



Urinary tract infection after voiding cystourethrogram

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Summary

Background

Reported rates of post-procedural urinary tract infection (ppUTI) after voiding cystourethrogram (VCUG) are highly variable (0–42%).

Objective

This study aimed to determine the risk of ppUTI after cystogram, and evaluate predictors of ppUTI.

Study design

A retrospective cohort study of children undergoing VCUG or radionuclide cystogram (henceforth 'cystogram') was conducted. Children with neurogenic bladder who underwent cystogram in the operating room and without follow-up at the study institution were excluded. Incidence of symptomatic ppUTI within 7 days after cystogram was recorded. Predictors of ppUTI were evaluated using univariate statistics.

Results

A total of 1108 children (54% female, median age 1.1 years) underwent 1203 cystograms: 51% were on peri-procedural antibiotics, 75% had a pre-existing urologic diagnosis (i.e., vesicoureteral reflux (VUR) or hydronephrosis; not UTI alone), and 18% had a clinical UTI within 30 days before cystogram. Of the cystograms, 41% had an abnormal cystogram and findings included VUR (82%), ureterocele (6%), and diverticula (6%). Twelve children had a ppUTI (1.0%; four girls, five uncircumcised boys, three circumcised boys; median age 0.9 years). Factors significantly associated with

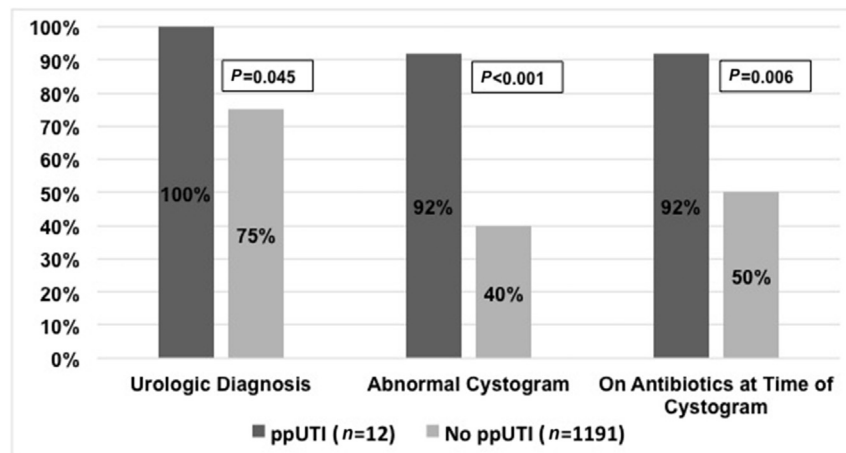
diagnosis of a ppUTI (Summary fig.) included: pre-existing urologic diagnosis prior to cystogram (12/12, 100% of patients with ppUTI), abnormal cystogram results (11/12, 92%), and use of peri-procedural antibiotics (11/12, 92%). All 11 children with an abnormal cystogram had VUR \geq Grade III. However, among all children with VUR \geq Grade III, 4% (11/254) had a ppUTI.

Discussion

This is the largest study to date that has examined incidence and risk factors for ppUTI after cystogram. The retrospective nature of the study limited capture of some clinical details. This study demonstrated that the risk of ppUTI after a cystogram is very low (1.0% in this cohort). Having a pre-existing urologic diagnosis such as VUR or hydronephrosis was associated with ppUTI; therefore, children with moderate or high-grade VUR on cystogram may be at highest risk. Development of ppUTI after cystogram also highlighted the potential for a delay in diagnosis or oversight of a healthcare-associated infection due to several factors: 1) cystograms may be ordered, performed/interpreted, and followed up by multiple different providers; and 2) such infections are not captured by traditional healthcare-associated infection surveillance strategies.

Conclusions

The risk of ppUTI after a cystogram is very low. Only children with pre-existing urologic diagnoses developed ppUTI in this study. This study's findings suggest that children undergoing a cystogram should not be given peri-procedural antibiotic prophylaxis for the sole purpose of ppUTI prevention.



Summary Fig Comparison of children developing post-procedural UTI (ppUTI) vs no ppUTI: significant associations.

Introduction

Imaging procedures such as VUCG and RNC that require catheterization and retrograde instillation of contrast are believed to have an inherent risk of post-procedural UTI (ppUTI). Risk of ppUTI has been documented in pediatric patients after VUCG, although the incidence of ppUTI varies widely in the literature. Previous investigations have demonstrated an incidence of 7–42% without antibiotic prophylaxis [1–3] and 0–13% with varying regimens of prophylaxis [1,2,4,5]. However, specific risk factors for ppUTI in patients undergoing VUCG have not been comprehensively explored. Additionally, the patient populations studied and the criteria used to define a ppUTI vary substantially among studies.

Given the high incidence of urologic anatomic abnormalities in children undergoing VUCG and RNC (henceforth, ‘cystogram’), a UTI occurring soon after cystogram may more often be febrile than in the general pediatric population. Thus, ppUTI after cystogram may result in increased morbidity, such as renal scarring or hospitalization for intensive treatment, compared with all children who have a UTI. This study therefore aimed to determine the risk of ppUTI after cystogram and evaluate predictors of ppUTI.

Material and methods

Study design

A retrospective cohort study was conducted on children who underwent a cystogram at Ann & Robert H. Lurie Children’s Hospital of Chicago (Lurie Children’s) – an urban, freestanding, tertiary care pediatric hospital – between January 2012 and December 2013. Searching the electronic medical records (EMR) for all patients who had a procedure containing the terms ‘cystogram’ or ‘cystourethrogram’ identified all potentially eligible children. Eligibility was confirmed via manual chart review. Patients aged >18 years, those with neurogenic bladder, those who underwent a cystogram in the operating room, and children without follow-up at the study institution after their cystogram were excluded. The study was reviewed and approved by the Lurie Children’s Institutional Review Board.

Variables collected

Data were obtained via manual chart abstraction from the EMR. Demographic characteristics (age, gender, ethnicity, and insurance status) and clinical factors were abstracted. Clinical factors included: indication for cystogram, ordering physician specialty, prior urologic history, UTI history, antibiotic prescription prior to cystogram, and cystogram result. RNC VUR Grades I, II and III were classified as VUCG VUR Grades I, III and V, respectively. A ppUTI within 7 days after cystogram was recorded, and was strictly defined as: 1) clinical symptoms (e.g. dysuria or fever) and 2) a positive urinalysis (UA) with positive urine culture (>10,000 CFU/ml of a single uropathogen). Presence of a ppUTI by clinical history alone was also recorded.

Statistical analysis

Descriptive statistics were used to characterize the study cohort. Incidence of symptomatic ppUTI within 7 days of cystogram was calculated. Fisher’s exact test was used to evaluate for predictors of ppUTI. A multivariate logistic regression was initially planned, but not performed due to the small number of ppUTI observed. Statistical significance was set at a two-tailed *P*-value of <0.05.

Results

Study cohort

Over the 2-year study period, 1108 children (54% female, median age at cystogram 1.1 years [range 0–17.2]) underwent 1203 cystograms that met eligibility criteria (1157 VUCGs, 46 RNCs). Full demographic characteristics are shown in Table 1. Clinical and procedural factors are shown in Table 2, including comorbidities, indications for cystogram, and ordering provider specialty. Three-quarters of children (905/1203, 75%) had a pre-existing urologic diagnosis (besides a history of UTI) prior to undergoing cystogram (57% had hydronephrosis, 28% VUR, 5% ureterocele, and 1.5% PUV). The most common (non-mutually exclusive) indications for cystogram were: febrile UTI (417/1203, 35%), history of VUR (307/1203, 26%), and prenatal hydronephrosis (286/1203, 24%). Most cystograms were ordered by a urologist (677/1203, 56%) or pediatrician (393/1203, 33%).

At the time of cystogram, 51% (607/1203) of children were prescribed antibiotics, 85% (517/607) of whom had a pre-existing urologic diagnosis besides a history of UTI. For children whose antibiotic dosing information was available, 33% (397/1203) were prescribed a prophylactic dose, and 15% (175/1203) were prescribed a therapeutic dose. A clinical UTI was documented in 18% of children (219/1203) within the 30 days prior to cystogram, including 14% (165/1203) with a confirmed positive urine culture.

Table 1 Demographic characteristics (*n* = 1203 cystograms, 1108 children).

	Mean (SD)/Median (range)/ <i>n</i> (%)
Age at study (years) (<i>n</i> = 1203 cystograms)	Mean: 2.6 ± 3.4 Median: 1.1 (0.0–17.2)
Gender (<i>n</i> = 1108 children)	
Female	600 (54.2%)
Male	508 (45.8%)
Ethnicity ^a (<i>n</i> = 1108 children)	
Not Hispanic/Latino	691 (62.4%)
Hispanic/Latino	391 (35.3%)
Not available/unknown	26 (2.3%)
Insurance status (<i>n</i> = 1203 cystograms)	
Private	598 (49.7%)
Public	562 (46.7%)
Unknown	42 (3.5%)
Self-pay	1 (0.1%)

^a Race data not reliably recorded.

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