COMMENTARY

Ultrasound in Hospitalized Children With First Febrile UTI: What Exactly Are We Looking For?

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Detection of genitourinary abnormalities and vesicoureteral reflux (VUR) in young children who present with a febrile urinary tract infection (UTI) is important because severe VUR may predispose to renal scar formation, which may lead to hypertension and impaired kidney function. In this issue of *Hospital Pediatrics*, Wallace et al[1] attempt to identify clinical factors that could be used to predict which hospitalized children 0 to 24 months of age with first febrile UTI are likely to have an abnormal renal bladder ultrasound (RBUS). The authors were not able to determine any clinical factors (other than known genitourinary tract abnormalities) that could be used to guide selective RBUS screening. The authors conclude that selective screening cannot be applied and recommend screening all young children at the time of first febrile UTI.

Screening for genitourinary abnormalities technically precedes UTI in most children because severe genitourinary abnormalities and clinically significant hydronephrosis may be noted on a prenatal ultrasound. One study of 4586 children revealed that a prenatal ultrasound identified severe genitourinary tract abnormalities requiring immediate intervention with a negative predictive value of 99.9%.[2] In a prescreened population, we would not expect an ultrasound at the time of first UTI to detect prenatally missed posterior urethral valves or high-grade obstruction. The population in this study was a prescreened population in which all patients had a normal prenatal ultrasound, and all patients with a postnatal ultrasound were excluded. Therefore, the question that the authors are really asking is the following: "What is the utility of acute RBUS in patients with normal kidneys on prenatal ultrasound?"

The primary purpose of acute RBUS in hospitalized patients with grossly normal kidneys is to determine which patients will need acute surgical intervention such as abscess drainage or ureterocele incision. In this study, 36% of patients had an abnormal RBUS, but only 1 patient with septic shock required an acute intervention with Foley catheter placement for urine output monitoring, so on the basis of those findings, the change in acute management was only 1 in 211. The low rate of change in clinical management based on acute RBUS is consistent with other articles that have revealed a low rate of intervention, usually $<5\%$.[3]

The American Academy of Pediatrics published updated guidelines in 2011 for children 2 to 24 months of age (which were affirmed in 2016) that continued to recommend RBUS at the time of first febrile UTI but also recommended waiting for the second febrile UTI to obtain a voiding cystourethrogram (VCUG) unless there was a renal abnormality.[4] The United Kingdom's National Institute for Health and Care Excellence (NICE) guidelines recommend against a screening ultrasound for first-time febrile UTI during the acute infection if the child responds well to treatment within 48 hours and has a "typical" infection (eg, *Escherichia coli* with no bacteremia).[5] This recommendation for acute RBUS

www.hospitalpediatrics.org
DOI:https://doi.org/10.1542/hpeds.2020-0049

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HOSPITAL PEDIATRICS (ISSN Numbers: Print, 2154-1663; Online, 2154-1671).

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: No external funding.

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

Drs Velaer and Wu conceptualized and drafted the initial manuscript and revised the manuscript; Dr Chang critically reviewed the manuscript and revised the manuscript; and all authors approved the final manuscript as submitted.

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for patients who do not defervesce within 48 hours was evaluated by Bachur,[6] who found no difference in the rate of hydronephrosis, abscess formation, atypical organisms, or bacteremia in responders versus nonresponders, suggesting that even performing acute RBUS for nonresponders may not change clinical management. The NICE criteria recommend ultrasound for all infants ≤6 months of age within 6 weeks of the infection but not during the acute infection, and thus the timing of ultrasound (if indicated) is the question. The study by Wallace et al[1] did not reveal a change in acute clinical management and thus supports avoidance of acute RBUS during hospitalization.

Because acute RBUS rarely changes immediate clinical management, in NICE criteria, ultrasound was recommended at the time of a second febrile infection for children >6 months of age to reduce unnecessary imaging and secondary procedures. The point of waiting for the second febrile UTI was to select for those patients at highest risk for significant VUR. In 2008, Schroeder et al[7] applied the NICE criteria to selectively screen children younger than 2 years with a first febrile UTI to determine if it could be used in clinical practice without missing clinically significant VUR. They demonstrated that selective screening decreased the rates of VCUG and antibiotic prophylaxis use without increasing UTI recurrence and without decreasing the detection rate of high-grade VUR. Therefore, the use of selective screening was able to decrease detection of clinically insignificant VUR and limit unnecessary procedures.

One notable consideration is whether patients with atypical (ie, non–*E coli*) pathogens are more likely to have abnormal RBUS findings. The authors report that the 2 children with the most severe findings on their ultrasound grading system had non–*E coli* pathogens and were also the only 2 children included in the study whose parents reported possible prenatal abnormalities. It would be interesting to determine if those children with severe RBUS findings in this study were children who may have shown a delayed response to antibiotics and would further meet selective criteria for ultrasound with the NICE criteria. This finding from the study actually support the use of selective screening by using NICE criteria over generalized screening at the time of first febrile UTI.

It is important to state that the NICE criteria apply to children >6 months of age, and young patients remain a difficult population for the clinician given lack of clinical data. However, it is reassuring that in this current study, 67% of the patients were <6 months of age, and obtaining an acute RBUS at the time of first UTI did not change clinical management. Although these are encouraging data for this patient population, clinical judgment and patient factors must be considered when deciding on the utility of RBUS during hospitalization.

Another limitation of this study is that all children underwent RBUS during hospitalization during the acute phase of the UTI, and it is not known when the RBUS was obtained during the course of the infection relative to the start of antibiotics. This is an important consideration because acute infection can worsen preexisting hydronephrosis.[8] This may inflate the perceived yield of RBUS and may result in false-positive findings that subject the child to unnecessary repeat imaging and procedures. In this study, 36% ($n = 76$) of children had an abnormal RBUS, with "moderate to severe abnormalities" (as defined by the authors) during the acute phase of the infection. This resulted in high rates of VCUG testing in the population. Patients with a normal RBUS also underwent VCUG testing for unclear reasons, perhaps because many of the patients hospitalized were <2 months, an age not covered by American Academy of Pediatrics guidelines. Ultimately, 66 children underwent VCUG, and only 26 children had VUR. The selection criteria for which patients ultimately underwent VCUG testing are not stated. If the authors used threshold B (grade 2 hydronephrosis) of their devised grading system, then this may have led to overdiagnosis of what may be physiologic hydronephrosis made slightly worse by infection. However, if threshold C (severely abnormal findings on ultrasound) was used to determine VCUG testing, then this would represent appropriate selection. It would be important to know the association between threshold C and significant VUR.

Overall, this study does not support obtaining a screening RBUS on hospital admission in children ≤2 years of age with a first febrile UTI who had normal prenatal ultrasounds. The study confirms that acute RBUS rarely changes clinical management during hospitalization for pyelonephritis. The findings of this study should not negate the NICE guideline that recommends selective screening to reduce the number of repeat imaging studies and secondary procedures.

REFERENCES

1. Wallace SS, Ban K, Singh A, et al. Clinical predictors for abnormal renal bladder ultrasound in hospitalized young children with a first febrile urinary tract infection. *Hosp Pediatr*. 2020;10(5):e20190240
2. Rosendahl H. Ultrasound screening for fetal urinary tract malformations: a prospective study in general population. *Eur J Obstet Gynecol Reprod Biol*. 1990;36(1–2):27–33
3. Giorgi LJ Jr, Bratslavsky G, Kogan BA. Febrile urinary tract infections in infants: renal ultrasound remains necessary. *J Urol*. 2005;173(2):568–570
4. Roberts KB;Subcommittee on Urinary Tract Infection; Steering Committee on Quality Improvement and Management. Urinary tract infection: clinical practice guideline for the diagnosis and management of the initial UTI in febrile infants and children 2 to 24 months. *Pediatrics*. 2011;128(3):595–610
5. National Institute for Health and Care Excellence. Urinary tract infection in the under 16s: diagnosis and management. 2007. Available at: www.nice.org.uk/guidance/cg54. Accessed November 1, 2019
6. Bachur R. Nonresponders: prolonged fever among infants with urinary tract infections. *Pediatrics*. 2000;105(5). Available at: www.pediatrics.org/cgi/content/full/105/5/e59
7. Schroeder AR, Abidari JM, Kirpekar R, et al. Impact of a more restrictive approach to urinary tract imaging after febrile urinary tract infection. *Arch Pediatr Adolesc Med*. 2011;165(11):1027–1032
8. Hellström M, Jodal U, Mårild S, Wettergren B. Ureteral dilatation in children with febrile urinary tract infection or bacteriuria. *AJR Am J Roentgenol*. 1987;148(3):483–486

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Hospital Pediatrics 2020;10;460
DOI: 10.1542/hpeds.2020-0049 originally published online April 17, 2020;

Hospital Pediatrics®

AN OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

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