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Original Article

Retrospective Statistical Study of Chronic Kidney Disease in Children at Tripoli University Hospital

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ABSTRACT

Background: Chronic kidney Disease has become a global health issue, beginning with a gradual loss of kidney function that eventually progresses to advanced stages. Early detection serves as a preventive solution to avoid reaching advanced stages and to reduce associated complications. This study aims to determine the prevalence rate of chronic kidney disease among children from birth up to the age of 16 at Tripoli University Hospital, as well as the prevalence of the disease among males and females, its causes, and its complications. **Methods.**Data was collected from 110 samples 68 males and 42 females (all participants were patients) using a manual questionnaire. All of them regularly visited the nephrology department at Tripoli University Hospital during the period from October 2023 to September 2024. The data was analyzed using statistical methods. **Result:** The prevalence among males was 61.8%, higher compared to females at 38.2%. Among the causes leading to the disease, 35.5% of the sample had unknown causes, followed by urinary tract infections at 17.2%, then vesicoureteral reflux at 13.6%. The disease may also be hereditary: 30.9% of the sample had a family member with the condition. **Conclusion:** Chronic kidney Disease in children is categorized into 5 stages, determined by the glomerular filtration rate (GFR). The current study showed that stage three was the most common at 40%. Complications of the disease include hypertension, with 26.4% of the children in the sample suffering from high blood pressure. Results also revealed a decrease in hemoglobin levels, elevated creatinine and urea levels, and hyperactivity of the parathyroid hormone.

Keywords: Children, Chronic kidney disease, Complications, Libya, Stages of disease.

Introduction

The kidney is an essential organ in the body that performs vital functions, including cleansing the blood of harmful substances to maintain the body's balance and health [1]. The kidney may be affected by diseases such as kidney disease, which is a condition characterized by a decreased ability of the kidneys to perform their natural function filtering the blood and removing toxins and wastes from the body. In addition, the kidneys regulate water and salt balance and blood pressure [2]. Chronic Kidney Disease in children is a persistent disorder in kidney function, manifested by either complete cessation or reduced urine output within a specific time frame. Functionally, this disease occurs in children when the kidney's functional units (nephrons) are damaged, leading to a decreased ability to control urine salt concentration, causing a buildup of waste and harmful substances in the body, resulting in deterioration of the patient's health [3]. The underlying causes of the disease can be genetic, congenital, or acquired [4] In pediatric populations, chronic kidney disease is often associated with congenital and hereditary conditions, and its clinical course may vary depending on the underlying cause and stage at diagnosis. Patients may exhibit symptoms such as anemia, high blood pressure, general fatigue and exhaustion, nausea and vomiting, loss of appetite, myocarditis and cardiac Disease, generalized swelling and difficulty breathing, and body itching [5]. The disease has five stages depending on the glomerular filtration rate [6]. Diagnosis is made through laboratory tests, imaging studies, and sometimes by taking a biopsy for microscopic analysis [7] Although advances in diagnostic techniques have improved early detection, CKD in children may still be under-recognized in some settings. Treatment involves improving the dietary regimen [8], dialysis, or kidney transplantation from a donor [9]. Chronic kidney Disease has become a global health problem, as it begins with a gradual loss of kidney function until reaching advanced stages. Early detection is a preventive solution to avoid progressing to advanced stages and limiting associated complications [10]. A study conducted on a sample of 324 children in southeast Europe found that children in stages four and five had significantly delayed growth compared to those in stages one and two. Growth delay did not improve with dialysis treatment but improved after kidney transplantation [11]. Another study in eastern Iran, at Dr. Sheikh Children's Hospital, on 326 children with chronic kidney disease, found a higher incidence in males compared to females [12]. Due to the lack of research concerning chronic kidney disease among children in Libya, Data on chronic kidney disease among children in Libya remain limited, highlighting the need for further studies to better understand its epidemiological and clinical characteristics. this study was conducted at Tripoli University Hospital to highlight its prevalence, causes, and stages. The aim of this study is to determine the prevalence of chronic kidney disease in children at Tripoli University Hospital from birth to 16 years old, to identify the incidence

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rate among male and female children, and to determine the causes of the disease.

Materials and Methods

Population of Study:

This study was conducted on children suffering from chronic kidney disease in the Nephrology Department at the University Hospital of Tripoli during the period from October 2023 to September 2024.

Study Sample:

Data were collected from 110 samples, including 68 males and 42 females. All of them are children diagnosed with chronic kidney disease at the Pediatric Nephrology Department of the University Hospital of Tripoli. Parts of the manual questionnaire were filled out, such as age, gender, weight, height, causes, stages, and a set of laboratory tests.

Date analysis:

Data from 110 samples were analyzed using statistical methods such as the arithmetic Median, percentages, and graphical representations using Excel 2010.

Results

The results in Figure (1) showed that the infection rate for males reached 62%, which is higher than the infection rate for females, which was 38%.

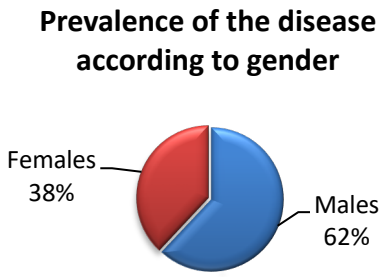

Figure 1: Prevalence of the disease according to gender

The results of Table (1) showed that unknown causes led to the disease in 35.5% of cases, followed by urinary tract infections at 17.2%, and then vesicoureteral reflux at 13.6%.

Table 1: Causes of infection and the relationship of infection among family members

Causes		Number	Percentage %
	Unknown causes	39	35.5
	Urinary tract infection	19	17.2
	Vesicoureteral reflux	15	13.6
	Congenital anomalies	8	7.3
	Chronic Kidney Disease	8	7.3
	Nephrotic syndrome	8	7.3
	Abnormal kidney size	6	5.5
	Kidney atrophy	4	3.6
	Polycystic kidney	3	2.7
	Total	110	100
Family history of the disease	There is a case	34	30.9
	There is no case	76	69.1
	Total	110	100

Table (2) shows that stage three was the highest at 40%. It is followed by stage four at 31.8%, stage five at 13.6%, then stage two at 10.9%, and the lowest was stage one at 3.6%.

Table 2: Distribution of disease stages among sample individuals

Stages	Number	Percentage %
First Stage	4	3.6
Second Stage	12	10.9
Third Stage	44	40
Fourth Stage	35	31.8
Fifth Stage	15	13.6
Total	110	100

The results of Figure (2) showed that 26% of the sample had high blood pressure.

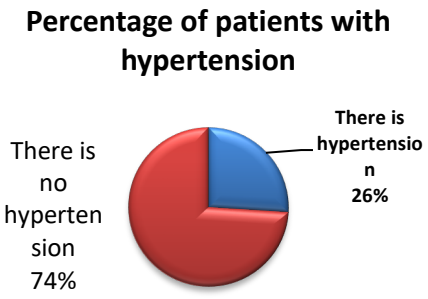

Figure 2: Percentage of patients with hypertension

The Median value for Complete Blood Count (CBC) analysis

Since the normal range for red blood cells (RBC) is 3.9-5.4 cells/µl, for white blood cells (WBC) is 4.5-11 cells/µl, for hemoglobin (Hg) in females is 11-14 g/dl, in males is 13.2-16.6 g/dl, and for platelets (PLT) is 150-400 cells/µl, Table 3 shows a decrease in the Median value of Hemoglobin for the entire sample.

Arithmetic Median for Kidney Function Test (KFT) Analysis

The normal range for blood creatinine (Sr. Creatinine) is 0.3-0.7 mg/dl, for urea (Urea) is 11–45 mg/dl, for sodium (Sodium) is 135–145 mmol/L, for potassium (Potassium) is 3.5–5.5 mmol/L, and for chloride (Chloride) is 96–107 mmol/L. As shown in Table (3), there is an increase in Cr and Urea among all individuals in the sample, due to kidney dysfunction that prevents proper filtration of waste from the blood. Sodium (Na) levels in males fall within the

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normal range, while in females there is a decrease below normal, As for K and Cl, all individuals in the sample were within the normal range.

Arithmetic Median for Parathyroid Hormone Test (PTH) Analysis

The normal range for PTH hormone is 14–65 Pg/ml. Table 3 shows that all children in the sample exhibit hyperactivity in PTH secretion.

Arithmetic Median for Calcium (Ca) Analysis

The normal range for calcium (Ca) is 8.8–10.8 mg/dl. According to the results in Table 3, all individuals in the sample were within the normal range.

Arithmetic Median for Phosphorous (Ph) Analysis

Since the normal range for phosphorus (Ph) is 4.0–7.0 mg/dl, all individuals in the sample were within the normal range, as shown in Table 3.

Table 3: Arithmetic Median of the Analyses

	Males	Females
RBC **(cells/µl)**	4	3.6
WBC **(cells/µl)**	7.7	8.9
Hg **(g/dl)**	10.7	9.6
PLT **(cells/µl)**	308.7	291.1
Cr **(mg/dl)**	4.5	4.9
Urea **(mg/dl)**	86.6	103
Na **(mmol/L)**	138.8	128.1
K **(mmol/L)**	4.1	4.2
Cl **(mmol/L)**	106	98.3
PTH **(Pg/ ml)**	437.7	592
Ca **(mg/ dl)**	8.8	8.7
Ph **(mg/ dl)**	5.7	5.9

Discussion

The results in Figure (1) showed that the infection rate for males is higher than the infection rate for females, this observed difference aligns with findings reported in previous studies. This is consistent with the study by [12], in which the rate for males was higher at 56.4% compared to females, due to the higher incidence of congenital abnormalities in the kidneys and urinary system among males[17]. However, this male predominance may also reflect referral bias or differences in healthcare-seeking behavior between genders, in addition to possible environmental and cultural factors influencing early diagnosis [18].

The results of Table (1) showed that unknown causes led to the disease, followed by urinary tract infections, and then vesicoureteral reflux. in contrast to these finding, previous studies have reported different leading causes. This does not align with a study conducted by [13], in which the main females compared to males. As for potassium (K) and chloride (Cl), all individuals in the sample were within the normal range. The observed gender difference in sodium levels may also reflect hormonal modulation, particularly cause of the disease was vesicoureteral reflux and obstructive uropathy. The high proportion of unknown causes may indicate limitations in diagnostic approaches, suggesting that advanced investigations such as genetic testing or renal biopsy were not consistently applied [19].

The table (1) also shows that 30.9% of the sample have a case among family members, while 69.1% of the sample do not have a case among family members. This finding may suggest a potential genetic or familial predisposition in a subset of patients, although the majority of cases appear to be sporadic. Further genetic studies are recommended to clarify this association [19].

Table (2) shows that stage three was the highest at 40%. The reason is that this stage is pivotal and important because symptoms appear at this point and the risk of disease progression to advanced stages increases. It is followed by stage four, stage five, then stage two, and the lowest was stage one. these finding may reflect a pattern of late clinical presentation. The predominance of stage three and four cases may also indicate delayed diagnosis and limited access to early screening programs, leading to presentation at more advanced stages [17].

The results of this study showed that 26% of the sample had high blood pressure, which is consistent with a study conducted by [14], where they found that high blood pressure is one of the most common complications, with a rate of 45–60%. Also, as the disease progresses, high blood pressure increases in affected children due to fluid retention, and one of the important procedures during the treatment phase is managing high blood pressure. The relatively lower percentage observed in this study may be due to underdiagnosis, differences in measurement criteria, or the possibility that some patients were already receiving antihypertensive therapy [20].

Table (3) shows a decrease in the median value of hemoglobin for the entire sample. This concurs with [15], who found that anemia is a common complication in children with chronic kidney disease due to reduced erythropoietin production, blood loss, iron deficiency, hyperparathyroidism, infections, and poor nutrition. In addition, chronic inflammation may further contribute to anemia in these patients, particularly in pediatric populations with long-standing disease [21].

Also. as shown in Table (3), there is an increase in creatinine and urea among all individuals in the sample, due to kidney dysfunction that prevents proper filtration of waste from the blood. Sodium (Na) levels in males fall within the normal range, while in females there is a decrease below normal, due to increased sensitivity to antidiuretic hormone (ADH), which leads to water retention. This condition is linked to physiological differences between the sexes, such as the influence of hormones and lower muscle mass and total body water in

the role of estrogen; however, this finding should be interpreted cautiously due to the relatively small sample size [18].

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In current study shows that all children in the sample exhibit hyperactivity in PTH secretion, which is consistent with the study by [16], which indicated that hyperparathyroidism is a complication of chronic kidney disease in children. This finding strongly suggests the presence of chronic kidney disease mineral and bone disorder (CKD-MBD), highlighting the importance of early monitoring of calcium phosphate balance in pediatric patients [22].

According to the results in Table (3), all individuals in the sample were within the normal range for calcium and phosphorus. Despite normal calcium and phosphorus levels, the elevated PTH indicates early disturbances in mineral metabolism, which may precede detectable biochemical abnormalities [22].

Conclusion.

This study has several limitations, including the relatively small sample size and its single-center design, which may limit the generalizability of the findings. Additionally, the lack of longitudinal follow-up restricts the ability to assess disease progression. Future studies should include larger, multicenter populations and utilize advanced diagnostic tools. Clinically, these findings emphasize the importance of early detection and comprehensive management to reduce complications and slow disease progression.

Conflict of interest:

The authors declare that there is no conflict of interest regarding the publication of this paper.

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