An exploratory project to develop an effective educational system to teach mastery of assistant laparoscopic gynecologic surgery skills

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Abstract

Introduction: In laparoscopic surgery, the cooperation of the first assistant surgeon is essential for the creation and maintenance of an appropriate and safe surgical field. The aim of this study is a validation of the impact of our educational system for first assistant laparoscopic surgeon residency in a single university-affiliated teaching hospital.

Methods: Five residents were recruited for this study. We created a slide-set as an educational tool using Microsoft's PowerPoint that was in line with our surgical procedure to master the assistant skills of laparoscopic gynecologic surgery. Immediately after surgery, the attending doctor and residents reviewed videos of the first assistant's operative procedures. This study evaluated the effect of our educational check-list against the transition of evaluation scores before and after training in two groups of residents, those with minimal experience (Group 1) or with high experience (Group 2).

Results: Before receiving our training tool, there was an expected significant difference in the review scores of the two experience groups (29.1 ± 3.1 vs 48.7 ± 3.9 , $p=0.01$). After our modified training, the inexperienced residents of Group 1 received review scores comparable to or higher than those of the experienced residents of Group 2 (81.9 ± 5.9 vs 70.4 ± 7.5 , $p=0.23$). As they assisted with more surgeries, the concordance between the resident's self-assessment and the attending doctor's assessment scores increased significantly ($p<0.001$).

Conclusions: Our educational system for first assistant surgeons is effective for new residents, as it proved capable of imparting them with many of the same skill sets as much more experienced attending doctors.

Introduction

The outcomes of surgeries significantly depend on the skills of the primary surgeon but are also strongly influenced by the competencies of the entire surgical team. Effective coordination among the members of the collective operative team, including the surgeons, anesthesiologists, and nurses, can contribute to a smooth operative procedure and better outcomes [1-9].

The first assistant surgeon plays a critical role in the operative procedure by creating the appropriate surgical field, providing good traction, and ensuring an optimal view of the dissection plane. Mastering the assistance skills to become the exquisite operator needed for laparoscopic surgery is also necessary for controlling the safety of the surgery. However, to our knowledge, an educational system for producing first assistant surgeons for laparoscopic surgery has yet to be reported.

In Japan, medical care is largely decentralized, unlike overseas, where it is often done at high-volume specialty centers. Hospital case volumes can positively influence the purely objective outcomes of surgery, such as operative time, blood loss, and risk for conversion to laparotomy [10-12]. Because of the decentralization in Japan, the number of specialized experiences per doctors is often small, so the proper

surgical education in a low-volume center is a critical issue, as it must balance the effective training of its residents against surgical safety.

Instructor feedback is an essential component of all surgical education. Although feedback increases the efficiency and reduces the time needed to reach a certain proficiency level [13-15], inefficient feedback requires an excessive amount of time. It is thus important for educational clinicians to create a laparoscopic educational system that combines with an appropriate feedback system.

This study evaluated the efficacy of our innovative educational system, equipped with a more effective feedback system, to improve the ability of new surgical residents to master their assistant skills in laparoscopic gynecological surgery.

Materials And Methods

Participants

Five residents receiving their training at Osaka University between April 2016 and March 2017 were recruited into this study. According to the number of previous cases of gynecologic laparoscopic surgery they had already experienced, the five residents were divided into two groups: Group 1 (n=3) was the less experienced group (the number of previous cases experienced was less than 40), and Group 2 (n=2) the number of previous cases experienced was more than or equal to 40.

An educational tool used to teach laparoscopic operative procedures

In laparoscopic gynecologic surgery for benign conditions, properly identifying the ureter is one of the most important operative procedures for accomplishing the surgery safely, so we stylized our operative procedure for identifying the ureter. First, we open the pelvic sidewall triangle and identify the ureter and the para-rectal space. We play up these procedures to accomplish total laparoscopic hysterectomies safely. Total laparoscopic hysterectomy and laparoscopic salpingo-oophorectomy involving these procedures were included in this study. All laparoscopic surgeries and evaluations were performed at our Osaka University Hospital.

We broke down the various operative procedures and created a Microsoft PowerPoint slide presentation with animations, videos, and illustrations describing the anatomical schema in each segmented step to master the surgical procedure (**Figure 1**). Residents postoperatively self-reviewed their operative procedures while referring to the educational tool checklist.

Assessment procedure

Immediately after the surgery, two experienced attending doctors evaluated the resident's procedure at the three stages of the residency experience: "0" was the stage at which the residents could do nothing, "1" was the stage at which residents can do supervised tasks, and "2" was the 'unsupervised stage. The

residents self-evaluated their procedure.

Educational system

Residents were responsible for reviewing their operative procedures in response to the attending doctor's assessment of each segmented operative procedure. In particular, the attending doctors encouraged the residents to review any operative procedure in which there was a gap between the resident's self-assessment and that of the attending doctor.

Primary Outcome

The primary outcome of this study was the objective evaluation of the transition of new resident's evaluation scores from before to after training in each experience group.

After completion of the educational system

Using the VAS scale, the residents were asked to express their subjective level of satisfaction with our novel educational system.

Statistical Analysis

Analysis of the subject's baseline characteristics was performed using the Mann-Whitney U Test. Differences between the transition of scores in both groups were tested using Pearson's Chi-squared test. We created a scatterplot of the concordance rates between the resident's self-assessment scores and the attending doctor's assessment scores using ANOVA. Statistical analyses were performed using JMP-14 software (SAS Institute, Inc., Cary, NC, USA), and $p < 0.05$ was considered to indicate a nominal statistical significance.

Results

Residents' characteristics

Table 1 lists the background characteristics of the residents. The residents of Group 2 has experienced on average more cases before our specialized training than did the residents in Group 1 (45 ± 5 vs 20 ± 15 , respectively, $p = 0.127$). For that reason, for their first assessed surgery at the start of their training, the more experienced residents of Group 2 had a higher evaluation score than Group 1 (48.7 ± 3.9 vs 29.1 ± 3.1 , $p = 0.010$). During the training course, there was no difference in the number of cases experienced between the two groups (12 ± 4 vs 7 ± 2 , $p = 0.20$).

Transitioning of the scores during the training course

Figure 2A displays the transition in evaluation scores in each group from before to after training. Before training, there were significant differences between the scores of each group (29.1 ± 3.1 vs 48.7 ± 3.9 , $p = 0.01$). However, after training, the less-experienced residents of Group 1 had achieved the same level of competency as had Group 2 (81.9 ± 5.9 vs 70.4 ± 7.5 , $p = 0.23$). Residents of both groups were able to

increase their scores significantly from the beginning to the end of their training: (Group 1: from 29.1 ± 3.1 to 81.9 ± 5.9 ; Group 2: from 48.7 ± 3.9 to 70.4 ± 7.5). **Figure 2B** shows the progression of scores for each individual resident during the study. The trainees all achieved higher scores as they experienced more surgeries.

Change of evaluation concordance during training

Figure 3 indicates the changes of concordance between the resident's self-assessment and the attending doctor's assessment of the resident's actions. In the beginning, the concordance rate between the two assessments was only 51%, but as the resident experienced more surgeries, the concordance increased significantly ($p < 0.001$).

Degree of satisfaction after completion of this educational system

Figure 4 shows the resident's level of satisfaction, using the VAS scale, with our educational system ($87.4 \pm 7.5\%$). All residents gave us predominantly positive feedback for our educational system. Concrete examples of the feedback were, "The Excel table made it possible to review in detail my procedures", "Having fun while accumulating meticulous improvement of my operative procedures helped me set goals for becoming a better operator", and "Instead of an ambiguous evaluation, this educational system clearly revealed my good points and guided improvements in my first assistant operative procedure using stylized surgery."

Discussion

This study clearly demonstrates the efficacy of our advanced educational system for first assistant laparoscopic surgeons in residency, whose importance is unquestioned. [16]. However, there have as yet been no reports regarding similar educational systems to be used for training first assistant surgeons and their operative procedures.

It is well established that intraoperative feedback appears to be associated with an improvement in surgical performance [17]; however, the distractions of constantly interrupting the operative procedure to provide and receive live feedback make performing a smooth operation difficult. Our video-recorded surgical feedback system needs only a few minutes to set up and does not interrupt the operation in any way. Immediate postoperative feedback of segmented operative procedures increases the amount of information provided in a permanent record form. By using our educational system, novice residents quickly caught up to the more experienced residents and all participants expressed a high level of satisfaction with the training.

Finnesgard *et al.* found that having a more experienced certified surgical assistant (CSA) led to significantly shorter operative times for laparoscopic pancreaticoduodenectomies [9]. Kim *et al.* found that having a novice first assistant resulted in longer operative times during laparoscopic sigmoidectomies, but this difference was canceled out after an initial learning curve of 10 cases [18].

As mentioned above, there are several reports regarding the importance of the first assistant surgeon, but as yet no articles on educational programs for them. In this study, we have developed an educational system that quickly, in just one year, brings less-experienced residents up to the same level as more experienced operators. In addition, as case experiences accumulated, there was a higher concordance achieved between the resident's self-assessment and the attending doctor's assessment. Having the same perspective for operative success as the attending doctor is very important for a first assistant surgeon.

In Japan, medical care is decentralized and the number of specialized experiences per resident surgeon is unusually small, thus complete mastery of the necessary highly technical operative skills is fairly difficult. This novel post-operative educational system will help to overcome this particular disadvantage.

The results of this study should be interpreted in the context of its limitations. First, this was a pilot study and thus had only a small sample size of five residents. If the sample size had been larger, different results might have been derived. Encouragingly, however, following this modified training, the inexperienced Group 1 accomplished a higher evaluation score than did Group 2, strongly suggesting that this educational system was effective. It would be interesting to see, in a much larger sample size, if this learning advantage for inexperienced surgeons holds up, as it would vindicate that old saying, 'You can't teach an old dog new tricks' – i.e., that once trained, the more experienced residents stuck with doing things the way they first learned them.

Second, this study was confined to a single university teaching center's experience, which limits both the study's ability to establish causative relationships and also limits the generalizability of its results. It will be necessary to further investigate whether the effects of this educational system are extendable to multiple institutions. Nevertheless, this study shows that residents entering at various experience levels at the beginning of this educational system could reach the same level of competency in a relatively short period with only a small number of cases for experience, regardless of the total number of prior cases under their belt.

Our immediate-post-operational video-review educational system for first assistant surgeon training is highly appropriate and effective. Further efforts toward better quality and expansion of operative procedures are obviously necessary.

Declarations

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Authors' contributions

M. Kakuda, E. Kobayashi, S. Matsuzaki, Y. Ueda, K. Yoshino and T. Kimura conceived and planned the experiments. M. Kakuda and E. Kobayashi carried out data collections. M. Kakuda, E. Kobayashi, S. Matsuzaki, Y. Ueda, K. Yoshino and T. Kimura contributed to the interpretation of the results. M. Kakuda took the lead in writing the manuscript. All authors provided critical feedback and helped shape the research, analysis and manuscript. The authors read and approved the final manuscript.

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Availability of data and materials

All data generated or analysed during this study are included in this published article [and its supplementary information files].

Declarations

Ethics approval

This study was approved by the Institutional Review Board of Osaka University (approval #10302, approved on March 11, 2011) and complied with the ethical principles contained in the Declaration of Helsinki (1964) and its later amendments. Written informed consent was obtained from all participants prior to participation in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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The authors thank A. Yagi and K. Sakiyama for administrative assistance in the preparation of this paper. This study involving human participants, human material, or human data was performed in accordance

with the Declaration of Helsinki and was approved by the Institutional Review Board and the Ethics Committee of the Osaka University Hospital (approval #10302, approved on March 11, 2011).

Disclosure

The authors report no conflict of interest.

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Tables

Table 1. Resident's characteristics

	Group 1 Inexperienced (n=2)	Group 2 More experienced (n=3)	<i>p</i> -value
Postgraduate year	6, 6	6, 6, 7	–
Number of laparoscopic surgeries experienced at the beginning (n, mean ± SD)	5, 35	41, 44, 50	0.127
Score of first surgery % possible, mean ± SD	29.1 ± 3.1	48.7 ± 3.9	0.010
Number of laparoscopic surgeries experienced while at our institution (n, mean ± SD)	12 ± 4	7 ± 2	0.231

Figures

Method of identify the ureter

- Peritoneal traction is important as it is usually invisible

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Method of identify the ureter

- Peritoneal traction is important (The ease of the process depends on your traction of left hand).

Figure 1

A sample of our educational slides

Group 1

Group 2

Figure 2

A. Transition of scores

B. Transition of individual resident scores

Broken curve: shift of resident's scores, straight line; approximate straight line of each resident's score

Figure 3

Scatterplot of concordance rates between resident's self-assessment and the attending doctor's assessment according to the chronologic order of the cases The straight line was a trend line

Figure 4

The level of resident's satisfaction with this training method