RESEARCH PAPER

Early Dimercaptosuccinic Acid Renal Scan in Children With First Febrile Urinary Tract Infection

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Objective: To determine use of early Tc-99m dimercaptosuccinic acid scintigraphy in screening for vesicoureteral reflux following first febrile urinary tract infection. **Methods**: 43 children (1 mo-5 yr) with first febrile urinary tract infection underwent micturating cystourethrography, abdominal sonogram and early dimercaptosuccinic acid scintigraphy. **Results:** Early dimercaptosuccinic acid scintigraphy had 72% sensitivity and 76% specificity for vesicoureteral reflux. For dilating vesicoureteral reflux, sensitivity and specificity were 100% and 75%, respectively. **Conclusion:** Early dimercaptosuccinic acid scintigraphy has the potential to replace micturating cystourethrography in initial evaluation of febrile urinary tract infection.

Keywords: *Diagnosis, Vesicoureteral reflux, Scintigraphy, Screening*.

Screening for vesicoureteral reflux (VUR) is an important part of evaluation in children with urinary tract infection (UTI) as it can lead to reflux nephropathy and renal scarring. VUR is detected in 30% to 70% of these children [1,2]. Micturating cystourethrography (MCU) remains the gold standard for diagnosing and grading VUR but the procedure is cumbersome. Recent studies have reported that a normal early dimercaptosuccinic acid (DMSA) renal scan excludes dilating VUR, and hence MCU can be avoided [2-4]. However, some other studies indicate that even clinically significant VUR is missed by early DMSA scans [5]. The extent to which DMSA scintigraphy can replace MCU is still unknown. This study was undertaken to assess the role of early DMSA scan in children with first episode of febrile UTI.

METHODS

Between May 2011 and April 2013, children (age 1 mo-5 yr) with first episode of febrile (temp. >37.5ºC) UTI (Urine culture showing colony count of 10^5 CFU, $>10^4$ CFU and ≥1 CFU for midstream clean catch, catheterisation and suprapubic aspiration samples, respectively) [6] were eligible for this study. Children with anatomical and neurological genitourinary abnormalities, previously diagnosed renal disease, recurrent UTI and atypical UTI (presence of poor urinary stream, abdominal mass, raised creatinine, septicemia and serious illness) were excluded. The study was approved by the Institutional Ethical committee. Purposive sampling technique was adopted and informed consent was obtained from parents of included children.

Renal ultrasonography (USG) was done soon after the diagnosis of UTI. DMSA renal scan was performed within 10 days of onset of fever. MCU was done after completion of the treatment of UTI when repeat cultures were sterile. USG was considered positive when there were features suggestive of pyelonephritis or dilated ureter. Early DMSA was taken positive when there were: (*a*) evidence of acute pyelonephritis, defined as single or multiple cortical defects having reduced tracer localization with indistinct margin without deforming renal contour; or (*b*) possible cortical scarring defined as, cortical thinning, ovoid or wedge shaped defect with sharp edges. Reflux was graded according to the international system of radiographic grading of VUR.

Data were analyzed using SPSS version 17.0. Mean, standard deviation, sensitivity, specificity, positive and negative predictive value, and likelihood ratios were used to interpret the data.

RESULTS

A total of 43 children with first episode febrile UTI were included, of which VUR was identified in 22 (51%) children. Eleven out of 14 children with dilating VUR, and five out of seven children with bilateral VUR were below 2 years of age. USG showed positive findings in seven children, with low sensitivity and high specificity for VUR (***Table* I**).

Abnormal DMSA scan was found in 21 patients in form of reduced cortical uptake (11 children) and possible cortical scars (10 children). All children with Grade III, IV and V reflux (dilating VUR) had a positive

WHAT THIS STUDY ADDS?

- Early DMSA scintigraphy can be used in evaluation of under-five children with first episode of febrile urinary tract infection.

early DMSA scan. The association between a positive DMSA and presence of VUR in MCU was statistically significant (P<0.001). The overall accuracy rate for the presence of VUR with a positive DMSA scan was 74% (***Table* I**).

DISCUSSION

About half of children with first febrile UTI had VUR in our study. Early DMSA renal scan was found to have high sensitivity and negative predictive value for detection of dilating VUR in our study.

The major limitation of this study was small sample size, due to which association between presence of dilating VUR with age group, and USG findings with grades of VUR could not be evaluated.

Lower sensitivity of USG abdomen in detection of VUR has also been demonstrated in other studies [7]. High sensitivity and high negative predictive value of early DMSA renal scan for VUR, as seen in this study has also been observed in some other studies [8-10]. Though contradicting results are observed in some studies [5,10], it has been observed that in children with dilating VUR missed out by early DMSA, development of significant renal disease was uncommon [3,12,13]. Some guidelines recommend detailed evaluation only after the second episode of febrile UTI but this may not be ideal in our population due to higher proportion of children having VUR and uncertainty in follow up. Although both DMSA and MCU employ a considerable amount of radiation, DMSA is still advantageous over MCU as it delivers radiation to relatively radio-resistant kidneys sparing the gonads [3].

To conclude, the risk of missing clinically significant VUR is very low with early DMSA scan (top-down approach). Further studies with larger sample size, including different age groups are required to validate these findings.

TABLE I DIAGNOSTIC PERFORMANCE OF USG AND EARLY DMSA IN DETECTING VUR AND DILATING VUR

Test	*VUR*		*Dilating VUR*	
	USG	*Early DMSA*	*USG*	*Early DMSA*
Sensitivity	29	72	28	100
Specificity	90	76	89	75
PPV (%)	71	76	57	66
NPV (%)	52	72	72	100
Positive LR	2.9	3	2.55	4
Negative LR	0.78	0.36	0.8	0

USG - Ultrasonography; DMSA – Dimercaptosuccinic acid renal scan; VUR Vesicoureteral reflux; PPV- positive predictive value; NPV-Negative predictive value; LR – Likelihood ratio.

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