

Usefulness of ^{99m}Tc Dimercaptosuccinic acid scan safter the first episode of urinary tract infection in children admitted to the Lady Ridgeway Hospital for Children, Sri Lanka

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Abstract

^{99m}Tc-DMSA scan is the best investigation to assess renal scarring after urinary tract infection (UTI) in children. The aim of this study was to describe the findings of DMSA scans done six months after the first UTI. A descriptive cross-sectional study was done among 110 boys and 80 girls selected by systematic sampling. Urine culture was positive in 164 (86.3%) children. There was no statistically significant association between the DMSA scan result and gender, family history of UTI ($p=1.00$), family history of vesico-ureteric reflux ($p=1.00$), febrile UTI ($p=0.134$) and positive urine culture ($p=1.00$). In 93.7% of children DMSA scan was negative. Hence routinely recommending DMSA scans following UTI must be reconsidered.

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Introduction

Urinary tract infection (UTI) is the most common bacterial infection among infants and young children [1]. UTIs may be limited to the lower urinary tract or involve the renal parenchyma, which may lead to renal cortical scarring [2]. Presence of vesicoureteral reflux (VUR) and young age are risk factors for development of renal cortical scars [2, 3].

^{99m}Tc dimercaptosuccinic acid (^{99m}Tc-DMSA) scan is the best investigation to assess renal scarring after UTI in children. ^{99m}Tc-DMSA binds to the proximal convoluted tubules of the renal tissues, and most of it gets fixed to the renal parenchyma, resulting in an unchanging image over many hours. Hence it is used to assess renal scars and the percentage function contributed by each kidney accurately [4].

A previous study found that acute phase DMSA scans were abnormal in 16.3%, but follow-up DMSA scans done 6-12 months later revealed no abnormality in 12 out of the 14 patients [5]. In another study, 309 children with UTI were investigated by DMSA scans during the acute period and repeated after 6 months. The repeat scans showed renal scars in 9.5% of the children [6]. Yet another study revealed similar results, showing renal scars in 9.8% of children in the follow-up DMSA scan [7].

In the Lady Ridgeway Hospital for Children (LRH), Colombo, Sri Lanka, about 120 ^{99m}Tc-DMSA scans are performed monthly, of which most are done after the first episode of UTI. In the guidelines given by the National Institute for Health and Clinical Excellence, a DMSA scan is indicated in a patient younger than three years, who has had atypical or recurrent episodes of UTI [8]. The aims of this study were to describe the disease characteristics, findings of the DMSA scans, and its associations with selected disease characteristics following investigation of the first episode of UTI.

Methods

A descriptive cross-sectional study was done from February to November 2014. The target population was children between six months and three years who underwent DMSA scanning. Children with a history of recurrent UTI and children with ectopic kidneys and horse shoe kidneys were excluded from the study.

DMSA scans were done on three days per week during the study period. Two medical officers (one was an investigator in the study) routinely attended the DMSA sessions. Sampling frame included children fulfilling eligibility criteria (about five) who presented for a DMSA scan each day. Systematic sampling was done on each

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day and recruitment of the participants was done by the medical officer who was not an investigator of the study. Data were collected by the medical officer who was an investigator.

The formula described by Lwanga and Lameshow for descriptive studies was used to calculate the sample size [9]. Expected prevalence of abnormalities on DMSA scans was taken as 15% according to the findings of Printza and others [5]. Significance level (alpha error) was taken as 95% and the level of precision as 5%. The required sample size was calculated as 196. Interviewer-administered questionnaire and a data extraction form were used. The former consisted of questions to gather demographic and past medical data. The latter gathered information on results of DMSA scans from records. Data were analysed using Statistical package for Software Sciences (SPSS version 17). Associations were described using the Chi Square test.

The decision to perform DMSA scans on patients was made by a consultant paediatrician or a Paediatric Surgeon as part of routine management, and was not based on requests of researchers. Parents' or guardians' verbal consent was taken as the study included retrospectively collected data of a routine investigation. Data collection was done without hindrance to the hospital management of the patient. Approval for the study was obtained from the Ethics Review Committee of the Lady Ridgeway Hospital.

Results

The study recruited 190 participants. There were 110 (57.9%) boys and 80 (42.1%) girls in the study population (Table 1). Majority of patients (n=65,34.2%) had been followed up at LRH and other patients had been regularly followed up in local hospitals from which they were referred. The majority of children (n=106, 55.8%) were in their second year (Table 1). Majority had no family history of UTI (n=189, 99.5%) and had fever during the index episode (n=158, 83.2%).

Table 1. Age and selected medical characteristics

Characteristic	Number (%)
Age	
6 to 12 months	61 (30.5)
13 to 24 months	106 (53.0)
25 to 36 months	23 (11.5)
Family history of UTI *	5 (2.6)
Fever	158 (83.2)
Total	190 (100)

Of those who had fever during the episode of UTI, 80 (42.1%) had high grade fever and 78 (41.1%) had low grade fever. Clinical features of acute pyelonephritis were seen in six participants. Only one child had a family history of VUR. Urine culture was positive in 164 (86.3%). Twenty three (12.1%) participants had abnormalities in the urinary tract by ultrasonography. They included mild renal pelvic fullness, moderate hydronephrosis and pyelonephritis. Fourteen (7.3%) children underwent micturating cystourethrography (MCUG), and of them only one patient had bilateral grade IV VUR.

There was no statistically significant association between the DMSA scan results and family history of UTI ($p=1.00$), family history of VUR ($p=1.00$), presence of fever during UTI ($p=0.134$) and positive urine culture ($p=1.00$) (Table 2).

Table 2. Associations of DMSA result and selected parameters

	DMSA result			
	Positive N	Negative N	Total N	
FH* of UTI				
Yes	1	5	6	$p=1.0$
No	11	173	184	OR=3.14(0.34-29.31)
FH* of VUR				
Yes	0	1	1	$p=1.0$
No	12	177	189	OR=4.73(0.18-122.27)
Febrile UTI				
Yes	12	146	158	$p=0.13$
No	0	32	32	OR=5.54(0.32-96.09)
Urine culture				
Positive	10	154	164	$p=1.0$
Negative	2	24	26	OR=0.78(0.16-3.77)

*FH= Family history

Discussion

UTI is common in children admitted to tertiary healthcare centres. LRH, Colombo, is the premier children's hospital in Sri Lanka with many referrals from the regional hospitals, and it manages children with UTI from all geographical areas of Sri Lanka. Current local practice is to perform ^{99m}Tc -DMSA scans to assess renal scarring after proven UTI episodes in children below five years. During this process, children are exposed to gamma rays emitted from ^{99m}Tc (technetium). Though the radiation dose is not as high as in plain radiography and computed tomography, it is wise to avoid unnecessary radiation exposure in growing children.

Hence recommending DMSA scans for children with a history of uncomplicated single episode of UTI ought to be done after weighing risks and benefits. As far as the health care system is concerned, unnecessary direct and indirect expenditure could be reduced by limiting the DMSA scans to needy children. Our study revealed that most of the DMSA scan results were negative for children who had only one episode of uncomplicated UTI (93.7%). Similar results have been obtained by studies done in other countries [5-7]. In conclusion, the conventional practice of recommending DMSA scans following UTI should be modified with an evidence-based protocol.

Conflicts of interests

There are no conflicts of interest.

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