Gynecol Surg (2008) 5:265–267
DOI 10.1007/s10397-008-0425-7

PERSPECTIVE

What is the impact of surgical expertise and how to get it?

Judith A. F. Huirne · Robin Kennedy · Jens-Uwe Stolzenberg · Hans A. M. Brölmann

Received: 19 June 2008 / Accepted: 1 August 2008 / Published online: 27 August 2008

Abstract Every surgeon will experience a learning curve while performing a new surgical procedure. Developing surgical training will shorten the learning curve, with less deleterious effects on patients during this period. There are exciting initiatives in different branches of surgical training that will be applicable across all surgical disciplines. These involve the combination of didactic repetitive training, coupled with skills training where it is applicable. These initiatives will help to move the focus, from developing technical excellence for a few individual surgeons to a more widespread approach in the training of complex laparoscopic surgery, resulting in considerable health benefits to patients.

Keywords Laparoscopy · Training · Expertise · Gynecological surgery · Learning curve

This question implies three issues: is surgical expertise measurable? Can training improve the learning curve of the trainee in mastering a new laparoscopic procedure and if yes, how? And finally, what is the importance of the laparoscopic case load in maintaining surgical expertise?

Every surgeon will experience a learning curve while performing a new surgical procedure. Surgical expertise can be judged by operative duration, complication rates and various other outcome measures, depending on the procedure. In gynecology there are examples of improved results after the learning curve has been completed. A higher pregnancy rate was achieved in the second half of a series of laparoscopic salpingostomies [1]. In 75 endometrial cancer patients undergoing laparoscopic hysterectomy with pelvic lymphadenectomy, the number of lymph nodes harvested was significantly higher in the second phase of the study [2]. In laparoscopic hysterectomy reports, operating time and conversion rates decreased with experience, resulting in a reduction of complications [3–8]. Not surprisingly, similarities are seen elsewhere in the literature with a reduction in operating times and conversions for colorectal and urological surgery, despite an increasingly complex caseload [9, 10].

The objective of surgical training is to shorten the learning curve, reducing the deleterious effects on patients during this period. The dilemma facing surgeons during the development of complex laparoscopic surgery has been the difficulty identifying which methods of training add the most value to this process. Training outside the operating room can include surgery in live animals, cadavers, low-technology bench models, or computerized simulators (virtual reality) in order to enable the acquisition of surgical skills. In laparoscopic surgery, simulation is most easily offered by a low-technology model such as a conventional box trainer, using direct vision, or video images. Navigation of instruments, but also more complex tasks, such as suturing, can be trained. The face validity (the degree to which the model reproduces the desired features) of conventional box training is often felt to be higher

J. A. F. Huirne (✉) · H. A. M. Brölmann
Department of Obstetrics and Gynaecology,
VU University medical center,
De Boelelaan 1117,
1181HV Amsterdam, The Netherlands
e-mail: j.huirne@vumc.nl

R. Kennedy
Department of Surgery, Northwick St Mark's Hospital,
Park Watford Road, Harrow, Middlesex,
HA1 3UJ London, UK

J.-U. Stolzenberg
Universitätsklinikum Leipzig AöR,
Klinik und Poliklinik für Urologie,
Liebigstr. 20,
04103 Leipzig, Germany

than the virtual reality training as the former incorporates force feedback.

Recently, a systematic review was published [11] assessing models of laparoscopic surgical training. Thirty RCTs reporting on laparoscopic simulation were examined and, in general, their quality was felt to be low. There were large differences in training time, ranging from 10 min to 10 h, but also concealment of allocation (3/30) and blinding of the supervisor (15/30) were often not implemented. In many studies, the outcome of skills training was measured on the trainer itself rather than during real surgery in the patient, and, thus, its value—concurrent validity—is in doubt. Based on these studies, it was concluded that virtual reality (VR) training was better than no training, but this could not be confirmed for box (video) training. Despite this, in a criterion validation study of third and fourth year residents, it was demonstrated that a core curriculum of intensive video laparoscopic skills training improved not only technical, but also operative performance [12]. In this study, the 'criterion' was a partial laparoscopic salpingectomy that was video recorded and scored. Recently, Van Cleynenbreugel has reported that frequent, but time limited, training sessions are more effective to increase skills than occasional training of longer duration (personal communication). It seems likely that the use of some form of repetitive simulated training is likely to be beneficial either before or combined with appropriate human operative teaching.

The delivery of training has recently been taken further in a novel and organized fashion by dividing the procedure of laparoscopic radical prostatectomy, one of the most difficult laparoscopic urological procedures, into different modules depending on the degree of difficulty. Stolzenburg et al. [13] have reported that trainees with little or no laparoscopic experience can be taught to reproduce this procedure after a relatively short learning curve, with minimal complications and acceptable operating times. The training is spread over several centers with different trainers teaching the same operative techniques but with the most difficult portions of the operation being taught in the high-volume center with the most experienced trainer. This has the advantage of spreading the training burden, making the most effective use to the training opportunities and increasing the efficiency and safety of the surgery. Particular emphasis is placed on training the theatre nursing staff, as complex laparoscopic surgery is very much a team activity, and integrating skills training with repetitive video assisted learning. By adopting a modular approach, trainees can perform the simpler steps of the modular program in the low-volume centers available within many countries under the supervision of surgeons who are still developing their techniques for the more complex parts of the operation. The more difficult modules may then be completed by spending short periods of time at a high-volume center where surgeons are very experienced in the procedure and are more accustomed to training. This development would be equally applicable to other disciplines with similar benefits.

For many years, there has been genuine concern about whether there is an adequate caseload for specialists to develop expertise in a new technique and also maintain it. With respect to gynecological surgery, major surgical procedures are steadily declining while the number of gynecologists is increasing [14, 15]. In 2001, it was estimated that in the Netherlands, by the year 2010, a gynecologist would perform 40 major surgical procedures per year, a number far too low to allow innovation in surgery.

That caseload can affect the quality of complex surgery was well established after publication of the Leapfrog initiative [16]. For several complex procedures, such as coronary bypass graft or pancreatectomy, hospitals that did not meet Leapfrog Group volume thresholds were associated with significantly higher odds for in-hospital mortality when compared with hospitals that met Leapfrog Group volume thresholds. In laparoscopic colorectal oncological

Table 1 Surgical training statements according to their grade of recommendation

	Surgical statements	Grades of recommendation	
1	The learning curve of the laparoscopic hysterectomy is measurable	B	[8]
2	Virtual Reality (VR) training can improve the learning curve of the trainee in mastering a new laparoscopic procedure compared to conventional training	B	[11]
3	Box training can improve the learning curve of the trainee in mastering a new laparoscopic procedure compared to conventional training	C	[11, 12]
4	Frequent but time limited training sessions were more effective than occasional training of longer duration in acquiring laparoscopic skills	D	
5	Case load affects surgical expertise in complex surgery	B	[9, 16]
6	Case load affects surgical expertise in complex gynecologic- and colorectal laparoscopic surgery	D A	[10]

Grades of recommendation [18]: A Consistent level 1 studies, B Consistent level 2 or 3 studies or extrapolations from level 1 Studies, C Level 4 studies or extrapolations from level 2 or 3 studies.
D Level 5 evidence or troublingly inconsistent or inconclusive studies of any level.

surgery less satisfactory results with a low caseload have been reported, there being increased chances of conversion as the volume of procedures decreases. Similarly, in radical hysterectomy undertaken for cervical cancer, case load affected operating time and blood loss [17]. Whether skills can be maintained with a decreasing case load after completion of the learning curve is debatable. As surgical techniques and equipment are often evolving, it seems unlikely this would be the case, but it is clear that the volume of procedures undertaken is only one factor in the equation of surgical excellence.

In conclusion, developing surgical training will shorten the learning curve and improve the results of surgery to the patient's benefit. There are exciting initiatives in different branches of surgical training that will be applicable across all surgical disciplines. The levels of evidence of these initiatives are summarized in Table 1. These involve the combination of didactic repetitive training coupled with skills training where it is applicable. If the focus can now move from developing technical excellence for a few individual surgeons to a more widespread approach in the training of complex laparoscopic surgery, this will result in considerable health benefits to patients.

References

1. Dunphy BC, Shepherd S, Cooke ID (1997) Impact of the learning curve on term delivery rates following laparoscopic salpingostomy for infertility associated with distal tubal occlusive disease. Hum Reprod 12:1181–1183
2. Eltabbakh GH (2000) Effect of surgeon's experience on the surgical outcome of laparoscopic surgery for women with endometrial cancer. Gynecol Oncol 78:58–61
3. Wattiez A, Soriano D, Cohen SB et al (2002) The learning curve of total laparoscopic hysterectomy: comparative analysis of 1,647 cases. J Am Assoc Gynecol Laparosc 9:339–345
4. Altgassen C, Michels W, Schneider A (2004) Learning laparoscopic-assisted hysterectomy. Obstet Gynecol 104:308–313
5. Ikhena SE, Oni M, Naftalin NJ et al (1999) The effect of the learning curve on the duration and peri-operative complications of laparoscopically assisted vaginal hysterectomy. Acta Obstet Gynecol Scand 78:632–635
6. Kreiker GL, Bertoldi A, Larcher JS et al (2004) Prospective evaluation of the learning curve of laparoscopic-assisted vaginal hysterectomy in a university hospital. J Am Assoc Gynecol Laparosc 11:229–235
7. Malzoni M, Perniola G, Perniola F et al (2004) Optimizing the total laparoscopic hysterectomy procedure for benign uterine pathology. J Am Assoc Gynecol Laparosc 11:211–218
8. Makinen J, Johansson J, Tomas C et al (2001) Morbidity of 10,110 hysterectomies by type of approach. Hum Reprod 16:1473–1478
9. Tekkis PP, Senagore AJ, Delaney CP et al (2005) Evaluation of the learning curve in laparoscopic colorectal surgery: comparison of right-sided and left-sided resections. Ann Surg 242:83–91
10. Guillou PJ, Quirke P, Thorpe H et al (2005) Short-term endpoints of conventional versus laparoscopic-assisted surgery in patients with colorectal cancer (MRC CLASICC trial): multicentre, randomised controlled trial. Lancet 365:1718–1726
11. Sutherland LM, Middleton PF, Anthony A et al (2006) Surgical simulation: a systematic review. Ann Surg 243:291–300
12. Coleman RL, Muller CY (2002) Effects of a laboratory-based skills curriculum on laparoscopic proficiency: a randomized trial. Am J Obstet Gynecol 186:836–842
13. Stolzenburg JU, Schwaibold H, Bhanot SM et al (2005) Modular surgical training for endoscopic extraperitoneal radical prostatectomy. B J U Int 96:1022–1027
14. Grimes DA (1986) Declining surgical case-load of the obstetrician–gynecologist. Obstet Gynecol 67:760–762
15. Brolmann HA, Vervest HA, Heineman MJ (2001) Declining trend in major gynaecological surgery in The Netherlands during 1991–1998. Is there an impact on surgical skills and innovative ability? BJOG 108:743–748
16. Allareddy V, Allareddy V, Konety BR (2007) Specificity of procedure volume and in-hospital mortality association. Ann Surg 246:135–139
17. Trimbos JB, Hellebrekers BW, Kenter GG et al (2000) The long learning curve of gynaecological cancer surgery: an argument for centralisation. BJOG 107:19–23
18. Phillips B (2004) GRADE: levels of evidence and grades of recommendation. Arch Dis Child 89:489