Patterns of Performance of Oncologic Surgery by North American Pediatric Urologists: A Report from the Pediatric Urologic Oncology Working Group of the Society for Pediatric Urology

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Purpose: Objective data on patterns of oncology practice among pediatric urologists are lacking. We reviewed surgical case logs submitted to the American Board of Urology by those self-reporting as pediatric urologists. We hypothesized that logs would reveal a low oncology volume (fewer than 5 cases) and identify orchiectomy as the most common oncology cases, and that less than 25% of logs would show nephrectomy for renal tumor.

Materials and Methods: Case logs submitted for American Board of Urology certification, recertification or pediatric subspecialty certification were reviewed and standardized to represent 12-month practice. Data were collected on pediatric oncologic surgeries as noted by procedure codes linked with oncologic diagnosis codes for patients up to age 30 years.

Results: We identified 281 case logs meeting study criteria. A total of 364 oncology cases were logged and 131 logs (46.6%) listed at least 1 oncology case, while 150 (53.4%) contained no oncology cases. The 75th, 90th and 95th percentiles of oncology volume were represented by reporting 2, 3 and 4 cases, respectively. A total of 13 logs (4.6%) accounted for more than a third of all oncology cases (35.9%). The most frequent oncology case logged was orchiectomy, which was documented in 83 logs (29.5%). On Poisson regression surgeon variables associated with higher oncology volume included male gender (IRR 2.8, 95% CI 2.1–3.9), 2010 log year (IRR 2.4, 95% CI 1.3–4.4), 2015 log year (IRR 3.7, 95% CI 2.1–6.4) and nonpediatric subspecialty certification log (IRR 1.6, 95% CI 1.2–2.3).

Conclusions: Few pediatric urologists perform a high volume of oncologic surgeries based on surgical case logs submitted to the American Board of Urology. A small cohort of pediatric urologists logged the majority of such cases.

Key Words: pediatrics, surgical oncology, urologic surgical procedures, certification

Abbreviations and Acronyms

ABU = American Board of Urology

PSCE = pediatric urology subspecialty certification

RPLND = retroperitoneal lymph node dissection

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THERE is increasing interest in how clinical volume relates to patient outcomes since the initial reports from Luft et al almost 40 years ago demonstrated improved outcomes after complex surgical and medical

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care at high volume centers.[1] Within urological oncology such data have typically revealed that high volume correlates with improved outcomes.[2] However, compared to adult urological oncology, there is a relative paucity of literature surrounding the impact of volume on outcomes in pediatric urological oncology. The relatively lower incidence of pediatric vs adult urological malignancies has likely contributed to the inconclusive findings from the few pertinent studies on the volume-outcome relationship in pediatric urological oncology.[3–5]

Anecdotally oncology care comprises a small proportion of the clinical volume for most pediatric urologists. However, there are no objective data on the patterns of oncology practice among pediatric urologists in North America. Recent literature has investigated this issue within adult urological oncology on the practice of RPLND and radical cystectomy by reviewing case logs submitted to the ABU during the process of board certification.[6,7] Such methodology of analyzing surgical volume prompted our current study. Using case logs submitted to the ABU by urologists self-describing as specializing in pediatric urology, we review and describe performance patterns of oncologic surgery.

METHODS

Aims and Hypotheses

Our main objective was to review ABU certifying logs to describe the current patterns of oncologic surgery among practicing pediatric urologists in North America. Additionally we sought to identify surgeon specific factors significantly associated with increased reported oncology volume. We generally hypothesized that oncology comprises a small proportion of the operative volume for North American pediatric urologists. The specific hypotheses were 1) submitted case logs of pediatric urologists would show a median of fewer than 5 oncology cases during a 12-month period, 2) orchiectomy would be the most common oncologic surgery within these case logs and 3) fewer than 25% of logs would list nephrectomy or partial nephrectomy for renal tumors.

Study Design

Before releasing any data this study proposal was submitted to and approved by the ABU publications committee. Additionally the final data analyses and the submission version of this article were reviewed and approved by the same committee. Accordingly case log data of urologists certifying between 2010 and 2015 were obtained from the ABU. Urologists initially certifying and subsequently recertifying every 10 years with the ABU are required to submit case logs with the CPT and ICD-9 codes listed for all procedures completed in a consecutive 6-month period. Additionally in 2010 the ABU first offered a PSCE in urology, and similar case logs are submitted for the PSCE. However, these logs cover a consecutive 12-month period. For the purposes of this study all logs were standardized to represent a 12-month period of practice by doubling the case volume of the initial certification and recertification 6-month case logs.

Case log data were included for all urologists self-reporting as practicing pediatric urology as their primary specialty. To specifically capture oncology volume, only cases specifying an ICD-9 code for an oncologic diagnosis and a CPT code for an oncologic case (supplementary table 1, http://jurology.com/) were included. Each log was assigned a unique surgeon identification number, and for the purposes of analysis each log was analyzed independently for the specific period of practice rather than combining logs of unique surgeons who may have submitted multiple logs for various certification types. To capture as many of the pediatric, adolescent and young adult oncology cases as may fall under the care of a pediatric urologist, we selected an age cutoff for cases involving patients less than 30 years old at surgery.

Statistical Analysis

Log data were analyzed for self-reported surgeon specific factors, including age, gender, certification type, date of initial certification, practice type, region and area population. Nonparametric descriptive statistics were used to compare case logs of urologists who reported any oncology volume to those reporting no oncology cases. Fisher exact or chi-square test was performed for comparisons of categorical variables, while Mann-Whitney U test was used for comparisons of continuous variables. In assessing for surgeon specific factors in the case logs as they were associated with oncology case volume a Poisson regression analysis was used to calculate IRR and corresponding 95% CI. In all analyses 2-sided p values less than 0.05 or a 95% CI not crossing 1.0 was considered significant.

RESULTS

We identified 281 case logs meeting study criteria (supplementary table 2, http://jurology.com/). Of the surgeons 210 (74.7%) were male and 71 (25.3%) were female. Median surgeon age at log submission was 40.9 years (range 32.6 to 70.4). Year of certification ranged from 2010 to 2015 but most logs came from 2010 (20.3%) and 2015 (36.7%). Of the 281 logs 170 (60.5%) were submitted for the PSCE in urology. Surgeon experience relative to initial ABU certification varied but most logs came from surgeons during the period before initial certification (114, 40.6%) or in the first 5 years after initial certification (43, 15.3%). Most logs (161, 57.3%) came from surgeons practicing in metropolitan areas of large population (more than 1,000,000 people) and the largest proportion (127, 45.2%) came from those in academic practice. When comparing logs with at least 1 oncology case to those with no oncology cases, logs from male surgeons and those practicing in a metropolitan area of more than 1,000,000 people demonstrated a higher proportion reporting at least 1 oncology case.

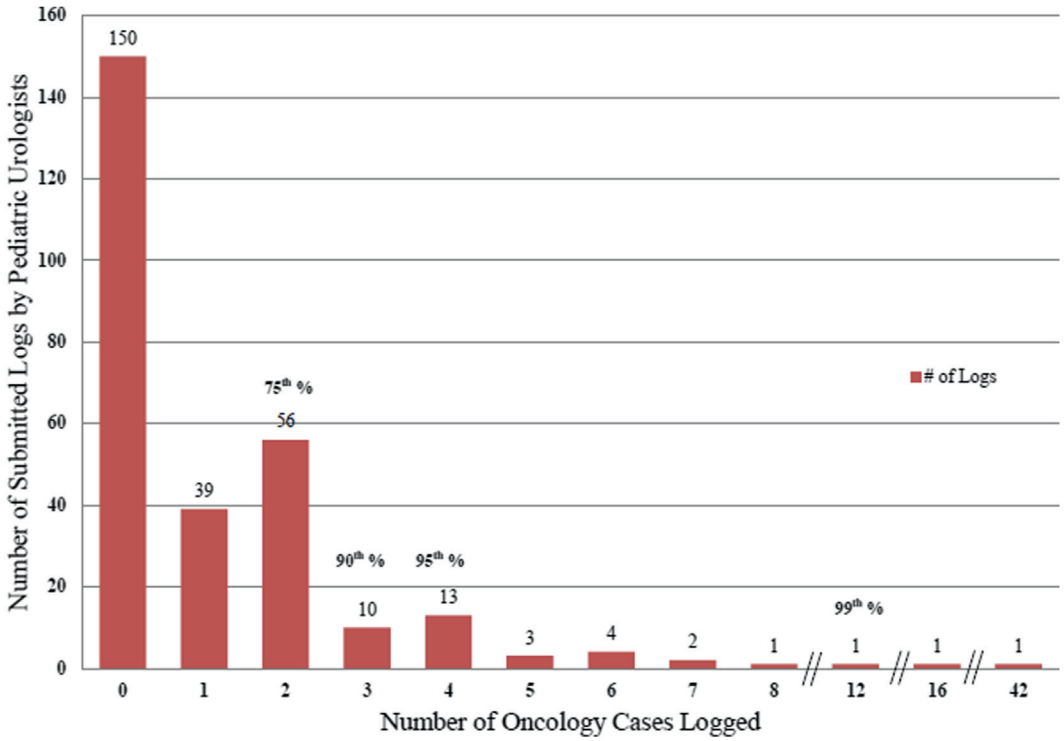
Overall 364 cases were logged, which met our study criteria of predefined "oncology" CPT and ICD-9 codes. Median patient age was 10 years (range 0 to 30, IQR 2 to 16). Of these patients 27 (7.4%) were age 21 years or older. A minority of the total logs (131, 46.6%) listed at least 1 oncology case, while 150 (53.4%) listed no oncology cases. Details on the number of logs listing oncology cases are provided in the figure, and information on type of oncology cases logged and case specific volume is outlined in supplementary table 3 (http://jurology.com/). The most common type of oncology case logged (83 logs, 29.5%) was orchiectomy (radical or partial). Nephrectomy (radical or partial) was the next most common (32 logs, 11.4%), followed by RPLND (27, 9.6%). In further analyzing the reported total oncology case volume the 75th, 90th, 95th and 99th percentiles of oncology volume were represented by logging 2, 3, 4 and 12 cases, respectively. Overall 13 logs (4.6%) accounted for more than a third of all reported oncology cases (131, 35.9%).

In investigating associations between surgeon specific factors available for review and reporting oncology case volume we conducted a Poisson regression analysis (see table). We identified that several variables were significantly associated with increasing oncology volume, including male gender (IRR 2.8, 95% CI 2.1–3.9), 2010 log year (IRR 2.4, 95% CI 1.3–4.4), 2015 log year (IRR 3.7, 95% CI 2.1–6.4) and nonPSCE log (IRR 1.6, 95% CI 1.2–2.3). Years of surgeon experience, surgeon practice area population and surgeon practice type were not significantly associated with higher volume.

DISCUSSION

Two recent publications in adult urological oncology used ABU certification logs to characterize patterns of care as it pertains to complex surgical care, specifically performance of RPLND and cystectomy.[6,7] Flum et al observed that a majority of reported RPLNDs were performed by surgeons who logged only 1 RPLND during the 6-month log period.[6] However, this finding may represent an artifact of the analysis since there are thousands of urologists in North America who submitted certification logs during this time, and of those only 290 reported performing at least 1 RPLND. Highly concentrated referral patterns were observed within this already small cohort of surgeons, in that 72 of these select surgeons (24.8%) performed 61% of all reported RPLNDs. Even more strikingly 3 surgeons (1.3%) performed 23% of the RPLNDs. These data objectively reveal some degree of centralization of complex oncologic surgery for testicular cancer.

Conversely the data on certifying urologists performing cystectomies appear to show that this care has not been as centralized. Overall half of reported



Histogram of number of case logs citing specific numbers of oncology cases

Poisson analysis regressing number of logged oncology cases on independent variables

	IRR (95% CI)	p Value
Surgeon gender:		<0.001
Male	2.85 (2.065–3.934)	
Female (reference)	1	
Certification yr for which log submitted:		
2010	2.439 (1.337–4.448)	0.004
2011	1.154 (0.538–2.473)	0.713
2012	0.961 (0.506–1.828)	0.904
2013 (reference)	1	
2014	1.452 (0.796–2.647)	0.224
2015	3.665 (2.085–6.444)	<0.001
Certification type for log:		0.003
NonPSCE log	1.633 (1.182–2.257)	
PSCE log (reference)	1	
Yrs experience	0.99 (0.969–1.011)	0.357
American Urological Association section of practice:		
Western (reference)	1	
North Central	1.301 (0.728–2.324)	0.374
South Central	1.422 (0.839–2.41)	0.191
Northeastern	Not available	
New England	1.41 (0.82–2.425)	0.214
New York	Not available	
Mid-Atlantic	1.115 (0.581–2.14)	0.743
Southeastern	1.119 (0.639–1.959)	0.694
Unknown/other	2.523 (1.477–4.31)	0.001
Practice area size:		0.583
More than 1,000,000	1.064 (0.853–1.328)	
All other (reference)	1	
Practice type:		0.136
Academic only	1.179 (0.95–1.463)	
All other (reference)	1	

cystectomies were done by surgeons performing only 1 cystectomy during the certification log period.[7] Median number of cystectomies logged was 2, and performing 5 or more cystectomies during the log period placed a surgeon in the 90th percentile. On logistic regression academic practice was associated with a statistically significantly increased likelihood of being in the 90th percentile of volume. However, more cystectomies were logged in private practice (45%) or mixed practice (17%) than in academic practice. Therefore, not all urological oncology practice demonstrates the same degree of care centralization or high volume referral patterns.

It is with similar interest that we used ABU certifying logs to study the patterns of oncologic surgery performed by pediatric urologists. The overarching objective of this investigation was to perform a background needs assessment for pediatric urologists in the area of oncology. One difficulty in undertaking this study was that many of the procedures used for oncologic indications in children, ie nephrectomy and orchiectomy, are more commonly performed for benign indications. The data collected by the ABU were helpful to overcome this hurdle since we could link procedure codes with diagnosis codes, allowing a review of cases done specifically for oncologic indications. In planning this review we elected to include logs submitted starting in 2010 to coincide with the initial offering of the PSCE in urology in an attempt to better sample the population of pediatric urologists.

As hypothesized, these data indicate that oncology makes up a small proportion of the operative volume of pediatric urologists. Less than half of the logs included an oncology case. While orchiectomy was the most common oncologic surgery reported, less than a third of logs included such a case. Additionally only 32 logs (11.4%) listed nephrectomy (radical or partial) for an oncologic indication. Similar to the data reported on practice patterns for RPLND and cystectomy,[6,7] in terms of volume a modest number of oncology cases qualified for relatively "high volume," with 3, 4 and 12 cases corresponding to the 90th, 95th and 99th percentiles. When compared to prior reports from ABU log data, these data more closely mirror the patterns of RPLND practice, with a small minority of pediatric urologists (13, 4.6%) accounting for more than a third of all oncology cases reported (131, 35.9%). Therefore, it appears that those with higher oncology volume likely benefit from variations in referral patterns.

The 2 main reasons why reported oncology case volume may be low among pediatric urologists are 1) these cases are being done by surgeons other than pediatric urologists (ie pediatric general surgeons) and 2) there are relatively few cases. These reasons are not mutually exclusive, and the low volume likely reflects a combination of both. There are data indicating that low reported oncology volume is not restricted to pediatric urologists alone. A recent publication studying recertification logs of pediatric general surgeons also identified that "rare" cases are indeed "rarely" logged by pediatric surgeons.[8] Specifically addressing oncology cases, a review of these pediatric general surgery logs noted that only 55% reported a kidney tumor nephrectomy in the last year, with a median of 1 tumor nephrectomy, an interquartile range of 0 to 2 and a maximum by any surgeon of 9 total. While this finding indicates that pediatric surgeons have a slightly larger experience compared to pediatric urologists, the per surgeon volume remains low for pediatric urologists and general surgeons.

Ultimately the question regarding volume and its impact on outcome is how these data affect patients. Should these infrequent and sometimes challenging cases be referred to those with higher volume and more experience? There are data from adherence to Wilms tumor surgical protocols indicating that surgical protocol violations are common at lower volume centers. These violations may be detrimental to the patient in potentially necessitating more intense treatment than may have been otherwise needed and potentially resulting in inferior outcomes.[9,10] While we are unable to comment

on oncologic outcomes using the data presented, such volume-outcome relationships must be studied to allow patients, families and referring physicians to feel secure that they can identify the highest quality care available.

As with any investigation, it is important to recognize the inherent limitations of this study, including logistics in the design and use of administrative data. One unique aspect of this study was the way procedure codes were linked to oncologic diagnosis codes to identify oncology volume. However, diagnostic miscoding may have resulted in a false increase or decrease in the number of oncology cases reported. Nevertheless, by including an exhaustive list of oncology specific diagnostic codes (supplementary table 1, http://jurology.com/), we attempted to mitigate this complication with a preferred bias of overreporting volume.

An additional issue is sampling error, which could have taken multiple forms. First, since we analyzed only a short period of practice, these logs may not accurately represent the true breadth of practice of a given surgeon. Also, based on the nature of case log submission by pediatric urologists for certification during the study period, and since those urologists who originally certified before 1985 are exempt from submitting case log data, this study overrepresents early career urologists. In addition, by sampling logs of urologists as they certify in the first 2 years of practice, as well as logs from the PSCE, which are likely submitted in the first few years following initial certification, there is likely double representation of some early career urologists. Finally, since recertification logs are only required every 10 years and we have only sampled from 2010 to 2015, there is likely a gap that misses a representative section of practicing mid career pediatric urologists.

One of the stated study goals was to identify modifiable, surgeon specific factors associated with increasing oncology volume. Unfortunately this objective was not achieved, as none of the factors observed to be significant on our regression analysis is modifiable (gender, log type, log year). However, the surgeon specific data are limited and many important factors cannot be accounted for in such an analysis. For example details on surgeon training, areas of research, subspecialty clinical expertise and involvement in oncologic cooperative groups are likely associated with increased oncology involvement but are not available in this data set. While we observed that logs submitted by male surgeons were associated with higher oncology volume, the reason behind this difference is unclear. Recent data have highlighted differences in patterns of practice between male and female urologists. However, how gender correlates to volume within a subspecialty and among similarly fellowship trained pediatric urologists is unclear.[11] One potential possibility is that there are fewer mid to late career female pediatric urologists, and this experience may otherwise have been correlated with oncology volume.

CONCLUSIONS

Based on ABU certifying log data, few pediatric urologists perform a high volume of oncologic surgeries. A small cohort of surgeons report the majority of oncology cases, suggesting variations in referral patterns for these specialized cases. However, no modifiable, surgeon specific factors available in these data were correlated with reporting higher oncology volume. Future investigation into these relationships is needed, as is more research into defining the impact of volume on functional and oncologic outcomes in children with urological malignancy.

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EDITORIAL COMMENTS

In 2014 the Pediatric Urologic Oncology Working Group emailed a survey to Society for Pediatric Urology members concerning participation in oncology care. Of 200 responding pediatric urologists 22% denied performing cancer surgeries, in contrast to the 53.4% noted in the present study. While 25% of survey respondents claimed more than 6 surgeries, this study found that 4 cases comprise the 95th percentile for oncology volume.[1] This discrepancy suggests recall bias by survey participants or sample biases within the case logs. The logs also revealed unintentional case centralization, with 4.9% of surgeons accounting for 36% of cases.

These findings invoke more topics for study. Why don't pediatric urologists perform more oncologic surgeries? Theories include disease rarity, referral patterns and urologist interest/comfort. Is there an annual case minimum for improved oncologic outcomes? How involved are pediatric urologists in nonextirpative cancer care, as with hemorrhagic cystitis, nephrolithiasis or fertility preservation, and does this factor influence referrals for urological malignancies? Finally, how can urologists increase their access to oncology patients?

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The authors have assembled data supporting a hypothesis, and a widely held perception among pediatric urologists, that the volume of oncologic surgeries being done by pediatric urologists is quite low. This finding is not a surprise. There are a lot of surgeons and not many tumors. The cited studies (references 3 to 5 in article), along with a more recent report,[1] suggest that there are at most small differences in outcomes between high and low volume hospitals. There do appear to be significant differences in outcomes between Children's Oncology Group and nonChildren's Oncology Group affiliated hospitals.

So are these data cause for concern? Should or even can anything be done to change them? Patient outcomes and needs assessment are important issues implicit in these questions. Perhaps because the difference in volumes between high and low volume hospitals is so small, because there is transference in skill between other more numerous procedures and these less frequent operations, who the surgeon is and how many oncology cases he or she has done that year appear to matter less than whether care is delivered at a cooperative group affiliated medical center. This is an encouraging message for pediatric urologists and for patients. A knowledgeable interest in protocol derived care, close collaboration and good communication with pediatric oncology colleagues are fundamental to high quality surgical care. A large case log of oncology operations is not.

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