SPECIAL SECTION

THE 2022 SCIENTIFIC MEETING OF THE SOCIETY OF GYNECOLOGIC SURGEONS

HIGHLIGHTS ISSUE, PART 1

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Society of Gynecologic Surgeons meeting champions training of future gynecologic surgeons

The 2022 annual meeting in San Antonio, Texas, March 27-30, focused on surgeon training and many additional significant issues

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It was such a pleasure at the 48th Annual Meeting of the Society of Gynecologic Surgeons (SGS) to witness record meeting attendance and strong enthusiasm after 2 depressing years with the COVID-19 pandemic. Evidently, everyone was tired of virtual gatherings and presentations. As a dedicated surgical educator and a passionate vaginal surgeon, SGS President Carl Zimmerman, MD, chose "Gynecologic surgery training: Lessons from the past, looking to the future" as the theme for this year's meeting. Our keynote speakers, Patricia Turner, MD, MBA, Executive Director of the American College of Surgeons, and Marta Crispens, MD, MBA, Professor and Division Director of Gynecologic Oncology at Vanderbilt, were spot on. They reviewed the current status of surgical training eloquently with convincing statistics. They mapped out the path forward by stressing collaboration and proposing strategies that might produce competent surgeons in all fields.

The meeting featured 2 panel discussions. The first, titled "Innovations in training gynecologic surgeons," reviewed tracking in residency, use of simulation for surgical proficiency, and European perspective on training. The panelists emphasized the dwindling numbers of surgical procedures, especially vaginal hysterectomies. Cecile Ferrando, MD, suggested that tracking might be part of the answer, based on their experience, which provided a structure for residents to obtain concentrated training in their areas of

interest. Douglas Miyazaki, MD, presented the prospects for his innovative, federally funded vaginal surgery simulation model. Oliver Preyer, MD, presented Austrian trainees' low case volumes, showing that the grass was not actually greener on the other side. Finally, this panel reinvigorated ongoing debate about separating Obstetrics and Gynecology.

The second panel, "Operating room safety and efficiency," shed light on human and nontechnical factors that might be as critical as surgeons' skills and experience, and it highlighted an innovative technology that monitored and analyzed all operating room parameters to improve operational processes and surgical technique. Points by Jason Wright, MD, on the relationship between surgical volume and outcomes complemented the meeting theme and the first panel discussion. He underlined how much surgical volume of individual surgeons and hospitals mattered, but he also indicated that restrictive credentialing strategies might lead to unintended consequences.

Importantly, the SGS Women's Council held a panel on the "Impact of Texas legislation on the physician/patient relationship" to provide a platform for members who had mixed feelings about attending this meeting in Texas.

The SGS meeting also included several popular postgraduate courses on multidisciplinary management of Müllerian anomalies, pelvic fistula treatment, surgical simulation, management modalities for uterine fibroids, and medical innovation and entrepreneurship. In this special section and in the next issue of OBG MANAGEMENT, several of these topics are presented.

How to teach vaginal surgery through simulation

Expert review of simulation principles for vaginal hysterectomy and discussion of self-constructed and commercial simulation models

Payton Schmidt, MD; Veronica Lerner, MD; Chi Chiung Grace Chen, MD; Douglas Miyazaki, MD; and Christine M. Vaccaro, DO

Vaginal surgery, including vaginal hysterectomy, is slowly becoming a dying art. According to the National Inpatient Sample and the Nationwide Ambulatory Surgery Sample from 2018, only 11.8% of all hysterectomies were performed vaginally.[1] The combination of uterine-sparing surgeries, advances in conservative therapies for benign uterine conditions, and the diversification of minimally invasive routes (laparoscopic and robotic) has resulted in a continued downtrend in vaginal surgical volumes. This shift has led to fewer operative learning opportunities and declining graduating resident surgical volume.[2] According to the Accreditation Council for Graduate Medical Education (ACGME), the minimum number of vaginal hysterectomies is 15, which represents only the minimum accepted exposure and does not imply competency.

In response, surgical simulation has been used for skill acquisition and maintenance outside of the operating room in a learning environment that is safe for the learners and does not expose patients to additional risk. Educators are uniquely poised to use simulation to teach residents and to evaluate their procedural competency. Although vaginal surgery, specifically vaginal hysterectomy, continues to decline, it can be resuscitated with the assistance of surgical simulation.

In this article, we provide a broad overview of vaginal surgical simulation. We discuss the basic tenets of simulation, review how to teach and evaluate vaginal surgical skills, and present some of the commonly available vaginal surgery simulation models and their associated resources, cost, setup time, fidelity, and limitations.

Simulation principles relevant for vaginal hysterectomy simulation

Here, we review simulation-based learning principles that will help place specific simulation models into perspective.

One size does not fit all

Simulation, like many educational interventions, does not work via a "one-size-fits-all" approach. While the American College of Obstetricians and Gynecologists (ACOG) Simulations Working Group (SWG) has created a toolkit (available online at https://www.acog.org/education-and-events/simulations/about/curriculum) with many ready-to-use how-to simulation descriptions and lesson plans that cover common topics, what works in one setting may not work in another. The SWG created those modules to help educators save time and resources and to avoid reinventing the wheel for each simulation session. However, these simulations need to be adapted to the local needs of trainees and resources, such as faculty time, space, models, and funding.

Cost vs fidelity

It is important to distinguish between cost and fidelity. "Low cost" is often incorrectly used interchangeably with "low fidelity" when referring to models and simulations. The most basic principle of fidelity is that it is associated with situational realism that in turn, drives learning.[3,4] For example, the term high fidelity does apply to a

virtual reality robotic surgery simulator, which also is high cost. However, a low-cost beef tongue model of fourth-degree laceration[5] is high fidelity, while more expensive commercial models are less realistic, which makes them high cost and low fidelity.[6] When selecting simulation models, educators need to consider cost based on their available resources and the level of fidelity needed for their learners.

Task breakdown

As surgeon-educators, we love to teach! And while educators are passionate about imparting vaginal hysterectomy skills to the next generation of surgeons, it is important to assess where the learners are technically. Vaginal hysterectomy is a high-complexity procedure, with each step involving a unique skill set that is new to residents as learners; this is where the science of learning can help us teach more effectively.[7] Focusing on doing the entire procedure all at once is more likely to result in cognitive overload, while a better approach is to break the procedure down into several components and practice those parts until goal proficiency is reached.

Deliberate practice

The idea of deliberate practice was popularized by Malcolm Gladwell in his book titled *Outliers,* in which he gives examples of how 10,000 hours of practice leads to mastery of complex skills. This concept was deepened by the work of cognitive psychologist Anders Ericsson, who emphasized that not only the duration but also the quality of practice—which involves concentration, analysis, and problem-solving—leads to the most effective training.[8]

In surgical education, this concept translates into many domains. For example, an individualized learning plan includes frequent low-stakes assessments, video recording for later viewing and analysis, surgical coaching, and detailed planning of future training sessions to incorporate past performance. "Just doing" surgery on a simulator (or in the operating room) results in missed learning opportunities.

Logistics and implementation: Who, where, when

The simulation "formula" takes into account multiple factors but should start with learning objectives and then an assessment of what resources are available to address them. For example, if one surgeon-educator and one resident-learner are available for 30 minutes in between cases in the operating room, and the goal is to teach the resident clamp-and-tie technique on pedicles, the "milk carton" model[9] and a few instruments from the vaginal hysterectomy tray are ideal for this training. On the other hand, if it is important to achieve competency for an entire procedure prior to operating room debut and a group of surgeon-educators is available to share the time commitment of 2-hour sessions per each resident, then the PROMPT (PRactical Obstetric Multi-Professional Training) shoulder dystocia model could be used (**TABLE**, page SS6).[10-14]

Learning curves

Ideally, educators would like to know how many simulated training sessions are needed for a learner to reach a proficiency level and become operating room ready. Such information about learning curves, unfortunately, is not available yet for vaginal hysterectomies. The first step in the process is to establish a baseline for performance to know a starting point, with assessment tools specific to each simulator; the next step is to study how many "takes" are needed for learners to move through their learning curve.[15] The use of assessment tools can help assess each learner's progression.

Evaluation, assessment, and feedback

With more emphasis being placed on patient safety and transparency in every aspect of health care, including surgical training, graduate medical education leaders increasingly highlight the importance of objective assessment tools and outcome-based standards for certification of competency in surgery.[16,17] Commonly used assessment tools that have reliability and validity evidence include surgical checklists and global rating scales. Checklists for common gynecologic procedures, including vaginal hysterectomy, as well as a global rating scale specifically developed for vaginal surgery (Vaginal Surgical Skills Index, VSSI)[18] are accessible on the ACOG Simulations Working Group Surgical Curriculum in Obstetrics and Gynecology website.[19]

TABLE **Vaginal hysterectomy simulators**

| Simulator	Description	Company, publication, website	Evaluation tools	Video demonstration
Suturing trainer	Do-it-yourself from easily obtainable tools and materials, low cost	Available on the ACOG SWG website	Not available	https://www.acog.org /education-and-events /simulations/vaginal -suturing-trainer
Milk carton	Do-it-yourself, low cost, requires basic sawing skills	Smith[9]	Not available	https://vimeo. com/123804677
Bony pelvis model	Multiple versions of using bony pelvis and low-cost inserts	Zoorob[12]; Barrier[13]	Available in references cited	https://www.acog.org /education-and-events /simulations/anatomic-low- fidelity-simulation-model -for-vaginal-hysterectomy
ACOG SWG flowerpot	Do-it-yourself, low cost; takes time to assemble	Available on the ACOG SWG website; Burkett[14]	Available on the ACOG SWG website	https://www.acog.org/ education-and-events /simulations/scog008 /simulation
PROMPT shoulder dystocia trainer pelvis	Uses high-cost pelvis from shoulder dystocia trainer and low-cost do-it- yourself inserts	Available on the ACOG SWG website; Greer[10]	OSAT (Greer[10]; Malacarne[11])	https://www.acog.org /education-and-events /simulations/vaginal -hysterectomy-task-trainer https://vimeo.com /447513217?embedded=tru e&source=vimeo _logo&owner=113468041

Abbreviations: ACOG, American College of Obstetricians and Gynecologists; PROMPT, PRactical Obstetric Multi-Professional Training; OSAT, Objective Skills Assessment Test; SWG, Simulations Working Group.

While checklists contain the main steps of each procedure, these lists do not assess for how well each step of the procedure is performed. By contrast, global rating scales, such as the VSSI, can discriminate between surgeons with different skill levels both in the simulation and operating room settings; each metric within the global rating scale (for example, time and motion) does not pertain to the performance of a procedure's specific step but rather to the overall performance of the entire procedure.[18,20] Hence, to provide detailed feedback, especially for formative assessment, both checklists and global rating scales often are used together.

Although standardized, checklists and global rating scales ultimately are still subjective (not objective) assessment tools. Recently, more attention has been to use surgical data science, particularly artificial intelligence methods, to objectively assess surgical performance by analyzing data generated during the performance of surgery, such as instrumental motion and video.[21] These methods have been applied to a wide range of surgical techniques, including open, laparoscopic, robotic, endoscopic, and microsurgical approaches. Most of these types of studies have used assessment of surgical skill as the main outcome, with fewer studies correlating skill with clinically relevant metrics, such as patient outcomes.[22-25] Although this is an area of active research, these methods are still being developed, and their validity and utility are not well established. For now, educators should continue to use validated checklists and global rating skills to help assess any type of surgical performance, particularly vaginal surgery.

FIGURE 1 Miya Model (Miyazaki Enterprises) vaginal hysterectomy simulation model (A) and components (B)
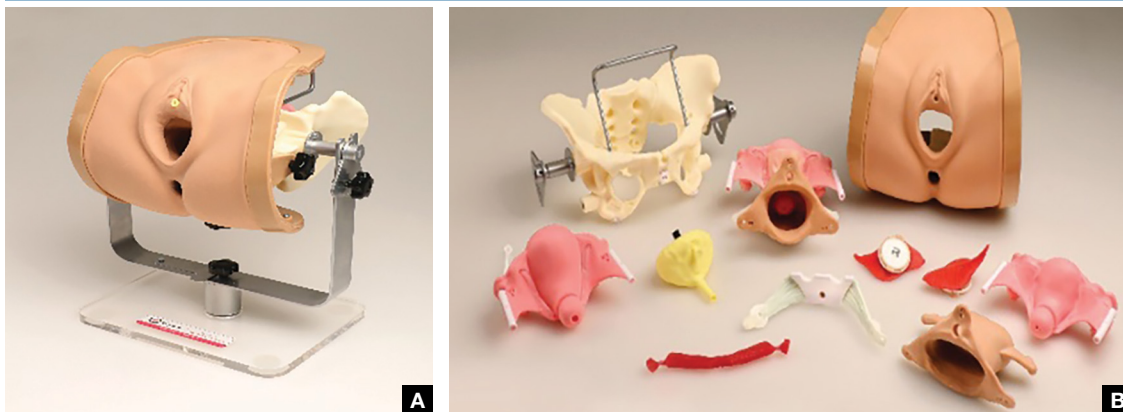
Used with permission.

Vaginal surgical simulation models

Vaginal surgery requires a surgeon to operate in a narrow, deep space. This requires ambidexterity, accurate depth perception, understanding of how to handle tissues, and use of movements that are efficient, fluid, and rhythmic. Multiple proposed simulation models are relevant to vaginal surgery, and these vary based on level of fidelity, cost, feasibility, ability to maintain standardization, ease of construction (if required), and generalizability to all of pelvic surgery (that is, procedure specific vs basic skills focused).[10,11,13,26-31]

Below, we describe various simulation models that are available for teaching vaginal surgical skills.

Vaginal hysterectomy simulation model

One commercially available simulation model for vaginal hysterectomy (as well as other vaginal surgical procedures, such as midurethral sling and anterior and posterior colporrhaphy) is the Miya Model (Miyazaki Enterprises) (FIGURE 1) and its accompanying MiyaMODEL App. In a multi-institutional study funded by the National Institutes of Health (NIH), the Miya Model, when used with the VSSI, was shown to be a valid assessment tool in terms of ability to differentiate a competent from a noncompetent surgeon.[20] Currently, an ongoing NIH-sponsored multi-institutional study is assessing the Miya Model as a teaching tool and whether

skills acquired on the Miya Model are transferable to the operating room.

Low-cost vaginal hysterectomy models

Multiple low-cost vaginal hysterectomy simulation models are described. Two models developed many years ago include the ACOG SWG flowerpot model[14] and the PROMPT shoulder dystocia pelvic trainer model.[10,11,14] The former model is low cost as it can be constructed from easily obtained household materials, but its downside is that it takes time and effort to obtain the materials and to assemble them. The latter model is faster to assemble but requires one to use a PROMPT pelvis for shoulder dystocia training, which has a considerable upfront cost. However, it is available in most hospitals with considerable obstetrical volume, and it allows for the most realistic perineum, which is helpful in recreating the feel of vaginal surgery, including retraction and exposure.

Many models created and described in the literature are variations of the models mentioned above, and many use commercially available low-cost bony pelvis models and polyvinyl chloride (PVC) pipes as a foundation for the soft tissue inserts to attach.[12,13,31-33] Each model varies on what it "teaches best" regarding realism—for example, teaching anatomy, working in a tight space, dissection, or clamp placement and suture ligature.

FIGURE 2 Milk carton simulator, showing construction of the inserts for the simulator **(A)** and the assembled model **(B)**

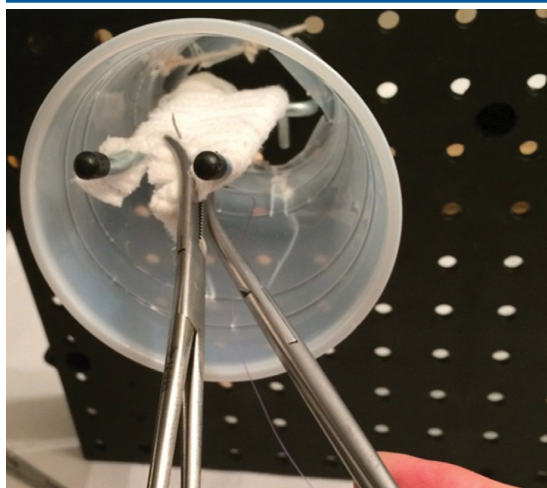*Photos courtesy of Veronica Lerner, MD*

Furthermore, since vaginal hysterectomy is a high-complexity procedure in terms of skills (working in confined space, limited view, "upside-down" anatomy, and need to direct assistants for retraction and exposure), task breakdown is important for simulation learning, as it is not efficient to repeat the entire procedure until proficiency is reached. Two trainers have been described to address that need: the milk carton and the vaginal suturing trainer. The latter allows learners to practice

FIGURE 3 Pegboard vaginal suturing trainer demonstrating learning in a confined space

clamp placement and pedicle ligation multiple times, including in confined space (**FIGURE 2**), and the former allows them to do the same in a procedural matter as the clamp placement moves caudad to cephalad during the procedure (**FIGURE 3**).

Native tissue pelvic floor surgery simulation

While there are few publications regarding surgical simulation models for native tissue pelvic floor surgeries, a low-cost anterior and posterior repair model was developed for the ACOG SWG Simulation Toolkit and published online in 2017, after their peer-review process. The fidelity is moderate for this low-cost model, which costs less than $5 per use. The simulation model requires a new vaginal insert for each learner, which is fast and easy to make and requires only a few components; however, the bony pelvis (for example, the flowerpot model) needs to be purchased or created. The stage of the anterior wall prolapse can be adjusted by the amount of fluid placed in the balloon, which is used to simulate the bladder. The more fluid that is placed in the "bladder," the more severe the anterior wall prolapse appears. The vaginal caliber can be adjusted, if needed, by increasing or decreasing the size of the components to create the vagina, but the suggested sizes simulate a significantly widened vaginal caliber that would benefit from a posterior repair with perineorrhaphy. Although there is no validity evidence for

this model, a skills assessment is available through the ACOG Simulation Surgical Curriculum. Of note, native tissue colpopexy repairs are also possible with this model (or another high-fidelity model, such as the Miya Model), if the sacrospinous ligaments and/or uterosacral ligaments are available on the pelvic model in use. This model's limitations include the absence of a high-fidelity plane of dissection of the vaginal muscularis, and that no bleeding is encountered, which is the case for many low-cost models.[19,34]

Fundamentals of Vaginal Surgery (FVS) basic surgical skills simulation

The FVS simulation system, consisting of a task trainer paired with 6 selected surgical tasks, was developed to teach basic skills used in vaginal surgery.[35] The FVS task trainer is 3D printed and has 3 main components: a base piece that allows for different surgical materials to be secured, a depth extender, and a width reducer. In addition, it has a mobile phone mount and a window into the system to enable video capture of skills exercises.

The FVS simulator is designed to enable 6 surgical tasks, including one-handed knot tying, two-handed knot tying, running suturing, plication suturing, Heaney transfixion pedicle ligation, and free pedicle ligation (**FIGURE 4**). In a pilot study, the FVS simulation system was deemed representative of the intended surgical field, useful for inclusion in a training program, and favored as a tool for both training and testing. Additionally, an initial proficiency score of 400 was set, which discriminated between novice and expert surgeons.[35]

An advantage of this simulation system is that it allows learners to focus on basic skills, rather than on an entire specific procedure. Further, the system is standardized, as it is commercially manufactured; this also allows for easy assembly. The disadvantage of this model is that it cannot be modified to teach specific vaginal procedures, and it must be purchased, rather than constructed on site. Further studies are needed to create gener-alizable proficiency scores and to assess its use in training and testing. For more information on the FVS simulation model, visit the Arbor Simulation website (http://arborsim.com).

Surgical simulation's important role

Surgical skills can be learned and improved in the simulation setting in a low-stakes, low-pressure environment. Simulation can enable basic skills development and then higher-level learning of complex procedures. Skill assessment is important to aid in learning (via formative assessments) and for examination or certification (summative assessments).

With decreasing vaginal surgical volumes occurring nationally, it is becoming even more important to use surgical simulation to teach and maintain vaginal surgical skills. In this article, we reviewed various different simulation models that can be used for developing vaginal surgical skills and presented the advantages, limitations, and resources relevant for each simulation model. ∎

FIGURE 4 Fundamentals of Vaginal Surgery demonstration videos

Scan the QR code for a demonstration of 6 surgical tasks using the Fundamentals of Vaginal Surgery simulation system.

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