



Value of Cortical Scintigraphy with Technetium-99m Dimercaptosuccinic Acid (99mTc Dmsa) in Children with Acute Urinary Tract Infections

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Abstract

Overview

- Urinary tract infection (UTI) is by far the most common serious bacterial infection in febrile young infants.
- The gold standard investigation for documenting acute pyelonephritis (APN) is cortical scintigraphy with technetium-99m Dimercaptosuccinic Acid (99mTc-DMSA scintigraphy).
- Renal ultrasound (US) can be normal in the presence of APN.

Objectives

Accurate diagnosis of pyelonephritis using clinical and laboratory parameters is often difficult, especially in children. The main aims of this prospective study were to compare the value of renal sonography and cortical scintigraphy with technetium-99m Dimercaptosuccinic Acid (99mTc-DMSA scintigraphy) in detecting renal involvement in acute urinary tract infections (UTI).

Methods

95 children diagnosed with UTI were assessed at The Children's Hospital Mumbai in a Low-Middle Income Country (LMIC). A culture from a mid-stream urine specimen containing >1,000 CFU/mL was considered diagnostic of UTI. All children underwent imaging by renal ultrasound (US), voiding Cystourethrography (VCUG), and renal nuclear scan with Tc99m Dimercaptosuccinic Acid (99mTc-DMSA scintigraphy).

Results

US abnormalities were seen in 42 children (45%). 99mTc-DMSA scintigraphy showed a parenchymal defect suggestive of pyelonephritis in 72 children (78%). Normal US findings did not rule out renal parenchymal involvement. Scintigraphy appeared to be more sensitive than US for renal involvement. The frequency and degree of initial renal parenchymal damage seemed to correlate with vesicoureteral reflux, but the most severe initial parenchymal defects were not associated with marked clinical or laboratory manifestations.

Conclusion

99mTc-DMSA scintigraphy should be considered as a reference in the detection of renal scarring associated with acute urinary tract infection as this technique is more sensitive than in the US.

Keywords: Urinary tract infection; children; 99mTc-DMSA scintigraphy

Introduction

Urinary tract infection (UTI) is by far the most common serious bacterial infection in febrile young infants.[1] 99mTc-DMSA scintigraphy is superior to ultrasonography in detecting cortical scars, although the later identifies dilatation of the collecting systems and renal swelling. This study was conducted to know the role of 99m- Tc Dimercaptosuccinic acids (99mTc-DMSA scintigraphy) scan in children with UTI, its role in the early detection of renal scar.

Methods

95 children diagnosed with UTI were assessed at The Children's Hospital Mumbai in a Low-Middle Income Country (LMIC). A culture from a mid-stream urine specimen containing >1,000 CFU/mL was considered diagnostic of UTI. All children underwent imaging by renal ultrasound (US), voiding Cystourethrography (VCUG), and renal nuclear scan with Tc99m Dimercaptosuccinic Acid (99mTc-DMSA scintigraphy).

Results

US abnormalities were seen in 42 children (45%). 99mTc-DMSA scintigraphy showed a parenchymal defect suggestive of pyelonephritis in 72 children (78%). Normal US findings did not rule out renal parenchymal involvement. Scintigraphy appeared to be more sensitive than US for renal involvement. The frequency and degree of initial renal parenchymal damage seemed to correlate with vesicoureteral reflux, but the most severe initial parenchymal defects were not associated with marked clinical or laboratory manifestations. 99mTc-DMSA scintigraphy should be considered as a reference in the detection of renal scarring associated with acute

urinary tract infection as this technique is more sensitive than in the US.

Discussion

Urinary tract infection (UTI) is by far the most common serious bacterial infection in febrile young infants [1]. The incidence of childhood UTI is unknown. Jakobsson and colleagues found an average incidence of 1% for both sexes [2]. It is believed that 8% of girls and 2% of boys are estimated to have at least one episode of UTI during childhood [3]. Recurrence of UTI after the first infection occurs in 50% of girls in the 1st year of follow-up and in 75% of the cases in a 2-year period [4]. The presence of renal scarring has been documented in 5% to 15% of the children assessed after the first febrile UTI. According to this fact, special attention has been given to early diagnosis and treatment of acute infectious episodes in children with UTI. Accurate diagnosis of pyelonephritis in children using clinical and laboratory parameters is often difficult, and location of urinary tract infection has a serious implication in diagnosis, treatment, and prognosis of these patients. The main aims of this prospective study were to compare the value of renal sonography and cortical scintigraphy with technetium-99m Dimercaptosuccinic Acid (99mTc-DMSA scintigraphy) in detecting renal involvement in acute urinary tract infections (UTI). The authors evaluated a total of 95 pyelonephritic children in this study and showed that 99mTc-DMSA scintigraphy has the highest sensitivity and specificity for detection of pyelonephritis compared to other modalities. However, kidney ultrasonography and VCUG are helpful imaging studies in this regard, they are able to predict renal involvement in acute pyelonephritis. UTI in childhood is one of the principal causes of acquired renal scarring. Renal scarring

has been associated with hypertension, preeclampsia, and end stage renal disease decades later [5-7].

Accurate diagnosis of pyelonephritis using clinical and laboratory parameters is often difficult, especially in children. Knowledge of the prevalence of renal scarring among different subgroups of children can assist clinicians in selecting children who would benefit from additional imaging. For children with a low probability of scar formation, routine imaging may not be necessary. For such children, an indiscriminate approach to imaging might lead to more harm than benefit. The recent review by Faust, et al focused on answering a narrower question: What proportion of children with changes on the acute phase 99mTc-DMSA scintigraphy end up with renal scarring? Because acute-phase 99mTc-DMSA scintigraphy are not routinely performed, this review does not address questions that most clinicians or parents are likely to pose. The decision as to which tests, if any, should be conducted routinely in children with UTIs is necessarily informed by many factors. Data presented here can be used, to some extent, as a starting point. The low rate of pre-existing abnormalities suggests that the yield of routine ultrasonography in children who present with an initial UTI and have no known genitourinary abnormalities on prenatal ultrasonography is likely to be low. This is in agreement with recent literature: ultrasonography modified management in less than 1% of the cases [8-10].

An early 99mTc-DMSA scintigraphy may be used as a screening test (the "top-down" approach). In addition to identifying almost all children with significant VUR, it also can identify most children who are likely to be scared [11,12]. Although children with a negative acute-phase 99mTc-DMSA scintigraphy result are unlikely to develop to a scar, like VCUGs, 99mTc-DMSA scintigraphy are expensive, invasive, and expose children to radiation. Furthermore, it is unclear how to best manage the large numbers of children with a positive acute phase 99mTc-DMSA scintigraphy result (57% of all children with UTIs), most of whom (85%) will not be scared [13]. Rushton and Majd reported that 99mTc-DMSA scintigraphy has high sensitivity (87%) and specificity (100%) as a diagnostic test for pyelonephritis [14]. In our study, 78% of pyelonephritis patients showed evidence of pyelonephritis on 99mTc-DMSA scintigraphy, which is comparable with Tseng and colleagues' study which showed evidence of pyelonephritis on 99mTc-DMSA scintigraphy in 70% of paediatric patients with pyelonephritis [15]. In each acute UTI episode with clinical signs of pyelonephritis, 99mTc-DMSA scintigraphy can detect pyelonephritis more than the other tests. We suggest that a negative result on a 99mTc-DMSA scintigraphy can be used to skip VCUG, which is important to decrease this procedure and its complications, including unpleasantness to the child, possible risk of trauma, secondary infection, radiation exposure, and common refusal by parents.

Conclusion

a) We found that in patients with clinical signs of pyelonephritis, 99mTc-DMSA renal scintigraphy can detect

pyelonephritis more accurately.

b) 99mTc-DMSA scintigraphy should be considered as a reference in the detection of renal scarring associated with acute urinary tract infection as this technique is more sensitive than in the US.

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