Trends in Followup Imaging after Adult Pyeloplasty

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Purpose: Although success rates are reported to be high, radiographic followup after pyeloplasty to correct ureteropelvic junction obstruction varies in intensity and modality. We characterized postoperative care after pyeloplasty to identify imaging trends.

Materials and Methods: Using the MarketScan® database we identified patients 17 to 65 years old treated with pyeloplasty from 2007 to 2010. Followup imaging was classified as functional (diuretic renogram or excretory urogram) and nonfunctional (ultrasound, computerized tomography or magnetic resonance imaging). The postoperative period was divided into intervals of less than 6, 6 to 12, 12 to 24, 24 to 36 and greater than 36 months. We excluded from study patients with less than 24 months of postoperative enrollment in MarketScan. Multivariate logistic regression was used to determine associations between demographic variables and imaging utilization patterns.

Results: We identified 742 patients with a mean ± SD followup of 36.8 ± 3.7 months, of whom 65% underwent minimally invasive pyeloplasty. Of the patients 12% underwent no postoperative imaging. Within the first 6 months 554 patients (75%) underwent at least 1 imaging study and within the first 12 months 82% underwent at least 1 imaging study, which was most commonly functional. After 12 months 54% of patients underwent any imaging, which was most commonly nonfunctional. At least annual imaging was significantly associated with older age, female gender and longer hospital stay. Secondary procedures were required in 62 patients (8%).

Conclusions: After pyeloplasty in adulthood most patients undergo a functional imaging study within 6 months. However, after 1 year only half of patients undergo followup imaging. Variability and insufficient radiological followup may bias the belief of pyeloplasty success.

Key Words: kidney, ureteral obstruction, hydronephrosis, diagnostic imaging, follow-up studies

Abbreviations and Acronyms

CCI = Charlson comorbidity index

CT = computerized tomography

HMO = health maintenance organization

IVP = excretory pyelogram

MRI = magnetic resonance imaging

UPJO = ureteropelvic junction obstruction

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Anderson-Hynes dismembered pyeloplasty is considered the gold standard to correct UPJO with reported success rates greater than 90%.[1–4] With the development of minimally invasive techniques there has been a dramatic increase in the last decade in the use of laparoscopic and robotic pyeloplasty.[5] The 2 techniques appear to have equivalent success rates and risks of complications compared with open pyeloplasty in nonrandomized comparative studies.[6] Contemporary series show success rates between 87% and 98% for laparoscopic,[4,7–10] and 93% and 100% for robotic[7,10–14] pyeloplasty.

Success in most published series has been defined by clinical and

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radiographic criteria but the duration and type of radiographic followup that should be performed are unclear. Late failures beyond 2 years have been reported.[9,10,15,16] We hypothesize that there is substantial variation in radiographic followup after pyeloplasty in terms of imaging type and timing. We characterized imaging followup using a large administrative database to identify trends in use and duration.

MATERIALS AND METHODS

Data Source

The MarketScan database contains information from American employer based commercial health plans, including records captured longitudinally from inpatient admissions and outpatient visits.[17] Individual level health services records include patient demographics, service dates, length of stay, ICD-9-CM diagnostic codes and CPT codes. The data set contains approximately 60 million inpatient records, comprising approximately 50% of annual discharges from American hospitals.[18] Race/ethnicity and socioeconomic data are unavailable. Because patients are de-identified in the database, institutional review board approval was not obtained for this study.

Study Population

We identified patients treated with pyeloplasty from 2007 to 2010 using CPT codes 50400, 50405 and 50544. A total of 1,535 patients were excluded from analysis due to age less than 17 years at surgery or greater than 65 years at the time of the last enrollment data, or there were less than 24 months of enrollment data after the index surgery. Patients older than 65 years were also excluded because they may have had concurrent Medicare insurance coverage.

Patient and Hospital Characteristics

Patient characteristics were evaluated, including age, gender, CCI, operative approach, surgery year, hospital region, patient insurance status and length of stay. CCI was calculated from inpatient and outpatient claims in the 6 months before the date of surgery.[19] Operative approach was categorized as open or minimally invasive. Insurance status was stratified as HMO or nonHMO.

Radiographic Followup

Imaging use after discharge from the index hospital admission was identified for abdominal and renal ultrasound, abdominal CT, abdominal MRI, renogram with and without diuretic administration, and IVP using CPT and the ICD-9-CM codes (see Appendix, http://jurology.com/). Imaging type was categorized as functional (renogram or IVP) or nonfunctional (ultrasound, CT or MRI). CPT and ICD-9-CM codes for CT with intravenous contrast medium do not allow for the specification of CT IVP/urogram. CPT codes 77160, 77170, 74177 and 74178 (CT with contrast) represented 376 of all 502 CTs (53.6%) in eligible patients. The use of magnetic resonance urography as a functional study could not be determined from the codes.

We examined certain postoperative intervals, including 0 to 6, 6 to 12, 12 to 24, 24 to 36 and greater than 36 months from the date of surgery. Observed imaging patterns were classified into 1 of 4 categories, including 1—no imaging, 2—imaging within 12 months only, 3—imaging after 12 months only, and 4—imaging before and after 12 months.

Secondary Interventions

We identified secondary interventions using CPT and ICD-9-CM codes. The Appendix (http://jurology.com/) lists abstracted diagnosis and procedure codes. For analysis stent/drain procedures and procedures corresponding to salvage endoscopic correction were grouped together. When patients had multiple codes corresponding to secondary interventions, only the most invasive procedure was counted. For instance, endopyelotomy with a stent was counted as endoscopic management and not a stent/drain. A pattern of repeat stent exchanges was counted as a single stent/drain management strategy.

Statistical Analysis

Unadjusted and adjusted multivariate logistic regression was used to determine associations between demographic factors with at least annual radiographic followup. Exploratory univariate analysis was done to determine demographic factors associated with no imaging followup. Statistical analysis was performed using Stata® 12.1 with 2-sided $p < 0.05$ considered statistically significant.

RESULTS

A total of 742 patients met study inclusion criteria. Mean $\pm$ SD followup was 36.8 ± 3.7 months. Table 1 lists patient demographics. The proportion of minimally invasive pyeloplasties increased from 61% in 2007 to 79% in 2010. Complicated pyeloplasty (CPT 50405) was performed in 146 patients (20%) in the cohort.

Figure 1 shows imaging utilization patterns after pyeloplasty. Followup imaging was done in 88% of patients, including 34% in the first 12 months only, 48.5% before and after 12 months postoperatively, and 5.5% only after 12 months postoperatively. Within the first 6 months after pyeloplasty 75% of patients underwent at least 1 imaging study and after 12 months only 54% of patients received followup imaging. In the 471 patients with multiple imaging studies during 2 years postoperatively the average number of imaging studies was 3.7 ± 2.3. Of the 554 patients with imaging in the first 6 months postoperatively at least 1 study was done within the first 3 months in 413 (75%). Of all 925 imaging studies done in the first 6 months 563 (61%) were done within the first 3 months.

Figure 2 shows specific imaging modalities by time, counted by the proportion of patients who underwent at least 1 study per category. Renal