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Enhancing Surgical Training in Italy: Proposing a Standardized Multidisciplinary Curriculum for Residency Programs. A four years experience of the SPIGC-AIMS working group.

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Abstract

In recent decades, surgical training has become a matter of growing interest. There are no common learning pathways leading to a uniform level of competence among surgeons. This retrospective observational study aims to identify the essential characteristics that a surgery course must possess to be appreciated by trainees. Thus, based on our four-year experience and the results from satisfaction questionnaires submitted to trainees, we propose a standardized and reproducible system for training residents. We recruited 242 residents from different Italian Universities from January 2020 to January 2023. They attended five different courses divided into theoretical and practical sessions. Tutors were surgeons with many years of experience in surgery coming from SPIGC (Società Polispecialistica Italiana dei Giovani Chirurghi). At the end of each course, learners answered a questionnaire to determine their satisfaction and gave their comments. The results showed a good appreciation of the courses and highlighted the elements that could be improved. Thus, to be fully satisfied, we identified that the learner must attend a course with an in-depth theoretical program, one tutor per training station, a maximum of two learners for training stations, and the learners with little experience gap.

Keywords: Surgical Training, Standardized Curriculum, Residency, Simulation

1. Introduction

Surgical training is crucial to ensure quality and safety in surgery (Shwab, 2017). Technological development, socio-health changes and cultural evolution have boosted the growth of surgical training methods (Bresler, 2020). Despite this, surgical training in Italy still needs a standardized pathway; following the COVID-19 pandemic, significant improvement has yet to occur (Gallo, 2023). Surgical training thus remains a challenge for residents, so it is essential to implement structured and evidence-based training courses that combine theoretical education and practical experience. Simulation is one of the best ways to let young surgeons learn practical skills, and skilled surgeons try new techniques without risks for real patients. Using synthetic and animal models for surgical training has proven to be a valuable educational tool, allowing surgeons to hone their surgical skills in a controlled and safe environment (Bjerrum, 2018). According to the report entitled "State of the Art in Matters of Simulation Practices in the Health Field" published in 2012 by the French National Authority for Health (HAS) training using health simulation methods must be integrated into all teaching programs for health professionals at all stages of their curriculum (https://www.has-sante.fr/portail/upload/docs/application/pdf/2013-01/guide_bonnes_pratiques_simulation_sante_guide.pdf).

Based on our experience gained from 4 years of arranging surgery courses, we propose a standardized training course for general surgery, plastic surgery and gynaecology residents. This proposal stems from analysing the satisfaction questionnaires administered during the courses. Our aim is to provide a standardized means of enabling trainees to acquire, in a democratic manner and without training gaps, the basic skills they need to deal safely with future clinical situations.

In this paper, we are going to discuss:

- The state of the art of surgical training programs;
- In the Materials and Methods section, how we created our courses and how we got the feedback from participants;
- In the Results, the analysis of feedback that we got from participants and their suggestions for a better organisation of the training course;
- Constructing an optimal training course for residents involving surgeons with different levels of experience to let them gradually learn skills required for each role during a surgical procedure.

2. State-of-the-art

Accredited surgical training programs play an essential role in shaping the next generation of surgeons and ensuring high-quality surgical care to patients. Numerous organizations aim to standardize and certify training in surgery. The best known are the Accreditation Council for Graduate Medical Education (ACGME), The American Board of Surgery (ABS), The American College of Surgeons (ACS), and the Gynaecological Endoscopic Surgical Education and Assessment (GESEA) programme. These organizations, through the development of standardised pathways such as the fundamentals of laparoscopic surgery (FLS) or the fundamentals of endoscopic surgery (FES) or through the standardization of curriculum, such as the SCORE curriculum, seek to certify the quality and competencies of a surgery specialist (Stahl and Minter, 2020). We know that attempting to manage formation in surgery is a challenging and arduous journey; surgical formation is often a lifelong journey that may never end. Moreover, we must consider the importance of ongoing innovation and adaptation in surgical education. Robotic surgery is spreading widely and in all branches of surgery. Surgical robot models are becoming increasingly numerous, each with its own characteristics. Also, the crucial issue for robotic surgery today is the standardisation of surgical programmes that certify operative skills. Several authors are trying to validate a robotic surgical curriculum that integrates theoretical and practical knowledge and mentoring and tutoring, even remotely. The ERUS Robotic Curriculum represents an evidence-based example of implementing training from novice to expert (Sinha, 2023). The COVID-19

pandemic has brought additional challenges and opportunities to accredited surgical training programs. The inability to provide in-person training has hindered the adoption of virtual and remote learning modalities and has encouraged simulation-based training and telemedicine. Surgical training programs have accepted these challenges as opportunities to enhance courses and current programs (Fu, 2023), always considering practice as a central element in learning the surgical gesture.

In Italy, such training programs are far from reality. A structured, common, mandatory training course is missing, and many Universities don't have any facilities, training centres, or simulators at all.

Looking to the future, surgical educators or tutors agree that accredited training programs must continue to evolve in response to changing healthcare landscapes and technological advancements: this includes integrating virtual and augmented reality simulations, embracing competency-based assessments, artificial intelligence, and machine learning (Veneziano, 2020).

3. Materials and Methods

3.1. Aim

This retrospective observational study aims to identify the essential characteristics a surgery course must possess to be appreciated by trainees. Thus, based on our four-year experience and the results obtained from satisfaction questionnaires submitted to trainees, it proposes a standardized and reproducible system for training general and plastic surgery residents.

3.2. Study Participants

From January 2020 to January 2023, 242 residents from various Italian universities were recruited. There were 164 residents in general surgery, 66 in plastic surgery and 10 in gynaecology. Each year, general surgery and plastic surgery residents, depending on their interests, enrol in minimally invasive surgical training, microsurgery of lymphatics or surgical flaps courses.

3.3. Type of surgical training courses

- Basic Laparoscopic Minimally Invasive Surgery Course on synthetic and biological models (Figure 1).
- Basic Laparoscopic Minimally Invasive Surgery Course on porcine models (Figure 2).
- Minimally invasive Hepatic surgery course on porcine models (Figure 2).
- Perforator flap planning and dissection course on porcine models.
- Advanced microsurgical course on multiple lymphatic-venous anastomoses and lymph node transfer on porcine models.
- Minimally invasive Gynecological surgery course on porcine models.

Figure 1. Surgery Course on synthetic models

Figure 2. Surgery Course on animal models

3.4. Speakers and Tutors

The speakers and tutors were surgeons aged less than 40 from the Italian Poli-specialistic Young Surgeons Society (SPIGC), selected on a call-for-interest basis, with expertise in laparoscopic surgery (performing more than 100 laparoscopic procedures per year in the last three years), working in high-volume abdominal surgery centers (performing at least 1000 surgical procedures per year) for general surgery and with plastic reconstructive surgery proficiency along with expertise (at least five years) in reconstructive microsurgery or lymphatic microsurgery respectively, based on the type of course across Italy. The tutors received no financial compensation. The SPIGC promoted the courses following its mission, enhancing training events nationwide and inspiring

young surgeons.

3.5. SPIGC (Poli-specialistic Young Surgeons Society)

The Italian Poli-specialist Society of Young Surgeons has been pursuing, for 35 years now, the objective of promoting the training not only of young specialists but also of the residents of the various branches of surgery while contributing, at the same time, to the scientific, technical, organizational, social and moral progress of the same, with particular attention to interdisciplinarity and exchange between the various disciplines that compose it (https://www.spigc.it/).

3.6. The courses

The courses held by general surgery consisted of both theoretical and practical components. The theoretical part occurred in person in the morning or online a few days before the practical session. The theoretical lessons detailed procedures with images and videos. For the practice session, participants were divided into groups of 2-3 people for each emplacement, and they were assigned one tutor who guided them step by step with advice and corrections. For two courses, one tutor was assigned to 4 or 6 participants. The Basic Laparoscopic Minimally Invasive Surgery Course was based on exercises with box trainers and P.O.P. (Pulsating Organ Perfusion) trainers (https://www.optimist.at/pop-trainer/).

Some examples are basic skills exercises with rings, cutting figures on a pad and more complex tasks such as anastomosis on a biological model. The exercise was performed with a P.O.P. trainer on a re-vascularized organ. The trainers performed dissection, vascular isolation, technical haemostasis, anastomosis and hepatic dissection. The course on porcine models was divided into essential laparoscopic surgery, where attendants could take on cholecystectomy, appendicectomy, splenectomy, bowel resections and intestinal anastomosis; the other course was focused on minimally invasive hepatic surgery with the possibility to carry out Pringle's maneuver, typical and atypical hepatic resections, hepatic bleeding control.

Regarding the courses held by plastic surgeons, the theoretical sessions were organized similarly. Then, the participants were divided into groups of 2 people for each surgical table, and one expert tutor handled the activity of each table. The hands-on courses were based on the operator-assistant team training approach, with two surgeons exchanging the operator role, each having allotted a hemi-body of the pig (flap course) or a groin (lymphatic surgery course). The Perforator Flap Planning and Dissection course was structured as follows. After computed tomography angiography at the veterinary table, doppler sonography confirmed the perforators' location; each trainer harvested five perforator flaps (Nistor, 2022; Jiga, 2022). Flap dissection was performed under 3x to 4x loupes magnification, guaranteeing suitable visualization of the perforator vessels. Atraumatic dissection techniques were the main focus of tutors' guidance. Each participant was provided with a microsurgery kit.

Advanced Microsurgical Course on Multiple Lymphatic-Venous Anastomoses and Lymph Node Transfer hands-on course started after subcutaneous administration of blue patent violet and indocyanine green for the visualization of lymphatic or lymph nodal structures of the superficial groin under operating microscope. Healthy lymphatic vessels were identified and prepared for entrance and anastomosis with saphenous vein. Then, in the same field, the subsequent exercise could start; the lymph node artery and vein dissection was accomplished with subsequent lymph node transfer. In this course, participants were provided with supermicrosurgery kits.

The gynaecology course aimed to provide a comprehensive understanding of pelvic anatomy and a theoretical-practical update on minimally invasive gynecologic surgery. Special attention was given to the detailed analysis of the techniques used, the anatomical foundations required for optimal treatment, and the management of complications and adverse events that could occur during surgical procedures. The trainer provided opening retroperitoneum, identification of ureters, total hysterectomy with bilateral salpingo-oophorectomy, and pelvic and lombo-aortic lymphadenectomy. They performed dissection, vascular isolation and ureterolysis. The practical session was conducted on live-tissue models, where course participants can interact with surgeons and tutors with extensive surgical experience, exchange opinions, share experiences, and clarify doubts.

Research Institute: The courses were held at the Advanced International Mini-Invasive Surgery (AIMS) Academy, a non-profit foundation dedicated to advancing medical and surgical sciences to improve the safety and quality of interventional procedures and patient care. The AIMS Academy is certified by AGENAS (Italian National Agency for Regional Health Services) as a provider (ID 7818). It serves as the organizational secretariat capable of managing and organizing any training event, even at a formal level.

Furthermore, AIMS is an accredited foundation by the Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC) International, reflecting its commitment to the highest standards of humane and responsible animal care and use.

3.7. Questionnaire

The questionnaire consisted of 6 questions, 5 of which asked for a numeric evaluation from 1 to 5, and one was open-ended. The former investigated the organization of the course, the quality of theoretical and practical knowledge, the competence of the tutors, and the educational usefulness. Responses

ranged from 1 to 5, where 1 is a negative score, and 5 is a positive score (Figure 3). The latter asked learners for comments and suggestions to improve the overall experience.

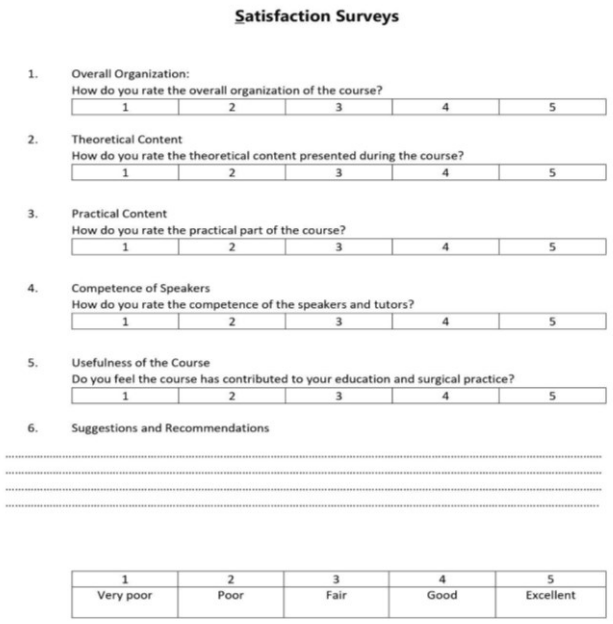

Figure 3. Satisfaction Survey

3.8. Data Analysis

The data collected from the questionnaires were analyzed using descriptive statistical methods to evaluate the overall satisfaction with the courses, perception of educational gain, and recommendations for future improvements.

4. Results and Discussion

The questionnaires were all correctly filled out. Analysing only the numeric evaluation answers, we found that 1065 (73,35%) were rated as excellent, 365 (24,52%) as good, 28 (1,93%) as fair, 2 (0,14%) as poor, and 1 (0,07%) as very poor. Analyzing each response, it can be observed that the "fair" and "poor" answers regarding theoretical content are, respectively, 2,41% and 5,51% (Figure 4).

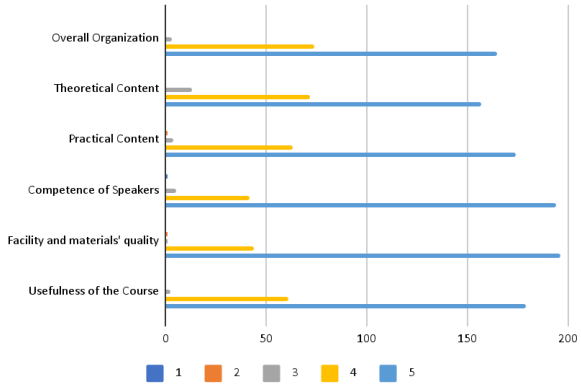

Figure 4. Distribution of answers to satisfaction surveys. The different colours represent the answer as in the legend.

We have categorized the responses to the question "suggestion and recommendation" into four types: "no comment", "more tutors are needed", "too many learners per station", "learners with different experience levels", and "theoretical part in the live session". Figure 5 represents the distribution of responses. "Too many learners per station" is the answer most frequently given, excluding "no comment."

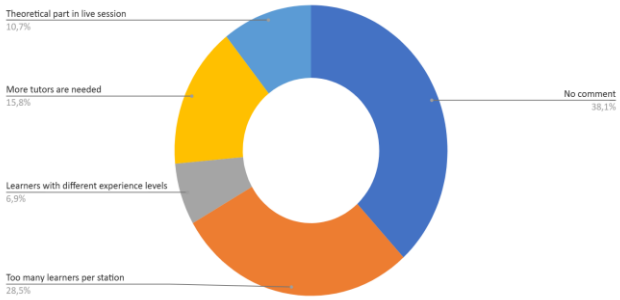

Figure 5. Distribution of "suggestion and recommendation."

Initially, to lower the costs, we organized two courses on pig cadavers with three learners in each station. One group member would go a long time without exercising, leading to a training deficit. This happened especially for learners with less experience, who took too long to perform the exercises.

For this reason, we abandoned the courses that involved three people for each station, maintaining higher costs but greater satisfaction. From the responses to the satisfaction survey, this training deficit does not emerge because, overall, the usefulness of the course is maintained, probably by looking at the other trainers doing exercises, which is also a learning mode, or because the trainers were satisfied despite this.

We calculated one tutor for every two stations. Still, we noticed that this resulted in a disadvantage for the learners at the beginning of their experience. Adding a

tutor for each station would significantly increase the course costs but is necessary to ensure intensive and satisfactory training. In some cases, a highly experienced learner was on a station with a learner with no experience, creating difficulties for both learners and dissatisfaction.

Based on these comments, we have developed key points on which all our courses are currently based:

- Maximum two learners for each training station
- One tutor for each training station
- Earners with the same experience at the same training station
- The theoretical part in a live session on the same day as the practical session

Our courses aimed to create a progressive learning pathway for residents with different experience levels. Through this kind of training, residents could start learning basic laparoscopic skills in a safe environment without the anxiety associated with working on a living patient as the very first approach to laparoscopic surgery. The sessions on porcine models were a step forward, directed to more trained surgeons experiencing the environment of an actual operating room, with a living being as a patient to which an actual surgical procedure has to be conducted. Based on the experience gained, we propose a model of a practical-theoretical course that is reproducible and progressive for trainees in general surgery and plastic surgery. This model is designed to make the learning system as efficient as possible by integrating and allowing interaction among trainees of different years and experience levels throughout their training. Each year, trainees will progressively acquire theoretical and practical skills of increasing complexity in theory and practice. At the same time, from the first year, they will be introduced to surgical anatomy.

5. A proposal for a General Surgical Course

Currently, general surgery residency lasts five years in Italy. We want to divide residents into five classes according to the year of their residency practice. First-year trainees perform exercises of basic minimally invasive surgical techniques, while those in the following years focus on advanced surgical techniques such as colorectal, upper GI, and hepatic surgery. Before engaging in practical sessions, all participants have preparatory theoretical lessons. The trainees work simultaneously. In the morning, theoretical courses on basic surgical techniques for first-year trainees and advanced surgery for other trainees occur. In the afternoon, the classes melt together, and three trainees from different years work together on a single animal in laparoscopic surgery. The first-year trainee acts as the assistant, while trainees from the second and fourth years and the third and fifth years perform anatomical dissections. This process is repeated annually, with trainees facing different and progressively more complex exercises each year, ultimately gaining simulated experience in the surgical pathologies of most significant interest by the end of the program (Figure 6).

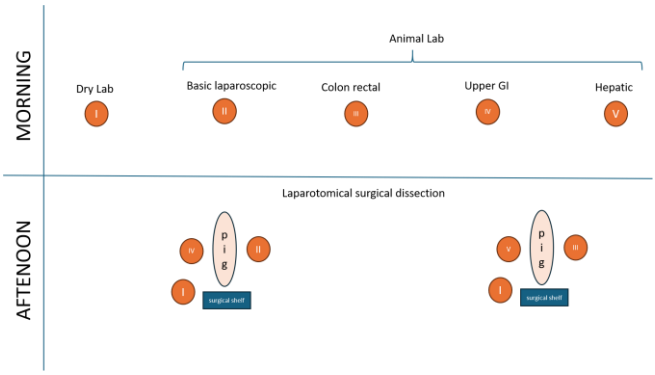

Figure 6. Structure of the practical part. The organization consists of a morning part specific to the different years of the course and an afternoon part in which all learners collaborate in laparotomic anatomical surgical dissection. Each learner plays a role depending on his or her experience.

6. Conclusions

The feedback from the questionnaires submitted after each course has highlighted the overall appreciation of these programs from various perspectives, including their usefulness, both theoretically and practically, as well as the quality of facilities, materials, and expertise of the speakers.

In conclusion, based on our experience and results obtained from the questionnaires, we believe that a standardized training surgical program has to be organised following some rules that are very important for trainer satisfaction:

- A maximum of two learners for each training station
- One tutor for the training station
- Learners with the same experience at the same training station
- Theoretical part in the live session on the same day as the practical session

The main limitation of our study is the lack of an evaluating plan to assess any improvement in trainees' surgical skills; our analysis is based only on participants' subjective satisfaction. We have used box trainers and animals, which are not always easily available and involve a huge bureaucratic burden and ethical arguing.

Further studies are necessary on how teaching surgical skills can be standardised and how to assess the improvement of the trained skills using new methods such as virtual reality and artificial intelligence.

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