The Use of Hybrid Educational Simulation Technology in Advance Surgical Skills Training-Optical Port Insertion is an Example

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Research Question

- To propose and evaluate an innovative interactive digital module to simulate optical trocar insertion technique.

Background

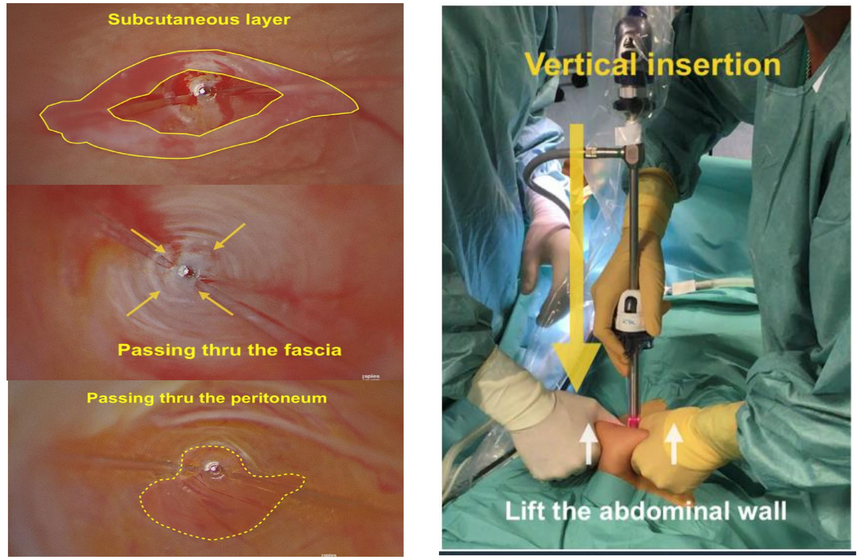
- Training on surgical skills continues to be challenging to trainees, instructors, and their training programs.
- The challenges involve multiple levels of difficulties including mentor availability and training opportunities.
- Educational technology offers alternative training opportunities.
- The currently available educational surgical videos follow the false educational principle of “showing means training”.
- Different types of laparoscopic surgical simulation devices currently exit. The most widely used laparoscopic simulators can be broadly divided into virtual reality and box-trainer devices.
- While, those simulation trainers do not provide the same visual realism and haptic feed back like the traditional operative training. They can play an essential role in the training of basic surgical skills.
- We are proposing an interactive digital module of a surgical procedure in multiple cases enhanced by educational illustrations and learners’ interactive input and evaluation.
- Insertion of optical port is a good example. This technique is used by many surgeons for the insertion of the first trocar in laparoscopic surgery under direct visualization (Figure).
- The laparoscopic camera is inserted in the optical port that consists of a cannula and a hollow transparent trocar.
- This allows for the direct visualization of the trocar as it passes through the various layers of the abdominal wall and thus decreases the incidence of abdominal organs injury.

Methods & Results

- Training on various surgical skills like laparoscopic optical port insertion, endoscopic simple polypectomy or submucosal injection, stapler application, and closing enterotomies, among others, can be conducted using the hybrid simulation-video recording interactive modules.
- We designed and constructed hybrid simulation-video recording interactive module as an introduction to this approach of surgical training technology.
- Each component of the skill is aided with additional illustrations to demonstrate the principles behind that part.
- Integrated questions are used to evaluate the cognitive aspect.
- In this exercise, multiple options are provided to choose from how to proceed with each step of the skill.
- The software used for the development of the models involves the following main components: 1) User Interface to guide the trainee through various simulation. 2) 3D models to simulate tasks using specialized graphical development kits. 3) Simulation to facilitate the interaction between the tools (hardware) with the 3D models. 4) Feedback and Evaluation to provide a real-time feedback during a simulation session and/or overall evaluation for the simulation session.

Conclusion

- Advanced surgical skills tasks simulation is the necessary next step in surgical simulation.
- The structured modules are valuable for training and competency evaluation.
- They are easily transferable and reproducible that can be made available nation- and world-wide.
- Proctorship and mentorship can be facilitated with these modules.
- Additional research/improvements can be conducted upon receiving feedback from phase 1 of use.



- Figure: Optical trocar insertion. Images from “Ciravolo G et al. Laparoscopic Access with Optical Gasless Trocar: A Single-center Experience of 7431 Procedures. J Minim Invasive Gynecol. 2020 Feb;27(2):535-540.”

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