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Universiteit Leiden



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Title: Laparoscopic hysterectomy : predictors of quality of surgery

Date: 2013-01-09

Chapter eight

Implementation of laparoscopic hysterectomy: maintenance of skills after a mentorship program

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Abstract

Objective

To evaluate the implementation and maintenance of advanced laparoscopic skills after a structured mentorship program in laparoscopic hysterectomy (LH).

Methods

Cohort retrospective analysis of 104 successive LHs performed by two gynecologists during and after a mentorship program. LHs were compared for indication, patient characteristics and intraoperative characteristics. As a frame of reference, 94 LHs performed by the mentor were analyzed.

Results

With regard to indication, blood loss and adverse outcomes, both trainees performed LHs during their mentorship program comparable with the LHs performed by the mentor. The difference in mean operating time between trainees and mentor was not clinically significant. Both trainees progressed along a learning curve, while operating time remained statistically constant and comparable to that of the mentor. After completing the mentorship program, both gynecologists maintained their acquired skills as blood loss, adverse outcome rates and operating time were comparable with the results during their traineeship.

Conclusion

A mentorship program is an effective and durable tool for implementing a new surgical procedure in a teaching hospital with respect to patient safety aspects, as indications, operating time and adverse outcome rates are comparable to those of the mentor in his own hospital during and after completing the mentorship program.

Introduction

Hysterectomy is the most frequently performed major gynecological surgical procedure worldwide.¹ The most common indication for hysterectomy is uterine fibroids, followed by dysfunctional uterine bleeding.^{1,2} Regarding the procedure, three different approaches can be distinguished: abdominal, vaginal and laparoscopic. Meta-analysis yielded that vaginal hysterectomy is the method of choice.³ Prerequisites for this approach are a uterus of fairly normal size with sufficient descensus and no additional adnexal pathology to be expected. In 1989, laparoscopic hysterectomy (LH) was introduced as an alternative to abdominal hysterectomy (AH).⁴ Compared to the abdominal approach, this procedure showed benefits of lower intraoperative blood loss, a smaller drop in hemoglobin level, shorter duration of hospital stay, speedier return to normal activities, fewer wound or abdominal wall infections, and fewer unspecified infections. However, due to a long learning curve for surgeons and longer operating time, accompanied by reports of possible higher risks of bladder and ureteric injury, the popularity of LH has been hampered.⁵⁻⁸ Regarding the latter, recent research has revealed a decline in bladder and ureteric injury rates in LH to percentages comparable to AH after completing the learning curve.⁹ Despite advantages for the patient and promising developments as stated above, implementation of LH in the Netherlands (among other countries) is proving to be rather slow.^{1,10} A plausible cause for this situation is the absence of training in LH [as well as other advanced level (level 3) gynecological laparoscopic procedures, according to the RCOG-classification] during residency.^{11,12} Gynecologist trainees, therefore, would be willing to perform LHs after specialization, but hesitate to do so, as they consider themselves as rather untrained.¹³

Other specialties researched and demonstrated that recruitment of an advanced laparoscopic surgeon positively influences the number of procedures and learning curve of the trainee, as well as the resulting increased transfer of skills to its residents.^{14,15} To measure the possible effect of a mentorship program in general, a research group studied data before and during implementation of advanced laparoscopic gynecological surgery in a teaching hospital. Its observations showed that a mentorship program facilitated the implementation of advanced laparoscopic surgery, which resulted in an increase in advanced procedures, while no increase in conversion and complication rates were observed.¹⁶ As mentioned above, although LH already has proven to be a valuable addition to the surgical palette of modes in hysterectomy, its implementation remains to be rather slow. This study aims to evaluate the implementation and maintenance of advanced laparoscopic skills after a structured mentorship program in LH in a teaching hospital.

Materials and Methods

In 2001, the obstetrics and gynecology department in a Dutch teaching hospital decided to implement the technique of LH with the use of a structured mentorship program. Two gynecologists with a special interest in gynecological laparoscopy and several years of experience in level 2 laparoscopic procedures were assigned to be trained. As a mentor, an advanced laparoscopic gynecological surgeon from an affiliated university hospital was

hired. LHs (i.e. total laparoscopic hysterectomies) were planned on a biweekly basis. During every procedure the trainee was the primary surgeon. The mentor acted as the assisting surgeon. His position could be compared with the role of a driving instructor: he taught, guided, advised and intervened if necessary. This way the trainee was instantly able to perform the full procedure while patient safety was guarded. The trainees were trained subsequently and on an individual basis. The end of the mentorship program was determined as the moment the trainee as well as the mentor judged the newly acquired technique to be accomplished adequately and safely with minimum transfer of skills from mentor to trainee during the procedure. A series of independently performed procedures by the trainee up to June 2008 were analyzed or evaluating the maintenance of the acquired skills. As a frame of reference, the series of successive procedures during the study period performed by the mentor in his own hospital were analyzed.

Data for this study was collected retrospectively via a prospectively kept database. Patient and intraoperative characteristics (length of surgery, blood loss, uterus weight, length of hospital stay and morcellation), as well as adverse outcomes, were extracted from medical charts. Both hospitals register adverse outcomes as defined by the Dutch Society of Obstetricians and Gynecologists.¹⁷

Primary outcomes were length of surgery, blood loss and adverse outcomes. In addition, patient characteristics and indication for surgery were recorded in order to assess similarity between groups. A method to construct a learning curve per trainee was adapted from Rogers et al.¹⁸ and was defined as the relation between length of surgery and the successive procedures. This curve was determined during and after the mentorship program to check for maintenance of the acquired skills. The effect of the mentorship program was determined by comparing length of surgery, blood loss and adverse outcome rates of both trainees with the performance of the mentor during and after the mentorship program. During the study period, annual hysterectomy rates for every approach were recorded. Indications for LH were categorized as uterine fibroids, dysfunctional uterine bleeding, endometriosis/abdominal pain and endometrial/cervical (pre) malignancy.² Analysis was performed using SPSS 16.0 statistical software (Chicago, Ill., USA). Differences between groups were assessed with the Chi square test for proportions in independent samples and t tests for continuous variables with a normal distribution. Trends for length of surgery were assessed with singular linear regression. R values (correlation coefficients) and 95% CI were calculated; p values < 0.05 were considered statistically significant.

Results

The first trainee performed 25 LHs over a period of 48 months before completion of the traineeship was reached. After completion, she performed 33 procedures in 33 months. The second trainee needed 22 LHs to be performed under supervision over a period of 30 months. After completion, he performed 24 LHs in 20 months. During the integral study period, the mentor performed 94 LHs in his own hospital. Patient characteristics (age: mean 45.9 years, 95% CI 44.5–47.4, SD 8 7.1, range 30.2–64.2; parity: mean 1.7, 95% CI 1.4–1.9, SD 8 1.2, range 0–5; BMI: mean 25.2, 95% CI 24.4–25.9, SD 8 3.9, range 16–37) were comparable between hospitals during and after the mentorship program ($p = 0.059$, 0.278 and 0.077 , respectively). Dysfunctional uterine bleeding (45%) and uterine fibroids (35%) were the main indications for surgery in both hospitals. Intraoperative characteristics between both trainees and their mentor were comparable during as well as after the mentorship program (table 1). Although the mean length of surgery for the procedures performed by the second trainee during his mentorship program was longer compared to his mentor, the mean length of surgery between the trainees during the mentorship program was equal ($p = 0.647$). Intraoperative characteristics of the procedures performed by the mentor remain constant during both mentorship programs. Adverse outcome rates [e.g. (bladder) infection, fever, blood loss more than 1 liter, blood transfusion] were comparable during and after completing the mentorship program between mentor and trainees together (19 and 16%, respectively), as well as among the trainees themselves ($p = 0.611$, $p = 0.188$, respectively). Severity of adverse outcomes is also comparable ($p = 0.229$, $p = 0.245$, respectively; table 2). A graphical representation of the learning curves of both trainees during and after completing their mentorship program is shown in figures 1 and 2. For both trainees, singular linear regression demonstrates a constant trend in length of surgery during the mentorship program ($R = 0.184$ and $p = 0.844$, $R = 0.144$ and $p = 0.180$, respectively), as well as a constant trend after completing the mentorship program ($R = 0.235$ and $p = 0.876$, $R = 0.069$ and $p = 0.572$, respectively). The dashed line in the charts represents the mean length of surgery of the mentor. Figure 3 demonstrates the annual trend in hysterectomies (subdivided by approach) in the trainee hospital during the study period. The total annual number of hysterectomies remains constant ($p = 0.398$), whereas the proportion of LHs has an increase which is statistically significant ($p = 0.001$) at the expense of AHs ($p = 0.002$).

Discussion

A mentorship program in LH is an effective and durable tool in order to implement a new surgical technique in a teaching hospital with respect to patient safety. Indications, operating time and adverse outcome rates were comparable to those of the mentor in his own hospital, both during and after completing the mentorship program. By consulting the mentor (regarding the

Table 1 Intraoperative characteristics during and after mentor-traineeship

	I: During mentor-traineeship			II: After mentor-traineeship			III: Reference outcomes			P value		
	1 st trainee (n=25)			1 st trainee (n=33)			Mentor (n=94)					
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range		I vs II	I vs III
Length of surgery (min)	139 ± 55	(60-320)		150 ± 49	(70-290)		127 ± 32	(60-240)		N.S.	N.S.	.003
Blood loss (mL)	318 ± 451	(25-2200)		169 ± 199	(25-900)		187 ± 260	(25-2000)		N.S.	N.S.	N.S.
Uterus weight (grams)	302,6 ± 200	(60-775)		247 ± 200	(35-830)		211 ± 145	(35-630)		N.S.	N.S.	.020

	2 nd trainee (n=22)			2 nd trainee (n=24)			Mentor (n=75)			P value		
	1 st trainee (n=33)			1 st trainee (n=33)			Mentor (n=94)					
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range		I vs II	I vs III
Length of surgery (min)	146 ± 37	(75-235)		176 ± 58	(85-335)		125 ± 31	(60-240)		N.S.	.003	.0001
Blood loss (mL)	142 ± 101	(25-400)		246 ± 470	(25-2300)		168 ± 274	(25-2000)		N.S.	N.S.	N.S.
Uterus weight (grams)	206 ± 133	(36-492)		279 ± 238	(64-850)		216 ± 154	(35-630)		N.S.	N.S.	N.S.

T-test was used for analysis of continuous variables

Table 2 Adverse events during and after mentor-traineeship

	I: During mentor-traineeship		II: After mentor-traineeship		P value
	AE / total	%	AE / total	%	
Trainee-hospital	9/47	19.1	9/57	15.8	N.S.
Mentor-hospital	12/52	23.1	7/42	16.7	N.S.

Chi square test was used for proportions. AE = adverse event.

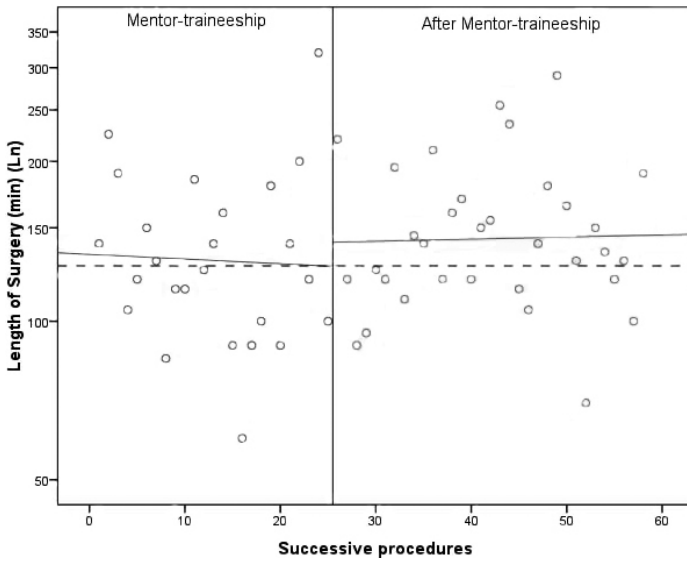


Figure 1 Learning curve of the first trainee during and after accomplishing her mentor-traineeship. The y-axis represents length of surgery (measured on a logarithmic scale), as the x-axis represents the successive procedures during mentor-traineeship. Singular linear regression demonstrates a statistic non-significant decline in length of surgery during mentor-traineeship ($P = .844$) as well as a constant trend after completing mentor-traineeship ($P = .876$). The interrupted line represents the mean length of surgery of the mentor.

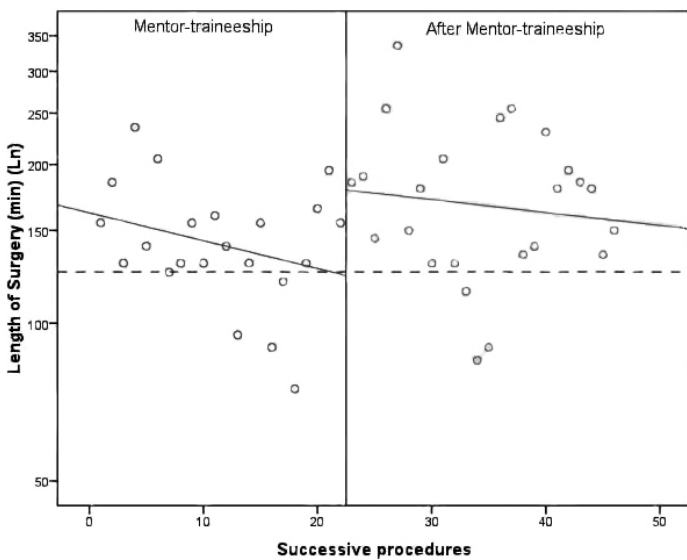


Figure 2 Learning curve of the second trainee during and after accomplishing his mentor-traineeship. The y-axis represents length of surgery (measured on a logarithmic scale), as the x-axis represents the successive procedures during mentor-traineeship. Singular linear regression demonstrates a statistic non-significant decline in length of surgery during mentor-traineeship ($P = .180$) as well as a constant trend after completing mentor-traineeship ($P = .572$). The interrupted line represents the mean length of surgery of the mentor.

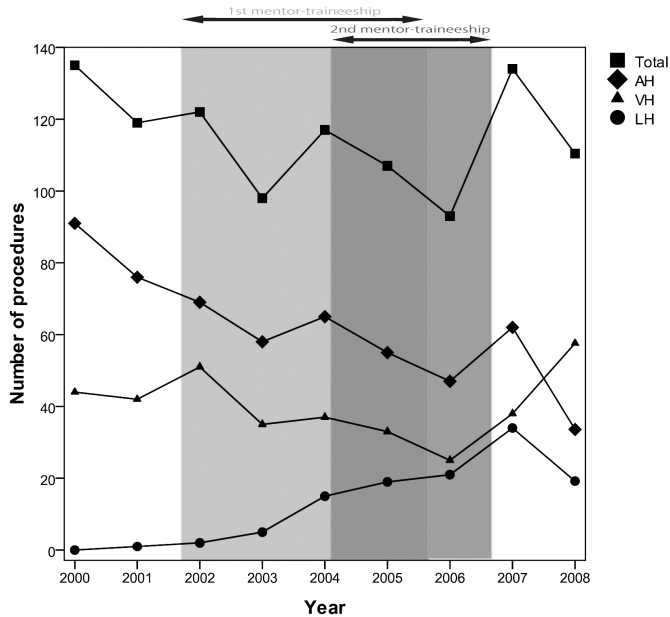


Figure 3 The annual trend in hysterectomies (subdivided by approach) in the trainee hospital during the study period is shown. The total annual number of hysterectomies remains constant ($P = .398$), whereas the number of LHs increase statistically significant ($P = .001$), at the expense of AHs ($P = .002$).

assessment of accurate indications) on a frequent basis, patient characteristics as well as indication proportions were found to be transferable. Studies in the fields of urology and surgery confirm our finding of maintenance of newly acquired laparoscopic skills.^{14;15} While length of surgery remained statistically constant, both trainees progressed along a learning curve as the mentor's role was gradually phased out. It is important to be aware of the fact that the mentor dosed the amount of knowledge per session. In this way, trainees could experience tailor-made learning moments, while length of surgery was guarded. Consequently, no redundant lengthy procedure was performed with the accompanying raised risk of adverse outcomes, which is known to be present especially at the beginning of an autodidactic learning process.⁹ After completing the mentorship program, both trainees maintained the same tempo as compared with the mentor. Comparable outcomes were also found in another study: procedures performed by residents in a teaching setting can be accomplished with low risk of adverse outcomes and a clinically nonsignificant lengthier procedure.¹⁹ In the presence of the mentor, the trainee was able to become familiar with the new procedure and its instruments, thereby creating a safe environment. Additionally, the mentor had the opportunity to coach the operating room team with respect to adaption to the new set-up. After all, availability and knowledge of material by the entire operating room team is paramount when we aim for safe implementation of minimally invasive surgery.²⁰

A prerequisite for a successful mentorship program as introduced in this model is that the trainee consults the mentor on a frequent basis to discuss patients and their possible indication for LH. Consequently, a comparable collection of patients can be selected from the very beginning.

As a major limitation, apart from its expense, we consider this method of mentorship program to be time-consuming. Acceleration of the traineeship could be achieved by raising the caseload via a fellowship or by centering multiple sessions for several trainees in one hospital. Other alternatives such as training in skills labs and plenary training weekends will possibly offer the essential techniques but leave out the 'total package' of performing LHs on personally selected patients in a familiar operating room.

Implementation of new surgical techniques needs time to habituate. This is illustrated by the fact that it took the second trainee almost half of the time necessary to complete his mentorship program, compared with the first trainee (30 vs. 48 months). This initial delay is explained by the need of the trainees as well as their referring colleagues to grow accustomed to the indication for LH. A distinct fall in the number of performed AHs after introducing LH confirms an accurate selection of patients and emphasizes this procedure to be a valuable addition to the surgical palette of modes in hysterectomy.

By gradually applying newly acquired skills in a controlled environment, both trainees succeeded in operating with adverse outcome rates comparable to their mentor.

Our research suggests 22–25 LHs need to be performed under supervision until one has gained sufficient experience to operate independently. Similar numbers are suggested by others.^{6,21} However, in order to objectify the endpoint of the mentorship program more accurately, we suggest considering measuring tools like OSATS in future research, though, until now, OSATS is only validated as an 'in vitro' skills assessment tool.²² A warranted transfer of skills is important where advanced laparoscopic skills need to be obtained after completing basic surgical specialization.¹¹ The mentorship program, as depicted in this article, proved to be a safe method. When applying this method of transfer, the supplementary advantage of the 'next generation' becoming familiar with the above mentioned procedure should not be underestimated. In this way, assisting residents will already be conversant with the new instruments, the procedure and the correct indication for LH during their specialization. With this in mind, a deliberate choice to use LH techniques might be considered later on. The advantages mentioned above will improve the current slow implementation in concerned countries. Whereas minimal invasive surgery does not answer the old adage 'see one, do one, teach one', our method of mentorship has been proven to be a safe, effective and durable tool for acquiring advanced laparoscopic skills. In this way we will be able to offer more patients the profits of minimally invasive hysterectomy in the very near future.

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