Introduction:
The aim of this study was to assess different grades of VUR and renal scar in children presented with single or recurrent episodes of UTI.

Material and Methods:
Thirty-six children aged one month to 16 years with single or recurrent episodes of UTI were enrolled in this prospective descriptive study performed from July 2012 to June 2013. Grading of vesico-ureteric reflux, renal cortical scar and their co-relation in children presented with UTI were the outcome variables.

Results:
Of 36 patients, 33 (91.6%) were male and 3 (8.4%) female. Patients were divided into three groups based on their age (<12 months, 12-60 months and older than 60 months). VUR was detected in 37 (51.39%) renal units among all the group of patients evaluated for UTI. Mild reflux (grades I and II) was found in 2 (2.78%), moderate in 9 (12.5%) and severe in 26 (36.11%) patients. Of 72 kidney units, 37 kidney units had different grades of cortical scar. Grades I & II renal scar found in 12 (33.33%) patients in the right kidney and 14 (38.88%) in the left kidney. Higher grades of scar (grades III & IV) were found in the right kidney and the left kidney in 5 (13.88%) and 6 (16.66%) patients, respectively. A positive co-relation was observed between grades of reflux and grades of renal scars (for the right kidney r= +0.670, p<0.01; the left kidney r= +0.700, p<0.01).

Conclusions:
Higher grades of renal scar were directly related in children with male sex, younger age and having higher grades of VUR.

Keywords:
Renal Scar; Urinary tract infection; Vesico-Ureteral reflux.
known, because it is not feasible to do voiding cystourethrogram (VCUG) in a large cohort of healthy children. Its prevalence varies from 1.3% of healthy children [6] to 8-50% of children evaluated after UTI [7]. In newborn and infants, the incidence of VUR after diagnosis of UTI is 36-49% [8]. VUR can vary in severity and is classified from grade I, as mild, to grade V, as severe (Figure 1). On the other hand, renal cortical scar may occur by either recurrent UTI with VUR or VUR without UTI, irrespective of their grading. Renal scarring is associated with its fatal consequence like chronic kidney disease (CKD) in children. Children with higher grade of VUR have an increased likelihood of developing renal scarring [9]. The International reflux study reported that renal injury is more frequent in children less than two years with high grade VUR [10]. Therefore, evaluation of reflux and associated scarring is of paramount importance, particularly in younger age, who are more prone to develop such fatal consequences.

Ultrasonography (USG) is the initial modality for the evaluation of post-natal hydronephrosis and UTI in children [4]. USG has been used to detect VUR successfully in high grades of VUR in several studies, but it failed to detect lower grades in many studies [11]. That is why VCUG is the primary diagnostic modality for identifying VUR. For diagnosing renal scar, dimercaptosuccinic acid renal scan (DMSA Renal Scan) is currently the accepted gold standard [12]. Though, this is an important issue, there are a few studies about VUR and renal scarring in our country. Therefore, this study was designed to assess different grades of VUR and renal scarring in children admitted with single or recurrent episodes of UTI.

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This study analyzed 36 children with UTI to determine the prevalence of VUR and renal scarring. The current study showed a male predominance (with a significant statistical difference, $P$ value=0.001), which was contradictory to the widely known female predominance in UTI. The significant male preponderance in this study was probably due to the presence of complicated UTI, which is more prevalent in male child and also due to gender attention of parents towards the male child prevailing in our society. Most Chinese studies about UTI cases reported a male predominance, but some Chinese authors reported equal distribution of male and female patients with UTI [13-15]. Gorelick MH reported a higher proportion of complicated UTI like anatomical abnormalities, VUR and voiding dysfunction in male child than female ones [16]. There was a higher mean age of patients at presentation in this study population, which is probably due to unawareness or under-evaluation of previous UTIs. Higher rate of scars at presentation was also found, as incidence of renal scarring increases with each episode of pyelonephritis [17]. In this study, the severity of renal cortical scarring was proportionately increased in each episode of subsequent UTI. The prevalence of VUR is not known in healthy children, however in UTI, the prevalence of VUR may vary from 29% to 50% [18]. In this study, 19 (52.77%) of 36 patients had different grades of reflux. Bhatnagar et al. from India found that 62% of children with UTI had VUR, of which a majority had grade V [19]. The similarity may be because both countries have similar geographical, cultural and social background and both studies were performed in tertiary level hospital where parents reach late. In a Chinese study, Yip a et al. found 23% VUR in children presented with UTI, but in that study only two-third of children underwent MCUG. In the present study, higher grade of VUR was found in older children. Thirty-eight percent of children in 12-60 month age group had reflux of high grade (grades III & IV). It is well known that reflux associated with UTI is more common in younger age group. In a study from USA, chand et al. found the incidence of VUR as 52% in 0-2 years, 26% in 3-6 years, 18% in 7-11 years and 4% in 12-21 years. Lack of antenatal sonologic evaluation and late referral of patients are the two important risk factors for this occurrence [20].

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In conclusion, predisposing factors of renal scarring among children presenting with UTI were male gender, younger age and high grade reflux and there is a positive correlation between renal scar and grade of reflux.

Acknowledgement
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Conflict of Interest
Authors had no conflict of interest.

Financial Support
None declared

References
Screening for Vesico-ureteral Reflux and Renal Scar in Patients With Urinary Tract Infection

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known, because it is not feasible to do voiding cystourethrogram (VCUG) in a large cohort of healthy children. Its prevalence varies from 1.3% of healthy children [6] to 8-50% of children evaluated after UTI [7]. In newborn and infants, the incidence of VUR after diagnosis of UTI is 36-49% [8]. VUR can vary in severity and is classified from grade I, as mild, to grade V, as severe (Figure 1). On the other hand, renal cortical scar may occur by either recurrent UTI with VUR or VUR without UTI, irrespective of their grading. Renal scarring is associated with its fatal consequence like chronic kidney disease (CKD) in children. Children with higher grade of VUR have an increased likelihood of developing renal scarring [9]. The International reflux study reported that renal injury is more frequent in children less than two years with high grade VUR [10]. Therefore, evaluation of reflux and associated scarring is of paramount importance, particularly in younger age, who are more prone to develop such fatal consequences. Ultrasonography (USG) is the initial modality for the evaluation of post-natal hydronephrosis and UTI in children [4]. USG has been used to detect VUR successfully in high grades of VUR in several studies, but it failed to detect lower grades in many studies [11]. That is why VCUG is the primary diagnostic modality for identifying VUR. For diagnosing renal scar, dimercaptosuccinic acid renal scan (DMSA Renal Scan) is currently the accepted gold standard [12]. Though, this is an important issue, there are a few studies about VUR and renal scarring in our country. Therefore, this study was designed to assess different grades of VUR and renal scarring in children admitted with single or recurrent episodes of UTI.

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