A Contemporary Analysis of Pediatric Urology Surgical Volume at a Tertiary Care Center

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OBJECTIVE To describe the annual volume of pediatric urology cases in an academic, tertiary care setting.

METHODS A retrospective review was performed of all patients operated on by 4 pediatric urologists (total of 2.5 full-time equivalents) at an academic, tertiary care center with a free-standing children's hospital from 2016 to 2017 (24 months). Basic case information was collected from operative reports. Descriptive statistics are reported using nonparametric methods. "Uncommon" was defined *a priori* as occurring <10% of the time.

RESULTS During the entire study period, 2718 patients underwent 4580 procedures. This equated to 1088 patients and 1832 procedures per full-time equivalent. Median age at surgery was 3.2 years (IQR 0.8-10) and 757 (16.5%) of patients were female. Most procedures were elective (4406, 96.2%) and did not require postoperative admission (3842, 83.9%). Urgent and emergent cases were uncommon (174, 3.8%). Most cases were classified as general pediatric urology (3894, 85%) with 319 (7%) classified as major reconstruction, 275 (6%) as laparoscopy/endourology and 92 (2%) as oncology. The most common cases involved the groin/scrotum (1415, 30.9%), prepuce (809, 17.7%), phallus (802, 17.5%), and endoscopy (652, 14.2%). All other case types were uncommon.

CONCLUSION This description of an academic pediatric urology practice at a tertiary care center with a free-standing children's hospital noted a high volume of elective, outpatient procedures that are largely general pediatric urology. Uncommon cases include urgent/emergent interventions, major reconstruction, laparoscopy/endourology, and oncology procedures. UROLOGY 125: 179−183, 2019.

INTRODUCTION

The landscape of pediatric urology has evolved over the last few decades. Recently, there has been an increase in fellowship training programs and many institutions in need of pediatric urologists.[1] Reasons for this increased interest are unknown. Since 2011, however, a comprehensive examination of a contemporary pediatric urology practice has not been described and such an examination has never been described of a pediatric urology practice specifically at a tertiary care training hospital.[1] These data are pertinent for a variety of reasons. For example, it is unclear today how common the various procedures are that pediatric urologists perform and what proportion of the practice is made up of truly "uncommon" conditions, even at a tertiary care center. A related issue is whether the distribution of time for given topics at academic meetings is representative of how common a given condition is in actual pediatric urology practice. Also, for trainees, there are questions about how well fellowship minimum case numbers appropriately represent clinical practice. Addressing these issues will inform residents considering pediatric urology on what an academic pediatric urology practice may look like and perhaps help in planning future meeting topics and fellowship requirements. This study aims to describe the annual volume of pediatric urology surgical cases in an academic, tertiary care setting with a free-standing children's hospital and to describe how provider subspecialization affects surgical volume. The hypothesis is that many procedures within pediatric urology are uncommon, and that subspecialty procedures within pediatric urology are uncommon and are mostly performed by providers with subspecialty interest.

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METHODS

Study Population

Consecutive patients operated on by 4 pediatric urologists (2.5 full-time equivalents; FTEs) at a free-standing, academic, tertiary-care children's hospital and 3 separate affiliated campuses

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from January 1, 2016 to December 31, 2017 were identified. The operating room schedule was used to identify cases that were completed. Charts were retrospectively reviewed and information was collected from operative reports on patient gender and age, surgeon, assistant, timing (ie, emergent, urgent, and scheduled), procedure(s) performed, and admission status. Each procedure was then categorized and an appropriate specialty was assigned (see below). The study was designed as a quantitative analysis of practice volume and no qualitative information (ie, surgical complications, redo procedures, unplanned postoperative visits) was collected. Canceled cases, as well as patients operated on by fellows as the attending surgeon, or by providers who began his/her practice during this study period were excluded from analysis.

Data Collection and Study Definitions

Procedures were classified as prepuce, phallus, groin/scrotum, torsion, female genitalia, oncology, laparoscopy/endourology, endoscopy, kidney, ureter, bladder, major reconstruction, open urolithiasis, and other (supplementary Table 1). Procedures were organized based on the operative report signed by the primary surgeon. Cases that included 2 or more procedures were unbundled so that each procedure was identified separately. Procedures were then more broadly classified into subspecialty categories of general, major reconstruction, laparoscopy/endourology, or oncology. Each of the 4 pediatric urologists were categorized into a subspecialty (other than general) based on his/her self-identified individual practice focus and the group's decision to support subspecialty interests and focus. All surgeons managed general pediatric urological issues. Importantly, no data were collected on outcomes, redo operations, or complications and thus these data are not reported.

Pediatric urology meeting agendas available online[2,3] were reviewed to calculate minutes and relative representation devoted to various topics for the most recent meetings corresponding to the study period (fall 2016 and 2017, spring 2017 and 2018). Fellowship case log minimum requirements and average fellow case numbers were used to determine the relative representation of various categories in fellowship training requisites. These data were obtained from The Accreditation Council for Graduate Medical Education 2016-2017 fellow case log reports.[4] Nonwhole numbers were rounded up if ≥0.5, and rounded down if <0.5.

Data Analysis

Descriptive statistics were calculated using SPSS V24.0 and are reported using nonparametric methods. *A* priori, "uncommon" was defined by the study authors as occurring <10% of the time and "common" as occurring >10% of the time. Categorical variables were compared with the Fisher exact or chi-square tests. A *P* value of <.05 was considered statistically significant.

RESULTS

During the 24 months studied, 2718 patients underwent 4580 procedures (1328 patients/2335 procedures in 2016 and 1390 patients/2245 procedures in 2017). This equated to 1088 patients and 1832 procedures per FTE (532 patients/934 procedures in 2016 and 556 patients/898 procedures in 2017).

Median age at surgery was 3.2 years (IQR 0.8-10) and 757 (16.5%) procedures were done for female patients. Most procedures were elective (4406, 96.2%) and did not require postoperative admission (3842, 83.9%). Urgent and emergent cases were uncommon (174, 3.8%). Of the urgent/emergent cases, 50 (28.7%) were for groin/scrotum, 48 (27.6%) were for testicular torsion, 40 (23%) were endoscopy and all other procedure categories were uncommon ($P < .001$). The median number of procedures performed in a single operative session was 2 (IQR 1-3), with 1485 (32.4%) of procedures performed as a "stand alone" procedure. Most procedures were assisted by a resident (2094, 45.7%) or fellow (1,928, 42.1%), and only 554 (12.1%) had no assistant at all.

The most common procedures involved the groin/scrotum (1415, 30.9%), prepuce (809, 17.7%), phallus (802, 17.5%), and endoscopy (652, 14.2%). All other cases represented <10% of total case volume (Fig. 1). Most cases were further assigned to general pediatric urology (3894; 85%) with 319 (7%) separately classified as major reconstruction, 275 (6%) as laparoscopy/endourology, and 92 (2%) as oncology (Table 1). Practice-defined provider subspecialization was analyzed and an appropriate subspecialty faculty performed 296 (93.9%) of major reconstruction cases, 247 (89.8%) of laparoscopy/endourology cases, and 86 (93.4%) of oncology cases (Table 2). Thus, we observed that the majority of subspecialty surgeries were performed by surgeons whose practice focused on that subspecialty. Though only 15% of all pediatric urologic procedures were considered subspecialty surgeries, females were more represented in subspecialty procedures than males (387, 9.9% of general cases and 370, 53.9% of subspecialized cases, $P < .001$).

The distribution of time spent on various topics during the 4 most recent pediatric urologic meetings is summarized in supplementary Figure 1.[2,3] Fetal urology and major reconstruction were the most highly-represented topics (18.1% and 17.2% of total time, respectively). Hypospadias and disorders of sex development were the next most common topics presented (8.0% and 9.7%, respectively). The least represented topics included testes/varicocele, imaging and diagnostics, and oncology (<2% each).

Pediatric urology fellowship minimum requirement data and 2016-2017 national averages are included in supplementary Table 2.[4] There are 300 total procedures required to complete a pediatric urology fellowship, and the 2016-2017 national average was 534 total procedures. The national average was greater than minimum requirements across all procedure categories. The categories with the largest difference in minimum requirement and national average of actual experience, (ie, the areas in which fellows performed many more surgeries relative to what was required) were scrotal/inguinal surgery and penile surgery. When fellowship requirements are roughly split into the specific subspecialty categories outlined in this study, the minimum requirements would be 20 (6.7%), 10 (3.33%), and 4 (1.3%) surgeries for major reconstruction, laparoscopy/endourology, and oncology, respectively. The 2016-2017 national averages within each of these categories were 60 (11.2%), 27 (5.05%), and 12 (2.3%), respectively.

DISCUSSION

In a single year at an academic, tertiary care center with a free-standing children's hospital, a 1.0 FTE pediatric urologist was observed to perform about 900 procedures on about 500 patients. Most of these patients are male and <5 years of age. It is uncommon for the pediatric urologist to perform emergent/urgent procedures and admit patients postoperatively. Generally, only about 15% of

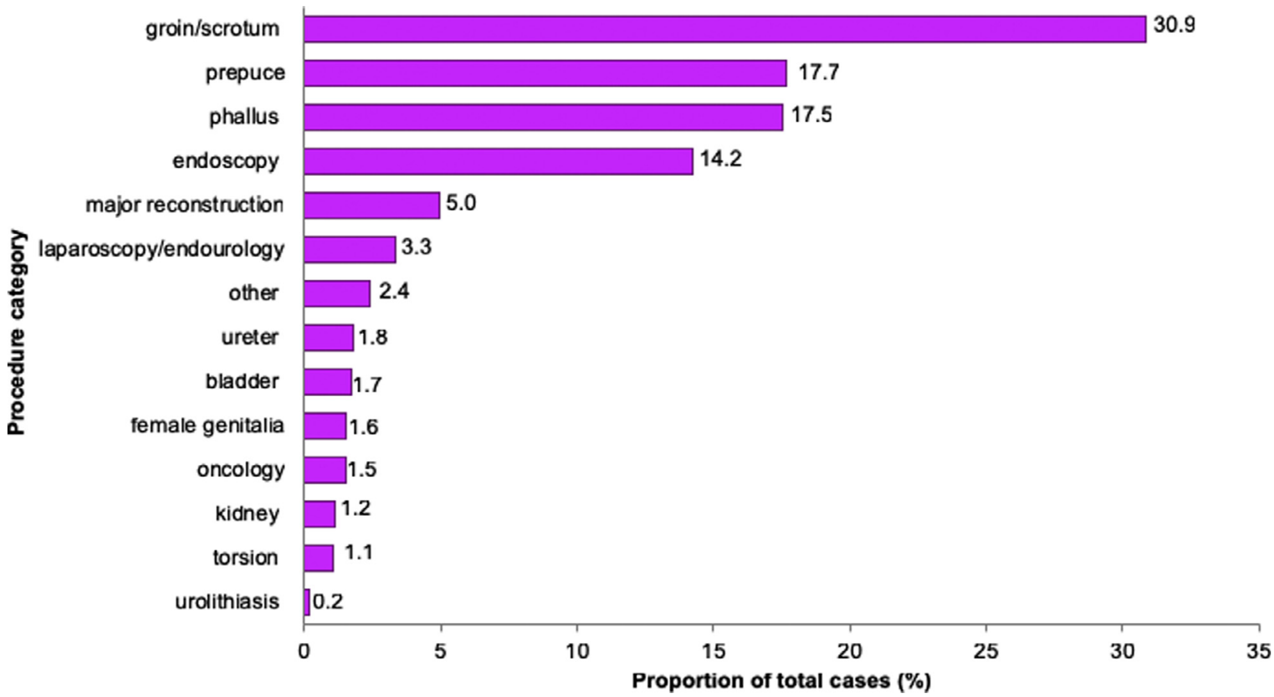

Figure 1. Distribution of procedure categories. (Color version available online.)

surgical volume in such a practice involves uncommon procedures.

As far as subspecialization within pediatric urology, most surgeries performed over the study period were classified as general pediatric urology, usually involving male genitalia. All subspecialty cases were considered uncommon by the outlined definition. Though many urological trainees may choose pediatric urology for the opportunity to perform uncommon procedures on uncommon conditions, this study highlights that procedures outside of male genitalia are uncommon, even at a high volume, academic, tertiary care center. This is supported by other studies examining case volume within pediatric urology. In 2011, Kogan and Feustal presented a review of pediatric urology certification logs, which similarly demonstrated that the most common procedures in a pediatric urology practice were penile and groin cases. This study also reported select uncommon procedures (ie, bladder exstrophy repair, laparoscopic pyeloplasty), which generally fit into the current study's categories of major reconstruction and laparoscopy/endourology.[1] Furthermore, within pediatric urologic oncology, there is 1 study examining the reported rates of renal tumor surgery among pediatric surgeons and pediatric urologists, with half of surgeons in this study reporting performing just 1 or 2 of these procedures annually.[5] A 2015 study by Shapiro, et al presented a survey of pediatric urologists, who self-reported an increasing number of minor cases and decreasing number of major reconstruction within their practice over 5 years.[6] These studies support the current study's findings that subspecialty procedures within pediatric urology are uncommon.

Table 1. Specialty categorization across entire study period

Specialty Category	*N* (%)
None	3889 (85)
Major reconstruction	315 (7)
Laparoscopy/Endourology	275 (6)
Oncology	92 (2)

High surgical volume has previously been defined as performing at or above the 90th percentile of national volume.[7] One study examining this in pediatric urology found that 75% of hospitals met criteria to be low volume (<5 major[1] pediatric urologic cases annually) while the remaining 25% high volume hospitals performed a mean of 52 major pediatric urology cases per year (range 5-657).[7] Using these definitions, the present institution, with a mean 343 major cases per year, is a high-volume center. Importantly, this is strictly a case volume definition and does not include outcomes or complications, consistent with the present study. The median age at surgery in this study (3.2 years) is consistent with prior studies that show high-volume pediatric urology hospitals tend to treat younger patients than low-volume hospitals (mean patient age 5.4 vs 9.6 years, respectively).[7] This is an important consideration as the observations reported herein are applied in other settings.

As compared to general surgery, where 1 study classified 14.2% of surgeries as emergent,[8] it appears that urgent/

[1] *Major pediatric urology cases included ureteral reimplantation, ureteroureterostomy, pyeloplasty, radical nephrectomy, partial nephrectomy, bladder exstrophy repair, appendicovesicostomy, bladder augmentation, vesicostomy, bladder neck sling, and percutaneous nephrolithotomy.*

Table 2. Distribution of specialty surgeries performed by 4 pediatric urologists based on individual subspecialty ($P < .001$)

Surgeon Subspecialty	Subspecialty of Procedure Performed (%)			
	General	Major Reconstruction	Laparoscopy/Endourology	Oncology
Major reconstruction	1008 (25.9)	224 (71.1)	10 (3.6)	0 (0)
Laparoscopy/Endourology	1968 (50.6)	18 (5.7)	247 (89.8)	6 (6.5)
Major reconstruction	371 (9.5)	72 (22.9)	4 (1.45)	0 (0)
Oncology	542 (13.9)	1 (0.3)	14 (5.1)	86 (93.5)

emergent cases in pediatric urology are uncommon (3.8%). Furthermore, most pediatric urology cases are performed on an outpatient basis (83.9%). Of note, combined service procedures (eg, neurosurgery and urology, etc.) were included in the analysis, and this has likely falsely increased the postoperative admission rate reported in this study, as some straightforward urological surgeries were performed under the same anesthesia as other procedures that were more complex and may have resulted in a postoperative admission which would have not otherwise been necessary based on the urologic surgery alone.

On the topic of subspecialization within pediatric urology practice, the use of a subspecialty provider was analyzed. For cases designated with a specialty area, most were done by the appropriately corresponding subspecialty faculty, suggesting that the self-identified and practice-supporting subspecialty model is well executed at this institution. The area with the least coverage by a subspecialty provider was laparoscopy/endourology. The performance of these cases by nonlaparoscopy/endourology specialization was not uncommon (10.2%). While this study does not argue for or against subspecialization within pediatric urology, it is utilized at this institution and thus has been reported as such.

Comparing the present findings to the time spent on various topics at national pediatric urology meetings highlights some incongruence. In fact, testicular/scrotal pathology was discussed for 1.8% of the total time across all 4 conferences but contributes to upwards of 31% of the pediatric urologist's procedural practice. Conversely, 17.2% of total time was spent on major reconstruction, but this comprised only 7% of a pediatric urologist's surgical practice in the present report. Minimally invasive surgery (laparoscopy/endoscopy) received 2.8% of total meeting time, but laparoscopy/endoscopy made up 14.2% of the procedures described herein. In summary, there appears to be a difference between this observation of a pediatric urology surgical practice and what is discussed at pediatric urological conferences. Whether this should promote change so that meetings reflect practice patterns is unknown. It can be argued that the current pattern is appropriate, and discussing uncommon topics at meetings is necessary for enhancing knowledge in these areas, since exposure on a day-to-day basis in practice is probably limited. On the other hand, it can also be argued that spending more time on topics that better represent a typical pediatric urology practice is more meaningful. Ultimately, the current study does not provide an answer to this question.

Examination of pediatric urology fellowship requirements to fellow national averages from 2016 to 2017 support this study's findings that phallus/prepuce and groin/scrotum are the most common procedures. These data also support the relatively lower case volume of major reconstruction, laparoscopy/endourology, and oncology cases. By the current study's definition, laparoscopic/endourology (5.05%) and oncology (2.3%) procedures are uncommon during a pediatric urology fellowship, but major reconstruction procedures (11.2%) are considered relatively common. The data analyzed here do not suggest that disparities between practice and training are positive or negative, but merely highlight that they exist. How many circumcisions does a fellow really need to perform to demonstrate competence? Are there enough uncommon cases to appropriately train someone? Likely, a fellow focuses their training toward the more complex procedures as these are less common and thus case logs likely over-represent what a pediatric urologist would see in practice. There is likely an advantage to this to improve exposure to uncommon procedures, so perhaps there should be more disparity for uncommon cases. One uncommon procedure, bladder exstrophy repair, has started to become more regionally specialized.[9] This change will affect both training volumes and volumes seen in practice, the consequences of which are unknown. If the trend of regional subspecialization to high volume centers, for which there are an abundance of data,[10-19] continues, perhaps fellows will not be trained in bladder exstrophy repair or ever repair a bladder exstrophy in practice. The present study certainly does not address these changes but allows an inventory of where training stands in comparison to clinical practice at this point in time.

Limitations of this study include sampling from a single academic institution, which restricts the ability for this experience to be generalized across institutions that are smaller or community-based. A future multi-institutional collaboration is planned to verify this study's findings and explore other differences in practice patterns across locations and facility type. The location may also influence geographic practice patterns as well as the lack of any other large, academic centers nearby. Additionally, this center hosts a pediatric urology fellowship, and thus may not be representative of institutions without a fellowship, or even without residents. This study focused exclusively on operative practice and did not investigate nonoperative clinical volume or clinic-based procedures, which are not insignificant. Certainly, non- or rarely operative topics, such a dysfunctional voiding, warrant discussion at meetings, but this was not represented in the study due to its design. The procedural classification was arbitrarily determined by the authors, and since multiple classification systems are used across studies and even across meetings, any comparisons are general, given the possible varying definitions. Despite these limitations, this is a contemporary series of procedure distribution of a pediatric urology practice in an academic tertiary care center and may influence those considering pediatric urology as a career or those involved with continuing education at the fellowship or meeting planning levels.

CONCLUSION

This observation of an academic pediatric urology practice at a tertiary care center with a free-standing children's hospital demonstrated a high volume of elective, outpatient cases, that are largely general pediatric urology (involving male genitalia). Uncommon events include urgent/emergent interventions, major reconstruction, laparoscopy/endourology and oncology procedures. Internal referral of uncommon cases to subspecialty providers was common.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.1016/j.urology.2018.12.030.

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