The Predictive Value of Renal Ultrasound of Vesicoureteral Reflux After First Urinary Tract Infection in Neonates and Infants 0-24 Months

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In 2011, the American Academy of Pediatrics (AAP) revised its Urinary Tract Infection (UTI) clinical practice guideline. A significant change to prior practice was the recommendation of a renal ultrasound (RUS) to determine whether to perform a voiding cystourethrogram (VCUG) for detection of vesicoureteral reflux (VUR) after initial UTI in infants 2-24 months old. The new recommendation has generated controversy, however, due to concerns that the RUS is not an ideal screening tool for detecting VUR, which may lead to potential delays in diagnosis of VUR, recurrence of UTI, and the possibility of renal scarring and long-term renal disease.

Additionally, the current AAP recommendation applies only to infants 2-24 months old and few studies have focused on neonates 0-2 months of age. It is unclear if predictive characteristics of RUS can or should be applied to infants 0-2 months old presenting with a first episode of UTI.

### Purpose:

The objective of this study was to evaluate the predictive characteristics of RUS to determine whether to perform a voiding cystourethrogram (VCUG) to detect VUR in neonates and infants after initial UTI.

### Study Objectives:

- To evaluate the predictive characteristics of RUS for detecting VUR in neonates and infants after initial UTI.
- To focus on neonates 0-2 months of age and infants 2-24 months old.
- To screen for VUR in neonates 0-2 months old.

### Methods:

- We conducted an IRB-approved, retrospective chart review of 91 infants 0-24 months of age who were admitted to the inpatient pediatrics unit with a diagnosis of first UTI between January 1, 2006 and December 31, 2010.
- All infants had a RUS and VCUG.
- Sensitivity, specificity, positive and negative predictive values were calculated for the ability of a non-renal RUS to predict VUR.
- Specific analyses distinguished between grades of detected VUR, as well as subject age.

### Results:

- Ninety-one infants, including 39 neonates (5 days to 2 months old), admitted with first episode of UTI were included in our study.
- Most of the infants in our study had culture-confirmed UTI (87%) following objective signs of infection (fever [42.9%] and appropriate urine collection methods [81%]). Table 1 summarizes the characteristics of the infants in this study.
- Overall, 37% of our study group had a RUS reading other than normal (i.e., renal reflux, pelviectasis, hydronephrosis), and 25% of infants were found to have VUR of any grade.
- The predictive performance of RUS in detecting VUR was highly dependent on VUR grade. In detecting any grade VUR, sensitivity, specificity, PPV and NPV were generally low. In restricting analysis to grades IV-V VUR only, RUS performance was not significantly better in any age group. However, the optimal effectiveness of RUS as a screening tool was in detecting grades IV and V VUR only, with sensitivity and NPV of 100% in both neonates and older infants. Table 2 summarizes the predictive characteristics of a RUS for detecting varying grades of VUR in neonates 0-2 months-old and older infants, 2-24 months-old.

### Discussion:

Until the recent AAP UTI CPG revision, it had been standard practice to perform both a RUS and VCUG on infants after initial UTI to detect renal abnormalities that could predispose to recurrent infection and potential chronic renal disease. More recently, the recommendation of prophylactic antibiotics in the presence of negative RUS leading to undiagnosed VUR. However, with effectiveness of prophylactic antibiotics still unresolved and the expectation that lower grades of VUR usually resolves spontaneously, then perhaps the benefit of both detection and prophylactic antibiotics may be observed with only the highest grades of VUR (e.g., III to V). Although RUS was no better at detecting grades III to V VUR than any VUR, sensitivity and NPV increased to 100% for grades IV or V only in all age groups. Therefore, RUS may be effective as a screening tool if future research demonstrates benefit of prophylactic antibiotics for only the highest grades of VUR. Additionally, because the predictive characteristics of RUS were similar in both neonates and older infants, a further finding of this study suggests that current AAP recommendations can be extended to neonates 0-2 months old.

### Conclusion:

- As a screening tool, RUS demonstrated poor sensitivity, specificity, PPV and NPV for any grade of VUR, or for grades IV or V VUR in infants after initial UTI.
- Sensitivity and NPV are significantly increased when limited to the highest, and perhaps more relevant, grade of VUR in infants only.
- The performance of RUS as a screening tool appears to be similar in neonates as in older infants, suggesting that the scope of the AAP's UTI CPG can include neonates.

### References: