Frontiers in Pediatric Urologic Education

FROM THE GUEST EDITOR
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There is currently a paradigm shift occurring in all levels of medical education. This is occurring in medical schools where new curricula are in place which changes the decades-old model of committing 2 years to learning the basic science of medicine, with a smattering of clinical exposure, followed by 2 dedicated years of clinical rotations by a more integrated model in which the basic sciences are taught within a patient-centered and disease-focused construct. In addition, students are exposed to pure clinical arenas earlier in their education. For example, at the Hofstra North Shore-LIJ School of Medicine, first year students train as emergency medical technicians, working shifts on ambulances and responding to 911 calls. Efforts to further enhance the other vital aspects of physician development include Stanford’s Educators-4-CARE Program which provides a formal 4 year curriculum fostering the development of Compassion, Advocacy, Responsibility, and Empathy. The growing number of graduating medical students, and residents, who continue their education and earn additional degrees (besides PhD) is taken into consideration by schools such as New York University School of Medicine where programs are available that offer dual degrees, such as MPA in Health Policy and Management, MPH in Global Public Health, MA in Bioethics, and MS in Clinical Investigation.

The master-apprentice model of residency training that has been in use for decades continues to evolve. The days in which a resident lived in the hospital and was on-call everyday for little to no pay are gone. The days in which residents received a modest stipend and worked in... (continued page 2)

FROM THE EDITOR
Elizabeth B. Yerkes, MD

This Edition of Dialogues is an update on the current requirements and benchmarks for the professional progression of the next-generation pediatric urologist and provides inspiration for innovative contributions to this formative process. I hope that you will enjoy the work of the... (continued page 2)

INSIDE THIS ISSUE:

Educational Theory of Surgical Simulation

Computerized Enhanced Visual Learning (CEVL©): A New Paradigm for Urologic Training and Education

Robotic Surgery Simulation

The Next Accreditation System and Milestones for Pediatric Urology Fellowship Programs
From the Guest Editor

(continued from previous page)

excess of 120 hours per week taking in-house call every other to every third night are also long gone. Today, resident work-hour limitations (80 per week and less for interns) are strictly enforced with severe penalties awaiting Program Directors and the hospitals in violation; in addition, salaries are more substantive. The ACGME has created guidelines aimed at securing an educational process rather than one of servitude.

One argument posed during the debate over reducing resident work hours was that clinical experience would be significantly limited and the impact on training would be to graduate residents who were inadequately or at least inferiorly competent to those trained in the old system. While the validity of that argument is in current debate, at least two outgrowths from the concern over the potential truth of the argument occurred. One was the development of the Core Competencies by the ACGME which guided training programs to better focus their educational efforts toward competencies in traditional areas, Medical Knowledge and Patient Care, but also in areas that focused on other aspects of conducting oneself as a physician; i.e., Practice-Based Learning and Improvement, Interpersonal and Communication Skills, Professionalism, and Systems-Based Practice. A second outgrowth from this argument regarding potentially inadequate preparation is the use of simulation. While simulation has been used extensively in training pilots, firefighters, soldiers, and other professions where there is little room for on-the-job training of novices, simulation in medical education, including pediatric urology, is really in its infancy but growing.

In this issue of *Dialogues in Pediatric Urology*, we have asked several of our colleagues who are committed to medical education to offer their insight into the innovations and trends as they relate to training pediatric urologists. While this topic may initially bring fellowship education to mind, please realize that these topics impact all of us, particularly medical simulation. Brett Johnson and Patrick McKenna will provide the educational theory and background necessary for us to understand the intent of simulation and the proper ways in which simulation can be structured to provide the trainee with the best learning opportunity. This section is followed by Dennis Liu and Max Maizels who present the reader with their insight into the current status of CEVL or Computer Enhanced Visual Learning. This innovative simulation model allows students (medical students, residents, and fellows) to learn pediatric urologic topics and surgeries in a methodical fashion which meets the educational imperatives outlined earlier. The system offers immediate feedback and can be adaptable to meet the needs of both the training program and the trainee. While simulators for classic open surgery are not yet widely available, robotic simulation is much farther along in availability and integration. Tom Lendvay, who has been intimately involved in robotic simulation, takes the reader through its young history describing the current state of simulation, deficiencies in the current state of the art and its future directions. Finally, Bruce Schlomer will update us on the latest innovations of the ACGME to secure competent fellowship training. The Next Accreditation System, which significantly modifies the current accreditation process and philosophy, is already in place for urology residency training and will start next year for pediatric urology fellowship training. In addition, a set of educational Milestones based on the Core Competencies have been developed for pediatric urology by pediatric urologists which included Bruce.

All of these contributions will impact fellowship training in the very near future as incoming fellows will have had simulation incorporated into their residency training and will have met Milestones at each level of training. Fellowship training programs will follow suit in making sure that in the one accredited clinical year, fellows will be able to meet Milestones and demonstrate competencies in areas that are unique to pediatric urology. I would like to thank the contributors of this issue for their commitment to education and offering the pediatric urology community insight into the future of how our medical students, residents, fellows, and attending will be educated.

From the Editor

(continued from previous page)

creative masterminds who make the most of the limited work hours residents have today. I enjoyed the variety of home-made (and farm-grown) simulations—a bell pepper will never look the same!

The most important take-home message is likely that education is customizable, so as to speak to both the teacher and the learner and give us what we need to reach our potential.

I will also draw your attention to our special features: Inside Cohen Children’s Medical Center of New York (page 20) in which our Guest Editor Lane Palmer introduces you to his group. This month’s As Above, See Below... draws parallels to both this Edition and the 2012 Editions on Minimally Invasive Surgery.

As Above, See Below

Max Maizels had been putting together a CEVL module on body positioning and yoga techniques to help us prepare for (or recover from) a long day in the OR. When I shared multiple somatic complaints after a few too many hours of MIS, he developed a section with our associate Bruce Lindgren to address ergonomics at the console.

Max and Tony Chaviano have generously shared this link to CORY: Comfortable with Operating Room Yoga.


There are real operating room scenarios and helpful modifications, and the CORY Relief tabs have pertinent yoga exercises from an instructor. Be sure to check it out!
Educational Theory of Surgical Simulation

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The traditional apprenticeship model of surgical education has become less effective due to limited duty hours, decreased autonomy, and increased body of knowledge. As a result, independent learning has become a crucial adjunct to traditional methods for knowledge acquisition. Educators are striving to define surgical competencies and apply a level of standardization to motor skill acquisition.1,2 As these factors also reduce operative experience for residents, they must derive more educational benefit from the time they dedicate to a particular task. Surgical simulation has become an essential component of surgical education as it allows residents to maximize the opportunity to improve their operative skills, assist in technical remediation, and provide an independent learning environment.3 Understanding and applying educational theory to surgical simulation enhances the experience and thus knowledge acquisition.4 In this section, relevant educational theory will be reviewed in the context of surgical simulation with examples of how these methods can be applied utilizing low cost high fidelity models.

When the traditional residency training system is viewed in the context of high fidelity educational models, the deficiencies in key components to learning becomes clear.5 During live surgery, there is little opportunity for deliberate repetitive practice of a particular part of the case; competency is known to be efficiently obtained with structured practice and reinforcement. The rapidity of a typical surgical case offers limited time to focus on improving specific motor skills, yet some technical skills require an extended period of repetitive practice before being mastered.6 Integration of surgical simulation allows for specific tasks to be isolated, practiced, evaluated and reinforced in a safe and structured environment.

Several authors describe the development of how one learns to perform technical tasks. Howell described the progression from a student being unconsciously incompetent, and then gaining awareness of the incompetence. Once aware, the student begins to become consciously competent and then finally unconsciously competent.7 Miller defined a hierarchal triangle comprised of four levels, “knows, knows how, shows how, does”. Fitts and Posner defined a similar model of phases of motor skill acquisition in which the learner builds a foundation of knowledge by understanding the task (cognition). The learner then applies motor skill to the task with repetition and practice (association) until able to perform the task without thought (autonomy).7,8

In the educational model of Constructivism, knowledge is based on interactions between ideas and experiences. Ideas are built into a framework of understanding, and experiences build upon that foundation.9 Consider a resident surgeon studying the anatomy of the abdomen and retroperitoneum. The framework of gaining knowledge develops from anatomical texts and illustrations which is then reinforced by participating in surgery. Once the knowledge is gained, a surgeon can apply this knowledge during different types of approaches and exposures. If operative cases are the only educational experience, then it is very difficult to learn in a Constructive manner, as one tries to focus on all educational aspects of a particular case and not on a particular motor skill. Surgical training becomes “fill-in-the-blank” rather than a deliberate curriculum.2

Residents are required to log a certain number of index cases to be deemed competent, yet is this an accurate mechanism? Although repetition is the key to association in the Fitts and Posner model, volume does not equal expertise or competence. There is a proven difference between deliberate practice and mindless practice.7 The association phase needs to be mindful, prepared, reflective and must be preceded by the cognition phase to be effective. In the traditional model, this occurs by reading pertinent literature prior to performing a case. Without a fundamental understanding of an operation or its steps, the learner will not be able to integrate the details of the case into a larger framework. This relates to understanding the anatomy of a particular operation, knowing the intricacies of the equipment used, or being familiar with how to apply specific techniques. The cognition phase must be incorporated into surgical simulation in the form of pre-simulation didactics and knowledge assessments.8 If simulation lacks the cognitive groundwork upon which to build, simulation will fail at its ultimate task of training a better surgeon. Where simulation results in repetitive practice, the active patient experience adds the decision making skills. Decision making skill can be acquired faster than the technical skill.4

The final stage of motor skill acquisition is autonomy, which is imperative in surgical training. Surgical simulation allows this autonomy to be achieved in a graduated fashion and allows junior residents to experience this stage earlier in their training. The traditional model typically yields a slow and diverse transition to autonomy over the course of months to years. Once learners experience the journey from cognition to autonomy, even for a simple task, they begin to understand the process and apply it to more complicated tasks.8

While volume of repetition is important, residents must actively understand what they are doing well and where they struggle. Feedback is crucial to surgical education and is present in the traditional training model, but varies greatly in quality, context, and punctuality. After feedback is given, there is often a delay, sometimes a long delay, until the resident can utilize the feedback constructively. Structured surgical simulation allows for the resident to perform a task, receive feedback, and integrate that feedback into that same task immediately. Particular motor skills can be reinforced substantially faster and more efficiently in the simulation laboratory than in the operating room.

Urology residents represent the top of their class and as new generation learners they thrive on self-directed learning and independent knowledge acquisition. Residents are adult learners who have established successful methods of learning in order to have a reached their (continued on next page)
level of success. Adult learners are self-motivated and should be involved in establishing the curriculum. The climate of curriculum based education must be physically and emotional tolerable. Educational outcomes are poor when the adult learner fails to see personal value or to feel a sense of responsibility for the task. In the operating room, a resident will naturally feel responsible for the best interests of the patient and the attending will likely be observing the resident’s moves and aware of every struggle. Thus, the operating room can be an intimidating educational venue, especially for a junior resident. Extremely high anxiety levels are not conducive to effective learning. Although the educational dynamics of the operating room can be tweaked, it is impossible to cultivate a true surgical curriculum. In contrast, unstructured simulation laboratories provide no sense of responsibility or consequence which is often required to motivate the surgical resident to deliberately practice. Surgical simulation curricula can be plastic, dynamic, and adaptable to individual residents and applied to address common weaknesses and accommodate various learning styles. Responsibility, self-reflection, and feedback can all be introduced in the simulation lab and be tailored to the learner. Tactics such as peer-to-peer competition, simulation achievements, and rewards can be utilized to generate self-pride in the activity. By striking the perfect balance of anxiety and comfort, surgical simulations can be used to hone surgical skills in a safe, effective, and efficient manner (Figure 1).

While the traditional master-apprentice model of surgical education is a very personal experience, data show that peer-level social learning improves retention. Simulation allows for a powerful social experience for surgical education in which same level residents can share common struggles in real time and same task competition between residents can promote active and mindful practice. Resident to resident teaching is pervasive in residency education, and the act of teaching often yields the highest rate of retention for the resident educator (Figure 2). By integrating simulation in a social fashion, residents to work cohesively and to become better teachers and better learners. Likewise it offers the faculty an opportunity to see the fellow faculty member technical capability and share technical tricks that they may have never had the opportunity to share with one another.

Surgical simulation is an important adjunct to resident surgical education. It allows residents to master technical skills without endangering patients and can be flexible, dynamic, and individualized. Proficiency of operative motor skills allows the surgical resident to focus on the more subtle and complexities of a case such as intraoperative decisions, subtle technical points, surgical indication, follow up, and other non-technical nuances. Moreover, proficiency based training using virtual reality simulator lead to fewer errors in the operating room. Laparoscopic models improved performance on live-animal models. Crucial components of an effective simulation curriculum is reviewed in Table 1.

Southern Illinois University developed a surgical skills model that utilized faculty-led instruction, guided practice, and expert performance videos. Fourth year medical students served as the novice group that underwent one week skill simulation with deliberate practice and feedback. These skills included chest tube insertion, suturing, bowel anastomosis, and laparoscopic skills. The initial teaching portion outlined equipment, technique, anatomy, indications, contraindications, and potential complications. Experts taught the skills to the novices, were available to provide immediate feedback while the novices performed deliberate practice on high fidelity cadaver, and porcine models, and provided formal feedback. Performances were videotaped before and after the simulation curriculum and rated by blinded experts. Pre and post intervention proficiency was evaluated and compared to data about end of PGY-1 and end of PGY-2 residents. The results were striking. Average performance ratings for novices improved dramatically for all
skills. Post-intervention novices performed as well as residents in completing the procedure’s checklist. Post-intervention novices also compared favorably with residents in economy and time of motion for all but the most complex skills. Surveys done after the novice group proceeded on to residency demonstrated that all the students felt that the simulation experience put them at an advantage over their peers.14

The broad range of surgical procedures in urology would be difficult to recreate by a computer simulator which led to the development of organized curriculum-based simulation laboratories utilizing inexpensive high fidelity models. The successful simulation laboratory should include a short didactic session with associated important decisions making for the procedure and the latest clinical guidelines for the skill.

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### Table 1. Components of an effective simulation lab:

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
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<tbody>
<tr>
<td>Syllabus</td>
<td>Contains learning objects, independent study material, diagrams, and references</td>
</tr>
<tr>
<td>Didactics</td>
<td>Concise, high yield, expert led didactic will introduce technique and goals as well as allows students to build a framework for the skill</td>
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<tr>
<td>Laboratory Simulation</td>
<td>Reinforcement of good technique on high fidelity models</td>
</tr>
<tr>
<td>Feedback</td>
<td>Expert feedback that is immediate, organized, and focuses on where to improve</td>
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<tr>
<td>Evaluation</td>
<td>Learner evolution of the simulation and implementation of changes to suit the learner</td>
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### References


Figure 3. Pictures of Urology residents performing surgical simulation labs. The models represented are transurethral resection (a), cystoscopy (b), Percutaneous Nephrolithotomy (c), Ureteral Reimplant (d), Ureteroscopy (e), Pelvic Floor Dissection (f).
Computerized Enhanced Visual Learning (CEVL©): A New Paradigm for Urologic Training and Education

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Introduction

Traditional surgical teaching through immersion learning and the reliance on static surgical atlases and textbooks are no longer sufficient for modern surgical education. Various pressures including resident work hour restrictions, medico-legal and patient safety concerns, and limitations on clinicians’ teaching times have necessitated implementing new surgical teaching methods. No longer is the axiom “see one, do one, teach one” sufficient for resident education. Furthermore, as the current trainees increase their reliance on modern technologies such as the Internet and away from traditional references, surgical educators must learn to adapt and incorporate these new technologies into their armamentarium. In order to meet these challenges, we have utilized Computer Enhanced Visual Learning (CEVL©) as a new paradigm for urologic residency education and training. CEVL© is an Internet-based program that provides a structured-learning platform that is modifiable, interactive, and readily available. It is a tool that allows for learning both inside and outside of the operating rooms and hospital setting. While CEVL© was originally designed to teach surgical procedures, it has evolved to become a powerful educational tool that is also effective to teach diagnosis and core knowledge. A video link to the CEVL© method is shown (CEVL Method). Click to view.

CEVL© for Teaching Surgical Procedures

The CEVL© concept began at Chicago Children’s Memorial Hospital in 2007 as a research effort to improve teaching of common Pediatric Urology procedures to Urology residents. In teaching surgical procedures, CEVL© adapts the Ericsson method of deliberate practice to teach psychomotor skills. The central tenet of Ericsson’s method is a cycle that begins with the study of basic skills, performance of the skill under supervision, and the provision of specific feedback for structured remediation. CEVL© adapts this method for surgical skills training by centering on 3 fundamental principles:

1. organization of trainee preparedness for surgery,
2. supervised performance of the procedure, and
3. focused areas of improvement based on feedback.

The CEVL© method for surgical training is exemplified in the following model of the pediatric orchiopexy.

Step 1: Organization of Trainee Preparedness for Surgery

The CEVL© method begins by providing a structured format of learning that will assist the learner to organize the key concepts required for the surgical procedure. This process begins with a review of the pertinent anatomy. CEVL© further conceptualizes the procedure into major procedural segments called components and further divides the components into specific steps. The division of pediatric orchiopexy into components and steps is shown (Figure 1). Difficult steps and concepts of the procedure are identified and their learning is promoted by use of a CEVi (Computer Exercise Virtual interactive), a 2/3-dimensional interactive graphic and model. For instance, identification and understanding of the anatomic associations of the hernia sac can be one of the most challenging concepts for resident understanding of pediatric orchiopexy. CEVi provides an interactive 3D model of the inguinal canal that allows the trainee to manipulate the various structures of the canal and gain a better understanding of the anatomic relationship of the hernia sac with the spermatic cord (Figure 2). More

Figure 1: A. Pediatric orchiopexy is broken down into components for ease of learning. The ordered steps of the components comprise the CEVL script. B. Components are further divided into steps which are explained in detail. C. Intraoperative pictures, video clips, or animations help illustrate the relevant anatomy and provide further pointers to successfully complete the steps. D. Explanatory text provides further details and tips on completing the steps. Both the steps and explanatory text are modifiable to reflect individual surgeon preferences. E. The CEVL dashboard provides further exercises or didactics that the user can access.

Figure 2: Interactive buttons on left and bottom edges permit the learner to build mental concepts of a pediatric hernia, stylized in aqua, emerging from the medial aspect of the internal ring (external oblique and cremaster muscle have been computer dissected away).
difficult technical skills are also learned and practiced with the use of simple, low-fidelity stimulation models that trainees can easily build at home and practice on in their own time. For example, suture ligation of the hernia sac is simulated with a Penrose drain (Figure 3). Lastly, residents show their preparedness for the procedure to both their supervising attending and themselves through computerized readiness exercises. Residents show their readiness by arranging components of surgery in the order they are done.

Step 2: Performance of the Procedure

Surgery is next learned by performing the procedure under the supervision of the attending surgeon. CEVL® provides detailed descriptions of how to perform each component and step through the use of text, pictures, video clips, and animations. This material may be modified to fit the individual techniques and preferences of each attending surgeon. By incorporating surgeon-specific nuances into CEVL®, trainees can more readily prepare for the surgery as it is done by the specific attending surgeon and increase their knowledge in variations in surgical techniques.

Although residents may come to the operating room well-prepared for surgery, they may become too overwhelmed by the task at hand to think clearly and logically when operating. In order to minimize this effect, CEVL® organizes the surgical procedure into a CEVL® script, an agreed-upon logical flow of how to perform the procedure. This script is posted in the operating room for all involved to view and may be referred to as needed. Having a readily accessible and organized resource available has been found to increase resident confidence in the operating room.

Step 3: Feedback and Remediation

Immediately following the surgical procedure, CEVL® provides web-based checklist by which the supervising surgeon may provide the trainee immediate quantitative and qualitative feedback on his/her performance. Feedback is also provided for the procedure globally as well as for specific components. Both the supervising surgeon and the trainee can then readily identify components or steps of the procedure that require improvement. Strategies to remediate skills are formed and the residents are able to structure their learning for improvement of specific skills for the next case. The emphasis on specific components rather than on the procedure as a whole allows for better identification of areas for improvement and makes learning more efficient. Records of evaluations are kept on a secure online registry that is accessible to both the trainee as well as the supervising surgeon. Review of this registry allows for the identification of patterns of deficiencies as well as a record of improvement through deliberate practice. Furthermore, the use of CEVL® is consistent with the documentation requirements of the ACGME by providing Program Directors with a record of resident performance and competency.

CEVL® for Teaching Diagnosis and Knowledge

In addition to teaching surgical skills, CEVL® has been adapted for use in teaching both diagnosis and core knowledge that are often difficult to learn via traditional teaching methods of immersion learning, lectures, and textbooks. Similar to teaching surgical skills, CEVL® continues to be rooted in the three fundamentals of preparedness, performance, and feedback/remediation. Computerized modules of content, such as how to grade pediatric hydronephrosis, are created and available for access via the web as described below.

Figure 3: Teaching basic surgical skills can be done using simple, self-made, CEVL simulations. Here a disposable basin and Penrose drain serve to practice tying in a “deep hole.” Rotating one’s torso (e.g. move monkey move) assures square knots are tied (tie monkey tie). “Monkey” references content details in the CEV-ule.

Figure 4: A. CEVL dashboard. B, C. Color-coded anatomical structures that are overlaid on ultrasound images to better illustrate the appearance of the renal collecting system on ultrasound imaging.

Step 1: Preparedness

CEVL® begins with a web-based tutorial on the basics of the subject matter that may involve a review of relevant embryology, pathophysiology, grading systems, and/or anatomy. For instance, in teaching the Society for Fetal Urology (SFU) grading system for hydronephrosis, the CEVL® tutorial provides interactive, 3D animations and models that depict the kidney and its collecting system and correlates the anatomy to ultrasonic imaging (see Figure 4). Characteristic features of the individual grades of hydronephrosis can be described and accurately depicted on both anatomical models and ultrasound imaging. This ability to correlate anatomy with ultrasound images strengthens the learners’ abilities to accurately interpret ultrasound images.
CEVL© (continued from previous page)

Step 2: Performance

Once confidence in the subject matter is obtained, the learner proceeds to performing the task. In the example regarding hydrenephrosis grading, this activity is accomplished by asking the trainee to assign grades to a series of newborn ultrasounds available in the CEVL© module.

Step 3: Feedback and Remediation

Immediate feedback is provided upon completion. In the example of hydrenephrosis grading, correct and incorrect answers are displayed and explanations are provided. The renal ultrasound with accompanying explicative text and interactivity with color overlays are also provided to further the learning experience. Similar to modules of surgical procedures, results of these self-evaluations are stored and accessible to the learner. This again allows for the identification of patterns of knowledge deficiencies that can be used to structure more deliberate practice. For example, if a learner consistently misidentifies SPU Grade2 and 3, the remediation would be to focus on the didactics and models depicting the differences in these two grades of hydrenephrosis (i.e., differentiating between major and minor calyces on an ultrasound image).

How CEVL© works

One of the major innovations of CEVL© is its accessibility and adaptability. Individual training programs have the flexibility to create and mold the CEVL© curriculum to meet their specific needs. Access to CEVL© is obtained through individual program directors who may review available content and determine which CEVL© modules to employ. Participating program directors forward their residents’ email addresses to CEVL© and an invitation to register is sent to all trainees. After registering at http://CEVLforhealthcare.org and creating a secure username and password, authorized residents will gain access to their individual programs’ educational curriculum, their past CEVL© scores, attending feedback on their past performances, and structured remediation plans to help improve their performance (Figure 5).

New CEVL© modules are created jointly between faculty and residents with the assistance, as needed, from CEVL© technical support staff. To create new modules, residents first identify surgical procedures or diagnoses that are confusing or problematic and work with faculty to develop the educational content. Images, videos, and animations are gathered and designed into a cohesive curriculum and made available for testing by faculty and residents. Modifications and edits are continuously made in a collective fashion to enhance the educational value of the module until it meets the satisfaction of the program director. After final approval, the module is made available on the program’s dashboard for use. Program directors may choose to include modules produced by other programs with the explicit approval of the module creators.

Current Experience with CEVL©

Since its introduction in 2007, our institution has been actively evaluating CEVL© as an educational tool. In 2008, our initial experience with pediatric orchiopexy demonstrated success in improvement of surgical skills in 96% of the residents over an average of 7 cases. McQuiston et al. subsequently replicated the success of CEVL© in teaching pediatric orchiopexies across 4 institutions, demonstrating its general applicability. Further publications have demonstrated applicability of CEVL© to teach other pediatric urologic procedures such as posterior urethral valve ablation, as well as difficult diagnostic skills such as SFU Grading of hydrenephrosis. CEVL© has also been shown to be effective in teaching surgical techniques to non-urologic residents, such as neonatal circumcisions to pediatric residents and closed reduction and pinning of pediatric supracondylar fractures.

Conclusion

Our institutional experience has demonstrated the effectiveness of CEVL© to promote resident education in the challenging modern environment of medical education. Increased accessibility via the Internet, incorporation of multimedia into didactic teaching, and structured remediation based on specific feedback allows CEVL© to make resident education more effective, efficient, and personalized. To learn more about CEVL©, visit http://www.cevlforhealthcare.org. To join CEVL©, please email info@CEVLforhealthcare.org.

References

Robotic Surgery Simulation

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Introduction

Almost 100,000 Americans die annually due to medical complications, and upwards of 32,000 are directly related to surgical complications. The average American can expect to have 7 surgeries in their lifetime. And the estimated surgeon workforce required to support the expected 2030 US population of 364 million is 100,000 new surgeons whose training will cost an estimated $37 billion. This burden of surgical complications coupled with the challenges of adequately training our future surgeons is compounded by the rapid adoption of new surgical technologies. In 2012, just over a decade since the first robotic surgery, 360,000 robotic surgeries were performed worldwide and over 80% of prostatectomies are performed robotically in the United States. Pediatric urology has been impacted by the introduction of robotic surgery, yet standard robotic surgery training methods lag. Furthermore, many educators involved in training our future pediatric urologists are just now working through their own learning curves, making it difficult to pass on skills.

Methods to optimize robotic surgery training center on both reality-based and virtual reality (VR)-based platforms. These simulators allow programs unable to purchase da Vinci training platforms the ability to train off-line. Yet practice on the actual surgical robot or in an animate lab is still integral to safe and effective human robotic surgery. Literature supports validation of robotic simulation curricula, but most training protocols are derived from general urology residencies and geared towards adult procedural skills. Based on sheer volume of procedures performed robotically in children, we have targeted pyeloplasty as the procedure of choice to practice. Through task deconstruction, graduated advancement and benchmarking, we have the ability to hone our novice roboticists’ skills to ensure safe practice.

Robotic surgery simulation in the coming decade will include patient-specific simulation, more efficient means of grading performance, and will most likely include alternative robotic platforms on which to practice. Our charge as patient advocates is to develop strategies to standardize pediatric urology robotic training through communication with simulator companies to develop patient-specific simulation modules, through more rigorous benchmarking of practicing clinicians new to robotics and trainees, and through evidenced-based study of the benefits of our training curricula on patient outcomes.

Robotic Simulators

The novice wishing to practice open suturing skills, has easy access to the necessary surgical instruments; however, in robotics, acquisition of the surgical ‘instruments’ can prove to be an insurmountable barrier. Most institutions purchase expensive surgical robots for clinical care. It is in the hospital’s financial interest to maximize their use which places a burden on the robotic novice to practice on the da Vinci on off hours such as nights and weekends. This may directly violate the Accredited Council of Graduate Medical Education duty hour regulations. Thus, alternative methods for training robotics have been developed.

The first virtual reality simulator for robotic surgery was the dV-Trainer (MIMIC Technologies, Inc. Seattle, WA) funded by the Department of Defense. Initially, the manufacturer of the da Vinci did not embrace the need for a training simulator for a robotic platform that was felt to be ‘intuitive’. However, after initial beta-testing of the simulator and early reports of simulator-based curricula improving robotic skills and discriminating robotic surgery skills, the simulator gained traction. The advantage of the dV-Trainer, now on its third iteration, is that it is a desktop device that does not require any of the da Vinci components to function, making it accessible at any time. (Figure 1)

The surgeon interface is similar to the da Vinci, but the mechanisms governing the hand-held telemanipulators differ from the da Vinci console. The desktop trainer can place a novice practicing on the simulator at the level of a novice practicing on the actual da Vinci for certain technical skills. Another advantage of the simulator over the actual da Vinci platform is the ability to provide granular performance feedback. These data can be tabulated, compared to peers or prescribed benchmarks, and used to create tailored simulation curricula for the trainee based on individual strengths and weaknesses. (Figure 2) The disadvantages of the dV-Trainer include a cost of $100,000 and the lack of certain functionalities of the actual da Vinci robot console, such as all the foot pedal functions.
Acknowledging the value of providing their clients with a means to practice da Vinci robotic manipulation through VR simulation, Intuitive Surgical, Inc. (Sunnyvale, CA) developed a modular hardware simulator (da Vinci Skills Simulator or dVSS) that attaches to the back of the da Vinci Si system and provides the user with the real console interface while performing VR tasks. (Figure 3) Like the dV-Trainer, the dVSS or ‘backpack’ simulator provides the user with detailed performance metrics such as economy of motion, path length of the tools, errors, and task time which all can be used by educators to assess technical skills and provide summative feedback. These metrics have been used to validate curricula using the backpack simulator. The disadvantages of the dVSS include an added $85,000 cost to the da Vinci and not all of the VR modules provide usable detailed feedback about task performance. For example, the suturing modules, although adequate for training the hand movements required to pass suture through tissue, lacks information about task time, tool path length, economy of motion and errors, which have all been described as surrogates for surgical skill. Furthermore, the dVSS requires an actual da Vinci console to work, which limits access unless $500,000 is invested to purchase a dual da Vinci console system on which to attach the simulator.

The RoSS (Robotic Surgery Simulator, Simulated Surgery Systems, LLC, Williamsville, NY) is a departure from the dV-Trainer and dVSS in that it includes novel software and a surgeon-assist mode that guides the surgeon through surgical tool motions by forward-drive kinematics. (Figure 4) RoSS system curricula have been validated and the system benefits and suffers from the fact that it is a stand-alone console interface just like the da Vinci console. The user can be immersed in a surgical cockpit environment like when operating on the da Vinci, but the platform occupies a large footprint unlike the desktop trainer. The use of motor driven surgical telemanipulators affords the user the ability to follow an ‘expert’ prostatectomist through the urethrovesical anastomosis as the expert would manipulate their instruments. The use of haptics (force feedback controls) sets this simulator apart from the other VR simulators and the use of actual patient surgery video provides the user with an opportunity to witness patient surgery through the eyes of the console. All three makers of the simulators claim to be working on methods to import patient-specific simulation modules, but not are available yet.

VR simulators are valuable for training basic robotic tool manipulation, but reality-based robotic simulation modules afford the user with real tool tissue interaction experience. Credentialing hospitals usually require training curricula to include practice on the console in either dry labs or animate labs or both. Animate lab da Vinci training at individual institutions is sporadic as many institutions cannot afford robots for animate use and with concern for zoonoses, hospitals are reluctant to shuttle the clinical robot in and out of a pig lab. The da Vinci console does not have haptics imbedded, and robotic surgery requires translation of visual cues into perceived applied forces. This ability takes practice and dry lab modules are a safe environment in which to understand the movements that tear tissues and break suture.

Another major advantage of reality-based da Vinci training over VR training is the ability to practice skills that are peripheral to surgical skills training, such as robotic arm positioning, docking, and team training. Furthermore, robotic catastrophe training such as robotic malfunction, power-outage, unrecoverable system faults, and acute hemorrhage or CO2 embolism drills can keep the operative team ready for rare events.

Pediatric Urology-Specific Robotic Training

Some of the challenges of adequately training our future generation of robotic pediatric urologists are 1) only a minority of pediatric urologists have at least 5 years of robotic experience, 2) programs newly adopt...
ing robotics invest efforts into training the practicing surgeons but not necessarily the pediatric urology trainees (fellows or residents), and 3) most VR and reality-based simulation modules are geared towards adult-sized spaces, instrument trajectories, and predominantly focused on 8 mm instrument manipulation.

These challenges make it difficult for our profession to establish pediatric urology benchmarks. Methods to safely introduce robotic trainees to human procedures has been through task deconstruction of patient surgery and graduated advancement. In Ali et al., bariatric surgery fellows learning robotic gastric bypass surgery were trained through successive advancement from the simplest steps to the hardest steps of the procedure. In their first 10 surgeries, they performed one fundamental step of the procedure and were tracked by operative time and patient outcomes. Another step was added in the second 10 cases. In the last ten cases, they performed the first two steps and added the most difficult portion of the case. The investigators observed that the last ten cases, where three different steps were performed, took as long as the average operative times of the first ten cases.19

In our program, our trainees are advanced through graduated practice on the da Vinci starting with basic docking skills followed by simple object manipulation, to suturing. Some simulation companies10 and some centers exploring the use of 3D printing technologies [Walid Farhat, personal communication] have created reality-based pyeloplasty modules for training, capitalizing on the fact that pyeloplasty is one of the most common minimally invasive surgeries performed in pediatric urology.7 (Figures 5 and 6) Using these reality-based modules, trainees can practice first division and spatulation of the ureter, then anterior wall closure, and then posterior to anterior wall closure in a graduated manner.

A major limitation to reality-based robotic training is the inability to track granular metrics. As only a few centers that have Application Programming Interface access to the da Vinci where all the tool motion data is captured20, the only metrics one can track when practicing on the da Vinci are task time and errors. Goh et al. in 2010 published the first structured assessment tool for robotic surgery called the Global Evaluative Assessment of Robotic Surgery (GEARS) for clinical surgery.21 (Figure 7) Chowriappa et al. recently published a validated structured assessment tool for VR simulation curricula using the RoSS platform.22 These tools help trainers to objectively measure robotic surgery and robotic surgery simulation performance. Validation studies with these new structured assessment tools are required before pediatric urology educators can confidently integrate them into standard training.

Additional limitations to pediatric urology robotic simulation education are the lack of animate analogues to our smaller patients, the generally smaller case volumes compared to adult procedures on which novices can progress through their learning curves, and the logistics of access to a clinical robot for pediatric surgery as some pediatric urology practices and training centers are in the shadows of their adult parent practices.

Future Perspectives

In the coming decade, we can expect:
- more established robotic simulation training standards
- the introduction of real patient-specific simulation
- the expanded role of surgical warm-up simulation for robotic surgery
- alternative methods to grade robotic surgery performance (crowd sourcing); and
- Relatively inexpensive robotic platforms for animate and dry lab training.

Fundamentals of Robotic Surgery

Through a joint Department of Defense, Florida Hospital System, and Intuitive Surgical, Inc. grant, a multi-disciplinary consortium has been established to generate a standard robotic surgery training curriculum including cognitive, technical, and team skills training modules called the Fundamentals of Robotic Surgery (FRS).23 FRS has a Memorandum of Understanding with professional surgical societies spanning urology, general surgery, otolaryngology, and gynecology to develop this fundamental training platform. Each surgical discipline will then build on this foundation to develop their own discipline-specific set of skills. The process is in the validation phase and may be rolled out nationally in the next 1-2 years. Much like the Fundamentals of Laparoscopic Surgery, a mandatory general surgery residency...
laparoscopic training certification process overseen by the American Board of Surgery, FRS may ultimately be employed for certification and credentialing of robotic surgery.24

Patient-Specific Simulation and Warm-up

Makiyama et al. in Japan described the first use of imported patient-specific imaging to practice a patient’s renal surgery on a VR laparoscopic simulator.25 This technology creates a 3D VR environment based on patient imaging with which a practicing surgeon can interact and operate. Rehearsing surgery before surgical performance has been shown prospectively to benefit both novice and experienced robotic surgeons in a dry lab setting. In Lendvay et al., fifty-one surgery residents, fellows, and faculty participated in a VR robotic simulation proficiency training curriculum followed by hypothesis testing of the role of VR robotic warm-up on similar and dissimilar da Vinci dry lab tasks. Surgeons randomized to doing a brief 3-5 minute VR simulator warm-up before doing a robotic ring transfer task or a suturing task had decreased task times, improved economy of motion, and reduced errors when compared to a group of surgeons who did not warm-up.26 It remains to be seen whether doing robotic simulation warm-up right before doing actual patient surgery will prime surgeons as was observed for some initial warm-up laparoscopic surgery studies.27, 28

Improvements in how we assess surgical skill are also required to enhance a practicing surgeon’s performance. The current means to objectively evaluate robotic skills involves real-time or video review of the performer’s operation which is time intensive, expensive, and is arguably not objective; the grading educator is usually from the same institution as the observed trainee and may be biased. A recent observation by our group of the accuracy of crowd sourcing surgical skills assessment may offer an alternative to conventional skills assessment. We identified equivalence of a random crowd of people from Amazon.com’s Mechanical Turk Project™ to grading a robotic suturing task as compared to the grading of experienced robotic surgeon educators using the GEARS grading tool.29 Additional validation of the crowd sourcing method we call Crowd Sourced Assessment of Technical Skills (C-SATS™) is required, particularly with human surgery, before using it in surgical training, but it promises to be more objective, less expensive, and faster than the standard assessment methods.

Alternative Robots

Advances in technology will enhance the role of both VR simulation, and reality-based training. The ideal robotic simulation training curricula would include both VR and animate robotic practice using the da Vinci hardware. Recognizing that this is impractical for many institutions, organizations are developing alternative and less expensive robotic platforms and with open source software allowing tailorable training. One such platform is the Raven surgical robot developed at the University of Washington. (Figure 8) The Raven is an 80 lbs two armed robot that can clamp on to an operative table and use expired da Vinci tools or its own designed graspers. The cost is under $350,000 and preliminary surgical skills studies demonstrate its use for animate lab surgery and dry lab training.30 In a recent prospective study testing the ability of the Raven to train users to a baseline da Vinci proficiency, we showed that the Raven training curriculum cut down by a third the number of trials a user would have to perform on the da Vinci to get to proficiency in doing a robotic FLS block transfer task. [unpublished data]

Conclusions

Robotic simulation training, whether on a VR simulator or on the da Vinci robot, is invaluable for elevating the proficiency level of the roboticist prior to patient surgery. Our future goals must be to 1) de-

(continued on next page)
Robotic Surgery Simulation (continued from previous page)

Figure 8. Raven II surgical robot, University of Washington Biorobotics Lab.

Develop standard training curricula adopted by all pediatric urology centers, 2) provide around-the-clock access to robotic platforms for our trainees and learners, 3) design and develop more efficient assessment methods and training platforms, and most importantly 4) design and test sound research studies demonstrating improved patient outcomes with our simulation interventions.

References


The Next Accreditation System and Milestones for Pediatric Urology Fellowship Programs

Introduction

The history of American pediatric urology fellowship training has evolved considerably from the lack of available training in the United States until the late 1970s, to apprentice-type training in the 1980s and 1990s, to accreditation, and organizational oversight and accountability currently. In 2014, the Accreditation Council for Graduate Medical Education (ACGME) accredits fellowship training programs in pediatric urology that offer 12 months of continuous clinical training with faculty and a curriculum that meets its standards. The American Board of Urology (ABU) offers a Pediatric Subspecialty Certificate which requires candidates to complete a fellowship program of at least 2 years duration, of which one clinical year must be accredited by the ACGME. Thus, all currently available pediatric urology fellowships (28) in the United States are ACGME-accredited and offer an additional year (or two) of research or a hybrid experience of clinical experience and research. This review will focus only on the ACGME accredited year in pediatric urology fellowship training and will discuss several aspects of the next accreditation system (NAS). In addition, we will discuss the pediatric urology Milestones that will be used as a basis for fellow evaluation and for reporting educational outcomes to the ACGME for program accreditation in the NAS.

What is the current ACGME accreditation system?

The ACGME was formed in 1981 when the quality of resident education was highly variable and subspecialty education was becoming more formalized. The ACGME’s initial approach focused on standardizing program structure, increasing the quantity and quality of formal education events, striking a balance between resident education and service, formalizing resident evaluation which included feedback, and requiring financial support of residents. While the ACGME has been largely successful in improving resident education and learning environments, program requirements and rules have become more and more specific leaving little room for innovative learning options. Program directors have had increasing administrative burdens that detract from trainee mentoring and can lead to burnout.2

The current ACGME program accreditation system that is being phased out includes periodic on-site reviews of programs yielding approval periods of up to 5 years. These reviews include the requirement of program directors to create a program information form (PIF) that provided the reviewer and the RRC detailed descriptions of how the training program meets both the common program requirements and the specialty-specific requirements. The PIF also includes information regarding the methods used to evaluate the performance of the fellow, and the performance of the program, its curriculum and faculty to meet the fellows’ educational needs. Information from the PIF, as well as a site visit by the ACGME, would be used by the RRC to determine if the program should continue to be accredited, if there were any issues that needed to be addressed, and the period of accreditation.

What is the Next Accreditation System (NAS)?

In 2009, the ACGME began a review of program evaluation methods from which the NAS was developed. The aims of the NAS are: “to enhance the ability of the peer-review system to prepare physicians for practice in the 21st century, to accelerate the ACGME’s movement towards accreditation on the basis of educational outcomes, and to reduce the burden associated with the current structure and process-based approach.”1 In other words, the NAS places more emphasis on educational outcomes than on detailed and prescriptive program requirements for accreditation. Other stated goals of the NAS are to promote ongoing improvement in all programs and to foster innovation in education in high performing programs.3

Under the NAS, many of the current processes of ACGME accreditation will continue. There will continue to be a list of ACGME program requirements for graduate medical education in pediatric urology, as well as the collection of case log data. Surveys will be conducted regarding the program from fellows and faculty, fellow and faculty scholarly activity, board pass rates, and fellow demographic information.

Although many of the surveys include specific aspects included in the PIF, the lengthy document will no longer be used. Important new aspects of the NAS include more frequent submission of data to the ACGME, different time frames and methods for site visits, and new methods for fellow evaluation including the use of Milestones. The NAS moves away from a periodic physical site visits and audit of documents to a continuous accreditation process that emphasizes monitoring of educational outcomes. Programs will be required to electronically submit data biannually to the ACGME that will be monitored by the pediatric urology residency review committee (RRC). Table 1 describes what data will be collected and how often it must be submitted.3 Under the NAS, periodic program site visits, called self-study visits (SSV), will occur routinely every 10 years with programs notified 12 to 15 months in advance of the SSV. The frequency of SSVs may be increased or a focused visit may be required if issues are identified by the RRC through evaluation of the continuously submitted data. The ACGME intends to ensure that preparation for a SSV would not be overly burdensome; a several page document will need to be submitted.

Table 1: Required Data Submission in the Next Accreditation System

<table>
<thead>
<tr>
<th>Data</th>
<th>Time frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>De-identified Milestones outcomes</td>
<td>Every 6 months</td>
</tr>
<tr>
<td>ACGME fellow survey</td>
<td>Annually</td>
</tr>
<tr>
<td>Faculty survey and scholarly activity</td>
<td>Annually</td>
</tr>
<tr>
<td>Case log and clinical experience data</td>
<td>Annually</td>
</tr>
<tr>
<td>Graduates' performance on board examinations</td>
<td>Annually</td>
</tr>
<tr>
<td>Accreditation Data System (ADS) update</td>
<td>Annually</td>
</tr>
<tr>
<td>CV of program director1</td>
<td>Annually</td>
</tr>
</tbody>
</table>

1The CVs for other faculty are no longer required
The Next Accreditation System

completed from which to start discussions at the SSV. The SSVs will also utilize data that has been submitted by the program over the prior years. The emphasis will be on educational outcomes achieved as measured by the Milestones and continuous program improvement. An overview of the aims of the SSVs are shown in Table 2.

### Table 2: Goals for Self-Study Visits

<table>
<thead>
<tr>
<th>Must accomplish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment of program compliance with requirements</td>
</tr>
<tr>
<td>Review citations</td>
</tr>
<tr>
<td>Review issues identified in fellow/faculty surveys</td>
</tr>
<tr>
<td>Verify data reported to ACGME</td>
</tr>
<tr>
<td>Continue to validate and improve the NAS system</td>
</tr>
<tr>
<td>Assess program aims and efforts to achieve aims</td>
</tr>
<tr>
<td>Assess and discuss program strengths, weaknesses, and problems with program’s environment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Should accomplish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide advice to program in areas identified by visit or in areas requested by program</td>
</tr>
<tr>
<td>Evaluate methods of program evaluation for improvement</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desirable to accomplish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunity for open dialogue between program and ACGME</td>
</tr>
<tr>
<td>Identify ways to improve future self-study visits</td>
</tr>
</tbody>
</table>

In 2010, amidst discussions regarding resident work hour standards, the ACGME authorized the development of a method for evaluating sponsoring institutions with periodic site visits, the Clinical Learning Environment Review (CLER) program. The CLER program emphasizes the responsibility of sponsoring institutions to create safe environments for resident and fellow learning and patient care. CLER program site visits will occur regularly every 18 months and more frequently, if needed. The six areas of focus of CLER program site visits are patient safety, quality improvement, transitions in care, supervision, duty hour and fatigue management and mitigation oversight, and professionalism. These site visits will primarily involve discussions with the executive leadership of the sponsoring institution and the GME committee. However, it is important for all programs to be aware that the sponsoring institution will be having these site visits periodically.

The Milestones are based on a model of development of professional expertise that includes 5 levels. Level 4 is the target for graduation (but not a requirement) while Level 5 is an aspirational goal that is not an expected achievement for fellows.

### Table 3: Minimum Case Numbers for 2014 Pediatric Urology Graduates

<table>
<thead>
<tr>
<th>Category</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endourology/Stone Disease</td>
<td>10</td>
</tr>
<tr>
<td>SWL/ureteroscopy/PCNL</td>
<td>5</td>
</tr>
<tr>
<td>Ureterocele incision</td>
<td>2</td>
</tr>
<tr>
<td>Posterior valve ablation</td>
<td>2</td>
</tr>
<tr>
<td>Scrotal/Inguinal Surgery</td>
<td>60</td>
</tr>
<tr>
<td>Hernia repair/Orchiopexy</td>
<td>50</td>
</tr>
<tr>
<td>Varicocelectomy</td>
<td>5</td>
</tr>
<tr>
<td>Penile Surgery</td>
<td>40</td>
</tr>
<tr>
<td>Distal hypospadias</td>
<td>30</td>
</tr>
<tr>
<td>Proximal hypospadias</td>
<td>5</td>
</tr>
<tr>
<td>Hypospadias complication repair</td>
<td>5</td>
</tr>
<tr>
<td>Epispadias</td>
<td>2</td>
</tr>
<tr>
<td>Bladder/Ureteral Surgery</td>
<td>30</td>
</tr>
<tr>
<td>Ureteroneocystostomy</td>
<td>15</td>
</tr>
<tr>
<td>Cysto with subureteric injection</td>
<td>5</td>
</tr>
<tr>
<td>Major Abd/Reconstructive Procedures</td>
<td>35</td>
</tr>
<tr>
<td>Pyleploplasty</td>
<td>10</td>
</tr>
<tr>
<td>Nephrectomy</td>
<td>4</td>
</tr>
<tr>
<td>DSD surgery</td>
<td>3</td>
</tr>
<tr>
<td>Complex Bladder Reconstruction</td>
<td>10</td>
</tr>
<tr>
<td>Appendicovesicostomy</td>
<td>5</td>
</tr>
<tr>
<td>Enterocystoplasty</td>
<td>2</td>
</tr>
<tr>
<td>Exstrophy closure</td>
<td>Tracked only</td>
</tr>
<tr>
<td>Urodynamic Studies</td>
<td>10</td>
</tr>
<tr>
<td>Total Laparoscopic</td>
<td>10</td>
</tr>
<tr>
<td>Total Robotic</td>
<td>Tracked only</td>
</tr>
<tr>
<td>Total Index Cases</td>
<td>300</td>
</tr>
</tbody>
</table>

(continued on next page)
minimum number of cases, this suggests to the pediatric urology RRC that the program may not provide adequate educational opportunities (which could negatively impact a program’s accreditation). However, the graduation of the fellow will not be affected nor will it impact the assessment of a fellow’s competency to practice without supervision after graduation.

**What is the current system for fellow evaluation?**

In 1999, the ACGME introduced 6 clinical competency domains thought to represent areas essential for resident and fellow education of all specialties and subspecialties. These competency domains are: patient care (and procedural skills), medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems based practice. (Table 4) Medical knowledge is what the fellows should know, patient care is what they should be able to do, and the other domains relate to how they should conduct themselves. Fellow evaluation requires objective assessments of competence in each of the six competency domains, use of multiple evaluators for that assessment, and provision of at least semi-annual feedback to the fellow. Upon completion of the ACGME-accredited year, the program director is required to provide a summative evaluation that documents the fellow’s performance and verifies that the fellow has sufficient competence to enter practice without direct supervision.4

**What are Milestones and how will they be used to evaluate pediatric urology fellows?**

The ACGME’s goals with the Milestones include increasing the use of educational outcome data for accreditation, providing accountability to public, and supporting the education of residents and fellows. Every ACGME accredited specialty has created or will create a set of Milestones related to each of the 6 clinical competency domains.

### Table 4: Clinical Care Competencies and Description of Desired Outcomes in ACGME Pediatric Urology Program Requirements

<table>
<thead>
<tr>
<th>Clinical Care Competency</th>
<th>Description of Desired Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Care and Procedural Skills</td>
<td>Fellows must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and promotion of health.</td>
</tr>
<tr>
<td></td>
<td>Fellows must be able to competently perform all medical, diagnostic, and surgical procedures considered essential for the area of practice.</td>
</tr>
<tr>
<td>Medical Knowledge</td>
<td>Fellows must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological and social behavioral sciences, as well as the application of this knowledge to patient care.</td>
</tr>
<tr>
<td>Practice Based Learning and Improvement</td>
<td>Fellows are expected to develop skills and habits to be able to systematically analyze practice using quality improvement methods, and implement changes with the goal of practice improvement.</td>
</tr>
<tr>
<td></td>
<td>Fellows are expected to develop skills and habits to be able to locate, appraise, and assimilate evidence from scientific studies related to their patients’ health problems.</td>
</tr>
<tr>
<td>Professionalism</td>
<td>Fellows must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles.</td>
</tr>
<tr>
<td>Interpersonal Communication Skills</td>
<td>Fellows must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals.</td>
</tr>
<tr>
<td>Systems Based Practice</td>
<td>Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care.</td>
</tr>
</tbody>
</table>
The Next Accreditation System (continued from previous page)

(continued on next page)
fellow evaluation such as faculty and nursing staff surveys but will need to report de-identified Milestones outcomes to the ACGME every 6 months. A summative evaluation at the end of fellowship is also still required and must become a part of the permanent record maintained by the institution and verify that the fellow has “demonstrated sufficient competence to enter practice without direct supervision”.4

The de-identified Milestones outcomes will be part of the information used for program accreditation. The decision of whether a fellow has demonstrated “sufficient competence to enter practice with direct supervision” will be left to the program director. Milestones will be updated after some time has passed (the ACGME suggests 3-5 years) for programs to become familiar with them and identify areas that need to be revised or updated.3

Conclusion
Prior to the formation of the ACGME the quality of resident and fellow education was highly variable. Through an initial approach that emphasized program structure and formal teaching, there was an overall improvement in graduate medical education and learning environments. However, over time the program requirements and accreditation process has become prescriptive and burdensome and did not appear to be focused on educational outcomes. With the NAS the ACGME intends to focus accreditation more on educational outcomes, ensure continuous program improvement, and encourage innovation. The ACGME also moves away from a periodic accreditation process to a continuous process with educational outcomes submitted every 6 months. Educational outcomes will be measured with the pediatric urology-specific Milestones that evaluate the progress of a fellow in 6 clinical competency domains.

References
Inside Cohen Children’s Medical Center of New York:
Getting to Know You

Is there an interesting story behind the name of your hospital?
The Children’s Medical Center of New York was opened in 1983 as the Schneider Children’s Hospital and renamed the Steven and Alexandra Cohen Children’s Medical Center of New York, North Shore Long Island Jewish Health System in 2010. The Cohen family pledged $50 million of the planned $120 million cost of expanding the existing facility which included a new pavilion housing separate pediatric ORs, expanded ED (largest in the Northeast) and new PICU and in-patient floor. A previous pledge of similar funding of the expansion was undermined by the economic downturn and the project placed on hold until the Cohen family offered their continued support to the Children’s Hospital.

How many beds in your hospital? 210

Regarding your program:
Parent Urology Institution: Arthur Smith Institute for Urology at North Shore Long Island Jewish Health System and Hofstra North Shore-LIJ School of Medicine under the Chairmanship of Louis Kavoussi.

Is that a Department or Division of Urology? Department

What is your relationship to the parent program? (all one group in all regards; academic appointment but no financial relationship, clinical adjunct faculty, etc)
The Division of Pediatric Urology functions seamlessly with the parent Department without formal financial ties. We are responsible for resident training, serving on departmental committees including resident education committee and departmental executive council, providing monthly grand rounds, and organizing departmental visiting professors.

Pediatric Urology Division Head: Lane S. Palmer, MD
Fellowship Program Director: Lane S. Palmer, MD

How many years have you had a fellowship (include years that pre-date ACGME)? Since 1993

Who are the full-time (clinical) pediatric urologists in your group:
Lane Palmer, Edward Reda, Jordan Gitlin, Israel Franco, Steven Friedman, Paul Zelkovic, Lori Dyer, Jaime Freyle, Ronnie Fine, Richard Schlussel, Mark Horowitz

Do you have any part-time pediatric urologists? No

Briefly, what is your basic science research niche(s)? None

How many cases did your group do last year (all sites)? 4100 patients + office procedures

If physician extenders are part of your group, how many and briefly how they function in group: We have included mid-level providers in our practice since 1997. Currently, we have 8 Nurse Practitioners, one of whom has a doctorate, and 1 Physicians Assistant. All have extensive training and mentoring in pediatric urology with several of them committed to the full-time management of children with voiding dysfunction including biofeedback, of which we were pioneers.

Describe your practice structure/model:
Pediatric Urology Associates (PUA) is a private practice started in 1982 by Selwyn Levitt. PUA started with a hub located at the Westchester Medical Center, where Selwyn served as Chief of Pediatric Urology, and grew to include satellites in the Bronx and more northern suburbs until 1993 when it merged with William Brock’s practice in Long Island where Bill served as Chief of Pediatric Urology at Schneider Children’s Hospital. PUA has since grown to include the boroughs of New York City and all surrounding suburban counties extending into eastern New Jersey and western Connecticut. PUA has been committed to strong academic ties since its inception. Today we maintain directorship of the ACGME-accredited pediatric urology fellowship at Cohens, positions as of Chief of Pediatric Urology for 5 Divisions of Pediatric Urology and provide pediatric urology training for residents from 8 urology programs in New York.

What are you best known for clinically? (one only, please)
Robotic and minimally invasive surgery

What else do you think you should be / will be known for? (two only, please)
Major genitourinary reconstruction, Voiding dysfunction

Describe the flavor of your group / program in four words or less:
Hardworking; Experienced; Committed to patient care and excellence; “Doing the right thing”