



European Association of Urology



Laparoscopy

Modular Training for Residents with no Prior Experience with Open Pelvic Surgery in Endoscopic Extraperitoneal Radical Prostatectomy

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Article info

Article history:

Accepted October 25, 2005

Published online ahead of
print on December 6, 2005

Keywords:

Laparoscopic radical
prostatectomy
Resident training
Learning curve

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Abstract

Purpose: To establish a teaching program for the performance of endoscopic extraperitoneal radical prostatectomy (EERPE) that would ascertain the safe and efficacious training of residents with no previous experience with open pelvic surgery.

Materials and methods: The technique of EERPE was divided in 12 segments with 5 levels of difficulty. We thus designed a training program, where the resident learned the procedure in a mentor-defined schedule. During each educational EERPE, the trainee only performed the operative steps corresponding to his acquired skill level. The mentor performed the remaining parts of the EERPE, with the trainee assisting. The first 50 and consequent 100 cases performed by the residents were compared to the first 50 and last 100 cases (cases 521–621) performed by the mentor.

Results: Two residents with no prior experience with open pelvic surgery participated in the study, and required 43 and 38 procedures respectively, until they were considered to be competent. The initial 50 procedures performed completely independently by the residents had mean operative times of 176 and 173 minutes. There were 2 intraoperative rectal injuries (one patient developed recto-urethral fistula), and 1 hemorrhage, and 1 lymphocele, postoperatively. The positive margin rate for pT2 disease was 14.3 and 11.5%, and for pT3 tumors 38.8 and 29.1%, respectively. After an additional 100 procedures operated by the same residents, mean operative times were 142 and 146 minutes. There

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was one patient who needed a transfusion. Postoperative complications requiring re-intervention were 1 hemorrhage, 2 anastomotic leakages and 4 symptomatic lymphoceles. The positive margin rate for pT2 disease was 12.8% and 6.5%, and for pT3 tumors 33.3% and 26.3% respectively.

No statistical significant differences were observed when comparing with the mentors cases.

Conclusion: We have showed that residents with no prior experience in open surgery of the pelvis can adhere to the modular training scheme and successfully perform the EERPE procedure with similar risk of complications compared to the tutor.

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1. Introduction

Laparoscopic radical prostatectomy (LRP) is one of the most technically demanding applications in urology. Nevertheless, the technique has been developed profoundly, and standardized to a point that many institutions no longer offer their patients the choice of open radical prostatectomy [1-6].

Teaching operative skills is of paramount importance to urology resident training. Halstead first introduced a mentor- trainee model that has been applied for long as a scheme for teaching conventional surgical techniques to residents [7]. The era of laparoscopy has created new training needs and demands that are certainly not fulfilled by the existing training modalities. Laparoscopic skills differ to those of open surgery, being more related to endoscopy than to traditional laparotomy. Procedures are performed with the aid of a two dimensional video image, with decreased tactile feedback, paradoxical instrument movements, and a limited range of motion [8-11].

Introducing laparoscopy to urologists, who did not receive this type of training during their residencies, is indeed a difficult task. Transfer of skills based on techniques learned performing open surgery is neither appropriate nor effective. There have been a plethora of workshops during post-graduate education courses attempting to provide basic concept and more advanced notions of laparoscopic techniques. Colegrove et al. showed that only 54.3% of the attending trainees performed laparoscopic surgery 5 years after the workshop. In addition, urologists who had attended a structured and organized laparoscopic fellowship performed approximately 25 cases per year [12].

A variety of simulators, ranging from mirrored boxes to costly virtual reality interfaces, have appeared in the literature claiming to be effective in the acquisition and amelioration of laparoscopic skills. Nevertheless, there seems to be a concurrence among laparoscopists that practice on stimulators

improves performance on that precise simulator and facilitates performance in animal models. There is an ongoing debate regarding the need to demonstrate the effect of training on laparoscopic simulators on actual operating room performance [13-18]. There seems to be a concurrence that a well structured mentor based training program is the ideal way for mastering laparoscopic techniques in vivo [19-23].

Some authors advocate that LRP could represent a better model to start laparoscopy than nephrectomy. Even though technically more demanding, there is a limited risk of mortality due to uncontrolled haemorrhage as in a kidney ablative procedure. An additional question that is raised in the literature regards the amount of training necessary for the safe and effective performance of laparoscopic surgery [19].

We herein present a modular training scheme, which used individual steps of endoscopic (laparoscopic) radical prostatectomy (EERPE) for resident training. The aim of the present study was to establish whether the proposed training methodology would ascertain the safe and efficacious training of residents with no previous experience with open pelvic surgery, and finally compare their performance to the mentor.

2. Materials and methods

The technique of EERPE has been previously described in detail [24-26]. More than 900 procedures have been performed up to now in our centre. The technique of EERPE was divided in 12 segments with 5 levels of difficulty, 5 being the most difficult (Table 1). The aim of this categorization was to enforce standardization of the procedure.

2.1. Level of trainees

Two residents from our department of urology with no previous surgical experience with open pelvic surgery, participated in the study. Both residents attended at least one dry-lab course before they initiated the program. Previous

Table 1 – The 12 segments of EERPE, with 5 levels of difficulty

No of step	Description of surgical procedure	Module Level of difficulty
1	Trocar placement and dissection of the preperitoneal space	I
2	Pelvic lymphadenectomy	II
3	Incision of the endopelvic fascia and Dissection of the puboprostatic ligaments	I
4	Santorini plexus ligation	III
5	Anterior and lateral bladder neck dissection	II
	Dorsal bladder neck dissection	III
6	Dissection and division of vasa deferentia	III
7	Dissection of the seminal vesicles	III
8	Incision of the posterior Denonvillier's fascia- mobilisation of the dorsal surface of the prostate from the rectum	III
9	Dissection of the prostatic pedicles	III
10	Nerve sparing procedure	V
11	Apical dissection	IV
12	Urethrovesical anastomosis	
	Dorsal circumference (4, 5, 6, 7, 8 o'clock stitches)	IV
	3 and 9 o'clock stitches	II
	Bladder neck closure and 11 and 1 o'clock stitches	III

laparoscopic experience ranged from five varicocelectomies to 80 procedures performed as the main surgeon (Table 2).

2.2. Training program

The training program was performed on consecutive patients scheduled for EERPE at our department. No case selection was performed for training purposes.

No special standardized dry- lab program was attended by the residents. Nevertheless, they were encouraged to practice on a dry- lab trainer, especially suturing. In the beginning of the training process, the trainees assisted the mentor, first as camera holder and then as first assistant. Consequently, the trainees started to operate by themselves having the mentor as their assistant. The trainees however did not perform the whole procedure themselves. In contrast, they performed individual steps of the operation, according to the module system. We thus designed a training program, where the resident learned the procedure in a mentor-defined schedule. During each educational EERPE, the trainee only performed the operative modules corresponding to his acquired skill level. The mentor performed the remaining parts of the EERPE, with the trainee assisting. Each resident was required to perform the procedure in an identical step by step fashion.

Each resident initiated his training with module I and performed step 1 and 3 of the operation. The mentor then performed all the other steps of the operation, with the trainee assisting. This schedule was repeated during the following operations, until the mentor estimated that the trainee could proceed to the following level. Then the resident would move to module II, performing steps 2, 5 and 12, and so on. Thus, the trainee would gradually and safely perform all modules of the operation by himself.

2.3. Data evaluation

The first 50, and additional 100 (total 150) consecutive cases, which have been performed by the residents independently, were analysed and compared to the first 50 and last 100 cases (cases 521-621) performed by the mentor. The analysis of the

residents progress was based upon the mean operating time, transfusion rate, intraoperative and postoperative complications, postoperative positive margins, and continence results during a 3 month follow up period.

Postoperatively, a cystogram was performed on day 5 and the catheter removed if an anastomotic leak was excluded.

When applicable, statistical significance was determined using the non-parametric Mann-Whitney-test.

3. Results

Both residents completed the whole training program and reached level five successfully which enabled them to perform EERPE with nerve sparing independently. Depending on their ability and previous experience the trainees performed different numbers of operations on a particular module. After a phase of cameraholding and assisting during EERPE, the residents initiated the training program and required 43 and 38 procedures respectively, until they were considered to be competent (Table 2). During this phase one intraoperative epigastric vessel injury occurred, caused by trocar placement, managed successfully by laparoscopic coagulation and clipping. No other intraoperative complications occurred.

Three postoperative complications occurred during the modular training phase. One patient underwent a re-intervention (laparoscopic fenestration for a symptomatic lymphocele). One deep vein thrombosis, caused by a lymphocele was managed conservatively. One patient with urinary extravasation was treated by prolonged catheterization (>14 days) and recovered without any problems including incontinence or stricture.

Preoperative data of the initial 50, and subsequent 100 patients, on whom the trainees performed

Table 2 – Surgical experience of the residents before the beginning of the training program, and number of cases required by each trainee on every module, before proceeding to the next level of difficulty

Trainee	Previous Laparoscopic Experience no of cases performed as Assistant/ as surgeon	Previous Experience with EERPE No of cases performed as cameraholder/ as assistant	Operations on module 1	Operations on module 2	Operations on module 3	Operations on module 4	Operations on module 5	Total number of operations performed by each resident
1	122/80 (TEP,CCE, AE, VE)	4/140	2	7	15	7	12	43
2	0/5 (VE)	62/15	5	8	14	4	7	38

(TEP: total extraperitoneal hernioplasty with mesh placement, CCE: Cholecystectomy, AE: Appendectomy, VE: Varicocelectomy).

EERPE independently, as well as the first 50 and last 100 cases (cases 521–621) performed by the mentor are shown in Table 3.

An analysis of the first 50 procedures, performed independently by the residents revealed mean operative times of 176 and 173 minutes. Two patients required transfusion. In addition there were 2 intraoperative rectal injuries, both repaired intraoperatively with a laparoscopic double-layer suture. No other intraoperative complications occurred (Table 4). Postoperative complications requiring re-intervention were 1 recto-urethral fistula (one of the patients with rectal injury) where colostomy was deemed necessary, 1 hemorrhage treated by laparoscopic fulguration, and 1 symptomatic lymphocele drained percutaneously. The positive margin rate for pT2 disease was 14.3 and 11.5%, and for pT3 tumors 38.8 and 29.1%, respectively. Three months postoperatively 64% and 72% of patients required maximum 1 pad per day, respectively (Table 5). The analysis of an additional 100 consecutive patients (total 150) operated by the same residents, revealed mean operative times of 142 and 146 minutes. One patient required a transfusion. There was one intraoperative rectal injury repaired laparoscopically in situ. Postoperative complications requiring re-intervention were 1 hemorrhage treated with laparoscopic fulguration, two cases of anastomotic leakage treated by retrograde stenting of both kidneys with a single J ureteric catheter, and 4 symptomatic lymphoceles treated either laparoscopically ($n = 1$) or with a percutaneous drainage ($n = 3$). The positive margin rate for pT2 disease was 12.8% and 6.5%, and for pT3 tumors 33.3% and 26.3% respectively. Three months postoperatively 71% and 76% of patients required maximum 1 pad per day, respectively (Table 5).

The comparison of the residents with the tutors intraoperative and postoperative findings is clearly shown in Tables 4 and 5.

Mean organ weight was comparable between both residents and the mentor. There was no statistical significant difference regarding the number of additional intraoperative procedures, i.e. hernia repairs and pelvic lymphadenectomies. There was no statistical significant difference in operative time between the 2 trainees and the mentor. Nevertheless, there was an ameliorating trend suggesting reduction of operative time between the first 50 and subsequent 100 cases for both residents and the mentor. None of the patients underwent a conversion to open surgery. The transfusion rate was comparable among the two residents and the mentor.

Table 3 – Preoperative data of the first 50 and following 100 consecutive patients who underwent EERPE performed by each resident independently (total 300 patients)

Trainee/Mentor	1	2	1	2	Tutor	Tutor
No of patients	50	50	100	100	50	100 (cases 521–621)
Mean age (range)	63.9 (57–74)	65.2 (53–76)	63.3 (51–74)	62.6 (50–73)	63.9 (49–76)	62.4 (41–75)
Mean PSA ng/ml (range)	10.2 (4–24.3)	9.51 (3.3–25.3)	9.6 (1.4–36.9)	9.4 (3–80)	12.9 (4.2–50.7)	9.6 (0.64–59.2)
Prior pelvic surgery	HR (5)	HR (7)	HR (12)	HR (8)	HR (14)	HR (7)
(procedure, no of patients)	AE (9)	TEP (1) AE (5)	TEP (1) TAPP (1) AE (18)	TEP (3) TAPP (1) AE (15)	AE (11)	TEP (2) TAPP (3) AE (15)
Prior TUR – prostate	TUR-P (3)	TUR-P (2)	TUR-P (7)	TUR-P (5)	TUR-P (3)	TUR-P (6)

In addition, of the first 50 and last 100 tutors cases are presented. HR: herniorraphy, TEP: total extraperitoneal hernioplasty with mesh placement, AE: Appendectomy, TURP: transurethral resection of the prostate.

Table 4 – Intraoperative data for the series of patients operated independently by the residents and the tutor

Trainee/cases	1/50	2/50	1/100	2/100	Tutor/50	Tutor/100
Mean minutes operative time ^a (range)	176 (110–285)	173 (110–270)	142 (85–240)	146 (75–230)	172 (110–265)	135 (50–195)
Intraoperative Hernia repair; uni-, bilateral (n)	Unilateral (2)	Unilateral (3) Bilateral (1)	Unilateral (5)	Unilateral (3)	Unilateral (6) Bilateral (1)	Unilateral (12) Bilateral (1)
Pelvic lymphadenectomy (n)	13	12	31	28	42	42
Transfusion-rate	n = 2 (4%)	n = 0	n = 1 (1%)	n = 0	n = 0 (0%)	n = 1 (1%)
Intraoperative complications (n)	Rectal injury (2)	None	None	Rectal injury (1)	None	1× injury of the inter-ureteric crest (DJ placement, no sequela)
Mean organ wt, gram (range)	52.7 (36–78)	54.6 (28–83)	46.5 (18–141)	54.3 (21–166)	41.4 (19–84)	57.2 (28–123)

^a Mean operative time includes hernia repair and lymphadenectomy.

Table 5 – Postoperative data and positive margin rates for the series of patients operated independently by the trainees and the tutor

Trainee/cases	1/50	2/50	1/100	2/100	Tutor/50	Tutor/100
Mean days catheterization (range)	7.6 (4–20)	6.4 (4–20)	6.2 (4–20)	5.6 (5–15)	8.6 (6–22)	5.8 (4–20)
Postoperative complications within 1 month of surgery (treatment)	1× rectourethral fistula (colostomy) 1× Haemorrhage (Laparoscopic fulguration)	1× symptomatic lymphocele (percutaneous drainage)	1× Haemorrhage (Laparoscopic fulguration) 3× symptomatic lymphocele (1× laparoscopic fenestration, 2× percutaneous drainage) 2× anastomotic leakage (single J ureteral stent)	1× symptomatic lymphocele (percutaneous drainage)	1× symptomatic lymphocele (lap. fenestration)	2× symptomatic lymphocele (lap. fenestration) 1× bleeding (end. revision)
% positive margin						
pT2 (n)	14.3% (2/14)	11.5% (3/26)	12.8% (9/70)	6.5% (4/62)	18.2% (4/22)	7.8% (5/64)
pT3 (n)	38.8% (14/36)	29.1% (7/24)	33.3% (10/30)	26.3% (10/38)	37.5% (9/24)	25% (9/36)
Continence 3 months p.o. (max. 1 pad/day)	32/50 (64%)	36/50 (72%)	71/100 (71%)	76/100 (76%)	31/50 (62%)	82/100 (82%)

Postoperatively, there was no statistical significant difference regarding catheterisation time. Out of the 300 patients operated on by the trainees ten required reinterventions. All patients recovered after the reinterventions without further problems.

There were no statistically significant differences regarding positive margin rates and overall continence-rate (maximum of 1 pad/day) 3 months after the operation, between the two residents and the mentor.

4. Discussion

Laparoscopic applications are constantly expanding within urology practice. LRP has been considered to be one of the most technically demanding laparoscopic procedures in urology. Urology residents of numerous academic institutions follow an exclusively laparoscopic training program, having never performed radical prostatectomies in the conventional "open" way. In addition, laparoscopic techniques require psychomotor skills that are not essential in open surgery, such as hand-eye coordination within a three-dimensional space on a two-dimensional monitor [18,20,26,27].

The need for the creation of laparoscopic courses has thus emerged, and a variety of models have been developed to train residents in basic laparoscopic skills within a structured curriculum, in a controlled environment, and free of the emotional stress of operating on real patients. However box trainers offer an unrealistic environment.

The animal models offer an alternative training tool with greater realistic potential, but are still far from ideal. The anatomy of animal organs is not the identical to humans, there is very little fat around them, and there are no adhesions due to previous surgeries. Nevertheless, training with animal models enables mastering of dissection and haemostatic techniques in pulsating tissue, that can certainly not be performed in a dry lab [10,13-19].

Reports of virtual reality simulation for laparoscopy training are continuously appearing in the literature. Technical limitations do not allow them to reproduce a full realistic image, thus restricting their use in training processes [15,16,18,19].

Mentor based training seems to be the most efficient way of mastering advanced laparoscopic procedures. Fabrizio et al. proposed the mentor initiated approach where an experienced surgeon served as the mentor and performed a series of consecutive operations with the trainee acting as

assistant. Once the trainee has gained enough confidence the subsequent procedures were performed by the trainee with the mentor acting as assistant [21].

Bollens et al. have showed that initial dry lab training, assisting for at least 25 cases and a few steps of prostatic dissection were enough to be able to do a solo LRP in less than 5 hours from skin to skin. After the first 10 cases a visit to the centre of excellence was deemed necessary to resolve further problems [19].

Chou et al. proposed a mini fellowship program as a mentor- proctor-preceptor experience, such that each participant would have 2 days of laboratory experience under the guidance of an instructor, 2 days of operating room experience and didactic sessions, and a final day during which they would perform a laparoscopic clinical procedure with a proctor at their home institution [28].

We believe that a mentor initiated approach, combined with intensive dry and wet lab training is the way to go, especially for laparoscopic radical prostatectomy. The training scheme must include an operation with standardised steps and that also can be practised and performed frequently. The herein presented modular training system has the scope to train those with without or with intermediate level of laparoscopic skill whether they have prior open pelvic surgical experience or not. Indeed one of our resident had essentially no prior laparoscopic experience.

An important issue is whether this complex and difficult operation can serve as a training tool for residents without impeding patients safety and functional results? We have shown that rigid adherence to our modular teaching concept of EERPE throughout the entire training period, equipped the residents with the appropriate skills to overcome intraoperative difficulties and progress rapidly from module to module. Even though both residents completed successfully our training program, it would be reasonable to expect that some residents, due to decreased innate ability, would never be able to perform EERPE.

Previous open or laparoscopic experience did not seem to influence the performance of the residents in our program. Our findings concur with those of Frede et al. who have shown that based on the Heilbronn step by step laparoscopic training program the personal level of education and prior experience with open radical prostatectomy had a minor impact on the results and reproducibility of the laparoscopic radical prostatectomy technique. They also showed comparable oncological and functional outcomes as well as intraoperative

parameters among the different generations of surgeons [20].

Both our residents had never seen an open radical prostatectomy before. Furthermore, none of our trainees required conversion to open surgery. Based on these findings one could indeed question the old time classic belief that surgeons can only consider laparoscopic procedures once they have a considerable experience in the anatomy and process of the open operation. Adherence to the teaching phases in the beginning of training of this operation has proved that the residents developed the required skills to overcome intraoperative difficulties laparoscopically thereby avoiding the need for open conversion.

There is a debate among investigators regarding the number of required procedures to complete the learning curve ascertaining the safe and effective practice of advanced laparoscopic procedures. The learning curve for LRP has been estimated to be 40 to 100 cases [22]. In addition, it has been shown that surgeons continued to improve in terms of operative time even after 300 cases. The adherence to numerical values is of no particular importance. Tang et al. have showed that the training in laparoscopic skills should be more flexible and individualized as the innate ability for manipulative work varies amongst trainees- in other words some will achieve competence before others [10]. One must therefore consider that the conceptual knowledge and manual skill of various trainees may differ significantly.

A prerequisite for any training laparoscopic program is the need of a high volume of cases. We perform approximately 350–400 prostatectomies per year allowing for a training segmentation. Indeed more experienced trainees can mentor the newer residents in the easier modules thereby relieving the main mentor from the responsibility of teaching each trainee. The proposed model also allows for preliminary training in the less difficult modules to be performed in collaborating international institutions.

One of the most important issues regarding training and learning in medicine is functional outcome and safety of the patients. The modular training scheme enables the mentor to emphasise on the levels that must be reached by the trainee, before entering the next step of the procedure. This allows completion of each module to the highest of standards, and allows prompt intervention by the mentor when the trainee is failing to progress, ascertaining patient safety.

There were ten postoperative complications requiring reintervention out of 300 operated

patients caused by the residents. Once they operated independently only three major intraoperative complications occurred to the residents. This amounts to an intraoperative complication rate of 1%, which compares favourable with the literature. In total, the overall postoperative complication rate, including problems requiring reinterventions was 3.3%. The low incidence of intraoperative and postoperative complications suggests the firm establishment and standardisation of the method in our centre. Guilloneau et al. reported on a similar complication rate of 3.7% in 567 patients [29]. The series from Creteil and Heilbronn even reported initial complication rates of 23% and 13.7% respectively which decreased to 3.2% and 6.4% with increasing number of patients [30,31].

In the present manuscript, the mean operative time for the residents was among the shortest reported in the world literature, despite inclusion of the time for laparoscopic hernia repair and bilateral pelvic lymphadenectomy when needed. Only 3 patients operated by the first resident required blood transfusion, amounting to an overall transfusion rate for the trainees of 1%, which again compares favourable to the literature [32]. The positive margin rate were 10.5% and 32% for pT2 and pT3 tumours, respectively. The Charité group from Berlin reported an 18% positive margin rate for pT2 and 45% for pT3a and 50% for pT3b respectively analyzing the consecutive results of 2 experienced and 2 junior surgeons [32]. The Montsouris group described their experience of a single surgeon with his first 100 laparoscopic radical prostatectomies and found an overall positive margin rate of 12.8% in pT2 tumours and 31.8% in pT3 tumours [23].

When the data of the first 50 and following 100 consecutive cases performed by the residents were compared to the data of the mentors first 50 and 100 latest cases, no statistical significant differences were observed. The comparison suggests that a trainee can achieve the level of his mentor within a reasonable training period when strictly adhering to the herein proposed level based training methodology.

In conclusion, the herein proposed training scheme for teaching EERPE is feasible, safe and effective. Based on a highly standardized technique this concept offers a short learning curve, and it makes it possible to start with this complex procedure as a beginner or without experience in open pelvic surgery. While training residents is of paramount importance to the future of urology, it cannot come at the expense of patient safety. Therefore the main advantage of our modular training proposal is, that it provides training in a

highly complex laparoscopic procedure, without putting patients at risk.

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Editorial Comment

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Laparoscopic radical prostatectomy is a technically difficult procedure consisting of several operative ablative and reconstructive steps. Whereas the pioneers of this technique – based on previous experience with laparoscopic and open surgery had to develop the technique thereby mastering all the difficulties such as control of hemorrhage (i.e. ligation of dorsal vein complex) or endoscopic suturing (i.e. urethro-vesical anastomosis), their second task involved the development of training programs to teach this technique to following generation of urologists. These can be defined as second generation surgeons with previous experience in open radical prostatectomy and third generation surgeons no prior experience in open pelvic surgery (20).

In the meantime, several training programs have been presented consisting mainly of

- pelvitainers (i.e. dry lab)
- animal models (i.e. wet lab)
- clinical training.

In accordance with the authors, we believe, that a continuous training at the pelvitainer should be the basis to learn laparoscopic radical prostatectomy. Initially, this focuses on basic talents such as hand-eye-coordination, but later on this should lead to a perfect technique of endoscopic suturing. I am convinced, that the patient should no more represent the initial training site. On the other hand, neither virtual reality trainers nor animal models can replace clinical training with application of previously trained capabilities. However, in laparoscopic surgery the situation has changed significantly compared to open surgery, mainly due to the use of video-endoscopy. The magnification of video-endoscopic technology provides the surgeon with an enhanced appreciation for the anatomic details surrounding the prostate. Transmission of the image on a monitor allows for the entire operating team to appreciate the unique anatomic nuances of each individual case, a feature quite different from open surgery where typically only the surgeon wears magnifying loupes. This means, that from the time as second assistant, the trainee gets an optimal view of the “situs” of the

operation, something totally impossible during open surgery (i.e. holding a retractor). Subsequently, the trainee will be much easier capable to perform the specific steps of the laparoscopic procedure.

Exactly the idea to graduate the difficulty of the 12 different steps of laparoscopic radical prostatectomy into five difficulty levels, represents the main innovation of this interesting article of Stolzenburg and co-workers. Thereby the procedure serves as a well-defined training model. One may discuss, whether 3 and 9 o'clock stitches are really only level II, but the principle behind this approach should be adapted to further models of laparoscopic, but also open surgical training.

Beside this, the authors did also encounter, that – based in a dedicated training program - previous experience with open radical prostatectomy has no significant impact on the performance of the trainee. Therefore, we will nothing loose, if future generations are trained only in laparoscopic pelvic surgery (with or without robotic assistance).

Finally, identification and reduction of surgical error has received increasing attention in recent years. To minimize or avoid errors, it is important to understand both the error itself and the factors leading up to it, as well as the type of error that has been committed. This will lead to a methodology including training at simulators (not at the patient) with a comprehensive curriculum consisting of the following components [1]:

- didactic teaching of anatomy
- didactic teaching of steps of procedure
- didactic teaching of errors
- test
- psychomotor skills training on simulator
- performance and outcomes analysis with feedback to the trainee

It is expected, that these concepts will evolve over time and eventually improve to a point where surgical errors will be as uncommon as errors in other industries.

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Editorial Comment

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During the last decade, laparoscopic surgery has rapidly spread in the urological community, involving advanced and reconstructive procedures which require the acquisition of delicate laparoscopic skills. This resulted in an increasing need to rapidly qualify urologists in laparoscopic surgery and highlighted the need for effective training tools [1].

Training in laparoscopy is available using various modalities such as box trainers, animal and cadaveric laparoscopy and virtual reality simulators. As accurately discussed by the authors, it was proved for each of these modalities that intense training would result in better performance of the laparoscopic tasks. The contribution of such training to real surgery in the OR, although in my mind absolutely exists, is still controversial in the literature [2].

In this article, the authors took one step further and suggested a change not in training modality but rather in training concept. They challenged the “old school” where the mentor would assist his apprentice in surgery until a certain point when things got more difficult, and often take over from there, although along the procedure, there were still multiple opportunities for the apprentice to train. Their refreshing idea of pre-dividing the

surgery to twelve steps of different difficulty levels ensured that the apprentice would gain the most from every procedure in which he is participating.

Laparoscopic radical prostatectomy is accepted as one of the most challenging laparoscopic procedures in urology [3]. The authors showed an impressive learning curve of their residents, who had no previous experience in this surgery, and were able to perform this procedure following 38–43 sessions, with an operating time, success and complication rate which equal their mentors', and the reports from other centers.

Modular training is an important teaching concept and could be employed to other laparoscopic procedures as well as open surgery.

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