

# The VITO(pn 20150100457, 2015) Novel Training Kit to Limit Down the Learning Curve of Upper GI Endoscopy: Endoscopic Hemostasis

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## Abstract

The VITO(pn 20150100457, 2015) is a novel training kit that has been designed to be portable, light, mobile, and non-expensive, adjusted to the clinical needs of both beginners and advanced surgeons allowing a continuous and systematic self-centered and/or collaborative training in Surgical Endoscopy. The VITO(pn 20150100457, 2015) assisted endoscopy training kit impact on the learning curve in terms of the "machine learning curve" which refers to the training process and computation of the time point considered as that, that an endoscopic operation is learned in the training process of Endoscopic Hemostasis is initially evaluated.

**Keywords:** Human System Interaction; Training Kit; Surgical Endoscopy; Machine Learning Curve; Endoscopic Hemostasis

## Introduction

Despite the great efforts it is established that the current training environment for the surgical endoscopy training has not changed dramatically even for the teaching hospitals in Europe. In fact, there is training in endoscopy on the site and there is a single nominated training lead. The assessment team advises the unit to ensure that training lists are adjusted where appropriate to meet the needs of trainees [1, 2]. Also, Health System Organizations are encouraged support appropriate co-ordination of training lists in which the use of Endoscopy Training System (JETS) e-portfolio is strongly encouraged [1, 3-5]. On the other hand, the training curve is even more steep for the so called Emergency or Acute Surgical Endoscopy.

The above mentioned are being currently addressed mainly to gastroenterologists while trainee surgeons do not share the same privileges in comparison with trainee gastroenterologists except from some teaching hospitals units that have adopted surgical endoscopy to their clinical program. Referring to the field of Emergency or Acute Surgical Endoscopy, Hemorrhage of the upper GI is a field

in which trainees have no exposure to acute clinical procedures at their hospitals while trainee Gastro-enterologists are exposed to elected endoscopic hemostasis clinical sessions very often [2-5].

Taking into consideration the abovementioned standards in Surgical Endoscopy that are in power mostly for trainees and trainers Gastroenterologists and Surgeons and that according to the ASGE guidelines for optimizing quality in diagnostic and therapeutic Endoscopy the *frequency* of applied Endoscopic procedures is the most crucial indicator for *quality in endoscopy*, we invented the *Vito* (pn:20150100457, 2015) training kit and developed it clinically in the context of the “Program of Excellence 2014-16” -so as to give the opportunity to Surgical Endoscopy trainees and the specialists to learn the prerequisites and indications and above all to practice without limits their technical skills in a self-centered or mainly in a collaborative way facing the technical challenges of the clinical diagnostic and therapeutic Gastroscopy, ERCP and EUS on both elective and acute endoscopic operations developed until the end of 2016 [3-14].

The first presentation and workshop on 15th of Mars 2018 focused on the description of the applied technology, the technological parts and ergonomics of VITO (pn 20150100457, 2015) training kit i.e. 3 training maps, a special device, and a user manual (Fig 1. Depicts the parts of the VITO (pn 20150100457, 2015) training kit for Endoscopic Hemostasis).



**Figure 1:** The VITO (pn 20150100457, 2015) training kit and parts of the training kit as presented in the demo CD.

The VITO (pn 20150100457, 2015) assisted endoscopy training kit impact on the learning curve in terms of the so called “machine learning curve” which refers to the assessment of the learning time limits computation of the set of instrumentation and maneuvers in endoscopy for Endoscopic Hemostasis in Diagnostic and Therapeutic Gastroscopy by the part of a trainee in Endoscopy but a specialist surgeon(considered as beginner) on a self-centered learning mode is evaluated [1, 3, 4, 6].

### **Paper content and technical requirements**

Given that the machine learning curve is useful for many purposes including comparing different algorithms and choosing model parameters during design adjusting optimization to improve convergence, and determining the amount of data used for training the abovementioned assessment we standardized the amount of time needed for each operation separately to reach the “learning” limit in terms of time to perform the defined operation which in this project is Endoscopic Hemostasis on an Emergency or Elective clinical mode [3, 4]. Several series of a number of sessions of sets of operative trials with the VITO training kit on each training day is proposed and given that an amount of 8-10 series of ten sessions are necessary in average, beginners (these are gastroenterologists or surgeons that have never operated on any emergency operation [15-19] before or they have just attended as observers or operated on a limited number endoscopic hemostasis clinical sessions) should spend the training time (two to three times per week) to train themselves in endoscopic hemostasis [9, 10].

As far as the advanced gastroenterologists are concerned these are those who deserve perfection in endoscopic hemostasis, and that is why is proposed that their training should include all types of endoscopic operations that needs hemostasis skills on each training day by repeating a series as analyzed for two or better three training days per week in a period of a month [3-5, 20-22].

The operational criteria that have to be fulfilled in endoscopic hemostasis by the part of the trainees are written in the manual of the kit and consists the diligent preparation of the prerequisites and the collection of instruments needed for endoscopic hemostasis and the reference of the safety criteria according to the third map of the kit before each operational repetition [6]. The applied technique is upon the necessary operational steps and the key maneuvers which are also described in the manual for elective or emergency endoscopic hemostasis separately for both diagnostic and therapeutic Gastroscopy. The VITO (pn 20150100457, 2015) training kit used in combination with the necessary set of devices for upper GI endoscopy i.e. Gastroscopy (the central unit, the monitor and the Gastro-scope) by a beginner trainee but specialist surgeon who had never applied any type of emergency or elective Endoscopic Hemostasis in the past in a period of a month. During the experimental period the trainee collaborated with a GI clinical endoscopy unit without having the right to perform any by him-self [6].

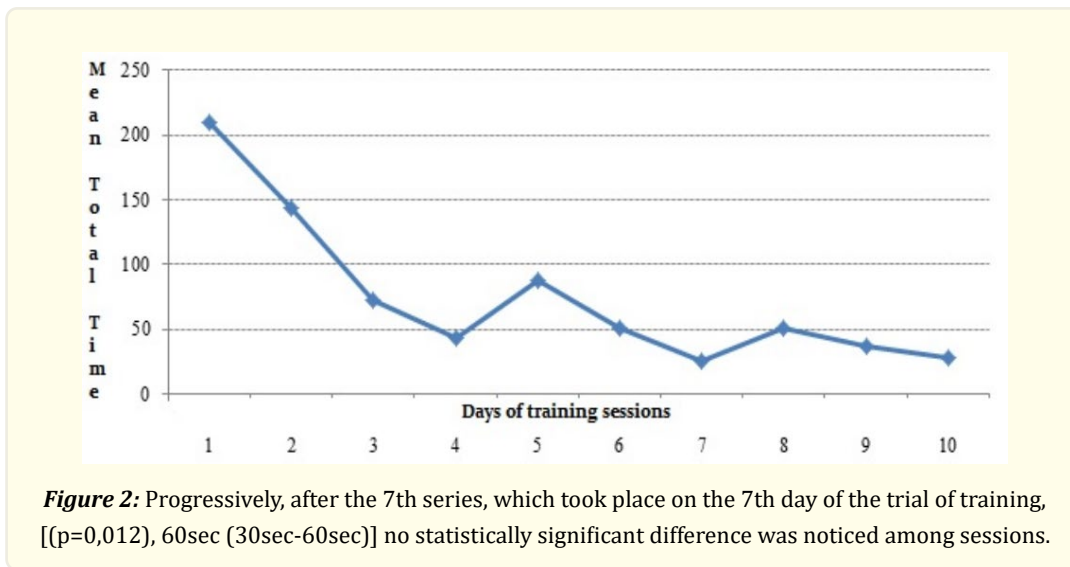
The aim was to evaluate the VITO (pn 20150100457, 2015) assisted endoscopy training kit learning curve in terms of the so called "machine learning curve" which refers to the assessment of the learning time limits computation for endoscopic hemostasis by the part of a trainee in Endoscopy but specialist surgeon (considered as beginner) on a self-centered learning mode. The metric that used for learning was the mean time for finishing the task in terms of the analysis of the mean time of each series spent in each training kit based set: Diagnostic gastroscopy session (to enter, to retrieve and the total) and hemostatic intervention (to approach and treat the hemorrhagic point by using endoscopic diathermy, clips or argon-beam methods and the related instrumentation), to compute the sequential training session after which the mean time spent for training was no statistically different than the previous training sessions (ANOVA, SPSS 17.0).

#### **Designing for Human factors: VITO (pn 20150100457, 2015) based Endoscopic Hemostasis initial machine learning curve**

Referring to VITO (pn 20150100457, 2015) based Gastroscopic Hemostasis (initiation and retrieval of the Endoscope, approach maneuvers, and bleeding site treatment) training, the trainee's trials consisted of ten series (N=10) of ten (n1=10) kit based gastro-scope hemostasis sets of ten trials (n2=10) in each session on several time points in a period of a week. Progressively, after the 7th series, which took place on the 7th day of the trial of training, [(p=0,012), 60sec (30sec-60sec)] no statistically significant difference was noticed among sessions as depicted on Table 1. (Fig.2. depicts the measurements) [3].

	<b>Minimum Total Time</b>	<b>Maximum Total Time</b>	<b>Mean Total Time (SD)</b>	<b>Median</b>
Day 1	120,0	480,0	210 (130,4)	120 (120 - 300)
Day 2	60	300	144 (81)	120 (60 - 180)
Day 3	60	120	72 (25,3)	60 (60 - 60)
Day 4	20,0	120,0	43,4 (30,2)	30 (29 - 60)
Day 5	30,0	180,0	87 (45,7)	60 (60 - 120)
Day 6	30,0	60,0	51 (14,5)	60 (30 - 60)
Day 7	15,0	60,0	25,2 (13,2)	21 (16 - 28)
Day 8	2,0	180,0	51,2 (56)	30 (17 - 60)
Day 9	21,0	55,0	36,7 (10,7)	37,5 (30 - 45)
Day 10	23,0	37,0	28,1 (4,5)	27,5 (25 - 31)

**Table 1:** Results of the statistical comparisons among measurements of the Mean Total Time (sec) in the series of trials using the VITO (pn 20150100457, 2015) training kit for Endoscopic both non-variceal and variceal bleeding Hemostasis.



The VITO assisted endoscopy training kit impact on the learning curve of the initial or complex maneuvers in diagnostic and therapeutic endoscopy seems really promising not only for beginners but also for advanced surgeons and nurses under specific standards of its design and consequent ergonomics in the context of training [3-6].

In fact, further endoscopic sessions are being developed and refer to the continuation of this particular innovative product engineering and improvement in the direction of advanced interventional Gastroscopy, therapeutic ERCP and diagnostic EUS in an hybrid type of self-centered and/or collaborative learning and training until the end of 2017 [3-6].

Currently and focused on the future training method and on the training standards of self-centered and/or collaborative training and learning using the VITO (pn 20150100457, 2015) training kit, is being tried in detail for standardization of: 1. The training technique, 2. The process of training and learning, 3. The ergonomics, and of 4. The results of its quality control integrated with the clinical performance of the trainees and/or the endoscopic teams in terms of clinical excellence in endoscopic performance with a priority to the technique, the time-point of the clinical performance from the part of the trainee and the therapeutic effect (clinical therapeutic effect and safety i.e. decrease in morbidity and mortality) in diagnostic and therapeutic endoscopy in Gastroscopy, in ERCP and in EUS of specific adult and pediatric elective and emergency endoscopic operations depicted on Table 2 [20-22].

<b><i>I. ERCP Therapeutic Interventions</i></b>	<b><i>II.EUS-Diagnostic and Therapeutic Interventions</i></b>
A. Sphincterotomy and bleeding complications. B. Pancreatic pseudocyst drainage and pancreatic leak and fistulas management an acute bleeding complications. C. Papillectomy and bleeding complications.	Pancreatic pseudocyst drainage and acute bleeding complications.

**Table 3:** To further evaluate the VITO (pn 20150100457, 2015) training kit assisted learning curve in terms of “machine learning” for each elective and/or emergency Endoscopic Hemostasis session on a self-centered learning mode and on a collaborative training mode for ERCP an EUS based elective and emergency endoscopic operations are being assessed.

## Conclusion

The VITO (pn 20150100457, 2015) training kit seems to be feasible and reliable for surgeons in training. Expected time of training for performing the Endoscopic Hemostasis *in vivo* for training reasons is after seven series of ten sets of ten trials for a beginner in endoscopic hemostasis but familiar with surgical endoscopy surgeon. Further experimental evaluation combined with industrialization and design's modification for both beginners and advanced surgeons on a self-centered or collaborative learning mode in Gastroscopy, ERCP and EUS training, is being developed.

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