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EDUCATION IN ENDOSCOPIC SURGERY

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SUMMARY

Education in endoscopic surgery is of great importance. It can be implemented by means of endoscopic trainer, on imitated materials or on animal organs, on anaesthetized animals, during the assistance in and/or while performing the operation under the guidance of a skilful surgeon. An important role in education has been acquired by endoscopic courses. In Split, four courses of the kind have been held so far. Eight different subjects were elaborated during the last course. As compared with the course held in 2001, the 2002 course, which lasted 5 days and processed 6 subjects, included a greater number of trainees, more lecturers, while the lectures, practice and operation had a longer duration in total. The trainees were satisfied with the quality of the course, and in an anonymous questionnaire taken at the end of the course, they evaluated the lectures, practice and operations, as well as the course itself, with average grades ranging from 4.1 to 4.7. As a conclusion, it may be stated that the indispensable education in endoscopic surgery may reach a high quality level if implemented through courses where trainees achieve suitable initial knowledge from the theory and acquire skills in practice. The courses should be continually upgraded and updated with the objective of securing their high quality and responding interest and engagement of the participants.

Keywords: *endoscopic surgery, education*

INTRODUCTION

Having appeared in practice for a period slightly longer than a decade, the endoscopic surgery has found its place in the surgery in general and has become its constituent part. The present-day surgery cannot be articulated into endoscopic and conventional surgery, nor can surgeons be classified as endoscopic or conventional surgeons. A surgeon must be equally well trained for both, conventional or open surgery, as well as for endoscopic surgical procedures. On the other hand, an indirect approach to the operational area may cause a series of difficulties, as for instance is a limited visibility, insecure eye-hand co-ordination for the surgeon, difficulties in handling instruments, restricted immovability and alike. Consequently, to be able to carry out operations of the kind, it is necessary to be well trained, skilful and experienced. The fact that the need of introducing a permanent education for endoscopic surgeons was recognized at an early stage, has shown to be of utmost importance. At the beginning, only short courses for surgeons with experience were held, with the duration of only a couple of days. However, shortly after, education became obligatory during the specialist training[1-2].

It is well known that the duration of operation, the occurrence of lesions and complications in endoscopic surgery are related to the operator's experience, as well as to the so-called learning curve. Subsequently, the development of the minimally invasive surgery has imposed the need of implementation of an educational mechanism not only within the specialization programme, but also through adequate courses of endoscopic surgery. This way, the trainees are allowed a sufficient period of time bother, for studying the theory and for developing the indispensable motor skills[3-6]. Nowadays, there are a number of educational centers all over the world, where the courses of endoscopic and/or minimally invasive surgery are continually held. The best known educational centers in Europe are in Norderstädt - Hamburg[7], Strasbourg[8], Tuebingen[9], and Dundee[10].

Accordingly, the Society of the American Gastrological Endoscopic Surgeons (SAGES) has issued recommendations for learning the endoscopic surgery, as well as for releasing and extending licenses for carrying out operations based on the endoscopic technique. The objective of these instructions is to point out

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the principles and define practical recommendations in order to facilitate decision taking for hospital authorities in appointing individuals for practicing endoscopic surgery so as to allow for the right choice of surgeons appropriately drilled to perform the required procedures. The importance of learning endoscopic surgery during the specialization is accentuated in the course of the educational process, and a determined level of knowledge and skill required. Should such learning not show as satisfactory, postgraduate courses are indicated. Such courses should comprise theoretical lectures given by lecturers experienced in endoscopic surgery, as well as training in practice, assistance and carrying out operations supervised by experienced endoscopic surgeons. All these presumptions should be covered by the sponsorship of a qualified higher rank association. Furthermore, such courses should include instructions on how to handle instruments and equipment, how to accomplish a safe pneumoperitonum tissue handling, tying nodes, practical exercises aimed to the objective of the course etc. Course participants should demonstrate to the presenter their ability to carry out the complete operation, which should, in the end, result in issuing relative certificates by the course presenter. Attendance in short courses failing to provide education as above defined, shall not be certified[11-20].

The educational background of the course presenters is also of utmost importance. They can be classified in two groups. One group covers relatively young presenters, themselves adequately trained in endoscopic surgery not long ago. Their education was covered by a trustworthy sponsorship, as the case had been with many generations of surgical registrars before them. The other group of presenters-instructors represents the surgeons who had initiated the endoscopic surgery by starting to apply this technique on their own, with slight, or almost no experience whatsoever, after attending the basic courses in laparoscopic surgery, or being utterly self-educated. As a matter of fact, there was an urge to start with something after all. Oddly enough, the question is risen now of whether these presenters should be additionally educated, be it both, to become qualified for carrying out endoscopic interventions and for instructing others[6].

Finally, it is important to mention the ethical aspect of approaching equipment manufacturers. Many professionals have developed a business relationship with them. A positive ethical attitude would be to use the equipment of the company with convenient business ties as long as they are to the best advantage of patients. On the other hand, circumstances where products cannot be defined as the ones best suiting the benefit of patients, for being inadequate or poor in quality, cannot be defined as ethical. The same can be said abbot those product which are not necessary, and the objective of their choice is to create a stronger business relationship. As non-ethical should also be considered the case where, for the same reason, the presenter gives preference to the products of one company at the expense of another. The best policy is to recommend the use of products affirmed as being of high quality regardless of which company has manufactured them. Of course, this does not mean that on account of good trading relations equipment manufacturers would not be given the opportunity to promote their products through sponsorship for courses, various educational procedures, conferences and similar events as long as it will not influence the professional judgement[6].

In Croatia, courses of surgeons' permanent professional improvement have been held from the verity beginnings of endoscopic surgery[21]. The latest courses of the kind were organized in compliance with the above described SAGESA recommendations[22].

EDUCATIONAL METHODS IN ENDOSCOPIC SURGERY

One of the simplest techniques of the kind is learning how to perform operations in the endoscopic trainer. The endoscopic surgery work conditions higher or lower degree of precision.

Trainers look like more or less rounded boxes, some of them resemble the shape of the part of a body - e.g. part of abdomen. For this reason they are sometimes referred to as phantoms.

In general, endoscopic trainers may be classified as those which to be used require endoscopic equipment, and as those which do not impose such a requirement. On the other hand, training techniques carried out by means of a trainer may be defined as those based on artificial materials and those including natural tissues and organs. Trainers may be of simple design, not provided with electrical elements whatsoever, but there are also trainers with incorporated electrical assemblies.

Trainers differ from a common plastic box in their horizontal upper surface. In all trainers it must be, by all means, made of rubber, or it must have openings provided with inserted rubber pieces. Such a soft material will make it possible for trocars to be introduced in cases when the application of various instruments is required.

The trainer, which does not require endoscopic equipment, has its upper part, or the whole of it, manufactured from a transparent plastic material. On their upper surface, such trainers are provided with inserted

rubber pieces in order to facilitate the insight through the transparent side.

It is clear that they do not allow for the trocars to be moved. In other words the position of a trocar is determined by the position of the inserted rubber piece. Practice on the trainers of this type is much more economical. It is simpler and easier as compared to that with trainers designed with non-transparent sides and requiring the use of endoscopic equipment. Of course, the training will result in a significantly lower outcome, particularly due to the fact that the work performed requires less effort and to the lack of need for developing skills so peculiarly typical of and indispensable for endoscopic surgery, as it is operating while observing the image on the monitor, gaining the feeling of the third dimension while watching the two-dimensional image on the monitor, as well as working in the reduced sight field.

There are a number of types of trainers which require endoscopic equipment while in use. They are all provided with the upper side made of a non-transparent material provided with inserted rubber pieces or simply made of rubber altogether (Figures 1 and 4).

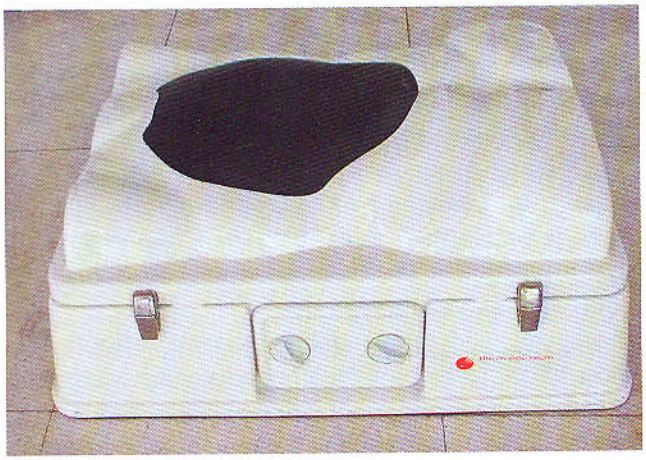

Figure 1. Endoscopic trainer.

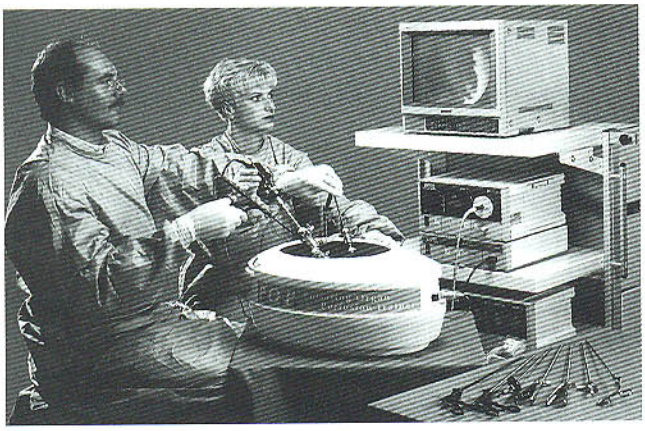

Figure 2. Practice with endoscopic trainer - conditions resembling those in endoscopic operation.

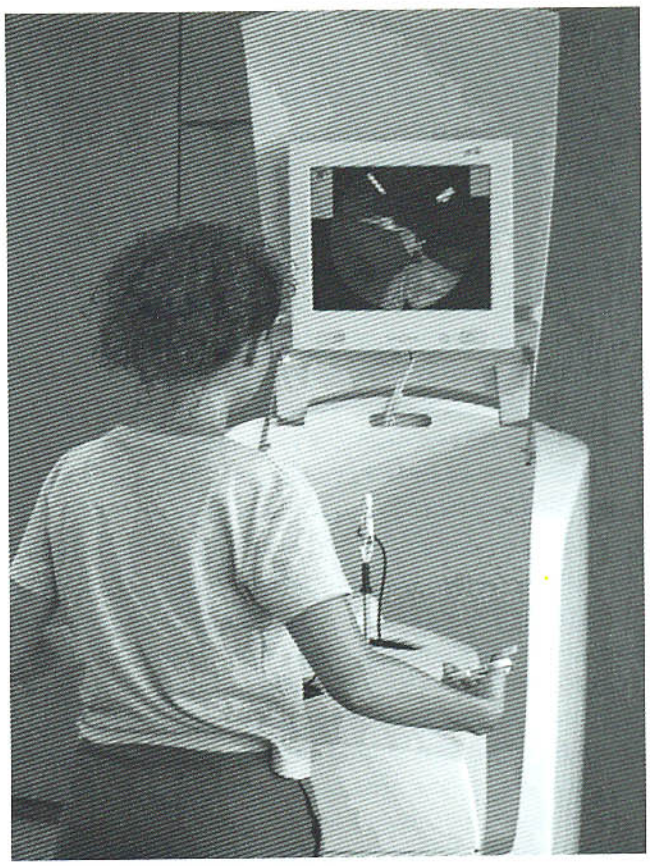

Figure 3. Practice with computer in a work station.

Trocars for endoscopes and instruments are introduced through such rubber. These trainers are very often used for training during various endoscopic courses. Most frequently, while being used they require assistance, while an extremely realistic endoscopic operation is being simulated (Figure 2). They may be provided with built-in endoscope holder to make the practice without assistance possible. The inside of a trainer is approached by lifting the upper non-transparent side. These trainers are normally provided with a special porthole allowing an easy access to the inside without removing the topside.

Some endoscopic trainers are fitted with special electrical assemblies similar to a pump. The system pumps the colored fluid in which it is immersed, which fluid is further injected into the blood vessel of the preparation and then circulated through the latter contained in the trainer. For this reason, these trainers are also defined as "perfusion trainers" as in them the preparation is permanently perfused by the colored fluid. Consequently, the virtual conditions resemble, with even more precision, the real operation as this way bleeding can also be simulated.

Practice on a trainer may be accomplished on artificial materials or on the preparations from the tissues and organs. Artificial preparations are used in practice

with the trainers not requiring the endoscopic equipment. However, in the practice with the preparations from the tissues and organs the trainers fitted with the endoscopic equipment are used. The application of tissue and organ preparations is definitely more efficient for education. On the other hand, it is connected with the difficulties of providing, adequate storing, preparing, handling and subsequent destroying such material, as well as with the very expenses arising therefrom.
A distinct part of educational aids are operations and processes simulated by computer. The so-called "working stations" have been developed to this purpose, and their constituent parts are the computer with a monitor, holders simulating instruments and adequate computer programmes. Their disadvantages are reflected in their high cost equipment, unconvincing display and restricted diversity of the operations due to still deficient software possibilities not allowing for storing and programming all the possible variations and circumstances which may develop in the course of a true operation. A continual upgrading and promotion of such programmes has been in progress (Figure 3)[23].
In addition to the above described methods of education by means of different trainers or computer programmes, learning the endoscopic surgery is accomplished also on various animals. It stands to reason that this method resembles to a far greater extent the conditions of an operation carried out on a human, resulting, consequently, as the most efficient one.
Pigs are most frequently used to this purpose. The anatomy of a pig is similar to the human anatomy and pigs are available and relatively inexpensive. However, this method is most expensive, most complicated and most demanding and therefore, it is most infrequently practiced. This type of education is usually adopted by surgeons with certain experience and developed skills in endoscopic surgery. It is understood that during the learning process including pigs, all the rules concerning the treatment of animals used in laboratory research and testing are to be strictly observed.
The preparations and pigs used for practice are to be examined by a veterinary surgeon beforehand and under the veterinary supervision during the process of practice. During the learning practice and/or operations, surgical gloves must be worn and other precautions should be undertaken. Instruments and equipment not intended for use on humans will only be used (Figure 5).
Finally, education in endoscopic surgery is under way in everyday work, during the assistance in operations, as well as in carrying out operations under the supervision of a surgeon experienced in endoscopic process. Another educational technique is the mentorship of an experienced endoscopic surgeon with the scope of attaining a degree of skillfulness verified by a certificate. Such an education complies with the above mentioned recommendations of SAGES.

COURSES OF ENDOSCOPIC SURGERY IN SPLIT, CROATIA

Up to the present day, four courses of endoscopic surgery have been organized in Split, whereas about twenty courses of the kind have been organized in Croatia. The first course of the laparoscopic cholecystectomy was held in 1999 under the sponsorship of the Medical School of the University of Zagreb, while the subsequent three courses were held in 2001, 2002 and 2003, under the sponsorship of the Medical School of the University of Split. The last but one course was held from September 17-21, 2002, and it was for the first time that, in Croatia, an endoscopic course was held to cover more than one subject and to last more than

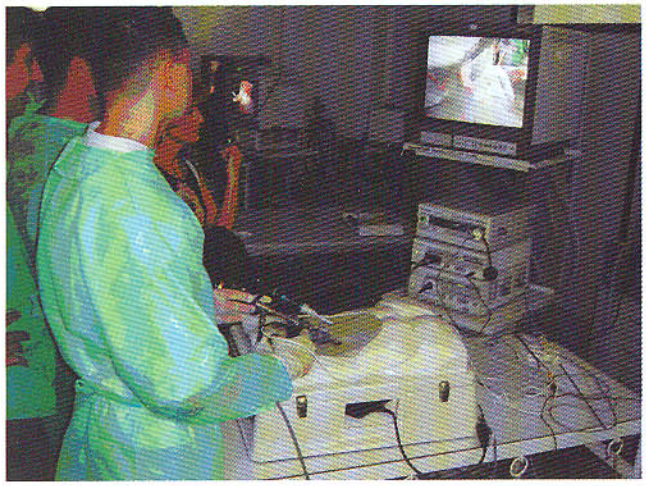

Figure 4. Practice with endoscopic trainer - true operation conditions are simulated (Split, 2003)

Figure 5. Operation on pigs - operating conditions equal to those in true operations (Split 2003)

two days. Also, it was then that for the first time a laparoscopic operation was accomplished on pigs outside the Veterinary Faculty of the University of Zagreb. During that course, a laparoscopic cholecystectomy was processed, as well as the open and endoscopic hernioplasy with the application of mesh reinforcement, appendectomy, introduction of peritoneal catheter and endoscopic stitching. The course included lectures, practice on pigs' livers and stitching on endoscopic trainer. (Fig. 4), operations on pigs (Fig. 5), and participating in a form of assistance during the operations. For all these reasons the course was defined as the First Autumn School of Endoscopic Surgery. A Book of Lectures was published for every course, whereas for the three last courses, the book was accompanied by a CD containing the lectures, the photographs of the instruments and videos of the operations. As compared with the Course of Laparoscopic Cholecystectomy from 2001, the First Autumn School of Endoscopic Surgery upgraded all the standards related to the scope and the quality of the courses, as well to the interest of the participants. So, in comparison with the 2001 course, the above stated one comprised 11 lecturers (formerly 7), 12 participants (formerly 11), 21 candidates wanted to participate, but, being in excess, could not be accepted (formerly 15). The lectures had duration of 420 minutes (formerly 160). The practice lasted 11 hours in total (formerly 4,5). A total of four operations were completed (formerly 2). The operations had duration of four hours (formerly 2). The cost for the participants was higher and amounted to KN 4000 - EURO 540 (formerly KN 1300 - EURO 175) (Table 1)

The participants were satisfied with the professional part, which resulted from an anonymous poll taken at the end of the course. Accordingly, an average grade of all the lectures was 4.7 (SD±0168), of the practice on pigs' livers 4.1 (SD±0.99) and of the assistance in operations on humans 4.1 (SD±0.5) (Table 2). Tests at the end of the course showed a competent knowledge of the participants.

As in the earlier courses, the participants had objections on account on their wish to have more practice, although the duration of practical work was increased for 244% (both practice and operations), whereas the entire duration of the lectures was increased for relatively low 163% (Table 1). Nevertheless, it is clear that the practical work segment will have to be additionally increased.

Finally, the last course was organized in Split from September 18-20 2003 with a covering on eight different subjects: the laparoscopic cholecystectomy, choledocholithotomy, hernioplasty, appendectomy, colon surgery, introducing peritoneal catheters, endoscopic stitching and experimental laparoscopic surgery. The course was defined as the Second School of Endoscopic Surgery and it has become the most comprehensive endoscopic course in Croatia. Lecturers from other medical schools in Croatia and from other European countries took part in all the courses.

It is our plan to organize a similar courses in autumn 2005, and thereupon, a specialized course for laparoscopic colorectal surgery, which will be held within the Croatian Congress of the Association of Colorectal Surgeons.

As a conclusion, it can be said that endoscopic surgery requires a continual and complementary education and that a satisfactory quality level towards this objective may be reached also by practicing in the form of courses of endoscopic surgery. There is a continual

Table 1. Comparison of Laparoscopic Cholecystectomy Course (Cholecystectomy 2001) and Autumn School of Endoscopic Surgery 2002

	CHOLECYSTE-CTOMY 2001.	*AUTUMN SCHOOL OF ENDOSCOPIC SURGERY* 2002.	*Augmentation* (%)
Lecturers	7	11	57
Trainees	11	12	9
Applicants	15	21	40
Duration of lectures (minutes)	160	420	163
Duration of practice (hours)	4,5	11	144
Number of operations	2	4	100
Duration of operations (hours)	3	6	100
Price (kunas)	1300	4000	208

Table 2. Anonymous opinion questionnaire completed by participants at the end of the course.

	Average estimate	SD
Lectures (total)	4,7	0,68
Practice on pigs' livers	4,45	0,69
Operation on pigs	4,1	0,99
Operations on humans - assistance	4,1	0,88
Average estimate of the course as a whole	4,55	0,5

need for such courses in Croatia, and they can be organized annually. Within such courses, the participants achieve a suitable initial knowledge from the theory and learn to master the skills required in the field of endoscopic surgery. At the same time they become aware of the latest developments in the theory and operational techniques of the open surgical interventions. A quality organization of the courses, compliance of the programmes with the wishes and the needs of the participants, introduction and elaboration of new, diversified and interesting subjects will guarantee the interest and engagement in the response of participants.

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