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The Effectiveness of Laparoscopic Training Box On Learning Curve In Gynecology Residents

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ABSTRACT

Laparoscopy poses a significant role in routine surgical operations recently. However, it needs a surgical skill and education programs to be applied safely and effectively. The aim of this study was to investigate the impact of laparoscopic training box practice on the learning curve in gynecology residents.

The study was conducted over for 6 months at our hospital laparoscopic simulation room. Twenty gynecology residents; aged range of 26 to 35 years, of either sex, who had not to have senior experience on laparoscopy were attended the education program. Each participant was given a list of tasks to perform during the six months of a training program. Each resident were allowed to work on a training box every two days of the week for six months. The baseline and sixth months evaluation scores were recorded. The recommended tasks were as: task 1 (loops and wire), task 2 (pea on a peg), task 3 (post and sleeve), task 4 (wire chaser), task 5 (holding the needle), and task 6(suturing and knot tying). Each task's time was measured from start to completion and the time was recorded at baseline and the sixth months of the training program.

The mean age of the participants was 28.3±1.8 and 12 were female and 8 were male residents. The mean scores of time taken to perform tasks at baseline evaluation were as follows: task 1 (32±8, second), task 2(34±6, second), task 3(50±10, second), task 4(34±5, second), task 5(60±12, second), task 6(300±100, second). The mean scores of time taken to perform tasks at 6th month of the evaluation were as follows: task 1 (22±4, second), task 2 (18±6, second), task 3 (34±8, second), task 4 (22±4, second), task 5 (40±8, second), task 6(250±50, second). When analyzing the improvement in surgical skill about concerning the time of task completion. There was a statistically significant difference between the baseline and at the 6th months of the training program ($p<0.05$).

The present study confirmed that laparoscopic training box improved the surgical skills of gynecology residents and was found to be effective for improvement of learning curve in the education of minimally invasive surgery practice.

Keywords: Training box, laparoscopic surgery, gynecology, learning curve, surgical skill

Introduction

Laparoscopy is the preferred type of surgery for the majority of cases in gynecologic practices (1). It has been shown that minimally invasive surgery including mainly laparoscopic approach has been associated with a shorter duration of hospital stay, less postoperative pain, decreased mortality rate, and improved cosmetic outcome (2). However, despite the laparotomic technique, laparoscopy needs a learning curve and it requires surgical skill and related to longer operation duration at the beginning phase. Laparoscopic surgery has some different aspects from open approaches with regards to the 2-D vision, loss of tactile sensation of tissues, and long instruments that causes some minor movement tremor (3). And also, laparoscopy needs an important learning curve that does not cover the traditional residency education of attending the surgery and just observation. It requires active participation in the surgery and practice by the surgeon himself or herself.

To improve the laparoscopic surgical skills, there are two types of simulators in which residents can do some practice before performing surgery on the patients directly at the operation room. The laparoscopic simulators are two types: training box and virtual reality trainers. These two simulator systems have been investigated in the training program and have been shown to increase the surgical ability to do laparoscopic operations. The training box system is somehow inexpensive and resembles directly to the same laparoscopic instruments that can be used in animal models or some synthetic models when compared to the virtual systems (4). It has been reported that repeated practicing in the laparoscopic system is crucial to improve surgical skill and increase the learning curve (5). Although the current pelvic

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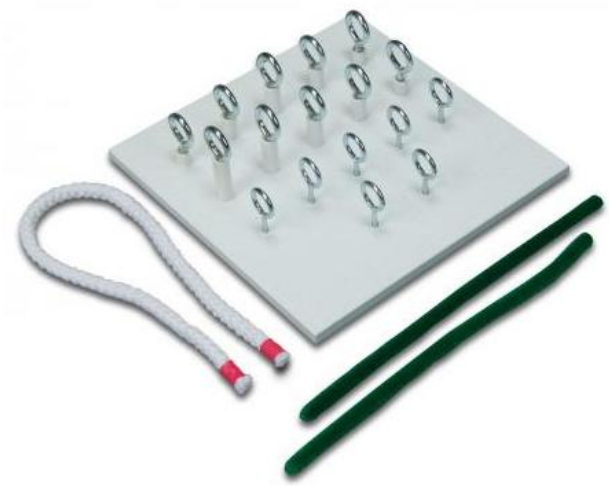

Fig. 1. Shows the 'loops and wire", Task 1

Fig. 2. Shows the Pea on a Peg, Task 2

floor simulation boxes seem to be beneficial in the education of gynecology residents, their use in routine practice still requires to be validated.

The aim of the current study was to evaluate the effectiveness of laparoscopic training box on learning curve of some predefined surgical skills in gynecology residents.

Material and Methods

This study was conducted as prospective non-randomized trial at a university hospital between November 1, 2019 and December 1, 2020. The twenty postgraduate gynecology residents with no advanced experience in laparoscopy were included in the study. They did not use the training box before the study. All residents were informed to fill a questionnaire including the demographic data regarding age, gender, the duration of residency and handedness, and any previous experience on laparoscopic surgery or training boxes. In the begining, the system was introduced to the participants by a senior consultant gynecologist

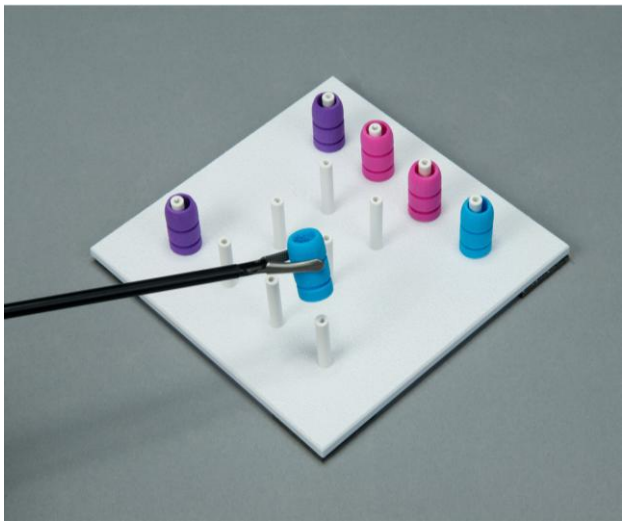

Fig. 3. Shows the 'Post and sleeve", Task 3

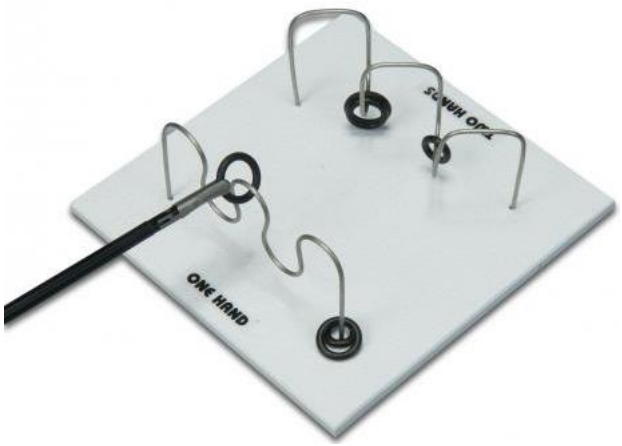

Fig.4. Shows the 'Wire chaser", Task 4

regarding the basic laparoscopy principles, the type of instruments, and the tasks that to be completed.

The training was spread over a period of six months. Each participant was instructed to attend the training program twice a week for 6 months. The training time was limited to 30 minutes for each participant. A training program's chart was created that shows the time and day of the participant's practice on the box. Six laparoscopic tasks were determined and every participant performed these tasks. The tasks were included and explained as follows:

Task 1: Defined as "loops and wire" that the resident should put a loop and pass through the wire. (Figure 1)

Task 2: Defined as "Pea on a Peg" that the resident should collect the peas on a peg. (Figure 2)

Table 1. Demographic Characteristics of The Residents

	Residents in training box group (n:20)
Age, years (mean±SD)	28.3±1.8
Female/Male, (n)	12/8
Dominant hand, (n)	
Right	20
Left	0
Previous training box experience	0
Year of education, (n)	
First-year	12
Second-year	8

n: number, SD: standard deviation

Table 2. Pre-Training And Post-Training Scores of Completed Tasks

P value	Pre-training score	Post-training score
Task 1(Loops and wire), second 0.01	32±8	22±4
Task 2 (Pea on a peg), second 0.001	34±6	18±6
Task 3 (post and sleeve), second 0.02	50±10	34±8
Task 4 (wire chaser), second 0.01	34±5	22±4
Task 5 (Holding the needle), second 0.001	60±12	40±8
Task 6 (suturing and knot tying), second 0.01	300±100	250±50

P<0.05 indicates statistical significance. The results are presented with mean±standard deviation.

Task 3: Defined as ''Post and sleeve'' that the resident should grab a post and put it on the sleeve. (Figure 3)

Task 4: Defined as ''Wire chaser'' that the resident should chase a plastic ring material in the wire. (Figure 4)

Task 5: Defined as ''Holding the needle'' that the resident takes a needle and correct it in normal position.

Task 6: Defined as ''Suturing and knot tying'' that the resident should make a suture after holding the needle and make a surgical knot tying.

The primary outcome of the study was the measurement of the time taken to complete these tasks. All these task measurements were done objectively by an automatic stopwatch and recorded. The time measurement was written as seconds. The time taken to complete each task was measured at two steps as firstly at the beginning of the training program and secondly at the end of the training program (at the sixth month of training). The pre-training and post-training scores were compared.

Statistical Analysis: Data were analyzed by using the SPSS Statistics package program 20.0 (IBM; Armonk, NY). Data are presented as means ± standard deviation. The normality of the data was assessed using the Shapiro-Wilk test and this was not met. Therefore, the Wilcoxon signed-rank test for related data was used to assess differences between pre-training and post-training scores. A P value of <0.05 was considered as statistical significance.

Results

A total of 20 residents were enrolled in the trial. All residents completed the study. The mean age of the residents was 28.3±1.8 years. 12 of them were female and 8 were male.

The mean age of the female residents was 27.3±2.4 and the male residents was 28.1±2.3. There was no significant statistical difference between female and male residents with regard to age. (1) The dominance of the right hand was observed in 20/20 residents. 8 out of 20 residents were in their second year of education and 12 were in their first year of education. The laparoscopic experience was questioned and none of the residents had an advanced level of laparoscopic skill and education. They did not study on the training box before.

The pre-training baseline measurement of each task completion time was found as for: task 1 (32±8, second), task 2(34±6, second), task 3(50±10, second), task 4(34±5, second), task 5(60±12, second), task 6(300±100, second). The mean scores of time taken to perform tasks at 6th month of evaluation (post-training measurement) were as follows: task 1 (22±4, second), task 2 (18±6, second), task 3 (34±8, second), task 4 (22±4, second), task 5 (40±8, second), task 6(250±50, second). (Table 2) When analyzing the improvement in surgical skill with regard to the time of task completion. There was a statistically significant difference between the scores of the baseline and at the 6th months of the training program ($p<0.05$). Time taken to complete all the tasks was shorter in residents at the end of the training box program. The trial resulted that the training box education improved the laparoscopic surgical skill of gynecology residents.

Discussion

The current study presents that the laparoscopic training box education can improve the surgical skills of the gynecology resident's performance. Laparoscopy has been implemented with increasing frequency into the current surgical education. It is demanding both by physician and also by the patients. It is well-known data that laparoscopy has been associated with a shorter hospital stay, less pain, and improved cosmetic results (6). Laparoscopic surgery differs from conventional open surgery with regards to the that it needs hand-eye coordination and pshyco-motor surgical skills (7). Surgical skills competence and education are one of the most wanted tasks of resident training.

There are several methods to improve the surgical skills of residents and make them comfor and self-confident during performing these procedures. Training box and virtual reality training programs which are computer-based techniques have been studied in the literature and reported that box trainer can improve the surgical skills (1). In the past, surgeon candidates watched the video to improve their skills however, it usually improves only the cognitive skills of the participants such as comprehension and understanding of the surgery. Box training with hands-on surgery performance is mandatory to improve the psychomotor competence.

The more important aspect of these training programs is coming from the fact that it is highly effective in inexperienced participants. Scott et al. reported that undergraduate students had more beneficial effects of simulators when compared to experienced postgraduate surgeons (8). They reported that maximum benefit could be taken with 30-35 repeated training on such tasks. In our study, the majority of participants were inexperienced on laparoscopic surgery and this might have a positive effect on the successfullness of the training program.

In the literature, there is some studies that compare the effectiveness of virtual reality simülatör with the conventional training box programs. The authors conducted a study with three weekly training sessions lasting 30 minutes each (1). It was reported that both trained groups had remarkably improvements in all parameters measured including motion analysis and error scores. In this study, the box trainer group showed remarkably better outcomes on most of the parameters. Likewise, Akdemir et al. conducted a study that investigated whether laparoscopic skills acquired via structured spaced training on a box trainer persist after 6 months (9). They reported that structured training with a box trainer improved laparoscopic skills, but deterioration was evident within 6 months.

The present study has some limitations. First, it has a small number of subjects; larger sample size is required to validate the outcomes. Second, the personal skill differences might have some effect on the interpretation of results.

In conclusion, our findings show that 30 minutes of structured use of a box trainer for two days each week for 6 months is useful for basic laparoscopic skill improvement. It can be recommended that every surgeon who desires to improve their laparoscopic surgical skills should practice on a low-cost box trainer.

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References

1. Munz Y, Kumar BD, Moorthy K, Bann S, Darzi A. Laparoscopic virtual reality and box trainers: is one superior to the other? Surg Endosc 2004; 18: 485-94.
2. Bridges M, Diamond DL. The financial impact of teaching surgical residents in the operating room. Am J Surg 1999;177(1):28–32.
3. Clevin L, Grantcharov TP. Does box model training improve sur- gical dexterity and economy of movement during virtual reality laparoscopy? A

randomised trial. Acta Obstetricia et Gynecologica 2008; 87: 99-3.
4. Scott DJ, Young WN, Tesfay ST, Frawley WH, Rege RV, Jones DB. Laparoscopic skills training. Am J Surg 2001; 182: 137-2.
5. Lee TD, Genovese ED. Some reminiscences on distribution of practice effects. Res Q Exerc Sport 1989;60(3):297–9.
6. Karaman E, Aras A, Çim N, Kolusarı A, Kızıltan R, Çelik S, Anuk T. Maternal and fetal outcomes after laparoscopic vs. Open appendectomy in pregnant women: data from two tertiary referral centers. Ginekol Pol. 2016;87(2):98-103. doi: 10.17772/gp/58752. PMID: 27306285.
7. Borahay MA, Jackson M, Tapısız OL, et al. Assessment of minimally invasive surgical skills of pre-medical students: What can we learn from future learners? J Turk Ger Gynecol Assoc 2014;15(02): 69–73. Doi: 10.5152/jtgga.2014.0044
8. Scott DJ, Young WN, Tesfay RN, Frawley WH, Rege RV, Jones DB, authors. Laparoscopic skills training. Am J Surg. 2001;182:137–42.
9. Akdemir A, Zeybek B, Ergenoglu AM, Yeniel AO, Sendag F. Effect of spaced training with a box trainer on the acquisition and retention of basic laparoscopic skills. Int J Gynaecol Obstet. 2014 Dec;127(3):309-13. doi: 10.1016/j.ijgo.2014.07.015. Epub 2014 Aug 13.