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Original Article

Is voiding cystourethrography necessary for evaluating unilateral ectopic pelvic kidney?

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ABSTRACT

Objective: The aim of this study is to evaluate if voiding cystourethrography (VCUG) is necessary for the evaluation of unilateral ectopic pelvic kidney (UEPK) in order to identify vesicoureteral reflux (VUR).

Material and methods: Files of the patients who had been followed-up for ectopic pelvic kidney in two pediatric nephrology clinics between August 2011 and December 2017 were retrospectively reviewed. Other anomalies, such as crossed, fused, and bilateral pelvic ectopia were excluded. Preliminary diagnoses were made via urinary ultrasonography while dimercaptosuccinic acid scintigraphy was carried out to confirm the diagnoses. Differential renal function and presence of renal scars was checked. VCUG results were obtained and those patients that showed VUR were noted.

Results: A total of 72 patients were included in the study (41 males and 31 females). The median patient age was 4.1 years (range: 2 months-14.5 years). Hydronephrosis was present in only 4 patients (5.6%), where 1 one of those was on the contralateral side. UEPKs contributed to the mean 37.9±7.8% of total renal function and 15% of these patients had renal scars (expressed as a global reduction in function, not as patchy scars). VCUG was obtained in 42 patients and VUR was present in only 1 patient (2.4%). The median follow-up period was 16.5 months (range: 3-92 months).

Conclusion: The results of our study indicated that hydronephrosis and VUR are not common in UEPKs. Therefore, routine VCUG should be avoided in the evaluation of UEPK in order to protect patients from unnecessary radiation exposure and an increased risk of urinary tract infections.

Keywords: Ectopic; pelvic kidney; renal ectopia; unilateral; vesicoureteral reflux.

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Introduction

Congenital anomalies of the kidney and urinary tract (CAKUT) constitute 20-30% of prenatally detected problems, and reports indicate an incidence of 3-7 per 1000 births.[1] Further, renal ectopia is one of the rare forms of CAKUT and is a result of the failed renal ascent of the urinary tract into renal fossa.[2] Ectopic kidneys may be seen in the pelvic, iliac, and abdominal regions, or crossed onto the contralateral kidney. Autopsy series have revealed the incidence of renal ectopia as 1:500-1200 with no gender predominance. The incidence of ectopic pelvic kidney is 1:2100-3000, according to a previous autopsy series.[3]

Renal ectopia is commonly asymptomatic, however, it may be diagnosed after a urinary tract infection (UTI), during evaluation for lower urinary tract dysfunction or renal colic. Historical studies indicate a high incidence of accompanying urinary tract abnormalities such as vesicoureteral reflux (VUR) and hydronephrosis.[4] In addition, recent studies have reported varying rates of VUR from 2% to 58% in various forms of ectopic kidneys.[5-8]

Due to the wide range of VUR incidence, the method of evaluation of these patients has remained controversial. Pediatricians and pediatric nephrologists tend to request voiding cystourethrography (VCUG) more frequently for these patients even in the absence of

hydronephrosis. Consequently, the evaluation of ectopic pelvic kidneys is not standardized and the indications for performing a VCUG depend on the clinicians' preference. Since VCUG is an uncomfortable imaging method with possible risks (UTI, dysuria, etc.) for children, it is important to perform it in cases where an actual benefit can be expected. The aim of this study is to show if VCUG is necessary for the evaluation of unilateral ectopic pelvic kidney (UEPK) to identify VUR.

Material and methods

Files of the patients who had been followed-up for ectopic pelvic kidney in two pediatric nephrology clinics between August 2011 and December 2017 were retrospectively reviewed. Other anomalies, such as crossed, fused, and bilateral pelvic ectopia were excluded. Age, gender, clinical presentation, presence of prenatal diagnosis, and familial history of ectopia that accompanies UEPK were noted. Preliminary diagnoses were made via urinary ultrasonography while dimercaptosuccinic acid scintigraphy was carried out to confirm the diagnoses. Differential renal function and presence of renal scars was checked. VCUG results were obtained and those patients that showed VUR were noted.

Normally distributed data were expressed as mean±standard deviation and those that did not show normal distribution were expressed as median (inter-quartile range (IQR)).

Results

A total of 72 patients were included in the study. There were 41 males (57%) and 31 females (43%) and their median age was 4.1 years (range: 2 months-14.5 years). Eight patients had been prenatally diagnosed (11.1%), whereas only 1 patient had a family history of renal ectopia (1.4%). In 41 patients (56.9%), the diagnosis was made incidentally, whereas 10 patients (13.9%) were admitted due to UTI, 7 patients (9.7%) for abdominal/side pain, 7 patients (9.7%) for microscopic hematuria, and 7 patients (9.7%) for lower urinary tract dysfunction, respectively (Table 1). UEPKs were on the right side in 44 patients (61.1%). Hydronephrosis was present in only 4 patients (5.6%), out of which 1 patient exhibited it on the contralateral side. In terms of differential renal function (DRF), 40 patients out of 72 (55.6%) had DRF under 40%. UEPKs contributed to a mean 37.9±7.8% of total renal function and 15% of these patients had renal scars (expressed as a global reduction in function due to renal dysplasia, as opposed to patchy scars due to febrile UTIs). VCUG was obtained in 42 patients and VUR (left-sided, grade 2) was present in only 1 patient (2.4%). The median follow-up period was 16.5 months (range: 3-92 months) During follow-up, 8 patients had a UTI (14.8%), and urolithiasis was observed in 2 patients (3.7%).

Table 1. Demographic features of all patients

	Number of patients
Gender (M/F)	41/31 (57%/43%)
Median age (years)	4.1 (2 months-14.5 years)
Clinical presentation	
Incidental	41 (56.9%)
Lower urinary tract dysfunction	7 (9.7%)
Urinary Tract Infection	10 (13.9)
Abdominal/Side pain	7 (9.7%)
Microscopic hematuria	7 (9.7%)
VCUG obtained	42
Total	72

VCUG: voiding cystourethrography

Discussion

Pelvic ectopia is the most common form of renal ectopia that is caused by a problematic interaction between the ureteric bud and metanephric blastema and an arrested migration. As a result, the kidney might be morphologically abnormal and malrotated.[3] Previous studies have shown an increased incidence of genitourinary abnormalities in ectopic kidneys.[2,5,8] VUR has been reported as the most commonly associated urinary tract abnormality. In a study evaluating simple renal ectopia, VUR was present in 26% of 82 children with unilateral simple renal ectopia.[7] Similarly, van den Bosch et al.[2] investigated a cohort of 41 patients where they found a 38% VUR rate in 26 unilateral pelvic kidneys. Similarly, in another study of 77 patients, dilating VUR was observed in 26% of the patients.[6] On the contrary, researchers from Italy reported only 2% VUR in 50 children with renal ectopia.[5] A study that investigated VUR in newborns with UEPK presented 16.6% VUR rate.[8] Our study indicated that VUR is present in only 2.4% (1 out of 42) of children who underwent VCUG. As there was no hydronephrosis or UTIs in the remaining 30 patients, we believe that we would not have discovered an important number of dilating VUR in those patients.

Previous studies have also demonstrated that a fair amount of patients have been complicated with contralateral VUR. Guarino et al.[7] revealed that 86% of patients with single renal ectopia had VUR on the contralateral side. Similarly, another group of researchers indicated that 11 of 15 patients out of 58 contralateral kidneys with hydronephrosis required surgery, mostly for VUR.[6] However, only 1 patient in our cohort had hydronephrosis.

Since CAKUT can be observed in patients with various syndromes and many genes have been determined to play a role

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in the etiology, difference in VUR rates between studies in the literature may be a result of changes in the genetic expression/imprinting and ethnic factors.[9,10] Also, there might be a difference in patient populations, as the centers with higher rates of VUR detection are academic centers that deal with more complicated patients. Additionally, the median patiant age in our study is 4.1 years, which might have an impact on decreased VUR rates due to possible spontaneous resolution. Even there is no data in the literature for spontaneous resolution rates of VUR in UEPKs, a lower incidence from normal may be speculated from duplex kidneys, which also represent an abnormal induction of the ureteric bud. Furthermore, older studies might have highlighted the darker side of renal ectopia patients that present with clinical problems rather than incidentally found in the advanced imaging era.

Decreased DRF has been found in patients with UEPK. A recent study reported a mean 39% DRF of the ectopic kidneys. [2] Another study showed reduced DRF in 40% of the UEPK with a mean DRF of 37.5%.[8] Our findings are similar to these previous studies (mean DRF of UEPK 37.9% and DRF <40% in 55.6% of the patients), which supports the notion that renal ectopy occurs due to abnormal induction of metanephric tissue and/or ureteric bud-metanephric mesenchyme interactions. Thus, reduced DRF seems to be a result of faulty embryogenesis rather than renal scarring after a febrile UTI.

The limitations of our study include a possible patient selection bias of a non-tertiary center that might have included less complicated cases. Also, indications for VCUGs were not standardized.

In conclusion, the results of our study indicated that hydronephrosis and VUR are not common in UEPKs. Therefore, routine VCUG should be avoided in the evaluation of UEPK in order to protect patients from unnecessary radiation exposure and an increased risk of UTIs. VCUGs should be ordered on a case-based approach.

Ethics Committee Approval: Authors declared that the research was conducted according to the principles of the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects", (amended in October 2013).

Informed Consent: Due to the retrospective design of the study, informed consent was not taken.

Peer-review: Externally peer-reviewed.

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