Editorial

Completeness of training in thoracic surgery: the perfect operative log book

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One of the most important and difficult aspect of surgical training is to assess the competence of a trainee. Miller's pyramid of clinical competence in surgery has been described as a ladder which starts with knowledge, followed by understanding of the pathophysiology (1). Then the trainee is expected to show how the procedure can be performed and then actually performs the procedure under the guidance or assistance of a mentor.

This advancement in training is certainly related with infrastructure of the training institution, number and quality of mentors and number of case load. Surgical principles by Halsted [1852–1922] are still valid today (2):

- The resident must have intense and repetitive opportunities to take care of surgical patients under the supervision of a skilled surgical teacher. This can only be possible in an institution with adequate number of qualified trainers and enough patient load.
- The resident must acquire an understanding of the scientific basis of the surgical disease. This principle necessitates the incorporation of regular educational activities, mortality-morbidity meetings to the training program.
- The resident must acquire skills in patient management and technical operations of increasing complexity with graded enhanced responsibility and independence. Other than educational activities, this principle can be applied with active involvement of trainers with physically helping and directing residents during their training period.

Learning methods have changed dramatically over the last century and especially during the last few decades. In the past, large operating rooms would accommodate numerous observants watching the master surgeon perform his surgical skills (*Figure 1*). However in the current era, with the advancement in visualization techniques and widespread application of minimally invasive surgical techniques, the surgical technique can be observed anywhere in the world much more easily and numerous times through a computer screen. However, this only helps with the "knows" and "knows how" steps of the Miller's pyramid of clinical competence.

The definition of clinical and surgical competence is also vague. However some of the best definitions are:

"Acquisition of knowledge, skills and abilities at a level of expertise sufficient to be able to perform in an appropriate work setting."

"Possession of a satisfactory level of relevant knowledge and acquisition of a range of relevant skills that include interpersonal and technical components at a certain point in the educational process."

Competence is important and it includes performance in a real life situation, which means application of those knowledge, skills and abilities when needed.

Number of cases performed for gaining competence—how important?

A survey in 2013 that was performed among 22 European countries has shown the variability among the countries about the case requirements (3). The range was between 35 and 560. Nine countries have not even defined any minimal requirement of surgical experience.

The reasons for variability of case requirements can be listed as:

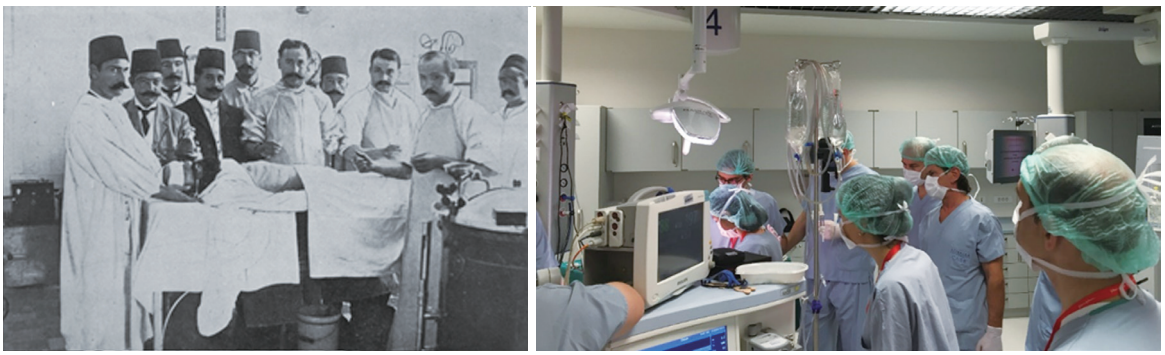

Figure 1 Despite a century of surgical development, the importance of observation and performance of surgical procedures have not changed. Left photograph shows Cemil Topuzlu Pacha who was a well-known international surgeon performing surgery at Hamidiye Hospital in Istanbul, 1903. The right picture was taken during a wet lab for VATS training in Istanbul, 2015.

- Thoracic surgery as a monospecialty: development of thoracic surgery as a monospecialty has been late and occurred in the three decades. Thoracic surgery was recognized as a monospecialty in 13 countries, in 8 as cardio-thoracic surgery, in 2 countries thoracic surgery is not recognized as such. In some of the countries, thoracic surgery is still combined with vascular surgery (3).
- Duration of training: the training time specifically devoted to thoracic surgery training ranged between 2 and 5 years in the same survey.
- Population served: data regarding the number of training centers was available for 21 countries. The number of inhabitants per training center ranged from 0.6 to 6.1 million.

The factors listed above obviously affects the number of cases performed by the residents. In US, the total number of cases required in 2017 for board eligibility is 415 in a general thoracic track (4). The breakdown of this total number includes 75 anatomic lung resections of which 25 need to be by VATS or robotic approach. Twenty open or minimally invasive esophagectomies are also required along with other cases involving intrathoracic pathologies.

In Europe, European Board of Thoracic Surgery (EBTS) and European Board of Cardiothoracic Surgery (EBCTS) require documentation of 100 thoracic cases with no specific case descriptions. EBTS and EBCTS have 5 and 4 years training requirements respectively.

An article in 2010 comparing US and German training in cardiothoracic surgery showed that 70% less thoracic cases were required in Germany compared with US (5).

One of the well structured training programs for Thoracic surgery is in United Kingdom (6). It requires a total of 8 years which includes 2 years of core surgical training and 6 years of cardiothoracic surgery which is divided in two separate tracks according to the choice for thoracic or cardiac respectively. After medical school all doctors first have to follow a two years foundation program in clinical practice during which they are gaining a wide range of clinical experience and obtaining a range of defined competencies. Trainees (also known as residents) must annually gain enough experience to meet the curriculum competencies required to progress toward consultancy.

There have been many efforts throughout Europe for a standardization of thoracic surgical training. One of those was ESTS Database initiative and quality measurement which demonstrated a need for centralization (7). This was implemented in several countries e.g. in Denmark. There are currently only four centres performing thoracic surgery where there used to be twelve. This led to total annual case volume >400 and minimally invasive surgery rate of >50% in each center (8). Appropriate planning of manpower and education of residents are possible with enough number of cases in each institution. Also in Sweden and Slovenia, the amount of centres was restricted to ten and three respectively. In France, major lung resections are restricted to centers performing >30 such resections/year.

Incorporation of numbers and other training tools

The number of cases performed is certainly important to gain a level of proficiency, however there are new methods

of training that are supportive during this period. Twenty hours of simulation exercises is a requirement in general thoracic surgery training in US (4).

Unconventional methods were shown to be effective in surgical training. In a study published in 2013, residents were divided into two groups and following laparoscopic simulator training, first group played a Nintendo Wii game for one hour/day for 4 weeks, whereas second group did not (9). It was shown that laparoscopic skills were better in the first group in 13 of the 16 criteria at the end of this period.

In terms of VATS lobectomy training, in a survey residents reported that best ways to gain minimally invasive surgical skills were during residency or fellowship period (10). Short term workshops, mini courses or animal lab exercises had minimal impact in gaining those skills.

Thus it is important to incorporate adjunct "unconventional" training methods to the residency programs together with assessment tools.

In recent years, use of video recording and evaluation of those videos have been shown to have important educational value. In VATS and robotic lobectomies, the steps of the procedures are well defined, starting with localization of the pathology, stepwise dissection and division of hilar anatomic structures, lymph node dissection/sampling and specimen retrieval (11). General respect for tissues and technical skills were also taken into consideration. All of these criteria were quantified using a scoring system which can in future lead to an independent objective evaluation of a surgeon's surgical technique and skills as a pre-requisite for certification. For robotic surgery, thoracic surgical procedures were classified to three groups in respect of their complexity which also proposes a stepwise approach (from simple to complex) in surgical procedures and training (12).

A study in 2012, also evaluated the role of video recording and post-surgical analysis of these videos (13). Video-based coaching was found to be an educational modality that targeted intraoperative judgment, technique, and teaching. Surgeons of all levels found it highly instructive. Thus it appears to be a practical and needed approach for continuous professional development (13).

Dry and wet lab exercises were also found to be useful in VATS training (14). Left sided VATS resections are performed in live pigs. It was found to be feasible, however as thoracic cavity of pigs are shallow, an artificial construction of the chest wall is implemented during some of those sessions.

The perfect operative logbook and conclusion

It is apparent that there are many methods of training that can be coupled with traditional residency programs. However, despite their promising outcomes, these novel training methods are not yet assessed independently and objectively for their efficacy.

Perfect operative logbook can be composed of:

- Simulation exercises to gain hand-eye coordination in the first two years of residency. Those simulation exercises will also increase anatomic knowledge.
- Dry and wet lab exercises before progressing to full clinical practice.
- Post-surgical video analysis is important at all stages of residency training. At all experience levels, video review was valuable in identifying episodes of failure to progress and troubleshooting alternative approaches. It was found that inclusion of trainees were most appropriate when coaching senior surgeons.
- Progress of skills for each resident is different. Thus individual skills assessment is crucial. Regular assessment of skills and knowledge of residents is required at preset dates. In Europe, a curriculum has been prepared through participation of major European Thoracic societies and numbers for each procedure are being determined based on training standards. These numbers can be taken as reference.

Similar to the advancements in surgical technology and methodology, educational tools are improving and developing very fast. Thus it is a very dynamic period with emergence of new technologies.

In conclusion, a perfect operative logbook during a thoracic surgical residency should include all of the criteria above with objective assessment tools and should be flexible to incorporate novel methodologies.

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Footnote

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