Development of a Transabdominal Preperitoneal (TAPP) Inguinal Hernia Repair Continuous Suture Model for Peritoneal Flap Closure

Aqeel Ashraf, MD[1]; Melissa Hanson, MD, FRCSC[1,2]; Safiya AlMasrouri, MD, FRCSC[1,2] ;Melina Vassiliou, MD, FRCSC [1,2] ; Liane Feldman, MD, FRCSC [1,2]
1. McGill University, Department of surgery,
2. Steinberg-Bernstein Center for Minimally Invasive Surgery, Montreal General Hospital

The Steinberg-Bernstein Centre for MINIMALLY INVASIVE SURGERY at McGill University

INTRODUCTION: Laparoscopic inguinal hernia repair is quickly becoming the gold standard for inguinal hernia repair (IHR). TAPP inguinal hernia repair (IHR) entails the development of a peritoneal flap (PF) in order to reduce the hernia sac and create a preperitoneal space in which to place mesh. Many methods for closure of the PF exist including sutures, tacks, and staples. Suture closure of the peritoneal flap has shown to decrease short-term discomfort and improves 2-week post-operative movement limitation[1]. However, long term results have not shown any significant difference between the techniques[2]. This is a complex procedure that has a steep learning curve[3, 4]. The use of laparoscopic simulators has been shown to translate into improved performance in the operating room[5]. Currently there is no simulator that allows surgical trainee to learn and master flap closure with this laparoscopic technique.

OBJECTIVES:

(1) To develop a low-cost synthetic model for PF closure that simulates TAPP suturing angles; and
(2) To gather preliminary evidence from expert surgeons for its application as a training model.

METHODS: Using an iterative process, we designed a 3D re-usable model, made of low-cost materials that resembles the pelvic wall as appreciated during TAPP, and that is used in an FLS box with standard laparoscopic instruments (Figures 1-3). MIS experts were invited to test the model by performing a simulated flap closure. They completed a pre- and post-simulation questionnaire. The pre-simulation questionnaire included baseline demographics and questions regarding surgical expertise and practice patterns. The post-simulation questionnaire focused on feasibility and educational value of the model, specifically for improving intra-corporeal PF closure.

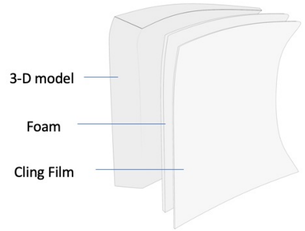


Figure 1: 3-D model and attachments

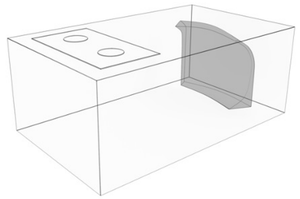


Figure 2: 3-D model inside FLS box

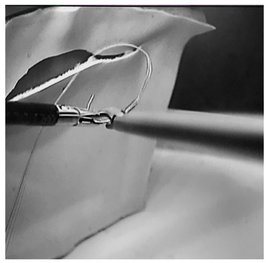
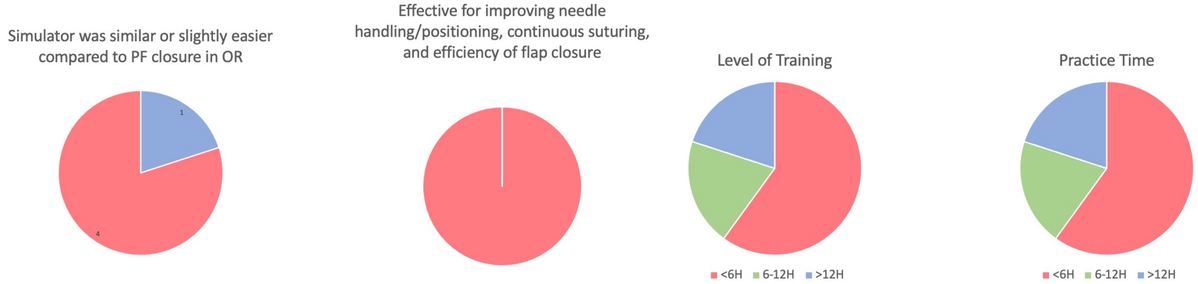


Figure 3: Closure of flap

RESULTS: Five experts participated in the study and provided feedback. All experts were FLS certified, performed laparoscopic continuous suturing >30x/year, and 4/5 had been in practice for >5 years. All performed TAPP hernia repairs 1-10x/year and 4/5 utilized suture for PF closure. 4/5 participants agreed that the simulator was similar or slightly easier compared to PF closure in the operating room, and they all thought that it would be effective for improving needle handling/positioning, continuous suturing, and efficiency of flap closure. Experts suggested that this model was most suitable for: senior residents(3), junior residents(1) or all levels of experience(1). Experts varied in their responses regarding how many hours residents would need to practice in the model to achieve competency; 3 of the 5 suggesting <6 hours, and the other 2 responding 6-12h and >12h.



CONCLUSION: The 3D model we developed has validity evidence as a tool to practice laparoscopic PF closure for TAPP. It is low cost, easily reproduced and can be used in an FLS box. Expert surgeons all considered it to be a potentially useful adjunct to the skills training curriculum. Additional studies are needed to assess if trainees can use the model to decrease their PF learning curve prior to going to the operating room.

References:
1. Ross SW, Oommen B, Kim M, Walters AL, Augenstein VA, Heniford BT. Tacks, staples, or suture: method of peritoneal closure in laparoscopic transabdominal preperitoneal inguinal hernia repair effects early quality of life. Surg Endosc. Jul 2015;29(7):1686-93. doi:10.1007/s00464-014-3857-3
2. Ross SW, Groene SA, Prasad T, et al. Does peritoneal flap closure technique following transabdominal preperitoneal (TAPP) inguinal hernia repair make a difference in postoperative pain? A long-term quality of life comparison. Surg Endosc. Jun 2017;31(6):2548-2559. doi:10.1007/s00464-016-5258-2
3. Poudel S, Kurashima Y, Kawarada Y, et al. Development of a novel training system for laparoscopic inguinal hernia repair. Minim Invasive Ther Allied Technol. Aug 2019;28(4):254-260. doi:10.1080/13645706.2018.1504800
4. Ivakhov G, Kolygin A, Titkova S, Anurov M, Sazhin A. Development and evaluation of a novel simulation model for transabdominal preperitoneal (TAPP) inguinal hernia repair. Hernia. Feb 2020;24(1):159-166. doi:10.1007/s10029-019-02032-5
5.Stefanidis D, Acker C, Heniford BT. Proficiency-Based Laparoscopic Simulator Training Leads to Improved Operating Room Skill That Is Resistant to Decay. Surgical Innovation. 2008;15(1):69-73. doi:10.1177/1553350608316683