

Urology resident training in laparoscopic surgery – results of the first national survey in Poland

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Abstract

Introduction: For many urological procedures the open approach is being replaced by the laparoscopic approach. Laparoscopy technique requires special training conditions. A well-designed, step-by step training program is significantly important for shortening the learning curve.

Aim: The purpose of the study was to evaluate urology residents' (UR) experience in laparoscopic procedures, training patterns and facilities available in departments of urology in Poland.

Material and methods: The survey developed by the authors included 18 questions concerning laparoscopy training and was distributed among UR who participated in 2 courses in laparoscopic surgery for UR in Poland in 2017. The survey consisted of questions regarding the number of laparoscopic procedures, acquired laparoscopic experience, laparoscopic simulation training and motivation for further learning.

Results: Of the 2017 invited UR in Poland, 108 (34%) completed the survey. Seventy-two (78%) UR from the study group have access to laparoscopic surgery in their department. Only 20 (25%) of urology departments are equipped with a laparoscopy box and a small number of UR perform regular training. As a primary operator basic (varicocele repair) and advanced (e.g. radical nephrectomy, radical prostatectomy, nephron-sparing surgery) laparoscopic procedures are performed respectively by 55 (71%) UR and 8 (10%) UR. Most residents evaluated their laparoscopic skills as poor (15, 19%), very poor (31, 40%) or absent (10, 13%), while only 22 (28%) evaluated them as at least satisfactory.

Conclusions: Laparoscopic technique is available in most Polish training centers. However, the majority of UR consider their skills unsatisfactory. Additionally, a large number of Polish UR do not have access to intensive training. UR considered that their availability of training courses and fellowships is low. Surgical exposure among Polish UR comprises mainly minor laparoscopic procedures.

Key words: laparoscopy, education, surgical training, urology, residency.

Introduction

Minimally invasive techniques, mainly including laparoscopic and robot-assisted techniques, are currently the primary tools used in the surgical treat-

ment of urologic diseases [1]. Laparoscopic surgery has been widely accepted in general urological practice and has now become the standard. The first laparoscopic procedures in Poland were carried out only a few years after the first pioneer procedures

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in Europe (laparoscopic radical nephrectomy at the Pomeranian Medical University in Szczecin – 1993 vs. 1990, laparoscopic radical prostatectomy at the Jan Biziel University Hospital in Bydgoszcz – 1995 vs. 1991) [2]. The laparoscopic technique has its limitations associated with the loss of three-dimensional vision, depth perception, increased costs compared to open surgery, and, above all, a long learning curve [3, 4]. Special training conditions and skills are required; hence numerous training programs have been developed to facilitate teaching laparoscopy [5]. On the basis of European programs the Polish concept of “Uro-lap” was created, whose main assumptions were published in 2007 [6].

Aim

The aim of the study is to assess the implementation of the Uro-lap concept, quality of laparoscopic

training, and possibilities for acquiring knowledge and skills in laparoscopic techniques among urology residents' (UR) in Poland.

Material and methods

For the purpose of the study we created an anonymous survey containing 17 questions concerning the quality of laparoscopic training in Poland. With the approval of the organizers of the 25th Symposium of Endourology and SWL and the 47th Congress of the Polish Urological Association, UR participating in both scientific meetings and undergoing residency in urology were invited to take part in the survey. The survey was based on questionnaires for analyzing the status of laparoscopic training in the rest of Europe, USA and Canada in order to compare the results obtained in Poland (Appendix 1) [3, 7–9].

It consisted mainly of multiple choice questions concerning the demographic data of the respondents, laparoscopic training opportunities, experience in performing laparoscopic procedures, number of procedures, subjective evaluation of own skills, and expected skill level at the end of residency.

Statistical analysis

The collected data were subjected to statistical analysis using Statistica 13.0 software.

Results

The study included 108 participants from centers providing training in urology. Individuals who have access to laparoscopic education in their centers constituted 72% ($n = 78$) of the entire group. Data obtained from UR, who at the time of survey had not been undergoing laparoscopic training in their home centers, were analyzed separately. The main analysis included questionnaires filled in by 78 UR with access to laparoscopic education in their department.

Table I presents the demographic data of survey participants. Almost half of the respondents (46%) undergo training in a clinical center. The number of laparoscopic surgeons in training centers varies (min. = 0, max. = 12 operating surgeons); on average 3.3 experienced urologists operate using laparoscopic techniques. Similarly, the number of UR varies depending on the center (min. = 1, max. = 11 residents). More than half of training centers perform on average 1–100 laparoscopic procedures per year.

Table I. Demographic data of UR with access to laparoscopic surgery in their department and laparoscopic department characterization ($n = 78$)

Parameter	Value
Residency year:	
1	13 (16.7%)
2	9 (11.5%)
3	26 (33.4%)
4	22 (28.2%)
5	4 (5.1%)
6	4 (5.1%)
Hospital type:	
Clinical center	36 (46%)
Other	42 (54%)
Number of laparoscopic surgeons in the department	Average: 3.32 \pm 2.11, min. 0, max. 12
Number of residents in the department	Average: 4.86 \pm 2.54, min. 1, max. 11
Number of laparoscopic procedures per year in the department:	
< 50	29 (37.2%)
50–100	21 (26.9%)
100–150	4 (5.1%)
> 200	24 (30.8%)

Only 25% of the respondents have access to laparoscopic trainers at their department or have their own training box. Self-study as a method of training, more than once a week, was mentioned by 32% and 60% of UR with and without access to laparoscopic training, respectively (Figure 1).

The most popular form of additional education, apart from compulsory residency, is national laparoscopic courses (Figure 2). Only a small percentage of UR participated in national and international internships and courses.

Most of the individuals undergoing training (61%) are aware of the possibility to receive a certificate of laparoscopic skills during the E-BLUS examination (European-Basic Laparoscopic Urological Skills); 73% of these individuals are considering taking the examination (Figure 3).

Figure 4 presents the UR level of advancement in performing laparoscopic procedures in each year of

their residency. From the very first year of training, all participants of the study report their participation in laparoscopic procedures as second assistants (laparoscopic camera operator). As the specialty training progresses, the number of UR assisting with surgical procedures as first assistants and operating surgeons increases. All UR of the last year of training state that they perform laparoscopic procedures as operating surgeons. In view of the disproportionate distribution of survey participants in individual years of training, significance statistical analysis was not performed.

The most common laparoscopic procedures performed by the study participants included varicocele ligation (71% of respondents) and marsupialization of renal cysts (41%). Advanced laparoscopic procedures are performed by a small percentage of UR (Table II).

Among the UR who had access to laparoscopic training in their centers, only 28% considered their

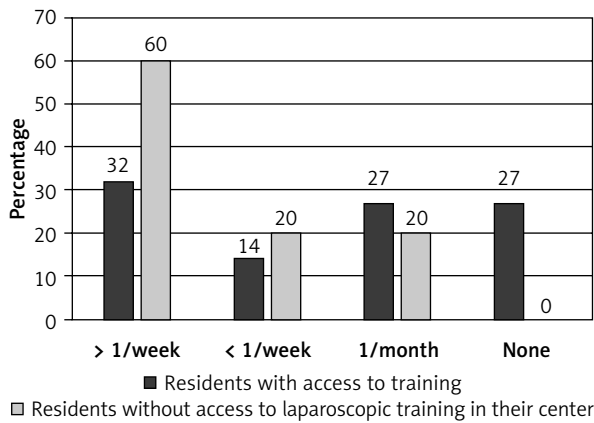


Figure 1. Percentage of UR who reported training on a laparoscopic box

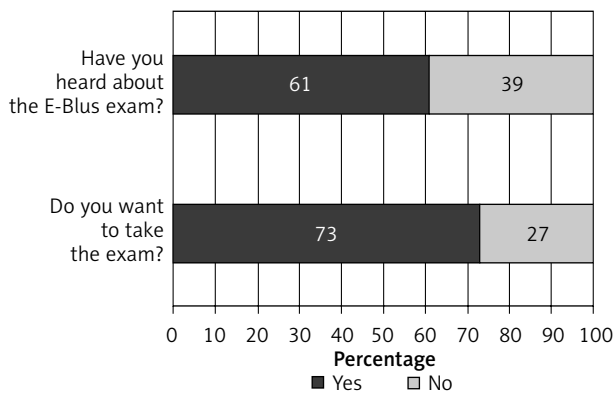


Figure 3. Level of knowledge and willingness to take the E-BLUS examination (all UR)

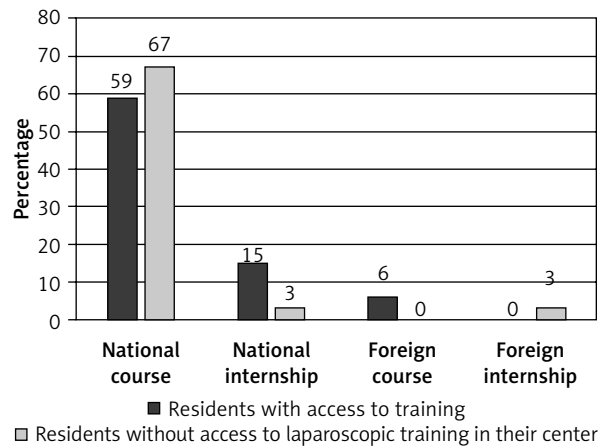


Figure 2. Forms of education of UR

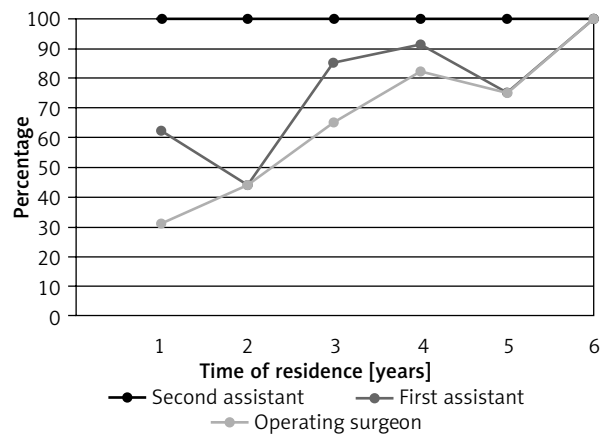


Figure 4. UR participation in laparoscopic procedures in each year of residency

current laparoscopic skills as at least satisfactory. However, no participant from the group of participants without access to laparoscopic training considered their skills as positive (Figures 5, 6).

In response to the question about the expected level of laparoscopic skills at the end of specialty training, we observed a significant shift towards “satisfactory” (37%), “good” (14%), and “very good” (10%) among UR with access to laparoscopic training. In the second group, the most frequent answer to the above question was “very weak” (50%). Moreover, analyzing the same issue from the perspective of senior UR (> 4th year) and junior UR (< 4th year), the former reported having more experienced at the

time of survey and also in their expected experience at the end of residency, but this difference was not significant ($p = 0.3938$, $p = 0.4773$) (Figures 7, 8).

Discussion

The traditional model of education practiced in open surgery is based on the “master-apprentice” relationship – see one, do one, teach one. The laparoscopic technique has its limitations associated with the loss of three-dimensional vision and depth perception, compared to open surgery, and, above all, a long learning curve. Acquisition of knowledge and practical skills in the traditional model in the case of laparoscopic and robot-assisted techniques

Table II. Number of procedures performed by UR with access to laparoscopic surgery in their department

Procedure	Number of procedures	%
Varicocele ligation	0	29
	1–5	40
	> 5	31
Renal cyst marsupialization	0	59
	1–5	32
	> 5	9
Ureterolithotomy	0	82
	1–5	17
	> 5	1
Radical nephrectomy	0	79
	1–5	14
	> 5	7
Pyeloplasty	0	88
	1–5	9
	> 5	3
Radical prostatectomy	0	86
	1–5	9
	> 5	5
NSS	0	88
	1–5	10
	> 5	2



Figure 5. Laparoscopic experience of UR with access to laparoscopic surgery in their departments

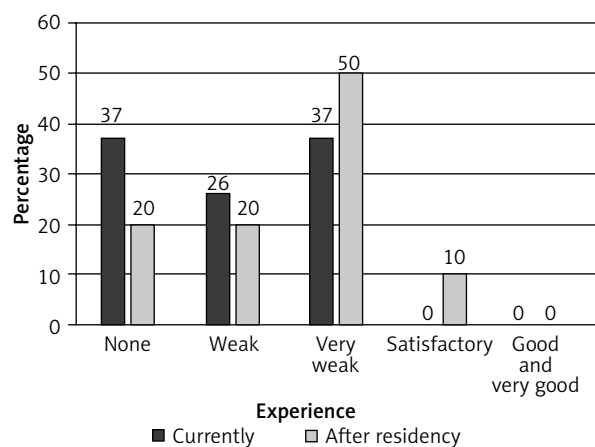


Figure 6. Laparoscopic experience of UR without access to laparoscopic surgery in their departments



Figure 7. Laparoscopic experience of junior and senior UR at the time of the survey (all UR)



Figure 8. Expected laparoscopic experience of junior and senior UR at the end of residency (all UR)

is not effective [10]. Furthermore, with a growing debate about whether it is safe and/or ethical to train on patients there is a clear need for change of traditional surgical education. A well-designed laparoscopic training program is one of the key conditions for implementation of minimally invasive methods in everyday medical practice. Based on the conducted research and experiments, laparoscopic and robotic curricula were created which precisely describe the educational path of training conducted under the auspices of European and national associations and sections [11, 12].

There is no doubt that basic laparoscopic skills should first be taught outside the operating theatre, emphasizing the role of exercises on laparoscopic training equipment (box trainers, pelvic trainer) [13]. This form of training provides the opportunity to use up-to-date tools and acquire basic laparoscopic skills, such as manipulation, preparation, suturing, binding, cooperation of both hands, and visual and motor coordination. The obtained data indicate that the majority of the respondents do not apply the method of self-improvement. Only about 25% of all urology departments possess laparoscopic training equipment, and 32% of UR from the group with such training possibilities practice regularly at least once a week. These numbers differ significantly from the values of European centers, where over 60% of treatment units have their own manual skills improvement laboratory and the reported period of time spent practicing is more than 90 min a day [8]. The gold standard of training should be training using a box trainer for at least one hour a day following a clearly defined schedule [14].

The preferred method of validation learning of basic laparoscopic skills seems to be the certified E-BLUS (European-Basic Laparoscopic Urological Skills) examination conducted by the EAU Section of Uro-Technology (ESUT). The examination consists of a theoretical part and a strictly standardized practical part, which includes performance of individual exercises with qualitative assessment within specified time criteria [15]. The E-BLUS examination is conducted annually during the EUREP and EAU Congress. The analysis of the first edition of the E-BLUS examination during EUREP in 2015 revealed that most of participants did not pass the examination. The most common cause of failure among trainees is not meeting the time criteria set for the exercises [16]. The authors of the publication emphasize that the reason for failure is insufficient time spent on exercises with the box trainer before taking the examination. It seems that regular popularization and organization of the E-BLUS examination in Poland by leading centers coordinating laparoscopic education may encourage trainees to become more involved in laparoscopic training and might promote this technique. So far this examination has been conducted in Poland twice – in 2015 and 2017 – by the Urology Department of the Jan Bizieli University Hospital in Bydgoszcz.

Training of basic laparoscopic skills on box trainers has a limited impact on the overall operative performance of trainees during *in vivo* laparoscopic surgery. Training of advanced laparoscopic skills with simulation is another significant step of education described in most laparoscopic curricula. In urology there are various simulation models avail-

able, including revitalized animal tissues, synthetic materials, anesthetized animals, and virtual simulators [17]. The advantage of using a simulator is the possibility of learning individual procedures in practice outside the operating theatre, in comfortable conditions, with multiple attempts available. Many new virtual simulation devices have recently emerged on the medical market and allow learning such advanced urological procedures as radical prostatectomy or radical nephrectomy. Virtual simulators enable quantitative evaluation of the economics and purposefulness of movements, time, and the number of mistakes made. It is expected that in the future surgical simulators will also enable one to demonstrate crisis situations – intraoperative complications, adverse events and anatomical anomalies [18]. Currently in Poland there are few training centers using virtual simulators, and commercial courses with animal preparations or anesthetized animals are available to improve skills in selected urological procedures, such as radical prostatectomy or radical nephrectomy.

Extending knowledge and laparoscopic skills during courses and internships is a recognized stage in education [19]. Our study showed that only 15% of the trainees had the opportunity to participate in national internships and nearly 60% of respondents attended additional national courses, while a much lower percentage took the courses abroad. It should be stressed that this form of education is also chosen by residents who do not have the opportunity to practice laparoscopy at their home centers, which emphasizes their strong motivation to gain knowledge and skills. In response to the open question regarding the level of satisfaction with the system of courses and internships, the most frequently given answer concerned the limited number, the need for individual financing, and the difference in the quality. The key aspect is, therefore, the better quality of the courses and internships and their impact on further surgical practice. Similar issues are also emphasized by UR in surveys from other countries.

The importance of learning non-technical skills is gradually gaining recognition in the education of surgeons. Non-technical skills are defined as abilities to communicate, work in a team and respond to stress while performing surgical procedures [20]. It appears that an appropriate scope of training, including the ability to select and assess information, work in a team, and make decisions, is as import-

ant as learning of manual skills and directly translates into treatment outcomes [21]. A poor level of non-technical skills can lead to surgical error, and it is proven that non-technical skills do not correlate with surgical experience. It is, therefore, justified to create laparoscopic teams consisting of well-cooperating urologists, anesthesiologists, and scrub nurses trained for laparoscopy. The number of laparoscopic operating surgeons per resident, which in Poland is currently around 1 to 11, may contribute to the development of non-technical skills among UR. Non-technical skills should also be incorporated in training programs of UR and can be improved during special courses with simulation.

Once the basic laparoscopic and theoretical skills have been mastered, the surgeons undergoing training can begin their education in the operating theatre, where they should learn skills in an appropriate order and conduct increasingly difficult procedures, with the learning curve being individually adjusted. Procedures conducted with the participation of a surgeon in training should be organized with the minimal risk for patients. Increased rates of pre- and postoperative complications or worse treatment outcomes should not be regarded as an acceptable cost of learning opportunities. Therefore, treatment of the patient is a priority, and the educational aspect must still be secondary, especially during live operations [22]. According to our survey, over 70% of urology centers in Poland provide training in laparoscopic technique. This level is comparable to the average for Western European countries, but differs from such countries as the USA and Canada, where it is close to 100% [8]. Almost all trainees, starting from the 1st year of training, participated in laparoscopic procedures not only as assistants, but also as surgeons. Similarly to other European countries, the most common procedures performed by UR are varicocele ligation and renal cyst marsupialization. Out of the group of Polish UR 41% reported having performed at least one laparoscopic marsupialization of renal cysts compared to 21% of UR in other European countries [7]. A much smaller percentage of UR performed advanced procedures such as nephrectomy, radical prostatectomy, or NSS (> 1 LRP procedure – 14% Poland vs. 12% Europe), which was caused mainly by the long learning curve of these procedures. It should be noted that the number of procedures carried out by doctors in Poland during their specialty training is comparable to the average

in Western Europe, where, as in Poland, most UR develop their manual skills as 1st and 2nd assistants, with only a small group practicing as operating surgeons [3, 7, 8]. In contrast, most describe their skills in this field as weak or very weak, and only 19% consider them satisfactory, but a significant proportion of the respondents are motivated to continue education and approximately 60% state that their level of experience at the end of the training will be at least satisfactory. The UR from other countries, where access to these techniques is more common, consider their skills to be at a similar level.

Effective teaching of UR complex procedures such as radical prostatectomy or radical nephrectomy is challenging and demands superior conditions such as mentoring. Modular training is one of the proposed forms of structured mentoring [23]. The idea behind modular training is to teach procedures under the supervision of an experienced surgeon by dividing them into stages of varying difficulty. In modular training the trainee first assists a procedure as a laparoscopic camera operator, learning the different stages of the procedure and the dexterity in using tools. Upon mastering this step, the surgeon starts training as the first assistant to improve his or her skills. The next step is to perform individual stages of the procedure, starting with the simplest ones. The mentor assesses progress of the trainee and, upon mastering a given stage of the procedure, allows him or her to move on to the next – more complex – stage, until the trainee finally masters the entire procedure. Modular training is used in urology to teach mainly radical prostatectomy and radical nephrectomy [24, 25]. Study authors stress the importance of the learning curve, which for radical prostatectomy is within the range of 200–250 procedures [26]. An obvious condition for beginning practical education in the operating theatre, according to the studies quoted above, is mastering the theoretical background as well as technical and non-technical skills in the previous stages of training. Internships in “high-volume centers”, where trainees have an opportunity to refine individual aspects of their technique under the supervision of the most experienced surgeons, also play a dominant role at this stage of education [27].

Conclusions

Minimally invasive surgical techniques are now taught according to a strictly defined formula, which consists of a few key points, such as exercises using

a training box, simulations, courses/internships, and transition to clinical practice in a clearly specified order. Non-technical skills have also been recently included in the training process and are now taught during specially designed courses. At each stage of the training the surgeon’s competence is objectively assessed and certified. This model is based on the principles of evidence-based medicine and parameterized evaluation of training results, constituting the gold standard in English-speaking and Western countries (Figure 9).

Our research shows that the laparoscopic education program for UR in Poland has similar limitations to those present in other European countries. It is necessary to continue cooperation in order to promote minimally invasive techniques, equipping urology units with laparoscopic training equipment, creating simulation centers, as well as increasing the availability of internships, courses and establishing a data management system. It should be noted that the study group was relatively small and did not encompass all UR. It also did not include information on the willingness of the participants to develop their own careers in laparoscopic techniques.

It seems optimal to further evaluate and regularly assess the quality of the training offered at regular

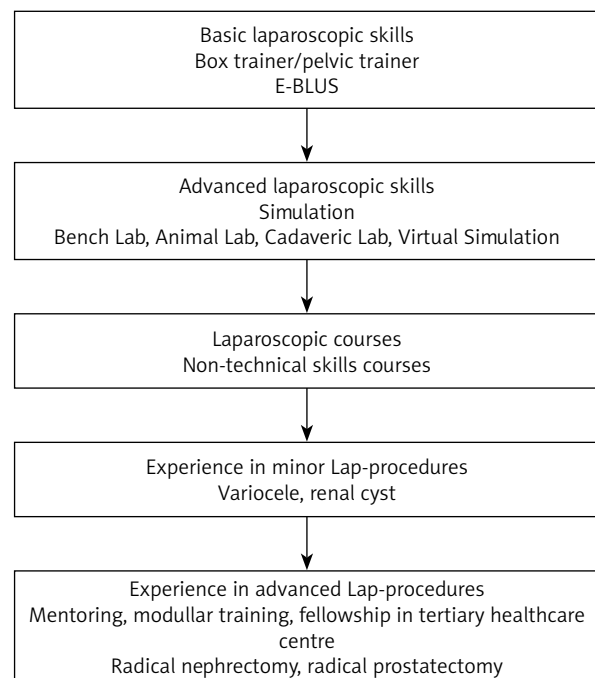


Figure 9. Proposed training pathway in laparoscopic education

intervals in order to accurately verify the direction of changes in laparoscopic training for young urologists in Poland.

Conflict of interest

The authors declare no conflict of interest.

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Appendix 1.

Questionnaire

1. What is your year of residency?
2. What type is your hospital? Academic center Other
3. Do you have access to laparoscopic training in your center? Yes No
4. How many laparoscopic surgeons does your department have?
5. How many urology residents does your department have?
6. How many urologic laparoscopic procedures are performed in your department each year?
0 < 50 > 50 < 100 > 100 < 150 > 200
7. Do you have access to laparoscopic training facilities in your center? Yes No
8. What kind of participation in laparoscopy does your department offer to residents?
 - a) Camera operator
 - b) First assistant
 - c) Operating surgeon
 - d) Laparoscopic box training
 - e) Virtual training
9. How many laparoscopic procedures have you performed as first surgeon (consider procedures in which you performed at least half of the surgical steps)?

Procedure	0	1–5	> 5
Varicocele ligation			
Renal cyst marsupialization			
Ureterolithotomy			
Radical nephrectomy			
Pyeloplasty			
Radical prostatectomy			
Nephron-sparing surgery			

10. Do you have your own laparoscopic training box? Yes No
11. How often do you train with the laparoscopic box?
More than once per week Less than once per week
Once per month I do not train at all
12. Have you ever taken part in any laparoscopy course or fellowship?
Yes, national course Yes, foreign course
Yes, national fellowship Yes, foreign fellowship
No, I have not
13. Have you heard about the E-Blus exam? Yes No
14. Do you want to take the E-Blus exam? Yes No
15. How do you rate your current laparoscopic experience?
None Very weak Weak Satisfactory Good Very good
16. What is your expected laparoscopic experience at the end of residency?
None Very weak Weak Satisfactory Good Very good
17. Are you satisfied with the system of laparoscopic education in urology? Yes No
If no, please write the reason