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Prevalence of Congenital Anomalies of the Urinary Tract at Ibn Sina-Sina Hospital Khartoum Sudan

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ABSTRACT: Anomalies of urinary tract can cause when present considerable pain for patients. Radiologic imaging is critical in determining the cause of urinary tract diseases. Objectives: This study aimed to assess the congenital anomalies of the urinary system in patients seeking treatment at Ibn Sina Hospital from March 2021 to December 2022. Material & Methods: This was a retrospective study. It was conducted in Ibn Sina Hospital at Khartoum City, Khartoum State, Sudan, during the period from March 2021 to December 2022. It involved 507 patients; the data was collected using a comprehensive, suitable data collection sheet, and then it was analyzed using SPSS 25. Result: The study involved 507 patients and revealed that 457 (90.1%) of them did not have congenital anomalies, while 50 (9.9%) have congenital anomalies. Among these patients, 44% were between 40 and 54 years old, and 38% were aged 25–39, with an average age of 41.8±12 years. In terms of gender, 56% were male. Among the patients with kidney conditions, 34% had ectopic kidney, 15% had horseshoe kidney, and 12% had polycystic kidney. The least common conditions were ureteropelvic junction obstruction (2%) and vesicourethral diverticulum (2%). Conclusion: The ectopic kidney was the most common pattern of congenital anomalies of the urinary system. Followed by horseshoe kidney, polycystic kidney, and the least one ureteropelvic junction obstruction and vesicourethral diverticulum, respectively.

Keywords: Congenital anomalies, ectopic kidney, renal agenesis and urinary tract

1. INTRODUCTION

Congenital kidney and urinary tract abnormalities (CAKUT) represent common birth defects, constituting 40-50% .of pediatric abnormalities and around 7% of adult end-stage renal disease worldwide [1]

Children often present with congenital abnormalities, which make up approximately 30% of all recognized .prenatal anomalies [2] Inadequate development of the kidneys and urinary tract during embryonic growth leads to congenital abnormalities in CAKUT, both structurally and functionally. Approximately 3-11% of individuals are impacted by these abnormalities [3]. These conditions can present a range of characteristics and are frequently associated with issues in other organ systems [4]. The onset of CAKUT may be influenced by a combination of genetic and environmental factors, such as alterations in kidney-related genes, infections, maternal diabetes, and the use of .certain medications [5] Persistent fetal lobulation occurs in about 4% of the population [6]. This disorder, characterized by the entire fusion of both kidneys in the pelvic cavity and frequently coupled with other genitourinary and vertebral abnormalities, affects one in every 65,000-375,000 people [7, 8]. Although supernumerary kidneys are uncommon, they may lead to urinary tract problems and abdominal pain. It might be related to a wide range of congenital anomalies, demanding imaging for diagnosis as well as therapy [9].

2. OBJECTIVES

The aim of this study is to evaluate the congenital anomalies of the urinary system in patients seeking treatment at Ibn Sina Hospital between March 2021 and December 2022.

3. MATERIALS AND METHOD

3.1 STUDY DESIGN

This was an observational retrospective study.

3.2 STUDY AREA

The study was conducted at Ibn Sina Specialist Hospital, located in Khartoum City, Khartoum State, Sudan.

3.3 STUDY DURATION

The research was carried out from March 2021 to December 2022.

3.4 STUDY POPULATION

The study population consisted of Sudanese patients of various ages and genders who attended Ibn Sina Specialist Hospital for CT scans between March 2021 and December 2022.

3.5 SELECTION CRITERIA

3.5.1. INCLUSION CRITERIA

All patients who were requested to undergo a CT KUB (kidneys, ureters, and bladder) scan.

3.5.2. EXCLUSION CRITERIA

Patients with insufficient file documentation, as well as patients who had undergone other types of CT scans instead of CT KUB.

3.6 DATA COLLECTION AND MANAGEMENT

3.6.1. DATA COLLECTION TOOLS

Data were collected using a data collection sheet filled out from patients' files and CT reports.

3.6.2. DATA COLLECTION TECHNIQUE

Samples were collected from patients presenting with acute renal colic or hematuria, suggesting urinary tract abnormalities, who underwent CT abdomen or CT urography (CTU) to evaluate the urinary system. CT scans were taken from the kidneys to the bladder.

3.6.3. STATISTICAL ANALYSIS

The data were analyzed with the Statistical Package for Social Sciences (SPSS) software version 26.0 (SPSS Inc., Chicago, IL, USA). The findings were provided as tables and figures. All study variables were subjected to descriptive statistics, with categorical data being represented by frequencies and percentages and numerical data by means and standard deviations. Inferential statistics, such as the Chi-square test and t-test, were employed to evaluate factors linked with patients' final results. The results were presented in the form of tables and figures. Data were used anonymously, with code numbers rather than names to preserve participants' identity. All information was maintained .securely and used only for research purposes.

3.7 ETHICAL CONSIDERATION:

Ethical clearance and approval for conducting this research were obtained from Omdurman Islamic University. Written permission was granted by the administrative authority of Ibn Sina Specialist Hospital.

4. RESULTS

A total of 507 patients participated in this study. Among them, 457 patients (90.1%) did not have congenital anomalies, while 50 patients (9.9%) were diagnosed with congenital anomalies (table 1). The age distribution of patients with congenital anomalies is summarized as follows: 25-39 years: 19 patients (38%), 40-54 years: 22 patients (44%) and other: 9 patients (18%). The mean age of patients with congenital anomalies was 41.8 ± 12 years (table 2). Gender Distribution among 50 patients with congenital anomalies: Male were 28 patients (56%) and Female 22 patients (44%) (table 3). Furthermore, 34% of the patients were housewives, and 26% were teachers. The majority of the patients (74%) were from areas outside of Khartoum. Among the patients with kidney conditions, 34% had ectopic kidney, 15% had horseshoe kidney, and 12% had polycystic kidney. The least common conditions were ureteropelvic junction obstruction (2%) and vesicourethral diverticulum (2%).

And see (table 4,5,6,7).

Table 1. - Distribution of patients in study according to their Congenital Anomalies

Total Number of patients	Numbers of patients without congenital anomaly	Numbers of patients with congenital anomaly
507	457	50
	90.1%	9.9%

Table 2. - Distribution of patients in study according to their age (n=50)

Age	Frequency	Percentage From 50	Percentage From 507	Mean ±STD
10-24	3	6.0%	0.6%	41.8±12
25-39	19	38.0%	3.8%	
40-54	22	44.0%	4.4%	
55-70	6	12.0%	1.2%	
Total	50	100.0%	10.0%	

Table 3. - Gender Distribution of Patients with Congenital Anomalies

Total Number of Patients with Congenital Anomalies	Male Patients	Female Patients
50	28	22
	56%	44%

Table 4. - Distribution of patients in study according to their Occupation

Occupation	Frequency	Percentage from 50	Percentage from 507
House wife	17	34.0%	3.4%
Teacher	13	26.0%	2.6%
Farmer	10	20.0%	2.0%
Student	3	6.0%	0.6%
Work free	4	8.0%	0.8%
Lawyer	1	2.0%	0.2%
Medical laboratory science	1	2.0%	0.2%
Nurse	1	2.0%	0.2%
Total	50	100.0%	10%

Table 5. - Distribution of patients in study according to sociodemographic data

Total Number of Patients with Congenital Anomalies	Khartoum	Out of Khartoum
	37	13
	74%	26%

Table 6. - Distribution of patients in study according to their pattern of congenital anomalies of urinary tract (n=50)

Pattern of congenital anomalies	Frequency	Percentage N 50	Percentage N 507
Ectopic kidney	17	34.0%	3.4%
Horseshoe kidney	8	16.0%	1.6%
Polycystic kidney	6	12.0%	1.2%

Renal hypoplasia	5	10.0%	1.0%
Mal rotation kidney	5	10.0%	1.0%
Duplication of the ureter	3	6.0%	0.6%
Renal agenesis	2	4.0%	0.4%
Duplex kidney	1	2.0%	0.2%
Ureteropelvic junction obstruction	1	2.0%	0.2%
Extra renal pelvis	1	2.0%	0.2%
Vesicourethral diverticulum	1	2.0%	0.2%
Total	50	100.0%	10.0%

Table 7. - Correlation between gender and pattern of congenital anomalies of urinary tract (n=50)

Congenital anomalies	**Gender**		**Total**
	male	female	
Ectopic kidney	7(14%)	10(20%)	17
Horseshoe kidney	5(10%)	3(6%)	8
Polycystic kidney	5(10%)	1(2%)	6
Renal hypoplasia	3(6%)	2(4%)	5
Malrotation kidney	4(8%)	1(2%)	5
Duplication of the ureter	1(2%)	2(4%)	3
Real agenesis	1(2%)	1(2%)	2
Duplex kidney	0(0%)	1(2%)	1
Ureteropelvic junction obstruction	0(0%)	1(2%)	1
Extra renal pelvis	1(2%)	0(0%)	1
Vesicourethral diverticulum	1(2%)	0(0%)	1
Total	28	22	50

5. DISCUSSION

Genetic mutations can influence the growth and development of the kidneys and urinary tract, consequently affecting clinical manifestations and phenotypic expression [10]. Abnormalities in the kidneys that lead to a reduction in nephron mass may cause hypertension, a lower glomerular filtration rate, proteinuria, and the progression of chronic .kidney disease towards renal failure [11] Ultrasonography was utilized to assess 412 asymptomatic first-degree .relatives of 145 index patients

Congenital Anomalies of the Kidney and Urinary Tract (CAKUT) were found in 23 individuals, which included the families of 21 index patients. Among the asymptomatic first-degree relatives, the identified anomalies included renal agenesis (RA) with grade 3 hydronephrosis (1 case), RA (7 cases), renal hypodysplasia (7 cases), grade 2 .hydronephrosis (1 case), and grade 1 hydronephrosis (7 cases).The overall familial incidence of CAKUT is 4%. [12] A thorough evaluation involving 2,684 cases was performed, indicating that 63% of the subjects were male. The Urban Renewal program showed an overall incidence rate of one in 2,000. Congenital Anomalies of the Kidney and Urinary Tract (CAKUTs) were found in 32% of the patients, with vesicoureteral reflux being particularly common at 24%. Furthermore, extrarenal anomalies were noted in 31% of the cases. Hypertension was detected in 16% of the .participants, while 21% displayed microalbuminuria [13]The current study involved 507 individuals, with a mean age of 41.8 ± 12 years. A significant portion of the participants, specifically 44%, fell within the age range of 40 to 54 years, while 38% were aged between 25 and 39 years. Regarding gender distribution and congenital abnormalities, the findings indicated that 56% of those with congenital issues were male, aligning with the observations made by Li et al. [14], who noted a higher prevalence of congenital abnormalities of the kidney and urinary tract (CAKUT) in males. Nevertheless, the outcomes of the current study contrast with those reported by Hays et al. [14]. They observed that congenital abnormalities of the kidney and urinary tract (CAKUT) were more prevalent in men. However, the results of the present study differ from those of Hays et al. [15], who discovered that 46.6% were girls; this could be related to differences in sample size. A study conducted with 150 children diagnosed with CAKUT revealed that 68% of the .participants were male, while 32% were female [16] This finding is consistent with the results of the current study Unlike prior studies, 74% of the patients in the current study were urban. Soliman et al. investigated children with CAKUT at Cairo University Children's Hospital. They discovered familial clustering in 14% of the patients and syndromic CAKUT in 31.8%, with posterior urethral valves constituting the most prevalent malformation [17]. There were 303 children (126 females, 177 males) diagnosed with CAKUT; the most common CAKUT anomalies were hydronephrosis (139) and solitary HN (58), followed by renal parenchymal malformations (109), collecting system anomalies (56), migration and fusion anomalies (53), and bladder and urethral abnormalities (27). In 56 cases of isolated hydronephrosis [18]. This study reveals the following highest incidence anomalies: ectopic kidney 17 (34%), horseshoe kidney 8 (16%), polycystic kidney 6 (12%), and renal hypoplasia (5) (10%) .These findings are comparable to those published by Gupta et al. [19], who determined that 47.2% of abnormalities involved the kidneys, with the remainder involving the renal pelvis (28.4%), ureters (22.4%), and bladder (2.1%).Over fifty percent of urinary tract abnormalities CAKUT identified prenatally were either multicystic dysplasia of the kidney or isolated hydronephrosis [20]. In approximately four out of five instances, ureter duplication and ureterocele anomalies was present with other CAKUT[21].This research found that 34% of patients presented with ectopic kidneys, while 15% exhibited horseshoe kidneys. Furthermore, 12% of the cases involved upper urinary tract abnormalities related to polycystic kidney disease, .and 10% were identified as renal hypoplasia

The obstruction at the ureteropelvic junction represents the most frequently encountered anomaly of Congenital Anomalies of the Kidney and Urinary Tract (CAKUT) within the pediatric urology department. [22] In contrast to the findings of this study, UPJO constituted only 2.0% of the overall subjects. The three primary types of CAKUT include posterior urethral valves, renal hypoplasia or dysplasia, and reflux nephropathy[23]. The findings of the present study suggest that ectopic kidney, horseshoe kidney, polycystic kidney, and renal hypoplasia are the most common forms of .CAKUT

Li et al reported that 22.69% of CAKUT cases presented with associated anomalies, with congenital cardiac conditions being among the most prevalent (8.89%) [14]. Congenital urinary tract abnormalities have been observed in of children with CAKUT who are below their expected gestational size [24]. Congenital defects in the kidneys %7.0 and urinary tracts may lead to compromised renal function at birth [25]. The present research revealed that the occurrence of Congenital Anomalies of the Kidney and Urinary Tract (CAKUT) was 9.9%. CAKUT presents a significant clinical challenge due to its potential impact on kidney health and overall development. Children identified with CAKUT are at risk of requiring renal dialysis, may encounter heightened rates of chronic kidney disease (CKD) progression, face complications related to transplantation, and ultimately, may experience renal failure. Eary diagnosis, ongoing monitoring, and integrated care are essential for maintaining kidney function and enhancing long-term survival.

6. CONCLUSION

In conclusion, 89.1% of patients exhibited no congenital anomalies, whereas 9.9% did. The research revealed that the predominant type of congenital urinary anomalies was the ectopic kidney, along with the horseshoe kidney, polycystic kidney, and at least one instance of ureteropelvic junction obstruction and vesicourethral diverticulum. Timely identification and appropriate intervention are essential for minimizing long-term complications and improving patient outcome.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest

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