagnostic skills are required and should be mastered before any ESD performance.

2. **Training of ESD should only be considered by a fully trained endoscopist. Proficiency in EMR and adverse events management is recommended before starting ESD training. (100% agreement)**

An endoscopy background is needed to begin ESD procedures safely. Japanese experts consider that a minimum of 4 years of endoscopy experience after graduation is needed [21] even if they underlined the importance of acquiring the skills whatever the time needed to assess this [22]. As ESD is a precise and challenging procedure, operators should have knowledge in therapeutic endoscopy and particularly in resection of superficial digestive neoplasia (EMR) [21]. An objective indicator for considering to start ESD training is to have at least 1000 upper GI endoscopies performed, since it has been shown that trainees with that number of endoscopies can acquire gastric ESD skills efficiently [23]. For colorectal ESD, a minimum of 500 colonoscopies appears to be

required before considering training [24]. ESD trainees must acquire proper handling and control of the endoscope with left hand all angulations of the scope, and rotation of the shaft using left wrist and arm. Right hand controls insertion/retraction of scope may support rotation of shaft, even in diagnostic procedures [25].

Overall, management of adverse events is also required before beginning such technique with at least experience in hemostasis technique for active bleedings and closure technique for perforations using clips, over the scope (OTS) clips, endoscopic suturing, and stent placement (for esophageal perforations). Expertise in hemostasis is highly advised because most of the difficulties during ESD procedures and training are related to uncontrolled bleeding [23,26].

ESD is an advanced endoscopy technique demanding precise control of the endoscope. Obviously, beginning endoscopy with ESD technique is not advised and previous experience in endoscopic resection techniques using EMR is logically recommended. All the reports on ESD learning curve involved experienced endoscopists already performing EMR routinely. From a technical point of view, maneuverability of the scope, placement, submucosal injection and management of adverse events are requested to perform EMR. Precision of ESD with meticulous movements is a further step that seems impossible to master without baseline EMR skills [27-30]. At the time of this curriculum, initial ESD teaching without previous EMR skills has never been evaluated or compared to EMR skilled endoscopists. In the units with large volume of ESD cases, some trainees may have an early access to ESD without a large experience in EMR but basic skills of injection, hemostasis and perforation closure should be mastered before any independent ESD case.

Cap assisted EMR (EMRc) or Band Ligation EMR (EMRb) are advanced techniques of resection essentially used for esophageal and to a lesser degree gastric and rectal lesions. Their technicity is different from ESD technique and this step does not seem absolutely necessary to pave the ESD training pathway. ESD training programs based on specific EMRb or EMRc experience has never been tested specifically since their technical specific skills do not seem to be linked to ESD skills. However, when ESD is being difficult to perform knowledge and experience with these techniques may be helpful since they may be used as rescue therapeutic options in some situations.

3. Knowledge of the “ESD theory” is necessary before and during training.
(95% agreement)

Before beginning ESD in models, theory has to be understood [23]. Starting a new technique has a little value without knowledge of its aims, indications, and the results that can be expected. Learning the different steps (marking, injection, cutting, dissection), the basic strategy (use of gravity, tractions) and the tools (needle type knives, insulated tools, water jet) is a prerequisite. A lot of information is now available on ESD technique (books, DVDs or on the web including videos). Attending live demonstration, meetings, and ESD procedures performed by an expert is recommended to understand the steps and the goals of this technique and in parallel to improve diagnostic skills front of neoplastic lesions. The ESD trainee should have a real perspective to work in an ESD expert center or implement such a center in her/his affiliated center.

4.2 TRAINING

4. **Live conferences and meetings are suggested before and during ESD training. (95% agreement)**
5. **ESGE discourages to start initial ESD training in humans. (95% agreement)**

Once basic theoretical knowledge is mastered, and before beginning ESD in models, attending live demonstration or meetings is probably a good way (controlled information) to learn prerequisites from experts [21]. These attendances may help the trainees to learn some tricks, understand techniques with different devices, in easy and difficult locations with the aim to improve their performance. Nevertheless, this point is based on expert opinion and clinical evidence is still lacking [31] since it has not yet been demonstrated that live demonstration attendance was able to improve ESD outcomes in trainees.

Regarding beginning of ESD training in humans, it is this panel's opinion that this should be strongly discouraged. The complexity of the technique and the potential serious side effects as well as the several options for training are strong reasons to avoid initial training steps in humans. A French study about initial rectal ESD experience [32] in humans without supervision demonstrated how dangerous ESD can be in non-experienced hands. In this study, the initial perforation rate was 34% and the initial R0 resection rate only 52%. Thus, beginning ESD in humans is strongly discouraged since it may be dangerous and ineffective.

6. **Animal models or/and ex-vivo models practice are useful to get the basic ESD skills. ESGE recommends at least 20 ESD cases in these models before human practice with the goal of at least 8 *en bloc* complete resections in the last 10 training cases, with no perforation. (95% agreement)**
7. **ESGE recommends supervision during training since it seems effective to improve the skills of trainees. (95% agreement)**

Some clinical evidence sustains the positive impact of animal model training before beginning ESD in humans but prospective comparative studies are still not available. Nevertheless, training in a live porcine model was considered very realistic by participants compared to the human setting and was highly appreciated as a learning tool [33,34]. Moreover, outcomes of ESD [32] even with previous animal training but not in

the respective human organ does not encourage to propose comparative studies between trainees who experienced previous animal training and those who did not.

ESD training is associated with a clear learning curve in animal models and in humans' procedures [35-39]. Hands-on training on animal models allows to improve ESD outcomes with an increase of the complete resection rate and a decrease of the perforation rate [29,30,37,40]. In an American experience with 3 trainees who performed 30 procedures each, the inflexion of the learning curve was achieved after 9 procedures on a colonic model although students were still progressing all along the 30 cases [40]. Animal models training is also effective to improve skills for the management of ESD adverse events (bleedings and perforations) [41].

Despite the lack of evidence to demonstrate the relation between ESD results in animal training and then in initial human experience, ESGE recommends an initial experience in animal models before human practice. Different animal models (ex-vivo pig stomach or esophagus, bovine or pig colon, living animal models) exist, but there is no comparative data on the training capacity of those different models. For initial experience, ex-vivo models are probably sufficient to train without sacrificing animals. In expert centers with strong supervision, initial training experience in humans may sometimes be proposed but clinical evidence is lacking to sustain this strategy.

In Japan, the number of ex-vivo or animal training courses needed before starting ESD training in humans is 5 or less [23]. However, learning curves are different from one trainee to another and therefore, determining a minimum number of courses or/and cases appears difficult. A performance objective appears more relevant, and each student should record his results (complete resections, perforations) during animal training (supplemental file e1 and e2). ESGE proposes a quality goal of at least 80% of complete resections during 10 consecutive procedures without perforations to define a trained student, as previously suggested [30,42]. In a prospective comparative study in a bovine rectum model, 20% of 20 students without any supervision reached this goal after 10 procedures, 50% after 20 procedures and 55% after 30 procedures [30]. With a virtual supervision, the rate of students who achieved the goal was respectively 32, 63 and 74% after 10, 20 and 30 procedures underlining the positive effect of supervision during animal training. In a study from USA and Japan, video based post-procedure analysis and recommendation by an expert allowed for 2 students to complete 3 successive R0 resections without perforations after 25 procedures [43].

The role of dedicated software or video watching is not yet clearly defined. When point-by-point supervision is available, this was shown to increase the number of students who reached 80% complete resections without perforations after 30 procedures [30]. These results underline the effectiveness of supervision during training [43] either with on-site experts if possible or with virtual supervision if a local expert is not accessible.

To reach the goal, ESGE recommends a minimum number of 20 cases, with a supervision if possible, but one half of the trainees will probably need more training to fulfill the quality threshold of 80% of *en bloc* complete resection (all marks visible in the specimen) without perforation in 10 consecutive procedures.

- 8. In order to understand strategies and risk management, ESGE recommends observation of experts performing ESD in tertiary referral centers. At least 20 ESD cases observation and 5 cases as assistant, ideally within a short period of time, is recommended. (91% agreement)**

Observing expert cases is effective to improve ESD skills as demonstrated by Draganov et al [44]. ESD procedure time was clearly reduced between pre-observation period (63 min) and post-observation period (32 min). This study compared 9 procedures in animal model performed before and after an observation period of 5 weeks. Assisting an expert during some procedures is probably a better option than only watching as it increases the involvement and the concentration needed. Furthermore, as these procedures are time consuming, this might also train the trainee to be patient even during bleeding episodes. Japanese experts recommend a minimum of 20 procedures observed and 5 as an assistant before starting ESD in patients [21]. A high number of procedures observed increase the understanding of a wide variety of situations, different organs and adverse events (bleedings, perforations and stenosis) management.

- 9. Performance of ESD in humans should start on carefully selected lesions, ideally small (< 30 mm), located in the antrum or in the rectum for the first 20 cases (initial period). Beginning human practice in the colon is not recommended. (95% agreement)**

10. ESGE recommends that at least the first 10 human cases should be done under supervision by ESD proficient endoscopist. (91% agreement)

In Japan, experts recommend to train in ESD with small lesions (≤ 20 mm) of the antrum without ulcer or scar [21] since these lesions are associated with the lowest risk of non-curative resections [45]. Lesions of the middle and upper third of the stomach are far more difficult to complete for beginners [27,30,46]. Nevertheless, this recommendation must be adapted to the incidence of each lesion in the different part of the world. However, in any scenario, it looks that ESD should be learnt in easy cases before doing colonic ESD. In Hong Kong, despite previous animal training program, initial experience with colorectal ESD without any gastric cases was dangerous and poorly effective with 32.2% of R0 resection in the initial experience and 15.5% of perforations [25]. Results reported by Shiga et al are less negative but initial rate of perforation was still 10% [27] in one study and 12.5% for the other study of the same group [47]. On the opposite, experienced endoscopists in gastric ESD have effective and safe outcomes during learning curve in colorectal ESD with more than 90% of R0 resection [36,48]. A Japanese study showed the relative safety of rectal ESD for beginners who had only an experience of 5 gastric ESD cases [27]. Shiga et al showed that choosing small lesions in the rectum was safer to get experience than colonic lesions. Furthermore, as demonstrated by Iacopini et al, initial experience in colorectal ESD should be preferred in the rectum and not in the colon to make a progressive stepwise approach with less risks [28]. Rectal location was a predictive factor of success during the learning phase of ESD for trainees without gastric ESD experience [49]. Progressive implementation from the rectum to more difficult parts of the colon is safe and effective with only 5.7% of perforations [50]. Due to the difficulty gap between rectal and colonic ESD it seems reasonable to suggest a progressive move from the small lesions of the rectum to the ascending colon and then to the transverse or the sigmoid and finally to the cecum where the risk of perforation is the highest [51-53]. Nevertheless, some rectal lesions with big nodular parts or with history of scars can be associated with fibrosis and bleeding, making the procedure very difficult. This phenomenon is relatively rare for small lesions. Thus, after animal training, it appears better to respect an initial human training in safe (rectum) or easy locations (antrum) before beginning cases in technically difficult locations (colon) or in the locations where perforations are highly morbid (esophagus). Antral lesions of 20-30 mm are rare in some European countries and should be reserved for beginners but we also have to consider

different locations to train in a relatively short period of time. Several arguments (incidence, maneuverability, low morbidity of rectal perforations) encourage a training in the middle rectum (at least few centimeters above the anus). According to ESGE guidelines, ESD in the colorectum can be considered instead of EMR for selected lesions larger than 20 mm. Thus, choosing rectal cases slightly larger than 20 mm (<30 mm) could be probably a good option [54]. Avoiding cases with technical difficulty (scar, incomplete resections, ulcerative colitis, fibrosis) is also advised [21].

The number of ESDs required for an endoscopist to become competent in the technique is not precisely defined. For gastric ESD 30 cases was defined as the number necessary to gain proficiency [55]. However, others suggested that 50-100 cases of gastric ESD would be needed for expertise [21]. For colorectal ESD approximately 30 cases and 80 cases are needed to competent level and proficient level of ESD, respectively [56]. In a recent European study, 120 colorectal ESD procedures were needed to reach a plateau of high effectiveness and low morbidity [53]. But here also, determining such high number of cases does not appear realistic in Europe. The role of supervision has to be reemphasized and the expert should be present in the necessary procedures for the trainee to be competent. ESGE recommends therefore that at least the first 10 human cases of ESD, ideally per organ, should be done under supervision by ESD proficient endoscopist.

Furthermore, particularly in low volume centers, in order to avoid spaced training, mixing animal model practicing with first human procedures is a good option to maintain a regular and frequent ESD practice and to reach high quality results on R0 resection and perforation rates [57]. In fact, a step-up training protocol over a 12-month period of 50 observational and supervised ESD cases as well as 24 animal procedures showed excellent results, particularly in the rectum and stomach with more than 90% R0 resections [52].

A logbook and a preclinical database suggested by ESGE for ESD training are available for trainees (supplemental file e1 and e2, respectively).

4.3 KNOWLEDGE AND MAINTANING COMPETENCE

11. Endoscopists involved in ESD should have specific knowledge on instrumentation, technique, and electro surgical equipment. (100% agreement)

ESD is a complex and a technically demanding procedure. Accordingly, in order to perform a safe and effective treatment while avoiding serious complications, the endoscopist should have a full understanding not only of the technique but also of the different instruments and the electro surgical unit (ESU) that are needed to perform a safe ESD [58,59]. We recommend that the endoscopist should have extensive knowledge of all the devices that can be used for ESD, such as knives, injection agents, caps and hoods, hemostatic and traction devices since this information can be important in more difficult and complex situations [58-61]. In fact, there are several knives available to perform ESD each one with its own particularities and advantages to use over others in some situations [58,59,62,63] but without enough evidence to recommend one knife over another. As a general rule we recommend that the endoscopist should use the material that he feels comfortable with, ideally the one that he had his training with, but at the same time knowing the full ESD “armamentarium” so he may choose other options in more difficult/complex scenarios.

The endoscopist should also know the principles and features of the ESUs that can be used for ESD. In fact, each ESU has its own settings and types of current and the recommended settings vary according not only to the cutting device that is being used but also with the lesions and organs in which the current is applied. Some manufacturers provide specific instructions for performing ESD [64]. In its absence we recommend that the endoscopist contacts the manufacturer of his own ESU before starting ESD in humans.

- 12. Endoscopists performing ESD should be able to correctly estimate the probability to perform a curative resection based on the characteristics of the lesion and they should know the benefit/risk relation of ESD when comparing to other therapeutic alternatives. (95% agreement)**
- 13. Endoscopists performing ESD should know how to interpret the histopathology findings of the ESD specimen, namely the criteria for low-**

risk resection (“curative”), local-risk resection and high-risk resection (“non-curative”) as well as its implications. (100% agreement)

By performing ESD, the endoscopist is responsible not only for a proper technical execution of the procedure, but also for the clinical decision making and clinical care. This implies that the endoscopist should be able to balance the benefits and risks of ESD against alternative treatment options for that specific disease. As previously stated, he should be familiar with advanced imaging diagnosis. Moreover, depending on the organ, location, type and other characteristics of the lesion, the endoscopist should be able to calculate a probability of performing a curative resection. Some platforms are available online that can help the endoscopist calculate the *a priori* probability of a curative resection and also the risk of post-resection bleeding [65]. Even though we recognize that to avoid more aggressive procedures (like surgery) in patients with several comorbidities the endoscopist may sometimes assume a low probability of a curative resection and advances to ESD, we do recommend that this should always be discussed with the patient, ideally in a multidisciplinary team.

In addition, the endoscopist is also responsible for the interpretation of the histopathology of the ESD specimen. The issues here are the followings: - several histopathological characteristics have different implications for different organs and diseases; - the definition of curative and non-curative resections varies between authors; - and, in fact, even after a non-curative resection the probability of the patients being cured is most of the times higher than having residual or distant disease. We therefore recommend that the endoscopist should be familiar with the type of resection as defined by ESGE [5]: - low-risk resection (“curative”); low risk for local or distant recurrence; no further immediate therapy is required; is defined as a R0, and no poor prognosis features (<cut-off invasion for specific organ, and no lymphovascular invasion); - local-risk resection; same as above with the exception of positive lateral margins; even though this type of resection increases the risk of local recurrence most of the times the patient will be cured at long-term and, so, only endoscopic follow-up and putative treatment is recommended; - high-risk resection (“non-curative”); in this case there is a real risk for distant disease, and adjuvant treatment should be considered in a case by case scenario; it is defined as a R1 resection (positive vertical margins), or deep sm-invasion (beyond organ-specific um-limit), or poorly differentiated tumour, or lymphovascular invasion.

The endoscopist should know that the specific criteria are different for each organ. ESGE recommends that further decisions should be made in multidisciplinary teams.

14. Ideally, a properly trained ESD-endoscopist should only start performing ESD at his own centre after being recognized by an ESD expert that he has the knowledge and skills to start performing ESD. (91% agreement)

15. ESD should only be performed in a setting where early and delayed complications can be managed adequately, namely, with the possibility to admit patients to a ward, and access to emergency surgery for the organ treated with ESD. In addition, centres performing ESD should have access to expert gastrointestinal pathology. (100% agreement)

The decision to start ESD at his own centre has several implications in the endoscopic team and in the hospital where ESD is going to be performed. Since ESD has the potential of serious and fatal adverse events it is our opinion that only someone with the proper training, knowledge and skills can start a new and risky technique by his own. Moreover, the confirmation that the endoscopist fulfils these requirements cannot be made objectively by himself. For these reasons, it is our opinion that the confirmation of the ability of the endoscopist to start ESD should be made by someone else, ideally an ESD expert. However, we recognize that a definition of a 'recognized ESD expert' is lacking. We suggest that a recognized ESD expert could be a person with extensive experience in ESD with more than 100 ESD cases performed and with referrals from other hospitals on a regular basis. This recognition of competence should preferably be provided by the ESD-expert by whom the trainee has followed his training. An ideal scenario would be to do the first ESD cases in his own centre by his own but with this expert present in the endoscopy room.

Regarding the centres where ESD can be performed it is ESGE's opinion that ESD cannot be made in every centre. Independently of the quality and skills of the endoscopist, the possibility of significant bleeding and perforation is always present and only centres that can handle these complications can be certified to perform ESD. In Japan and Asia, patients undergoing ESD are usually admitted to hospital for several days [66] in contrast to Western countries where they are only admitted for one or two days [67] or even as

outpatients [68]. Nevertheless, it appears that a treatment strategy with at least the possibility of admitting the patient to the hospital is fundamental to forearm a serious adverse event [69]. Moreover, even though most ESD complications can be solved endoscopically, surgery may be needed in almost 1% of the cases, particularly in centres with less experience [70]. For all these reasons it is our opinion that ESD should only be performed in a centre where complications can be managed adequately, namely, with the possibility to admit patients to a ward, and access to emergency surgery for the organ treated with ESD.

In addition, it is the ESGE's opinion that centres performing ESD should have access to expert gastrointestinal pathology. The histopathological diagnosis of an endoscopic resection specimen is the basis for further clinical decision (low vs high-risk vs local-risk resection; need for further treatment or not) [5]. Thus, the report on the specimen needs to include all the relevant information needed to make that decision. For all ESD specimens, the following risk factors have to be reported: depth of invasion, lymphatic vessel permeation, blood vessel permeation, budding (for colorectal lesions), perineural invasion, resection margin involvement, as well as typing and grading of neoplasia according to the WHO classification [5]. It is our opinion that this can only be made in a proper manner by an expert gastrointestinal pathologist in continuous interaction with the endoscopist, ideally in an oncological multidisciplinary team.

16. In order to maintain proficiency in ESD, the ESGE recommends a minimum case load of 25 cases of ESD per year. (100% agreement)

17. All cases should be registered in a prospective database covering items as endoscopic classification, location and size of lesion, technique used, en-bloc resection rate, complications rate, time of procedure, R0 resection rate and final histopathology (including type of resection). En-bloc resection rates should be above 90%, and perforation rate should be below 3%, with less than 1% need for surgery because of complication. (95% agreement)

The volume of ESDs performed per year appears a very important factor since it correlates strongly with most of the outcomes measures and rate of complications [71]. This appears more important for colorectal than for upper GI ESD. A meta-analysis

comparing Eastern vs Western ESD results concluded that Eastern results (with a larger case load) were better, but this was particularly true for colorectal ESD and less clear for oesophageal and gastric ESDs [72]. This appears more dependent on the endoscopist experience than in being Eastern or Western [73]. Indeed, in a larger Eastern colorectal ESD series, including 10 institutions, performing less than 50 ESDs (total) was an independent risk factor for an increased number of complications [74]. The authors concluded that performing ESD on a regular basis is important for improving outcomes with less complications. Fuccio et al calculated that performing at least 2 ESDs per month is important to achieve higher R0 and en bloc resection rates with less incidence of adverse events requiring surgery and less recurrence rates [71].

Although beyond the scope of the specific ESD postgraduate curriculum training, ESGE recommends a minimum case load of 25 ESDs per year in order to maintain proficiency in the technique. Ideally, these 25 ESD cases per year should be counted separately for the different organs. However, we may argue that the proficiency lays in the technique and the technique is similar for every organ. Moreover, it does not look realistic to perform 25 ESDs cases per organ year in every reference centre and for this reason ESGE advise to set the minimum standard as 25 ESDs cases per year, independently of the organ. Future studies should compare outcomes of centres with different case load (and caseloads in different organs) in order to set a more evidence base recommendation for the minimum volume of ESDs per year.

In order to answer to this and other questions, ESGE recommends that each centre performing ESD keeps prospective records of each procedure. Quality indicators for ESD have been proposed [75]. We recommend that the following parameters should be always recorded in each case (supplemental file e3): lesion characteristics (including advanced imaging diagnosis and Paris classification), general (esophagus, gastric, colorectal) and specific location (upper or lower stomach, rectum or sigmoid), size of the lesion, technique used (ESD, hybrid, tunnelling), en-bloc (endoscopic) and R0 (histologic) resection rates, complications rate (immediate and delayed bleeding, perforation, need for surgery because of complication, length of hospital stay), time of procedure, and type of resection according to final histopathology result (low, local or high-risk resection). Follow-up variables should also be recorded, such as recurrence, metachronous lesions, surgery because of non-curative resection or because of recurrence and medications that

can interfere with outcomes (such as proton pump inhibitors, aspirin, NSAIDs and anticoagulants).

Given all the available evidence and published metanalysis [71,72,76] ESGE recommends that the goal of every endoscopist performing ESD should be to achieve more than 90% en bloc resections with less than 3% perforations. Ideally, more than 80-85% R0 resections rates should be the goal. However, we do recognize that this goal may be unrealistic even for expert endoscopists, since bigger and more advanced lesions are being referred for endoscopic resection. Nevertheless, since correct evaluation of the lesion with the decision of a proper indication for ESD should be a prerequisite for an ESD endoscopist we do recommend that the goal for the rate of low-risk resection (“curative”) should be above 75%.

Since bleeding depends on too many factors, sometimes completely independent of the technique (such as medication), we do not set a specific goal for the bleeding rate. Nevertheless, the endoscopist performing ESD must be able to solve most of these adverse events without surgery and, so, we recommend that the need for surgery because of complication should be less than 1%. Regarding surgery because of non-curative resection, this depends more of the characteristics of the lesion than of the ESD technique, and no goal is set.

5. CONCLUSIONS

This ESGE position statement comprehensively addresses major steps in the ESD training program. ESD needs specific meticulous skills and a dedicated training to get competency. The ability to perform a curative resection by ESD without surgery enables us to significantly benefit our patients.

The diverse topics covered in this curriculum include the baseline endoscopy experience requested in diagnosis and therapeutic before ESD training, the basic theoretical knowledge on the devices, the strategy and the histological issues, the way to get this knowledge, the initial hands on training in animal models under supervision, the best choices of sites for the first procedures in humans under supervision, the number of cases to get trained in the different locations, and the minimum number to maintain proficiency (Figure 1). As learning curves may be different from a trainee to another one, this ESGE curriculum states on a quality threshold in animal models ESD with more than 80% of *en-bloc* complete resection and no perforation in the last 10 consecutive cases before starting human procedures. Once ESD in humans has been started, ESGE also highlights the need for auditing ESD cases, to monitor quality and safety. Throughout this ESGE curriculum, areas where further research is required to answer critical questions are highlighted, providing direction for researchers to design future studies. We look forward to the opportunity to incorporate the results of such studies into updates of this curriculum in the years to come.

6. LEGAL DISCLAIMER

ESGE Guidelines and Position Statements represent a consensus of best practice based on the available evidence at the time of preparation. They might not apply in all situations and should be interpreted in the light of specific clinical situations and resource availability. Further controlled clinical studies may be needed to clarify aspects of these statements, and revision may be necessary as new data appear. Clinical considerations may justify a course of action at variance with these recommendations.

ESGE Guidelines and Position Statements are intended to be an educational device for providing information that may assist endoscopists in providing care to patients. They are not rules and should not be construed as establishing a legal standard of care or as encouraging, advocating, requiring, or discouraging any particular treatment.

The legal disclaimer for ESGE guidelines applies to the present position statement [4].

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Figure 1.

