

National Practice Patterns and Outcomes of Pediatric Nephrectomy: Comparison between Urology and General Surgery

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Purpose: In adults nephrectomy is under the purview of urologists, but pediatric urologists and pediatric general surgeons perform extirpative renal surgery in children. We compared the contemporary performance and outcome of all-cause nephrectomy at pediatric hospitals as performed by pediatric urologists and pediatric general surgeons.

Materials and Methods: We queried the Pediatric Health Information System to identify patients 0 to 18 years old who were treated with nephrectomy between 2004 and 2013 by pediatric urologists and pediatric general surgeons. Data points included age, gender, severity level, mortality risk, complications and length of stay. Patients were compared by APR DRG codes 442 (kidney and urinary tract procedures for malignancy) and 443 (kidney and urinary tract procedures for nonmalignancy).

Results: Pediatric urologists performed more all-cause nephrectomies. While pediatric urologists were more likely to operate on patients with benign renal disease, pediatric general surgeons were more likely to operate on children with malignancy. Patients on whom pediatric general surgeons operated had a higher average severity level and were at greater risk for mortality. After controlling for differences patients without malignancy operated on by pediatric urologists had a shorter length of stay, and fewer medical and surgical complications. There was no difference in length of stay, or medical or surgical complications in patients with malignancy.

Conclusions: Overall compared to pediatric general surgeons more nephrectomies are performed by pediatric urologists. Short-term outcomes, including length of stay and complication rates, appear better in this data set in patients without malignancy who undergo nephrectomy by pediatric urologists but there is no difference in outcomes when nephrectomy is performed for malignancy.

Key Words: kidney, kidney neoplasms, nephrectomy, physician's practice patterns, treatment outcome

In adult patients nephrectomy is routinely under the purview of urology but in children PUROs and GPSs perform the procedure. Little is known about comparative outcomes

between PUROs and GPSs for all-cause nephrectomy but differences in outcomes were studied in children who underwent nephrectomy for malignancy. Ritchey et al examined

Abbreviations and Acronyms

ACGME = Accreditation Council for Graduate Medical Education

APR DRG = all-patient refined diagnosis related group

COG = Children's Oncology Group

GPS = general pediatric surgeon

NWTS = National Wilms Tumor Study

PHIS = Pediatric Health Information System

PURO = pediatric urologist

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intraoperative and postoperative complications in children enrolled in NWTs-4.¹ There was no difference in the complication rate between children treated with nephrectomy by a pediatric surgeon or a pediatric urologist but those operated on by adult surgeons were more likely to experience a complication. In that sample GPSs performed almost 6 times the number of nephrectomies as PUROs.

To become a fellowship trained pediatric urologist in the United States one must first complete an accredited residency in urology while GPSs complete a general surgery residency. ACGME made recommendations specific to the number of nephrectomies that should be completed for adequate urology training.² Further, to complete a PURO fellowship there is a recommendation to program directors concerning the number of pediatric nephrectomies in which a fellow participates.³ ACGME does not specify a recommended number of nephrectomies for general surgery residency but it includes nephrectomy among the index cancer cases for a GPS fellowship.⁴

Given the experience with extirpative renal surgery in an adult urology residency and the knowledge of congenital renal anomalies of a pediatric urology fellowship, we hypothesized that PUROs perform more nephrectomies for all causes than GPSs. We questioned whether there were differences in the complication rate and length of stay. We also analyzed differences between children treated with surgery for malignancies vs congenital renal anomalies.

MATERIALS AND METHODS

We analyzed PHIS to identify which type of surgical specialist performed pediatric nephrectomy in pediatric hospitals. We hypothesized that PUROs performed more nephrectomies for all causes than GPSs with differences in the indications for which each subspecialty would operate. As secondary outcomes we analyzed the complication rate and length of stay.

Pediatric Health Information System

The PHIS database includes inpatient, medical/surgical ambulatory or short stay and emergency department patient encounters collected from 44 pediatric hospitals. It includes more than 125 data elements per encounter. Data points are entered by the hospital from the hospital medical record and billing systems. PHIS adheres to a stringent data quality program and works with hospitals to ensure accurate data entry. Because the PHIS database does not blind hospitals, it can be used for hospital quality improvement as well as for more academic pursuits.

Study Population

To identify who performed pediatric nephrectomy we queried the PHIS database for ICD-9 nephrectomy procedure codes, including 55.5 (complete nephrectomy), 55.51

(nephroureterectomy), 55.52 (completion nephrectomy) and 55.54 (bilateral nephrectomy). Patients who underwent partial or transplant nephrectomy were excluded from analysis. To be included patients had to be 18 years or younger, have undergone nephrectomy performed by a urologist or GPS between January 1, 2004 and June 30, 2013, and have been assigned APR DRG code 442 (kidney and urinary tract procedures for malignancy) or 443 (kidney and urinary tract procedures for nonmalignancy).

Data Points and Definitions

Data points extracted for each patient included principal procedure physician subspecialty, age in years, gender, APR DRG code, severity level, mortality risk, length of stay in days, and medical and surgical complication flags. The principal procedure physician subspecialty identifies the type of surgeon who performed nephrectomy. Because the database does not distinguish between pediatric urology and urology, some procedures may be performed by general urologists with pediatric privileges.

Severity level is a 4-point scale assigned by APR DRG software from 1—minor to 4—extreme. Mortality risk uses the same scale and is also assigned by APR DRG software. This software incorporates patient age, diagnoses and procedures, and their potential interaction to assign the severity level and mortality risk. Severity levels and mortality risk are only comparable for the same APR DRG code. Thus, APR DRG codes 442 and 443 were run separately in the statistical analysis. The medical and surgical complication flags are yes/no variables depending on whether any ICD-9 diagnoses for the encounter are considered medical or surgical complications. The supplementary Appendix (<http://jurology.com/>) lists examples of medical and surgical complications.⁵ The full list varies by fiscal year and is maintained by the Children's Hospital Association.

Data Analysis

After data extraction we compared data points between procedures performed by PUROs or GPSs as identified by the principal procedure physician subspecialty. After identifying differences with the Student t-test or chi-square test we performed ANCOVA using SPSS®, version 21 to control for potential confounders with $p < 0.05$ considered statistically significant.

RESULTS

Of 6,520 nephrectomies performed during the study period 5,553 met the study criteria (table 1). PUROs performed 61% more nephrectomies than GPSs. PUROs were more likely to operate for benign

Table 1. Nephrectomies performed by PUROs or GPSs between January 1, 2004 and June 30, 2013

Procedure	No. PURO	No GPS
Nephroureterectomy	3,230	1,972
Completion nephrectomy	23	18
Bilat nephrectomy	173	137
Totals	3,426	2,127

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