

# ROLE OF ENDOTRAINERS IN LAPAROSCOPIC SURGICAL TRAINING OF YOUNG SURGEONS

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## ABSTRACT

**Objective:** To access the role of endotrainers of laparoscopic surgery in training of postgraduate general surgical trainees.

**Material and Methods:** This study was carried out at Skill lab of Surgical B Unit of Lady Reading Hospital, Postgraduate Medical Institution (PGMI), Peshawar. Duration of the study was one month from June 2013 to July 2013. Fifteen surgical trainees from third year and fourth year of residency were included in this study.

**Results:** A home made, inexpensive endotrainer wooden box was used. The basic steps of laparoscopic surgery were chosen like Peg transfer, ligating endoloop, intracorporeal knotting and extracorporeal knotting. The time before starting training for all these three exercises was noted and it was compared with time after one month training on endotrainers. A cutoff time was not assigned for each task. The residents who were trained with the endotrainer performed the peg transfer task (at start of training it was 5 minutes 50 seconds vs. 2 minutes 35 seconds at end of training  $P=0.012$ ). The group that was randomized to the endotrainer laparoscopic training also performed significantly more efficiently with the Endoloop task (12 minutes 45 seconds vs. 7 minutes  $P = .015$ ) and intracorporeal knotting (7 minutes 13 seconds vs. 2 minutes 10 seconds,  $P = 0.049$ ) at 1 months when compared with their initial evaluation. For extracorporeal knotting (11 minutes 40 seconds vs. 3 minutes 20 seconds  $P = 0.015$ ). Residents were quick and safe at the end of one month training in basic laparoscopic skills.

**Conclusion:** Endotrainer is an excellent device for training in laparoscopy. It is a safe and convenient for surgical trainees to practice the various basic laparoscopic surgical without the pressures of the operating room.

**Key Words:** Endotrainers, Simulations.

## INTRODUCTION

Nowadays, the laparoscopic approach represents the gold standard for a wide range of various basic and advanced procedures. Minimal access surgery is a safe technique in most of surgical procedures. The training in minimal access surgery has always been difficult in developing countries due to limited resources, lack of skill labs and endotrainers. The learning skills can be improved by endotrainers even in repair of groin and ventral hernias. The endotrainers are not only useful for trained and experienced surgeons, it shows good results even for surgical residents. There is a need to train general surgeons and Laparoscopic surgeons outside operation theaters. This method of learning is cost effective, patient safe and devoid of less complications. To reduce the learning curve in advanced laparoscopic surgery, in this era a lot of advances are

introduced in General and Laparoscopic Surgery like Robotic and telerobotic surgical trainings. The ability of a good procedure is that it should be safe and secured for patients.<sup>1</sup> Minimal access surgical training is a dilemma for third world country due to lack of facilities like formal animal labs, in-affordability of conventional endo-trainers and lack of trained endo-surgeons. It is very difficult to introduce a newly introduced procedures in such countries where not only the patients but the traditional departments are reluctant to accept newer ideas and newer trends in both open and laparoscopic surgery. An easily affordable, home made, inexpensive endo-trainers can be used for pre-operation table practice. Audio-visual seminars can be arranged during such trainings. This training module can be employed not only by urban hospitals but also by rural hospitals to improve the skills of endo-surgery.<sup>2</sup> The laparoscopic surgery has been rapidly accepted and implemented by majority of the general surgeons. Individual hospitals, which have the interest for different trainings in laparoscopic surgery can train their surgeons on endo-trainers before operating real patients<sup>3</sup>.

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In this era, the laparoscopic surgery is the gold standard for a wide range of various basic and advanced procedures<sup>4</sup>. In order to improve the learning curve in basic and advanced laparoscopic surgery, the search for new teaching tools and training methods is of prime importance which can train the surgeons outside Operation Theaters. Recently a lot of advances are developed in open and Laparoscopic Surgery like Robotic surgical training. It consists of system training and procedural training. System training should be formally organized and should be based on competence, instead of time based. Procedural training should be developed in a stepwise objective assessment manner.<sup>5</sup> Surgeons can now perform operations on their patients while sitting at a distant area like in telerobotic operations. The evolution of telerobotics into clinical practice is as questionable like the introduction of laparoscopic cholecystectomy in the late 1980s.<sup>6</sup>

## MATERIAL AND METHODS

This study was carried out at surgical skill lab of Surgical Unit B, PGMI Lady Reading Hospital from January 2012 to July 2013. This lab is in process of establishment. It is a fully self support skill lab in whole Lady Reading Hospital, Peshawar. After thorough discussions with senior surgeons and faculty of laparoscopic surgery, we developed a training policy to train the surgeons over a period of time through various exercises before allowing them to assist in the actual laparoscopic surgeries. A home made, inexpensive endotrainer wooden boxes were designed for these exercises. An inexpensive camera was placed inside box which was connected with a computer monitor. The basic steps of laparoscopic surgery were chosen like a Peg transfer, ligating endoloop, intracorporeal knotting and extracorporeal knotting. An additional

benefit observed were hand and eye coordination, depth perception, tactile feedback. They were very much improved as observed by the faculty of surgical B Unit. The time before starting training for all these three exercises was noted and it was then compared with time taken for each of this procedure after one month training on endotrainers.

## RESULTS

The endo-training of postgraduate trainees occurred over a 1-month period, during which a series of tasks were assessed at 0 and 1 month on a wooden box endo-trainer. Each trainee's performance was reviewed by an experienced laparoscopic surgeon blinded to the training status and identity of the subject. Each exercise was scored for time. The residents were not informed of the time of testing and were blinded to the fact that they were being recorded. All statistical analysis evaluating the efficacy of the interventions were measured with 95% confidence intervals. Analysis was initiated by evaluating the distribution of time taken for each activity at start of training and after one month. Time was measured by means and standard deviations. t-tests was used to evaluate the efficacy of the training intervention.

Our study group consisted of 15 third and fourth year surgery residents. There was a little variability between the third and fourth year residents performance during their initial assessment (time 0), suggesting that both sets of residents were not trained to laparoscopic techniques. During the 1-month assessment, the residents who were randomized to the endotrainer training were more efficient in completing their tasks than initially evaluated. The residents who were trained with the endotrainers performed the peg transfer task (at start of training it was 5 minutes 52 seconds vs. 2 minutes

**Table 1: Comparison of improvement of time taken for each procedure before and after training**

| Tasks                   | Initial time before training on endotrainers                                                        | Time after one month training on endotrainers                                                          |
|-------------------------|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Peg transfer            | 05 minutes 45 seconds to 10 minutes 25 seconds (mean 05 min 52 seconds) Task Failure 2              | 01 minute to 4 minutes 12 seconds (mean 2 minutes 34 seconds) Task Failure none                        |
| Ligating loop           | 12 minutes 25 seconds to 14 minutes and 40 seconds. (Mean 12 minutes and 45 seconds) Task failure 2 | 06 minutes and 30 seconds to 08 minutes and 20 seconds (Mean 07 minutes and 30 seconds) Task failure 1 |
| Intracorporeal knotting | 11 min 30 seconds to 18 minutes 20 seconds (mean 7 min 13 seconds) with. Task Failure: 3            | 3 minutes 40 seconds to 4 min 12 seconds (mean 2 minutes 10 seconds) Task Failure: 2                   |
| Extracorporeal knotting | 10 min 45 seconds to 20 minutes 25 seconds (mean 11 minutes 40 seconds) Task failure: 2.            | 2 minutes 10 seconds to 4 minutes and 25 seconds (mean 3 minutes 20 seconds) Task failure: None        |

34 seconds at end of training ( $P=0.012$ ). It was a much quicker task after their 1-month assessment versus their initial evaluation. The group that was randomized to the endotrainer laparoscopic training also performed significantly more efficiently with the Endoloop task (12 minutes 45 seconds vs. 7 minutes  $P = .015$ ) and intracorporeal knot tying (7 minutes 13 seconds vs. 2 minutes 10 seconds,  $P = 0.049$ ) after 1 months when compared with their initial evaluation. For extracorporeal knotting (11 minutes 40 seconds vs. 3 minutes 20 seconds  $P = 0.015$ ).

## DISCUSSION

The recent approach has been introduced in order to decrease complications of Laparoscopic cholecystectomy which is a single-port access (SPA) laparoscopic surgery. SPA cholecystectomy was initially introduced by where two trocars were introduced through a single umbilical incision results in scarless surgery with lesser pain<sup>8</sup>. Many studies have been documented which revealed SPA cholecystectomy is an effective and safe method as compared to traditional laparoscopic surgery<sup>9</sup>. Surgical residents can be trained for both open and laparoscopic on simulations. The two-dimensional visual hands-on training is important for the training of laparoscopy and endoscopic surgery<sup>10-11</sup>. Now a days, a more useful training module by using virtual reality simulators is rapidly used<sup>12-13</sup>. Vlaovic and McDougall reported that surgical simulation may improve residency experience and training. The surgical simulations can develop the ability to learn new skills and strengthen the competency of the candidates. Surgical simulation will be an important innovation in traditional surgical training skills which will allow surgeons to develop their experiences in the minimally invasive surgery. The pioneer surgeons who were a role model in Laparo-endoscopic surgery, they were excellent in the open surgery. They introduced and learned laparoscopic and endoscopic surgery after they had mastered traditional open surgery. In contrast, young surgeons now learn open and Laparo-endoscopic surgery simultaneously, or they learn laparoscopic surgery first followed by open surgery (e.g., cholecystectomy). The learning of young surgeons is opposite to the conventional teaching system. Some surgeons are in favor of open surgery and show little interest in learning laparo- endoscopic surgery<sup>14</sup>.

According to Funch-Jensen the surgery is rapidly revolutionized into laparoscopic procedures and the classical open surgery will not be familiar in future except for some exceptions<sup>15</sup>. The techniques of the Laparoscopic surgery are different from open general surgery. However such techniques should be included

in general surgery residency programs until that time the additional training for laparoscopic surgery are appropriate<sup>3</sup>. The introduction of advanced laparoscopic surgical skills into surgical residency is mandatory. The competent performance of advanced laparoscopic operations is a dynamic processes. It is important to develop curriculum guidelines for resident training in laparoscopic surgery. There should be measures by which resident and faculty training in advanced laparoscopic surgical skills should be implemented. As the number of laparoscopic operations are increased now a days so the opportunities for residents to learn required skills are increased. It will improve the safety of operations. Sanchez-Santos et al worked on new Laparoscopic bariatric team. It may be associated with a higher number of postoperative complications due to the long learning curve. In his study they selected two groups: (1) without formal laparoscopic bariatric training (thirteen surgeons) and (2) with formal laparoscopic bariatric training (five surgeons). Postoperative complications were more frequent in group 1 which was 18.1% ( $\pm 7.6$ ) vs. 7.7% ( $\pm 1.96$ ,  $p = 0.046$ ) in group 2; also mortality was more common in group 1: 0.57% ( $\pm 0.87$ ) vs. 0% ( $p = 0.05$ ) in group 2. A training in laparoscopic bariatric surgery will play its significant role in significant reduction in postoperative complications and mortality.<sup>16</sup>

In recent years, simulation has been using for teaching technical skills to surgical trainees. In developed countries, there is a paradigm shift towards the use of simulation-based training. There are some limitations like a decrease in work hours for residents in laparoscopic theaters, short training programs, a decrease in available operating-room time, and ethical issues of patients. In future trainees will learn all basic and advanced skills in a supervised training environment. Simulations are safe for practice and minimal chances of error. They provide good opportunities for learning in order to standardize the experience for trainees. A large variety of models are currently available for training. These models range from high-fidelity animal or cadaveric models to virtual-reality simulators.<sup>17</sup>

In different studies different models of simulations are used like Giger et al used Thiel human cadavers for laparoscopy training in colon, vascular, hernia and bariatric surgery. In Thiel cadavers, the preservation of color and consistency of cadaveric tissues are done. Moreover, it would be beneficial to determine which aspects of surgical training are likely to benefit from cadaver training and to preserve the valuable resource for these particular skills. Educational institutions have focused on improving the facilities and techniques required to run cadaveric training.<sup>18</sup>

## CONCLUSION

Endo-trainers are excellent aid to training in laparoscopy and it allows trainees to practice the various surgical procedures without the pressures of the operating room. It permits the repetitive performance of a single task to allow the trainee to develop hand-eye coordination and motor skills before entering the real-patient setting and the learning curve for any laparoscopic procedure is smooth and in less time.

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