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The effects of consanguineous marriage on small kidney in chronic kidney disease

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Abstract

Aim: To determine the effects of small kidney and consanguineous marriage in chronic kidney disease (CKD).

Materials and Methods: Patients with a vertical kidney size of 100 mm or less, who applied to the outpatient clinic between September 2021 and 2022, were included in the study. Urinary ultrasonography and renal function tests were recorded one year apart. Two groups, with and without relatives, were compared. SPSS 22.0 program was used for statistics. P<.05 was considered significant.

Results: The parents of 50 of the 94 cases with small kidney included in the study were related and 44 of them were not related. 57.4% were female, mean age was 49.86. Urea, creatinine, e-GFR, hemoglobin, albumin, phosphorus, calcium, PTH, ferritin and urinary USG used in chronic kidney disease progression follow-up were compared between the groups with and without parental consanguinity.

Conclusion: Early application of prevention measures with ultrasound detection of small kidney related to consanguineous marriage at an earlier age in before kidney dysfunction is established will slow down the progression.

Introduction

Chronic kidney disease (CKD) is a common health problem with known and unknown etiologies. Diabetes mellitus and hypertension are the leading causes in economically developed countries. In low- and middle-income countries, there are potential factors such as infectious diseases and toxin exposure, as well as unknown causes [1-3]. Uncertain etiology is used to define CKD that cannot be attributed to conventional risk factors. Known regional factors such as heavy metals, water hardness, ambient temperature, use of agrochemicals, and heat exposure were defined [3].

Renal hypoplasia, defined as developmental arrest in which an organ remains below its normal size or in an immature state, was updated by Bernstein in 1968 and the Academy of Pediatrics in 1989 and was associated with the development of chronic kidney disease [4]. Kidney mass and nephron measurement can only be done ex vivo. Kidney volume is proportional to its mass, and ultrasonography can be used as an in vivo proxy for nephron number. When compared with other radiological methods, it has been shown that the kidney size measured by ultrasonography corresponds to that measured by the surgical procedure [5-9].

We aimed to evaluate the effect of small kidney structure, which may occur due to the large number of children locally owned, maternal exposure to malnutrition, and narrowing of the genetic pool as a result of consanguineous marriage in closed societies, on the progression of CKD.

Materials and Methods

Patients who were referred to the nephrology outpatient clinic with renal dysfunction between September 2021 and 2022, who were unaware of their small kidney size, and whose vertical kidney size was 100 mm or less with at least two measurements were included in the study. Urinary ultrasonography at the first admission and one year later, urea, creatinine, e-GFR, e-GFR annual difference, phosphorus, calcium, PTH, ferritin, hemoglobin, albumin, number of siblings, number of children, and parental kinship were recorded. e-GFR was calculated according to the CKD-Epi formula. Those who did not come for control, had one kidney, and those with small kidneys secondary to frequent infections and operations were not included in the study.

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Table 1. Demographic and laboratory results of the groups.

	Total	Consanguineous	Unrelated	Statistics	
	(n=94)	(n=50)	(n=44)	z	p
Age	49.86 (39)	44.84 (39)	65 (27)	-3.777	.000
Gender,n=%					
Female	57.4	53.7	46.3		
Male	42.6	52.5	47.5		
Right renal vertical 1	90.7 (15)	90 (12)	90 (17.5)	-.273	.785
Right renal cortex 1	10 (4)	9.5 (3.3)	10 (3.3)	-.834	.404
Right renal vertical 2	87 (14.2)	89 (11.5)	85 (17.7)	-.838	.402
Right renal cortex 2	9 (4)	8.75 (4)	9.25 (3.8)	-.415	.678
Left renal vertical 1	90 (18)	90 (15)	87.5 (20)	-.963	.335
Left renal cortex 1	10 (3.1)	10 (4.6)	10 (10)	-.347	.729
Left renal vertical 2	86.5 (19)	89.5 (20)	84 (16.5)	-2.116	.034
Left renal cortex 2	10 (4)	10 (4)	10 (2.7)	-.480	.632
Urea 1	55.6 (51.6)	48.1 (51.2)	60.9 (46.8)	-1.747	.081
Urea 2	69.5 (70)	60.9 (72.7)	77.0 (68.4)	-1.296	.195
Creatinin 1	1.54 (1.9)	1.41 (2.3)	1.63 (1.5)	-.788	.431
Creatinin 2	1.75 (2.79	1.62 (4.2)	1.97 (1.8)	-.428	.669
e-GFR 1	43.3 (44)	47.5 (47.2)	40.5 (38.7)	-.762	.446
e-GFR 2	36.0 (39.2)	39.5 (44.7)	31.5 (35.5)	-.538	.590
e-GFR difference	6 (8)	6 (9)	4 (7.7)	-.867	.386
Phosphorus 1	3.7 (1)	3.6 (1.1)	3.8 (0.8)	-1.290	.197
Phosphorus 2	3.95 (1.53)	3.8 (1.63)	4.05 (1.47)	-1.126	.260
Calcium 1	9.24 (0.76)	9.24 (0.72)	9.25 (0.79)	-.542	.588
Calcium 2	9.3 (0.83)	9.37 (0.83)	9.21 (0.84)	-.587	.557
PTH 1	102 (180)	120.7 (297.2)	96.35 (95.9)	-.746	.455
PTH 2	120.7 (203)	123.9 (229.7)	120.7 (119.3)	-.224	.823
Ferritin 1	105 (165)	105.7 (179.4)	105.3 (145.9)	-.606	.544
Ferritin 2	110 (154.9)	110 (144.1)	106 (175)	-.333	.739
Hemoglobin 1	12.8 (9.1)	12.9 (3.4)	12.7 (2.9)	-.519	.604
Hemoglobin 2	11.9 (2.8)	11.9 (3.7)	11.9 (2.3)	-.099	.921
Albumin 1	4.35 (0.5)	4.5 (0.5)	4.3 (0.3)	-1.433	.152
Albumin 2	4 (0.4)	4 (0.4)	4 (0.4)	-1.017	.309
Number of siblings	7 (2)	7 (3)	8 (1.7)	-1.721	.085
Which child	4 (3)	4 (3)	4 (2)	-1.281	.200

Values: Median (ınterquartyl range) Vertical and cortex: mm, e-GFR: glomerular filtration rate, urea, creatinin, phosphorus. Calcium: mg/dL, albümin, hemoglobin:g/dL, ferritin: ng/ml, PTH: pg/ml.

The total group was divided into two groups as those with and without consanguinity in their parents. Laboratory parameters showing chronic kidney disease progression between the two groups were compared. Consent was obtained from all patients in the study, which was conducted in accordance with the Helsinki principles. The study was carried out after the decision of Mardin Artuklu University Non-Invasive Clinical Research Ethics Committee dated 08.06.2022 and numbered 2022-9.

Statistical analysis

Analyses were conducted using BM Statistical Package for the Social Sciences 22.0 version (IBM SPSS Corp.; Armonk, NY, USA). All data were first checked for normality of distribution using the Kolmogrov-Smirnov and Shapirov-Wilk test. Normally distributed data were presented as the mean ± standard deviation. Non-normally distributed data are represented as the median (interquartile range). Independent samples T test was used to compare parametric continuous variables between groups. Mann Whitney U was employed for the comparison of non-parametric variables between groups.

Results

While there was consanguinity in the parents of 50 of the 94 cases with small kidney included in the study, 44 did not. 57.4% of the cases were female, and the mean age was 49.86 median (interquartyl range of 39). The median age was found to be significantly younger in the group whose parents were related ($p<.00$) (Table 1).

No significant difference was found between the vertical and cortex thicknesses of the right and left kidneys in both groups in the measurements made at one-year intervals. Although the annual rate of decrease in e-GFR was higher in the consanguineous group, no statistically significant difference was found between the two groups. Again, no statistically significant difference was found between the

two groups in the values of urea, creatinine, phosphorus, calcium, PTH, ferritin, albumin and hemoglobin. There was no difference between the two groups in terms of the number of siblings, and there was no difference in the order of the number of children.

Discussion

Chronic kidney disease (CKD) is a common health problem with known and unknown etiologies. In low- and middle-income countries, there are known potential factors as well as unknown causes [1-3]. While diabetes and hypertension are in the first place in the etiology of chronic renal failure in our country, as in the rest of the world, different regional causes may come to the fore. While height and temperature levels in the etiology of chronic renal failure were studied in Central America, family history, pesticide use, and heavy metal exposure were studied in South Asia [10-14]. In addition, in rural areas, dehydration, snake bites, set water and infectious diseases, as well as genetic factors can be effective.

We aimed to evaluate the effect of small kidney structure, which may occur due to the large number of children locally owned, maternal exposure to malnutrition, and narrowing of the genetic pool as a result of consanguineous marriage in closed societies, on the progression of CKD. We found that CKD develops at a younger age in those whose parents are related with small kidney. While CKD developing in known etiologies was seen at older ages, CKD of unknown etiology was found to start at younger ages.

Ultrasonography is a non-invasive method that can be applied in daily routine to determine the size of the pie [5-9]. Since kidney volume is proportional to its mass, kidney sizes provide important information in the follow-up of chronic renal failure. Kidney weight with age 4-5. It starts to decrease in decades and in the 7th-8th. It decreases by 10-30% per decade. In aging, which is a natural process, the kidney is exposed to co-morbid diseases that develop with age, apart from normal organ aging [15]. In the study, parental consanguinity and regional factors were considered, since there were no age factors and co-morbid conditions to explain the decrease in kidney sizes in our young patients. It is known that the kidney volume is stable except in very old age. Having children regionally with frequent intervals, disrupts maternal nutrition and causes some developmental problems [16]. Frequency of consanguineous marriage increases the risk of genetic diseases by narrowing the genetic pool.

Conclusion

In chronic kidney disease of uncertain etiology, we believe that in regions with regional consanguinity in the parents, frequent and high birth rate and insufficient maternal nutrition, early application of prevention measures with ultrasound detection of small kidneys at an earlier age before kidney dysfunction is established will slow down the progression.

Ethical approval

The study was carried out after the decision of Mardin Artuklu University Non-Invasive Clinical Research Ethics Committee dated 08.06.2022 and numbered 2022-9.

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