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Perioperative considerations and complications in pediatric parathyroidectomy

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ABSTRACT

Objectives/Hypothesis: To evaluate perioperative considerations and post-operative complications associated with parathyroidectomy in the pediatric population.
Methods: The Kids' Inpatient Database 21 (KID) was searched for patients who underwent parathyroidectomy in 2009 and 2012. Patient demographics, hospital stay, associated charges, and post-operative adverse sequelae were evaluated in all patients and included patient comorbidity and additional procedure requirement analysis.
Results: There were 182 patients extrapolating to 262 parathyroidectomies over the two years analyzed. Although a minority of patients were male (45.4%), these patients had greater rates of complications, length of stay, and hospital charges. Importantly, minorities and younger patients (≤15y) also had more complicated post-operative courses. The lengths of stay for patients experiencing post-operative altered mental status (18.7d), post-operative infection (15.5d), respiratory complications (19d), and cardiac complications (13d) were significantly increased compared to individuals without major complications (3.4d) ($p < 0.001$). Patients with pre-existing chronic kidney disease, dialysis-dependence, and bone sequelae (most commonly from hungry bone syndrome) also had significantly lengthier stays and greater associated costs.
Conclusion: Findings from this analysis can be included in a comprehensive pre-operative informed consent process between physicians and patients discussing perioperative considerations and potential complications of parathyroidectomy. Males, younger children, and patients with preexisting renal conditions experienced lengthier and more complicated hospital stays, suggesting the need for closer monitoring of these cohorts.

1. Introduction

There are numerous indications for parathyroidectomy in the pediatric population. Among the more common causes, secondary hyperparathyroidism due to renal insufficiency can be managed in several ways. For example, previous literature has suggested total parathyroidectomy with autotransplantation in children with chronic kidney disease is safe and can be considered in refractory hyperparathyroidism [1]. Although secondary hyperparathyroidism has been widely studied among adult samples, there has been far less inquiry dedicated to pediatric patients.

In contrast to chronic kidney disease, primary hyperparathyroidism within the pediatric population presents several diagnostic challenges. Accordingly, although children commonly exhibit symptoms, diagnosis is frequently delayed [2]. One study evaluating 52 pediatric patients indicated that parathyroidectomy is a largely safe and effective procedure [2], an assertion demonstrated in other series as well. Although these studies possess great value and contain detailed patient information due to the availability of

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individual patient clinical data, examining these considerations from a population-based perspective may be an invaluable complement. Importantly, population-based resources allow for greater sample sizes and consequently greater power to detect statistical differences in perioperative considerations within various demographic groups. The objective of the present analysis was to evaluate perioperative considerations and complications of parathyroidectomy among the pediatric population to identify patients with high risk and complicated hospital courses by utilizing a widely recognized nationwide database. We hypothesized that patient length of stay, and hospital charges would vary significantly based on associated patient diagnoses.

2. Methods

Our analysis reviewed the two most recent editions of the Healthcare Cost and Utilization Project's (HCUP) Kids' Inpatient Database (KID) (2009 and 2012) in order to characterize contemporary hospital stay and surgical outcomes associated with pediatric parathyroidectomy. The KID details patient demographics, payment information, resource utilization, and hospital stay characteristics in the largest national database classifying pediatric inpatient hospital stays. Information is collected by the HCUP using discharge paperwork. International Classification of Diseases – 9th revision (ICD-9) codes, hospital characteristics, and procedural information are among the variables reported when available for each visit. Encounters are recorded regardless of payer type, outcome, or treatment location for all children <21 years of age discharged from one of 5118 hospitals spanning 44 of the 50 United States. The HCUP requires completion of a Data Use Agreement training course before accessing the KID files. All authors with access to patient information completed the training and obtained the required certification before accessing these data.

In all, 6,602,928 patient discharges, representing a nationally extrapolated 14,045,425 cases, were reviewed for ICD-9 codes 06.81 “total parathyroidectomy” and 06.89 “other parathyroidectomy” (including parathyroidectomy NOS, and partial parathyroidectomy). Returned cases were compiled into a master file for analysis using SPSS statistical software. Patient comorbid conditions, hospital stay complications, and procedural information was reviewed and grouped for analysis. National estimations were calculated from HCUP supplied patient discharge weights which factor in hospital size and location to accurately estimate a true national incidence.

Endpoints of interest included procedural incidence, patient age, sex, length of hospital stay (LOS), hospital discharge costs, comorbid condition analysis, procedural data, hospital stay complications, and hospital type. Hospital costs for each inpatient stay equal the billed total and do not include physician fees. Inflation was adjusted for using the US Department of Commerce Bureau of Economic Analysis website to match 2009 data with 2012 totals. Hospital characterization data was identified following cross reference of HCUP provided hospital identification numbers and American Hospital Association's Annual Survey Database (AHAASD) information. The HCUP and AHAASD classify hospitals as teaching if it has an American Medical Association Approved residency program, is a member of the Council of Teaching Hospitals, or has a ratio greater than 0.25 when totaling training interns and residents to hospital beds.

2.1. Statistical analysis

Paired t-tests and ANOVA analysis were used for comparison of continuous variables where applicable. Chi-square tests were used for comparison of categorical variables. Threshold for significance was set at $p < 0.05$. A binary logistic analysis was used to identify hospital stay characteristics contributing to LOS >5 days. Statistical analysis was completed using SPSS statistical software version 23. (an IBM Company, Chicago, IL).

3. Results

3.1. National incidence and characteristics

We reviewed the information of 182 patients characterizing the hospital course of a nationally extrapolated 262 parathyroidectomy cases for patients <21 years of age. In all, 54.2% of patients were female (Table 1), and 45.4% were male. A majority of patients were over the age of 15 (63.4%) (Fig. 1), whites accounted for the greatest proportion of patients (42.0%), and a majority of procedures were performed at teaching hospitals (80.9%). Age and hospital teaching status were each documented in 99.6% of cases and race in 90.1%. Patients younger than 16 years old had longer average length of stay compared to a similar group aged 16–20 years old - 7.2d (95% confidence interval (CI) 4.4–10.0 days) vs 4.2d (95% CI 3.5–4.9 days) $p = 0.010$ (Table 1) (Table 2) Overall, males had statistically significant longer hospital stays; an average of 7.2 days (95% CI 5.0–9.4 days) vs. 3.8 days (95% CI 3.1–4.5 days) in their female counterparts ($p = 0.002$) (Table 1); this difference was significant in both young and old cohorts (Table 2). Additionally, their total hospital costs were statistically greater as well; $68,074 (CI $47,965-$88,184) vs $44,490 (CI $39,348-$49,632) ($p = 0.017$) (Table 1). A comparison among different races revealed that black patients had longer hospital courses – 8.0 days (CI 4.1–12.0 days) ($p = 0.035$) but similar hospital charges when compared to white patients, Hispanics, and other/not recorded populations ($p = 0.145$). No statistical difference was noted in length of stay, or total hospital charges upon comparison of hospital teaching status ($p = 0.14$ and $p = 0.187$ respectively). Additionally, there was no significant difference in LOS or cost based on national region (data not shown).

3.2. Complications

The group with the highest incidence of hospital stay complication was the male cohort aged 0–15 years old - an average of

Table 1
Parathyroidectomy demographics.

	N	LOS (95% CI)$^{p\ value}$	Charges (95% CI)$^{p\ value}$
Totals	262	5.3 (4.3–6.3)	$55,344 ($45,802-$64,886)
Year			
2009	129	5.4 (3.9–6.9)$^{0.927}$	$47,142 ($35,868-$58,415)$^{0.098}$
2012	133	5.3 (3.6–6.9)	$63,449 ($47,685-$79,213)
Sex			
M	119	7.2 (5.0–9.4)$^{0.002}$	$68,074 ($47,965-$88,184)$^{0.017}$
F	142	3.8 (3.1–4.5)	$44,490 ($39,948-$49,632)
Ages			
0–5	6	7.3 (0–16.3)$^{<0.001}$	$58,549 ($10,333-$106,764)$^{<0.001}$
6–10	15	14.9 (1.7–28.3)	$147,549 ($15,477-$279,621)
11–15	74	5.7 (3.2–8.2)	$54,676 ($35,475-$73,878)
0–15	95	7.2 (4.4–10.0)$^{0.010}$	$69,319 ($44,625-$94,012)$^{0.029}$
16–20	166	4.2 (3.5–4.9)	$47,070 ($42,057-$52,088)
Race			
W	110	4.1 (3.2–5.0)$^{0.035}$	$49,138 ($42,424-$55,852)$^{0.145}$
B	45	8.0 (4.1–12.0)	$63,529 ($33,156-$93,902)
H	56	6.7 (3.1–10.3)	$73,405 ($37,238-$109,572)
O	50	3.9 (2.9–5.0)	$41,868 ($32,295-$51,441)
Hospital			
Teach	212	5.7 (4.4–7.1)$^{0.14}$	$41,555 ($34,074-$49,036)$^{0.187}$
N-Teach	49	3.6 (2.4–4.8)	$58,420 ($46,695-$70,144)

LOS = length of stay; Charges = billed hospital stay without physician fees.
Teach = teaching hospital; N-Teach = non-teaching hospital.