Ann Med Res

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Annals of Medical Research

journal page: annalsmedres.org

Renal outcomes of children with ectopic kidneys: A single-center experience

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MAIN POINTS

- Renal ectopia was frequently associated with left-sided involvement in this pediatric cohort.
- Crossed renal ectopia (CRE) was observed in 15.5% of the patients, with 77.7% showing crossed-fused anatomy.
- Additional urogenital anomalies, including hydronephrosis, neurogenic bladder, vesicoureteral reflux, and duplicated collecting systems, were common.
- Renal scarring was detected in 8 patients, all with vesicoureteral reflux, emphasizing the need for early detection and follow-up.
- Consanguinity and positive family history of CAKUT were frequent, highlighting potential genetic predisposition in renal ectopia.

Cite this article as: Aydin Z, Cam Delebe EO. Renal outcomes of children with ectopic kidneys: A single-center experience. *Ann Med Res*. 2026;33(2):56–59. doi: 10.5455/annalsmedres.2025.08.226.

ABSTRACT

Aim: This study aimed to evaluate the clinical characteristics, associated anomalies, and outcomes of children diagnosed with renal ectopia in a single tertiary care center.

Materials and Methods: We retrospectively reviewed the medical records of 58 children with renal ectopia who were followed up between January 2024 and June 2025. Data on demographics, anomalies, laboratory findings, imaging findings, and treatments were analyzed.

Results: Among 58 patients (mean age 71.6 ± 56.4 months; 33 females, 25 males), 26 (44.8%) had right renal ectopia and 32 (55.2%) had left renal ectopia. Crossed renal ectopia was present in 9 (15.5%) patients, of whom 7 (77.8%) had crossed-fused renal ectopia. Additional urogenital anomalies included hydronephrosis in 7 (12.1%), neurogenic bladder in 4 (6.9%), and vesicoureteral reflux in 3 (5.2%). Prenatal diagnosis was achieved in 4 (6.9%) patients. Consanguinity was noted in 28 patients (48.3%), and 11 patients (19.0%) had a family history of CAKUT. Voiding cystourethrography was performed in 12 patients (20.7%) and high-grade vesicoureteral reflux was identified in 3 patients. Renal scarring was detected in 8 (15.1%) of the 53 patients who underwent DMSA scintigraphy; of these, 1 patient had hypertension, 1 had proteinuria, 1 was followed with stage 2 chronic kidney disease, and 1 with stage 5 chronic kidney disease.

Conclusion: Renal ectopia may be accompanied by additional urogenital anomalies. Early diagnosis and comprehensive evaluation are essential for optimal management and prognosis.

Keywords: Renal ectopia, Crossed renal ectopia, Congenital anomalies

Received: Aug 18, 2025 **Accepted:** Oct 23, 2025 **Available Online:** Feb 25, 2026

INTRODUCTION

Renal ectopia refers to the abnormal positioning of one or both kidneys due to disrupted renal ascent during fetal development. It occurs in approximately 1 in 900 live births and is more frequently observed in males [1]. Ectopic kidneys may be located in various anatomical regions, including the pelvic, iliac, abdominal, or, more rarely, thoracic areas [2].

Renal ectopia is classified as either simple ectopia—where the kidney is located on the correct side but in an abnormal position—or crossed ectopia, in which the kidney crosses to the opposite side. The ectopic kidney is fused with the contralateral kidney in most cases of crossed renal ectopia (approximately 90%), a condition known as crossed-fused renal ectopia [3]. Crossed-fused renal ectopia is identified in approximately 1 in 7500 autopsies, whereas nonfused crossed renal ectopia is considerably rarer, occurring in approximately 1 in 75,000 cases [4].

Although many children with renal ectopia are asymptomatic, the condition may lead to various urological complications. These include ureteral obstruction, recurrent urinary tract infections, and urolithiasis. Hydronephrosis (56%), vesicoureteral reflux (30%), and ureteropelvic junction obstruction (29%) are among the most common complications. Affected kidneys may develop cystic dysplasia, calculi, or malignancies less frequently [2,3].

Renal ectopia is also frequently associated with other congenital anomalies, particularly crossed ectopia. These include genital tract anomalies (50%), skeletal malformations (40%), and anorectal anomalies, such as imperforate anus (20%). Renal ectopia has been associated with several congenital syndromes, including thrombocytopenia with absent radius syn-

https://doi.org/10.5455/annalsmedres.2025.08.226

drome, caudal regression syndrome, and VACTERL [1,5].

While the relationship between renal ectopia and long-term renal dysfunction—such as hypertension, proteinuria, or chronic kidney disease—remains unclear, thorough evaluation and ongoing monitoring for associated anomalies are essential. This study aimed to evaluate the clinical presentation and associated abnormalities in children diagnosed with renal ectopia at a single tertiary care center.

MATERIALS AND METHODS

We retrospectively reviewed the medical records of 58 children with ectopic kidney disease who were followed in our department between January 2024 and June 2025. Patients' data, including age, gender, accompanying anomalies, laboratory findings, imaging results,and treatments, were retrospectively evaluated. The study was approved by the Scientific Research Evaluation and Ethics Committee of Gaziantep City Hospital (Number: 207/2025). All procedures were performed in accordance with the ethical standards and principles of the Declaration of Helsinki.

All ectopic kidneys were initially evaluated using ultrasonography (US). In a few patients whose kidneys were not visualized in the renal fossa on US, the ectopic kidney was subsequently confirmed by DMSA scintigraphy. Pelvic dilatation was graded according to the Society for Fetal Urology classification as follows: Grade 0, no dilation; Grade 1, mild dilation of the renal pelvis without calyceal involvement; Grade 2, mild dilation of the renal pelvis and a few calyces with normal renal parenchyma; Grade 3, moderate dilation of the renal pelvis and calyces with preserved renal parenchyma; Grade 4, severe dilation of the renal pelvis and calyces accompanied by thinning of the renal parenchyma [6].

Indications for voiding cystourethrogram (VCUG) included recurrent urinary tract infections ($\geq$2 episodes) or ultrasonographic findings suggestive of vesicoureteral reflux (VUR), such as hydronephrosis or ureteral dilatation. The International Reflux Study in Children system was used to grade VUR [7]. Indications for DMSA renal scintigraphy included the presence of VUR or recurrent urinary tract infections.

Urinary tract infection was defined as the growth of a single uropathogenic microorganism of $>10^5$ colony-forming units (CFU)/mL in a midstream urine sample or $>10^4$ CFU/mL in a catheterized urine sample [8]. If a random dipstick urinalysis was positive for protein ($\geq$1+), the protein/creatinine ratio in early morning urine was measured, and values >0.2 mg/mg were considered indicative of proteinuria [9].

Hypertension was defined as an average systolic or diastolic blood pressure $\geq 95^{th}$ percentile for sex, age, and height on at least three separate occasions or the use of antihypertensive drugs [10]. The estimated glomerular filtration rate (eGFR) was calculated using the Schwartz formula [11].

Statistical analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences version 22. Continuous variables were expressed as mean ± standard deviation or median (range) as appropriate. Categorical variables are expressed as numbers and percentages.

RESULTS

A total of 58 patients, including 33 females (56.8%) and 25 males (43.1%), with a mean age of 71.6 ± 56.4 months and a mean follow-up duration of 21.6 ± 38.9 months, were included in the study. Prenatal diagnosis was made in 4 patients (6.8%) and postnatally in 54 patients. Consanguinity was present in 28 patients (48.2%), and a family history of congenital anomalies of kidney and urinary tract (CAKUT) was reported in 11 patients (18.9%).

Table 1. Socio-demographic data and urogenital system findings in children with ectopic kidney.

(n=58)	Mean±SD n (%)
Gender	
Female	33 (56.8)
Male	25 (43.1)
Timing of the diagnosis diagrenatal	4 (6.8%)
Postnatal	54 (93.1%)
Age (months)	71.6 ± 56.4
Follow-up duration (months)	11.6 ± 8.9
Consanguinity (n)	28 (48.2)
CAKUT family historyFamily history of CAKUT (n)	11 (18.9)

n: number of patients, SD: standard deviation, CAKUT: congenital anomalies of the kidney and urinary tract.

Table 2. Urogenital anomalies identified in patients with ectopic kidney disease.

Urogenital Anomaly	n (%)
Hydronephrosis	7 (12)
Vesicoureteral reflux	4 (6.8)
Neurogenic bladder	4 (6.8)
Duplicate collection system	3 (5.1)
Nephrolithiasis	2 (3.4)
Left undescended testicle	2 (3.4)
Hypospadias	1 (1.7)
Contralateral multicystic dysplastic kidney	1 (1.7)
Contralateral renal agenesis	1 (1.7)
Vesicostomy	1 (1.7)

Table 3. Laboratory data of the patients at presentation.

	Mean ± SD
Urea (mg/dl)	13±4.1
Creatinine (mg/dL)	0.56 ±0.6
Na (mmol/L)	135.6±4.2
K (mmol/L)	3.87 ±0.1
Al (mmol/L)	101.3±1.9
eGFR (mL/min/1.73 m^2)	112.2±13.4

https://doi.org/10.5455/annalsmedres.2025.08.226

Of the 58 patients, 26 (44.8%) and 32 (55.1%) had right and left renal ectopia, respectively. Crossed renal ectopia (CRE) was observed in 9 (15.5%) patients. Among these, 3 cases were right-sided CRE and 6 were left-sided CRE. Additionally, 7 patients with CRE had crossed-fused renal ectopia, of whom 3 had right-sided and 4 had left-sided crossed-fused renal ectopia. Table 1 presents the sociodemographic data and urogenital system findings.

Additional urogenital anomalies were identified as follows: hydronephrosis (n = 7), neurogenic bladder (n = 4), vesicoureteral reflux (VUR) (n = 3), duplicated collecting system (n = 3), nephrolithiasis (n = 2), left undescended testicle (n = 2), hypospadias (n = 1), contralateral multicystic dysplastic kidney (MCDK) (n = 1), contralateral renal agenesis (n = 1), and vesicostomy (n = 1). Additional urogenital anomalies are given in Table 2.

Eleven patients (18.9%) had additional abnormalities, including meningomyelocele (n = 3), anal atresia (n = 3), ventricular septal defect (VSD) (n = 2), cerebral palsy (n = 1), liver transplantation (n = 1), and Henoch-Schönlein purpura nephritis (HSP nephritis) (n=1).

Ten patients (17.2%) had a history of UTI. Voiding cystourethrography (VCUG) was performed in 12 (20%) patients. Of these, 1 patient had grade 5 vesicoureteral reflux (VUR) on the same side as the ectopic kidney, and 2 patients had bilateral grade 3 VUR.

Among the 58 patients, 53 (91.3%) underwent DMSA scintigraphy. Renal scarring was detected in 8 of these patients. Among the patients with scarring, 1 had hypertension, 1 had proteinuria, 1 was being followed-up with stage II chronic kidney disease (CKD), and 1 had stage 5 CKD. Table 3 summarizes the patients' laboratory parameters at presentation.

DISCUSSION

Renal ectopia was more frequently observed in females than males in our cohort, with a mean age at diagnosis of 71.6 ± 56.4 months. Prenatal detection was achieved in a minority of patients, which is lower than the 15%–20% rates reported in recent studies where widespread antenatal ultrasonography has improved early diagnosis [12,13]. This disparity may be attributed to regional demographics, as access to regular antenatal care and ultrasonographic screening can be limited by socioeconomic barriers and health care disruptions. Consanguinity was present in nearly half of our patients, similar to other Turkish cohorts investigating congenital anomalies of the kidney and urinary tract (CAKUT) [14]. In addition, a positive family history of CAKUT was reported in a subset of patients, supporting the role of genetic predisposition in the pathogenesis of renal ectopia [15,2].

Embryologically, fusion anomalies likely result from abnormal kidney migration and rotation during early gestation, and the predominance of fusion in CRE may be due to shared vascular and positional disturbances during renal ascent [3,4]. Left renal ectopia was more common than right renal ectopia, consistent with previous reports [1]. The proportion of crossed-fused renal ectopia among patients with CRE aligns with the findings of prior pediatric studies [3,16].

Additional urogenital anomalies were present in a considerable proportion of patients, with hydronephrosis being the most common finding, followed by neurogenic bladder, VUR, and duplicated collecting system. The coexistence of contralateral anomalies, such as MCDK or renal agenesis, may have implications for long-term renal function, particularly in patients with a solitary functioning kidney. Anomalies involving the lower urinary tract underline the importance of thorough urogenital evaluation, as timely detection and management may prevent further renal damage.

Systemic congenital anomalies were observed in a subset of patients, supporting the association between renal ectopia and multisystem congenital disorders, in line with previous reports [17].

VUR was identified in a subset of patients with renal scarring, highlighting its role in renal injury. Our findings suggest that the presence of hydronephrosis or a history of recurrent urinary tract infections may serve as predictive indicators for VUR. Therefore, VCUG may be considered selectively in patients with these risk factors rather than universally in all patients with ectopic kidneys.

Renal scarring emphasizes the increased risk of renal damage due to anatomical abnormalities. Careful follow-up and early detection of urological abnormalities are crucial in determining the long-term prognosis and guiding management.

The strengths of our study include a relatively large single-center pediatric cohort and comprehensive evaluation of associated anomalies.

Limitations

The limitations include its retrospective design and limited follow-up duration for some patients. Although all patients with renal scarring had VUR, the small number of events precluded formal statistical analysis to assess the association's strength or significance.

CONCLUSION

A careful and detailed physical examination is essential due to the frequent presence of additional congenital and urogenital anomalies. Early detection of urological abnormalities, such as vesicoureteral reflux (VUR), plays a crucial role in determining long-term prognosis and guiding management.

Ethics Committee Approval: The study was approved by the Scientific Research Evaluation and Ethics Committee of Gaziantep City Hospital (Number: 207/2025).

Informed Consent: Individual informed consent is not applicable for this study because no identifiable personal patient information was used.

https://doi.org/10.5455/annalsmedres.2025.08.226

Peer-review: Externally peer-reviewed.

Conflict of Interest: The authors have no conflicts of interest to declare.

Author Contributions: Conception: Z.A, E.O.C.D; Design: Z.A, E.O.C.D; Supervision: E.O.C.D; Materials: Z.A, E.O.C.D; Data Collection and/or Processing: Z.A; Analysis and/or Interpretation: Z.A, E.O.C.D; Literature Review: Z.A, E.O.C.D; Writing: Z.A; Critical Review: E.O.C.D.

Financial Disclosure: This study received no external funding.

Artificial Intelligence Disclosure: The authors declare that an artificial intelligence–based tool (ChatGPT, OpenAI, version GPT-4) was used solely for language editing and improving the clarity and readability of the manuscript. The AI tool did not contribute to the study design, data collection, data analysis, interpretation of results, or the formulation of scientific conclusions, and no original scientific content, clinical interpretation, or analytical reasoning was generated by the AI system. All content was critically reviewed, revised, and approved by the authors, who take full responsibility for the manuscript. We confirm that the use of artificial intelligence complies with the ethical standards and authorship policies of Annals of Medical Research.

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https://doi.org/10.5455/annalsmedres.2025.08.226