

Finally, the AAP guideline recommendations are aimed at children between 2 months and 2 years of age. Ordering guidelines are often extrapolated to children outside the target age range because there are no guidelines for VUCG acquisition in younger or older children. While children 2 months to 2 years of age were examined as a subpopulation, the patient cohort was also examined as a whole to account for guideline usage outside of the target age range. Guideline adherence was associated with abnormal VUCG result among all children, but not among children aged 2-24 months. Instead, post hoc analysis revealed a strong association between guideline adherence and abnormal VUCG result among the older patient cohort. Further multicenter evaluation is necessary to determine if the 2011 AAP VUCG ordering recommendations should be revised.

CONCLUSION

At this urban, pediatric, and tertiary care referral center, 2011 AAP UTI guideline adherence for VUCG ordering was more likely among urologists and nephrologists than pediatricians or other specialists. Guideline adherence increased the diagnostic yield of VUCG studies in the full patient cohort, but there was no association in children aged 2-24 months. Further multicenter evaluation is necessary to determine whether VUCG ordering recommendations should be revised.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at <https://doi.org/10.1016/j.urology.2018.12.044>.

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EDITORIAL COMMENT

The American Academy of Pediatrics (AAP) guidelines for investigating infants with an initial febrile urinary tract infection (UTI) were designed in the hopes of minimizing unnecessary testing and treatment. Presumably the detection rates of reflux would be higher by raising the bar for ordering a voiding cystourethrogram (VUCG), namely by requiring either an abnormal renal sonogram or the second febrile UTI before performing the VUCG.



The authors of this paper chose to test the AAP's hypothesis. This paper shows that in fact there was no difference in reflux rates in children aged 2-24 months if the guidelines were adhered to or not. Reflux was detected in 26% of these children regardless of guideline adherence. Interestingly, reflux differences were seen in guideline adherence vs nonadherence for those children older than 2 years (51% vs 26% respectively).

The paper also found that 60% of the VCUGs were ordered as prescribed by the AAP guidelines. These guidelines seem to be shifting clinical practices and fewer VCUGs ordered may be a factor in the trend toward fewer ureteral reimplantations being done in the United States.¹

Our charge as physicians is to remove our patients from the greatest danger facing them and for children with febrile UTIs, that danger is not reflux, but rather high grades of reflux. I hope the future of data analysis will follow the direction of those nomograms that allow for greater accuracy in predicting clinical outcomes in reflux such as the reflux resolution calculator.² Adding more patient characteristics (such as age, ethnicity, family history, degree of fever, etc.) along with more specific sonogram findings (such as ureteral dilation, duplication, and dysmorphia³) to a reflux incidence nomogram will increase our likelihood of knowing not only who has reflux but also who has which grade of reflux. In an age when companies armed with data can predict every consumer's exact preferences, we should be able to accurately predict which degree of reflux children have and, armed with that information, be better able to achieve the goals of the AAP guidelines of minimizing unnecessary testing and treatment.

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AUTHOR REPLY

We appreciate the thoughtful response to our study findings and agree that the medical community should re-evaluate the



American Academy of Pediatrics guidelines for febrile urinary tract infections. While the guidelines rely on the use of renal and bladder ultrasound findings to determine the need for VCUGs, several previous investigations have shown that ultrasound findings are a poorly predictive of VCUG abnormalities. Hoberman et al determined that identification of urinary tract dilation on renal ultrasound following the first febrile urinary tract infection had only a 10% sensitivity and 40% positive predictive value for detection of vesicoureteral reflux on VCUG among 302 children.¹ These results were corroborated by Juliano et al, who reported evidence of dilating vesicoureteral reflux among 23/84 children with a normal renal ultrasound.² A larger study by Logvinenko et al revealed that renal ultrasound had a sensitivity of only 32% for detecting grade 3-5 vesicoureteral reflux among nearly 4000 patients. The group concluded that ultrasound was a poor screening tool for diagnosis of high-grade vesicoureteral reflux.³ The use of renal ultrasound findings to guide VCUG administration, therefore, should be called into question. It is perhaps for this reason that guideline adherence did not improve vesicoureteral reflux detection among children aged 2-24 months in our patient cohort.

Furthermore, while our study demonstrated an association between guideline adherence and vesicoureteral reflux detection among older patients, the current American Academy of Pediatrics guidelines were not intended to target this patient population. The lack of guidelines for a broader range of patients may lead to application among a patient cohort for whom the guidelines were not intended. We support the development of a predictive nomogram to tailor VCUG recommendations for the current age range of patients, and also for older children and very young infants.

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