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Post-surgical infections and perioperative antibiotics usage in pediatric genitourinary procedures☆

Justin Ellett, Michaella M. Prasad, J. Todd Purves, Andrew A. Stec

Medical University of South Carolina, Department of Urology, Charleston, SC, USA

Correspondence to: A. A. Stec, 96 Jonathan Lucas St, CSB 644, Charleston, SC 29425, USA

stec@musc.edu (A.A. Stec)

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Summary

Background
Post-surgical infections (PSIs) are a source of preventable perioperative morbidity. No guidelines exist for the use of perioperative antibiotics in pediatric urologic procedures.

Objective
This study reports the rate of PSIs in non-endoscopic pediatric genitourinary procedures at our institution. Secondary aims evaluate the association of PSI with other perioperative variables, including wound class (WC) and perioperative antibiotic administration.

Study design
Data from consecutive non-endoscopic pediatric urologic procedures performed between August 2011 and April 2014 were examined retrospectively. The primary outcome was the rate of PSIs. PSIs were classified as superficial skin (SS) and deep/organ site (D/OS) according to Centers for Disease Control and Prevention guidelines, and urinary tract infection (UTI). PSIs were further stratified by WC1 and WC2 and perioperative antibiotic usage. A relative risk and chi-square analysis compared PSI rates between WC1 and WC2 procedures.

Results
A total of 1185 unique patients with 1384 surgical sites were reviewed; 1192 surgical sites had follow-up for inclusion into the study. Ten total PSIs were identified, for an overall infection rate of 0.83%. Of these, six were SS, one was D/OS, and three were UTIs. The PSI rate for WC1 (885 sites) and WC2 (307 sites) procedures was 0.34% and 2.28%, respectively, $p < 0.01$. Relative risk of infection in WC2 procedures was 6.7 (CI 1.75–25.85, $p = 0.0055$). The rate of infections in WC1 procedures was similar between those receiving and not receiving perioperative antibiotics (0.35% vs. 0.33%). All WC2 procedures received antibiotics.

Discussion
Post-surgical infections are associated with significant perioperative morbidity. In some studies, PSI can double hospital costs, and contribute to hospital length of stay, admission to intensive care units, and impact patient mortality. Our study demonstrates that the rate of PSI in WC1 operations is low, irrespective of whether the patient received perioperative antibiotics (0.35%) or no antibiotics (0.33%). WC2 operations were the larger source of morbidity with an infection rate of 2.28% and a 6.7 fold higher increase in relative risk.

Conclusions
WC1 procedures have a rate of infection around 0.3%, which is independent of the use of perioperative antibiotics. WC2 procedures have a higher rate of infection, with a relative risk of 6.7 for the development of PSI, and should be the target of guidelines for periprocedural prophylaxis.

Table Infection occurrence rate based on surgical site.

Surgical site	Infection rate % (occurrences/total surgical sites)		
	Overall	Wound class 1	Wound class 2
Overall	0.83% (10/1132)	0.34% (3/885)	2.28% (7/307)
Penis	0.85% (6/705)	0.42% (2/471)	1.71% (4/234)
Abdominal	1.29% (3/232)	0% (0/159)	4.11% (3/73)
Inguinal	0% (0/101)	0% (0/101)	n/a
Scrotal	0.64% (1/154)	0.64% (1/154)	n/a

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Introduction

Postoperative surgical site infections are a source of potentially preventable perioperative morbidity. Numerous studies have investigated the prevalence of these infections following adult urologic procedures [1—4]. These infections have risen to such prominence that the Center for Medicare/Medicaid services now adjusts reimbursement based on their incidence. Guidelines have been initiated that govern the use of perioperative antibiotics to prevent these infections in adults [5]. In 2008, the American Urologic Association (AUA) released a Best Practice Polity Statement on Urologic Surgery Antimicrobial Prophylaxis [5]. Very limited guidelines exist for pediatric genitourinary (GU) procedures as the available data are limited, and due to the unique challenges of caring for infants through post-pubertal children, the adult guidelines may not be directly applicable to the pediatric population [6].

The emergence of multi-drug resistant organisms is partially attributed to overuse of antibiotics and is an important consideration when using perioperative prophylaxis. While the use of these antibiotics may help avert postoperative infections, they are inconsistently used due to concerns that they may also contribute to adverse drug reactions and increased prevalence of antibiotic resistance [7]. Perioperative drug reactions may occur in 1 in 5000 to 1 in 25,000 cases, and these reactions may carry a mortality of up to 6% [8]. While not all of these reactions are attributable to antibiotics, it is difficult to distinguish the true rate of antibiotic allergic reactions in the perioperative setting. In some studies, perioperative allergic reactions accounted for 1.6% of anesthetic adverse events, and a quarter of these can be life threatening [9]. These factors have led to a wide variety of perioperative antibiotic utilization patterns among pediatric urologists. In a recent survey of pediatric urologists, more than 85% gave antibiotics to patients undergoing open pyeloplasty, ureteroneocystostomy, bladder reconstructive surgery, open ureteral reimplantation, or hypospadias repair when a urethral catheter is left in place. Conversely, more than 90% did not give prophylaxis to patients undergoing circumcision, chordee repairs, hernia repairs, or hydrocelectomies. There was a large variation in the use of prophylaxis in patients undergoing other open and minimally invasive surgeries [7].

This study aims to prospectively track and report the actual rate of post-surgical infections (PSIs) in non-endoscopic pediatric GU procedures. The secondary aim is to evaluate the association of PSIs with perioperative variables, such as wound class (WC) and perioperative antibiotic usage. We hypothesize that there will be a low-risk of PSI with WC1 procedures, and these procedure possibly do not require the use of perioperative antibiotics. Similarly, we hypothesize that WC2 procedures will have a higher rate of infection and would likely benefit from perioperative antibiotics. This study will seek to determine the actual rates of these infections, so as to provide evidence for future guidelines regarding the necessity of perioperative antibiotic usage.

Methods

A prospective quality assurance database on PSIs and the use of perioperative antibiotics was maintained and retrospectively analyzed for consecutive patients undergoing non-endoscopic pediatric urologic surgical procedures performed by three pediatric urologists. We included subjects that had any incision, including laparoscopic procedures. We did not include purely endoscopic procedures, such as cystoscopy and ureteroscopy. Institutional Review Board approval was obtained to review the database of all pediatric GU procedures performed between August 2011 and April 2014. The primary outcomes were the incidence of PSI and the use of perioperative antibiotics. Perioperative antibiotics were administered immediately (within 30 min, in accordance with institutional guidelines) before the procedure, or re-dosing given during the operative procedure; this does not include prophylactic antibiotics given postoperatively. Patients were included only if they returned for a follow-up visit after their surgical procedure.

All patients in our practice are given follow up for even simple procedures with a pediatric urology practitioner, typically between 1 and 4 weeks post procedure. All infections were confirmed by these practitioners, and being infection free was confirmed similarly by physical examination and parental report. PSIs were classified as superficial skin (SS) and deep/organ site (D/OS) according to Centers for Disease Control and Prevention (CDC) guidelines [10]. Briefly, superficial infections were those with purulent drainage (with or without positive wound culture) or those with fever, pain, swelling, redness of the incision that is opened by the surgeon, or those that were diagnosed by the attending physician. D/OS infections were those with superficial erythema, purulent drainage or abscess formation of the deeper tissues, fever, or purulent drainage from a surgical drain, or those diagnosed by the attending surgeon. Urinary tract infections (UTIs), while not specifically noted by the CDC guidelines as surgical site infection (SSI), are important perioperative infections in GU procedures and have been included as such in our study. Additionally, CDC guidelines were used to classify wounds as WC1 or WC2 [10]. Class one wounds were uninfected operative wounds in which no inflammation was encountered and the respiratory, alimentary, genital, or urinary tract was not entered. These wounds are closed primarily. Class two wounds were operative wounds in which the respiratory, alimentary, genital or urinary tract was entered under controlled conditions without unusual contamination.

PSIs were confirmed by the surgeon and required antibiotic therapy. Wound cultures were not routinely collected, and infection was diagnosed via physical examination by the attending surgeon, in accordance with CDC guidelines. UTIs were diagnosed based on symptoms, followed by a positive urine culture, which was defined for this study as greater than 100,000 colonies of a single organism. Perioperative antibiotic usage was not standardized during the study time. Perioperative antibiotic use was based on the practice pattern of each individual pediatric urologist. The majority of patients underwent betadine paint and scrub skin prep, with a small minority (mainly

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