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学 位 論 文 題 名 (Title of dissertation)

Development of safe and efficient training system for laparoscopic inguinal hernia repair surgery

(安全かつ効率的な腹腔鏡下鼠径ヘルニア修復術のトレーニングシステムの構築)

Introduction:

Despite the gain in its popularity in recent years, laparoscopic inguinal hernia repair (LIHR) is hampered by the technical difficulty of the procedure. The procedure has a long learning curve and there are few training systems using simulators, and these systems are not feasible in the setting where residents are distributed over a wider variety of the hospitals. For novices, assessment of their performance and providing them with formative feedback plays a vital role in development of their skills. The objective of my research project was to develop a novel education system based on assessment and feedback.

I divided the project into three phases

Phase 1: Development and validation of the Assessment tool

Objective: To develop an assessment tool to assess the performance of LIHR, transabdominal preperitoneal (TAPP) procedure and demonstrate its validity using the video recordings of the surgical performance.

Method:

The TAPP checklist, which can be used to assess the performance of TAPP repair with the procedure video and to give appropriate feedback to the surgeon, was developed by the hernia experts from multiple institutes. Checklist consisted of list of twenty-four important steps of TAPP procedure and details of what was expected in each step. Thirty unedited TAPP videos of various levels surgeons were collected from eleven institutes. Three blinded hernia experts rated these videos using newly developed TAPP checklist. Inter-rater reliability, construct and concurrent validity were evaluated.

Results:

The Inter-rater reliability between 3 raters was 0.75 (95%CI 0.60-0.86). The median total score of each group demonstrated significant difference between experienced (>50 TAPP), intermediate ($TAPP\ 10 \leq$, <50) and novice ($TAPP <10$) surgeons ($p < 0.001$).

Conclusion: TAPP checklist is a valid tool for the assessment of the surgical skill of TAPP procedure using surgical video.

Phase 2: Development of the Educational system

Objective: To develop an educational system using for TAPP procedure.

Method: I developed a TAPP educational video explaining each item of the TAPP checklist and basic knowledge of the procedure. A training manual was developed for the instructors that would help them

to educate, evaluate and give feedback to the trainees using the TAPP checklist. I integrated a training tool with the evaluation and feedback where the trainees used them to learn the procedure.

Phase 3: Validation of the new educational system

Objective: To evaluate the educational impact of the TAPP education system on novice surgeons.

Method: Residents and surgeons from participating hospitals, who had performed 0 or 1 TAPP procedure were recruited for this study. The participants were randomly assigned to Intervention Group (IG) who trained under the educational system developed in phase 2 and Control Group (CG) who trained using the conventional system. They were required to send the surgical videos of their TAPP cases. These videos were rated by blinded raters. All the participants performed their first case before randomization as control. The participants scoring more than 20 (full marks 24) in their first case were excluded from the study. IG then received the educational tools and both ratings and feedback from their surgery. They were allowed to perform further cases after they met the predetermined operator criteria. The improvement of the TAPP checklist scores in both each group from case 1 to 3, and the 3rd case score between 2 groups were compared.

Result: The eighteen participants from 9 institutes were recruited for this study. Seven participants in IG and 5 participants in CG completed the study and were included in the final analysis. There was no difference between the backgrounds of the participants. From their first case to third case, the participants in IG significantly improved their scores from 12.4(SD 3.7) to 21.3 (SD 2.0) ($p=0.008$). On the other hand, the scores of the participants of CG did not change significantly from their first case 15.4 (SD 2.6) to third case 16.4 (SD 4.7) ($p=0.52$). The IG score of 3rd case was also significantly higher than that of CG ($p=0.04$).

Conclusion: The newly developed TAPP educational system was effective in improving the TAPP performance of novice surgeons.

Discussion: Assessment and feedback is very important for the training of novices. It helps them identify the portions that they need to work on and helps in deliberate practice, leading to the improvement in their performance. One of the advantages of video assessment system is to get performance evaluation and feedback by the external experts. Other validated educational system for LIHR are mainly simulation based training, making it suitable only for large teaching hospitals. Our educational tool has been able to drastically improve the performance of novice trainees mainly by using the systematic approach to the education and utilizing video assessment and feedback system and tools that were readily available in each individual hospital. The positive impact of this tool was noted on the novices scattered over variety of hospitals.

The TAPP checklist uses several subjective terms, however, these terms have been avoided at the critical aspects of the procedure. The RCT didn't show the significant difference in the patient outcome as it was also not our main objective. Also as these studies were done in the controlled environment, the instructors took over the case to avoid patient complications.

Overall conclusion:

This newly developed education tool based on the assessment and feedback has the potential to reduce the learning curve of the novices for TAPP procedure. It may also be able to improve the patient outcome by enhancing the quality of the surgery performed by the trainees during the early stages of their learning curve and improving their understanding of the procedure. The educational tool is simple and cost effective enough to be implemented at almost any institute in the world.