

# The Prevalence of Renal Scars Among Infants Under One Year Old With a First UTI With or Without VUR in Qom, Iran, 2017

Mohsen Akhavan Sepahi,<sup>1</sup> Fateme Toloui,<sup>2</sup> Shahram Arsang Jang,<sup>3</sup> Bibi Leila Hoseini<sup>4</sup>

<sup>1</sup>Department of Pediatric, School of Medicine, Qom University of Medical Sciences, Qom, Iran

<sup>2</sup>Pediatric Clinical Research of Development Center, Hazrat Masoomeh Hospital, Qom University Of Medical Sciences, Qom, Iran

<sup>3</sup>Department of Epidemiology and Biostatistics, Faculty of Health, Research Center for Environmental Pollutants, Qom University of Medical Sciences, Qom, Iran

<sup>4</sup>Department of Midwifery, School of Medicine, Sabzevar University of Medical Sciences, Sabzevar, Iran

Renal scarring with reflux develops renal nephropathy. The risk is higher when it is associated with urinary tract infection (UTI). Hence, we investigated the prevalence of renal scars among children under one-year-old with the first UTI in Qom, Iran. We conducted this retrospective study on 140 infants divided in two reflux (n = 70) and non-reflux (n = 70) groups. Participant's records had been analyzed by descriptive and analytic statistics. The prevalence of renal scar was 32.12% among all 140 infants. The prevalence of renal scars among children with and without reflux, was 33 (47.1%), and 12 (17.1%) out of 70 ( $P < .001$ ); respectively. The rate of renal defects increased with higher grades of reflux. We found that the rate of renal scar is high in Qom. Therefore, we recommend screening susceptible children in order to prevent renal damage.

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## INTRODUCTION

Renal scarring induced by reflux can progress to reflux nephropathy. This risk would be higher, if vesicoureteral reflux (VUR) is associated with urinary tract infection (UTI).<sup>1</sup> UTI is one of the most common infections among children.<sup>2-4</sup> It is the first sign in 30% of children with urinary tract anomalies.<sup>5</sup> Although renal scar can be developed by even a single urinary tract infection, but repeated infections more probably cause reflux nephropathy.<sup>1</sup>

VUR is the retrograde urinary flow from the bladder to the ureter or kidney.<sup>6</sup> It may be familial or secondary to distal obstacle of the bladder or any other urinary tract anomalies.<sup>7</sup> Reflux can lead to incomplete urinary evacuation.<sup>1</sup> This defect may prepare children's renal infection.<sup>8</sup> Although VUR is often diagnosed following a UTI, the routine

ultrasonographic imaging in pregnancy may reveal this defect before UTI represented. There is no reliable clinical sign to differentiate UTI in patients with or without reflux.<sup>1</sup>

Diagnostic techniques used for urinary tract assessment included: Renal ultrasound (RUS), voiding cystourethrogram (VCUG), and nuclear cystogram (NCG).<sup>1,9</sup> Dimercaptosuccinic Acid (DMSA) scan is the best way to identify renal scars.<sup>10</sup>

Any delay in treatment of UTI predisposes the children to kidney injuries.<sup>4</sup> The long-term complications of renal scarring include hypertension, renal dysfunction and end-stage renal disease (ESRD).<sup>3,8</sup> VUR is divided into 5 grades I-V.<sup>7</sup> Surgical intervention is rarely used for under one-year-old infants with reflux. It is indicated in some cases such as a high-grade reflux, and renal

impairment induced by renal nephropathy.<sup>11</sup>

As mentioned above, children are more likely to develop kidney damage following UTI. But the risk is highest in young children since ureteral bladder reflux is more common in this group. On the other hand, one more influencing factor on renal scar is genetic predisposibility.<sup>3</sup> Although several researches had been performed on renal scar prevalence, we did not find any study focused on children in the first year of life in Qom city. Thus, we investigated the rate of renal scars in under one-year-old infants with the first UTI affected to reflux or not in Qom, Iran in 2017.

### MATERIALS AND METHODS

This historical cohort study was conducted in Hazrat Masoume hospital, Qom, Iran. This hospital has a referral nephrology ward for patients with urinary infection. The appropriate sample size was 139 children. It was calculated based on the statistical indices from previous studies and considering the probability of type I error 5%, power 80%, patients with VUR and abnormal DMSA equal to 75.9%. Data were gathered randomly from records of the patients admitted in nephrology ward anytime in the past till accomplishing the required sample size. So, we included all under one-year-old infants suffering from UTI. We diagnosed whether each infant affected with reflux or not and its severity by using VCUG data. The patients with reflux were allocated to exposed group, and those in unexposed group had no VUR. Both groups had been evaluated to detect renal scars by DMSA at

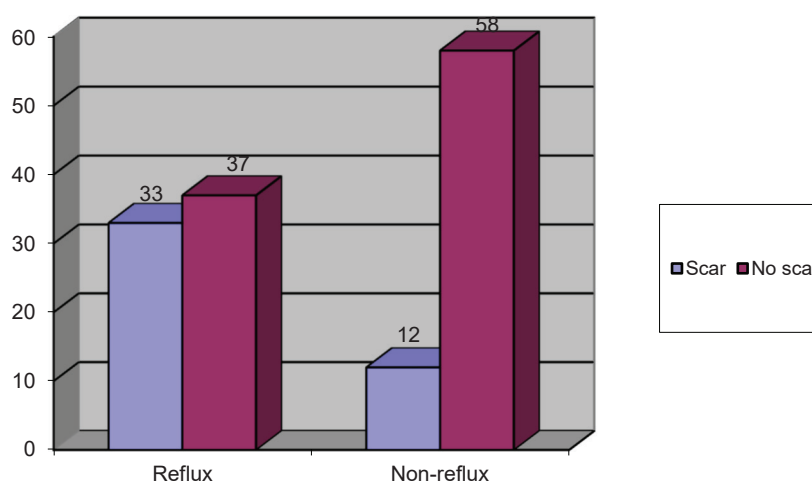
intervals of 6 months. Some variables including age and gender were extracted, too.

The Research Committee of Qom University of Medical Sciences (IR.MUQ.REC.1396.124) approved this study. All data were gathered, coded, entered into a computer, and analyzed. Statistical analysis was performed using the STATA version 14. We analyzed data by using descriptive statistics and Pearson, chi squared tests, as well as logistic regression model, ordinal logistic regression model. The significance level used was a *P* value of less than .05.

### RESULTS

Records of 140 infants affected with the first UTI were examined. In each group, 70 children were assessed. The average age of the children was 10 months. The mean age was 5 and 8 months, respectively, in the exposed and unexposed groups.

Of 140, number of 45 patients had abnormal DMSA in favor of scars. Thus the prevalence of renal scar was 32.12% among infants under one-year-old with the first urinary tract infection. Among them, 8.6% (*n* = 12) belongs to unexposed group; and 23.6% (*n* = 33) belongs to exposed group. The prevalence of renal scars in children with and without reflux was 33 (47.1%), and 12 (17.1%) out of 70; respectively. The chi - square test showed a significant relationship between kidney defects and the presence or absence of reflux (*P* < .001, Figure). Odds ratio for scar prevalence in the exposed group was 4.31 (95% CI: 1.98 to 9.39) folds comparing the unexposed group. The number of girls affected



It shows frequency distribution of children affected to scar according to exposed and non-exposed groups.

The Assessment of the Relationship Between Renal Scars and VUR Grade

VUR Grade	Renal Scar				Total		P
	Yes		No		n	%	
	n	%	n	%			
Mild	18	34.6	34	65.4	52	100	< .001
Moderate and Sever	15	83.3	3	16.7	18	100	
Total	33	47.1	37	52.9	70	100	

with scar (n = 9) was higher than the boys (n = 3) in the unexposed group. Similar findings were observed in the exposed group (n = 25 (girls) vs. n = 8 (boys)). Chi-square test showed no significant relationship between gender and VUR.

In the exposed group, the number of 33 infants affected with scar. Of which, 18 babies had moderate and severe reflux (Grade 3, 4, 5), and 15 had mild reflux (Grade 1, 2). There was a positive relationship between renal scarring and VUR grade ( $P < .001$ , Table).

## DISCUSSION

The present study investigates the prevalence of renal scars among infants under one-year-old with the first UTI in two groups with and without VUR. Of 140 children, 32.12% had renal scar. The prevalence of renal scars reported by Warren *et al* was 15.5%.<sup>12</sup> This prevalence is nearly half of our study. Faust *et al* reported the rate of renal defects in patients following acute pyelonephritis varied from 26.5% (Australia) to 49.0% (Asia).<sup>13</sup> It shows renal defect in Iran has a better situation compared with other countries in the Middle East region.

According to the present findings, 47.1% of the babies with reflux and 17.1% of ones without reflux had kidney scars. Our findings are nearly consistent with this study. Based on Lee *et al.*, the first DMSA showed renal damage in 34 (70.8%) out of 48 refluxing units and in 13 (27.1%) out of 48 without reflux ( $P < .01$ , OR = 6.54).<sup>14</sup> Although similar results concluded from these two studies based on higher prevalence of scars in patients with reflux, the rate of renal scars in our study ( $P < .01$ , OR = 4.31) is lower than Lee's study.

Shaikh *et al.* reported the prevalence of renal scarring 15% in the follow up by DMSA in children with the first UTI. This rate is half of our study. Since Shaikh's study was a systematic review, which assessed 325 worldwide articles, it could be considered as a serious warning for us. Since it demonstrates the rate of renal scar in the present

society is catastrophic in comparison with the other places. They also concluded that children with reflux are more likely to affect to renal defects other than the other group (RR = 2.6 [95% CI: 1.7 to 3.9]).<sup>15</sup> This finding is in consistence with ours.

According to the present study, the rate of kidney defects was 83.3% and 34.6%, respectively in high and low grades of reflux. According to Nelson, the prevalence of renal scars in patients with low-grade reflux is 15%, and in patients with high-grade reflux is 65%.<sup>1</sup> However, according to the present and previous studies, the higher the severity of VUR, the greater the risk of renal scarring, but the rate of our study is more than the others.

Wide variations of renal scars also reported as 15 to 60% in different studies. Some reasons for controversial findings in the mentioned above researches can be confounding factors such as different sample sizes, race, geographical regions, genetic context, age, gender, the presence or absence of reflux, and any human mistake in accurate diagnosis.<sup>3</sup>

Some limitations of the present study included: hard achievement to data due to lack of electronic records, and incomplete records of patients' information. These conditions may increase the likelihood of human errors. So, we recommend similar studies in different communities for a more precise assessment with an experimental, etc. methods, esp. with larger and a multi-center sample size, and assessing more confounding factors influencing on the patients' prognosis. As we know that the prevalence of renal scar in patients with vesicoureteral reflux clearly increased, it is suggested to conduct studies to evaluate appropriate screening tests for UTI in the exposed children, too.

## CONCLUSION

According to the findings, the rate of renal defects in our society is high in comparison with the worldwide statistics. We observed all children

with UTI, even those without VUR, are at risk of renal scar. As we mentioned before, renal scars can lead to irreversible renal injuries. So, we must prevent urinary infections in children esp. infants under one-year-old. Also, we suggest to apply screening methods for early detection of UTI in infants to prevent such these complications.

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Correspondence to:

Bibi Leila Hoseini

MSc in midwifery, Department of Midwifery, School of Medicine, Sabzevar University of Medical Sciences, Sabzevar, Iran  
Tel: 0098 915 517 5082

E-mail: hoseiniL871@gmail.com

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