National Trends in Secondary Procedures Following Pediatric Pyeloplasty

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Purpose: Although reported success rates after pediatric pyeloplasty to correct ureteropelvic junction are high, failure may require intervention. We sought to characterize the incidence and timing of secondary procedures after pediatric pyeloplasty using a national employer based insurance database.

Materials and Methods: Using the MarketScan® database we identified patients 0 to 18 years old who underwent pyeloplasty from 2007 to 2013 with greater than 3 months of postoperative enrollment. Secondary procedures following the index pyeloplasty were identified by CPT codes and classified as stent/drain, endoscopic, pyeloplasty, nephrectomy or transplant. The risk of undergoing a secondary procedure was ascertained using Cox proportional hazards models adjusting for demographic and clinical characteristics.

Results: We identified 1,976 patients with a mean ± SD followup of 23.9 ± 19.8 months. Overall 226 children (11.4%) had undergone at least 1 post-pyeloplasty procedure. The first procedure was done within 1 year in 87.2% of patients with a mean postoperative interval of 5.9 ± 11.1 months. Stents/drains, endoscopic procedures and pyeloplasties were noted in 116 (5.9%), 34 (1.7%) and 71 patients (3.1%), respectively. Length of stay was associated with undergoing a secondary procedure. Compared with 2 days or less the HR of 3 to 5 and 6 days or greater was 1.65 and 3.94 ($p = 0.001$ and <0.001, respectively).

Conclusions: Following pediatric pyeloplasty 1 of 9 patients undergoes at least 1 secondary procedure with the majority performed within the first year. One of 11 patients undergoes intervention more extensive than placement of a single stent or drain, requiring management strategies that generally signify recurrent or persistent obstruction. Estimates of pyeloplasty success in this national data set are lower than in other published series.

Key Words: kidney, hydronephrosis, ureteral obstruction, treatment failure, minimally invasive surgical procedures

Abbreviations and Acronyms

HMO = health maintenance organization

LOS = length of stay

MIP = minimally invasive pyeloplasty

UPJ = ureteropelvic junction

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PYELOPLASTY remains the gold standard management of UPJ obstruction in children with success rates greater than 94% reported across open, laparoscopic and robotic assisted approaches in recent series.[1–6] However, these data were derived predominantly from single or multi-institutional experiences at high volume academic centers. In addition, although a favorable result is defined by a combination of clinical and radiographic criteria, imaging followup to determine success after pyeloplasty is inconsistent. In a recent study using MarketScan data almost 6% of pediatric patients underwent no imaging after pyeloplasty and a third

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were not monitored radiographically beyond 1 year.[7] It can be assumed that lack of imaging mirrors lack of clinical followup and, thus, insufficient followup may bias estimates of pyeloplasty success.

One indicator of success after pyeloplasty is freedom from additional surgery or secondary procedures. Although the rate of secondary procedures for obstruction underestimates pyeloplasty success if one considers undiagnosed silent failures, this incidence may serve as an objective, reportable measure of failure.

In this study we aimed to characterize the incidence, type and timing of secondary procedures after pediatric pyeloplasty using a national employer based insurance database and determine factors that may contribute to the likelihood of undergoing secondary procedures. We hypothesized that the secondary procedure rate following index pyeloplasty would be higher than reported in the literature, and comorbidities and LOS would be associated with increased secondary procedure rates.

MATERIALS AND METHODS

Data Source

MarketScan contains information from employer based commercial health plans in the United States, including records captured longitudinally from inpatient and outpatient encounters.[8] De-identified individual health service records comprise patient demographics, service dates, LOS, and ICD-9-CM and CPT codes. The data set contains approximately 60 million inpatient records, representing approximately 50% of annual discharges from American hospitals. Race/ethnicity and socioeconomic data are unavailable.

Study Population

We identified patients 0 to 18 years old who underwent pyeloplasty from 2007 to 2013. We used CPT codes for simple, complicated and laparoscopic pyeloplasty and ureteropyelostomy, and ICD-9 codes for correction of UPJ, which we defined as the index pyeloplasty. The supplementary Appendix (http://jurology.com/) lists abstracted diagnosis and procedure codes. While it is possible that some index pyeloplasties were redo procedures if the true index procedure occurred before 2007, this chance of misclassification was expected to be low, given the low incidence of redo pyeloplasty. Unless a secondary procedure was performed within 3 months after pyeloplasty we excluded from analysis patients with greater than 3 months of postoperative enrollment in MarketScan so that insurance coverage was maintained postoperatively. This criterion was applied to ensure that if there was a lack of additional detected procedures, it was not due to change in insurance status.

Patient and Hospital Characteristics

Characteristics evaluated included age at surgery, gender, number of comorbidities, MIP, year of surgery, hospital region, urban status, insurance status (HMO or nonHMO) and LOS. Age was divided into categories of 0 to 2, 3 to 6, 7 to 13 and 14 to 18 years based on NIH (National Institutes of Health) categories. LOS was divided into categories of 1 to 2, 3 to 5 and 6 or more days.

CPT and ICD-9-CM codes were used to identify procedural interventions following initial pyeloplasty hospitalization during distinct postoperative encounters. The secondary procedure categories were stents/drains, including nephrostomy placement; endoscopic correction, including balloon ureteral dilation, and antegrade and retrograde endopyelotomy; repeat pyeloplasty; nephrectomy; and renal transplant. Ureteral stent removal as the first postoperative procedure was considered an indicator of intraoperative stent use and evaluated separately from the other procedures as an expected postoperative event. When patients had multiple codes corresponding to a single encounter, only the most invasive procedure was counted. For instance endopyelotomy with stent placement was counted as endoscopic management rather than as stent/drain. Repeat stent exchanges were counted as a single stent/drain management strategy. Time to first occurrence of each secondary procedure was assessed.

Statistical Analysis

Univariate and multivariate Cox proportional hazards regression models were used to determine risk factors associated with secondary procedures. These risk factors included MIP, age, gender, LOS and comorbidities. Kaplan-Meier curves were generated to illustrate the likelihood of secondary procedure with time by LOS categories. Time to event was defined as time from the index pyeloplasty to the first unplanned secondary procedure. Subjects without an event were censored at loss of MarketScan enrollment or at the end of 2013. Statistical analysis was performed using Stata® 12.1 with 2-sided $p < 0.05$ considered statistically significant.

RESULTS

A total of 1,976 patients were identified with a mean $\pm$ SD followup of 23.9 $\pm$ 19.8 months (median 17.9, range 1 to 83.6). Table 1 lists patient demographics. MIP was done in 161 index cases (31%) and in 18 redo pyeloplasties (25%). From 2007 to 2013 the percent of MIPs increased from 16.4% to 42.3% of index cases. It rose from 0 of 4 (0%) to 5 of 14 (35.7%) redo pyeloplasties, although yearly redo case numbers were small. Stent removal after pyeloplasty was coded in 797 patients (40.3%).

Overall 226 children (11.4%) underwent at least 1 unplanned secondary procedure after index pyeloplasty. The first postoperative procedure was done within 1 year of surgery in 87.2% of patients, between 1 and 2 years in 8.4% and after 2 years in 4.4% (fig. 1). Mean time to the first postoperative procedure was 5.9 $\pm$ 11.1 months. Management included a stent/drain, endoscopic procedure and redo pyeloplasty in 116 (5.9%), 34 (1.7%) and 71 (3.6%) patients, respectively, with nephrectomy in 4 and transplantation in 1 (table 2).