CREATING AN EXPERIMENTAL MODEL OF MINIMALLY INVASIVE SURGERY IN PIGS

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Abstract: Minimally invasive surgery is a common technique that replaces classic surgery because of many benfits, including reduced postoperative pain and shorter hospitalization time. Getting familiar with the skills needed to perform this techniques requires specific training. In this study, we developed a two-day training on four live pigs, where the participants had to identify the uro-genital tract, liver, gall bladder, stomach, intestines and performing certain maneuvers on them and we preferred to focus on the basic laparoscopy procedures, which can then be integrated into any procedure.

Keywords: laparascopy, minimally invasive surgery, pig, training.

INTRODUCTION

Minimally invasive surgery replaces the standard technique in more and more procedures. Similar or even better postoperative outcomes have been described in laparoscopic procedures compared to open surgeries. Moreover, minimally invasive surgery provides reduced postoperative pain, shorter hospitalization time and thus a faster return to daily activities. However, the learning curve required for dexterity in performing a laparoscopic intervention is a barrier to its spread (Trialists, 2000; Nelson et al., 2004; Hamad and Curet, 2010; Harell and Heniford, 2005). Laparoscopic surgical courses have been developed to help surgeons overcome the difficult learning curve. These may include video tutorials, training exercises either on models, molds, anatomical parts or live animals (Aggarwal and Balasundaram, 2008; Aggarwal and Darzi, 2005; Aggarwal et al., 2004; Korndorffer et al., 2006; Undre and Daryi, 2007). Corpses and animal models provide the most realistic training for surgery, but have limited availability (Gutt et al., 2002; Nickel et al., 2013).

In this study, we aim to describe the activities carried out in a course on biological material *in vivo* and to evaluate the improvement of the surgeons' skills regarding the technique. More manoeuvres will be performed on the animals to reproduce a real surgery. A short training period can improve laparoscopic surgical skills, although it is often not sufficient to provide laparoscopic skills for participants. However, this short training period may enhance the laparoscopic proficiency of surgeons.

MATERIAL AND METHOD

During a two-day course, the participants worked on four live animals, identifying the uro-genital tract, liver, gall bladder, stomach, intestines and performing certain maneuvers on them (Fig.1).

Fig. 1

Fig. 2

Fig. 3

The sessions started with a 30-minute breefing, explaining the theory of the course and the tasks to be performed. The participants were divided into teams of two persons, to combine the students with similar levels of experience from different centers (Fig. 2). These teams then participated in three 2-hour sessions, during which they performed different surgical manoeuvres. Two coordinators who did not know the participants carried out an evaluation of them. The following tasks were considered: knowledge of the special instrumentation for laparoscopy, testing the convergence, knowledge of how to insert the trocars and performing an exploratory laparoscopy (Fig. 3).

RESULTS AND DISCUSSIONS

This study showed that developing an experimental model using the swine model, met the requirements for validation of a simulation program. When we decided to develop this program, we also responded to the desire expressed by the participants to improve their surgical training. We chose the swine model because it most closely resembles the human one, with very similar intraoperative tactile reactions, a similar anatomy and all the problems that can arise in human surgery that a surgeon has to know and anticipate (adhesions, hemorrhages, malformations etc.). Our students were

very involved and enthusiastic from the beginning. The study shows that everyone was satisfied, without any difference between those who first attended a session and those who had before attended such courses. Therefore, we asked them to offer suggestions and incorporated them successively into the program. Unlike some teams that have developed training programs based on performing complete surgical procedures (Varas et al., 2012), we preferred to focus on the basic laparoscopy procedures, which can then be integrated into any procedure.

The trainees usually prefer animal models for manual training rather than a virtual simulator model, because they are closer to reality. Tissue manipulation and living body reaction are clear advantages compared to virtual simulators and pelvic-trainer models. Also, intraoperative complications such as hemorrhage and organ damage are realistic only in the animal model (Palter et al., 2010; La Torre, 2012). Zimmerman et al. (2011) evaluated 36 residents on surgery of a multimodal intensive laparoscopic training course, who followed a 5-day intensive training on the swine model and found that post-course performance scores increased from 100% to 200 %. The main areas of interest in laparoscopic manual training during residency are general surgery, urology, gastrointestinal surgery and gynecology.

"Mini-residency" is another form of laparoscopic training, usually performed over a period of 5 days. Chou et al. (2005) presented the experience with 16 participants who had individual teaching sessions, with training sessions with molds, pelvi-trainers, virtual simulators, corpses and live animals.

From all these studies, it is noted that short-term training can improve laparoscopic surgical skills, although it is often not sufficient to officially certify the participants. However one thing is certain, short-term courses are capable of increasing laparoscopic skills of surgeons.

CONCLUSIONS

In vivo training with the swine model continues to be probably the most sophisticated training method before practicing the actual interventions in clinical cases. The various training models reported in the literature have evolved from general and simplistic versions, to more complex and more real versions. Due to the properties of the living tissues of the swine models, they prove to be indispensable in obtaining complex surgical skills, such as dissection, suturing and use of energy sources such as cauter, all of which are required in clinical scenarios.

This training needs to be structured and can integrate several simulation methods, including the pelvi-trainer, virtual simulator or animal model. We show in this study that this method is relevant and valid for the evaluation of surgeon training and that this teaching method is very successful among the students.

REFERENCES

1. Aggarwal, R., Balasundaram, I., Darzi, A. (2008). Training opportunities and the role of virtual reality simulation in acquisition of basic laparoscopic skills. J Surg Res, 145(1):80-86.

2. Aggarwal, R., Darzi, A. (2005). Training in laparoscopy - which model to use?. Indian J Gastroenterol, 24(3):95-96.

3. Aggarwal, R., Moorthy, K., Darzi, A. (2004). Laparoscopic skills training and assessment. Br J Surg, 91(12):1549-1558.

4. Alba Mesa, F., Sanchez Hurtado, M. A., Sanchez Margallo, F. M. (2015). Application of Failure Mode and Effect Analysis in Laparoscopic Colon Surgery Training. World J Surg, 39: 536 42.

5. Chou, D. S., Abdelshehid, C. S., Uribe, C. A., Khonsari, S. S., Eichel, L., Boker, J. R., Shanberg, A. M., Ahlering, T. E., Clayman, R. V., McDougall, E. M. (2005). Initial impact of a dedicated postgraduate laparoscopic miniresidency on clinical practice patterns. J Endourol, 19:360-365.

6. Gutt, C. N., Kim, Z. G., Krahenbuhl, L. (2002). Training for advanced laparoscopic surgery. Eur J Surg, 168(3):172-177.

7. Hamad, G. G., Curet, M. (2010). Minimally invasive surgery. Am J Surg, 199(2):263-265.

8. Harrell, A. G., Heniford, B. T. (2005). Minimally invasive abdominal surgery: lux et veritas past, present, and future. Am J Surg, 190(2):239-243.

9. Hernia , E. U. (2000). Laparoscopic compared with open methods of groin hernia repair: systematic review of randomized controlled trials. Br J Surg, 87(7):86-867.

10. Komorowski, A. L., Alba Mesa, F., Amaya Cortijo, A. (2014). Early postoperative complications of transvaginal access in minimally invasive sigmoid colon procedures. Ginekol Pol, 85: 117 20.

11. Korndorffer, J. R. Jr., Stefanidis, D., Scott, D. J. (2006). Laparoscopic skills laboratories: current assessment and a call for resident training standards. Am J Surg, 191(1):17-22.

12. La Torre, M., Caruso, C. (2012). Resident training in laparoscopic colorectal surgery: role of the porcine model. World J Surg, 36: 2015-2020.

13. Nelson, H., Sargent, D. J., Wieand, H. S., Fleshman, J., Anvari, M., Stryker, S. J., Beart, R. W. Jr., Hellinger, M., Flanagan, R. Jr., Peters, W., Ota, D. (2004). Clinical Outcomes of Surgical Therapy Study Group: A comparison of laparoscopically assisted and open colectomy for colon cancer. N Engl J Med, 350(20):2050-2059.

14. Nickel, F., Bintintan, V. V., Gehrig, T., Kenngott, H. G., Fischer, L., Gutt, C. N., Muller-Stich, B. P. (2013). Virtual reality does not meet expectations in a pilot study on multimodal laparoscopic surgery training. World J Surg, 37(5):965-973.

15. Palter, V. N., Orzech, N., Aggarwal, R., Okrainec, A., Grantcharov, T. P. (2010). Resident perceptions of advanced laparoscopic skills training. Surg Endosc, 24:2830-2834.

16. Undre, S., Darzi, A. (2007). Laparoscopy simulators. J Endourol, 21(3):274-279.

17. Varas, J., Mejia, R., Riquelme, A. (2012). Significant transfer of surgical skills obtained with an advanced laparoscopic training program to a laparoscopic jejuno-jejunostomy in live porcine model: feasibility of learning advanced laparoscopy in a general surgery residency. Surg Endosc, 26:3486-94.

18. Zimmerman, H., Latifi, R., Dehdashti, B., Ong, E., Jie, T., Galvani, C., Waer, A., Wynne, J., Biffar, D., Gruessner, R. (2011). Intensive laparoscopic training course for surgical residents: program description, initial results, and requirements. Surg Endosc, 25: 3636-3641.