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# Robotic-assisted laparoscopic surgery in pediatric urology: capacity building and reflecting on five years' experience in West Virginia

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## Robotic-assisted laparoscopic surgery in pediatric urology: capacity building and reflecting on five years' experience in West Virginia

Robotic surgery was born at the turn of the millennium as it was first approved by the US Food and Drug Administration in 2000 with the introduction of the da Vinci (Intuitive Surgical, Inc., Mountain View, Ca) robotic surgical platform. Enhanced three-dimensional visualization and increased dexterity with seven degrees of freedom led to its rapid implementation by surgeons worldwide and it quickly became vital to the armamentarium of the practicing, modernized urologist.[1] However, its adoption by pediatric urologists did not occur until 2002, and even then it was used by only a select handful of surgeons. Early impediments to robotic urologic surgery in the pediatric patient dealt with the steep learning curve in using an unfamiliar technology and addressing safety concerns as instruments designed for adults must also be used in children. Just as laparoscopy represented a paradigm shift, so too did robotics. In terms of efficacy and safety robotics has since proven its worth in pediatric urology, with a conversion rate of 1.6%, on-par with that of traditional laparoscopy.[2]

While the use of robotics in pediatric urology has grown steadily worldwide, its implementation in treating pediatric urology patients in West Virginia has been much slower. Reasons for this are twofold: historically, the lack of pediatric urology capability in the state, and comfort with the technology. Dedicated pediatric urology arrived in West Virginia in 1983 thanks to the efforts of the late William Tarry MD. While he finally brought complex pediatric urologic procedures to West Virginia, his training vastly predated the robotics era. This deficiency was remedied with the arrival in 2012 of the second ever pediatric urologist in the state, Osama Al-Omar MD, MBA, current chief of pediatric urology and director of pediatric robotic surgery at West Virginia University (WVU) Medicine Children's, who brought with him a proficient robotics background and established the first, and currently only, pediatric robotic program in the state of West Virginia.

Adult robotic urologic surgery has been around for several years at WVU, thanks to the impressive program established by Hesam Moheseni MD in 2007. This was further developed and advanced by Dr. Mohamad Salkini, director of urologic oncology at Ruby Memorial Hospital. In the transition of an adult robotic surgery program to the pediatric population in our institution in 2013, we were presented with several key roadblocks. We had to keep in mind that children are not just small adults. The pediatric patient provides a plethora of challenges - anatomically, physiologically, and logistically. Robot positioning becomes crucial as contacting a child's face or body may cause unintended mechanical trauma that may otherwise be deflected by the adult patient. This makes patient positioning, padding, and robot docking important early on in any pediatric robotic case. Additionally, the smaller intra-abdominal working space coupled with adult-sized instruments demands more exact maneuvering so as to avoid injury to surrounding organs. Unlike laparoscopy, robotic surgery lacks haptic feedback. Constant awareness of this difference is required as handling delicate pediatric tissue is much different than handling tissue in adults who can tolerate rougher tissue handling. The selection and training of a dedicated pediatric robotics team, in which each team member has an acute understanding of the robot and various ways to troubleshoot, was a priority in establishing our pediatric urology robotics program.

Postoperative care of the pediatric patient after robotic intervention is just as important. Much like selecting and training the intraoperative team, postoperative nursing care required specialized instruction to understand what occurred intraoperatively and how that may affect recovery. Physical examination dedicated to the abdomen, trocar sites, and understanding of referred pain secondary to insufflation were just a few pieces of the educational process.

The efforts in building a pediatric urologic robotics program at WVU are evident in the success of the program thus far. To date, 86 robotic urology cases have been performed in pediatric patients. Importantly, we report no significant complications (Clavien-Dindo Classification 2 or more) and no open conversions for our cohort. Demographically, the average age for our population at date of surgery was 8 years (range 1-19 years) with an average weight of 31.3 kg (10.3-74.7 kg). Intraoperatively, the average duration of surgery (cut-to-close) was 247.6 minutes with minimal blood loss and no patient requiring transfusion. Postoperatively, patients in our group did great, with an average length of hospitalization of 29.71 hours, thanks in large part to our postoperative nursing care that included early ambulation, if old enough and physically able to do so.

Though seemingly daunting, the implementation of a full-spectrum pediatric urology robotics program has proven successful through the dedicated effort of dozens of people from several different groups within our larger pediatric robotics team. Our first case was performed in 2013 on a 4-year-old and was a pyeloplasty for ureteropelvic junction obstruction (UPJO). In the interim since, our program has safely allowed more advanced cases at younger ages, with our youngest patient being just 13 months (Table 1). This has since been bolstered by the recent arrival of Michael Ost MD, MBA in 2017, the first ever urologist in the US fellowship trained in endo-urology and pediatric urology, and newly named surgeon-in-chief of WVU Children's. Undoubtedly, pediatric urology in our state will continue to grow with the expected completion of West Virginia University (WVU) Children's Hospital in 2020. We hope that our success may serve as an example of implementing robotics within other pediatric specialties where robotic implementation has been slow.

Table1: Pediatric Urology Robotic Case Distribution by Surgical Site

| **Surgical Site** | **Number** |
|---|---|
| Kidney | |
| Nephrectomy | 14 |
| Ureter | |
| Ureteroureterostomy | 7 |
| Pyeloplasty | 31 |
| Ureterolysis | 2 |
| Scrotal | |
| Orchiopexy | 32 |

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1. Kearns J, Gundeti MS. Pediatric robotic urologic surgery-2014. J. Indian Assoc Pediatr Surg. 2014;19(3):123-128.
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