Journal of Urology, Nephrology Research & Case Reports

doi: 10.39127/JUNRCR:1000110
Nasser E, et al. J Uro Neph Re Cas Rep: JUNRCR-110.

Research Article

The Relationship Between DMSA To VUR And Pyelonephritis Diagnosis in Children in Northern Israel

Ehsan Nasser[1,3], Aluma Elkayam[1], HaiaNasser[1,3], Jerdev Michael[2], Susan Nasser[1], Az Said[1], Boshra N[3], Wael Nasser[3*]

[1]Department of Pediatrics, Baruch Padeh Poriya Medical Center, Lower Galilee
[2]Department of Radiology, Baruch Padeh Poriya Medical Center, Lower Galilee
[3]Nephrology & Hypertension Division, Baruch-Padeh Poriya Medical Center, Lower Galilee, Faculty of Medicine in Galillee, Azrieli University, Israel

[*]**Corresponding author:** Wael Nasser, Department of Pediatric Nephrology, Baruch Padeh Poriya Medical Center, Lower Galilee, Israel. Email: wael-nasser@hotmail.com

Citation: Nasser E, Elkayam A, Nasser H, Michael J, Nasser S, et al. (2019) The Relationship Between DMSA To VUR And Pyelonephritis Diagnosis in Children in Northern Israel. J Uro Neph Re Cas Rep: 110.

Received Date: 22 July, 2019; **Accepted Date:** 26 July, 2019; **Published Date:** 02 August, 2019

Abstract

Introduction and Objective: *It is estimated that 31.1% of pediatric patients with UTI also suffer from Vesicoureteral reflux (VUR). Having both UTI and VUR simultaneously poses as a risk factor for developing pyelonephritis and renal scarring. Pyelonephritis may be detected using Dimercaptosuccinic acid (DMSA)- a radionuclide scan to discover renal scarring, with minimal radiation. On the other hand, the gold standard for VUR diagnosis is voiding cystourethrogram (VCUG), a traumatic test with high radiation, which is unsuitable for discovering renal scarring. Therefore, the objective of this research is to examine DMSA as a possible means to replace VCUG in VUR diagnosis.*

Methods: *a retrospective study of 88 children from birth to age 9 with symptoms fitting of UTI. These children were tested for VUR presence using VCUG and DMSA.*

Results: *19 of the 88 patients did not undergo DMSA. Out of the 69 pediatric patients who were tested, 39 did not have reflux while 30 had VUR. Among the 39 children without reflux, 69.2% had typical DMSA results, while 30.8% had abnormal DMSA results, meaning almost 70% of DMSA findings were compatible with the diagnosis among the children without reflux. Among the 30 remaining patients- 12 were diagnosed with VUR grade I-II and 18 were diagnosed with VUR grade III-V, according to VCUG results. 66.7% of the patients with VUR grade I-II had abnormal DSMA results, while a remarkable figure of 88.9% of children with VUR grade III-V had abnormal DSMA results.*

Conclusion: *DMSA may be used as a useful tool for VUR diagnosis, replacing VCUG.*

Keywords: • Dimercaptosuccinic acid (DMSA) • Vesicoureteral reflux (VUR) • Pyelonephritis

Abbreviations

UTI: Urinary Tract Infection
VUR: Vesicoureteral Reflux
DMSA: Dimercaptosuccinic Acid
VCUG: Voiding Cystourethrogram

Introduction

Urinary tract infection (UTI) is a common cause for hospitalization among pediatric patients. Patients between the ages of 2 months and two years presenting with fever should be examined for the presence of UTI [1].

It is estimated that 31.1% of pediatric patients with UTI also suffer from Vesicoureteral reflux (VUR)- a retrograde flow of urine [2]. Having both UTI and VUR simultaneously poses as a risk factor for developing pyelonephritis and renal scarring as the bacterial infection is moving upwards through the urinary system. Reflux allows the infected urine in the bladder to reach the upper urinary tract and the kidneys, causing pyelonephritis, inflammation of the kidneys.

Pyelonephritis may be detected using Dimercaptosuccinic acid (DMSA)- a radionuclide scan that uses dimercaptosuccinic acid to discover renal scarring, with minimal radiation. On the other hand, according to the EAU (European association of urology) and the ESPU (European society of pediatric urology) guidelines, the gold standard for VUR diagnosis is voiding cystourethrogram (VCUG) [3].

This test takes pride in having a high detection rate, but unfortunately, VCUG uses ionizing radiation and is considered traumatic for the patients as it includes the insertion of a urethral catheter [3]. Besides, VCUG is unsuitable for discovering renal scarring- a common clinical manifestation of pyelonephritis which may arise due to reflux, especially in high-grade VUR. Therefore, the objective of this research is to examine DMSA as a possible means to replace VCUG in VUR diagnosis.

Subjects and Methods

This is a retrospective study which examined the demographic and clinical data as well as tests results of 88 pediatric patients from birth to age 9 with symptoms fitting of UTI during the years 2009-2013 at the Baruch Padeh medical center, northern Israel. These children were tested for VUR presence using VCUG within a month since the clinical manifestation for infants up to 6 months old. Infants and children older than six months also underwent DMSA 3-5 months after the clinical manifestation of UTI had begun.

The statistical data regarding the study group is presented according to gender, age group, presence of UTI, infection location, and infection type, concerning the presence of VUR .This study excluded children with any congenital anatomical abnormalities.

Results

Overall, 88 pediatric patients with the clinical presentation of UTI were tested for VUR (table 1). In terms of gender, 83% of subjects were females while males consisted of the remaining 16% and 1% of subjects whose gender was not recorded in the hospital's medical records. VUR was slightly more common in the female gender as 38% of female subjects had VUR, and only 29% of the male subjects had VUR. When referring to the age of our subjects, 41% of the subjects were under the age of 1 and 57% between the ages 1-9 years old (remaining 2% unknown). Only 25% of the infants under one-year-old had VUR, while almost half of the rest (48%), aged 1-9 years old, had VUR.

Though presenting with symptoms fitting for UTI, two patients did not have a confirmed diagnosis of UTI. As for the ones who had UTI, it seems that those with recurrent UTI were more prone to have VUR since 29% of patients with first UTI also had VUR, whereas 49% of those were recurrent UTI had VUR. Infection site may also have some effect over the presence of VUR. Of our research population, 11% had lower UTI, 69% had upper UTI, and in 19% the location of the infection was unknown. 50% of patients with lower UTI had VUR, in contrast to 38% of patients with upper UTI which have had VUR.

Finally, 65% of the group had pyelonephritis, 18% had nephronia, and only 3% had cystitis. The data of the remaining 14% could not be recovered from medical records. As regards to DSMA findings in the study population (table 2): 19 of the 88 patients did not undergo DMSA and therefore are irrelevant to evaluate the test's abilities. Out of the 69 pediatric patients who were tested, 39 did not have reflux, 12 had VUR grade I-II, and 18 had VUR grade III-V. Among the 39 children without reflux, 69.2% (27/39) had typical DMSA results, while less than a third, to be accurate, 30.8% (12/39) had abnormal DMSA results, meaning almost 70% of DMSA findings were compatible with the diagnosis among the children without reflux. Among the 30 remaining patients- 12 were diagnosed with VUR grade I-II and 18 were diagnosed with VUR grade III-V, according to VCUG results. 66.7% (8/12) of patients with VUR grade I-II had abnormal DSMA results, while a remarkable figure of 88.9% (16/18) of children with VUR grade III-V had abnormal DSMA results.

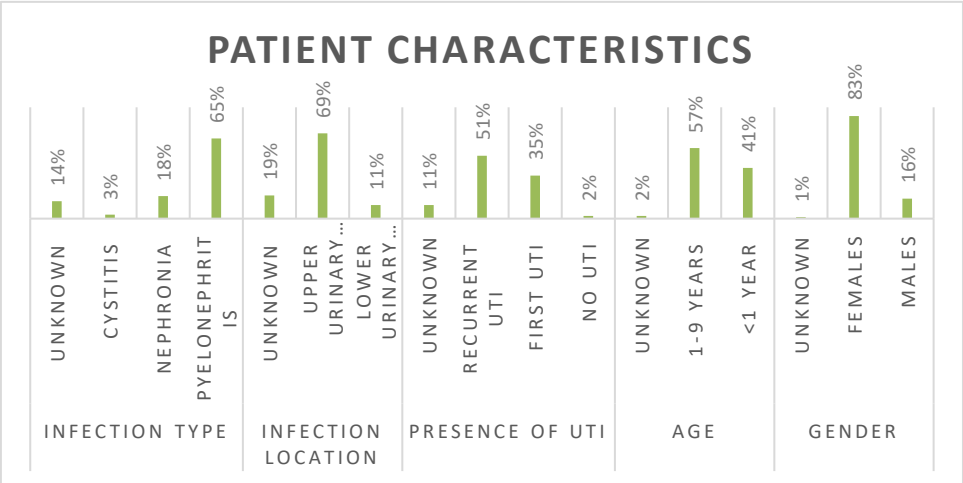

Chart 1: Patient characteristics.

Characteristic		VUR (row percentiles)	No VUR found (row percentiles)	Total (column percentiles)
Gender	**Males**	4/14 (29%)	10/14 (71%)	14 (16%)
	Females	28/73 (38%)	45/73 (62%)	73 (83%)
	Unknown	1/1 (100%)	0/1 (0%)	1 (1%)
Age	**<1 year**	9/36 (25%)	27/36 (75%)	36 (41%)
	1-9 years	24/50 (48%)	26/50 (52%)	50 (57%)
	Unknown			2 (2%)
Presence of UTI	**No UTI**	1/2 (50%)	1/2 (50%)	2 (2%)
	First UTI	9/31 (29%)	22/31 (71%)	31 (35%)
	Recurrent UTI	22/45 (49%)	23/45 (51%)	45 (51%)
	Unknown	1/10 (10%)	9/10 (90%)	10 (11%)
Infection location	**Lower urinary tract**	5/10 (50%)	5/10 (50%)	10 (11%)
	Upper urinary tract	23/61 (38%)	38/61 (62%)	61 (69%)
	Unknown	5/17 (29%)	12/17 (71%)	17 (19%)
Infection type	**Pyelonephritis**	24/57 (42%)	33/57 (58%)	57 (65%)
	Nephronia	6/16 (38%)	10/16 (62%)	16 (18%)
	Cystitis	1/3 (33%)	2/3 (67%)	3 (3%)
	Unknown	2/12 (17%)	10/12 (83%)	12 (14%)

Table 1: Patient characteristics in patients with and without VUR.

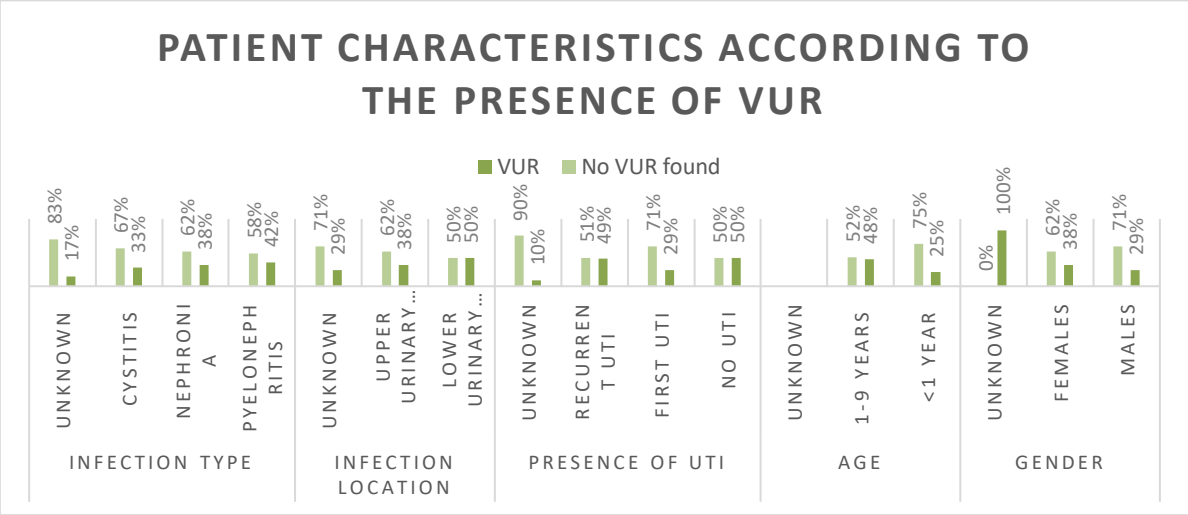

Chart 2: Patient characteristics according to the presence of VUR.

	No reflux	VUR grade I-II	VUR grade III-V	Total
Number of patients	55/88	14/88	19/88	88 patients
DMSA was not performed	16/55	2/14	1/19	19/88
DMSA was performed	39/55	12/14	18/19	69/88
DMSA results compatible with diagnosis	27/39 (69.2%)	8/12 (66.7%)	16/18 (88.9%)	51/69 (74%)
DMSA results not compatible with diagnosis	12/39 (30.8%)	4/12 (33.3%)	2/18 (11.1%)	18/69 (26%)

Table 2: DMSA findings in patients with and without VUR.

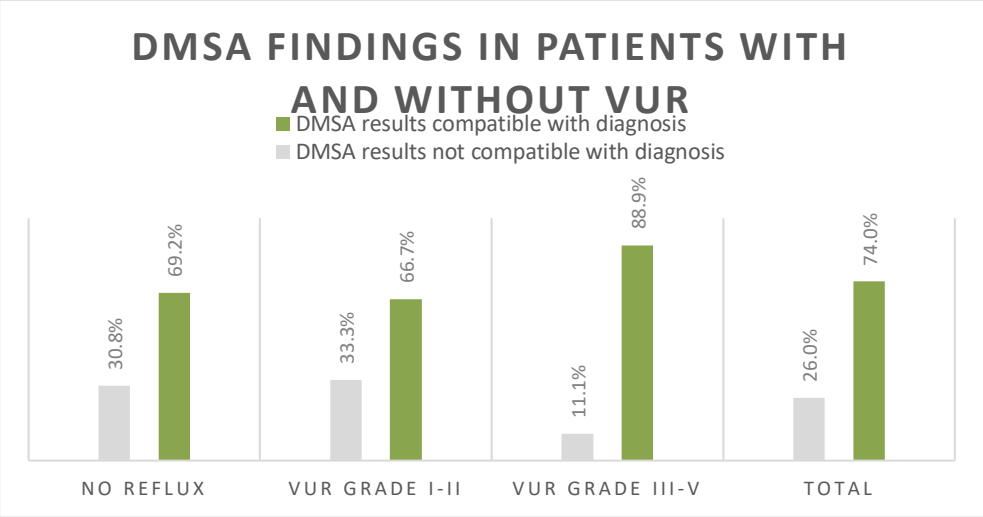

Chart 3: DMSA findings in patients with and without VUR.

Discussion

This research tested 30 patients with VUR using DSMA. By showing that 24 of them (80%) had abnormal DSMA findings, meaning their DSMA results were compatible with their diagnosis, the study supports other studies which concluded that abnormal DSMA results are associated with VUR diagnosis [4-11]. By doing so, the consequences of this research contrast other researches which did not show a clear connection between DSMA findings and VUR [13-14].

VUR is graded on a scale of I-V according to the degree of urine backflow. Grade I: urine reflux is limited to the ureter; Grade II: urine reflux reaches the kidney, without causing dilation; Grade III: urine reflux reaches the kidney and causes mild dilation of the ureter and renal pelvis; Grade IV: urine reflux reaches the kidney and causes moderate dilation of the ureter, the renal pelvis, and the calyces; Grade V: urine reflux reaches the kidney and causes significant dilation of the ureter, the renal pelvis, and the calyces, with ureter tortuosity and loss of papillary impression. It is essential to keep in mind that renal scars may be infected or sterile in our study, the highest detection rate for DMSA, an outstanding rate of 88.9%, was noted among the patients with VUR grade III-V. As the increasing grade shows renal involvement, our test becomes more accurate since it is directed for renal scarring.

Conclusion

Following the examination of 88 pediatric patients, this study showed that DMSA is applicable as a useful and reliable test to detect the presence of VUR, especially when dealing with a high-grade VUR, and hence may replace the current gold-standard method for diagnosis.

That being said, about a third of the tested patients had abnormal DSMA results without having VUR.

References

1. Roberts KB (2011) Subcommittee on Urinary Tract Infection. Steering Committee on Quality Improvement and Management. Urinary tract infection: Clinical practice guideline for the diagnosis and management of the initial UTI in febrile infants and children 2 to 24 months. Pediatrics 128: 595-610.
2. Sargent MA (2000) What is the normal prevalence of vesicoureteral reflux? Pediatr Radiol 30: 587-593.
3. Celik O, Ipekci T, Aydogdu O, Yucel S (2013) Current medical diagnosis and management of vesicoureteral reflux in children. Nephrourol Mon 6: e13534.
4. Hoberman A, Charron M, Hickey RW, Baskin M, Kearney DH, et al. (2003) Imaging studies after a first febrile urinary tract infection in young children. N Engl J Med 348: 195-202.
5. Mahyar A, Ayazi P, Mavadati S, Oveisi S, Habibi M, et al. (2014) Are clinical, laboratory, and imaging markers suitable predictors of vesicoureteral reflux in children with their first febrile urinary tract infection? Korean J Urol 55: 536-541.
6. Gordon I, Barkovics M, Pindoria S, Cole TJ, Woolf AS (2003) Primary vesicoureteric reflux as a predictor of renal damage in children hospitalized with urinary tract infection: a systematic review and meta-analysis. J Am Soc Nephrol 14: 739-744.
7. Polito C, Rambaldi PF, Signoriello G, Mansi L, La Manna A (2006) Permanent renal parenchymal defects after febrile UTI are closely associated with vesicoureteric reflux. Pediatr Nephrol 21: 521-526.
8. Lee JH, Son CH, Lee MS, Park YS (2006) Vesicoureteral reflux increases the risk of renal scars: a study of unilateral reflux. Pediatr Nephrol 21: 1281-1284.
9. Faust WC, Diaz M, Pohl HG (2009) Incidence of postpyelonephritic renal scarring: a meta-analysis of the dimercapto-succinic acid literature. J Urol 181: 290-297.
10. Shaikh N, Ewing AL, Bhatnagar S, Hoberman A (2010). Risk of renal scarring in children with a first urinary tract infection: a systematic review. Pediatrics 126: 1084-1091.
11. Peters CA, Skoog SJ, Arant BS Jr, Copp HL, Elder JS, et al. (2010) Summary of the AUA guideline on management of primary vesicoureteral reflux in children. J Urol 184: 1134-1144.

12. Garin EH, Olavarria F, Garcia Nieto V, Valenciano B, Campos A, et al. (2006) Clinical significance of primary vesicoureteral reflux and urinary antibiotic prophylaxis after acute pyelonephritis: a multicenter, randomized, controlled study. Pediatrics 117: 626-632.
13. Doganis D, Siafas K, Mavrikou M, Issaris G, Martirosova A, et al. (2007) Does early treatment of urinary tract infection prevent renal damage? Pediatrics 120: e922e8.
14. Pecile P, Miorin E, Romanello C, Vidal E, Contardo M, et al. (2009) Age-related renal parenchymal lesions in children with first febrile urinary tract infections. Pediatrics 124: 23-29.