Original paper

Congenital Anomalies of the Kidney and Urinary Tract a single center study

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Abstract

Background: Congenital anomalies of the kidney and urinary tract (CAKUT) are a major cause of morbidity and collectively represent a significant cause of chronic kidney disease (CKD) in children and young adults.

Aims of study: To describe the types, presentations, and methods of diagnosis of the CAKUT cases, attended the central teaching hospital of pediatrics in Baghdad-Iraq.

Patients & methods: A retrospective Cross-sectional study, conducted during the period from June 2017 to December 2017 in the nephrology department of the central teaching hospital of pediatrics in Baghdad/Iraq, where medical records of all patients who were diagnosed with CAKUT during the period from January 2007 to December 2016, were reviewed and analyzed in relation to patient demographics, clinical presentation, investigations, types of anomalies which were further subdivided to obstructive and non-obstructive and the difference between them.

Results: Total of (308) patients records were collected and analyzed. The patients aged less than one year (43.8%) at the time of diagnosis. There were (64%) male and (36%) female. The patients had vesicoureteric reflux (VUR) (44.5%), followed by pelviureteric junction obstruction (PUJO). (8.4%) of patients had combined anomalies. Skeletal anomalies represented (4.2%). the patients presented with urinary tract infection (UTI) (50.6%). There were 149 patients (48.4%) had elevated Blood urea at the time of diagnosis, while 63 patients (20.5%) had elevated Serum creatinine. the obstructive anomalies were diagnosed in the age group below one year (63%). The obstructive anomalies was seen among male patients (80.2%). The obstructive anomalies was seen among patients presented with UTI (65.4%). (11.1%) of patients with non-obstructive anomalies presented with failure to thrive (FTT).

Conclusion: Most of the patients diagnosed with CAKUT were males, aged less than one year. VUR was the most common anomaly, followed by PUJO. UTI was the most common presentation and skeletal anomalies were the most common extra-renal anomaly.

Keywords: congenital anomalies of the kidney and urinary tract, chronic kidney disease, end stage renal disease, vesicoureteral reflux, pelviureteric junction obstruction.

Introduction

Congenital anomalies of kidney and urinary tract (CAKUT) are the major cause of morbidity and collectively represent a significant cause of CKD in children and young adults[(1)]. The prevalence of CAKUT has been reported to range between 3 and 6 per 1,000 births by prenatal ultrasound and tends to increase owing to improved antenatal screening and postnatal evaluation of infants[(2)]. Despite recent advances in prenatal diagnosis and early surgical intervention, CAKUT account for 40–50% of the etiology of CKD in children worldwide, and still remain the leading cause of ESRD in childhood[(3)]. It is important to diagnose these anomalies early enough and initiate therapy to minimize renal damage, prevent or delay the onset of

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ESRD, and provide supportive care to avoid complications of ESRD[4]. CAKUT cover a wide range of structural and functional malformations that result from a defect in the morphogenesis that occur at the level of the kidney, collecting system, ureter, bladder, or urethra[5]. The conditions may appear as an isolated feature or as part of a syndrome in association with extrarenal manifestations; most cases of CAKUT are nonsyndromic. The cause of most cases of nonsyndromic CAKUT remains unknown. The types of CAKUT were assumed to be multifactorial and occur as a result of a combination of epigenetic and environmental factors affecting genetically susceptible individuals[6]. CAKUT may either be diagnosed sporadically or was described with familial aggregation in up to 15% of cases. In familial cases, the mode of inheritance in most pedigrees is autosomal dominant with variable expressivity and reduced penetrance[5]&[6]. To date, 23 monogenic CAKUT causing genes have been identified in patients with isolated, familial, or syndromic CAKUT, each gene representing a monogenic recessive or dominant cause of CAKUT. The malformation phenotypes vary from normally appearing kidneys with intact kidney function (i.e. incomplete penetrance) to severe hypodysplasia and ESRD [4]. Routine prenatal ultrasound examination and advanced ultrasound equipment result in a prenatal detection rate of ~89% of renal and urinary tract malformations. Accurate diagnosis is important for counseling of the parents and planning of multidisciplinary care for the newborn. Antenatal investigations that predict postnatal renal function present varying accuracy of outcomes mainly based on the amount of amniotic fluid and the morphological appearance of the renal system in association with fetal serum and urine markers[7]. Although CAKUT are frequently asymptomatic, most common antenatal manifestations include oligohydramnios or variations in gross morphology of the kidney, ureter, or bladder. Postnatal manifestations of CAKUT may include the presence of palpable abdominal mass or single umbilical artery, feeding difficulties, decreased urine output, deficient abdominal wall musculature, and undescended testes in a male infant or multiorgan birth defects[8]. Patients can later suffer from growth retardation, impaired sexual maturation and numerous other partially disabling multisystem complications, many of which continue into adult life and compromise their chances of leading a successful work and social life. From a societal perspective, CAKUT pose a significant economic burden on health care systems related to the patients' lifelong costly therapeutic needs and severely impact the employment potential of affected individuals and their families. These manifold consequences of CAKUT provide a firm rationale for experimental and clinical research exploring novel diagnostic, preventive and therapeutic avenues in order to improve the outcomes of this disorder[7]&[8].

The malformed kidney is classified by its gross and microscopic anatomical features. A generally accepted classification scheme consists of: Renal Agenesis, Simple renal hypoplasia, Renal dysplasia, Renal dysplasia/hypoplasia (hypodysplasia)[9]. Anomalies in shape and position which include renal ectopia and renal fusion. Congenital anomalies of the urinary tract (VUR). Congenital obstructive uropathy (PUJO, ureterovesical Junction Obstruction UVJO, ectopic ureter, ureterocele, duplex Kidneys, and posterior Urethral Valves). Congenital anomalies of the bladder which include anomalies of bladder formation (agenesis of bladder, hypoplastic bladder). Anomalies of bladder compartmentalization (duplication of bladder, septate bladder, hourglass bladder, and bladder diverticulae). Megacystis (congenital megacystis, megacystis-megaureter syndrome, and Megacystis-microcolon-hypoperistalsis syndrome). Urachal abnormalities (patent urachus, urachal cyst, urachal sinus, and

urachal diverticulum). Bladder exstrophy and epispadias complex[10].

Aim of the study

To describe the types, spectrum of clinical presentation, and methods of diagnosis of the Congenital anomalies of the kidney and urinary tract cases, attended the central teaching hospital of pediatrics in Baghdad-Iraq.

Patients and methods

A retrospective cross-sectional study was conducted in the nephrology department of the central teaching hospital of pediatrics in Baghdad/Iraq. A total of 318 patients with Congenital anomalies of the kidney and urinary tract, attended the nephrology department in the period from January 2007 to December 2016.Our study was conducted from June 2017 till December 2017, only 308 patients were included in the study, and 10 patients were excluded. Exclusion criteria include incomplete information in medical records.

The Medical Records of all patients who were diagnosed with CAKUT in the previously mentioned time period were thoroughly reviewed, and the collected data included the following variables: Patient gender and age at time of diagnosis, Presence of family history of CAKUT in 1st and 2nd-degree relatives, and the presence of consanguinity, Weight in (kg), height/length in (cm), were measured at time of diagnosis and in the follow-up visits using standardized procedures and data are compared to centile charts. Failure to thrive is considered if a child's weight is below the 5th percentile, if it drops down more than 2 major percentile lines, or if the weight for height is less than the 5th percentile[11], Blood pressure (mmHg) was monitored at time of diagnosis and regularly on each visit and data are compared to centile charts for age, gender and height of the patient, Hypertension was considered when Systolic or diastolic blood pressure ¬is ≥ 95th percentile for gender, age, and height[11], Antenatal detection of CAKUT depended on prenatal ultrasonography, specific details of the fetal kidney U/S were needed to assist antenatal counseling, which include: number, location, size, duplication, renal parenchyma (echogenicity), pelvic dilation, calyceal dilation, urothelial thickening, and cystic disease. Hydronephrosis, or dilation of the renal pelvis, was the most common urologic abnormality found on the prenatal U/S. Measurement of the anteroposterior diameter of the renal pelvis obtained in the maximal transverse plane (usually near hilum region) in ultrasound, used as an index of the severity of hydronephrosis in cases of urinary tract obstruction (mild from 7mm to < 9mm, moderate 9mm to 15mm, and severe > 15mm)[11]. Nonobstructive conditions (e.g., vesicoureteral reflux) can show similar findings of dilatation of the renal collecting system and hydronephrosis. Ultrasonography can detect increased echogenicity and cysts in the fetal kidney, which are suggestive of renal dysplasia; it also can determine amniotic fluid volume, associated anomalies, and fetal sex. Some cases were had spontaneous resolution while others require surgical intervention, therefore suspected cases were confirmed by postnatal ultrasonography[11,12]. Data about extra-renal anomalies mentioned in the medical records were collected and then were classified according to their system of origin into (skeletal, GIT, nervous system, cardiac, urogenital, eye, syndrome, dysmorphism).

Mode of presentation was categorized into: (UTI, Renal failure, Asymptomatic, Renal stone, Hypertension, and Failure to thrive).

UTI diagnosis in symptomatic patients was based on positive urine culture which was collected by urethral catheterization or adhesive sterile urine bag in children younger than 2 years and non-toilet trained patients. Mid-stream urine sample was satisfactory for older or toilet trained children. Culture was considered positive when there was a single organism cultured with

a colony count >100,000 colony forming units/Ml[11]. Also, the presence of any bacteria per High Power Field (HPF) and pyuria (more than 5 white blood cells per HPF) was regarded as significant and indicative of UTI[13].

Asymptomatic patients include: patients who accidentally discovered having CAKUT while doing abdominal ultrasonography for other reasons. Patients with a history of antenatal detection of CAKUT who consulted the nephrology clinic for confirmation of the suspected anomaly without yet showing any manifestations at time of presentation.

The presence of renal stone in symptomatic patients was confirmed by renal ultrasonography or computed tomography (CT) scan[12].

Laboratory investigations: (serum creatinine (µmol/l), blood urea (mmol/l) (At time of diagnosis), urine culture/sensitivity and urinalysis) were collected.

Radiologic imaging methods included: Ultrasounds scan (U/S) of abdomen for all patients, some patients had other methods such as, Voiding cystourethrogram (VCUG), intravenous pyelogram (IVP), computerized tomography (CT) scan of the abdomen, Magnetic resonance imaging (MRI) of the abdomen/spine.

CAKUT were studied for the 308 patients, some had combined anomalies, and patients were divided into two groups according to the type of their renal anomaly:

* Obstructive anomalies: PUJ, PUV, VUJ, Duplex kidney, Ureterocele.

* Non-obstructive anomalies: VUR, renal agenesis, renal hypoplasia, renal dysplasia, MCKD, polycystic kidney disease, ectopic kidney, horseshoe kidney (4).

A comparison was done between these two groups, regarding patients' demographics, presentation and renal function, patients with combined obstructive and non-obstructive anomalies were excluded from the comparison.

-Patients with VUR combined with PUV were considered as having secondary VUR and were excluded from the study, but these patients considered as having only PUV (included in the study).

Statistical analysis: Statistical analysis was performed using SPSS windows version 23 Software. Suitable tables and graphs were used to describe the data. Chi-square and Fisher's exact probability test were used to test qualitative and frequency data and to assess the relations between risk factors and different outcomes. Student's t-test was used for comparison between continuous variables. P value < 0.05 was considered significant.

Results

The patients' age at time of diagnosis was ranging from five days to 14 years with a mean of 2.77 years and standard deviation (SD) of ± 3.31 years. The highest proportion of patients aged less than one year (43.8%) (135 patients).There were 124 patients (40.3%) aged from 1 year to 5 years. There were 38 patients (12.3%) aged more than 5 years to 10 years, and there were 11 patients (3.6%) aged more than 10 years. There were 197 (64%) male and 111 (36%) female, with a male to female ratio of 1.75:1.

Table 1. Distribution of patients by age.

Age Group (Years)	No. (total=308)	Percentage (%)
< 1	135	43.8
1 – 5	124	40.3
5 – 10	38	12.3
> 10	11	3.6

In this study, the majority of patients did not have a positive family history of CAKUT or consanguinity (81.8% and 60.4% respectively). most of the patients' anomalies were not detected prenatally (81.5%). Regarding radiological methods that were used to diagnose CAKUT, abdominal u/s was used in all patients to diagnose the pathology (100%), followed by VCUG (51.3%). As shown in table (2).

Figure 1. show the distribution of patients by type of anomaly. The highest proportion of patients in our study had VUR

(44.5%), followed by PUJO (12.7%), and Renal agenesis (10.7%).

Table 2. Distribution of patients by Radiological Methods.

Detection of anomaly	No. (total=308)	Percentage (%)
Antenatal Detection		
Yes	57	18.5
No	251	81.5
Radiological Method*		
Abdominal U/S	308	100.0
VCUG	158	51.3
IVP	54	17.5
CT Scan	9	2.9
MRI	5	1.5

* Patients might have more than one radiological investigation, so the total methods exceeded the total no. of patients.

Twenty six patients (8.4%) had combined anomalies. The highest proportion of patients who had combined anomalies presented with PUJ and VUR (23.1%).As shown in Table (3).

Most of the patients in this study did not have evident extra-renal anomalies which include 248 patients (80.5%). Regarding the most common extra-renal anomaly, skeletal anomalies represented the highest one 13 patients (4.2%), followed by cardiac 11 patients (3.6%), GIT anomalies 10 patients (3.2%), nervous system 7 patients (2.3%), dysmorphism 6 patients (1.9%), urogenital 5 patients (1.6%), syndrome 5 patients (1.6%), and eye 3 patients (1%).

Patients' B. urea at time of diagnosis was ranging from 1.3 to 45 mmol/L with a mean of 10.88 mmol/L and SD of ± 6.32 mmol/L. There were 149 patients (48.4%) had elevated B.urea. About S. creatinine at time of diagnosis, it was ranging from 11 to 400 µmol/L with a mean of 125.63 µmol/L and SD of ± 31.15 µmol/L. There were 63 patients (20.5%) had elevated S. creatinine.

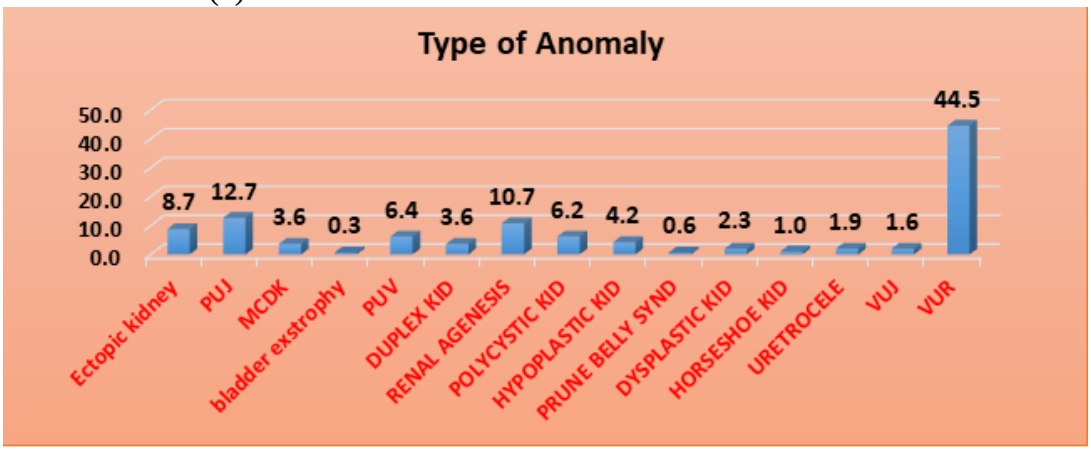

Figure 1. Distribution of patients by type of anomaly

Table 3. Distribution of patients by combined anomalies

Combined Anomaly	No. (total=26)	Percentage (%)
PUJ + VUR	6	23.1
Ectopic Kidney + PUJO	4	15.4
Ectopic kidney + VUR	3	11.5
Duplex Kidney + Ectopic Kidney	2	7.7
MCKD + PUJO	2	7.7
MCDK + VUR	1	3.8
Ectopic Kidney + Dysplastic Kidney	1	3.8
Renal Agenesis + PUV	1	3.8
VUR+ Hypoplastic kidney	1	3.8
Renal Agenesis + PUJO	1	3.8
PUJO + Hypoplastic Kidney	1	3.8
Renal Agenesis + Duplex Kidney	1	3.8
Renal Agenesis + Ectopic Kidney	1	3.8
Duplex Kidney + VUR	1	3.8

In this study out of 308 patients, 19 patients had combined both obstructive and non-obstructive anomalies, so they were excluded from the comparison, 208 patients (72%) had non-obstructive anomalies, while 81 patients (28%) had obstructive anomalies, as shown in figure (2).

In comparison between obstructive and non-obstructive anomalies regarding general characteristics, observed that the prevalence of obstructive anomalies decreased with increasing age and the highest proportion of obstructive anomalies were diagnosed in age group below one year (63%), most non-obstructive anomalies (47.6%) were diagnosed between age of (1-5 years), we had significant association (P=0.001) between age and condition of anomaly.

Regarding gender, the highest proportion of obstructive anomalies was seen among male patients (80.2%), also in non-obstructive anomalies male patients were (59.6%), and there was a significant association (P=0.001) between gender and condition of anomaly. There was no significant association (P=0.07) between family history and condition of anomaly. As shown in table (5).

Comparison between obstructive and non-obstructive anomalies regarding mode of presentation, we found that the highest proportion of obstructive anomalies was seen among patients presented with UTI (65.4%), while (45.2%) of non-obstructive patients presented with UTI, and there is a significant association (P=0.001) between UTI and condition of anomaly. (14.8%) of patients with obstructive anomalies presented with renal failure, while (21.2%) of patients with non-obstructive anomalies presented with renal failure, there was no significant association (P=0.369) between renal failure and condition of anomaly. only (2.5%) of patients with obstructive anomalies presented with FTT, while (11.1%) of patients with non-obstructive anomalies presented with FTT, there was a significant association (P=0.019) between FTT and condition of anomaly. There was no significant association between the condition of anomaly and all other modes of presentation ($P \geq 0.05$).As shown in table (6).

Discussion

In this study of CAKUT, the patients' age at time of diagnosis was ranging from five days to 14 years with a mean of 2.77 years and standard deviation (SD) of ± 3.31 years, this was consistent with the Iraqi study by Ahmed Z. Jaffar (2016)[14], which showed the age at time of diagnosis ranged between prenatal diagnosis to 13 years old with a mean 31.36± 37.44 months, apart from in our study, diagnosis was not considered to be established until prenatal detection was confirmed by postnatal imaging, also the age range and mean was consistent with study done by Neveen A. Soliman et al (2015)[4],which showed age range (0.59 - 156 months), with a mean of 25months,and study done by B. Bulum et al (2013)[2], which showed age range at diagnosis (4 days to 15.2 years), with a mean of 3.7±3.4 years.

Table 4. Distribution of patients by presentation.

Presentation	No. (total=308)	Percentage (%)
UTI	156	50.6
Renal Failure	63	20.5
Asymptomatic	35	11.4
FTT	25	8.1
Hypertension	19	6.2
Renal Stone	10	3.2

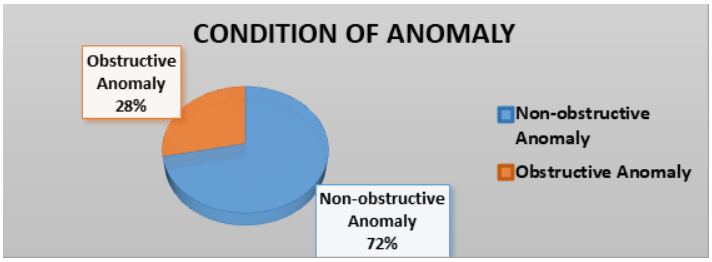

Figure 2. Distribution of patients by condition of anomaly.

Table 5. Association between condition of anomaly and general characteristics.

Variable	Condition of Anomaly		Total (%) n=289	P- value
	Obstructive (%) total= 81	Non-obstructive (%) total= 208		
Age Group (Years)				
< 1	51 (63)	76(36.5)	127 (43.9)	0.001
1 – 5	21 (26)	99 (47.6)	120 (41.5)	
5+ - 10	9 (11)	26 (12.5)	35 (12.1)	
> 10	0 (0)	7 (3.4)	7 (2.4)	
Gender				
Male	65 (80.2)	124 (59.6)	189 (65.4)	0.001
Female	16 (19.8)	84 (40.4)	100 (34.6)	
Family History				
Positive	10 (12.3)	45(21.6)	55 (19)	0.07
Negative	71 (87.7)	163(78.4)	234(81)	

Table 6. Association between condition of anomaly and presentation.

Presentation	Condition of Anomaly		Total (%) n=289	P- value
	Obstructive (%) n= 81	Non-obstructive (%) n= 208		
UTI				
YES	53(65.4)	94 (45.2)	147 (50.9)	0.001
NO	28 (34.6)	114 (54.8)	142 (49.1)	
Renal Failure				
YES	12 (14.8)	44(21.2)	56 (19.4)	0.369
NO	69 (85.2)	164 (78.8)	233 (80.6)	
Asymptomatic				
YES	10(12.3)	23 (11.1)	33 (11.4)	0.549
NO	71 (87.7)	185(88.9)	256 (88.6)	
Renal Stone				
YES	1 (1.2)	8 (3.8)	9(3.1)	0.565
NO	80 (98.8)	200 (96.2)	280 (96.9)	
Hypertension				
YES	3 (3.7)	16 (7.7)	19(6.6)	0.219
NO	78 (96.3)	192(92.3)	270 (93.4)	
Failure to thrive				
NO	2(2.5)	23 (11.1)	25 (8.7)	0.019
YES	79 (97.5)	185(88.9)	264 (91.3)	

In this study, the highest proportion of patients aged less than one year (43.8%) at diagnosis, followed by age group from 1 year to 5 years (40.3%), while in the Iraqi study by Ahmed Z. Jaffar (2016)[14], the most frequent age group at time of diagnosis was>1-≤ 5 age group (48.8%), followed by ≤1 year age group (38.1%), this difference is due to different sample size, time period and centers between for the two studies.

In this study, male patients were (64%) and female patients were (36%), with a male to female ratio of 1.75:1, this male predominance is consistent with other studies done by Ahmed Z. Jaffar (2016)[14], and Ali Ahmadzadeh et al (2009)[15]. Egyptian study by Neveen A.

Soliman et al (2015)(4), showed a slightly more male predominance of (70.09%) with a male to female ratio 2.3:1, this is due to the inclusion of patients from pediatric urology department in the Egyptian study, which contains more male patients with congenital obstructive uropathies.

In the current study, family History was positive in (18.2%) of cases, which was higher than the Macedonian study done by Nadica R. Bojkovska (2016)[16], which showed family history of (12.42%), this dissimilarity might be due entirely different populations and increased consanguineous marriages in our society, while B. Bulum et al (2013)(2), stated positive family history for CAKUT was present in (22.9 %) of cases, which was due to screening of first degree relatives of index patients in the Turkish study. In this study, consanguinity was (39.6%), which is a high percentage, near to what was observed in Neveen A. Soliman et al (2015) study[4], that revealed consanguinity of (50.5%) in study patients, this displays the high frequency of consanguineous marriage among Iraqi and Egyptian people.

In this study, antenatal Detection of CAKUT was (18.5%), which is less than the Turkish study by B. Bulum et al (2013)[2]and the Macedonian study done by Nadica R. Bojkovska (2016)[16],that both showed antenatal Detection of (28.9 %) and (25%) respectively, this difference might be due to more advanced antenatal care and diagnostic radiology protocols. Neveen A. Soliman et al (2015) study [4] showed antenatal Detection of (36.6%), which was because obstructive cases comprised about two-thirds of cases in the Egyptian study. Ahmed Z. Jaffar (2016)[14], revealed antenatal detection of only (8.1%) of the patients, that can be explained by the smaller sample size and time period in comparison with our current study.

Abdominal u/s was the most commonly used imaging procedure, done to all patients to diagnose the pathology (100%), this finding was comparable to a German study done by Susanne E. Gruessner et al (2012)[17], who concluded that Sonographic imaging of the kidneys and the urinary tract was shown as an effective and non-invasive method to diagnose renal anomalies in their large 10-year period cohort, and recommended Sonographic screening for all neonates in the early postnatal life. In our study, VCUG was the second most commonly used modality (51.3%), owing to the high proportion of patients in our study who had VUR.

The current study showed that the highest proportion of patients had VUR (44.5%), this goes along with several studies done by Daw Y. Hwang et al (2014)[5], Nadica R. Bojkovska (2016)[16], Ali Ahmadzadeh et al (2009)[15], and B. Bulum et al (2013)[2], which all showed the same VUR predominance. Taiwan study by You-Lin Tain et al (2016)[18], stated that the most common anomaly was polycystic Kidney disease, that might be due to a different population and various ethnic groups which participated in the Taiwanese study. Indian study by Abhijeet Saha et al (2009)[19], showed that the most common anomaly was PUJO, that is because the Indian study was based upon collection of cases of fetal hydronephrosis, in which PUJO constitutes the most common cause of prenatal hydronephrosis[20],and appears as moderately to severely dilated renal pelvis in (10-30%) of antenatal hydronephrosis cases, in contrary to VUR which appears with no pathognomonic ultrasound findings[21] Egyptian study by Neveen A. Soliman et al (2015) study[4], showed PUV as the most common anomaly, that was because of collection of patients from pediatric urology units. Combined anomalies in this study were (8.4%), this finding was comparable with Neveen A. Soliman et al (2015) study[4], who revealed combined anomalies of (10.3%).Among the combined anomalies, PUJO and VUR was the most common combination (23.1%), that goes along with the Iraqi study by Ahmed Z. Jaffar (2016)[14].

In this study, 60 patients (19.5%), had evident extra-renal anomalies in which skeletal anomalies represented the highest one (4.2%), followed by cardiac and GIT anomalies (3.6%) and (3.2%) respectively. Neveen A. Soliman et al (2015) study [4] showed that (31.8%) of CAKUT patients had extrarenal anomalies, skeletal and CNS anomalies were at the top of the list with (8.4%) for both.

The most common mode of presentation in this study was UTI (50.6%), this is comparable with Ahmed Z. Jaffar (2016) study [14], in which UTI was the leading presentation accounted for (62.5%) of cases.

Patients' B. urea at time of diagnosis had a mean of 10.88 mmol/L and SD of ± 6.32 mmol/L, S. creatinine at the time of diagnosis had a mean of 125.63 µmol/L and SD of ± 31.15 µmol/ L.Ahmed Z. Jaffar (2016) study [14] revealed B. urea mean of 5.26 mmol/L and SD of ± 3.9 mmol/L, S. creatinine mean 102.1 µmol/L and SD of ± 90.64 µmol/L, this dissimilarity might be related to the difference in types and percentage of renal anomalies between studies, and several cases were referred to our center for dialysis, had extremely elevated renal function tests readings.

In comparison between obstructive and non-obstructive anomalies regarding general characteristics, observed that the highest proportion of obstructive anomalies were diagnosed in age group below one year (63%), while most non-obstructive anomalies (47.6%) were diagnosed between age of (1-5 years), had significant association (P=0.001), that was because obstructive cases are presented earlier due to significantly dilated system causing back pressure effects and renal parenchymal changes[12],also the prenatal detection of obstructive anomalies in our study contributed to the earlier diagnosis, these findings are consistent with Ahmed Z. Jaffar (2016) [14] study.

Conclusion

Most of the patients diagnosed with (CAKUT) were males, aged less than one year, with a male to female ratio of 1.75:1. Ultrasound was the most commonly used radiologic modality to diagnose (CAKUT), followed by VCUG. VUR was the most common anomaly, followed by PUJO and Renal Agenesis. PUJO and VUR combination was the most common in this study. Skeletal anomalies were the most common extra-renal anomaly in patients with (CAKUT). UTI was the most common presentation followed by renal failure. Obstructive renal anomalies were most common in male patients, less than one year of age, while non-obstructive anomalies were most common between the ages of (1-5 years).UTI was significantly more common in patients who had obstructive anomalies, while FTT was significantly more common among non-obstructive cases. More patients with non-obstructive anomalies presented with renal failure than obstructive anomalies with no significant association.

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