The Role of Prophylactic Antibiotics After Minimally Invasive Pyeloplasty With Ureteral Stent Placement in Children

Matthew C. Ferroni, Timothy D. Lyon, Kevin J. Rycyna, Moira E. Dwyer, Francis X. Schneck, Michael C. Ost, Glenn M. Cannon, and Heidi A. Stephany

OBJECTIVE To determine whether children discharged with prophylactic antibiotics following laparoscopic pyeloplasty with indwelling ureteral stent have a decrease risk of postoperative urinary tract infections (UTIs) compared to those discharged without antibiotics.

MATERIALS AND METHODS A retrospective review of all minimally invasive pyeloplasties performed at our institution from January 2009 to March 2015 was conducted. Patients were discharged home with or without daily prophylactic-dose antibiotics continued until 3 days after ureteral stent removal per surgeon preference. The primary outcome was incidence of culture-positive UTI. Secondary outcomes included bacteriuria at time of stent removal and adverse events associated with extended antibiotic therapy.

RESULTS Of 163 pyeloplasties (106 robotic and 57 pure laparoscopic) performed over the study period, 126 patients were discharged on prophylactic antibiotics whereas 37 patients were discharged without prophylaxis. Groups were different with respect to median age (7.1 vs 12.0 years, $P = .03$) and median duration of ureteral stent (35 days vs 28 days, $P = .02$). The incidence of culture-positive UTI between the time of discharge and stent removal was comparably low between groups; 2/126 (1.6%) in the prophylaxis group and 1/37 (2.7%) in the group not on prophylaxis. At time of stent removal, perioperative urine culture was positive in 2/20 (10.0 %) patients who received prophylactic antibiotics and in 1/25 (4.0%) patients who did not ($P = .54$).

CONCLUSION The administration of extended prophylactic antibiotics showed no significant impact on the rate of UTI following minimally invasive pyeloplasty. UROLOGY 89: 107–112, 2016. © 2016 Elsevier Inc.

Dismembered pyeloplasty in children was first described in 1949 by Anderson and Hynes,[1] and since that time has become the gold standard procedure for the correction of ureteropelvic junction obstruction. In many centers worldwide, a minimally invasive approach (either pure laparoscopic or robotic assisted) has supplanted the open technique showing similar overall success rates with comparable postoperative outcomes.[2-5] In the last decade alone, the rate of minimally invasive pyeloplasty in pediatric patients has risen over 10-fold.[6] Although data are emerging on the safety and efficacy of stentless laparoscopic pyeloplasties, the perioperative placement of a transanastomotic ureteral stent remains the standard of care.[7,8] Bacterial colonization of indwelling stents has been reported to occur in as many as 42%-90% of patients in adult series.[9,10] As a result, many pediatric urologists routinely prescribe prophylactic oral antibiotics after pyeloplasty to reduce the risk of bacteriuria and urinary tract infection (UTI) while the stent remains in place. A recent survey of pediatric urologists reported a 66.7% administration rate of postpyeloplasty prophylactic antibiotics citing history of UTI and indwelling ureteral stent as the two most common reasons.[11]

Despite high bacterial colonization rates, very few patients with ureteral stents develop a clinically significant symptomatic UTI, particularly when the stent duration does not exceed 90 days.[12] Furthermore, positive urine cultures in symptomatic patients have not been shown to accurately correlate to bacteria isolated from ureteral stents in the same patients, indicating that biofilms which form on ureteral stents are likely composed of multiple organisms and may not be eradicated with a single antimicrobial

Financial Disclosure: *The authors declare that they have no relevant financial interests.*

From the Department of Urology, University of Pittsburgh, Pittsburgh, PA; and the Department of Urology, Division of Pediatric Urology, Children's Hospital of Pittsburgh, University of Pittsburgh, Pittsburgh, PA

Address correspondence to: Matthew C. Ferroni, M.D., Department of Urology, University of Pittsburgh, 3471 Fifth Avenue, Suite 700, Pittsburgh, PA 15213. E-mail: ferronimc@upmc.edu

Submitted: September 20, 2015, accepted (with revisions): November 10, 2015

agent.[13] To determine whether postoperative antibiotic prophylaxis reduces the incidence of postoperative UTI, we reviewed our institutional series of minimally invasive pyeloplasties. We hypothesized that children who were not prescribed prophylactic antibiotics while the ureteral stent was in place following laparoscopic pyeloplasty would show similar infectious outcomes compared to children who did receive prophylaxis.

MATERIALS AND METHODS

After receiving appropriate Institutional Review Board approval, we conducted a retrospective review of all pediatric patients who underwent minimally invasive pyeloplasty from January 2009 to March 2015 at the Children's Hospital of Pittsburgh. Exclusion criteria included age less than 12 months and greater than 18 years at time of surgery, patients with a positive preoperative urine culture, patients who were receiving antibiotics (either continuous prophylaxis or active treatment for infection) at time of surgery, cases in which a ureteral stent was not placed due to surgeon discretion, and any case that required an open conversion. Surgery performed with robotic assistance vs traditional laparoscopy, as well as method of intraoperative stent placement (retrograde vs antegrade), was based on the usual practice of each surgeon. Barring a documented penicillin or cephalosporin allergy, in which an appropriate alternative was given, all patients received a weight-based dose of intravenous (IV) cefazolin perioperatively, administered within 1 hour of first skin incision. Antibiotics were redosed during postoperative admission every 8 hours for 24 to 48 hours in all patients. All patients had an indwelling urethral catheter placed at the time of surgery, which was removed on postoperative day one unless otherwise indicated.

Based on individual surgeon preference, patients were discharged home either with or without a prescription for prophylactic dose (2 mg/kg) trimethoprim/sulfamathoxazole (TMP/SMX) from the time of discharge until 3 days after ureteral stent removal. The decision to provide antibiotic prophylaxis reflected the usual practice of each surgeon based on previous background training and personal opinion on possible efficacy. This did not vary on a patient-by-patient basis. In patients with a sulfa allergy, an alternative antibiotic was provided. All patients were scheduled for ureteral stent removal in the operating room 4 to 8 weeks after discharge. At the time of stent removal, all patients received a single perioperative dose of IV antibiotics and urine was collected for culture in some cases based on the usual practice of the surgeon. Only symptomatic bacteriuria at the time of stent removal was treated with additional antibiotics.

Data collected included patient age, gender, history of UTI, operative time, method of stent placement (antegrade vs retrograde), and duration of ureteral stent. The primary outcome was the incidence of culture-positive UTI from the time of postoperative discharge until the ureteral stent was removed. Secondary outcomes included positive urine culture at time of stent removal and adverse events or side effects associated with extended prophylactic antibiotics.

Statistical Analysis

Categorical data were compared using χ^2 and Fisher's exact tests, as appropriate. Continuous nonparametric data were compared using the Mann-Whitney *U* test. Statistics were analyzed using SPSS, version 20 (IBM Corp., Armonk, NY). Statistical significance was defined as the $P < .05$ level using two-tailed tests.

RESULTS

A total of 219 minimally invasive pyeloplasties were conducted during the study period, 56 of which were excluded from analysis based on patient age at time of surgery. The remaining 163 pyeloplasties (106 robotic and 57 pure laparoscopic) were analyzed. No exclusions were necessary for positive preoperative urine culture, antibiotic therapy at time of surgery, or conversion to open procedure. None of the patients studied had a concurrent history of vesicoureteral reflux. A total of 126 patients (77.3%) received prophylactic antibiotics upon hospital discharge, whereas 37 patients (22.7%) did not. A comparison of patient demographics between the two groups is shown in Table 1. The median age between the two groups was significantly different, 7.1 years (interquartile range [IQR] 3.3-13.4) in patients who received antibiotics vs 12.0 years (IQR 4.1-16.6) in those who did not, $P = .031$. A significantly higher percentage of patients who did not receive discharge prophylaxis underwent a robotic-assisted procedure, 97% (36/37) vs 56% (70/126), $P < .001$. Antegrade stent placement was more common in the nonprophylaxis group, 76% (28/37) vs 19% (24/126), $P < .01$. These differences reflect the practice patterns by each surgeon, not decisions made on a patient-by-patient basis. Mean operative time differed between the groups, 239 minutes (IQR 213-276) in the prophylaxis group vs 176 minutes (IQR 154-198) in the nonprophylaxis group.

Table 2 describes the postoperative and postdischarge infection outcomes between the groups. Median duration of ureteral stent was longer in the group receiving prophylaxis, 35 (IQR 28-46) vs 28 (IQR 24-42) days, $P = .02$. The rate of culture-positive UTI from the time of postoperative discharge to stent removal was comparably low between groups; 2/126 (1.6%) in the prophylaxis group vs 1/37 (2.7%) in the nonprophylaxis group. Due to low event rate, comparative statistics could not be used for this outcome. Of the two patients in the prophylaxis group with infection, one patient with a significant history of cerebral palsy, using clean intermittent catheterization for bladder management, grew *Pseudomonas aeruginosa* in the urine. The other patient grew coagulase-negative staphylococcus and had a history of severe constipation and duration of ureteral stent for 64 days. Both of these patients required hospital admission for IV antibiotics due to associated fever. The single patient in the nonprophylaxis group, a 2-year-old female with history of preoperative UTIs, grew *Enterococcus faecalis* and was also admitted to the hospital due to fever and received IV antibiotics. Her stent duration at time of infection was 48 days. Summary data for individual patients with postdischarge infection are shown in Table 3.

At the time of stent removal, urine was collected for culture in 20 patients from the prophylaxis group, with incidence of bacterial growth in 2/20 (10%). This