EDUCATION

Implementation and validation of a retroperitoneal dissection curriculum

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BACKGROUND: Competency-based education requires educators to use simulation training for the purposes of education and assessment of resident trainees. Research demonstrates that improvement in surgical skills acquired in a simulated environment is transferrable to the operative environment. Laparoscopic retroperitoneal dissection, opening the retroperitoneal space and identifying the ureter, is a fundamental skill for gynecologists. Integrating simulation models into a formal and comprehensive curriculum for teaching ureterolysis could translate to increased surgical competency.

OBJECTIVE: Our goal was to validate a comprehensive curriculum for laparoscopic retroperitoneal dissection for the purpose of identification of the ureter by evaluating intraoperative performance.

STUDY DESIGN: A comprehensive curriculum, encompassing didactic and technical skills components and using a previously developed pelvic model, was designed to teach laparoscopic ureterolysis. Novice surgeons (postgraduate years 3—5) were recruited. Participants completed precurriculum and postcurriculum multiple-choice questionnaires to evaluate a didactic component. Preperformance and postperformance on the model was video-recorded. As part of the technical component, participants received constructive feedback from expert surgeons on how to perform laparoscopic retroperitoneal dissection using the simulation model. Participants were then video-recorded performing laparoscopic retroperitoneal dissection in the operating room within 3 months of the curriculum. All videos were blindly assessed by an expert using the Objective Structured Assessment of Technical Skills tool. At the conclusion of the study, participants completed a course evaluation.

RESULTS: Thirty novice gynecologic surgeons were recruited. High baseline knowledge of ureteric anatomy and injury (multiple-choice question score median and interquartile range) still significantly increased from 7 (5—7.25) precurriculum to 8 (7—9) postcurriculum ($P < .001$). The median (interquartile range) technical Objective Structured Assessment of Technical Skills score increased significantly from 24.5 (23—28.25) precurriculum to 30 (29.75—32) postcurriculum ($P < .001$). Videorecordings were completed for 23 participants performing laparoscopic retroperitoneal dissection in the operating room. Intraoperative Objective Structured Assessment of Technical Skills scores (median of 29 [interquartile range 27—32]) correlated with postcurriculum Objective Structured Assessment of Technical Skills scores on the model ($r = 0.53$, $P = .01$). The ureter was identified intraoperatively by 91% ($n = 21/23$) of participants. The majority of residents (81%, $n = 21/26$) were more comfortable completing a supervised retroperitoneal dissection as a result of participating in the curriculum. Residents believed that this model would be useful to enhance skills acquisition prior to performing the skill in the operating room (65%, $n = 17/26$).

CONCLUSION: A comprehensive retroperitoneal dissection curriculum showed improvement in cognitive knowledge and technical skills, which also translated to competent performance in the operating room. In addition to the objective measures, residents believed that their skills acquisition was improved following course completion.

Key words: resident education, retroperitoneal dissection, surgical simulation

Introduction

Residency training has shifted from the traditional "see one, do one, teach one" method of surgical education to competency-based education.[1] Competency-based education requires educators to use simulation training for the purposes of education and assessment of resident trainees. Synthetic simulation models have enabled teaching of surgical skills and enhanced competency in a controlled environment.[2] Research demonstrates that improvement in surgical skills acquired in a simulated environment is transferrable to the operative environment[3,4] and correlates with better patient outcomes.[5,6]

Ureteric injury is one of the most frequent types of injury in gynecologic surgery and is associated with significant litigation for gynecologists.[7] Identifying the ureter in the retroperitoneal space is a key component of several gynecologic surgical procedures.[8] Ureteric injury rates have been reported to be higher in laparoscopic hysterectomy compared to abdominal hysterectomy.[9] In addition to the route of surgery, limited experience and low surgical volume have been associated with higher rates of urinary tract injury.[10] Proper identification of ureteric location and path is particularly important in the prevention of ureteric injuries.[8] We have designed a low-fidelity simulator, which has been validated for the purpose of laparoscopic retroperitoneal dissection (LRD) (Figure 1).[11] Expert minimally invasive gynecologists (MIGs) evaluated the model and found it to closely resemble reality, be low-cost (US$65—75 per simulator and US$<1 for replaceable parts per use), and be easily reproducible.[11] The integration of simulation models into formal and comprehensive curricula has been demonstrated to increase surgical competency.[12] Recently, the American Congress of Obstetricians and Gynecologists (ACOG) developed the ACOG Simulations Working Group, which develops and implements

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AJOG at a Glance

Why was this study conducted?
To implement and validate a laparoscopic retroperitoneal dissection model for ureteric identification.

Key findings
Intraoperative Objective Structured Assessment of Technical Skills (OSATS) scores correlated with postcurriculum OSATS scores on the model. The median OSATS scores showed a statistically significant improvement from precurriculum to postcurriculum.

What does this add to what is known?
A comprehensive retroperitoneal dissection curriculum showed improvement in cognitive knowledge and technical skills, which also translated to competent performance in the operating room.

standardized and validated simulation-based curricula.[13] Procedure-specific simulation models are lacking in relation to gynecologic laparoscopic training.[14] The importance of standard simulation for obstetrics and gynecology trainees was included in the Royal College of Obstetricians and Gynecologists, London, strategic plan (2011 through 2014).[15]

The purpose of this study was to design an educational curriculum to teach LRD to identify the ureter using our previously developed simulation model, audio-visual materials, and a didactic session. Our primary objective was to validate the positive effect of the curriculum through blinded intraoperative performance scores. Our secondary objectives were to assess the curriculum's effect on cognitive knowledge of procedural aspects, surgical skills in a simulated environment, and overall satisfaction with the curriculum and the model.

Materials and Methods

Trial design
This prospective single-blinded observational study was conducted at a tertiary care academic center (Figure 2). Ethics approval was obtained from the St Michael's Hospital (REB no. 15-223) Institutional Review Boards. Written informed consent was obtained from all participants in the study.

Participants
All residents who entered their third through fifth postgraduate years (PGY) of obstetrics and gynecology training ($n = 44$; $n = 17$—PGY 3, $n = 10$—PGY 4, $n = 17$—PGY5) were invited by e-mail to participate in June 2016. Residents who had completed ≥5 LRD as the primary surgeon were excluded from the study. These parameters have been used previously to ensure inclusion of novice trainees with minimal previous experience in the performance of laparoscopic surgery.[6,16,17]

Intervention
A comprehensive curriculum to teach LRD during pelvic surgery was designed encompassing: (1) a didactic curriculum, and (2) a technical skills curriculum. An experienced MIG (A.A.Y.) facilitated the curriculum. These sessions took place during the scheduled 3-hour academic half-day sessions. Half an hour was spent on the cognitive didactic component, 2 hours were spent on the technical skills curriculum, and half an hour was spent on the questionnaires (15 minutes each, pre and post).

The cognitive component was developed based on a review of the literature and opinions of MIGs experts. It was composed of a presentation on ureteric anatomy, common locations of ureteric injury, types and locations of injuries, recognition, and management strategies. The lecture included an educational surgical video on laparoscopic ureterolysis using operating room (OR) footage.

The technical skills curriculum involved one-on-one coaching with an experienced preceptor using a previously developed and validated simulation model for LRD.[11] The model consists of materials representing: pelvic bone, uterus, ovary, the infundibulopelvic ligament, ureter, bladder, major iliac vessels, uterine vessel, retroperitoneal adipose tissue, and peritoneal layer (Figure 1). Its size accommodates a traditional laparoscopic box trainer that is commonly available in simulation labs. The training focused on surgical steps of laparoscopic opening of the retroperitoneal space in an avascular plane, identifying the ureter and the relevant anatomical structures as well as performing ureterolysis to the level of the uterine vessels using this model (Video).

Primary outcome measure: intraoperative performance
To assess our primary outcome, the impact of the experimental curriculum on intraoperative performance, all participants subsequently performed LRD in the OR on a human patient. LRD in the OR was defined as opening up the retroperitoneal space, identifying the ureter, and watching it vermiculate in order to permit safe adnexal surgery. Eligible surgeries were operations where identifying the ureter using LRD was clinically indicated (eg, salpingo-oophorectomies). Patients with pathologies causing expected dissection difficulties such as endometriosis, multiple fibroids, and significant adnexal pathologies were excluded. MIG faculty member assisted the resident in the usual fashion, which included verbal direction and takeover as required. This portion was video-recorded through the laparoscopic camera with no identifying data of the patient or the operating team. All video-recordings were standardized such that the surgeon with 2 instruments was the participant. An experienced video assessor and MIG surgeon (H.F.), who was blinded to the identity of the residents, scored the videos using a modified Objective Structured Assessment of Technical Skills (OSATS) tool for laparoscopic surgery (Appendix 1).[18] H.F. did not facilitate the video-recording of any intraoperative videos. All surgeries